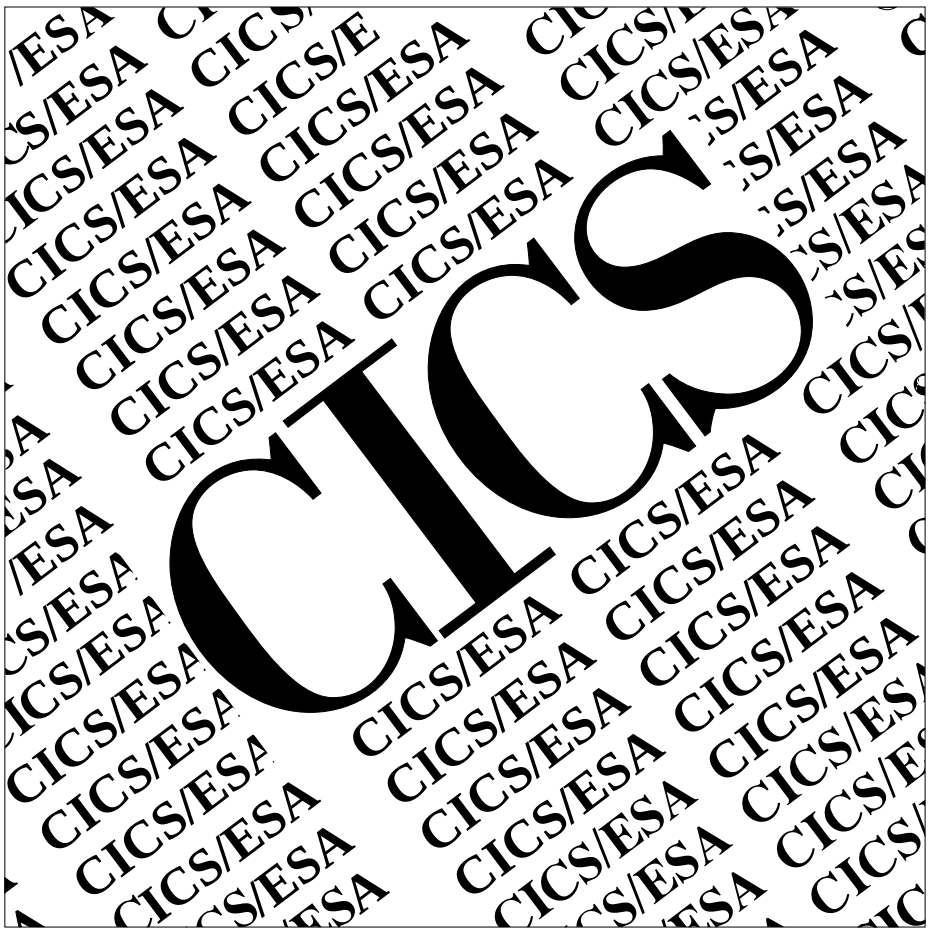
CICS/ESA

CICS-IMS Database Control Guide

Version 4 Release 1



SC33-1184-02

CICS/ESA

CICS-IMS Database Control Guide

Version 4 Release 1

SC33-1184-02

Note!

Before using this information and the product it supports, be sure to read the general information under “Notices” on page vii.

First edition (October 1994)

This edition applies to Version 4 Release 1 of the IBM licensed program Customer Information Control System/Enterprise Systems Architecture (CICS/ESA), program number 5655-018, and to all subsequent versions, releases, and modifications until otherwise indicated in new editions. Consult the latest edition of the applicable IBM system bibliography for current information on this product.

This book is based on the CICS-IMS DBCTL Guide for CICS/ESA 3.3, SC33-0660-02. Changes from that edition are marked by vertical lines to the left of the changes.

The CICS/ESA 3.3 edition remains applicable and current for users of CICS/ESA 3.3.

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Programming interface information

This book is intended to help you evaluate, install, and use CICS/ESA-IMS/ESA interface Database Control (DBCTL).

This book also documents Product-sensitive Programming Interface and Associated Guidance Information and Diagnosis, Modification or Tuning Information provided by CICS.

Product-sensitive programming interfaces allow the customer installation to perform tasks such as diagnosing, modifying, monitoring, repairing, tailoring, or tuning of CICS. Use of such interfaces creates dependencies on the detailed design or implementation of the IBM software product. Product-sensitive programming interfaces should be used only for these specialized purposes. Because of their dependencies on detailed design and implementation, it is to be expected that programs written to such interfaces may need to be changed in order to run with new product releases or versions, or as a result of service.

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Diagnosis, Modification or Tuning Information is provided to help you diagnose problems with your CICS system.

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Resource Measurement Facility	RMF
VTAM	3090

Preface

Who this book is for

This book is for anyone who uses the CICS/ESA-IMS/ESA interface Database Control — referred to as DBCTL in the rest of this book.

This book is intended to help you understand DBCTL. It contains guidance on evaluating, installing, and using DBCTL. This book also discusses local DL/I for migration and coexistence purposes.

If you need to know more about where programming interface information is described, or about the definitions of the different types of information in the CICS library, read the *CICS Family: Library Guide*.

For programming information on programming interfaces provided by IMS/ESA, see the *IMS/ESA Application Programming: EXEC DLI Commands* and the *IMS/ESA Application Programming: DL/I Calls* manuals.

What this book is about

The aim of this book is to give introductory and guidance information on evaluating, installing, and using DBCTL.

This book is intended to be used in conjunction with existing manuals in the CICS and IMS libraries, to which it refers where appropriate.

What you need to know before reading this book

Before you read this book, you need a general understanding of CICS and IMS. You can find general introductory information in the *CICS Family: General Information* and the *IMS/ESA General Information* manual. You should also have some knowledge of the concepts of data management and databases. For guidance on these topics, see the *IMS/ESA Database Administration Guide*.

How to use this book

We expect that you will read this book sequentially. Aspects of DBCTL, from installation through performance considerations, are presented in the order in which we anticipate you will need them. However, ***new*** users of DL/I should skip Chapter 3, “Migration considerations for DBCTL” on page 15.

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Terms used

In general, this book refers to Customer Information Control System and Information Management System as “CICS” and “IMS,” respectively. However, when it is necessary to distinguish between particular CICS or IMS products, we use the following abbreviations, with a version and release number where appropriate:

CICS/MVS refers to Customer Information Control System/Multiple Virtual Storage.

CICS/ESA refers to Customer Information Control System/Enterprise Systems Architecture.

IMS/VS refers to Information Management System/Virtual Storage.

IMS/ESA refers to Information Management System/Enterprise Systems Architecture.

IMS/VS DB/DC refers to Information Management System/Virtual Storage Database/Data Communication.

IMS/ESA DM/TM refers to Information Management System/Enterprise Systems Architecture Database Manager/Transaction Manager.

MVS refers to the MVS/Enterprise Systems Architecture (MVS/ESA) operating system, which is a prerequisite for CICS/ESA.

For definitions of DBCTL-related terminology used in this book, see “Glossary” on page 217.

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For CICS books, these softcopy updates appear regularly on the *Transaction Processing and Data Collection Kit* CD-ROM, SK2T-0730-xx. Each reissue of the collection kit is indicated by an updated order number suffix (the -xx part). For example, collection kit SK2T-0730-06 is more up-to-date than SK2T-0730-05. The collection kit is also clearly dated on the cover.

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- When the softcopy version of a publication is updated for a new collection kit the order number it shares with the hardcopy version does not change. Also, the date in the edition notice remains that of the original publication. To compare softcopy with hardcopy, and softcopy with softcopy (on two editions of the collection kit, for example), check the last two characters of the publication’s filename. The higher the number, the more recent the publication. For example, DFHPF104 is more recent than DFHPF103. Next to the

publication titles in the CD-ROM booklet and the readme files, asterisks indicate publications that are new or changed.

- Updates to the softcopy are clearly marked by revision codes (usually a “#” character) to the left of the changes.

Bibliography

CICS/ESA 4.1 library

Evaluation and planning		
Release Guide	GC33-1161	April 1997
Migration Guide	GC33-1162	April 1997
General		
CICS Family: Library Guide	GC33-1226	April 1995
Master Index	SC33-1187	October 1994
User's Handbook	SX33-1188	April 1997
Glossary (softcopy only)	GC33-1189	n/a
Administration		
Installation Guide	GC33-1163	April 1997
System Definition Guide	SC33-1164	April 1997
Customization Guide	SC33-1165	April 1997
Resource Definition Guide	SC33-1166	April 1997
Operations and Utilities Guide	SC33-1167	April 1997
CICS-Supplied Transactions	SC33-1168	April 1997
Programming		
Application Programming Guide	SC33-1169	October 1994
Application Programming Reference	SC33-1170	April 1997
System Programming Reference	SC33-1171	April 1997
Sample Applications Guide	SC33-1173	October 1994
Distributed Transaction Programming Guide	SC33-1174	October 1994
Front End Programming Interface User's Guide	SC33-1175	October 1994
Diagnosis		
Problem Determination Guide	SC33-1176	October 1994
Messages and Codes	GC33-1177	April 1997
Diagnosis Handbook	LX33-6093	October 1994
Diagnosis Reference	LY33-6082	April 1997
Data Areas	LY33-6083	April 1997
Supplementary Data Areas	LY33-6081	October 1994
Closely-Connected Program Interface	LY33-6084	November 1996
Communication		
Intercommunication Guide	SC33-1181	April 1997
Server Support for CICS Clients	SC33-1591	February 1996
CICS Family: Inter-product Communication	SC33-0824	October 1996
CICS Family: Communicating from CICS on System/390	SC33-1697	October 1996
Special topics		
Recovery and Restart Guide	SC33-1182	October 1994
Performance Guide	SC33-1183	October 1994
CICS-IMS Database Control Guide	SC33-1184	October 1994
CICS-RACF Security Guide	SC33-1185	October 1994
Shared Data Tables Guide	SC33-1186	October 1994
External CICS Interface	SC33-1390	April 1997
CICS ONC RPC Feature for MVS/ESA Guide	SC33-1119	February 1996
CICS Web Interface Guide	SC33-1892	November 1996

The book that you are reading was published in hardcopy format on the date shown in the right-hand column in the above table. Some of the CICS/ESA 4.1 books were republished in new hardcopy editions in April 1997 to incorporate updated information previously available only in softcopy. Note that it is possible that other books in the library will be updated after April 1997.

When a new order is placed for the CICS/ESA 4.1 product, the books shipped with that order will be the latest hardcopy editions.

The style of IBM covers changes periodically. Books in this library have more than one style of cover.

For information about the softcopy books, see “Determining if a publication is current” on page x. The softcopy books are regularly updated to include the latest information.

Other CICS books

- *CICS Application Migration Aid Guide*, SC33-0768
- *CICS Application Programming Primer (VS COBOL II)*, SC33-0674
- *CICS/ESA Facilities and Planning Guide* for CICS/ESA Version 3 Release 3, SC33-0654
- *CICS/ESA XRF Guide* for CICS/ESA Version 3 Release 3, SC33-0661
- *CICS Family: API Structure*, SC33-1007
- *CICS Family: General Information*, GC33-0155
- *IBM CICS Transaction Affinities Utility MVS/ESA*, SC33-1159

CICS Clients

- *CICS Clients: Administration*, SC33-1436
- *CICS Family: Client/Server Programming*, SC33-1435

IMS/ESA Version 3 and 4 libraries

Table 1 (Page 1 of 2). IMS/ESA 4.1 library

Title	Version 3	Version 4
Application Programming: DC Calls	SC26-4283	----
Application Programming: Data Communication	----	SC26-3058
Application Programming: Design Guide	SC26-4279	SC26-3066
Application Programming: DL/I Calls	SC26-4274	SC26-3062
Application Programming: EXEC DLI Commands	SC26-4280	SC26-3063
Application Programming: DL/I Calls Summary	----	SX26-3818
Application Programming: EXEC DLI Commands Summary	----	SX26-3819
Application Programming Reference Summary	SX26-3765	----
Customization Guide	SC26-4285	----
Customization Guide: Database	----	SC26-3064
Customization Guide: Data Communication	----	SC26-3059
Customization Guide: System	----	SC26-3067
Database Administration Guide	SC26-4281	SC26-3065
Data Communication Administration Guide	SC26-4286	SC26-3060
Diagnosis Guide and Reference	LY27-9539	LY27-9616

Table 1 (Page 2 of 2). IMS/ESA 4.1 library		
Title	**Version 3**	**Version 4**
Failure Analysis Structure Tables (FAST) for Dump Analysis	LY27-9512	LY27-9617
General Information	GC26-4275	GC26-3068
Installation Guide	SC26-4276	SC26-3069
Introduction to the IMS Library	GC26-4294	----
Installation Listings	SC26-4392	----
Licensed Programming Specifications	GC26-4289	----
Licensed Program Specifications: IMS/ESA DB	----	GC26-4803
Licensed Program Specifications: IMS/ESA TM	----	GC26-4804
LU 6.1 Adapter for LU 6.2 Applications: Program Description/Operations	SC26-4392	SC26-3061
Master Index and Glossary	SC26-4291	SC26-3070
Messages and Codes	SC26-4290	SC26-3071
Operations Guide	SC26-4287	SC26-3072
Operator's Reference	SC26-4288	SC26-3073
Release Planning Guide	GC26-4386	GC26-4630
Sample Operating Procedures	SC26-4277	SC26-3074
Summary of Operator Commands	SC26-4277	SX26-3817
System Administration Guide	SC26-4282	SC26-3075
System Definition Reference	SC26-4278	SC26-3076
Utilities Reference	SC26-4284	----
Utilities Reference: Database	----	SC26-4627
Utilities Reference: Data Communication	----	SC26-4628
Utilities Reference: System	----	SC26-4629

Other related publications

Operating system

- *MVS/ESA System Programming Library: Application Development 31-Bit Addressing*, GC28-1820
- *MVS/ESA Operations: System Commands*, GC28-1826
- *MVS/ESA Message Library: System Messages Volume 1*, GC28-1812
- *MVS/ESA Message Library: System Messages Volume 2*, GC28-1813
- *MVS/ESA Message Library: System Codes*, GC28-1815
- *MVS/ESA Interactive Problem Control System User's Guide*, GC28-1833.

Security management

- *Resource Access Control Facility (RACF) Security Administrator's Guide*, SC28-1340.

Programming languages

- *C Language*, SC09-1128
- *IBM C/370 User's Guide*, SC09-1264
- *IBM C/370 Programming Guide*, SC09-1384
- *OS/VS COBOL Compiler and Library Programmer's Guide*, SC28-6483
- *VS COBOL II Application Programming Guide*, SC26-4045
- *OS PL/I Optimizing Compiler Programmer's Guide*, SC33-0006
- *OS/VS, VM/370 Assembler Programmer's Guide*, GC33-4021.

Performance tools

- *MVS/ESA Resource Measurement Facility General Information*, GC28-1028
- *Service Level Reporter Version 3 General Information*, GH19-6529.

Data management

- *DB2 General Information*, GC26-4373.

Summary of changes

Changes for this edition

Changes are indicated by vertical lines to the left of the changes.

| The following topics have been added or changed since the CICS/ESA 3.3 edition:

| A CICS-supplied transaction, CDBM, used to issue DBCTL operator commands

| A CICS-DBCTL installation verification procedure, DFHIVPDB

| Specifying a DBCTL identifier during CICS initialization or via the CDBC
| transaction

| Release of DBCTL threads at syncpoint instead of task termination

| IMS AIB call format

| Withdrawal of support for IMS/VS 2.2 with local DL/I

| New system initialization parameters DSALIM and EDSALIM, which replace
| CDSASZE, ECDSASZE, ERDSASZE, EUDSASZE, and UDSASZE parameters

| Migration scenarios

| Example trace entries

| Example of DFHSTUP output.

Changes for CICS/ESA 3.3 edition

The book has been updated to reflect the replacement of the following system initialization parameters:

Obsolete	**Replaced by**
DSASZE	CDSASZE and UDSASZE.
EDSASZE	ECDSASZE, ERDSASZE, and EUDSASZE.

Changes for CICS/ESA 3.2.1 edition

Since the CICS/MVS 3.1.1 edition, the following topics have been added:

• Using IMS/ESA 4.1 with local DL/I

- Using the CICS system initialization parameter INITPARM to automate connection to a particular DBCTL

• Changes to the CICS system initialization parameter PISCHD because
IMS/ESA 4.1 does not support intent scheduling

- Using the /SWITCH OLDS command, which is now valid for DBCTL
- Suppressing messages or rerouting them to particular transient data queues (for example, CDBC)
- Using the CICS-supplied sample in-doubt resolution program, DFH$INDB

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- Using the new EXEC DLI SCHD keyword NODHABEND to avoid DHxx abends being issued after a PSB schedule failure
- Additional XRF user exit parameters returned if using MVS/ESA SP 4.1
- Examples of CICS trace entries have been updated to reflect current trace output
- Additional information returned by SLR
- # Performance benefits of using the IMS/ESA 4.1 asynchronous buffer purge facility
- Benefits of using high speed sequential processing (HSSP) with DEDBs
- An example of using the global user exit XDLIPRE to change the name of a PSB to be scheduled.

Chapter 1. Overview of Database Control (DBCTL)

This overview of DBCTL introduces the concepts of a CICS/ESA-IMS/ESA interface that uses Database Control (DBCTL), including:

- An overview of DL/I request handling in CICS, and how DBCTL fits into the CICS-IMS environment
- A description of the components of a CICS-IMS DBCTL environment
- A list of resources you can access using DBCTL.

DBCTL is an IMS facility that provides an IMS/ESA Database Manager (IMS/ESA DM) subsystem that can be attached to CICS, but runs in its own address spaces. The benefits of DBCTL are summarized below and are discussed in more detail in Chapter 2, “Benefits of using DBCTL” on page 9.

- Release independence — you do not need to regenerate the DL/I support in CICS if you change to a new release of CICS or IMS.
- Access to more IMS functions for CICS users — DBCTL gives one or more CICS systems online access to data entry databases (DEDBs) as well as full function DL/I databases.
- Virtual storage constraint relief for CICS systems that currently contain DL/I because DL/I code is outside the CICS address space.
- Improved throughput on multiprocessors, because DL/I requests run under task control blocks (TCBs) separate from those used by CICS and because CICS and DBCTL reside in separate address spaces.
- Improved logging — DBCTL uses a separate log (the IMS log), so DL/I activity does not appear on the CICS system log. This means that all DL/I information is on a single log and can be processed using IMS logging facilities. IMS logging facilities include dual logging and are well integrated with database recovery control (DBRC). For more information, see “IMS logging” on page 41.
- Ability to use CICS support for the extended recovery facility (XRF). (In addition, if your CICS system is connected to an IMS/ESA Database Manager/Transaction Manager (IMS/ESA DM/TM) system to obtain DBCTL support, you can use IMS XRF facilities.)
- Improved failure isolation between CICS and IMS — a DBCTL failure should not cause your CICS system to fail.
- Batch jobs can be run as batch message processing programs (BMPs), which are application programs that perform batch type processing online using the same DBCTL as CICS and sharing its databases. You can usually run the same program as a BMP or as a batch program. Using DBCTL gives you concurrent access to IMS databases from BMPs and from CICS.

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Overview of DL/I request handling in CICS

CICS can access DL/I databases in the following ways:

- Via DBCTL.

  This is when DBCTL satisfies the DL/I request issued from the CICS system by means of the CICS-DBCTL interface. We recommend you use DBCTL because it provides additional functions (described in Chapter 2, “Benefits of using DBCTL” on page 9). Note that ***CICS and its associated DBCTL must reside in the same MVS image***.

  Installing and using DBCTL are introduced in this manual (but note that you will also need to refer to other CICS/ESA and IMS/ESA manuals for further information).

- Via local DL/I.

  In this situation, DL/I runs within the CICS address space. Local DL/I is the method used in all versions of CICS before Version 3. The level of functional support for local DL/I remains the same as in CICS/MVS except that IMS/ESA 3.1 and later releases do not provide ISAM support, and IMS/ESA 4.1 does not support intent scheduling.

  We recommend that new users do not use local DL/I, but use DBCTL. Existing users of local DL/I can use it with DBCTL in order to ease migration. Chapter 3, “Migration considerations for DBCTL” on page 15 introduces reasons for migration, and outlines possible migration scenarios. Migration information related to specific tasks is mentioned where appropriate in the rest of this book. Information about migration for local DL/I without DBCTL is in the *CICS/ESA Migration Guide*. Information about installing local DL/I without DBCTL is in the *CICS/ESA Installation Guide*.

- Via remote DL/I.

  Remote DL/I is done by means of CICS function shipping a DL/I request to another CICS system, in which the DL/I support can be local DL/I, remote DL/I, or DBCTL. See the *CICS/ESA Intercommunication Guide* for more information on function shipping, and the *CICS/ESA Installation Guide* for information on adding remote DL/I support.

Note: Although all these methods of accessing DL/I databases can coexist, a program specification block (PSB) can only contain databases that are controlled by ***one*** of the methods.

CICS can also access DL/I databases in an IMS/ESA Database Manager/Transaction Manager (IMS/ESA DM/TM) system using the CICS-DBCTL interface. This means that you can have access to DL/I databases controlled by IMS/ESA DM/TM without needing to use IMS data sharing, provided that CICS and IMS/ESA DM/TM are in the same MVS image. Both the IMS/ESA DM/TM system and the CICS system can include the extended recovery facility (XRF).

Figure 1 on page 3 illustrates the three kinds of DL/I request.

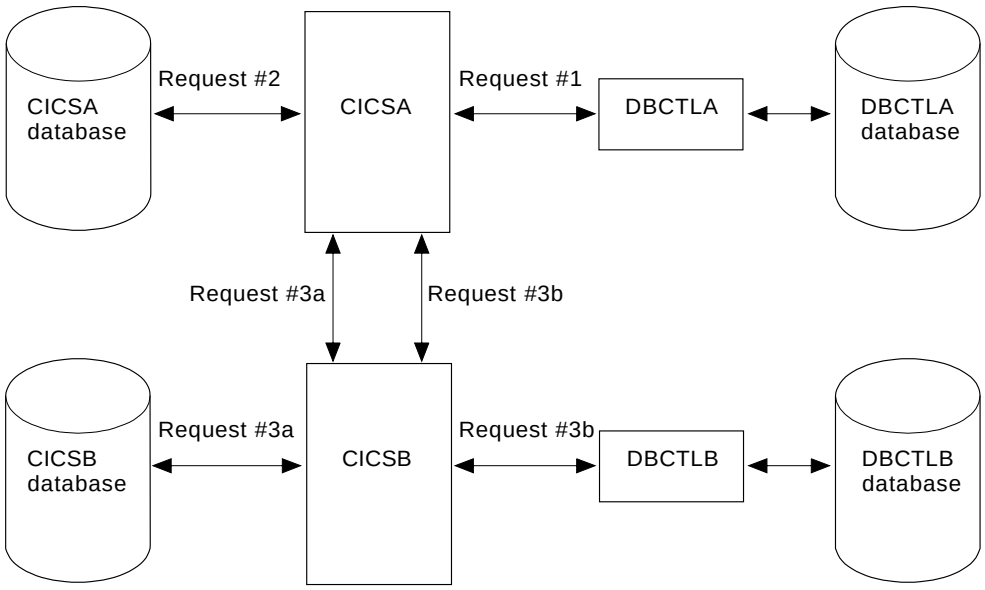

Figure 1. DL/I request handling within CICS

Notes:

1. Request #1 is a DBCTL request from CICSA to DBCTLA for a database controlled by DBCTLA. See "CICS-DL/I router (DFHDLI)" on page 5 for a description of request processing.
2. Request #2 is a local DL/I request from CICSA to a database that it controls.
3. Requests #3a and #3b are two separate remote (function shipped) DL/I requests to databases controlled by, or connected to, other CICS systems (which may be in the same MVS image or a different one). There are two ways of issuing such requests:
   - Request #3a from CICSA to CICSB for a database controlled by CICSB
   - Request #3b from CICSA to CICSB for a database controlled by DBCTLB. The most likely reason for using request #3b is if CICSA and CICSB are in different MVS images.

Connecting to DBCTL

You can connect to, and disconnect from, DBCTL using the CICS-supplied transaction CDBC. When you have connected to DBCTL by means of CDBC, you can issue DL/I requests from your application programs. There is another CICS-supplied transaction, CDBI, which you can use to inquire on the status of the connection to DBCTL from CICS. See "Connection, disconnection, and inquiry transactions" on page 55 for information on using CDBC and CDBI.

CICS-IMS DBCTL environment

Figure 2 on page 4 gives an overview of a CICS-IMS interface that includes DBCTL and local DL/I. Each box represents an address space running within a single MVS system. The marked area between the second CICS and the first BMP is the point at which CICS components end and IMS components begin.

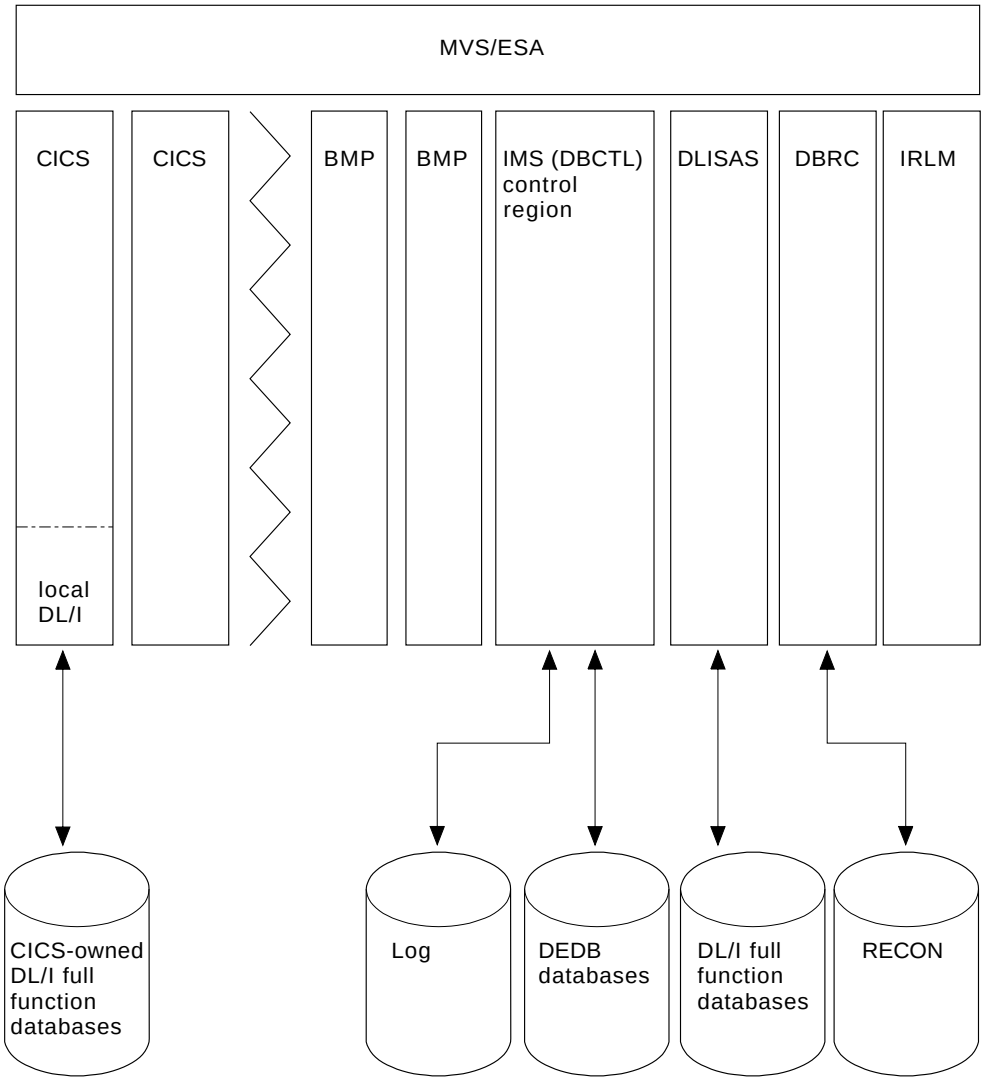

Figure 2. CICS-IMS interface

CICS-IMS DBCTL environment — description of components

The following sections give detailed information about each of the major components of the CICS-IMS DBCTL interface. See Figure 3 on page 7 for an illustration of these components. At this point, you may prefer to go directly to Chapter 2, “Benefits of using DBCTL” on page 9 and use the following information for reference later.

CICS-DBCTL interface control components in CICS address space

The components of the CICS-DBCTL interface in the CICS address space are:

- The CICS-DL/I router (DFHDLI)
- The CICS database adapter transformer (DFHDBAT)
- The database resource adapter (DRA).

CICS-DL/I router (DFHDLI)

The CICS-DL/I router, DFHDLI, forms the interface between your application programs and the DL/I call processor. It accepts requests for remote, local, or DBCTL database processing. If DFHDLI decides that the request is for DBCTL, it passes the request to the CICS-DL/I DBCTL processor, DFHDLIDP. The request then goes to the task-related user exit interface and then to the CICS database adapter transformer, DFHDBAT. (The task-related user exit interface is also referred to as the resource manager interface (RMI). These terms are defined and compared in "Glossary" on page 217, and you can find programming information about the task-related user exit interface in the *CICS/ESA Customization Guide*.)

CICS database adapter transformer (DFHDBAT)

The main responsibility of the CICS database adapter transformer, DFHDBAT (also referred to in IMS publications as the adapter, or adapter/transformer) is to communicate with the database resource adapter (DRA), which is described below. DFHDBAT constructs parameter lists for the DRA. These parameter lists enable CICS to connect to and disconnect from DBCTL, and enable DL/I requests to be processed. To summarize, DFHDBAT:

- Tells the DRA that it must initialize the interface to DBCTL in response to a request from the connection program (DFHDBCON).
- Tells the DRA when it must issue PSB schedule requests, DL/I requests, and syncpoint requests in response to a request from the CICS-DBCTL processor (DFHDLIDP).
- Tells the DRA that it must terminate the interface to DBCTL in response to a request from the disconnection program (DFHDBDSC). If an orderly disconnection has been requested, DFHDBAT ensures that all current CICS ***tasks*** using DBCTL complete before telling the DRA to terminate the interface. If an immediate disconnection has been requested, DFHDBAT ensures that only the current CICS-DL/I ***request(s)*** using DBCTL can complete before telling the DRA to terminate the interface.

CICS master terminal operators can use the CICS-supplied transaction CDBC to connect to and disconnect from DBCTL. They can also automate connection to DBCTL, as described in "Connection to DBCTL" on page 53.

Database resource adapter (DRA)

The functions of the database resource adapter (DRA) are to:

- Request connection to, and disconnection from, DBCTL.
- Tell CICS when a shutdown of DBCTL has been requested, or if DBCTL has failed.
- Manage threads. A CICS application thread provides a two-way link between an application and DBCTL. When a CICS transaction issues a DL/I request to DBCTL, the thread represents that CICS transaction in DBCTL. It identifies the transaction's existence, traces its progress, sets aside the resources it needs to be processed, and delimits its accessibility to other resources.
- Establish contact with the DBCTL address space and load the DRA startup parameter table. The DRA startup parameter table provides the parameters needed to define the interface to a DBCTL subsystem. (See "Defining the IMS DRA startup parameter table" on page 45, for a list of DRA startup table parameters.)

Components of DBCTL in IMS address spaces

The components of DBCTL that reside in IMS address spaces are:

- DBCTL
- DL/I separate address space (DLISAS)
- Database Recovery Control (DBRC)
- Internal resource lock manager (IRLM).

DBCTL

The DBCTL subsystem contains support and features required to process full function DL/I databases and DEDBs. Full function supports HSAM, SHSAM, HISAM, SHISAM, HDAM, and HIDAM databases. Each DBCTL subsystem is made up of three address spaces: DBCTL, DLISAS, and DBRC. A single DBCTL can service multiple CICS systems, but a CICS system can connect to only one DBCTL at a time. A CICS system can connect to one DBCTL, disconnect from it, and then connect to a different DBCTL.

DL/I separate address space (DLISAS)

DL/I separate address space (DLISAS), which is ***required*** with DBCTL, is a separate address space that contains DL/I code, control blocks, buffers for DL/I databases and program isolation (PI), which is DL/I's lock manager. (Lock management is the process of controlling concurrent requests.) You use PI for lock management unless you need the extra facilities provided by the IRLM, which is described below. For example, you need the IRLM if you are data sharing with another DBCTL subsystem, with local DL/I, or with an IMS/VS DB/DC or IMS/ESA DM/TM system. See the *IMS/ESA System Administration Guide* for guidance information on PI.

Database Recovery Control (DBRC)

Database Recovery Control (DBRC) is an IMS facility that supports log management, recovery control, and database sharing by providing the necessary information to subsystems, batch programs, and utilities. DBRC is required with DBCTL for log control and can optionally be used for database recovery control and data sharing. See "Database recovery control (DBRC)" on page 82 for information on DBRC and logging, and the *IMS/ESA Operations Guide* for more general information on using DBRC.

Internal resource lock manager (IRLM)

The internal resource lock manager (IRLM) is a global lock manager that is a feature of IMS and resides in its own address space. In simple configurations, you do not need to use the IRLM; program isolation (PI) locking is sufficient. However, you must use the IRLM to maintain data integrity if you are sharing databases at block level. (For VSAM databases, a block is a control interval (CI); for any other kind of database, it is a physical block.) You also need the IRLM if you need to process a set of common databases from multiple IMS/ESA (or CICS/ESA) subsystems. The IRLM is also the lock manager used by DATABASE 2 (DB2), and so you may prefer to use it with DBCTL if you already use, or intend to use, DB2. See the *IMS/ESA System Administration Guide* and the *IMS/ESA Operations Guide* for more information on the IRLM.

Summary of DBCTL components in CICS and IMS

Figure 3 summarizes the major components in a simple CICS-IMS DBCTL environment. Each separate box represents an address space. All the components shown in Figure 3 except the IRLM are mandatory.

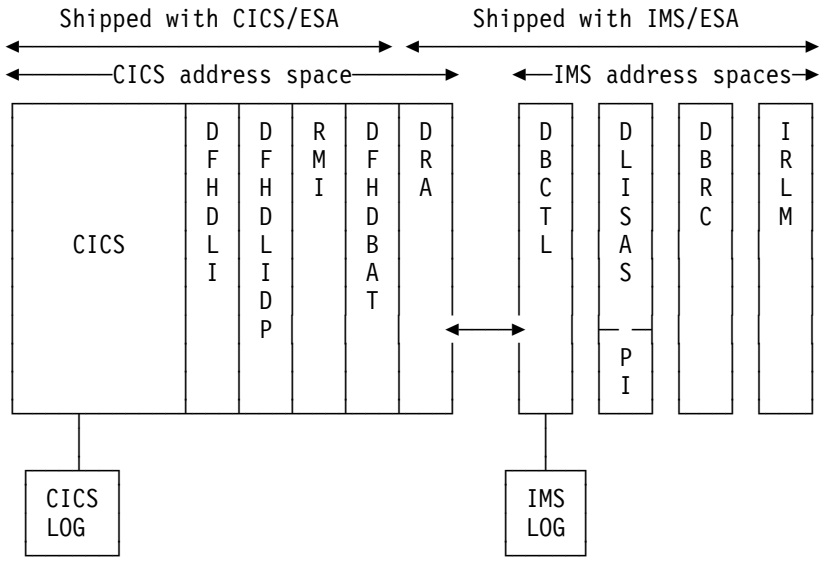

Figure 3. Major components of a simple CICS-IMS DBCTL environment

Coordinator control subsystem (CCTL)

The coordinator control subsystem (CCTL) is the transaction management subsystem that communicates with the DRA, which in turn communicates with DBCTL. In a CICS-DBCTL environment, the CCTL is CICS. The term CCTL is used in a number of DBCTL operator commands and in the IMS manuals. CICS users of DBCTL should take the term CCTL to mean a CICS system that is attached to IMS by means of DBCTL.

Resources you can access from a CICS environment that includes DBCTL

Figure 4 summarizes the resources you can access from a CICS environment that includes DBCTL.

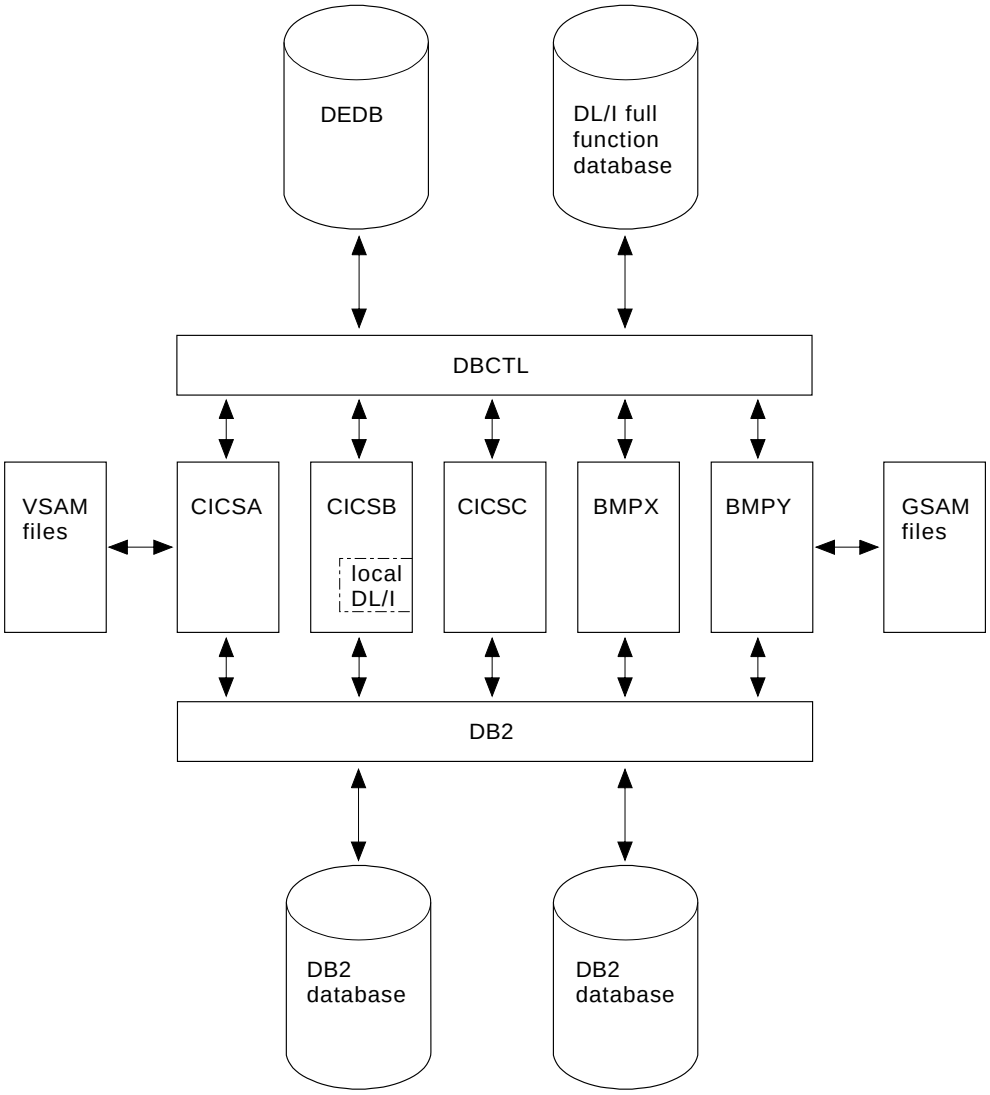

Figure 4. Resources you can access from a CICS environment that includes DBCTL

A single CICS task can use DB2 tables, IMS databases (using DBCTL, local DL/I, or remote DL/I), and CICS-managed local or remote resources (for example, VSAM files).

The CICS-DB2 and the CICS-DBCTL interfaces are similar in that they both use the task-related user exit interface, and have a two-phase commit process. However, they differ in a number of respects. For example, CICS supports DBCTL, local DL/I, and remote DL/I, and has to determine at PSB schedule time which of them is being used. For more information, see “Support for existing methods of DL/I” on page 16. For introductory guidance on DB2, see the *DB2 General Information* manual.

Chapter 2. Benefits of using DBCTL

The benefits of using DBCTL are in the following main categories:

- Function
- System availability
- Performance.

The aims of DBCTL are to provide CICS users with additional function, a release independent interface, to remove DL/I code from the CICS address space, to improve throughput on multiprocessors, and to make operations more flexible.

Function

The functional benefits that DBCTL offers are in the areas of:

- Data availability
- Batch message processing programs (BMPs)
- System service requests
- Access to data entry databases (DEDBs).

Data availability

If you do not use DBCTL, and a database is unavailable when CICS tries to schedule a program specification block (PSB), the transaction receives a return code to say that the schedule has failed. DBCTL enables CICS to take advantage of the data availability that IMS provides; you can successfully schedule a PSB, even though some of the databases used in that PSB are unavailable.

Scheduling for database recovery is more flexible because database blocks (or CIs) that have had read or write errors are still available after a DBCTL restart.

See “Enhanced scheduling” on page 105 for more information on data availability and the system service requests you can use in connection with it.

Batch message processing programs (BMPs)

Running batch jobs (both CICS shared database and “native” IMS batch jobs) as BMPs enables you to use system service requests, such as symbolic checkpoint (CHKP) and extended restart (XRST), and to access GSAM databases, which you cannot do with CICS shared database. With BMPs, all logging goes to a single log (the IMS log), which eliminates the need for separate batch logs. BMPs also support automatic backout, and automatic restart from the last checkpoint (without requiring JCL changes). BMPs communicate directly with the DBCTL address space instead of accessing databases through CICS, and enable concurrent access to databases without the need to use IMS data sharing. Using BMPs gives a performance advantage compared with the same programs running as CICS shared database jobs, both in terms of the elapsed time of the batch jobs themselves, and in terms of transaction response and throughput, because they do not delay the CICS online workload as much. See “Batch message processing programs (BMPs)” on page 108 for more information.

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System service requests

Your CICS application programs can use the following IMS system service requests in addition to those related to data availability:

- DEQ (in its command or call format) releases segments that were retrieved using the LOCKCLASS keyword or the Q command code. LOCKCLASS and Q enable an application program to reserve segments for its use.
- LOG (in its command or call format) can be used to write a record from an application program to the IMS log. You may prefer to use this instead of EXEC CICS journal commands so that all your DBCTL information is on the IMS log instead of the CICS log.

See Chapter 7, “Application programming considerations” on page 99 for more information on using these requests.

Access to data entry databases (DEDBs)

Data entry databases (DEDBs) provide the same features as HDAM databases (with the exceptions of secondary indexing and logical relationships). They also have a number of advantages. Using DEDBs enables you to have very large databases with high availability. DEDBs are designed to provide efficient storage and fast online gathering, retrieval, and update of data, using VSAM entry sequenced data sets (ESDSs).

DEDBs are hierarchic databases that can contain up to 127 segment types. One of these segments is always a root segment. The remaining 126 segments can either be direct dependent (DDEP) segments, or 125 DDEP segments and one sequential dependent (SDEP) segment. A DEDB structure can have as many as 15 hierarchical levels.

DEDBs are made up of database records stored in a set of up to 240 areas. Each area contains a range of database records (which you can specify using the DEDB randomizing routine) that contain the entire logical structure for a set of root segments and their dependent segments. Areas are independent of each other, are individually recognized, can be accessed by multiple programs and DEDB utilities, are the basis for recovery procedures, and are largely transparent to application programs.

DEDBs provide the following advantages:

- Large databases
  - Areas can be as large as 4 gigabytes, and because you can have up to 240 areas in a single database, you can use very large databases, which you would have to partition if you were not using DEDBs.
- Flexible design
  - Each area can be designed to meet your storage, availability, performance, and application needs. Areas can be separately reorganized and reacquired.
  - You use the DEDB direct reorganization utility to physically reorganize DEDBs to reduce ESDS fragmentation without taking them offline.

- Increased data availability
  - If a DEDB area is not available, a PSB requiring that database can still be scheduled provided the area it requires is not the one that is unavailable and, of course, the database itself is available. A PSB that requires an unavailable area is still scheduled, and receives a status code indicating the condition. You can therefore delay recovery until it is convenient to take the area offline.
  - You can have up to seven copies of the same area. Each copy is called an area data set (ADS) and all are automatically maintained in synchronization. This is called multiple area data set (MADS) support. Write operations are done to each ADS, but read operations are done from only one ADS. With MADS, read and write errors are much less common because, if data cannot be read from, or written to, the first copy, the next copy will automatically be used. Read errors are transparent to application programs (except in the rare instance where a read operation is unsuccessful with all ADSs).
  - You can use DEDB utilities, which are run on an area basis and can be run online concurrently with online update. This helps to reduce the time for which areas have to be taken offline. For example, you can avoid using offline database recovery by using the DEDB area data set create utility. This online utility makes a new corrected copy of an area from existing copies of that area. It creates one or more copies from multiple DEDB ADSs during online transaction processing, enabling application programs to continue while the utility is running.
  - You use the DEDB initialization utility to initialize one or more data sets or one or more areas of a DEDB offline.
  - You can use the DEDB area data set compare utility if you suspect you may have problems with compatibility of data. It compares control intervals (CIs) of different copies of an area, and lists all the CIs that do not have equal content. In the case of unequal comparison, full dumps of up to ten unmatched CIs are printed out on the device you have specified.
- Efficient data retrieval and entry
  - DEDB attempts to physically write DDEP segments hierarchically in the same CI as the parent segment, which can make retrieval faster.
  - The SDEP segment (located at the end of the ADS) is designed especially for fast, online, mass insert in applications such as data collection, auditing, and journaling. This is because SDEP segments for an area are stored rapidly, regardless of the root on which they are dependent. For example, in a banking application, transaction data can be collected during the day and inserted as SDEPs in an account database. At the end of the day, these transactions can be reprocessed by first retrieving them using the sequential dependent scan utility. This online utility retrieves SDEP segments in mass and copies them to a sequential data set. You can then process this data set offline using your own programs; for example, for a statistical analysis. The area involved remains available while the utility is running.
  - You can delete SDEPs using the DEDB sequential dependent delete utility, which deletes SDEP segments within a specified limit of a DEDB area.

  - The ability to use high speed sequential processing (HSSP), which is available from IMS/ESA Version 3 onwards. HSSP is useful with applications that do large scale sequential updates to DEDBs. HSSP can reduce DEDB processing time, enables an image copy to be taken during a sequential update job, and minimizes the amount of log data written to the IMS log. For further guidance, see "DBCTL data returned to IMS log" on page 186.

- Improved performance
  - Pathlength is reduced because DEDBs use the MVS Data Facility Product (MVS/DFP) Media Manager offering.
  - You can improve speed of access, or concurrent access, to DEDBs by tuning DEDB buffer pool specifications. (See "IMS monitor reports with DBCTL" on page 183.)
  - Logging overhead is reduced because only after-images are logged and because logging is done during syncpoint processing only.
  - The amount of I/O needed for each SDEP segment inserted can be very low, because SDEPs are gathered from various transactions, stored in last-in first-out order in one buffer, and are written out only when that buffer is full. This means that many transactions "share the cost" of SDEP writes.
  - Most DEDB processing is done in parallel to allow multithreading. Writes to the database are done by a number you specify (up to 255) of parallel processes called output threads. Furthermore, the DEDBs are not updated during application program processing, but the updates are kept in buffers until a syncpoint occurs. (See "When updates are written to databases" on page 83.) This means that waiting applications can be processed sooner and improves throughput on multiprocessors.
  - DEDBs have their own resource manager and normally need to interact very infrequently with program isolation or the IRLM (unless you are using block level sharing). DEDBs maintain their own buffer pool.
  - You can use subset pointers in your application programs to speed up processing. A major problem in some applications is the need to process long twin chains of segments. Occasionally database design must be modified because some database records have excessively long twin chains. Subset pointers give direct access to subsets of long twin chains of segments, which can speed up application processing because segments located in front of the subset do not have to be searched. Each pointer points to the first occurrence of a subset in a range of direct dependent segments. See "Command codes to manage subset pointers in DEDBs" on page 100 and "Keywords and corresponding command codes" on page 103 for information about using subset pointers in application programs. (See the *IMS/ESA Database Administration Guide* for guidance on database structure.)

System availability

The benefits that DBCTL offers in the area of system availability are:

- Release independent interface
- Improved sharing of databases between multiple CICS systems
- Failure isolation
- Operational flexibility
- Ability to use XRF.

Release independent interface

You do not need to regenerate the DBCTL interface every time you upgrade your CICS or IMS system.

Improved sharing of databases between multiple CICS systems

With DBCTL, sharing of databases between multiple CICS systems is improved. CICS systems in the same MVS image can share databases with other CICS systems, with batch (as BMPs), and with IMS/ESA TM ***without the need for IMS data sharing***. Performance with DBCTL is better than using CICS database-owning regions (DORs) with multiregion operation.

Failure isolation

The interface is designed so that a failure in CICS should not cause DBCTL to fail, and a failure in DBCTL should not cause CICS to fail.

Operational flexibility

CICS and DBCTL are independent of each other; that is, CICS can be running while DBCTL is not, and vice versa. A CICS transaction, CDBC, is provided for you to connect to, and disconnect from, DBCTL dynamically. Another CICS transaction, CDBI, enables you to inquire on the status of the connection.

DBCTL enables you to do a number of operations online, including:

- Online image copy
- Online change
- Online reorganization for DEDBs.

These utilities are summarized below, see “Database utilities” on page 89 for more information.

Online image copy utility

The online image copy utility is used to create an as-is copy of your database while it is being updated. The copy can then be used for recovery purposes. This utility is used for HISAM, HDAM, and HIDAM databases only.

Online change utility

In many installations, it is important for the online system to be is available to users for most of the day. The online change utility enables you to update ACBLIBs, which contain PSBs and data management blocks (DMBs), and security information belonging to full function databases, without bringing down the system. For guidance information on this utility, see the *IMS/ESA System Administration Guide* and the *IMS/ESA Utilities Reference: Database* manual.

Online reorganization for DEDBs

As mentioned in “Access to data entry databases (DEDBs)” on page 10, the DEDB direct reorganization utility enables you to reorganize DEDBs without taking them offline.

Ability to use XRF

DBCTL users can use CICS or IMS support for the extended recovery facility (XRF) in either of the following ways:

- Standard DBCTL, in which the active is a standard DBCTL subsystem. The “alternate” is simply another standard DBCTL subsystem that is preinitialized and waiting for a restart command. You use this method with or without full CICS XRF support and you can have more than one preinitialized DBCTL in the same MVS image. (***This method is for users who do not have an IMS/ESA DM/TM system***.)
- If your CICS system is connected to an IMS/ESA DM/TM system to obtain DBCTL support, you can use IMS XRF facilities. In this case, your active and alternate DBCTL subsystems are the standard IMS active and alternate. (***This method is for users who already have an IMS/ESA DM/TM system***.)

See Chapter 8, “Extended recovery facility (XRF)” on page 123 for more information.

Performance

The benefits that DBCTL offers in the area of performance are:

- Virtual storage constraint relief
- Improved throughput on multiprocessors.

Virtual storage constraint relief

If you do not use DBCTL, DL/I code and its associated control blocks (including DBRC) reside in the CICS address space. If you do use DBCTL, all this is moved out of the CICS address spaces, freeing virtual storage within CICS systems that currently contain local DL/I.

| From CICS/ESA Version 3 onwards, you can obtain further virtual storage constraint relief because DFHDBAT and the DBCTL scheduling blocks are placed above the 16MB line. See Chapter 11, “Statistics, monitoring, and performance” on page 177 for more information.

Improved throughput on multiprocessors

Because the components of the CICS-DBCTL interface reside in separate address spaces and, because DBCTL uses a separate task control block (TCB) for each application thread, throughput on multiprocessors is improved and there can be more concurrent activity. See “Data available for a CICS-DBCTL system” on page 177 for more information on thread and TCB performance considerations.

Chapter 3. Migration considerations for DBCTL

Considerations for migrating from local DL/I to DBCTL include:

- Reasons for migrating to DBCTL
- A description of continued support for existing methods of DL/I
- CICS-IMS release compatibility
- Migration paths and procedures based on your current system setup
- Planning your new DBCTL setup
- Considerations for running DBCTL and local DL/I together.

See Appendix A, “Migration task summary and fallback considerations” on page 195 for checklist of tasks to be done to migrate to DBCTL, and a list of fallback considerations.

See the *CICS/ESA Migration Guide* and the *IMS/ESA Release Planning Guide* for information on migrating to CICS/ESA Version 4 and to IMS/ESA respectively.

Reasons for migrating to DBCTL

We assume you have read Chapter 2, “Benefits of using DBCTL” on page 9 before reading this section.

We recommend all CICS-DL/I users to migrate to DBCTL. Using DBCTL will be of particular interest to you if any of the following apply to your installation:

- You run many batch DL/I jobs.

  Using DBCTL, and converting your CICS shared database batch jobs and IMS batch jobs to BMPs will give you a number of benefits, as described in “Migrating CICS shared database batch jobs to BMPs” and “Migrating native IMS batch jobs to BMPs” on page 118.

- You are considering using IMS data sharing.

  DBCTL is an attractive alternative to data sharing because data can be shared between CICS systems and batch jobs within a single MVS image, but with additional functions. These functions are described in Chapter 2, “Benefits of using DBCTL” on page 9.

- You have a short batch window (that is, the time available for running batch jobs is decreasing).

  If you do not use DBCTL, you have two alternatives:

  – CICS shared database
  – IMS data sharing.

  DBCTL provides BMP support, which has performance benefits over CICS shared database, and overcomes the setup and log management needs of IMS data sharing.

- You have a need for continuous operations.

  DBCTL enables you to do online image copy for databases and online change for PSBs and DMBs, which should help quicken operations in this area.

- You want to use DBRC, but are short of virtual storage in CICS, or even if you already have DBRC but are short of virtual storage.

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We recommend you use DBRC to control the recovery of your DL/I databases. However, DBRC requires over 500KB of storage below the 16MB line within the CICS-DL/I address space (and another 400KB for the DBRC commands). If you do not have enough storage for this, you should consider using DBCTL, which takes DL/I and DBRC out of the CICS address space.

- You are currently using MRO with database-owning regions (DORs).

  DBCTL provides higher throughput than function shipping to a DOR.

- You currently have both CICS and IMS/VS DB/DC or IMS/ESA DM/TM in the same MVS image.

  If you already use IMS/VS DB/DC or IMS/ESA DM/TM and are therefore already accustomed to its resource utilization (mainly common system area (CSA) and operational aspects), you may want to convert your CICS-local DL/I systems to communicate with IMS/ESA DM/TM using CICS-DBCTL to get the benefits of DBCTL.

Support for existing methods of DL/I

CICS/ESA Version 4 enables you to continue using local DL/I and remote DL/I alongside DBCTL for the purpose of migration as described in "Local DL/I" and "Remote DL/I" on page 17. However, you should be aware that CICS/ESA 4.1 is the last release of CICS that is planned to support local DL/I. Access to DL/I databases in any future releases will be via DBCTL or remote DL/I only.

Local DL/I

CICS/ESA Version 4 enables you to continue accessing databases using local DL/I support; that is, through the existing CICS-DL/I interface. You do not need to have DBCTL installed or active if you want to use only local DL/I requests.

Note: You can no longer use IMS/VS 2.2 to access local DL/I databases with CICS/ESA 4.1.

See "Overview of DL/I request handling in CICS" on page 2 for a description of DL/I request processing and the coexistence of different types of DL/I request. Information about installing local DL/I is in the *CICS/ESA Installation Guide*.

You can access databases using a combination of local DL/I and DBCTL. However, you must arrange your databases so that all databases in a PSB are managed by ***either*** local DL/I ***or*** DBCTL. A PSB that contains databases from more than one environment cannot be scheduled. If you do try to do this, what happens depends on whether the PSB appears in the CICS PSB directory (PDIR), and is described in "Failures during PSB scheduling" and "Failures during DL/I request processing" on page 154. You can find information on defining PSBs in "PSB directories (PDIRs) and database directories (DDIRs)" on page 32 and "Generating DBCTL" on page 35.

If you have a CICS system that uses local DL/I and is also connected to DBCTL, you must use the same release of DL/I for both local DL/I and DBCTL.

Enhanced DL/I function, such as access to DEDBs, is available with DBCTL only, and not with local DL/I.

Batch jobs that use the ***CICS shared database*** facility cannot access databases owned by DBCTL. If you want to use CICS shared database jobs with DBCTL, you must migrate them to run as BMPs, which communicate directly with the DBCTL address space.

Remote DL/I

Remote database support remains in CICS/ESA for function-shipped DL/I requests. Your remote databases can be managed either by local DL/I or by DBCTL. As with local DL/I, databases within the same PSB must be managed by either local DL/I or DBCTL, but not both.

Function shipping supports the additional system service requests, DEDB requests, and enhanced scheduling (usually known as "data availability") supported by a DBCTL environment, all of which are described in Chapter 7, "Application programming considerations" on page 99.

In previous releases of CICS, you needed to perform additional system generation if you wanted to use CICS with IMS databases. From CICS/ESA Version 3 onwards, DBCTL and remote DL/I support are part of the CICS pregenerated system. This means that you do not need to perform a partial generation of CICS to set up a CICS system that supports DBCTL or function shipping of DL/I requests, provided that the same CICS system does not also support local DL/I. However, you will need to perform additional system generation, as with previous releases, if you want local DL/I support.

CICS-IMS release compatibility

The starting point for migration is a version of CICS prior to CICS/ESA Version 4 that is running with IMS/VS 1.3 or IMS/VS 2.2. The aim is to install CICS/ESA Version 4 and then IMS/ESA Version 3 or later. Table 2 shows which CICS and IMS releases can be used together, and whether they can be used with DBCTL, local DL/I, or both.

Table 2. CICS-IMS release compatibility

CICS	Local DL/I	DBCTL
CICS/MVS 2.1.2	IMS/VS 1.3 IMS/VS 2.2 IMS/ESA 3.1 IMS/ESA 4.1	----
CICS/MVS 3.1.1	IMS/VS 1.3 IMS/VS 2.2 IMS/ESA 3.1	IMS/ESA 3.1
CICS/ESA 3.2.1	IMS/VS 2.2 IMS/ESA 3.1 IMS/ESA 4.1	IMS/ESA 3.1 IMS/ESA 4.1
CICS/ESA 3.3	IMS/VS 2.2 IMS/ESA 3.1 IMS/ESA 4.1	IMS/ESA 3.1 IMS/ESA 4.1 IMS/ESA 5.1
CICS/ESA 4.1	IMS/ESA 3.1 IMS/ESA 4.1	IMS/ESA 3.1 IMS/ESA 4.1 IMS/ESA 5.1

Notes:

1. If you are migrating from a release prior to CICS/MVS Version 2, you may prefer to migrate to CICS/MVS Version 2 with local DL/I first rather than migrating directly to CICS/ESA Version 4. (See the *CICS/ESA Migration Guide* for more information.)
2. If you use CICS/MVS Version 2 with IMS/VS 1.3, you cannot use CICS support for XRF.
3. To use CICS/MVS 2.1.2 with IMS/ESA 3.1 or IMS/ESA 4.1 your CICS system must have the relevant SPE applied.
4. If you are using IMS data sharing, we strongly recommend that you install IMS/VS 2.2 before installing IMS/ESA Version 3 or later. This is because you cannot share databases between IMS/VS 1.3 and IMS/ESA Version 3 or later.
5. The IMS environments supported by CICS/ESA 3.3 when storage protection is active are:
   - DBCTL with IMS/ESA 4.1
   - DBCTL with IMS/ESA 5.1
   - Local DL/I with IMS/VS 2.2
   - Local DL/I with IMS/ESA 3.1
   - Local DL/I with IMS/ESA 4.1.
6. The IMS environments supported by CICS/ESA 3.3 when storage protection is ***not*** active are:
   - DBCTL with IMS/ESA 3.1
   - DBCTL with IMS/ESA 4.1
   - DBCTL with IMS/ESA 5.1
   - Local DL/I with IMS/VS 2.2
   - Local DL/I with IMS/ESA 3.1
   - Local DL/I with IMS/ESA 4.1.

   Any attempt to connect CICS/ESA 3.3 with storage protection active, to a DBCTL subsystem running IMS/ESA 3.1 results in CICS terminating the connection attempt abnormally. Message DFHDB8118 with return code 4 is sent to transient data destination CDBC, indicating that CICS detected that the release of IMS/ESA does not support the MVS subsystem storage-protection facility. CICS only allows connection to this DBCTL subsystem if storage protection is turned off.

Possible migration paths

This section outlines some possible migration scenarios to CICS/ESA 4.1 with DBCTL, based on your current setup.

CICS with local DL/I

CICS with local DL/I:

1. CICS/ESA 4.1 with local DL/I with IMS/ESA Version 3 or later
2. CICS/ESA 4.1 with local DL/I with IMS/ESA Version 3 or later and DBCTL (***optional***)
3. CICS/ESA 4.1 with DBCTL.

CICS with local DL/I and data sharing

1. CICS/ESA 4.1 with local DL/I with IMS/ESA Version 3 or later data sharing in a single-MVS environment
2. CICS/ESA 4.1 with local DL/I with IMS/ESA Version 3 or later and DBCTL with data sharing (***optional***)
3. CICS/ESA 4.1 with DBCTL without data sharing.

CICS with shared database

1. CICS/ESA 4.1 with local DL/I with IMS/ESA Version 3 or later CICS shared database
2. CICS/ESA 4.1 with DBCTL and BMPs — CICS shared database programs converted to BMPs.

CICS with IMS data sharing and batch

1. CICS/ESA 4.1 with local DL/I with IMS/ESA Version 3 or later and data sharing with batch in a single-MVS environment
2. CICS/ESA 4.1 with DBCTL and BMPs without data sharing — batch programs converted to BMPs in a single-MVS environment.

CICS with function shipping

1. CICS/ESA 4.1 with IMS/ESA Version 3 or later, local DL/I — multiple MRO regions — TORs, AORs, and DORs
2. Multiple CICS/ESA 4.1 systems using DBCTL — DBCTL replaces DORs.

CICS with IMS/VS DB/DC or IMS/ESA DM/TM

CICS with IMS/VS DB/DC or IMS/ESA DM/TM (scenario 1)

1. CICS/ESA 4.1 with local DL/I and IMS/ESA DM/TM version 3 or later data sharing (possibly in a multi-MVS environment)
2. CICS/ESA 4.1 with IMS/ESA TM Version 3 or later via DBCTL in a single-MVS environment.

CICS with IMS/VS DB/DC or IMS/ESA DM/TM (scenario 2)

1. CICS/ESA 4.1 with IMS/ESA DM/TM Version 3 or later via LU 6.1 in a single-/MVS environment or multi-MVS
2. CICS/ESA 4.1 with IMS/ESA DM/TM Version 3 or 4 via DBCTL (application program rewritten) in a single-MVS environment.

CICS with XRF

CICS with XRF (scenario 1):

1. CICS/ESA 4.1 and XRF with local DL/I with IMS/ESA Version 3 or later in a single-MVS environment
2. CICS/ESA 4.1 and XRF with preinitialized DBCTL in a single-MVS environment.

CICS with XRF (scenario 2):

1. CICS/ESA 4.1 and XRF with local DL/I IMS/ESA Version 3 or later in a multi-MVS environment
2. CICS/ESA 4.1 and XRF with preinitialized DBCTL in a multi-MVS environment.

CICS with XRF (scenario 3):

1. CICS/ESA 4.1 and XRF with IMS/XRF or IMS/ESA DM/TM Version 3 or later in a single-MVS environment
2. CICS/ESA 4.1 and XRF with IMS/XRF in a single-MVS environment. (In this case, you use new applications or rewritten LU 6.1 applications, or IMS data sharing).

CICS with XRF (scenario 4):

1. CICS/ESA 4.1 and XRF with IMS/XRF or IMS/ESA DM/TM Version 3 or later in a multi-MVS environment
2. CICS/ESA 4.1 and XRF with IMS/XRF in a multi-MVS environment. (In this case, you use new applications or rewritten LU 6.1 applications, or IMS data sharing).

Suggested migration procedure

If you already use CICS with DL/I, we suggest you migrate as follows:

- Install MVS/ESA (without changing your CICS or IMS systems).
- Install IMS/ESA Version 3 or later.
- Install CICS/ESA 4.1 with IMS/ESA Version 3 or later running locally and put these systems into production together. (At this stage, there are no great changes in the CICS-DL/I environment.)

After you have done the above, plan how to install and set up DBCTL and put it into production. You will probably want to migrate to DBCTL in stages, perhaps as follows:

1. Set up a test system. If you already have a test system that is used for testing new applications, consider using it for testing migration to DBCTL.
2. If you do not want to begin with a test system, begin by setting up a trial production system, perhaps one you already use for testing existing production applications problems.
3. Set up a production DBCTL.

You then:

- Generate DBCTL, DLISAS, and DBRC.

  You must use DBRC with DBCTL. If you are not familiar with using DBRC, you should use it initially just to control log facilities. To do this, specify SHARECTL when you install DBRC, but do not register databases.
- Decide which applications to migrate.
- We recommend that you take full image copies of databases before migrating them to use DBCTL. This is because information for CICS-DL/I databases is on both the CICS and the IMS logs. Taking an image copy will ensure that the

RECON is updated, and information for that database will be from the IMS log only. See the *IMS/ESA Operations Guide* for information on taking image copies, and the *IMS/ESA Utilities Reference: Database* manual for information on the utilities you can use to do so.

- If you intend to convert CICS shared database programs to BMPs, do so at this stage.
- Ensure that all your CICS shared-database batch jobs that use DL/I calls are sensitive to I/O PCBs. If not, convert them. Check for DL/I log requests. (In a DBCTL-exclusive environment, DL/I log requests go to the IMS log, not the CICS system log.)
- Convert any programs that use DFHFC TYPE=DLI macros to issue DL/I commands or calls instead. Note that from CICS/ESA 3.2.1 macro level programming is no longer supported, so this step may already have been done as part of the general migration procedure.
- Convert production CICS/ESA 4.1 systems.
- Tune CICS-DBCTL.
- Convert batch jobs to BMPs (they must issue checkpoints).
- If you are migrating your CICS shared database programs or "native" IMS batch programs to BMPs, we recommend that you define PSBs in DBCTL security generation.

  # **Note:** If you run the application with CICS Local DL/I (which IMS treats as a
  # batch job), IMS allows path inserts without the PROCOPT=P parameter.

  # IMS issues status code AM if a CICS online program or a CICS shared
  # database program issues an ISRT call with the D command code when
  # the program does not have the PROCOPT=P parameter specified in the
  # DB PCB that was referenced in the call. IMS batch programs, however,
  # do not need the PROCOPT=P parameter to issue an ISRT call with the
  # D command code unless the program uses field level sensitivity.

  # If you then convert to DBCTL, and run the application in a BMP region
  # (which IMS treats as online processing rather than batch), you are no
  # longer permitted to use path inserts without the PROCOPT=P
  # parameter.

  For information on doing this, see Chapter 9, "Security checking with DBCTL" on page 143.
- Consider DEDBs for new applications.

Planning your new DBCTL setup

- If you are running multiple CICS regions, each with its own copy of local DL/I,
| we recommend that you migrate all your local DL/I systems to use a single DBCTL. If you are running the same applications that schedule the same PSBs on each of your CICS systems, but access different instances of the same databases, migrating to a single DBCTL means that you will need a separate DBD and separate PSBs for each instance of a database. However, your applications could continue to schedule the same PSBs because there is a CICS global user exit available to DL/I users which may help with migration to a single DBCTL in this case. It is called XDLIPRE, and it enables you to change the PSB name that the application program has scheduled at execution

time. Appendix E, “Using global user exit XDLIPRE to change PSB to be scheduled” on page 211 contains an example of XDLIPRE that you can copy and modify. Note that this example is provided for guidance only. See the *CICS/ESA Customization Guide* for programming information on using these exits.

- You have a remote DL/I environment, in which you are running multiple CICS AORs that function ship DL/I requests to a DL/I resource owning CICS region in the ***same*** MVS image. In this case, you could replace the DL/I resource-owning region with DBCTL. However, if you are function shipping DL/I requests to a DL/I resource owning CICS region in a ***different*** MVS image (as shown in Figure 5), you cannot replace the DL/I resource owning region with a DBCTL subsystem. This is because CICS and DBCTL can only communicate with each other when they are in the same MVS image. However, the DL/I resource owning CICS region could use DBCTL instead of local DL/I, as shown in Figure 6. In this case, you keep the DOR, but it communicates with DBCTL; that is, DBCTL replaces local DL/I, but not the DOR.

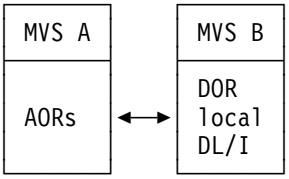

Figure 5. Function shipping to a DOR in a different MVS image with local DL/I

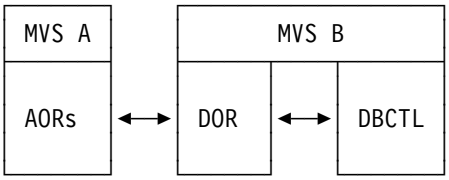

Figure 6. Function shipping to a DOR in a different MVS image with DBCTL

- CICS/ESA 4.1 systems running in a separate MVS image from DBCTL must function ship their DL/I requests to a CICS/ESA 4.1 system located in the same MVS image as DBCTL.
- If you want batch programs to run concurrently with CICS, and you do not already use IMS data sharing or DBRC:
  - Install DBRC in the existing CICS system and become familiar with it before migrating to DBCTL; or
  - Install DBCTL and use DBRC to control logs only. Run the batch programs as BMPs. When you are familiar with this environment, extend your usage of DBRC to control database integrity.
- You have an IMS data sharing environment, in which you are running multiple CICS systems that are data sharing with one another and with batch, and all the data sharing is taking place within a single-MVS environment. In this case, you could consider migrating completely to a single DBCTL within an MVS image instead of using data sharing. If you do this, you should migrate all the DL/I batch jobs involved to BMPs, which will simplify log management.

You can use IMS data sharing across multiple DBCTLs in a single- or multi-MVS environment.

- If you use IMS data sharing, but you need DBCTL to remove the need for batch logs, you can either run batch programs as BMPs using DBCTL and data share the DBCTL region with the CICS-local DL/I region(s), or migrate all your DL/I applications to use DBCTL. Because of the need to become familiar with DBCTL logging and the way DBRC controls it, you will probably prefer to use the first alternative as a “stepping stone” to the second.
- If your current CICS is sharing databases with IMS/VS DB/DC or IMS/ESA DM/TM using IMS data sharing, it may be appropriate to migrate to using the IMS/VS DB/DC or IMS/ESA DM/TM region as the DBCTL region.

Setting up test and production systems

You should bear the following points in mind when setting up your test and/or production systems.

Using local DL/I with DBCTL

If you already use data sharing, you may find it easier to begin with multiple CICS subsystems data sharing with each other using local DL/I. This enables you to migrate CICS subsystems to DBCTL one at a time.

If, as part of your migration process, you want to access both local DL/I and DBCTL from a single CICS system, you need to plan very carefully which databases to migrate from local DL/I to DBCTL. This is because a PSB can be scheduled only if all the databases contained in it are controlled by local DL/I or by a particular DBCTL. You must find a set of PSBs that not only encompasses all usages of the database, but also all usages of all the other databases referred to by the set of PSBs. For example, if you have four PSBs containing databases A,B; B,C; C,D; and D,E; respectively, you cannot migrate one database without migrating the rest.

Number of DBCTL subsystems to use

You will need to determine the number of DBCTLs you require in a single-MVS environment; for example, one DBCTL subsystem for the whole MVS image, or one DBCTL subsystem for each CICS system in single-MVS environment. You should balance the number of DBCTLs within a single MVS image against the amount of CSA needed. You should also be aware of the need to differentiate DBCTL systems on the same MVS image to avoid causing any confusion between subsystems.

We recommend that you have only one production DBCTL in a single-MVS environment. Normally, this should be large enough to serve all CICS/ESA 4.1 systems within one MVS image. For multiple CICS systems with local and remote DL/I, running in several MVS images using IMS data sharing, count the number of DL/I threads needed. If the sum of these threads, plus the number of expected active BMPs is less than 255, you should need only one DBCTL without data sharing.

You need one log for each DBCTL, so bear in mind that logging can become more complex the more DBCTLs you have. You should balance the need for multiple DBCTLs against the logging procedures you will need. However, log throughput

time should be improved compared with local DL/I, because DBCTL uses the write ahead data set (WADS), which can reduce the elapsed time needed for a log write.

ACBLIB considerations

In a mixed local DL/I and DBCTL environment, you should bear in mind the need for ACBLIBs for local DL/I and DBCTL. You need one ACBLIB for local DL/I and two ACBLIBs for DBCTL if you are using online change. In this case, you can either choose not to use online change, or have separate ACBLIBs. You can have separate ACBLIBs because local DL/I and DBCTL use separate PSBs, and should use separate databases in a non-data-sharing environment.

Running DBCTL and local DL/I together

Considerations for running DBCTL and local DL/I together while migrating to DBCTL fall into the following main categories:

- Storage required
- Awareness of where resources are located
- The need for separate procedures.

These considerations are summarized below. You can find more detailed task-oriented information about using local DL/I and DBCTL together in the rest of this book, where appropriate.

Storage

Check that you have enough storage to run both local DL/I and DBCTL. Before starting DBCTL, check that you have enough CSA. This is particularly important if you intend to run a test and a production DBCTL. See “Tuning a CICS-DBCTL system” on page 188 and the *IMS/ESA System Administration Guide* for further guidance on storage estimates for DBCTL.

Location of resources

When running local DL/I with DBCTL, it is particularly important to be aware of the location of the resources you are using. You need a clear separation of JCL libraries and procedures between local DL/I and DBCTL.

Check that the PSB directory (PDIR) is correctly defined so that you know whether a PSB will be scheduled in DBCTL or local DL/I. For example, preparing a PDIR and a database directory (DDIR) that do not specify PSBs and DMBs for applications that are in DBCTL enables you to continue using local DL/I at the same time as DBCTL, but you should be sure you know which applications you can use in which system.

Finding out where the PSB is located is a first stage in problem determination, as described in “Failures during PSB scheduling” on page 154. You must also be aware of the location of PSBs and databases for recovery purposes. For example, if you need to run forward recovery you must know whether you need to use the CICS system log or the DBCTL log, depending on where your database is located. If you are already using DBRC with local DL/I, make sure that you are aware which databases belong to DBCTL, and which to local DL/I.

Separate procedures

When running DBCTL and local DL/I, you should bear in mind the need for separate procedures for system and resource definition, operations, recovery, security, problem determination, and performance tuning. You will need to retain any existing procedures for local DL/I alongside those described for DBCTL in the rest of this book.

Chapter 4. Installing DBCTL, and defining CICS and IMS system resources

Installing DBCTL and defining CICS and IMS system resources involves:

- Installing and generating DBCTL, presented in the form of a checklist
- Defining CICS system resources in a DBCTL environment and the effects on system definitions in an existing DL/I environment
- Generating a DBCTL subsystem, including some examples of JCL you can copy to provide a basic DBCTL subsystem
- Starting DBCTL, DLISAS, and DBRC
- Defining the IMS DRA startup parameter table, including some example JCL
- Customizing DBCTL by means of a user-replaceable program and two global user exits.

Checklist for installing and generating DBCTL

In this checklist, we assume that you have already installed CICS/ESA 4.1 and IMS/ESA 3.1 or higher, and have read the *Program Directory* for each product to check for any PTFs or APARs that you may need, as recommended in the *CICS/ESA Installation Guide*. This checklist is an example from which to develop your own procedures for installing DBCTL, which will depend on the DBCTL facilities you decide to use. When developing your own checklist, refer to the *IMS/ESA Installation Guide* and the *IMS/ESA System Definition Reference* manual for further guidance on IMS installation and system definition.

CICS/ESA 4.1 supplies a DBCTL installation verification procedure, DFHIVPDB. For more information about this IVP, see *CICS/ESA Installation Guide*.

Using DBCTL instead of local DL/I simplifies installation, because you do not have to perform a partial system generation of CICS in order to use DL/I resources. (From CICS/ESA Version 3 onwards, you do not have to do a partial system generation if you use remote DL/I support.) However, if you use local DL/I you ***will*** have to perform a partial system generation. See the *CICS/ESA Installation Guide* for help on doing so.

1. You can leave CICS system initialization parameters unchanged if you are using local DL/I with DBCTL; you need change them only when you want to remove local DL/I support. At that point, change the DLI= parameter to DLI=NO, and remove the parameters that relate to local DL/I. For a list of these parameters, see “Reviewing CICS SIT parameters” on page 29. For more information on DL/I system definition in CICS, see the *CICS/ESA System Definition Guide*.
2. Prepare a PDIR and DDIR that do ***not*** specify PSBs or DMBs for an application that is to be migrated to DBCTL for testing. (See “PSB directories (PDIRs) and database directories (DDIRs)” on page 32.)
3. Instead of the previous step, you may prefer to run a test CICS with DLI=NO specified in the system initialization table (SIT) to ensure that all DL/I requests are passed to DBCTL, and not to local DL/I. (See “Reviewing CICS SIT parameters” on page 29.)

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4. Perform DBCTL startup. (See “Starting DBCTL, DLISAS, and DBRC” on page 45.)
5. Update system procedure libraries; for example, SYS1.PROCLIB, with the startup procedures for DBCTL, DLISAS, DBRC, and the IRLM (if you are using it). (These startup procedures are in the IMS.PROCLIB library.)
6. Check that DBCTL has been fully installed, integrated with MVS, and that all required online data sets have been allocated and initialized, where applicable. (For further guidance on doing this, see the *IMS/ESA Installation Guide*.)
7. Perform an ACB generation to create members of the IMS.ACBLIB, if you have not done this already.

   An ACB generation should have been performed when CICS with local DL/I was migrated to IMS/ESA 3.1 or later. DBCTL can use ACBs generated for a local DL/I (IMS/ESA 3.1) environment, but you should not simply include existing ACBLIBs in the DBCTL and DLISAS JCL. We recommend that you use a pair of new, separate, ACBLIBs, which will enable you to use the IMS online change facility. You ***can*** copy them from, say, CICS.LOCAL.ACBLIB into a DBCTL.ONLINE.ACBLIBA and DBCTL.ONLINE.ACBLIBB but, if you do this, you should be aware that you might copy some invalid (that is, pre-IMS/ESA 3.1) ACBs. To avoid this, start with empty ACBLIBA and ACBLIBB libraries, and regenerate ACBs as required.
8. If you intend to use dynamic allocation, create DFSMDA members. (See “IMS dynamic allocation macro (DFSMDA)” on page 43.)
9. Start DBCTL. DBCTL will issue a start command for DLISAS and DBRC. This requires the DLISAS and DBRC JCL procedures to be in SYS1.PROCLIB. (See “Starting DBCTL, DLISAS, and DBRC” on page 45.)
10. Test DBCTL, for example by using the DBCTL operator command /DISPLAY to verify that DBCTL recognizes the PSBs and DBDs you defined in the DBCTL generation. (See “Finding out current status of DBCTL activities” on page 68.)
11. Check your log archiving setup works before doing any more testing. (See “Log control with DBRC” on page 42.) If it does not, the IMS logs may eventually fill and stall the system.
12. Assemble a DRA that will enable CICS to connect to DBCTL. (See “Defining the IMS DRA startup parameter table” on page 45.)
13. Start CICS and test the connection to DBCTL, using the CDBC transaction. (See “CDBC transaction for connect and disconnect” on page 56.)
14. Generate an initialization PLT, so that CICS can connect to DBCTL automatically at startup time. (See “Connecting DBCTL to CICS automatically” on page 54.)
15. Test the application(s) you defined to DBCTL.
16. Set up and test recovery and restart of CICS and DBCTL, and database recovery. (See Chapter 6, “Recovery and restart operations” on page 77.)

Defining CICS resources

This section tells you how defining system resources is changed with DBCTL.

System initialization table (SIT)

The CICS system initialization table (SIT) contains information needed to initialize and control system functions and the initialization process. It also contains module suffixes to enable you to choose between different versions of CICS modules and tables. You can generate several SITs and select the one that best meets your current requirements at initialization time. If you have more than one CICS system, each can use a different SIT.

Specifying DL/I support in the SIT

Before CICS/ESA version 3, specifying DLI=YES in the SIT meant that both local and remote DL/I support were present in the CICS system using that SIT. Specifying DLI=NO meant that no DL/I support was present. From CICS/ESA Version 3 onwards, DBCTL support is present in all cases regardless of how you specify DLI. You need only change the SIT if you want to include (or exclude) local DL/I or function shipping in a particular CICS system. The DLI= options have the following meanings from CICS/ESA Version 3 onwards:

- DLI=NO — you can access DBCTL databases ***only***. (This is the default.)
- DLI=REMOTE — you can access DBCTL and remote databases.
- DLI=YES — you can access DBCTL, remote, and local databases.

See the *CICS/ESA System Definition Guide* for more details about these parameters.

Reviewing CICS SIT parameters

If you are using DBCTL exclusively, many CICS SIT parameters are replaced by DBCTL ***generation*** parameters, and you will need to change what you specify for others because DL/I code has been removed from the CICS address space.

Table 3 on page 30 lists the CICS SIT parameters relevant to DL/I. It states whether each parameter applies in a DBCTL-only, local-only, or remote-only environment (in the **D**, **L**, and **R** columns, respectively). Where applicable, it lists the corresponding IMS startup parameter that applies to DBCTL. Finally, it mentions special considerations for DBCTL.

See the *CICS/ESA System Definition Guide* for the syntax of CICS SIT parameters. See “Generating DBCTL” on page 35 for more information about the IMS and DBCTL parameters mentioned in this table. See “Defining the IMS DRA startup parameter table” on page 45 for information about DRA startup table parameters.

Table 3 (Page 1 of 2). CICS SIT parameters and DBCTL

CICS SIT parameter	D	L	R	IMS/DBCTL startup parameter	Comments
APPLID	Y	Y	Y	N/A	The generic VTAM application identifier for this CICS system.
DBP	Y	Y	Y	N/A	Version of dynamic transaction backout program to be included in CICS.
DBUFSZ	N	Y	N	N/A	Size of dynamic backout buffer. For local DL/I, relate to average transaction update activity. Still applies with DBCTL (for example, for file activity), but no allowance is needed for DL/I activity itself.
DDIR	N	Y	N	N/A — use DATABASE macro	For local DL/I, suffix of DDIR. With DBCTL, DDIR is created during DBCTL generation, using the DATABASE macro.
DLDBRC	N	Y	N	N/A	DBRC to be included in CICS. DBRC is a mandatory part of DBCTL subsystem specified in DBCTL stage 1 macros.
DLI	N	Y	Y	N/A	DL/I to be included. DBCTL is always present. Use if you want local or remote DL/I. See “Specifying DL/I support in the SIT” on page 29.
DLIRLM	N	Y	N	IRLM and IRLMNM	With local DL/I, specifies whether local DL/I is to be connected to the IRLM. With DBCTL, if you use the IRLM, you specify it in DBCTL stage 1 macros, or during startup.
DLIOLIM	N	Y	Y	N/A	Maximum number of I/O errors allowed for each DL/I database. When this number is exceeded for a database, CICS attempts to stop that database. Any new schedule requests for that database will fail. Any tasks that have the database scheduled are allowed to continue until they issue a DLI TERM call or a CICS SYNCPOINT, or the task finishes.
DLLPA	N	Y	N	SRCH	Reentrant DL/I modules are to be used from the LPA, if possible. With DBCTL, you specify this in the DBCTL startup JCL.
DLMON	N	Y	N	N/A — use /TRACE command	DB monitor to be active in CICS system. With DBCTL, you can use the IMS monitor online, with the /TRACE command. See “Controlling tracing of DBCTL events” on page 68.
DLTHRED	N	Y	N	N/A — use MAXREGN, MINTHRD, and MAXTHRD	Number of DL/I threads to be used by CICS-DL/I interface. With DBCTL, you specify minimum and maximum threads in the DBCTL stage 1 macros and in the DRA startup parameter table.
DLXCPVR	N	Y	N	N/A — use IOBF	OSAM buffer pool to be page-fixed when using local DL/I. DBCTL owns the OSAM buffer pool and you specify its size using the DFSVSMxx member in the DBCTL startup JCL.
DMBPL	N	Y	N	N/A — use BUFPOOLS and DMB	Size of DMB pool. This pool is part of the DBCTL subsystem. You can specify its size in DBCTL generation using the BUFPOOLS macro, and override it at startup using DMB.
DSALIM	Y	Y	Y	N/A	Upper limit of the total amount of storage within which CICS can allocate the individual dynamic storage areas (DSAs) below the 16M byte line. See *CICS/ESA System Definition Guide* and the *CICS/ESA Performance Guide* for information about specifying DSALIM. See the *IMS/ESA System Administration Guide* for guidance on DBCTL storage estimates.

Table 3 (Page 2 of 2). CICS SIT parameters and DBCTL

CICS SIT parameter	D	L	R	IMS/DBCTL startup parameter	Comments
EDSALIM	Y	Y	Y	N/A	Upper limit of the total amount of storage within which CICS can allocate the individual dynamic storage areas (EDSAs) above the 16M byte line. For more information, see the *CICS/ESA System Definition Guide* and the *CICS/ESA Performance Guide* for information on specifying EDSALIM. See the *IMS/ESA System Administration Guide* for guidance on DBCTL storage estimates.
ENQPL	N	Y	N	N/A — use IMSCTF	Maximum amount of storage to be used for the program isolation ENQ blocks, if used. With DBCTL, you specify it in DBCTL stage 1 macros.
INITPARM	Y	N	N	N/A	Used to pass parameters to programs (for example, PLT programs) during CICS startup. With DBCTL, you can use it to specify DRA startup parameter table suffix and DBCTL identifier to automate connection to a particular DBCTL. INITPARM applies to COLD, WARM, or EMERGENCY starts of CICS. With XRF, INITPARM applies only if the active CICS was not connected to DBCTL. Otherwise, the alternate CICS is automatically connected to the same DBCTL as the active.
PDIR	N	Y	Y	N/A — use APPLCTN	Suffix of the PDIR. With DBCTL, the PDIR is generated during DBCTL generation using the APPLCTN macro.
PISCHD	N	Y	N	N/A	PISCHD=YES specifies program isolation scheduling. Applies only if DLIRLM=NO is specified. If DLIRLM=YES is specified, anything you specify for PISCHD is ignored. PISCHD=NO specifies segment intent scheduling. IMS/ESA 4.1 does not support intent scheduling. If you are using local DL/I with IMS/ESA 4.1, there is no need to specify PISCHD, because program isolation scheduling is automatically used. In IMS/ESA 4.1, anything you do specify for PISCHD is overridden, and message DFHDL3944I is issued if PISCHD=NO is specified.
PSBCHK	N	Y	Y	N/A	With local DL/I, requests security checking of a remote terminal initiating a transaction using transaction routing.
PSBPL	N	Y	N	N/A — use CSAPSB and DLIPSB parameters	Specifies size of local DL/I PSB pool. DBCTL owns the PSB pool, and you use the BUFPOOLS macro to specify its size at DBCTL generation.
RST	Y	N	N	N/A	Suffix of recoverable service table (RST), which contains alternative DBCTL IDs to which CICS can try to connect, and which is used by CICS XRF with DBCTL. See Chapter 8, “Extended recovery facility (XRF)” on page 123.
XPSB	Y	Y	Y	N/A	Security class name by which PSBs are defined to RACF. For DBCTL, you specify the RACF resource class to be used to security check PSBs. (See the *CICS/ESA CICS-RACF Security Guide* for more information.)

PSB directories (PDIRs) and database directories (DDIRs)

PSB directories (PDIRs) contain entries defining each PSB to be accessed using local DL/I. They also contain entries for remote PSBs, to which requests will be function-shipped using remote DL/I. Database directories (DDIRs) contain a list of data management blocks (DMBs) that define, for local DL/I, the physical and logical characteristics of databases that are used by application programs.

If you are using DBCTL exclusively, you do not need to generate a PDIR or a DDIR for CICS. Instead you must define PSBs and DMBs using the IMS macros APPLCTN and DATABASE respectively. (For information on the APPLCTN and DATABASE macros, see “Generating DBCTL” on page 35.)

If you are using local DL/I, you need a PDIR and a DDIR for local resources. To do this, you use the CICS macros DFHDLDBD and DFHDLPSB, as described in the *CICS/ESA System Definition Guide*.

If you want to function ship requests to a CICS system, at which the database manager may be DBCTL, local DL/I, or remote DL/I (function shipping), you will need to generate a PDIR but ***not*** a DDIR. See the *CICS/ESA System Definition Guide* and the *CICS/ESA Resource Definition Guide* for details about defining PDIRs and DDIRs.

CICS routes DL/I requests to local DL/I, remote DL/I, or DBCTL according to the PSB that is named. If the PSB appears in the CICS PDIR, the request is routed to local DL/I or remote DL/I (that is, function shipped to another CICS system). If the PSB does not appear in the CICS PDIR, and CICS is connected to DBCTL, CICS routes the request to DBCTL.

DD statements

You must put the following two modules, which appear in the IMS.RESLIB library, in the CICS STEPLIB data set concatenation:

- The DRA startup parameter table—DFSPZPxx (where xx is the user-defined suffix)
- The DRA startup router program — DFSPRRC0.

You can do this by placing a DD statement for IMS.RESLIB in the CICS STEPLIB concatenation (which must be APF-authorized). For example:

```
//STEPLIB   DD  DSN=CICS410.SDFHAUTH,DISP=SHR
//          DD  DSN=IMS.RESLIB,DISP=SHR
```

IMS.RESLIB (which must also be APF-authorized) contains a default DRA startup table, in which the suffix is set to 00. You can generate your own versions into this library. If you decide to use a ***different*** library for your own versions, make sure it is APF-authorized, and is included in the CICS STEPLIB concatenation.

The DRA will dynamically allocate the IMS.RESLIB library using the DD name CCTLDD and the data set name IMS.RESLIB, unless either has been overridden in the DRA startup parameter table.

DD statements removed from CICS JCL in a DBCTL-exclusive environment

DFSCTL

For DBCTL, DFSCTL is not required. DBCTL owns the OSAM buffer pools, which are specified in DBCTL startup JCL and in the DRA startup parameter table. See “Database buffer specifications and option parameters” on page 44 and “Defining the IMS DRA startup parameter table” on page 45.

DFSRESLB

For DBCTL, DFSRESLB is not required. DFSRESLB is replaced by the DRA dynamically allocating IMS.RESLIB as described in “DD statements” on page 32.

IEFRDER

Used to define DL/I batch logging. For DBCTL, DL/I logging is to the IMS log. See “Defining IMS logging parameters” on page 43.

IMSMON

With DBCTL, you can start and stop the IMS monitor dynamically. See “Using the IMS monitor” on page 185.

IMSACB

For DBCTL, IMSACB is in the DBC procedure and the DLS procedure. There are additional DD statements — IMSACBA and IMSACBB. One is the active library and the other is available for the IMS online change utility.

DFSVSAMP

For DBCTL, DFSVSAMP is not used. The information it contains, for example, VSAM buffer parameters and performance and trace options, is in the DFSVSMxx member of IMS.PROCLIB in the PROCLIB DD statement of the DBCTL startup procedure (DBC). The DFSVSMxx member must be available to DLISAS, which means that you must add a data set with member DFSVSMxx to the DLISAS address space. The last two characters of the DFSVSM member are a suffix, which you specify in the VSPEC parameter of the DBCTL startup procedure (DBC).

RECON data sets

RECON data sets are generally specified in DFSMDA IMS dynamic allocation members in the IMS.RESLIB library. See “IMS dynamic allocation macro (DFSMDA)” on page 43. For DBCTL, RECON data sets can be specified in the DBRC procedure.

JCLPDS

For DBCTL, JCLPDS is in the DBRC procedure.

JCLOUT

For DBCTL, JCLOUT is in the DBRC procedure.

Database DD statements

Generally, you specify database DD statements in DFSMDA IMS dynamic allocation members in the IMS.RESLIB library. For DBCTL, they can be specified in the DLS address space for DL/I databases, or in the DBC address space for DEDBs.

DFHJ01X

You do not need a DD statement for the emergency CICS system log data set, DFHJ01X because, with DBCTL, all DL/I logging is to the IMS log. However, you may still want to specify DFHJ01X and the CRUCIAL extent because the CICS system log is still used as normal for CICS-owned recoverable resources; for example, the CSD and APPC, if you are using it. For background information on CICS recoverable resources, see the *CICS/ESA Recovery and Restart Guide*.

CICS-supplied groups within CICS system definition

Program, transaction, and mapset entries for the CICS system definition (CSD) file to provide DBCTL support are supplied in the group DFHDBCTL. This includes the DBCTL connection and disconnection transaction, CDBC, the inquiry transaction, CDBI, and the operator transaction, CDBM. DFHDBCTL is in DFHLIST, which contains the CICS resource definitions needed to run IBM-supplied transactions that must be installed in your system. Also in DFHLIST is the DFHEDP group, which provides the program definition required to run EXEC DLI applications. The group DFHEDP must always be installed in the CICS system. If you need further information on DFHLIST, see the *CICS/ESA Resource Definition Guide*.

To add recovery and restart capabilities for DBCTL, install the CICS resource definition online (RDO) groups DFHJRNL (for CICS journals), and DFHAKP (for CICS activity keypoints used to provide records for CICS journals).

You may also want to specify the following options of the TRANSACTION definition for transactions using DBCTL:

- RESTART

  This option defines whether or not CICS will attempt to restart a transaction that has been backed out after a failure. (See “Deadlocks and interactions with automatic restart” on page 96.)

- SPURGE

  We recommend that you specify SPURGE(YES) so that the transaction can be purged using CEMT. “Purging a transaction that is using DBCTL” on page 73 tells you how to use CEMT in this way.

Log management

All DBCTL-related information is sent to the IMS log, not the CICS system log. This method of logging uses the IMS log utilities and the online log data sets (OLDS) and write-ahead data sets (WADS). Because database change records are written to the IMS log, you do not need to retain the CICS system log for use by IMS database recovery utilities in a DBCTL-exclusive environment. IMS logging operations are described in “IMS logging” on page 41.

Monitoring control table (MCT)

If you are already using local DL/I, and are converting to DBCTL, you can remove the entries for the DL/I event monitoring points (EMPs) from the monitoring control table (MCT) when you are no longer using local DL/I. However, you will need additional monitoring control table (MCT) entries if you want to provide support for the monitoring information returned from DBCTL. These MCT entries are in CICS410.SDFHSAMP in the copy member DFH$MCTD.

Program list table (PLT)

To connect CICS to DBCTL at CICS startup time, you must invoke it in the second stage of program list table postinitialization (PLTPI) processing (that is, the third stage of CICS initialization). You do this by including an entry for DFHDBCON (the DBCTL connection program) using the DFHPLT macro. See the *CICS/ESA Resource Definition Guide* for help on using the DFHPLT macro. If you are using XRF, you must also do this for your alternate CICS subsystems. CICS will then invoke DFHDBCON after takeover, passing the same DBCTL startup table suffix as was being used by the active CICS system when the failure occurred.

Including an entry for DFHDBCON in the PLT enables you to connect automatically to the same DBCTL as when the system was last shut down, or to a different one. For more information on doing this, see "Connecting DBCTL to CICS automatically" on page 54.

Destination control table (DCT)

You will need a CDBC entry in the destination control table (DCT) for the CDBC transient data queue. The CDBC transient data queue is used for messages issued by the CICS-DBCTL interface.

In CICS/ESA 3.2.1 and later, you can suppress or reroute messages sent to transient data queues such as CDBC. You can reroute from CDBC to a list of consoles, from CDBC to a different transient data queue, or reroute console messages to CDBC. For programming information on coding the CICS-supplied user exit used to re-route messages, and on the example user exit provided to help you do so, see the *CICS/ESA Customization Guide*.

Generating DBCTL

You generate the appropriate IMS control blocks and resource definitions for a DBCTL subsystem by performing an IMS system definition. IMS system definition is a two-stage process with an optional preprocessor. Stage 1 checks your input specifications (appropriate JCL and macro statements, which are described below) and generates a series of MVS/ESA job steps for stage 2. Stage 2 builds IMS system libraries, execution procedures, and the DBCTL control program. The optional preprocessor is a convenient tool that checks for duplicate names and checks the length and format of the names used as input for stage 1.

Defining the DBCTL subsystem

IMS uses macro statements for system definition. These macro statements define the operating systems, operating system interfaces, storage pools, PSBs, and databases. From some of these macro statements, DBCTL constructs a set of control blocks with which to execute.

To define the environment in which DBCTL operates, you use DBCTL startup parameters and control information in a number of IMS system data sets. You then use the appropriate suffixes to specify the information to be used for a particular DBCTL run. (This is similar to selecting CICS tables by specifying their suffixes in the SIT or in SIT overrides.)

The IMS system generation macros you need are listed in "IMS system generation macros used by DBCTL" on page 36. See the *IMS/ESA System Definition*

Reference manual for guidance on the syntax of these macros. Appendix B, “Illustration of DBCTL startup parameter creation and selection” on page 201 shows how DBCTL startup parameters are created and selected during startup. If you are new to IMS system definition, you may find it helpful to refer to this illustration while reading the information on generating DBCTL.

IMS system generation macros used by DBCTL

- IMSCTRL

  The first macro in a DBCTL system generation is IMSCTRL. It is always required and there can be only one within each IMS system definition. IMSCTRL describes the MVS system under which IMS executes, the type of IMS system, the type of generation to be performed, and the components of the IMS environment, for example, IRLM and DBRC. Note that, because DBRC is mandatory for DBCTL, you do not need to specify the IMSCTRL parameter, DBRC=YES. (If you do specify this parameter, it is ignored.) You can use IMSCTRL to cause the IMS nucleus and/or the DDIR and PDIR to be regenerated.

  – MAXREGN

    MAXREGN is the number of regions (threads) that DBCTL will allocate at startup. This can be from 1 through 255. It can increase dynamically to a maximum of 255. Each BMP needs one region. Each connected CICS needs from MINTHRD to MAXTHRD regions. See also MINTHRD and MAXTHRD, which are used to specify the minimum and maximum numbers of threads for a particular CICS system, as described in “Defining the IMS DRA startup parameter table” on page 45. For information on how these parameters interact, see “Monitoring DBCTL—transaction level data” on page 180. (MAXREGN is not the only parameter you need in IMSCTRL, but we mention it here to contrast it with MINTHRD and MAXTHRD.)

- APPLCTN

  You use the APPLCTN macro to name PSBs (one macro for each PSB) that are to be used by application programs to access databases through DBCTL.

  If multiple CICS transactions or BMPs are to schedule a PSB concurrently, the APPLCTN macro for that PSB must specify SCHDTYP=PARALLEL. ***If you do not specify SCHDTYP=PARALLEL, only one transaction at a time will be able to schedule a PSB***. You can change the SCHDTYP of a PSB using the online change process and the /MODIFY command, which you enter at the DBCTL console. See “Changing DBCTL resources online” on page 70 for more information about the online change process and the /MODIFY command.

  In DBCTL, PSBs used by CICS transactions can be defined either with the TP option or the BATCH option. In the example in Figure 7 on page 39, we have used the BATCH option. Figure 7 also includes an example of defining a PSB for the CDBM operator transaction.

  The CICS-local DL/I equivalent of APPLCTN is DFHDLPSB, which is used to create a PDIR entry.

- BUFPOOLS

  You use the BUFPOOLS macro to specify default main storage buffer pool sizes for DBCTL, including the size of the DMB and PSB pools. You can override these values at startup using the CSAPSB=, DLIPSB=, and DMB= parameters.

- DATABASE

  You use DATABASE macro statements to define the databases that DBCTL will access (one macro for each database). Each physical database must be referenced on a DATABASE macro statement. You can change this resource through the online change process using the /MODIFY command, which you enter at the DBCTL console. See “Changing DBCTL resources online” on page 70 for more information on the /MODIFY command.

  The CICS equivalent of DATABASE is DFHDLDBD, which is used to create a DDIR entry.

- FPCTRL

  The FPCTRL macro statement defines the fast path options when DEDBs are used. You need to use this macro only if you want DEDB support.

  Note: For DBCTL users, fast path support refers only to DEDBs. Parameters that begin with FP refer to DEDBs in a DBCTL-exclusive environment.

- IMSCTF

  The IMSCTF macro statement includes parameters to define the SVCs to be used by DBCTL (as is the case with local DL/I), logging options, and the device type for DBCTL’s restart data set.

- SECURITY

  The SECURITY macro statement enables you to specify optional security features to be in effect during IMS execution, unless they are overridden during system initialization.

  If you are implementing IMS security, the security maintenance utility is used to place descriptions of protected resources into suffixed members of a matrix data set called IMS.MATRIX.

  The IMS.MODBLKS data set is used as input to the security maintenance utility, which means that:

  – The IMS system generation has to be completed before the security maintenance utility can be run

  – The security maintenance utility will use IMS.MODBLKS members that have the same suffix as you specified for the IMS.MATRIX members about to be created (as the second parameter of the security maintenance utility EXEC statement).

  For more information about security with DBCTL, see Chapter 9, “Security checking with DBCTL” on page 143.

- IMSGEN

  The IMSGEN macro statement must be the last system definition macro in the Stage 1 input. It specifies the assembler and linkage editor data sets and options, and the system definition output options and features. It specifies the suffix character for the IMS nucleus (DFSVNUCx in IMS.RESLIB) and for the DDIR (DFSDDIRx) and PDIR (DFSPDIRx) in IMS.MODBLKS. Note that you must specify the MACLIB parameter of the IMSGEN macro as MACLIB=ALL when using DBCTL for the first time.

Implementing CICS-supplied transaction, CDBM

CICS/ESA 4.1 provides a transaction, CDBM, which enables DBCTL operator commands to be input from a CICS terminal (which must be a BMS supported device), as described in “CDBM operator transaction” on page 64. CDBM uses the AOI commands (available from IMS/ESA 5.1 onwards) that can be issued across the DRA interface between CICS and DBCTL. For more information, see “Issue IMS AIB call format” on page 100.

To use CDBM you must:

1. Have a DBCTL system running IMS/ESA 5.1, or later.
2. Generate, and add to the DBCTL system, a PSB named DFHDBMP. We recommend that you specify parallel scheduling for this PSB, to enable multiple CDBM transactions to be active at the same time. DFHDBMP need not have any associated PCBs. Example input for the PSBGEN is:

   ```
   PSBGEN LANG=ASSEM,PSBNAME=DFHDBMP,IOASIZE=1000
   ```

   The IOASIZE parameter must be large enough to cope with the largest AOI command issued. Large AOI commands can result from using wild cards. For example, issuing CDBM /START DATABASE D* results in a start command being issued for all database names beginning with D. See the *IMS/ESA Utilities Reference: System* manual for information on defining IOASIZE.

Modifying IMS system data sets using online change

You can modify the IMS system data sets MODBLKS, MATRIX, and ACBLIB using online change. Each of them must be present in the following copies:

- A staging library, which is identified by an unsuffixed DD statement (MODBLKS, MATRIX, ACBLIB), and is used offline only to prepare changes to the active library.
- An active and an inactive library, which are used in flip-flop mode and are identified by suffixed DD statements (MODBLKSA and MODBLKSB, and so on). The same parameter (MODBLKSx, where x= A or B) controls the active library for both MODBLKS and MATRIX. While the active library (either ...A or ...B) is being used online by DBCTL, you can use the online change utility to copy the contents of the staging library to the inactive library. You use a series of /MODIFY commands to perform the actual switch from the active library to the updated inactive library.

The IMS.MODSTAT data set, which is created during the IMS system generation and updated automatically, indicates which of the suffixed data sets is currently active. For guidance on using online change, see “Changing DBCTL resources online” on page 70 and the *IMS/ESA System Administration Guide*.

Example of JCL required to generate a basic DBCTL subsystem

The minimum generation required to generate DBCTL is ON-LINE,DBCTL. (You will need to perform an online generation to change the SVC numbers.) You must include the dash (-) in the ON-LINE parameter. If you do not, you will get the following messages when you try to generate DBCTL:

```
IEV254 *** MNOTE *** 7+ 4,G002 FOLLOWING OPERAND(S) OMITTED OR INVALID:
IEV254 *** MNOTE *** 8+ 4,      SYSTEM
```

You use an ACB generation to create members of the IMS.ACBLIB. See the *IMS/ESA Utilities Reference: Database* manual for further guidance on doing this.

Figure 7 shows an example DBCTL generation that you can copy and modify to generate a DBCTL subsystem. Note that this example includes only the parameters needed to get a “basic” system up and running. It does not include optional parameters, such as those for DEDB support, and it assumes that you will want to tune other parameters (such as the number of threads) later, when you have had an opportunity to see how the subsystem runs.

Note: You can, instead, use the IMS INSTALL/IVP dialog to generate stage 1 macros for DBCTL. For guidance on doing so, see the *IMS/ESA Installation Guide*.

```
//DBCGEN   JOB 1,PGMERID,
//         MSGCLASS=A,MSGLEVEL=(1,1),
//         CLASS=A,NOTIFY=PGMERID
//ASM EXEC PGM=IEV90,
// PARM='DECK,NOOBJECT',
//       REGION=4096K
//SYSLIB DD DSN=IMS.OPTIONS,DISP=SHR
//       DD DSN=IMS.GENLIB,DISP=SHR
//       DD DSN=IMS.GENLIBA,DISP=SHR
//       DD DSN=IMS.GENLIBB,DISP=SHR
//       DD SYS1.MACLIB
//*
//SYSUT1 DD UNIT=SYSDA,SPACE=(1700,(400,400))
//SYSUT2 DD UNIT=SYSDA,SPACE=(1700,(400,400))
//SYSUT3 DD UNIT=SYSDA,SPACE=(1700,(400,400))
//SYSPRINT DD SYSOUT=*
//SYSPUNCH DD DSN=IMS.STAGE2,DISP=SHR
//SYSIN    DD *
```

Figure 7 (Part 1 of 2). Example JCL to generate DBCTL

```
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
*                                                                       *
*  SAMPLE DBCTL SYSTEM DEFINITION STAGE 1 INPUT SPECIFICATIONS          *
*                                                                       *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
         IMSCTRL SYSTEM=(VS/2,(ON-LINE,DBCTL),3.1),                     X
               MAXREGN=(20,52K,A,A),                                    X
               MCS=(2,7),DESC=7,MAXCLAS=1,IMSID=IMSA
*
         IMSCTF SVCNO=(,203,202),                                       X
               LOG=(DUAL,MONITOR),                                      X
               RDS=(3380,4096),                                         X
               CPLOG=1000,CORE=(,50,1)
*
*        DEFINE SYSTEM BUFFERS
*
         BUFPOOLS PSBW=60000,DMB=10000,SASPSB=(20000,80000)
*
*        DEFINE DL/I DATABASES
*
         DATABASE RESIDENT,DBD=DI21PART
*
*        DEFINE SAMPLE APPLICATIONS
*
         APPLCTN PSB=DFHSAM04,PGMTYPE=BATCH,SCHDTYP=PARALLEL
         APPLCTN PSB=DFHSAM05,PGMTYPE=BATCH,SCHDTYP=PARALLEL
         APPLCTN PSB=DFHSAM14,PGMTYPE=BATCH,SCHDTYP=PARALLEL
         APPLCTN PSB=DFHSAM15,PGMTYPE=BATCH,SCHDTYP=PARALLEL
         APPLCTN PSB=DFHSAM24,PGMTYPE=BATCH,SCHDTYP=PARALLEL
         APPLCTN PSB=DFHSAM25,PGMTYPE=BATCH,SCHDTYP=PARALLEL
|        APPLCTN PSB=DFHDBMP,PGMTYPE=BATCH,SCHDTYP=PARALLEL
*
         IMSGEN ASM=(H,SYSLIN),                                         X
               ASMPRT=ON,                                               X
               LKPRT=(XREF,LIST),                                       X
               LKSIZE=(880K,64K),                                       X
               LKRGN=4096K,                                             X
               SUFFIX=1,                                                X
               SURVEY=NO,                                               X
               SYSMSG=TIMESTAMP,                                        X
               MACLIB=ALL,                                              X
               OBJDSET=IMS.OBJDSET,                                     X
               USERLIB=IMS.LOADLIB,                                     X
               PROCLIB=(YES,),                                          X
               NODE=(IMS,IMS,IMS),                                      X
               JCL=(GENJOB,                                             X
               (1),                                                     X
               PGMERID,                                                 X
               A,                                                       X
               (TIME=5,CLASS=K,NOTIFY=PGMERID)),                        X
               SCL=(99)
         END
```

Figure 7 (Part 2 of 2). Example JCL to generate DBCTL

For more detailed system definition examples and further guidance on selecting the appropriate system definitions, and for IMS system definition examples, see the *IMS/ESA System Definition Reference* manual.

IMS logging

IMS logging uses two types of data set: online log data sets (OLDS) and write ahead data sets (WADS). These data sets are described below. For further guidance on using the OLDS and the WADS, see the *IMS/ESA Operations Guide*.

IMS online log data set (OLDS)

IMS writes log records to a DASD data set called the online log data set (OLDS). The OLDS is made up of multiple data sets written in wraparound form. Using more than one OLDS enables IMS to continue logging when the first OLDS is full. Also, if an I/O error occurs while writing to an OLDS, IMS can continue logging by isolating the OLDS where the problem occurred and switching to another one.

IMS can write committed log records to the write-ahead data set (WADS) so that these records are externalized to avoid the need to write partially filled and padded log blocks to the OLDS. The WADS is described in "IMS write-ahead data set (WADS)."

When the OLDS is full, it is archived to the system log data set (SLDS). How frequently the OLDS is archived depends on whether you specified automatic archiving using the ARC=parameter in the DBC JCL. You can specify ARC=1 through ARC=99. Automatic archiving takes place only when the number of OLDS you specified is full. The system reuses the OLDS after it has been archived. An SLDS can be on DASD or on tape. The contents are used as input to the database recovery process.

IMS archives the OLDS using the log archive utility (DFSUARC0). During archiving, IMS can write a subset of the log records it writes to the SLDS to the recovery log data set (RLDS). This subset consists only of the log records required to perform a database recovery.

During logging, IMS writes system checkpoint ID information (including OLDS positioning information) to the restart data set (RDS). IMS uses the RDS during the restart process to determine from which checkpoint to begin a restart. (See the *IMS/ESA Operations Guide* for further guidance about the RDS.)

IMS write-ahead data set (WADS)

The main purpose of the write-ahead data set (WADS) is to contain a copy of committed log records that are in the OLDS buffers, but have not yet been written to the OLDS because the OLDS buffer is not yet full. IMS uses the WADS to avoid the need to write partially filled and padded blocks to the OLDS. WADS space is continually reused after the appropriate log data has been written to the OLDS. If there is a system failure, IMS uses the log data in the WADS to complete the content of the OLDS in use, and then closes the OLDS as part of an emergency restart. This is also an option of the IMS log recovery utility (DFSULTR0). (The OLDS must be closed before database recovery can take place.) You can change the following specifications for the WADS at any restart:

- Number of WADSs
- Sequence of WADSs
- WADSs data set names
- Use of single or dual WADSs.

Log control with DBRC

Database Recovery Control (DBRC) assists you in controlling DBCTL logs and in managing recovery of databases. With DBCTL, you ***must*** use DBRC to control DBCTL logs, and you may optionally use it to control batch logs and database recovery. DBRC places the information it uses to control recovery in the RECON data sets, which are required with DBCTL. These data sets include information about the OLDS; for example, it indicates whether an OLDS is available for use or contains data that must be archived.

You should define three RECON data sets when you install DBRC. Two of the RECON data sets are active; the third is a spare. For most purposes, you can think of the two active RECON data sets as a single RECON data set, or simply the RECON.

DBCTL requires DBRC to be at SHARECTL level; if it is not, DBCTL will not start. To initialize the RECON specify (or let it default to) INIT.RECON SHARECTL. Figure 8 shows some example JCL you can copy to initialize the RECON.

```
//INITREC JOB 1,PGMERID,CLASS=Q,MSGCLASS=A
//*
//RECON    EXEC PGM=DSPURX00,REGION=1000K
//STEPLIB  DD DSN=IMS.RESLIB,DISP=SHR
//DFSRESLB DD DSN=IMS.RESLIB,DISP=SHR
//SYSPRINT DD SYSOUT=*
//RECON1   DD DSN=IMS.RECON1,DISP=SHR
//RECON2   DD DSN=IMS.RECON2,DISP=SHR
//SYSIN    DD *
 INIT.RECON SSID(IMSA)
/*
```

Figure 8. Example JCL to initialize the RECON

If you already have a RECON, specify (or let it default to) CHANGE.RECON SHARECTL. When the OLDS is full, DBRC starts a log archive job. Skeleton JCL statements are edited by DBRC before the job is submitted. The skeleton JCL is member ARCHJCL of the library specified in the JCLPDS DD statement in the DBRC JCL. You do not have to wait for the OLDS to fill in order to test the automatic log archive. Instead, you can cause the OLDS to switch using the DBCTL operator command /SWITCH OLDS. Alternatively, you can use the /DBRECOVERY without the NOFEOV keyword. For guidance on the syntax of the /SWITCH and /DBRECOVERY commands, see the *IMS/ESA Operator's Reference* manual. (See also "Operator communication with DBCTL" on page 62 for information on using DBCTL operator commands.)

For detailed guidance on automatic log archiving and DBRC skeleton JCL, see the *IMS/ESA Utilities Reference: Database* manual. For further guidance on using DBRC, see the *IMS/ESA Operations Guide*.

Defining IMS logging parameters

You define IMS logging parameters in member DFSVSMxx in the IMS.PROCLIB, identified by DD name PROCLIB in the DBC and DLISAS JCL. You specify the suffix xx for DFSVSMxx in the DBCTL startup parameter VSPEC. For an illustration of the parameters involved, see Appendix B, "Illustration of DBCTL startup parameter creation and selection" on page 201. The logging parameters in DFSVSMxx include:

- Number of OLDS
- Number of OLDS buffers
- Selection of single or dual OLDS
- Number of WADS.

A further logging parameter, used to specify single or dual copies of the WADS is in the DBCTL startup parameters. See "Starting DBCTL, DLISAS, and DBRC" on page 45 for information about the DBCTL startup procedure.

You must preallocate the OLDS and WADS data sets and specify the block size when the data set is allocated. See the *IMS/ESA Installation Guide* for guidance on doing this.

You should provide dynamic allocation members for all OLDS and WADS data sets. See "IMS dynamic allocation macro (DFSMDA)."

Archiving

DBRC automatically submits a job to archive the OLDS when:

- IMS terminates
- The OLDS fills and logging switches to an empty OLDS
- You issue a /DBRECOVERY command without the NOFEOV keyword
- You switch the OLDS manually.

See the *IMS/ESA Operations Guide* and the *IMS/ESA Utilities Reference: Database* manual for guidance on implementing automatic archiving, and the *IMS/ESA Operator's Reference* manual for the syntax of the /DBRECOVERY command. (You can also use the /DBRECOVERY command without the NOFEOV keyword to test your implementation.)

IMS dynamic allocation macro (DFSMDA)

We recommend that you use the IMS dynamic allocation macro (DFSMDA) in all production databases, because:

- Allocation is controlled from a central point.
- You do not have to change DBCTL JCL or batch job JCL in order to change a data set name.
- It avoids possible confusion over which DBCTL address space requires the DD statement for a database, because the library with the DFSMDA members can be concatenated in the STEPLIB DD statement.
- If you do not use DFSMDA, DL/I database DD statements must be in the DLISAS (DLS) address space, and DEDB DD statements must be in the DBCTL (DBC) address space.

If you are migrating from IMS/VS Version 2 or IMS/ESA Version 3.1 with local DL/I, you may already be using dynamic allocation for local DL/I.

To use dynamic allocation, you need one member per database in the IMS.RESLIB library (or an authorized STEPLIB library), using the IMSDALOC procedure to assemble and link-edit the appropriate DFSMDA macros. See the *IMS/ESA System Administration Guide* for general guidance on dynamic allocation and the *IMS/ESA Utilities Reference: Database* manual for guidance on using the DFSMDA macro.

Database buffer specifications and option parameters

You define the VSAM and OSAM database buffer pool specifications and IMS performance and trace options in the DFSVSMxx member of the IMS.PROCLIB data set, which is pointed to by the PROCLIB DD statement of the DBCTL startup
| procedure (DBC). The last two characters of the DFSVSMxx member are a suffix. You specify this suffix in the VSPEC parameter of the DBCTL startup procedure. See the *IMS/ESA System Definition Reference* manual for guidance on the syntax of these parameters and the *IMS/ESA Database Administration Guide* for guidance on specifying the database buffer pool parameters. For an illustration of the parameters involved in DBCTL startup, see Appendix B, “Illustration of DBCTL startup parameter creation and selection” on page 201.

In local DL/I, you still specify both the buffer pools and the trace options using the DFSVSAMP DD statement.

Overriding DBCTL generation parameters at execution time

You can change many IMS system definition values at DBCTL startup using parameters on the DBC procedure. You can specify these override parameters on the PARM of the EXEC statement. However, there is a 100-character limit to the length of the PARM field you can specify on a JCL EXEC statement, which means
that you cannot override all possible DBC parameters in the JCL. A better
approach is to use member DFSPBDBC, which allows you to specify DBCTL
control region execution parameters that override those specified in the stage 1
macros. You can place several DFSPBDBC members in PROCLIB by replacing
the member name DFSPBDBC with DFSPBxxx, where xxx must be three
alphanumeric characters. The RGSUF= keyword in the DBC procedure specifies
the xxx suffix to be used during startup of the DBCTL control region. For more
information about DFSPBDBC, see the *IMS/ESA Installation Guide*.

Using local DL/I and DBCTL in a single CICS system

CICS with local DL/I must have an ACBLIB, and an ACBLIB must also be available for use by DBCTL. CICS with local DL/I and DBCTL ***can*** use the same ACBLIB, but we recommend that you use separate ones because, with DBCTL, you can change them using the online change utility. However, if you have CICS with local DL/I data sharing with DBCTL, you may prefer to use the same ACBLIB. When data sharing between CICS and DBCTL, you can make a change to the ACBLIB by coordinating a shutdown and restart of CICS with an online change on DBCTL.

Naming convention

The DBCTL display commands (for example, /DISPLAY ACTIVE and /DISPLAY CCTL, described in “Finding out current status of DBCTL activities” on page 68). and the DRA startup table USERID parameter, all use what is known in IMS and DBCTL as the CCTL ID to identify the transaction management subsystem. In the case of CICS, the CCTL is CICS and the ID is the CICS APPLID.

However, many IMS messages use the jobname of the CICS system instead. An example of this sort of message is DFS554, which notifies you that a BMP region, or a thread from a CICS transaction, has terminated abnormally. If the DFS554 message was caused by an abnormal termination of a thread that originated from ***CICS***, the message text contains the CICS job name or CICS startup procedure name. You will therefore need a naming convention that enables operators to immediately identify a corresponding CICS APPLID and CICS JOBNAME. For example, if you use the APPLID DBDCCICA, your job name could also contain the characters CICA.

Starting DBCTL, DLISAS, and DBRC

You use the procedure library member DBC that is supplied with DBCTL to start the DBCTL subsystem. The procedure is generated during IMS system definition and must be modified to fit your system's needs.

Also generated during system definition are procedures for DBRC and DLISAS, which are used to generate the DBRC and DLISAS address spaces. The DBRC
and DLISAS procedures are started automatically by DBCTL during DBCTL startup.

The region types specified for each one are:

```
PARM='DBC' for DBCTL
PARM='DRC' for DBRC
PARM='DLS' for DLISAS
```

All three procedures use positional parameters on the EXEC statement:

```
PARM='region type,parm1,parm2,parm3,...'
```

Many of the positional parameter defaults are specified during system generation, but you can override them with parameters you specify at execution time.

When all three address spaces have been started successfully, DBCTL issues the following message indicating it is ready to accept an appropriate restart command:

```
DFS989I IMS (DBCTL) READY (CRC=x) xxxx
```

where x is the command recognition character (CRC), as explained in "Operator communication with DBCTL" on page 62, and xxxx is the DBCTL sysid, as specified in the IMSID= parameter of the DBCTL startup JCL. See "Messages issued by DBCTL during startup" on page 204 for a list of other messages that should be issued at this stage.

See the *IMS/ESA System Definition Reference* manual for guidance on DBCTL procedures, including JCL and descriptions of parameters.

Defining the IMS DRA startup parameter table

The DRA startup parameter table provides the parameters needed to define the interface to the DBCTL subsystem. You create the DRA startup parameter table by assembling the DFSPRP macro and link-editing it into the IMS.RESLIB library (or another APF-authorized library) as DFSPZPxx, where xx=00, for the default, or any other alphanumeric characters. Unless your IMS RESLIB uses the default name IMS.RESLIB, supplied in DFSPZP00, you must specify the name you have chosen

in your version of the DRA. In our example, in “Example JCL to generate a DRA startup table” on page 49, we have used IMS.RESLIB.

Note: The macro used is DFSPRP, but the name of the module you must link-edit is DFSPZPxx. You must also link-edit the DRA into an authorized library that is part of the CICS STEPLIB concatenation.

The parameters for the DFSPRP macro are:

- DSECT=NO

  A DSECT statement for PZP will not be generated. You must specify this in order to create a CSECT, which is required in order to assemble the module DFSPZPxx.

- FUNCLV=

  The CCTL (in this case, CICS) functional level. The default (and the only valid value) is 1.

- DDNAME=

  A 1- to 8-character ddname to be used with dynamic allocation of the DRA RESLIB. The default is CCTLDD.

- DSNAME=

  A 1- to 44-character data set name of the DRA RESLIB. The default is IMS.RESLIB.

- DBCTLID=xxxx

  The 1- to 4-character name of the DBCTL address space. The default is SYS1. This parameter must be the same as the IMSID in the DBCTL startup procedure for the DBCTL to which you want this CICS to connect. You can connect multiple CICS systems to the same DBCTL, but a CICS system can connect to only one DBCTL at a time.

- USERID=xxxxxxxx

  CICS users do not specify this parameter; it is supplied by CICS itself. If you do specify anything, CICS will override it. However, we explain the USERID parameter here to show how it is used. USERID is the 1- to 8-character name of the CICS address space (or CCTLID). The value CICS supplies when it connects to DBCTL is either the CICS APPLID (in a non-XRF CICS environment) or the generic APPLID (in a CICS XRF environment). (The generic APPLID is the name of the active-alternate pair of CICS systems.)

- MINTHRD=xxx

  This parameter specifies the number of threads for this CICS system that will be created when CICS connects to DBCTL and will remain created while the DRA is active. These threads remain allocated until this CICS system is disconnected from DBCTL, except if a thread is stopped by a /STOP command or by a thread failure. Additional threads are created, up to the number specified in MAXTHRD, or the number specified in MAXREGN, or the maximum of 255, whichever of these is the lowest. These additional threads (not the MINTHRDs) are released when there is not enough system activity to require them. The maximum value you can specify for MINTHRD is 255, and the default is 1. For information on specifying values for MINTHRD, see “Monitoring DBCTL—transaction level data” on page 180. See also MAXREGN in “IMS system generation macros used by DBCTL” on page 36.

- MAXTHRD=xxx

  This parameter specifies the maximum number of transactions for which this CICS system can have PSBs scheduled in DBCTL. Any schedule requests that are over this limit are queued in the DRA. You can balance the load sent to a single DBCTL from multiple CICS systems by specifying appropriate values

for MAXTHRD in each CICS. Note that, prior to CICS/ESA 4.1, a transaction does not release a thread until the transaction itself terminates; the thread is retained after a DLI TERMINATE or CICS SYNCPOINT request. From CICS/ESA 4.1 onwards, a thread is released after a DLI TERMINATE or CICS SYNCPOINT request.

The maximum value you can specify for MAXTHRD is 255 (but it should not exceed the value specified for MAXREGN) and the default is 1, or the value you specified in MINTHRD. For information on specifying values for MAXTHRD, see “Monitoring DBCTL—transaction level data” on page 180. See also MAXREGN in “IMS system generation macros used by DBCTL” on page 36.

- TIMER=xx

  The frequency, in seconds, with which CICS is to repeat attempts to connect to DBCTL when connection has failed and the console operator has requested that CICS wait for connection in reply to a DFS690 message (rather than canceling the connection attempt). You can specify any value from 0 through 99. However, note that if you specify 0, the default value is used. The default is 60.

- CNBA=xxx

  The total number of DEDB buffers that will be allocated for this CICS system. The default is 0.

- FPBUF=xxx

  The number of DEDB buffers to be allocated and fixed per thread. The default is 0. See “IMS monitor reports with DBCTL” on page 183 for information defining DEDB buffer pools.

- FPBOF=xxx

  The number of DEDB overflow buffers to be allocated per thread. The default is 0. See “IMS monitor reports with DBCTL” on page 183 for information defining DEDB buffer pools.

  Notes:

  1. For DBCTL users, fast path support refers only to DEDBs. Parameters that begin with FP refer to DEDBs in the DRA startup table.
  2. You do not need the parameters CNBA, FPBUF, and FPBOF if you are not using DEDBs.
  3. For detailed guidance on specifying DEDB buffers, see the *IMS/ESA System Administration Guide*.

- TIMEOUT=xxx

  The amount of time, in seconds, that CICS should wait for the a DRA TERM request to complete. The maximum value is 999, and the default is 60. For guidance on what to specify, see the section on TIMEOUT in “CICS failure” on page 93.

- SOD=x

  The output class to be used for a snap dump of abnormal thread terminations. The default is A. See “Dumps produced by the DRA” on page 170 for more information on these dumps.

- AGN=xxxxxxxx

  The 1- to 8-character application group name (AGN). You need to use this parameter only if you have specified AGN security checking for DBCTL. There is no default. See Chapter 9, “Security checking with DBCTL” on page 143 for more information.

Example JCL to generate a DRA startup table

Figure 9 shows some example JCL you can copy to generate a DRA.

```
//DRAJOB   JOB 1,PGMERID,MSGCLASS=A,MSGLEVEL=(1,1),
//         CLASS=A,NOTIFY=PGMERID
//ASM EXEC PGM=IEV90,
//       PARM='DECK,NOOBJECT,LIST,XREF(SHORT),ALIGN',
//       REGION=4096K
//SYSLIB DD DSN=IMS.OPTIONS,DISP=SHR
//       DD DSN=IMS.GENLIB,DISP=SHR
//       DD DSN=IMS.GENLIBA,DISP=SHR
//       DD DSN=IMS.GENLIBB,DISP=SHR
//       DD DSN=SYS1.MACLIB,DISP=SHR
//*
//SYSUT1 DD UNIT=SYSDA,SPACE=(1700,(400,400))
//SYSUT2 DD UNIT=SYSDA,SPACE=(1700,(400,400))
//SYSUT3 DD UNIT=SYSDA,SPACE=(1700,(400,400))
//SYSPUNCH DD DSN=&&OBJMOD,
//       DISP=(,PASS),UNIT=SYSDA,
//       DCB=(RECFM=FB,LRECL=80,BLKSIZE=400),
//       SPACE=(400,(100,100))
//SYSPRINT DD SYSOUT=*
//SYSIN DD *
```

Figure 9 (Part 1 of 2). Example JCL to generate a DRA startup table

```
PZP      TITLE 'DATABASE RESOURCE ADAPTER STARTUP PARAMETER TABLE'
DFSPZP00 CSECT
*********************************************************************
*        MODULE NAME: DFSPZP00                                      *
*                                                                   *
*        DESCRIPTIVE NAME: DATABASE RESOURCE ADAPTER (DRA)          *
*                  STARTUP PARAMETER TABLE.                         *
*                                                                   *
*        FUNCTION: TO PROVIDE THE VARIOUS DEFINITIONAL PARAMETERS   *
*                  FOR THE COORDINATOR CONTROL REGION. THIS         *
*                  MODULE MAY BE ASSEMBLE BY A USER SPECIFYING      *
*                  THEIR PARTICULAR NAMES, ETC. AND LINKEDITED      *
*                  INTO THE USER RESLIB AS DFSPZPXX.  WHERE XX      *
*                  IS EITHER 00 FOR THE DEFAULT, OR ANY OTHER ALPHA- *
*                  NUMERIC CHARACTERS.                              *
*                                                                   *
*********************************************************************
         EJECT
         DFSPRP DSECT=NO,                                           X
               DBCTLID=IMSA,                                        X
               DDNAME=CCTLDD,                                       X
               DSNAME=IMS.RESLIB,                                   X
               MAXTHRD=99,                                          X
               MINTHRD=10,                                          X
               TIMER=60,                                            X
               USERID=,                                             X
               CNBA=10,                                             X
               FPBUF=,                                              X
               FPBOF=,                                              X
               TIMEOUT=60,                                          X
               SOD=A,                                               X
               AGN=
         END
/*
//LNKEDT EXEC PGM=IEWL,
//       PARM='LIST,XREF,LET,NCAL'
//SYSUT1 DD UNIT=SYSDA,SPACE=(1024,(100,50))
//SYSPRINT DD SYSOUT=*
//SYSLMOD  DD DSN=IMS.RESLIB,DISP=SHR
//SYSLIN   DD DISP=(OLD,DELETE),DSN=&&OBJMOD
//         DD DDNAME=SYSIN
//SYSIN    DD *
   NAME  DFSPZP00(R)
/*
```

Figure 9 (Part 2 of 2). Example JCL to generate a DRA startup table

Customizing DBCTL

This section provides information on facilities that you can use to customize DBCTL.

DFHDBUEX

DFHDBUEX is an IBM-supplied user-replaceable program that is invoked each time CICS connects to, and disconnects from, DBCTL. You can use DFHDBUEX to enable, or disable, CICS-DBCTL transactions at DBCTL connection and disconnection time. The transactions are available to be run if that DBCTL is connected. Users who attempt to enter one of these transactions when DBCTL is not connected are notified immediately that the transaction is unavailable. This means that end users will not be able to start one of these transactions, only to find that it fails because the database is unavailable.

To summarize, DFHDBUEX is invoked when:

- CICS has successfully connected to DBCTL.
- CICS is disconnecting from DBCTL, and has been notified that:
  - DBCTL has been terminated normally (using a /CHECKPOINT FREEZE or /CHECKPOINT PURGE command, as described in "Stopping DBCTL normally" on page 75).
  - The DRA has terminated abnormally.
  - DBCTL has terminated abnormally.
  - The menu transaction CDBC has been used to request disconnection from DBCTL.

See the *CICS/ESA Customization Guide* for programming information on DFHDBUEX.

Global user exits XDLIPRE and XDLIPOST

There are two global user exits — XDLIPRE and XDLIPOST. They are available to all DL/I users (that is, local and remote as well as DBCTL), and you can use them to intercept any Call level or EXEC level DL/I request on entry to and exit from DL/I. XDLIPRE is invoked before the DL/I request is processed. XDLIPOST is invoked after the DL/I request is processed. If you are using function shipping, the exits are invoked from the application owning region (AOR), and the database owning region (DOR). However, there are restrictions on what actions can be performed by an exit program running at exit point XDLIPRE or XDLIPOST in a DOR. For programming information on these exits, see the *CICS/ESA Customization Guide*.

To help with migration of applications from local DL/I to DBCTL, you can use XDLIPRE to change the PSB name that the application program has scheduled at execution time. There is an example of XDLIPRE in Appendix E, "Using global user exit XDLIPRE to change PSB to be scheduled" on page 211 that you can copy and modify. Note that this example is provided for guidance only. See the *CICS/ESA Customization Guide* for programming information on using these exits.

Another example of using the exits to ease migration from local DL/I to DBCTL concerns DBCTL enhanced scheduling, whereby the schedule of a PSB does not fail if one of the databases used by that PSB is unavailable. Instead, a status code

is set in the relevant PCB indicating the database is unavailable. This is different from local DL/I, where an 0805 response code would be set for CALLDLI programs, or a DHTE abend would occur for EXEC DLI programs, if any of the databases are unavailable. The XDLIPOST exit could be used, on return from a schedule request, to scan down the list of PCBs and, if any of the status codes indicate a database is unavailable, the XDLIPOST exit could change the UIB response codes to 0805. This would cause EXEC DLI programs to abend DHTE, and CALLDLI programs to receive an 0805 response. With this technique, DBCTL thinks that the PSB is still scheduled, so a new schedule request must not be attempted before the PSB is terminated either explicitly, by transaction termination, or by an abend. New applications should use the EXEC DLI ACCEPT STATUS GROUP(A) command to cope with DBCTL enhanced scheduling.

Global user exits XRMIIN and XRMIOUT

The global user exits XRMIIN and XRMIOUT enable you to monitor activity across the resource manager interface (RMI). XRMIIN is invoked just before control is passed from the RMI to a task-related user exit, and XRMIOUT is invoked just after control is returned to the RMI. You can use these exits to monitor DL/I activity; for example, control being passed to and from DFHDBAT for DBCTL requests, or DFHEDP for EXEC DLI. For programming information on using these exits, see the *CICS/ESA Customization Guide*.

Global user exits for XRF

If you use CICS support for XRF, global user exits XXDFA, XXDFB, and XXDTO are available to enable you to establish a takeover mechanism for DBCTL. See “Global user exits used” on page 125 for more information on using these exits.

Chapter 5. Operations with DBCTL

Operating DBCTL involves:

- Connecting to, and disconnecting from, DBCTL
- Using operator commands to communicate with DBCTL
- Dealing with messages from DBCTL and CICS.

Areas related to recovery are described in Chapter 6, “Recovery and restart operations” on page 77.

Connection to DBCTL

You can perform CICS and DBCTL startup from a TSO terminal or an MVS console. Before DBCTL can begin accepting transactions, several things must happen, as shown in Figure 10. The numbers in the figure and corresponding step numbers indicate the sequence of events.

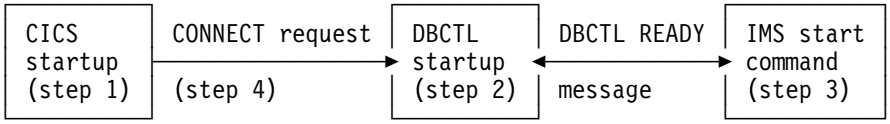

Figure 10. Connecting to DBCTL

1. CICS is started by submitting a job or starting a procedure, as described in the *CICS/ESA Operations and Utilities Guide*.
2. DBCTL is started by submitting a job or starting a procedure, as described in “Starting DBCTL, DLISAS, and DBRC” on page 45.
3. After receiving a DBCTL READY message, indicating that startup is complete, the IMS console operator enters a start command, as follows:
   - If starting DBCTL for the first time, use /NRESTART CHECKPOINT 0 FORMAT ALL. This command cold starts DBCTL and formats the write ahead data set (WADS) and the restart data set (RDS).
   - /NRESTART for a warm start.
   - /ERESTART for an emergency restart after a failure.

   The / used in these commands is explained in “Operator communication with DBCTL” on page 62. See “Restarting DBCTL” on page 79 for information on restart options.

   When the start has completed, the following message is issued:

   ```
   DFS994I rtype START COMPLETED
   ```

   where rtype is the type of start requested (COLD, WARM, or EMERGENCY).
4. The CICS operator requests connection to DBCTL using the CDBC transaction.

Step 1 can be done before, during, or after steps 2 and 3. Steps 2 and 3 must be done in the sequence shown, and all three steps must be completed successfully before step 4 can begin.

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Connecting DBCTL to CICS automatically

You can specify that CICS be connected automatically to either the same or a different DBCTL.

If you want to connect automatically to the DBCTL that was being used when CICS was last shut down, just add an entry for DFHDBCON to the PLTPI so that it is invoked in the second stage of PLTPI processing (that is, the third stage of CICS initialization), as described in the *CICS/ESA Resource Definition Guide*.

If you want to connect automatically to a specific DBCTL, or to connect CICS to DBCTL when it was not connected at shutdown, use the CICS SIT parameter, INITPARM, in addition to specifying DFHDBCON in the PLTPI. INITPARM enables DFHDBCON to have access to the DRA startup parameter table suffix you want to use. Specify:

```
INITPARM=(DFHDBCON='xx[,yyyy]')
```

where xx is a 1-to 2-character DRA startup table suffix, which you must enter, and yyyy is an optional 1-to 4-character DBCTL identifier. The DBCTL identifier specified in INITPARM overrides the DRA startup parameter DBCTLID.

Using INITPARM avoids the need to use the CRLP or DASD sequential terminal as your means of automating connection to a specific DBCTL. If you prefer to use a CRLP or DASD sequential terminal,

Apar PQ20293

Documentation for Apar PQ20293 added 26/11/98

code the following:

```
//DDIN DD *
  CDBC CONNECT SUFFIX(xx) DBCTLID(yyyy)\
```

where xx is the 1- to 2-character DRA startup table suffix and yyyy is the 1- to 4-character DBCTL identifier, both of which are optional. Specifying a DBCTL identifier here overrides the one specified in the DRA startup table parameter DBCTLID. \ is the end-of-line character. (See the *CICS/ESA Resource Definition Guide* and the *CICS/ESA Application Programming Guide* for guidance on using sequential terminal support.)

What happens at startup depends on the type of CICS start being used (or whether you are using DBCTL with CICS XRF) whether you specified INITPARM, and on whether DBCTL was connected to CICS when CICS was last shut down.

Connecting to DBCTL after a CICS WARM or EMERGENCY start

If CICS startup is WARM or EMERGENCY:

- If you used INITPARM, the DRA startup table suffix and DBCTL identifier specified there are used to determine which DBCTL to connect to, whether or not CICS and DBCTL were connected when CICS was last shut down.
- If you did not use INITPARM:
  - If CICS and DBCTL were connected when CICS was last shutdown, CICS is reconnected to the same DBCTL. (DFHDBCON uses the DRA startup

parameter table suffix and DBCTL identifier override (which may be blanks) from the catalog.)

- If CICS and DBCTL were ***not*** connected when CICS was last shut down CICS issues message DFHDB8117 and does not attempt to connect to DBCTL.

Connecting to DBCTL after a CICS COLD start

If CICS startup is COLD:

- If you used INITPARM, CICS attempts to connect to DBCTL, using the suffix and DBCTL identifier (if any) you specified.
- If you did not use INITPARM, CICS attempts to connect to DBCTL using the default DRA startup table suffix (00) and no DBCTL identifier override, whether or not DBCTL was connected when CICS was last shut down.

Connecting to DBCTL after a CICS XRF takeover

If you are using DBCTL in a CICS XRF environment:

- If CICS and DBCTL were connected when takeover occurred, CICS connects to that DBCTL, whether or not you used INITPARM.
- If CICS and DBCTL were not connected when takeover occurred:
  - If you used INITPARM, CICS connects to the DBCTL specified
  - If you did not use INITPARM, message DFHDB8117 is issued and no connection attempt is made.

See Chapter 8, “Extended recovery facility (XRF)” on page 123 for information on using DBCTL with CICS XRF.

Connection, disconnection, and inquiry transactions

There are two CICS transactions that you can use to connect to, disconnect from, and inquire on the status of the CICS-DBCTL interface. They are:

- CDBC, which enables users (for example, CICS operators and network controllers) to display a menu to connect to and disconnect from DBCTL.
  - For ***connection***, CDBC issues a DBCTL connection request to DFHDBAT, which issues a DRA INIT request internally to the DRA.

    CDBC also enables you to override the DRA startup parameter table suffix and DBCTL identifier when you are connecting CICS to DBCTL. (See “Defining the IMS DRA startup parameter table” on page 45 for information on the contents of the DRA startup table.)
  - For ***disconnection***, CDBC can issue an orderly or an immediate disconnection request to DFHDBAT, which issues a DRA TERM request internally to the DRA.

    (See “CDBC transaction for connect and disconnect” on page 56 for more information on using CDBC.)
- CDBI, which enables users to inquire on the status of the CICS-DBCTL interface. See “CDBI transaction for inquiry” on page 60 for more information.

You can enter CDBC and CDBI from either a CICS terminal or an MVS console. You can restrict access to these transactions using transaction security. Messages

from CDBC can be sent to the transient data destination CDBC. (For help on defining transient data destinations, see the *CICS/ESA Resource Definition Guide*.)

CDBC transaction for connect and disconnect

Typing CDBC on a 3270-type terminal displays a menu for connecting CICS to, and disconnecting it from, DBCTL. Figure 11 shows an example of the menu.

```
CDBC               CICS-DBCTL CONNECTION/DISCONNECTION                 93.259
                                                                      13:39:20

          Select one of the following:

               1 Connection
               2 ORDERLY disconnection
               3 IMMEDIATE disconnection


          Option Selection     ==> 2
          Startup Table Suffix ==> 00
          DBCTL ID Override    ==>

  DFHDB8209D DBCTL orderly disconnection requested. Press PF5 to confirm.

  Status of the Interface: DFHDB8293I DBCTL connected and ready.
              CICS APPLID: IYAHZCD2
                 DBCTL ID: SYS2
     Startup Table Suffix: 00


PF1 = Help   2 = Refresh   3 = End
```

Figure 11. CDBC transaction menu screen

To connect to DBCTL, enter option number 1 after:

```
Option Selection ==>
```

If you want to specify a DRA startup table suffix, you can enter it after:

```
Startup Table Suffix ==>
```

If you do not specify a suffix, CICS uses the one that was used when it was last connected to DBCTL. If this is the first time you have connected CICS to DBCTL, and you do not specify a suffix, CICS uses the default suffix, which is 00.

If you want to specify a DBCTL identifier, you can enter it after:

```
DBCTL ID Override ==>
```

If you do not specify a DBCTL identifier, the DRA uses the DBCTL identifier specified on the DBCTLID parameter in the DRA startup table.

When you have pressed ENTER, you should get the message:

```
DFHDB8209 I DBCTL orderly disconnection requested. Press PF5 to confirm.
```

as shown on the example screen in Figure 11.

The CDBC menu screen displays the following additional information:

- Status of the CICS-DBCTL interface; in this case, DBCTL is connected and ready
- The APPLID of the CICS system; in this case, DBDCCICS
- The identifier of the DBCTL system; in this case, SYS1
- The DRA startup parameter table suffix for this connection; in this case, 00.

The DBCTL identifier and the DRA startup parameter table suffix are only displayed when CICS has been connected to DBCTL. You can refresh any of the information on the CDBC menu screen by pressing PF2.

You can obtain a help screen for the CDBC menu by pressing PF1. As you can see in Figure 12, the CDBC help screen reminds you which number to specify for which option, what the options mean, and summarizes the CICS-DBCTL interface information displayed on the CDBC menu screen.

```
                HELP : CICS-DBCTL CONNECTION/DISCONNECTION

To CONNECT to DBCTL, select option 1. You can also specify a startup
 table suffix, or accept the existing suffix. The id of the DBCTL system is
 obtained from the startup table, but can be optionally overridden.

To DISCONNECT from DBCTL, select option 2 or option 3.

   Select option 2 for ORDERLY disconnection: this allows all CICS-DBCTL
   transactions from this CICS to complete before disconnecting from DBCTL.

   Select option 3 for IMMEDIATE disconnection: this allows all CICS-DBCTL
   requests from this CICS to complete before disconnecting from DBCTL.
-------------------------------------------------------------------------------
Displayed information (press PF2 to refresh the information):
   STATUS OF THE INTERFACE The current status of the connection to DBCTL.
   CICS APPLID             The application identifier for this CICS system.

   Displayed when available:
   DBCTL ID                 Identifier of the DBCTL system with which this
                            CICS system is communicating.
   STARTUP TABLE SUFFIX     Suffix used when CICS was connected to DBCTL.

                PRESS ENTER TO RETURN TO SELECTION SCREEN
```

Figure 12. CDBC transaction menu help screen

Using CDBC without the menu screen: The menu screen is displayed if you use CDBC from a 3270-type terminal, However, if you issue CDBC from a a CRLP or DASD sequential terminal or operating system console,

Apar PQ20293

Documentation for Apar PQ20293 added 26/11/98

the menu screen is **not** displayed. For example, if you specify:

```
CDBC CONnect
```

DBCTL is connected using the default suffix, 00.

If you specify a suffix:

```
CDBC CONnect SUFfix(12)
```

and DBCTL is connected using suffix 12.

You can also type a DBCTL identifier, in addition to the suffix, or on its own. For example, if you enter:

```
CDBC CONnect DBCtlid(DBC1)
```

CICS is connected to the DBCTL named DBC1.

You can also enter:

```
CDBC CONnect DBCtlid(DBC2) SUFfix(11)
```

or

```
CDBC CONnect SUFfix(11) DBCtlid(DBC2)
```

in either case, CICS is connected to DBCTL DBC2, using suffix 11.

See “What happens when you have requested connection to DBCTL” for details of the system’s response to your connection request.

If you disconnect CICS from DBCTL using a BSAM CRLP-type terminal, the menu screen is not displayed.

For orderly disconnection, specify:

```
CDBC DISconnect
```

For immediate disconnection, enter:

```
CDBC DISconnect IMMediate
```

See “Deciding whether to use orderly or immediate disconnection” on page 60 for information on the two types of disconnection request.

What happens when you have requested connection to DBCTL

When you have requested connection to DBCTL, you should get messages confirming that connection is taking place. If you have used the CDBC menu, the following messages appear on the terminal:

```
Status of the Interface: DFHDB8292I DBCTL CONNECT PHASE 2 IN PROGRESS.
Status of the Interface: DFHDB8293I DBCTL CONNECTED AND READY.
```

If you have not used the CDBC menu, the following messages appear on the MVS console:

```
+DFHDB8210D CONNECTION TO DBCTL IS PROCEEDING. CHECK CDBC TD QUEUE.
+DFHDB8225I DBDCCICS THE DBCTL ID IS SYS1. THE DRA STARTUP TABLE SUFFIX IS 00.
```

The *CICS/ESA Messages and Codes* manual contains information about interpreting the CICS DFHDBnnnn messages that are issued when you are using CDBC.

If DBCTL is not yet available, the main CICS-supplied IMS control exit, DFHDBCTX, is invoked. DFHDBCTX in turn calls DFHDXAX.

As in earlier releases of CICS, the CICS-supplied module, DFHDXAX, is provided to handle reconnections to DBCTL. For more information about the IMS control exit routines, see the *IMS/ESA Customization Guide: Database*, SC26-3064.

DFHDXAX ensures that CICS reconnects to DBCTL without operator intervention in the event of a DBCTL restart, or a restart of both CICS and DBCTL. In releases earlier than CICS/ESA 4.1, the actions of DFHDXAX are based on the use of a recovery service table (RST), because it was intended for use where either CICS, DBCTL, or both, were running with XRF.

DFHDXAX is extended in CICS/ESA 4.1 to try and avoid operator intervention in those instances when no RST ID defined; that is, where there is no XRF support. It does this invoking an existing retry loop (based on a timer).

For a DBCTL restart, the control exit is invoked as for any DBCTL connection attempt. However, instead of returning control directly to the DRA, the control transaction invokes the DFHDXAX module. This control exit routine checks to see if it is being invoked for a failing connection:

- If it is not being invoked for a failing connection, it does not attempt to connect and passes control back.
- If it is being invoked for a failing connection, it checks the input arguments to determine whether:
  - An IDENTIFY attempt failed, and
  - CICS is not in the process of terminating.

If an IDENTIFY failed, and CICS is not terminating, the action taken then depends on whether there is an RST defined, which may or may not contain alternative DBCTL IDs.

CICS regions without a recoverable service table (RST): If there is no RST, DFHDXAX selects the current DBCTL ID, and initiates repeated attempts to reconnect to the current DBCTL.

Retries are made every five seconds for a ten minute period, and message DFHDB8297 is issued periodically. If reconnection is still not successful after ten minutes, DFHDXAX abandons the attempt, and requests IMS to issue message DFS0690A, which requires operator intervention. The *IMS/ESA Messages and Codes* manual contains guidance on interpreting the IMS DFSnnnn messages that are displayed when you are using CDBC. If you reply CANCEL, the connection attempt is abandoned. It you reply WAIT, the DRA retries the connection attempt after the number of seconds specified in the TIMER parameter in the DRA startup parameter table. If the connection attempt fails again, the DRA will continue to retry after the same number of seconds. You can stop these repeated connection attempts by using the CDBC transaction to disconnect from DBCTL. (This can be either the same instance of CDBC or one from a different terminal.) Disconnection takes effect when the DRA next tries to reconnect to DBCTL.

CICS regions with an RST: If you are using XRF, and therefore have defined an RST, and it does contain alternative DBCTL IDs to which CICS can try to connect, DFHDXAX module selects each DBCTL subsystem ID in the RST in turn as a candidate for reconnection.

The processing, which can take one of two courses, is as described in “What happens when CICS uses the RST to connect to DBCTL” on page 130.

Deciding whether to use orderly or immediate disconnection

Orderly disconnection allows all existing CICS-DBCTL tasks to complete before CICS is disconnected from DBCTL. Tasks not currently using DBCTL are prevented from issuing further PSB schedule requests. This means that there should not be any in-doubt logical units of work (LUWs), and database records are available to other CICS systems connected to that DBCTL.

Immediate disconnection allows only current DL/I requests to DBCTL from this CICS system to complete before CICS is disconnected from DBCTL. Any new DL/I or PSB schedule requests are prevented. This can cause in-doubt LUWs for the task involved and leave database records unavailable for other CICS systems connected to that DBCTL until it is reconnected. What happens depends on the type of request issued to DBCTL after the immediate disconnection request:

- If it is a PSB schedule request, a DHTJ abend (for a command-level program) or a DLINA condition (for a call-level program) is issued.
- If it is a DL/I request, the LUW is backed out and an ADCA abend is issued.
- If it is a PREPARE request, the LUW is backed out and an ASP7 abend is issued.

  In all the above cases, database records are available to other applications.
- If it is a COMMIT request, the task remains in-doubt and DBCTL records are unavailable. The in-doubts will not be resolved until DBCTL is reconnected to CICS. An abend is issued when the next PSB schedule is received, as described for PSB schedule request, above.

  See “Two-phase commit” on page 83 for information on PREPARE and COMMIT requests.

We therefore recommend that you use immediate disconnection only if necessary. For example, you may need to use it if you have already issued an orderly disconnection request which has not taken place, and you need disconnection to take place soon. Orderly disconnection may be delayed by a task that is issuing many DL/I requests, or by a conversational task that is awaiting input from an unattended terminal. If you think the problem is being caused by such a task, you may prefer to identify it using CEMT INQ TASK, and then use CEMT SET TASK(n) PURGE, where “n” is the task identifier to purge it. You can then use orderly disconnection. However, if the problem is being caused by many tasks or by a single task that you cannot identify, you may have to use immediate disconnection.

CDBI transaction for inquiry

You can use the CDBI transaction to inquire on the status of the DBCTL connection. Typing CDBI displays a screen like the one shown in Figure 13 on page 61. The CDBI screen shows the status of the CICS-DBCTL interface (in this example, DBCTL is connected and ready), plus the APPLID of the CICS system (DBDCCICS) and the DBCTL identifier (SYS1). You can refresh the information by pressing PF2.

```
CDBI                    CICS-DBCTL INTERFACE INQUIRY            93.194
                                                               11:23:50
            Status     : DFHDB8293 I DBCTL connected and ready.
            CICS APPLID: DBDCCICS
            DBCTL ID   : SYS1









PF1 = Help   2 = Refresh   3 = End
```

Figure 13. CDBI transaction screen

You can obtain a help screen for CDBI by pressing PF1. Figure 14 shows an example of such a panel. The CDBI help screen tells you how to refresh the information on the CDBI screen, and explains that information. It includes a list of the CICS messages describing the status of the CICS-DBCTL interface that can appear on the CDBI screen. The *CICS/ESA Messages and Codes* manual tells you how to interpret these messages.

```
                    HELP : CICS-DBCTL INTERFACE INQUIRY
 The CICS-DBCTL interface inquiry screen shows:
   STATUS OF THE INTERFACE    The status can be:
     DFHDB8290I DBCTL NOT CONNECTED TO CICS.
     DFHDB8291I DBCTL CONNECT PHASE 1 IN PROGRESS.
     DFHDB8292I DBCTL CONNECT PHASE 2 IN PROGRESS.
     DFHDB8293I DBCTL CONNECTED AND READY.
     DFHDB8294I DBCTL ORDERLY DISCONNECT IN PROGRESS.
     DFHDB8295I DBCTL IMMEDIATE DISCONNECT IN PROGRESS.
     DFHDB8296I DBCTL CANNOT BE CONNECTED TO CICS.
   CICS APPLID  The application identifier of this CICS system.
 Displayed when available:
   DBCTL ID     The identifier of the DBCTL system with which this CICS
                is communicating
 You can press PF2 to update (refresh) the information shown on the screen









                 PRESS ENTER TO RETURN TO INQUIRY SCREEN
```

Figure 14. CDBI transaction help screen

Operator communication with DBCTL

IMS operations can be done from an IMS master terminal operator console, which is usually the primary MVS console. Prior to CICS/ESA 4.1, operator communication with DBCTL is from an MVS console, This ***can*** be the primary MVS console, but we recommend that you have a secondary MVS console that is specifically dedicated to DBCTL. We refer to this as the ***DBCTL console***.

From CICS/ESA 4.1 and IMS/ESA 5.1 onwards, you can choose to issue operator commands to DBCTL from a CICS terminal, using a CICS-supplied transaction, CDBM, as described in "CDBM operator transaction" on page 64.

DBCTL operator commands

The operator commands you can use to communicate with DBCTL are a subset of IMS operator commands. This book summarizes the ways in which you can use these commands with DBCTL. For guidance on syntax, see the *IMS/ESA Operator's Reference* manual. See also Appendix D, "Summary of DBCTL operator commands" on page 207 for a list of DBCTL operator commands and their corresponding CICS commands, and a list of valid keywords for DBCTL users.

Format of DBCTL operator commands

DBCTL commands begin with a command recognition character (CRC). A CRC of / is the default. (The examples of DBCTL commands in this manual use the default CRC.) You can override it on the DBCTL job, but remember that ***each DBCTL subsystem in a single MVS image must have a different CRC***. This CRC must also be different from every other subsystem in the processor (or multiprocessor), not just DBCTL subsystems. The same applies to any test systems you may be using. You can, if you prefer, use the subsystem ID (for example, SYS1) of the DBCTL you are using instead of a CRC.

The general format of DBCTL commands is a CRC, a verb, then a password (if required), followed by keyword(s), and finally comments (if any). There must be no space between the CRC and the verb. Usually there is a space between parameters, except as noted for specific parameters in the *IMS/ESA Operator's Reference* manual. Many verbs and keywords have abbreviations. Guidance on using them is in the *IMS/ESA Operator's Reference* manual.

Multisegment DBCTL operator commands

The DBCTL operator commands /CHANGE, /ERESTART, /RMxxxxxx, and /SSR can be entered in multiple segments. The format of multisegment commands varies according to the environment you are using. For multisegment commands in a DBCTL environment, each segment preceding the last segment requires an end-of-**segment** (EOS) indicator, which is the CRC followed by the ENTER key. The last (or only) segment requires an end-of-**message** (EOM) indicator, which is the ENTER key. In addition, each segment must begin with the CRC.

Figure 15 on page 63 is an example of a multisegment command that has two segments. The CRC is a slash (/), and appears at the beginning and end of the first segment. The EOS of the first segment is the CRC (/) followed by the ENTER key, which does not appear because it is not displayable. The EOM of the second (and last) segment is the ENTER key, so this segment begins with the CRC, but does not end with it.

DBCTL can handle single-segment commands from an unlimited number of consoles concurrently, but the number of consoles that can concurrently issue multisegment commands is limited to eight. A single multisegment command is limited to 241 bytes. If either of these limits is exceeded, a message is sent to the issuing console.

```
/RMI DBRC='ic dbd(dedbdd01) area(dd01ar0) icdsn(fvt31.dedbdd01.dd01ar0
.ic.dummy1) icdsn2/
/(FVT31.DEDBDD01.DD01AR0.IC2.DUMMY1) HSSP'
DFS000I MESSAGE(S) FROM ID=SYS1 490
INIT.IC DBD(DEDBDD01) AREA(DD01AR0) -
ICDSN(FVT31.DEDBDD01.DD01AR0.IC.DUMMY1) -
ICDSN2(FVT31.DEDBDD01.DD01AR0.IC2.DUMMY1) HSSP
DSP0203I  COMMAND COMPLETED WITH CONDITION CODE 00
DSP0220I  COMMAND COMPLETION TIME 89.045   16:24:58.7
DSP0211I  COMMAND PROCESSING COMPLETE
DSP0211I  HIGHEST CONDITION CODE = 00
DSP0058I  RMI COMMAND COMPLETED
/RMI DBRC='ic dbd(dedbdd01) area(dd01ar0) icdsn(fvt31.dedbdd01.dd01ar0
.ic.dummy2) /
/ICDSN2(FVT31.DEDBDD01.DD01AR0.IC2.DUMMY2) HSSP'
DFS000I MESSAGE(S) FROM ID=SYS1 514
INIT.IC DBD(DEDBDD01) AREA(DD01AR0) -
ICDSN(FVT31.DEDBDD01.DD01AR0.IC.DUMMY2) -
ICDSN2(FVT31.DEDBDD01.DD01AR0.IC2.DUMMY2) HSSP
DSP0203I  COMMAND COMPLETED WITH CONDITION CODE 00
DSP0220I  COMMAND COMPLETION TIME 89.045   16:28:10.3
DSP0211I  COMMAND PROCESSING COMPLETE
DSP0211I  HIGHEST CONDITION CODE = 00
DSP0058I  RMI COMMAND COMPLETED
```

Figure 15. Example of using multisegment commands in a DBCTL environment

For further guidance on multisegment operator commands, see the *IMS/ESA Operator's Reference* manual.

You can use null words (for example, FOR, and TO) within the operator commands to help clarify the syntax without affecting the command itself. Because null words are reserved, you must not use them to name system resources. For further guidance on null words, see the *IMS/ESA Operator's Reference* manual.

You may need to use a password, depending on how the verb was defined when the security maintenance utility was run at system definition. See the *IMS/ESA Utilities Reference: Database* manual for guidance on running the security maintenance utility; see the *IMS/ESA System Administration Guide* for guidance on determining passwords; and see "Deleting password security authorization" on page 68 if you need to delete a password. See Chapter 9, "Security checking with DBCTL" on page 143 for information about security considerations with DBCTL.

The rest of this chapter describes situations that occur during normal system operation in which you need DBCTL operator commands, sometimes in conjunction with CICS operator commands. For information on operator commands to use if the system (or some part of it) fails, see Chapter 6, "Recovery and restart operations" on page 77.

CDBM operator transaction

With CICS/ESA 4.1, and IMS/ESA 5.1 or later, you can use CDBM to issue most of the IMS operator commands that are valid for DBCTL across the DRA interface to DBCTL to display and change the state of selected resources.

When dealing with databases, you can use an asterisk (*) to refer to generic groups; for example DB21* refers to all databases starting with the characters DB21. You can also use a plus (+) sign in place of a single character; for example, DB+2 displays databases DB12, DB22, DB32, and so on.

You can issue CDBM via a menu panel, as shown in Figure 16.

```
CDBM                 CICS-DBCTL Operator Transaction                 93.335
                                                                    13:24:20

Type IMS command.
             ____________________________________________________________
             ____________________________________________________________
             ____________________________________________________________
             ____________________________________________________________


For /DBDUMP or /DBRECOVER commands

Choose one. 1 1. Do not force end of volume
              2. Force end of volume


Press enter to display responses.


CICS APPLID DBDCCICS
DBCTL ID    SYS3


F1=Help  F3=Exit  F5=Refresh  F12=Cancel
```

Figure 16. CDBM CICS-DBCTL operator transaction panel

There is also a help screen, as shown in Figure 17 on page 65.

```
 CDBM               Help: CICS-DBCTL Operator Transaction


CDBM           Use the transaction to send an IMS command to a DBCTL system.

Command        Type the command recognition character / followed by an IMS
               command and press enter to display responses.

Responses      Use the PF keys to page IMS responses.

Wildcards      * or + can be used within one database name.

End of volume  For /DBDUMP or /DBRECOVER commands only
               Choose one.
                 1. Do not force end of volume
                 2. Force end of volume

CICS APPLID    These are shown for information.
DBCTL ID

Example        /DIS DB DEPT* displays the status of several databases.


F3=Exit  F12=Cancel
```

Figure 17. CDBM CICS-DBCTL operator transaction help panel

Responses to commands issued from the CDBM screen are returned on a screen like the one in Figure 18, which shows the first of a number of screens resulting from a /DISPLAY DB ALL command.

```
 CDBM                    CICS-DBCTL IMS Responses                Screen 1
                                                      Responses 1    to 18
                                                                More:   +
 DATABASE  TYPE  TOTAL UNUSED  TOTAL UNUSED ACC  CONDITIONS
 ACCOUNDB                                   UP   STOPPED, NOTOPEN, NOTINIT
 ADMIDX1                                    UP   STOPPED, NOTOPEN, NOTINIT
 ADMOBJ1                                    UP   STOPPED, NOTOPEN, NOTINIT
 ADMOBJ2                                    UP   STOPPED, NOTOPEN, NOTINIT
 ADMOBJ3                                    UP   STOPPED, NOTOPEN, NOTINIT
 ADMSYSDF                                   UP   STOPPED, NOTOPEN, NOTINIT
 BE1CHKPT  DL/I                             UP   NOTOPEN
 BE1PARTA                                   UP   STOPPED, NOTOPEN, NOTINIT
 BE1PARTB                                   UP   STOPPED, NOTOPEN, NOTINIT
 BE1PARTC                                   UP   STOPPED, NOTOPEN, NOTINIT
 BE1PARTS                                   UP   STOPPED, NOTOPEN, NOTINIT
 BE2ORDER  DL/I                             UP   NOTOPEN
 BE2ORDRX  DL/I                             UP   NOTOPEN
 BE2PARTS  DL/I                             UP   NOTOPEN
 BE2PCUST  DL/I                             UP   NOTOPEN
 BE3ORDER  DL/I                             UP   NOTOPEN
 BE3ORDRX  DL/I                             UP   NOTOPEN
                                                                  More...

F1=Help  F3=Exit  F4=Top  F6=Bottom  F7=Bkwd  F8=Fwd  F9=Retrieve  F12=Cancel
```

Figure 18. CDBM CICS-DBCTL IMS responses panel

Alternatively, you can issue CDBM and the DBCTL command directly, as follows:

```
CDBM /xxxxxxxx
```

where / is the default CRC and xxxxxxxx is a IMS operator command that is valid for use with DBCTL and CDBM.

Note: IMS requires that each command is prefixed with the default CRC. The CRC is present only for syntax checking; it does not determine to which DBCTL the command is sent. You cannot use a CRC value to route a command to a particular DBCTL system through CDBM. It can be sent only to the one currently connected to CICS. This DBCTL may have its own CRC value which is different from the default one of '/'. However, this does not matter to CDBM, because the '/' character is used only for syntax checking, and the command is presented to the connected DBCTL without a CRC, using the AIB interface.

The following IMS operator commands are valid with CDBM:

- /CHANGE
- /CHECKPOINT (simple form) and /CHECKPOINT STATISTICS
- /DBDUMP
- /DBRECOVERY
- /DELETE
- /DEQUEUE
- /DISPLAY
- /LOCK
- /LOG
- /PSTOP
- /RMCHANGE
- /RMDELETE
- /RMGENJCL
- /RMINIT
- /RMLIST
- /RMNOTIFY
- /START
- /STOP
- /SWITCH OLDS
- /TRACE SET PI
- /UNLOCK
- /VUNLOAD

The following IMS operator commands are not valid with CDBM and must be issued via the MVS console:

- /CHECKPOINT FREEZE and /CHECKPOINT PURGE
- /MODIFY
- /ERESTART
- /NRESTART
- /SSR

For more information, see Appendix A, “Migration task summary and fallback considerations” on page 195.

Issuing DBRC commands

With DBCTL, you must issue DBRC commands via DBCTL console commands (/RMxxxxxx) because DBRC runs outside the CICS address space. If you are using CICS/ESA 4.1 and IMS/ESA 5.1 or later, you can issue the /RMxxxxxx commands via the CICS-supplied transaction CDBM. (With local DL/I, where DBRC runs within the CICS address space, you use the CICS-supplied transaction

CBRC to issue DBRC commands. For help on using the CBRC transaction, see the *CICS/ESA CICS-Supplied Transactions* manual.)

You can use the following /RMxxxxxx commands ***online***:

- /RMCHANGE — to change or modify information in the RECON
- /RMDELETE — to delete information from the RECON
- /RMGENJCL — to generate JCL for a specified utility
- /RMINIT — to create records in the RECON
- /RMLIST — to list the contents of the RECON
- /RMNOTIFY — to add information to the RECON.

For example:

```
/RMINIT DBRC='DB DBD(IVPDB2) SHARELVL(3)'.
```

See the *IMS/ESA Operator's Reference* manual for further guidance on the syntax of these commands.

You can also enter DBRC commands in ***batch***, but the syntax is slightly different, as shown in Figure 19.

```
//INITDB JOB 1,PGMERID,CLASS=Q,MSGCLASS=A
//*
//RECON    EXEC PGM=DSPURX00,REGION=1000K
//STEPLIB  DD DSN=IMS.RESLIB,DISP=SHR
//DFSRESLB DD DSN=IMS.RESLIB,DISP=SHR
//SYSPRINT DD SYSOUT=*
//RECON1   DD DSN=IMS.RECON1,DISP=SHR
//RECON2   DD DSN=IMS.RECON2,DISP=SHR
//SYSIN    DD *
 INIT.DB DBD(IVPDB2) SHARELVL(3)
/*
```

Figure 19. Example JCL to register a database with DBRC

Authorizing access to databases and PSBs

To stop a PSB being scheduled, use the /LOCK command with the PROGRAM keyword. To stop access to a database, use the /LOCK command with the DATABASE keyword. To negate or reset the effects of previous /LOCK commands, use the /UNLOCK command with the DATABASE and PROGRAM keywords.

Changing IMS passwords

To protect DBCTL against unauthorized /LOCK and /UNLOCK commands for certain PSBs (referred to as "programs" in the IMS publications) and databases, you can establish IMS passwords for those PSBs and databases.

IMS passwords are defined by the security maintenance utility or the /CHANGE command with the PASSWORD keyword. (See Chapter 9, "Security checking with DBCTL" on page 143 for a description of DBCTL password security.) Using the /CHANGE command with the PASSWORD keyword changes the password immediately.

To add a password security definition, use the PASSWORD keyword with the /MODIFY PREPARE command. To request that password security specifications

should take effect when restart processing has completed, use the PASSWORD keyword with the /NRESTART command.

Deleting password security authorization

To delete IMS password security authorization for a specified database or PSB, use the /DELETE command with the PASSWORD keyword. Password security authorization is used on the /LOCK and /UNLOCK commands, and requires a password to be supplied when entering that command.

Controlling tracing of DBCTL events

To start and stop tracing of internal DBCTL events dynamically, and define activities to be monitored by the IMS monitor, use the /TRACE command, as follows:

- The PI keyword specifies that program isolation (PI) trace data be written to a trace table. PI trace entries contain information about program isolation ENQ/DEQ calls and DL/I calls.
- The PSB keyword requests a trace of all DL/I calls issued for a specified PSB.
- The TABLE keyword specifies that online tracing into the specified trace tables be started or stopped.

In local DL/I, you control the PI trace using the CEMT transaction, and the DL/I and LOCK traces are specified in the data set referred to by the DFSVSAMP DD statement and can only be set for the entire CICS session.

| From CICS/ESA Version 3 onwards, you can use the CICS-supplied transaction CETR to trace DL/I (including DBCTL) activity. For DBCTL, CETR traces a DL/I request until it leaves DFHDBAT. (See the *CICS/ESA CICS-Supplied Transactions* manual for help on using CETR.)

See “Trace entries produced by DBCTL” on page 167 for information on obtaining DBCTL trace entries. See the *IMS/ESA Operator’s Reference* manual for guidance on the syntax of /TRACE commands and keywords, and the *IMS/ESA System Administration Guide* for guidance on the effects using /TRACE commands can have on your system.

Finding out current status of DBCTL activities

To find out the status of particular DBCTL activities, use the /DISPLAY command, as follows:

- The /DISPLAY command with the ACTIVE keyword gives you an overview of activity in the entire DBCTL subsystem including processing for BMPs and for threads processing scheduled CICS transactions. For each thread that is currently active (has a PSB scheduled) from a CICS transaction, there is an entry “DBT” in the column headed “TYPE,” as shown in the /DISPLAY command examples in the *IMS/ESA Operator’s Reference* manual. (The TYPE column shows the thread type and DBT stands for DBCTL thread.) The display may show fewer DBT threads than the number specified by MINTHRD in the DRA startup parameter table.
- The /DISPLAY command with the CCTL keyword displays all (or specified) CICS systems currently connected to DBCTL. To specify a CICS system, add a CCTLNAME, which is the APPLID of the connected CICS system. The

/DISPLAY command with the CCTL keyword also displays the following items for all or specified CICS systems:

  - All in-doubts for a given CICS or for all CICS systems (when you enter /DISPLAY CCTL INDOUBT).
  - Pseudo recovery token (only when status is INDOUBT). See “Resolving in-doubt logical units of work (LUWs) manually” on page 87 for information on using the pseudo recovery token in a /CHANGE command.
  - Recovery token.
  - Thread number (displayed as REGID) for all threads.
  - PSB name.
  - Status of thread(s).
  - All threads for a given CICS or all CICS systems.

  Note: The /DISPLAY command uses the CCTL ID (which, in the case of a CICS system, is the APPLID). However, many IMS messages use the jobname of the CICS system. We therefore recommend that you have a naming convention that enables operators to immediately identify a corresponding CICS APPLID and CICS JOBNAME. For example, if you use the APPLID DBDCICA, your job name could also contain the characters CICA.

- The /DISPLAY command with the OLDS keyword displays the system logging status. You can use it to determine how many OLDS data sets are available for use or require archiving.
- The /DISPLAY command with the POOL keyword displays main storage utilization statistics for IMS storage pools.
- The /DISPLAY command with the AREA keyword displays the status of DEDB data sets in an area.
- The /DISPLAY command with the DATABASE keyword displays the status (for example, NOTOPEN or STOPPED) of specified databases. If the database you specify is a DEDB, the associated DEDB areas are also displayed.
- The /DISPLAY command with the DBD keyword displays, for databases that are being accessed, their type, the PSBs accessing them, and the type of access. (You can use the DBD keyword only if you have DEDB support installed.)
- The /DISPLAY command with the MODIFY keyword displays the status of resources to be deleted or changed using the /MODIFY command. See “Changing DBCTL resources online” on page 70 for information on the /MODIFY command.
- The /DISPLAY command with the PSB keyword displays the status of PSBs, the databases being accessed, and the type of access. (You can use the PSB keyword only if you have DEDB support installed.)
- The /DISPLAY command with the PROGRAM keyword displays the status of PSBs; for example, NOTINIT or STOPPED.
- The /DISPLAY command with the SHUTDOWN STATUS keywords displays system activity during a shutdown type of checkpoint; for example, the number of regions still active.
- The /DISPLAY command with the STATUS keyword displays the status of DBCTL resources, such as databases and PSBs.

- The /DISPLAY command with the TRACE keyword displays status and options for IMS traces and the IMS monitor, and whether restart should occur without backout of BMP updates. (You can restart without using backout or recovery of databases — see the description of the COLDBASE keyword of the /ERESTART command in “Emergency restart” on page 80.)

Specifying messages to be logged on IMS log

Use the /LOG command to specify any alphanumeric character message to be logged on the IMS log.

Changing DBCTL resources online

The /MODIFY command is a part of the online change process used to control the modification of DBCTL resources online. However, note that online change for DBCTL is very different from CICS resource definition online (RDO). You first use the offline process for doing a generation (whether it be an ACBGEN, a security maintenance utility matrix data set generation, or a partial MODBLKS generation for the DATABASE and APPLCTN macros). Guidance information on doing these generations is in the *IMS/ESA System Definition Reference* manual and the *IMS/ESA Utilities Reference: Database* manual. To bring the new libraries online, use the /MODIFY command. First use the /MODIFY command with the PREPARE keyword to indicate the type of system definitions that need to be replaced. Depending on the parameters entered, the system initiates quiescing of the appropriate resources. Then use the /MODIFY command with the COMMIT keyword to bring all newly defined resources online, update the changed resources, and invalidate the deleted resources. If the /MODIFY command deletes a database, the database is closed and made unavailable to programs. You cannot use the /MODIFY command on DEDBs.

If some kind of failure occurred before a COMMIT could complete, the changes defined by the /MODIFY command with the PREPARE keyword are not recovered across an emergency restart and you must reenter them. When a commit is successful, changes persist across all DBCTL restarts.

You can use the /MODIFY command with the ABORT keyword to reset the status that was set by the /MODIFY command with the PREPARE keyword. You can also use the /MODIFY command with the ABORT keyword if you have previously used the /MODIFY command with the COMMIT keyword, but it was not successful and you decide not to continue with the change. See also “Finding out current status of DBCTL activities” on page 68 for details of using the /DISPLAY command with the MODIFY keyword.

Preventing programs and transactions from updating databases

You can use the /DBDUMP command with the DATABASE keyword to prevent programs from updating DL/I full function databases.

You can use the /DBRECOVERY command to prevent transactions or programs from accessing a database (with the DATABASE keyword) or a DEDB area (with the AREA keyword, which is valid with DEDBs only). The command closes and deallocates the database(s) or area(s), so that they are not authorized to DBRC.

If a specified database is being used when you enter either /DBDUMP or /DBRECOVERY, the thread currently using the database is allowed to complete, but no further PSB schedules are allowed.

If a database specified in either of these commands is being used by a BMP, an error message is issued, and the command is ignored for that database. You reenter the /DBDUMP or /DBRECOVERY command when the database is no longer being used by a BMP. If you need to recover the database immediately, use the /STOP command with the THREAD keyword (or its synonym, REGION) to terminate any BMPs using the database before you reenter the /DBDUMP or /DBRECOVERY command.

For a whole DEDB, the PSB is not scheduled. For a DEDB area, programs are not allowed access to data in that area. For a DL/I database, programs are not allowed access to the database.

Note: Issuing the /DBRECOVERY and /DBDUMP commands causes the OLDS to switch; an archive job may be generated to archive the previous OLDS. (This is controlled by the ARC=xx startup parameter.) Use the NOFEOV keyword to prevent the OLDS switching when you issue these commands.

The /START command reverses the effects of a /DBDUMP or /DBRECOVERY command. The /START command allocates the database or area. A database is authorized on the first schedule request it receives, and is opened at the first DL/I request. An area is authorized and opened on receipt of the first DL/I request.

Switching to a new OLDS

In IMS 4.1, specifying /SWITCH OLDS causes the IMS log to switch to the next OLDS. This switch to the next OLDS is marked as a recovery point for log archiving purposes. If you also specify the (optional) CHECKPOINT keyword, IMS issues a simple checkpoint after the active log data set has been switched to the next OLDS. This switch capability is identical to that provided with the DBRECOVERY command, as described in “Preventing programs and transactions from updating databases” on page 70 and “Log control with DBRC” on page 42.

Entering external subsystem commands from DBCTL

If you are using DBCTL to access DB2 databases via BMPs, you can use certain DBCTL operator commands to enter ***external subsystem*** commands (where DB2 is the external subsystem).

To display the status of all or specified external subsystems, use the /DISPLAY command with the SUBSYS keyword. (This is similar to using the /DISPLAY command with the CCTL keyword to display the status of CICS systems connected to DBCTL.)

To display the status of origin application schedule numbers (OASNs), which are IMS recovery elements in a DB2 subsystem, use the /DISPLAY command with the OASN and SUBSYS keywords. If you then need to purge any incomplete LUWs in the external subsystem, use the /CHANGE command with the SUBSYS, OASN, and RESET keywords.

To enter an external subsystem command from the DBCTL console or a program authorized do so, use the /SSR command. For example:

```
/SSR -DISPLAY THREAD
```

displays information about DB2 threads. The command is processed in DB2 and the response is sent back to the terminal from which you issued the /SSR command.

Making DBCTL resources available

To make DBCTL resources available to refer to and use, enter the /START command, as follows:

- Specify that the stopped status of particular DEDB areas be reset (AREA keyword).
- Change the automatic archiving option selected at system initialization or specified in a previous /STOP command (AUTOARCH keyword).
- Specify databases to be started so that they can be referenced by PSB schedule commands (DATABASE keyword).

  Add the NOBACKOUT keyword to the DATABASE keyword for databases that are not registered in DBRC and were backed out using standard batch backout. If your databases are registered with DBRC, the /START process inquires with DBRC whether backout needs to be done before starting a database.
- Specify that a previously stopped online log data set (OLDS) is to be started or that DBCTL is to add a new OLDS (OLDS keyword). (See “IMS online log data set (OLDS)” on page 41 for more information on this data set.)
- Specify a PSB to be started (PROGRAM keyword). DBCTL stops a PSB after most pseudo abend codes that can occur. If this happens, you must use a /START PROGRAM command before that PSB can be scheduled again.
- Start BMPs from a JCL partitioned data set (REGION keyword). Using /START REGION in this way enables you to keep all your BMP JCL in one place.
- Specify that a write-ahead data set (WADS) is to be added to the pool of WADS (WADS keyword).

Preventing scheduling of PSBs and use of databases

The /STOP command stops the scheduling of specific PSBs and can stop the use of a given database, as follows:

- The ADS keyword specifies that a DEDB area data set (ADS) is to be stopped and deallocated. Note that this commands stops only the ADS, not the entire area. The area is stopped only if there is no ADS allocated. This command is rejected if the ADS you specified is the last data set available in the area because ADSs are invalidated when they are stopped. ADSs are reestablished by running the DEDB area data set create utility.
- The AREA keyword specifies that all the data sets associated with an area are to be stopped and deallocated. The status of this area is set to STOP, as displayed with a /DISPLAY DATABASE command. (See “Finding out current status of DBCTL activities” on page 68.) If the area is already stopped, the /STOP command just deallocates the data sets.
- The AUTOARCH keyword specifies that automatic archiving is to be stopped.
- The DATABASE keyword stops the use of the specified database.
- The OLDS keyword specifies that DBCTL is to stop using an OLDS.
- The PROGRAM keyword specifies that a PSB is to be stopped.
- The REGION or THREAD keywords specify a region or thread that is to be stopped. This can be a region or thread shown by the /DISPLAY CCTL command. (See “Finding out current status of DBCTL activities” on page 68.)

- The WADS keyword indicates that a WADS is to be removed from the pool of WADS.

Purging a transaction that is using DBCTL

You can query and purge tasks that use DBCTL using the CICS CEMT transaction as for any CICS task. However, if a transaction has “hung” in DBCTL, and you need to purge it, you must use the DBCTL command /STOP THREAD.

To find out what is happening to a task:

1. Issue CEMT INQ TASK to find out what tasks are active.
2. Expand the information on individual tasks by typing a ? to the left of the task you want to see. You will get a display like the one in Figure 20.

```
I TA
SYNTAX OF SET COMMAND
 Tas(0000110) Tra(DLID) Fac(D2D3) Sus Ter Iso Pri( 001 )
    Hty(DBCTL   ) Hva(DLSUSPND) Hti(000007) Sta(TO)
    Use(CICSUSER) Rec(X'9EDA1F61E11CFA02')
 CEMT  Set TAsk() | < All >
  < PRiority() >
  < PUrge | FOrcepurge >

                                                    SYSID=CIC1 APPLID=DBDCCICS

PF 1 HELP       3 END                    7 SBH 8 SFH 9 MSG 10 SB 11 SF
```

Figure 20. CEMT INQ TASK (expanded)

Figure 20 includes the following useful information:

`Tas(0000110)` — task identifier
`Tra(DLID)` — transaction name of the task
`Fac(D2D3)` — identifier of the terminal or queue that initiated the task
`Sus` — the task is suspended
`Ter` — the task was initiated from a terminal
`Pri(001)` — the task is running with a priority of 1
`Hty(DBCTL)` — the task is currently issuing a DL/I request to DBCTL
`Hva(DLSUSPND)` — the task is suspended in DBCTL
`Hti(000007)` — how long, in seconds, the task has been suspended
`Sta(TO)` — how the task was started; TO means from a terminal by an operator entering a transaction
`Use(CICSUSER)` — is the userid of the user who initiated the task
`Rec(X'9EDA1F61E11CFA02')` shows the recovery token associated with the task

The screen also contains a reminder of the syntax of the CEMT SET TASK command, which you may need to use; for example, if you want to purge the suspended task.
`SYSID=CIC1` — CICS system identifier, as specified in the system initialization parameter SYSIDNT.
`APPLID=DBDCCICS` — APPLID for the CICS system.

3. Issue CEMT INQ TASK again.
   - If the response indicates that the task is no longer suspended in DBCTL, you can purge it using CEMT SET TASK(n) PURGE as for any CICS task. (Information on using CEMT commands is in the *CICS/ESA CICS-Supplied Transactions* manual.) The purge takes place after the DL/I request to DBCTL has completed.
   - If the response indicates that the task is still suspended in DBCTL, the task has "hung" in DBCTL, and you must use DBCTL operator commands to purge it.

To do this:

1. From the CEMT INQ TASK display, make a note of the CICS APPLID and the 16-digit recovery token. (You can use a recovery token to find the thread number of a CICS task in DBCTL. For a fuller definition, see "Recovery tokens" on page 86.)
2. At the DBCTL console, enter /DISPLAY CCTL cctlname, where cctlname is the CICS APPLID (in this example, it is DBDCCICS). This causes the current status of DL/I activity to be displayed, as shown in Figure 21.

```
0080  /DIS CCTL DBDCCICS
0080  DFS000I MESSAGE(S) FROM ID=SYS1 047
0080      CCTL     PSEUDO-RTKN  RECOVERY-TOKEN   REGID  PSBNAME   STATUS
0080      DBDCCICS                                          ATTACHED
0080                           9EDA1F61E11CFA02     6  PC3COCHD  ACTIVE
0080                           9EDA1F4E9B571B02     5  PC3COCHD  ACTIVE
0080      *88204/101241*
```

Figure 21. Output from /DISPLAY CCTL cctlname

3. Find the recovery token (9EDA1F61E11CFA02 in this example) that matches the one you noted from the CEMT INQ TASK display, and then note the thread number that is next to it in the REGID column (6 in this example).
4. Issue the command:

   `/STOP THREAD n ABDUMP`

   where n is the thread number.

   This causes the thread and transaction to terminate when it has finished processing the current request, and causes a dump to be taken.

   If the thread does not stop, use:

   `/STOP THREAD n CANCEL`

   Do not use /STOP THREAD CANCEL if you do not need to, because it may cause DBCTL to terminate with a U113 abend.

Stopping DBCTL normally

To stop DBCTL normally and disconnect it from CICS, use the /CHECKPOINT command with the FREEZE or PURGE keywords. Active threads are terminated, CICS threads are terminated when they reach a syncpoint, and BMPs are processed until they reach a checkpoint, a SYNC call, or the end of a program. Shutdown then completes and the system status is saved in a system checkpoint on the log, and in the checkpoint ID table on the restart data set. See “Messages issued by DBCTL during normal termination” on page 205 for a list of messages that should be issued at this stage.

The difference between the FREEZE and PURGE keywords applies to BMPs. FREEZE stops them after the next checkpoint, or at program completion, whichever is the sooner, and PURGE allows them to complete.

When you have stopped DBCTL using /CHECKPOINT FREEZE or /CHECKPOINT PURGE, you can warm start it using /NRESTART, as described in “Warm start” on page 80.

Stopping DBCTL abnormally

There is no equivalent of a CICS immediate shutdown in DBCTL. If you need to force termination of DBCTL, the MVS console operator has to issue an MVS MODIFY jobname STOP command. This causes an abnormal termination without a dump. If you want a dump to be taken, use an MVS MODIFY jobname DUMP command. For guidance on using MVS commands with IMS, see the *IMS/ESA Operator's Reference* manual.

Dealing with messages from DBCTL and CICS

Messages from DBCTL (in the form DFSnnnn) are sent to console(s) as specified in the MCS= parameter of the IMSCTRL macro in the IMS generation. These messages include notification of change in status and of abnormal events.

Messages that are prefixed with a DFHDL3910 header and sent to CSMT in local DL/I are one example of this type of message. There are many additional messages in the DBCTL environment. You can direct them to the console from which DBCTL commands will be entered. However, if you find that the volume of messages means it is impractical to view them “live” at the console, you may prefer to direct them to the console log and process them with whatever tool your installation uses to review console output.

The DFS554 message is a notification of the abnormal termination of a BMP region or a thread from a CICS transaction. If it has been caused by an abnormal termination of a thread that originated from CICS, the message text contains the CICS job name or CICS started procedure name. It also contains the abend code in the form SSS, UUU where SSS is a system abend code and UUU is an IMS user abend code. (See “Return codes in DBCTL” on page 172 for more information on these codes.) The message may contain the characters “PSB.” If it does, the PSB contained in the message has been stopped. All attempts to schedule that PSB will fail until a /START PROGRAM command is issued for that PSB. See the *IMS/ESA Messages and Codes* manual for guidance on interpreting DFSnnnn messages.

From CICS/ESA 3.2.1 onwards, messages from CICS that relate to DBCTL begin with DFHDB, messages that relate to DBCTL in an XRF environment begin with DFHDX, and messages that relate to local DL/I begin with DFHDL.

Messages from CICS that relate to DBCTL (for example, those relating to the CDBC transaction) are sent to the transient data destination CDBC so that they are located in one place. You can reroute these messages from CDBC, as you can with CSMT.

From CICS/ESA 3.2.1 onwards, you can ***suppress or reroute*** messages sent to transient data queues such as CDBC. You can reroute from CDBC to a list of consoles, from CDBC to a different transient data queue, or reroute console messages from their transient data queues to CDBC. For programming information about coding the CICS-supplied user exit used to re-route messages and on the example user exit provided to help you do so, see the *CICS/ESA Customization Guide*.

Messages DFHDB8103 and DFHDB8104 are issued if there is a failure to connect to DBCTL. They contain the DBCTL reason codes for the connection failure.

Message DFHDB8109 is issued when:

- A schedule request has failed.
- DBCTL has abnormally terminated a thread and, as a result, CICS abnormally terminates the transaction.

Message DFHDB8109 is ***not*** issued when an error type status code is returned to the application program.

DFHDB8109 enables you to identify the IMS reason for which this CICS transaction has failed. The *IMS/ESA Messages and Codes* manual contains guidance on interpreting the IMS abend and reason codes referred to above. See the *CICS/ESA Messages and Codes* manual for help on interpreting messages beginning with DFH.

Chapter 6. Recovery and restart operations

To deal with recovery and restart in a DBCTL environment, you need to know about:

- How recovery and restart differs between CICS and IMS
- The recovery and restart process in DBCTL itself
- The database and log utilities used in recovery
- The impact on your DBCTL environment of different component, transaction, and thread failures.

Some recovery and restart design principles apply to DL/I whether you are using DBCTL or local DL/I; for more details, see the section on design factors related to the use of DL/I in the *CICS/ESA Recovery and Restart Guide*, but note that intent scheduling applies only to local DL/I used with IMS/ESA 3.1 and earlier.

Using CICS with DBCTL introduces a number of changes to recovery and restart procedures:

- DBCTL performs backout of DL/I databases. DBCTL is a resource manager and is responsible for the integrity and recoverability of its own resources, regardless of the using subsystem (for example, CICS or a BMP).
- Because DL/I code is no longer in the CICS address space, you must restart both the CICS and DBCTL address spaces, and DBCTL must be reconnected to CICS if there is a processor or power failure.
- LUWs left in-doubt after a failure can only be resolved when DBCTL has been reconnected to CICS.

Overview of CICS and IMS recovery and restart

CICS and IMS perform similar recovery functions, but there are differences in terminology and in implementation. The following paragraphs give an overview of the similarities and the differences of the recovery areas of the two products. See the *CICS/ESA Recovery and Restart Guide* and the *IMS/ESA Operations Guide* for background information on recovery in CICS and IMS, respectively. If you are familiar with CICS or IMS, but not both, we recommend that you read this overview and then read the manual for the product that you are not familiar with.

CICS initialization and termination

CICS has the following types of initialization or restart depending on the SIT START parameter and on how it was last terminated:

- Cold start
- Warm start
- Emergency restart.

You cannot specify warm start or emergency restart explicitly. Instead, you specify START=AUTO in the SIT, and CICS determines which of these two kinds of start to use. See the *CICS/ESA Operations and Utilities Guide* for information about specifying CICS START options.

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If CICS performs a warm start or an emergency restart on a system to which DBCTL was connected and you have put DFHDBCON in the PLT, so that it is invoked in the second stage of PLTPI processing, the same DRA startup table suffix is automatically used when DBCTL is reconnected. The suffix may change if you have used the SIT parameter INITPARM (described in "Reviewing CICS SIT parameters" on page 29) to override the suffix previously used. (For information on methods of connecting to the same, or a different, DBCTL see "Connecting DBCTL to CICS automatically" on page 54.)

CICS initialization begins when the job is submitted and, in almost all cases, continues until completion of the specified type of restart. Error conditions may require operator replies or may cause abnormal termination.

CICS has three types of termination:

- Normal
- Immediate
- Abnormal — due to abend or an MVS CANCEL.

The CICS master terminal command to shut down CICS has two options — normal and immediate. A ***normal*** shutdown allows transactions to complete before shutting down and saves the system status in the CICS catalog. You can do a warm start after a normal shutdown. An ***immediate*** shutdown does not allow transactions to complete. This means it is equivalent to an abnormal termination, and you must restart CICS using emergency restart.

There are special considerations for canceling CICS when it is connected to DBCTL. See the information on causing an abnormal termination of CICS, in "CICS failure" on page 93.

When considering CICS and IMS recovery and restart, you should bear in mind the capabilities of the extended recovery facility (XRF), which can provide you with automatic takeover of a failing system, based on an emergency restart. For further guidance on XRF, see:

- *CICS/ESA 3.3 XRF Guide* for information about XRF support in CICS
- *IMS/ESA System Administration Guide* for information about XRF support in IMS
- Chapter 8, "Extended recovery facility (XRF)" on page 123 for information on using DBCTL with CICS XRF and IMS XRF.

Restarting DBCTL

DBCTL has three types of (re)start:

- Cold (/NRESTART CHECKPOINT 0)
- Warm (/NRESTART)
- Emergency (/ERESTART).

The startup process has two distinct phases — initialization and restart. You can use AUTO restart to do either a warm start or an emergency restart.

With an AUTO restart, (DBCTL startup parameter AUTO=Y), DBCTL decides whether warm start or emergency restart is required, based on the contents of the IMS restart data set (RDS), and proceeds with the restart without your needing to enter any further restart command.

If you need to enter your own restart command (for example, to perform a cold start), use a non-AUTO restart (DBCTL startup parameter AUTO=N). Non-AUTO restart stops after initialization, at which point you must manually enter a restart command.

AUTO=N will have been specified, or defaulted to, for the first startup of DBCTL. For subsequent restarts, use warm start or emergency restart, which means that you will need to change the parameter to AUTO=Y. For guidance on specifying AUTO=Y and AUTO=N, see the *IMS/ESA System Definition Reference* manual.

During restart processing, the log and RECON are opened.

The sections that follow state how you use these types of (re)start with DBCTL.

Cold start

With this type of start, DBCTL is brought up in the state it was in at system generation. You should not use cold start after a DBCTL failure. Instead, you should use an emergency restart. See “Emergency restart” on page 80 for more information.

To request a cold start of DBCTL, use the /NRESTART command with the CHECKPOINT 0 keyword. Additional keywords with /NRESTART CHECKPOINT 0 enable you to:

- Specify whether you want the RDS, or the WADS (or both) formatted as part of restart process (the RDS, WADS, or ALL keywords). You should format the RDS and the WADS if there has been a data set I/O error, if you need to reallocate a data set or change its size, or if you are starting DBCTL for the first time.
- Specify whether the IMS system definition password security option is to be in effect — provided your system definition enables operators to change password security (the PASSWORD keyword).

  Before you do a cold start, you must ensure that the IMS you intend to start does not have a subsystem record in the RECON. This will be the case if it is a new subsystem, if it was shut down normally the last time it was used, or if it was not shut down normally but the appropriate DBRC commands (including DELETE.SUBSYS) and other actions needed to ensure database integrity were performed.

Warm start

With this type of start, DBCTL is brought up in the environment it was in when it terminated normally using a /CHECKPOINT FREEZE or /CHECKPOINT PURGE command, as described in “Stopping DBCTL normally” on page 75. After a warm start, resources are in the same state they were in at the time the system was shut down.

The difference between the FREEZE and PURGE keywords applies to BMPs. FREEZE stops them after the next checkpoint, or at program completion, whichever is the sooner, and PURGE allows them to complete. See the *IMS/ESA Operator's Reference* manual for a list giving guidance on the differences between these options.

To request a warm start of DBCTL, use the /NRESTART command without CHECKPOINT 0.

Any in-doubt LUWs are re-created for this type of start. (An ***in-doubt*** LUW is a piece of work that is pending during commit processing. If commit processing fails between DBCTL's response to CICS's request to prepare for commit and CICS's decision to execute the commit, recovery processing must resolve the status of any work that is in-doubt.) See “Resolving in-doubt logical units of work (LUWs) manually” on page 87 for information on using operator commands to resolve in-doubt LUWs.

You can use the following optional keywords on /NRESTART:

- If the WADSs have been reallocated, specify whether you want them to be formatted as part of the restart process. You should format the RDS and the WADS if there has been a data set I/O error or if you need to reallocate a data set or change its size.
- Specify whether the IMS system definition password security option is to be in effect — provided your system definition enables operators to override password security.

Emergency restart

To perform an emergency restart of DBCTL, use the /ERESTART command. With this type of start, DBCTL is restarted in the environment it was in ***before*** a DBCTL failure. DL/I in-flight LUWs (that is, those that were still being processed when the failure occurred) are backed out. Committed but unwritten DEDB changes are applied to the database. Units of work that were in-doubt are retained and are resolved automatically when CICS and DBCTL are reconnected. For further guidance on how this is done, see the *IMS/ESA Operations Guide*. If the LUWs fail to be resolved automatically, you can use DBCTL operator commands to do so, as described in “Resolving in-doubt logical units of work (LUWs) manually” on page 87.

If a failure in emergency restart prevents backout being completed, instead of using a COLD start, you can reattempt the emergency restart using the COLDBASE keyword on the emergency restart command. Full function DL/I databases and DEDB areas that have in-doubt data or that need backout or recovery are identified and stopped. Database backout and committed DEDB updates are not done. You must then use the appropriate IMS utilities to backout or forward recover these databases. (See the *IMS/ESA Utilities Reference: Database* manual for guidance on using the utilities.)

You can also specify whether the restart or write ahead data sets should be formatted as part of the restart process. You should format the RDS and the WADS if there has been a data set I/O error or if you need to reallocate a data set or change its size.

CICS keypoints and IMS checkpoints

This section discusses system-level keypoint and checkpoint information. Both CICS and IMS also have task or program (thread) level synchronization information.

CICS keypoints and IMS checkpoints both contain system status information that is modified during online operation. The concepts are basically the same, but they are implemented differently.

A CICS warm start uses a warm keypoint that was written to the CICS catalog by the previous normal CICS shutdown.

A CICS emergency restart reads the CICS system log backwards until it has located at least one activity keypoint and the logical start of task for each recoverable task that was active at the time of the failure. It then reads the CICS system log forward from this point.

An IMS warm start reads the checkpoint ID table on the RDS to find the shutdown checkpoint on the log. The RDS is a data set that IMS uses to record system checkpoint ID information during the logging process. IMS finds the information it needs and uses it automatically. If the RDS is not available at restart, you can obtain the checkpoint information needed from the log, but this may lengthen the restart process. Generally, you do not need to know the content of the RDS. However, if you are faced with a particularly complex recovery problem, you may need to examine the RDS. You can find guidance on its contents in the *IMS/ESA Operations Guide*.

An IMS emergency restart reads the checkpoint ID table on the RDS and selects the checkpoint that precedes the last synchronization point of each program that was active at the time of the failure. It then reads the IMS log forward from the selected checkpoint.

To take a simple checkpoint of DBCTL, use the /CHECKPOINT command.

Backing out uncommitted updates after a failure

The meaning of the term ***dynamic backout*** differs slightly between CICS and IMS.

In CICS, dynamic backout means backout as a result of a transaction (or application program) failure. The term **transaction backout** is used for backout done during CICS emergency restart.

In IMS, dynamic backout means backout as a result of a program failure. In a DBCTL environment, program failures include CICS transaction abends and BMP failures. The IMS /ERESTART command also performs emergency restart backout. IMS provides a batch backout utility, DFSBBO00, which you can use if dynamic backout or emergency restart fails. See the *IMS/ESA Operations Guide* for guidance on ***when*** to run this utility, and *IMS/ESA Utilities Reference: Database* manual for guidance on ***how*** to run it.

Because IMS does the backing out of database updates in a DBCTL environment, we concentrate on IMS backout in this section.

For IMS full function databases, database changes are placed in the log buffers and the database buffers as they are made. Depending on system activity, they may be written before they are committed and so, after a program failure or an IMS system failure, databases may require backout. The IMS log data sets (OLDS) are used for dynamic backout. (See "IMS online log data set (OLDS)" on page 41 for more information.) Additionally, if dynamic backout or /ERESTART backout fails, for a database, that database is stopped. The backout is automatically reattempted when the database is restarted.

For DEDBs, no changes are placed in the log buffers until syncpoint processing begins, and no changes are written to the database until a commit has been received. This means that they do not need backout if there is a failure during phase 1 of the syncpoint process. The system can undo the changes by releasing the database buffers that have been modified but not yet written.

Log records

The IMS log is a record of activities and database changes. Among the log records written to the IMS log are those that record both phases of the commit for each unit of work. These log records contain the information necessary for database recovery and system restart. The *IMS/ESA Diagnosis Guide and Reference* manual contains, for guidance, a list of the types of log records and tells you how to obtain a listing of these DSECTs. The *IMS/ESA Utilities Reference: Database* manual gives guidance on using the file select and formatting print utility, DFSERA10, to print the IMS log records.

Database recovery control (DBRC)

Database recovery control (DBRC) assists you in controlling DBCTL logs, and in managing recovery of databases. With DBCTL, you ***must*** use DBRC to control your logs, and you may optionally use it to control batch logs and database recovery. DBCTL requires DBRC to be at SHARECTL level; if it is not, DBCTL will not start.

You may optionally use DBRC to control the data sharing environment by allowing (or preventing) access to databases by various subsystems sharing those databases.

If you use DBRC to control database recovery, you must register your databases with DBRC, so that it can record the relevant information in the RECON, and then use that information to control the recovery of your databases. See the *IMS/ESA Operations Guide* for general guidance on registering databases. You can register your databases using either of the following:

- The recovery control utility, DSPURX00. See the *IMS/ESA Utilities Reference: Database* manual for guidance on using DSPURX00.
- The /RMINIT.db and /RMINIT.dbds commands. See the *IMS/ESA Operator's Reference* manual for guidance on the syntax of these commands.

To recover a database that is registered with DBRC, use the /RMGENJCL.RECOV command. DBRC recovers the database using a combination of available input; for example, image copy data set, change accumulation data sets, log data sets, and archived log data sets.

Recovery control (RECON) data sets

DBRC automatically records information in dual recovery control (RECON) data sets. Both data sets contain identical information, and so are usually referred to as one — the RECON. The information from the RECON is needed during warm and emergency restarts. DBRC selects the correct data sets to be used by a recovery utility when you enter a GENJCL command. For a restart, the RECON shows which data set — the OLDS or the SLDS — contains the most recent log data for each database data set (DBDS) you have registered with DBRC. For the OLDS, the RECON shows whether the OLDS has been closed and whether it has been archived. The RECON contains timestamp information for each log data set and volume. IMS uses this information to determine which data set and volume contain the checkpoint information needed to restart DBCTL.

Commit protocols and units of recovery

This section describes what happens when a transaction has updated DBCTL databases, and is issuing a syncpoint, or a TERM request, or is terminating. If a failure occurs at any of these stages, DBCTL may not be able to determine whether CICS intended these updates to be backed out or committed and has to request this information from CICS when it has been reconnected.

Two-phase commit

DBCTL uses a ***two-phase commit*** to record a syncpoint. At the completion of a two-phase commit, the requested processing is committed and if a failure occurs, DBCTL does not ABORT committed changes.

Two-phase commit consists of the PREPARE and COMMIT phases. Within the PREPARE phase, CICS issues a PREPARE request to DBCTL. DBCTL writes to the log and issues its response to the PREPARE request to CICS. Within the COMMIT phase, there are two possible actions: COMMIT and ABORT. The ABORT action for data belonging to full function DL/I databases is ***backout***. There is no backout for data belonging to DEDBs because, as explained below, it is not written to the database before the COMMIT phase. The effect of an ABORT for DEDBs is also referred to as ***undo***. Because a CICS thread may be accessing data belonging to both full function DL/I databases and DEDBs, we use the term ABORT to refer to both backout and undo.

When updates are written to databases

The DEDB terms UNDO and REDO are analogous to the DL/I full function terms BACKOUT and COMMIT respectively. However, although the processes that these terms refer to have the similar end results, the processes themselves differ. The difference is in the stage at which updates are written to the database. This is shown in Figure 22 on page 84.

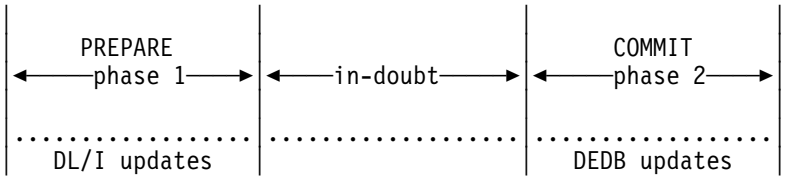

Figure 22. When updates are written to databases

This difference in timing of writing updates dictates the action taken during the second phase of two-phase commit.

For full function DL/I databases:

- If the phase 2 action is COMMIT, no action is needed to commit updates because DL/I wrote them to the database during phase 1.
- If phase 2 action is ABORT, a BACKOUT of the updates is required because DL/I wrote them to the database during phase 1.

For DEDBs:

- If phase 2 action is COMMIT, the changes must be REDOne to the database because they have only been made in main storage. (They are written (committed) to the database on DASD by the output threads, which are generated by the IMS system generation parameter OTHREADS. See the *IMS/ESA System Definition Reference* manual for guidance on this parameter.)
- If phase 2 action is ABORT, no changes have to be made to the database, because the changes are still in main storage, and can be UNDOne from there.

REDO is also used to refer to the action required for committed DEDBs during emergency restart of IMS. IMS can determine from the log that a COMMIT was initiated, but that phase 2 is not indicated as complete. In this case, DEDB updates must be REDOne. The two phases are:

1. Phase 1, in which CICS directs syncpoint preparation and asks whether or not the updates to DBCTL databases can be committed.
2. Phase 2, in which CICS tells DBCTL that it must either COMMIT or ABORT the resources. (CICS can request an ABORT without first issuing a PREPARE request. That is, CICS can bypass the first phase of two-phase commit when an update is being backed out.)

Figure 23 on page 85 shows two-phase commit and describes the activities taking place.

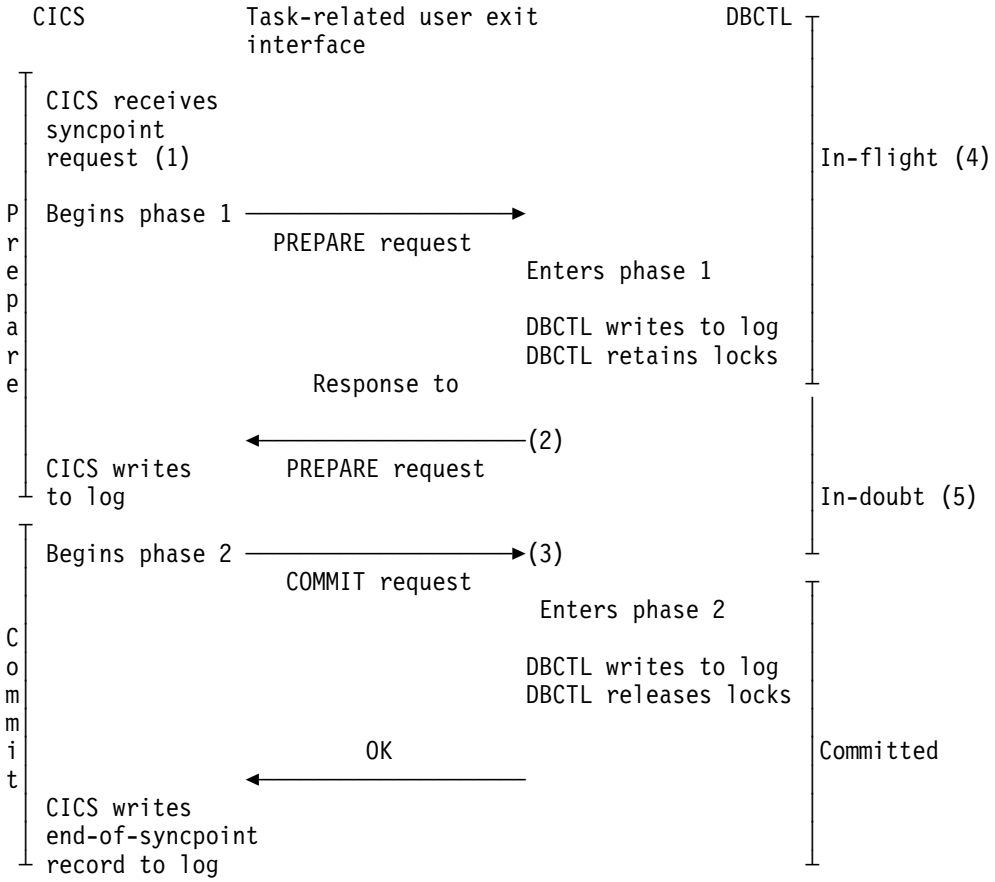

Figure 23. Two-phase commit

Notes:

1. The syncpoint request can be EXEC CICS SYNCPOINT, a DL/I TERM call, or a CICS task termination.
2. If DBCTL indicates that it cannot commit the updates, CICS aborts the unit of recovery and the rest of the Figure 23 does not apply.
3. If CICS tells DBCTL to commit the updates, DBCTL ***must*** commit.
4. At this stage, units of recovery are ***in-flight*** and, if DBCTL fails, all database updates are aborted.
5. At this stage, from the time that DBCTL issues its response to the PREPARE request to the time it receives a COMMIT request from CICS, units of recovery are ***in-doubt***. DBCTL retains the in-doubt information. When DBCTL is restarted after a failure, it inquires with CICS about the status of the in-doubts. This is part of ***resynchronization***.

LUWs and resources belonging to multiple resource managers

The two-phase commit process also applies if an LUW is updating resources that belong to more than one resource manager; for example, any of the following: local DL/I databases ***or*** DBCTL databases (DL/I full function or DEDBs, or both), local VSAM files, and DB2 databases. As explained above, CICS is the coordinator of the two-phase commit process; DBCTL is a participant. CICS must ensure that all the resource managers, including DBCTL, are in synchronization. To do this, at phase 1 of two-phase commit, it issues a PREPARE request to all the resource managers involved to find out if a COMMIT can be done. This is as shown in

Figure 23, in which CICS is communicating with DBCTL only. If ***all*** the other resource managers indicate that a COMMIT is possible, CICS tells them all to COMMIT. If not, CICS tells them ***all*** to ABORT. The COMMIT or ABORT must now be carried out in all the resource managers. For this reason, CICS considers the COMMIT or ABORT to be completed at this stage, even if it is slightly delayed.

DBCTL unit of recovery

A DBCTL **unit of recovery** is created for each processing request when the first schedule request is made by the transaction, and is kept until the two-phase commit is complete. As described in "Resolving in-doubt logical units of work (LUWs) manually" on page 87, commands are available to display the units of recovery and take appropriate actions for committing or ending them.

In-flight unit of recovery: If DBCTL fails and is subsequently restarted, all in-flight units of recovery are backed out.

In-doubt unit of recovery: When a failure occurs, a recoverable in-doubt structure (RIS) is constructed for each in-doubt unit of recovery and is also written to the IMS log. The RIS contains:

- Residual recovery element (RRE), which contains the recovery token
- In-doubt extended error queue element (IEEQE), which contains the changed data records
- Buffer extended error queue element (BEEQE), which indicates a data block that cannot be accessed because of unresolved in-doubts
- Extended error queue element link (EEQEL), which links the basic portion of the RIS (the RRE) with the IEEQE and the BEEQE, which are used to protect in-doubt data.

The IMS batch backout utility, DFSBBO00, and the IMS database recovery utility, DFSURDB0, process the in-doubt units of recovery.

CICS logical units of work (LUWs)

CICS LUWs and DBCTL units of recovery are more or less synonymous, except that from CICS's point of view, an LUW begins at the beginning of a task, and a unit of recovery begins when that task issues its first DL/I request. For simplicity, in the rest of this book, we use the CICS term LUW to refer to both. The IMS publications use the term "unit of recovery."

Recovery tokens

Recovery tokens are created by CICS and passed to DBCTL. They are unique identifiers for each LUW. The lifetime of a recovery token is the same as for an LUW. You can use them to correlate work done between CICS and DBCTL in the same LUW. Each recovery token is 16 bytes long; the first 8 bytes are the CICS APPLID (passed to DBCTL when CICS is first connected) and the second 8 bytes are an LUW identifier. CICS creates an identifier like this for every LUW. DBCTL validates the recovery token to protect against duplication of LUWs. You can use the recovery token in certain operator commands. For example, you can display it as part of the output of the /DISP CCTL and CEMT INQ TASK commands, and you can enter it in /CHANGE commands, in the form of a pseudo recovery token, as explained below. The recovery token is included in certain messages (for example, the CICS message DFHDB8109, which is issued when a DL/I request has failed). Recovery tokens can be useful in problem determination, because they are

displayed in dumps produced by CICS and DBCTL and in trace entries produced by CICS. See Chapter 10, “Problem determination” on page 151 for more information.

The pseudo recovery token is an 8-character decimal token, which can be used in place of the 8-byte hexadecimal recovery token and is displayed when the status of a thread is in-doubt. It is made shorter than the recovery token so that it is easier to make note of (for example, from /DISPLAY commands) and enter (for example, in /CHANGE commands).

Figure 24 shows a pseudo recovery token (00010040 in the column headed PSEUDO-RTKN) and a recovery token (F0F58879641002C2) for thread number 4 (in the column headed REGID) for PSBNAME PC3COCHD, whose STATUS is INDOUBT.

```
0080  /DIS CCTL DBDCCICS
0080  DFS000I MESSAGE(S) FROM ID=SYS1 047
0080      CCTL     PSEUDO-RTKN  RECOVERY-TOKEN   REGID  PSBNAME   STATUS
0080      DBDCCICS                                                  ATTACHED
0080                           9EDA1F61E11CFA02     6  PC3COCHD  ACTIVE
0080                           9EDA1F4E9B571B02     5  PC3COCHD  ACTIVE
0080                00010040   F0F58879641002C2     4  PC3COCHD  INDOUBT
```

Figure 24. /DISPLAY CCTL cctlname command showing pseudo recovery token

Resolving in-doubt logical units of work (LUWs) manually

Having to manually resolve LUWs about which DBCTL is in-doubt whether to commit or backout should be the exception, rather than the rule. Normally, an emergency restart of DBCTL followed by reconnection of CICS and DBCTL after a failure should resolve in-doubts automatically. However, you may sometimes need to do this yourself. For example, if a CICS system using DBCTL disconnects abnormally from DBCTL (for instance, if CICS or DBCTL abends, or CDBC DISCONNECT IMMEDIATE is issued), there may be some incomplete updates about which DBCTL is in doubt. If CICS then needs to be cold started for some reason, its record of the in-doubt updates is lost and they are not resolved automatically. (For this reason, you should avoid unnecessary cold starts of CICS or of DBCTL.)

The DFS2283I message, issued during the resynchronization process, indicates that there are LUWs that have not received a COMMIT or ABORT request, and are therefore in-doubt.

In this situation you must use DBCTL operator commands (described in “Using DBCTL operator commands to resolve in-doubts” on page 88) to resolve the in-doubts.

Sample in-doubt resolution program: To help you decide whether to commit or backout updates in these circumstances, there is a sample batch utility program called DFH$INDB, which you run ***before reconnecting CICS to DBCTL***.

DFH$INDB produces a list of in-doubts for a given resource manager (in this case, DBCTL) and the action needed to resolve each update. The information produced is for in-doubts recorded on the archived copies of the CICS system logs up to the time CICS disconnected abnormally from DBCTL.

DFH$INDB gives you the following information:

- Recovery token
- Name of the CICS transaction being used
- CICS task number
- ID of the terminal on which the transaction was running
- ID of the operator running the transaction
- Time at which the commit processing for the update began
- Action required to resolve the in-doubt.

Most in-doubts for a given DBCTL appear on the report produced by DFH$INDB. However, in two cases, DBCTL can be in doubt about a record, but there is no corresponding entry in the DFH$INDB report:

- The in-doubt may have been created before the last cold start of CICS. In this case, run DFH$INDB against the archived copies of the logs used prior to the cold start to decide how to resolve the in-doubt.
- DBCTL completes its prepare process before CICS writes a “prepare” record to its log. Therefore, if DBCTL disconnects abnormally from CICS at this point, DBCTL is in doubt, but CICS has no record of it. In this case you should backout.

DFH$INDB may list in-doubts that DBCTL does not know about. This can happen if CICS is disconnected abnormally from DBCTL after DBCTL resolved the in-doubt and before CICS writes the “forget” record to its log. It can also occur if you run DFH$INDB after issuing DBCTL operator commands to resolve in-doubts. In these cases, you need do nothing more to resolve the in-doubts.

For information on job control statements to execute DFH$INDB, a sample job stream, examples of output and return codes from DFH$INDB, see the *CICS/ESA Operations and Utilities Guide*. See CICS410.SDFHSAMP for a sample of DFH$INDB that you can copy to create your own version.

Using DBCTL operator commands to resolve in-doubts: When you have run DFH$INDB, and examined its output, use the following DBCTL operator commands to commit or backout, as recommended.

1. Use /DISPLAY CCTL cctlname INDOUBT, as shown in Figure 25 to obtain the pseudo recovery token that identifies the in-doubt work. (Pseudo recovery tokens are defined in “Recovery tokens” on page 86.)

```
0080  /DIS CCTL DBDCCICS INDOUBT
0080  DFS000I MESSAGE(S) FROM ID=SYS1 047
0080      CCTL     PSEUDO-RTKN  RECOVERY-TOKEN   REGID  PSBNAME   STATUS
0080      DBDCCICS                                                 ATTACHED
0080               00010040     F0F58879641002C2     4  PC3COCHD  INDOUBT
```

Figure 25. /DISPLAY CCTL cctlname command showing in-doubt

2. Use /CHANGE CCTL cctlname PRTKN token command to abort or commit the in-doubt. The cctlname is the APPLID of the CICS system. The PRTKN keyword specifies the pseudo recovery token of the element to be processed. The command is either:

   - ABORT to backout changes for a unit of recovery, or COMMIT to commit changes for recovery. For example:

     ```
     /CHANGE CCTL DBDCCICS PRTKN 00010040 COMMIT
     ```

     would commit the in-doubt shown in Figure 25 on page 88.

When the action you specified has been completed, the recoverable in-doubt structure (RIS) for the in-doubt LUW is removed.

Database utilities

DBCTL enables you to use utilities that IMS provides to help with the backup and recovery of your databases. These utilities are listed below.

Note: Because database change records are written to the IMS log, you do not need to retain the CICS system log for use by IMS database recovery utilities in a DBCTL-exclusive environment.

- Database image copy utility, DFSUDMP0

  The database image copy utility, DFSUDMP0 is a batch utility that creates a copy of data sets within a database. For DEDBs, you can copy an area
  # concurrently with DBCTL activity. In IMS/ESA 4.1, you can also use concurrent
  # image copy for full function DL/I databases.

  If the databases are updated while the utility is running, all logs including the one that was being used when DFSUDMP0 was started, are needed for use with DFSURDB0. You need both the log and the image copy to give a complete “picture” of the database for recovery purposes.

  If you have not created an image copy, the data set to be recovered is used as input to DFSURDB0.

- Online database image copy utility, DFSUICP0

  The online database image copy utility, DFSUICP0, is a BMP that creates an output copy of a data set within a full function DL/I database while the database is allocated and being used by DBCTL.

  If the databases are updated while the utility is running, all logs including the one that was being used when DFSUICP0 was started, are needed for use with DFSURDB0. You need both the log and the image copy to give a complete “picture” of the database for recovery purposes.

  If you have not created an image copy, the data set to be recovered is used as input to DFSURDB0.

- Database change accumulation utility, DFSUCUM0

  If system availability is a major concern for your installation, you will probably want to use this utility. It collects the changes from the other log data sets onto a single log, thus helping to speed recovery. You should balance the benefits of using it against the overhead it incurs, and the fact that you may not need to use its output.

- Database recovery utility, DFSURDB0

  The database recovery utility uses a backup copy of your database together with either (or both) the change accumulation utility or the logs, and reapplies changes made since the backup copy to create a new, reconstructed, database.

  The database recovery utility performs recovery at the data set level, or at the track level. Often, only a single data set of the database requires recovery. However, if more than one data set has been lost or damaged, you need to recover each one separately. If an I/O error caused the problem, you might need to recover only a single track instead of reconstructing the entire data set.

You can use these utilities together to perform recovery by updating a copy of the database with the changes logged since the copy was made, as shown in Figure 26 on page 91. See the *IMS/ESA Utilities Reference: Database* manual and the *IMS/ESA Operations Guide* for further guidance on using the utilities, including any restrictions that may apply.

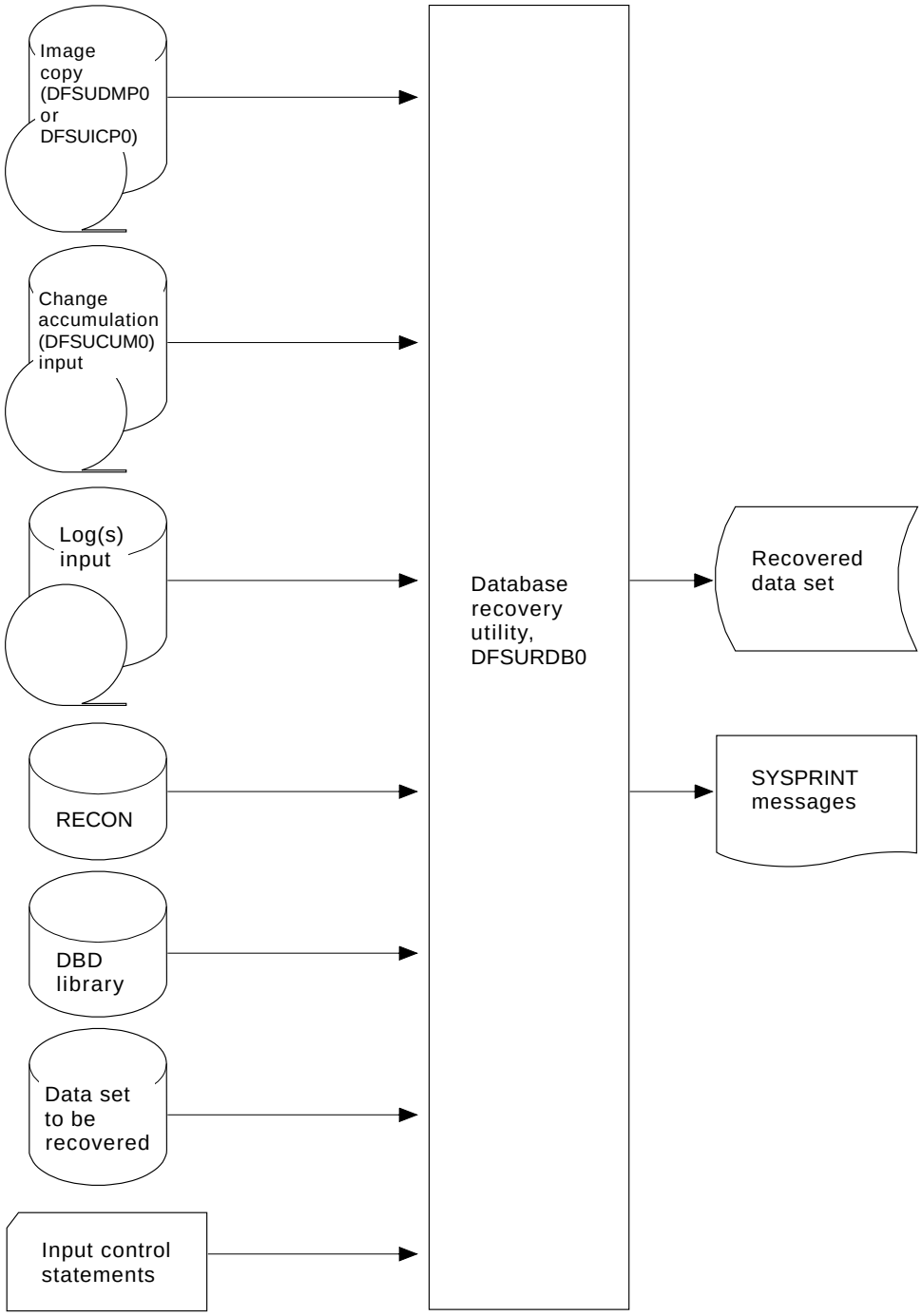

Figure 26. Database recovery utility, DFSURDB0, showing inputs and outputs

Note: Input from the image copy and change accumulation utilities is optional.

Log utilities

DBCTL enables you to use the following IMS log utilities:

- The log archive utility, DFSUARC0 produces a system log data set (SLDS) from a filled OLDS. DBCTL can automatically invoke DFSUARC0 to archive the OLDS when an OLDS switch occurs. You use the ARC= parameter in the DBC procedure to control automatic archiving. (See the *IMS/ESA System Definition Reference* manual for further guidance on specifying ARC, and the *IMS/ESA Utilities Reference: Database* manual for guidance on setting up the skeleton JCL needed.) Alternatively, you can use the DBRC command GENJCL.ARCHIVE to initiate manually an archive if you did not specify the automatic archive option, or if an automatic archive fails. See the *IMS/ESA Operations Guide* for further guidance about automatic archiving. The log archive utility runs as a batch job, and you can run multiple log archive jobs concurrently. The SLDS it creates may be on DASD, MSS, or tape. DFSUARC0 is the recommended utility for archiving logs in a CICS-IMS environment.
- The log recovery utility, DFSULTR0 produces a usable log data set from one that contains read errors or could not be closed properly. You can recover both system log data sets (SLDSs) and online log data sets (OLDSs) with this utility.
- The file select and print formatting utility, DFSERA10 enables you to display and examine data from the IMS log data set in the following ways:
  - Print or copy a whole log data set
  - Print or copy from multiple log data sets based on control statement input
  - Select and print log records according to their sequential position in the data set
  - Select and print log records based upon data contained within the record itself, such as the contents of a time, date or identification field
  - Enable your exit routines to do special processing on selected log records.

See the *IMS/ESA Utilities Reference: Database* manual for further guidance on using these utilities.

Component failures

This section discusses the impact of failures of different components of a CICS-DBCTL environment and of transaction and thread failures.

CICS failure

If CICS fails, DBCTL retains locks on database records updated by in-doubt LUWs. These records remain unavailable until in-doubts are resolved. CICS records information about the disposition of LUWs on its log. A CICS warm start or emergency restart reconstructs information describing LUWs that may be in-doubt. When CICS reconnects to DBCTL, DBCTL returns a list of any in-doubt LUWs. CICS notifies DBCTL of the resolution of all in-doubts, so DBCTL can commit or backout as appropriate.

If CICS fails, or if you need to cause an immediate shutdown, CICS attempts to disconnect from DBCTL. At this time, CICS gives the requests in progress time to complete before shutdown occurs. The time is specified in the DRA startup table parameter, TIMEOUT. (For information on this parameter, see “Defining the IMS DRA startup parameter table” on page 45.) If TIMEOUT is exceeded and CICS terminates while threads are still active in DBCTL, a U113 abend of DBCTL will occur. If this happens, you will have to restart DBCTL (IMS).

Choosing a value for TIMEOUT involves a trade-off between the length of restart process, which may be delayed if the value you specify is too high, and the risk of causing U113 abends, which may increase if you specify to low a value. One possible solution is to specify a TIMEOUT value that is about equal to the average length of time between BMP checkpoints. If a BMP checkpoint has been taken, there is less likelihood that CICS resources are waiting. This lessens the likelihood of U113 abends without lengthening the restart process too much.

If you need to cause an abnormal termination of CICS, and CICS does not respond to an immediate shutdown you should use an MVS CANCEL command. This, and CICS abends with different causes should not result in an IMS U113 abend, because DBCTL “traps” the CANCEL and an MVS system abend code of 08E is issued instead. Changing the effect of an MVS CANCEL from a U113 abend to an MVS system abend of 08E makes the effects of a CANCEL more like the effects of a CICS immediate shutdown, as described above. If you have been obliged to cancel CICS in this way, do not cold start it unless absolutely necessary, especially if there is a possibility of in-doubt units of work for DBCTL, because CICS will not know that they exist. (If you do have to use a cold start for any reason, see “Resolving in-doubt logical units of work (LUWs) manually” on page 87.)

For further information on the effects of a CICS failure in a DBCTL environment, see the section on CCTL termination in the *IMS/ESA Customization Guide: Database* manual.

Database resource adapter (DRA) failure

If the DRA fails:

- DBCTL notifies CICS that the DRA is terminating abnormally, and message DFHDB8106 is issued.
- CICS cleans up the storage associated with the CICS-DBCTL interface and disconnects from DBCTL.
- When it has done this, CICS issues message DFHDB8102.
- Then you must reconnect DBCTL using the CDBC CONNECT command.

DBCTL failure

A termination of DBCTL should not cause CICS to terminate; but simply leaves CICS without DBCTL services. The DRA is left partially initialized to help reduce the restart time.

If any of the DBCTL address spaces (DBC, DBRC, or DLISAS) fails, all of these address spaces are terminated and you must restart the system using an /ERESTART command.

If you are using the IRLM as your lock manager, and it has failed as well as DBCTL, you must restart it before restarting DBCTL. See “IRLM failure” on page 95.

Normally, you terminate DBCTL with a /CHECKPOINT FREEZE or a /CHECKPOINT PURGE command, but an MVS MODIFY command can be used to force the termination of DBCTL. The STOP option used with the MODIFY command forces termination without a dump and the DUMP option forces termination with a dump. The DBCTL address space terminates with a U0020 abend. The messages received at the system console are:

```
DFS628I  ABNORMAL TERMINATION SCHEDULED
DFS629I  IMS DBC REGION ABEND jobname 0020
```

If DL/I is processing a request and the thread that is doing the processing abends is active in DL/I or is waiting on a lock, DBCTL abends with a U113 after the following message has been sent to the system console:

```
DFS613I  DBC RCN U113 DUE TO Sxxx Uyyyy DURING DL/I CALL IN CCTL
         zzzzzzzz dddd
```

where:

`xxx` is the system abend code. This is `S000` if it is a user abend.

`yyyy` is the user abend code. This is `U0000` if it is a system abend.

`zzzzzzzz` is the job name of the abending CICS system or BMP.

`dddd` is the DBCTL system identifier.

For example, for a user abend:

```
DFS613I  DBC RCN U113 DUE TO S000 U0474 DURING DL/I CALL IN CCTL
         DBDCCICS IMSA
```

CICS is isolated from such abends because, in DBCTL (unlike local DL/I), each thread TCB has its own extended subtask ABEND exit (ESTAE).

The threads are then terminated and the DRA attempts to reconnect to DBCTL. Any requests made by the subsystem during this period results in a return code of 40, which indicates that no active communications exist with DBCTL, or a return code 28, which indicates that the specified thread does not exist. These return codes are included in messages DFHDB8104, DFHDB8109, DFHDB8111, and DFHDB8130. Guidance on interpreting them is in the DBCTL DRA return codes appendix of the *IMS/ESA Messages and Codes* manual.

The DRA attempts to reconnect to DBCTL. After the first failing attempt, you are given the opportunity to reply to message DFS690A. You can reply either WAIT, in which case the DRA continues trying to reconnect, or CANCEL, in which case the DRA stops trying to reconnect. If you reply CANCEL, you must use the CDBC transaction to reconnect DBCTL.

If you reply WAIT, the time interval between each attempt to reconnect is as specified in the DRA startup parameter TIMER (described in “Defining the IMS DRA startup parameter table” on page 45).

If you reply WAIT and later want to prevent further attempts to reconnect, use the CDBC DISCONNECT transaction. (See “Deciding whether to use orderly or immediate disconnection” on page 60.)

IRLM failure

When the IRLM fails, DBCTL subsystems using it cannot continue normal operation. DBCTL terminates active programs that are using the IRLM with a U3303 abend and forces any PSB schedule requests to wait until it has been reconnected to the IRLM. You reconnect DBCTL to the IRLM by first restarting the IRLM using an MVS START command, and then issuing an MVS MODIFY RECONNECT command to DBCTL. For guidance on using MVS commands with the IRLM and DBCTL, see the *IMS/ESA Operator's Reference* manual.

Transaction and thread failures

If a transaction fails in ***DBCTL***, the CICS transaction is abended.

If a transaction fails in ***CICS*** when a DL/I request it has issued is being processed in DBCTL, the error is passed to the DBCTL thread. When a transaction terminates, the thread allocated to it is released and a record is written to the IMS log. If there is an error, a return code is returned to the application in the usual form:

- For command level requests, this is to the DL/I interface block (DIB) as a status code, or transaction abend. (Definitive Programming Interface and Associated Guidance Information on what is returned to the DIB is in the *IMS/ESA Application Programming: EXEC DLI Commands* manual.)
- For call level requests, it is to the user interface block (UIB) as a PCB status code or a transaction abend. (Definitive Programming Interface and Associated Guidance Information on what is returned to the UIB is in the *IMS/ESA Application Programming: DL/I Calls* manual.)

  (Response codes for a DBCTL environment are in “Summary of abends and return codes” on page 119.)

Where the transaction has been abended, the thread is also terminated, and all recoverable resources, including DL/I, are backed out. (DL/I backout is assumed on all thread and transaction failures.)

In some cases, other resources may not have been backed out, but DL/I backout has taken place. In these cases, one of the following status codes will be returned: BB, FD, FR, FS. You can also receive the FD status code on a call to a full function database if the PSB for the program (BMP) has a DEDB PCB. See "Status codes and backout" on page 107 for actions you should take if this happens.

Deadlocks and interactions with automatic restart

As described for local DL/I in the *CICS/ESA Recovery and Restart Guide*, DBCTL detects transaction deadlocks, which can occur when two transactions are waiting for the same two resources to become available; that is, both resources are needed by both transactions, as illustrated in Figure 27.

If one resource is a DBCTL database and the other is a CICS resource, the task waiting for the CICS resource is abended after its DTIMOUT period has elapsed, if you have specified one. (See the *CICS/ESA Resource Definition Guide* for help on specifying the DTIMOUT option of the TRANSACTION definition.)

In the example shown in Figure 27, transaction A is the one that is abended when DTIMOUT expires. This is because it is waiting in an enqueue until transaction B frees the lock held for CICS resource C. However, CICS resource C is not freed because transaction B is waiting for transaction A to free the lock it is holding on DBCTL resource D.

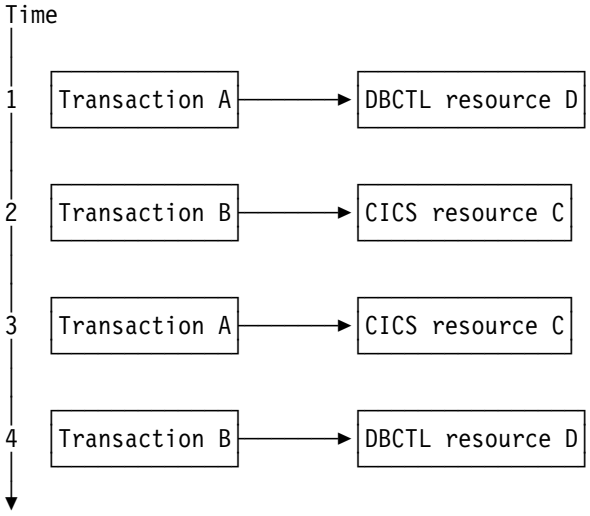

Figure 27. Transaction deadlock

If you did not specify DTIMOUT for the task using the CICS resource, both tasks will remain suspended indefinitely, unless one of them is canceled by the CICS master terminal operator (as described in "Purging a transaction that is using DBCTL" on page 73).

If the resources are both DBCTL databases, DBCTL detects the potential deadlock when the database requests that create the deadlocks are attempted. DBCTL then causes the task with less update activity to be abended. The abend (ADCD) causes all resources to be backed out. If a deadlock is detected when you are

using DEDBs, an FD status code is issued instead of an ADCD abend. See “Status codes and backout” on page 107 for details.

For DL/I full function databases and DEDBs, if you have specified automatic restart, the task can be restarted at this point. (See the *CICS/ESA Recovery and Restart Guide* for help on specifying automatic restart.) However, this can take place only if the transaction abended in the first (or only) LUW, and there has been no terminal input or output since the initial terminal input was read.

BMP failures

If a BMP fails, DBCTL backs out any changes made by that BMP following the latest successful syncpoint. You must restart BMPs, because DBCTL does not restart them automatically.

The JCL used to restart BMPs depends on whether the checkpoint for the BMP is still on an OLDS available to DBCTL. If the BMP’s last checkpoint records are ***not*** in the OLDS, they will be in the SLDS, and you must add an IMSLOGR DD statement for the SLDS(s) containing the log records required to the BMP JCL. Guidance on the JCL needed to do this is in the *IMS/ESA Utilities Reference: Database* manual.

There is an option to defer changes made to databases by backout of BMPs at emergency restart. If you specify NOBMP on the /ERESTART command, changes made to databases by BMPs are not backed out and all PSBs affected are stopped. Databases that were being updated by BMPs when the failure occurred are also stopped. You must then do batch backout for the databases that are stopped. (Batch backout will also backout the databases that were affected.) You should be aware that using NOBMP may mean that the online DBCTL is restarted sooner, but it also delays data availability for the databases that were stopped by the BMP failure.

MVS, processor, or power failures

If an MVS, processor, or power failure occurs, DBRC is unable to mark the subsystem (SSYS) records in the RECON as having terminated abnormally. This means that you cannot use automatic restart. Instead, you must use the /ERESTART command with the OVERRIDE keyword to override the RECON subsystem record. Alternatively, use the DBRC command CHANGE.SUBSYS to mark the subsystem record as abnormally terminated. You will need to do this if you want to run any utilities (such as database recovery or log utilities). This is because these utilities will fail if the subsystem record is still marked as active. For information on doing this, see the *IMS/ESA Utilities Reference: Database* manual. Backout of in-flight updates should then occur. You can then restart CICS with an AUTO (emergency) restart. When CICS has reconnected to DBCTL, CICS decides whether any in-doubt LUWs exist, and resolves them in the same way as for other failures.

Chapter 7. Application programming considerations

Other product information

The information given about IMS commands is intended to help you understand the facilities available to your CICS system when you use DBCTL. The information is not part of the CICS Programming Interface and Associated Guidance Information.

Programming information on DL/I requests is in the *IMS/ESA Application Programming: EXEC DLI Commands* and the *IMS/ESA Application Programming: DL/I Calls* manuals.

Application programming considerations in a DBCTL environment include:

- Additional facilities available to application programmers with DBCTL
- Migrating programs to DBCTL
- Additional abends and return codes that may be issued with DBCTL.

In most cases, your existing application programs should not need any changes to access databases controlled by DBCTL. See “Migrating a DL/I program to a DBCTL program” on page 116. However, you should be aware of the following considerations:

- We strongly recommend that you migrate batch CICS shared database programs to BMPs, and we also recommend that you migrate “native” IMS batch jobs to use BMPs. (See “Batch message processing programs (BMPs)” on page 108, “Migrating CICS shared database batch jobs to BMPs” on page 117, and “Migrating native IMS batch jobs to BMPs” on page 118.)
- Your application programs will need to deal with a number of abend and response codes that may be issued with DBCTL. (See “Summary of abends and return codes” on page 119.)
- Enhanced scheduling with DBCTL enables a PSB to be scheduled even if some of the full function databases or DEDB areas it requires are not available. (See “Enhanced scheduling” on page 105.)
- You can use the DL/I LOG request instead of the EXEC CICS WRITE JOURNALNUM command so that all DBCTL logging information is on the IMS log instead of the CICS system log. (See “LOG command and call” on page 112.)
- DBCTL supports additional DL/I requests for application programs. DL/I requests available with DBCTL are described for guidance. It also supports all existing call level and EXEC level requests already supported in the local DL/I environment. Programming information on DL/I requests is in the *IMS/ESA Application Programming: EXEC DLI Commands* and the *IMS/ESA Application Programming: DL/I Calls* manuals.

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Programming languages and environments

You can write your programs in COBOL, (VS COBOL II or OS/VS COBOL), C, PL/I, or assembler. The examples of DL/I requests in this chapter are in COBOL.

You have a choice of two interfaces — the **command** level interface (EXEC DLI) and the **call** level interface (using DL/I CALLs). The *IMS/ESA Application Programming: Design Guide* contains guidance on comparing the two interfaces. For programming information on the functions of EXEC DLI commands and DL/I CALLs, see the *IMS/ESA Application Programming: EXEC DLI Commands* or the *IMS/ESA Application Programming: DL/I Calls* manuals, respectively.

Issue IMS AIB call format

CICS/ESA 4.1 with IMS/ESA 5.1 supports application interface block (AIB) format for issuing the new GMSG, ICMD, and RCMD calls. This enables DBCTL operator commands to be sent in a CICS transaction, CDBM. (See "CDBM operator transaction" on page 64.) Note that AIB applies to Call DL/I only, not EXEC DLI, and the calls cannot be function shipped.

A CICS abend, ADPM, is issued if a program attempts to issue any DL/I call other than GMSG, ICMD, or RCMD in AIB format.

See the *IMS/ESA Application Programming: DL/I Calls* manual for programming interface information on these calls, plus information on defining AIB format instead of PCB format, and on the AIBTDLI entry point for link-edit.

Additional facilities available with DBCTL

Additional facilities available with DBCTL include application program access to DEDBs, a number of additional commands, calls, and keywords, increased data availability, and the ability to use BMPs.

Application program access to DEDBs

With DBCTL, your EXEC DLI and CALL DL/I application programs can access DEDBs. For an overview of the benefits of using DEDBs (including subset pointers), see "Access to data entry databases (DEDBs)" on page 10.

For programming information on using subset pointers and EXEC DL/I keywords, see the *IMS/ESA Application Programming: EXEC DLI Commands* and the *IMS/ESA Application Programming: DL/I Calls* manuals.

Command codes to manage subset pointers in DEDBs

With DEDBs, you can set and use up to eight subset pointers for each direct dependent segment type in the database description (DBD). You must also define in the PSB, using the SENSEG statement, which subset pointers your program will use. You can then use subset pointers from within the application program together with certain command codes. "Keywords and corresponding command codes" on page 103 tells you which subset pointers you can use with which command codes.

Additional EXEC DLI keywords

You can use a number of additional EXEC DLI keywords in a CICS-DBCTL environment; they are described in the headings that follow. Each of these keywords has a corresponding CALL DL/I command code. These are shown in “Keywords and corresponding command codes” on page 103.

LOCKCLASS

The LOCKED keyword corresponds to the Q command code. You use either of these to reserve a segment so that other programs cannot update until after you have finished with it. You can associate the Q command code with a 1-character field, from A through J, but the LOCKED keyword cannot take an argument. The LOCKCLASS keyword enables you to make full use of the DEQ command.

You use the LOCKCLASS keyword, with retrieve requests only, in the same situations that the LOCKED keyword can be used. However, the LOCKCLASS keyword can take a 1-character argument, in the range B to J inclusive. You cannot use LOCKED and LOCKCLASS for the same segment.

MOVENEXT

The MOVENEXT keyword sets the subset pointer to the segment following the current segment. You can only use it with a DEDB that uses subset pointers. You can use it when retrieving, inserting, or replacing a segment. You cannot use it with a SETZERO keyword for which you have specified subset pointer values, or with the LOCKED or LOCKCLASS keywords.

MOVENEXT, which corresponds to the M command code, can take an argument, which can be a constant of up to 8 bytes or a variable of exactly 8 bytes. Each byte indicates a subset pointer and should be a single number from 1 through 8. If you use a variable that is longer than the number of subset pointers to be referenced, you should left justify the data and set the rest of the variable to blanks (for example, `X'F1F3404040'`).

GETFIRST

The GETFIRST keyword, which corresponds to the R command code, causes the first segment in a subset to be retrieved or inserted. You can only use it when retrieving or inserting a segment in a DEDB that uses subset pointers. You can only use one GETFIRST keyword with each parent or object segment. You cannot use the GETFIRST keyword with the FIRST, LOCKED, or LOCKCLASS keywords.

GETFIRST can take a single argument, which can be a constant or a 1-byte variable. The value of the argument must be a number from 1 through 8, in character form, that indicates a subset pointer.

SET

The SET keyword, which corresponds to the S command code, causes the appropriate subset pointer to be set unconditionally to the current position, in a DEDB with subset pointers. Use the SET keyword when retrieving, inserting or replacing a segment. You cannot use it with a SETZERO keyword that has the same subset pointer value, or with the LOCKED or LOCKCLASS keywords.

SET can take an argument, which can be a constant of up to 8 bytes, or a variable of exactly 8 bytes. Each byte indicates a subset pointer and must be a single integer, in character form, from 1 through 8. If you use a variable that is longer

than the number of subset pointers to be referenced, you should left justify the data and set the rest of the variable to blanks (for example, X'F1F3404040').

SETCOND

The SETCOND keyword, which corresponds to the W command code, causes the appropriate subset pointer to be set only if it is not already set to a segment. You can only use it when processing a DEDB with subset pointers. You can use SETCOND when retrieving, inserting, or replacing a segment. You cannot use it with the SETZERO keyword that has the same subset pointer value, or with the LOCKED or LOCKCLASS keywords.

SETCOND can take an argument, which can be a constant of up to 8 bytes or a variable of exactly 8 bytes. Each byte indicates a subset pointer and must be a single number, in character form, from 1 through 8. If you use a variable that is longer than the number of subset pointers to be referenced, you should left justify the data and set the rest of the variable to blanks (for example, X'F1F3404040').

SETZERO

The SETZERO keyword, which corresponds to the Z command code, causes the appropriate segment subset pointer to be set to zero. You can only use it with DEDBs that use subset pointers. You can use SETZERO when retrieving, inserting, replacing, or deleting a segment. You cannot use it with SET, SETCOND, or MOVENEXT keywords that have the same subset pointer values. You cannot use it with the LOCKED or LOCKCLASS keywords.

SETZERO can take an argument, which can be a constant of up to 8 bytes or a variable of exactly 8 bytes. Each byte indicates a subset pointer and must be a single number, in character form, from 1 through 8. If you use a variable that is longer than the number of subset pointers to be referenced, you should left justify the data, and set the rest of the variable to blanks (for example, X'F1F3404040').

System service (SYSSERVE)

If your application program issues a system service request in an EXEC DLI environment, you do not need to specify the PCB number, because the IOPCB is assumed for this type of request. However, if you are using one of the following EXEC DLI system service requests:

- LOG command
- REFRESH command
- ACCEPT command
- SETS command
- ROLS command (without the USING PCB(1) option).

first issue a PSB schedule command specifying the SYSSERVE keyword. See “PSB schedule command and call” on page 111 for the format of the schedule request.

Keywords and corresponding command codes

Table 4 lists EXEC DLI keywords and corresponding DL/I CALL command codes that are valid in a DBCTL environment.

Table 4. Keywords and corresponding command codes

EXEC DLI keyword	DL/I CALL command code	Purpose
KEYS	C	Using the concatenated key of a segment to identify the segment.
INTO or FROM specified on segment level to be retrieved or inserted	D	Retrieving or inserting a sequence of segments in a hierarchic path using only one request, instead of having to use a separate request for each segment (path call or command).
FIRST	F	Backing up to the first occurrence of a segment under its parent when searching for a particular segment occurrence. Disregarded for a root segment.
LAST	L	Retrieving the last occurrence of a segment under its parent.
MOVENEXT[1]	M[1]	Moving a subset pointer to the next segment occurrence after your current position.
Leaving out the SEGMENT option for segments you do not want replaced	N	Designating segments you do not want replaced, when replacing segments after a get hold request. Used when replacing part of a path of segments.
SETPARENT	P	Setting parentage at a higher level than usual. (It is usually the lowest SSA level of the call.)
LOCKED[2] LOCKCLASS [2]	Q[2]	Reserving a segment so that other programs will not be able to update it until after you have finished processing and updating it.
GETFIRST[1]	R[1]	Starting search with the first segment occurrence in a subset.
SET[1]	S[1]	Unconditionally setting a subset pointer to the current position.
No EXEC equivalent	U	Limiting the search for a segment to the dependents of the segment occurrence on which position is established.
CURRENT	V	Using the current position at this hierarchic level and above as qualification for the segment.
SETCOND[1]	W[1]	Setting a subset pointer to your current position, if the subset pointer is not already set.
SETZERO[1]	Z[1]	Setting a subset pointer to zero.

Notes:

1. DEDB subset pointer operations only. These command codes are new for CICS users who are new to DBCTL.
2. Cannot be used with DEDBs.

POS command and call

With DEDBs, you can use the position (POS) command and call to retrieve the location of a specific sequential dependent segment or the location of the last inserted sequential dependent segment. The POS command and call also provides information about unused space.

You can specify only one SSA with the POS request; that is, either the root segment, or a sequential dependent segment. You can use POS to locate a specific sequential dependent segment when you already have a valid position of a root segment. If you do not already have one, you must first issue a separate POS request, or other request, to establish the position of a root segment.

The format of the POS ***command*** is:

```
EXEC DLI POS|POSITION
           USING PCB(n)
           INTO(data-area)
           [KEYFEEDBACK(area)[FEEDBACKLEN(expression)]]
           [SEGMENT(name)|SEGMENT((area))]
           [WHERE(qualification_statement)[FIELDLENGTH(expression)]]
```

Figure 28. EXEC DLI POS command

The format of the POS ***call*** is:

```
CALL 'CBLTDLI' USING POS,dedb_pcb,i/o_area[,ssa]
```

See “Keywords and corresponding command codes” on page 103 and “Comparing EXEC DLI commands and DL/I calls” on page 114 for brief comparisons of commands and calls. For further guidance on the differences between commands and calls, see the *IMS/ESA Application Programming: Design Guide*.

Addressing and residency mode

Addressing mode (**AMODE**) refers to the address length that a program is prepared to handle: 24-bit addresses, 31-bit addresses, or both (ANY). Programs with an addressing mode of ANY must have been designed to receive control in either 24- or 31-bit addressing mode.

Residency mode (**RMODE**) specifies where a program is expected to reside in virtual storage. RMODE 24 indicates that a program is coded to reside in virtual storage below 16MB. RMODE ANY indicates that a program is coded to reside anywhere in virtual storage.

See the *MVS/ESA System Programming Library: Application Development: 31-Bit Addressing* manual for more information on AMODE and RMODE. See also the appropriate programming guides for COBOL and PL/I for guidance on placing parameters above or below the line.

Note that you cannot place parameters above the 16MB line if you are using OS/VS COBOL.

Table 5 on page 105 summarizes the support of AMODE/RMODE processing for DBCTL, remote DL/I, and local DL/I programs that use the command, and call level interfaces. It tells you whether you can place the parameters that application

programs supply to IMS above or below the line. Note that “AMODE 31 with parameters above the line” means that RMODE=ANY programs are supported.

Table 5. AMODE and RMODE processing

Type of program	DBCTL	Remote	Local
DL/I command level	AMODE 31. Parameters can be above the 16MB line.		
DL/I call level	AMODE 31. Parameters and parameter list can be ***above*** the 16MB line.		AMODE 31. Parameters and parameter list must be ***below*** the 16MB line.

Enhanced scheduling

DBCTL supports enhanced scheduling. That is, PSB scheduling completes successfully, even if some of the full function databases or DEDB areas it requires are not available. Full function databases that have been stopped or locked by the commands /STOP, /DBRECOVERY, or /LOCK, or that are unavailable for update because a /DBDUMP command has been issued, do not cause scheduling failures. Instead, the application program is prevented from accessing only the unavailable database(s) or area(s). Application programs can have read access to databases that have been made unavailable for update by the /DBDUMP command. If a program issues a call to an unavailable database or area, a transaction abend is issued. To avoid this happening, you can issue requests, after a PSB has been scheduled, to obtain information regarding the availability of each database and to indicate that your program will handle data availability status codes. These requests are described in “Obtaining information about database availability” and “Accepting database availability status codes” on page 106.

Obtaining information about database availability

A PSB scheduling request places data availability status codes in each of the DB PCBs. You can use DL/I requests to obtain and refresh this information, as described below.

QUERY and REFRESH DBQUERY commands

In a command-level environment, issue the following command after a PSB schedule request for each PCB:

```
EXEC DLI QUERY PCB(n)
```

where n is the number of a PCB.

This obtains the status code and other information in the DL/I interface block (DIB). You should get one of the following values in the DIB:

- TH, which means that a PSB has not yet been scheduled and results in a DHTH abend.
- NA, which means that at least one of the databases that can be accessed using this PCB is unavailable, but does not result in an abend.
- NU, which means that at least one of the databases that can be updated using this PCB is unavailable and does not result in an abend.

- bb (blanks), mean that the data accessible using this PCB is available for all functions that the PCB sensitivity allows.

DIBDBORG, which is returned when DIBSTAT has been set to NA, NU or bb (blanks). DIBDBORG contains one of the following values describing the database organization:

- DEDB
- GSAM
- HDAM
- HIDAM
- HISAM
- INDEX
- HSAM
- SHISAM
- SHSAM.

DIBDBDNM, which is returned when DIBSTAT has been set to NA, NU or blanks, and contains the DBDNAME. You can refresh these status codes using the command:

```
EXEC DLI REFRESH DBQUERY
```

INIT call — format for refreshing status code information

Application programs using the DL/I CALL interface can access the PCB status codes directly. You can refresh these status codes using the INIT call as follows:

```
CALL 'CBLTDLI' USING INIT,i/o pcb,i/o_area
```

where `i/o_area` contains a string in the format `LLZZcharacter_string`.

- `LL` is a halfword containing the length of the `character_string` including `LLZZ`.
- `ZZ` contains binary zeros
- `character_string` contains DBQUERY.

The data availability status codes used in this context are:

- bb (blanks), which means that all of the databases are available.
- NA, which means that at least one of the databases that can be ***accessed*** using this PCB is unavailable.
- NU, which means that at least one of the databases that can be ***updated*** using this PCB is unavailable for update.

Accepting database availability status codes

You can use DL/I requests to indicate that your application program is prepared to accept and handle database availability status codes for DL/I calls, as described in “ACCEPT STATUSGROUP command” on page 107 and “INIT call — format for accepting status codes” on page 107. These status codes may have been issued because PSB scheduling has completed without all of the referenced databases being available.

ACCEPT STATUSGROUP command

For ***command*** level application programs, use:

```
EXEC DLI ACCEPT STATUSGROUP('A')
```

INIT call — format for accepting status codes

For ***call*** level application programs, use:

```
CALL 'CBLTDLI' USING INIT,i/o pcb,i/o_area
```

where `i/o_area` contains a string in the format `LLZZcharacter_string`.

`LL` is a halfword containing the length of the `character_string` including `LLZZ`
`ZZ` contains binary zeros
`Character_string` contains STATUSGROUPA.

If you have used ACCEPT STATUSGROUP, and a DL/I request tries to access a database or a DEDB area that is not available after PSB schedule, DBCTL returns a status code instead of abending the transaction. If you have not used ACCEPT STATUSGROUP, the transaction will be abnormally terminated with ADCI if it tries to access unavailable data. (See "Summary of abends and return codes" on page 119 for details of accompanying return codes.)

The status codes used are:

- `bb` (blanks), which means that the request completed successfully.
- BA, which means that the request could not be completed because a database was not available. In this case, only the updates done for the current DL/I call are backed out.
- BB, which means that the request could not be completed because a database was not available. In this case, all DL/I updates are backed out to the last commit point.

Note: Only DL/I resources are backed out because the transaction has not abended. You should therefore ensure that you keep DL/I and other resources in synchronization.

See the *IMS/ESA Application Programming: EXEC DLI Commands* or the *IMS/ESA Application Programming: DL/I Calls* manuals for programming information on status codes.

Although a PSB can contain PCBs for GSAM and MSDB databases, and the PSB can be scheduled, programs using DBCTL (or any other kind of CICS-DL/I program) cannot access those GSAM or MSDB databases online from CICS. Access to such databases is by means of batch and BMPs only. See "I/O PCB" on page 109 for information on the option SCHD, which you can use to state whether you require an input/output PCB (I/O PCB).

Status codes and backout

The following DEDB status codes are returned when DL/I backout has taken place: BB, FD, FR, FS. If you receive one of these status codes, it is as if any update requests you issued to full function databases or to DEDBs in the same LUW had not taken place.

If you are using EXEC DLI, these status codes are, as usual, accompanied by a DHBB, DHFD, DHFR, or DHFS abend.

If you are using CALL DL/I and if you want any other resources you may have been updating in the same LUW to be backed out, issue an EXEC CICS ABEND request or a SYNCPOINT ROLLBACK command.

Batch message processing programs (BMPs)

Batch message processing programs (BMPs) are application programs that perform batch type processing online and can access databases controlled by DBCTL. You can run the same program as a BMP or as a batch program. Figure 29 shows the kind of data BMPs can access. See the *IMS/ESA Application Programming: Design Guide* for further guidance on using BMPs.

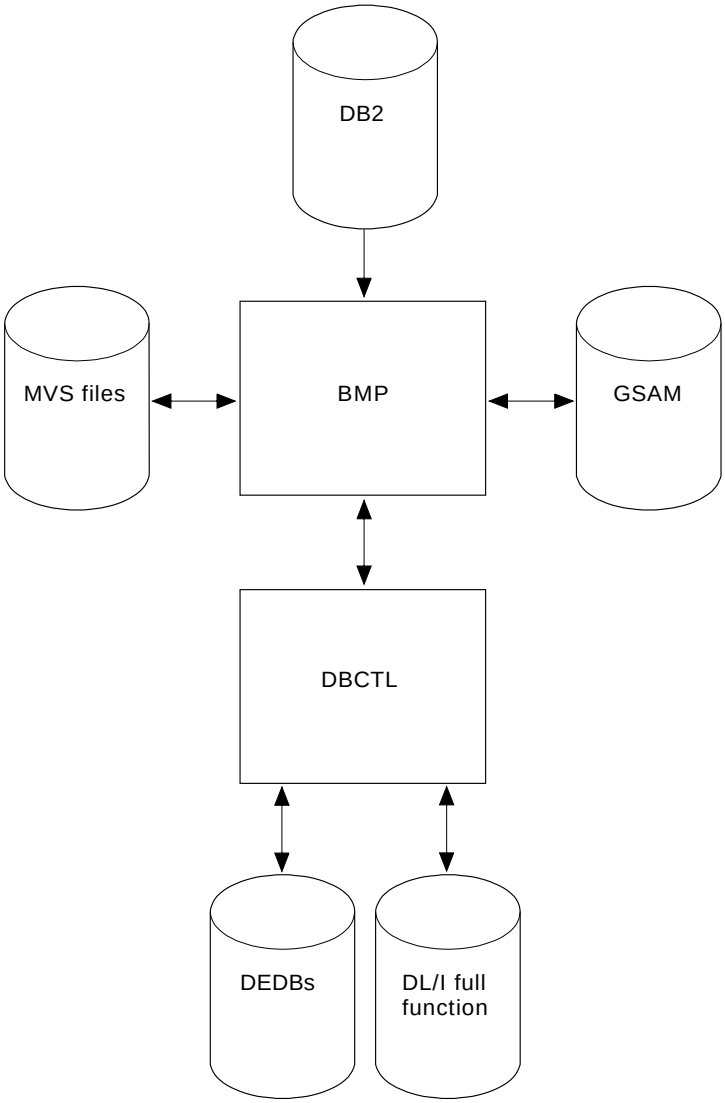

Figure 29. BMP access

System service requests

I/O PCB

A PSB used in a DBCTL environment can contain any of the following PCB types:

- **I/O PCB**. In a CICS-DBCTL environment, an input/output PCB (I/O PCB) is needed to issue DBCTL service requests. Unlike other types of PCB, it is not defined with PSB generation. If the application program is using an I/O PCB, this has to be indicated in the PSB scheduling request, as explained in "Format of a PSB" on page 110.
- **Alternate TP PCB(s)**. An alternate TP PCB defines a logical terminal and can be used instead of the I/O PCB when it is necessary to direct a response to a terminal. Alternate TP PCBs appear in PSBs used in a CICS-DBCTL environment, but are used only in an IMS/VS DC or IMS/ESA TM environment. CICS applications using DBCTL cannot successfully issue requests that specify an alternate TP PCB, an MSDB PCB, or a GSAM PCB, but PSBs that contain this kind of PCB can be scheduled successfully in a CICS-DBCTL environment. Alternate PCBs are included in the PCB address list returned to a call level application program. The existence of alternate PCBs in the PSB can affect the PCB number used in the PCB keyword in an EXEC DLI application program, depending on whether you are using CICS online, CICS shared database, batch programs, or BMPs. For more information, see "PCB summary" on page 110 below.
- **DB PCB(s)**. A database PCB (DB PCB) is the PCB that defines an application program's interface to a database. One DB PCB is needed for each database view used by the application program. It can be a full function PCB, or a DEDB PCB.
- **GSAM PCB(s)**. A GSAM PCB defines an application program's interface for GSAM operations.

With DBCTL, a CICS online application program receives, by default, a DB PCB as the first PCB in the parameter list passed to it after scheduling.

With the EXEC DLI interface, in order to use system service requests, you specify the SYSSERVE keyword on the SCHD command to indicate that your application program can handle an I/O PCB. In an EXEC DLI environment, the SYSSERVE keyword does not change the PCB numbering, which means that your first PCB is still the DB PCB, and you do not need to specify a PCB number when you issue a system service request.

With the DL/I CALL interface, in order to use system service requests, you use the IOPCB parameter on the PCB to indicate that your application program can handle an I/O PCB. The I/O PCB will then be the first PCB in the parameter address list passed back to your application program.

Format of a PSB

PSBs used in a DBCTL environment will be of the following form:

```
[IOPCB]
[Alternate TP PCB ... Alternate TP PCB]
[DBPCB ... DBPCB]
[GSAMPCB ... GSAMPCB]
```

Figure 30. General format of a PSB in a DBCTL environment

Each PSB must contain at least one PCB. A DB PCB can be a full function PCB, or a DEDB PCB.

PCB summary

This section summarizes information concerning I/O PCBs and alternate PCBs in the supported environments. Read it if you intend to issue system service requests.

CICS online programs

- EXEC DLI

  The first PCB in your PCB address list always refers to the first database PCB (DB PCB) whether or not you specify the SYSSERVE keyword.

- CALL DL/I

  If you specify the IOPCB option on the PCB call, the first PCB in your PCB address list will be the I/O PCB, followed by any alternate PCBs, followed by the DB PCBs.

  If you do not specify the IOPCB option, the first PCB in your PCB address list will be the first DB PCB.

Shared database jobs

- EXEC DLI and CALL DL/I

  If you specify CMPAT=Y in the JCL to run the CICS shared database job, your PCB list contains the addresses of the I/O PCBs followed by the addresses of the DB PCBs.

  If you do not specify CMPAT=Y, your PCB address list refers only to the DB PCBs.

BMPs

- EXEC DLI and CALL DL/I

  The PCB list always contains the address of the I/O PCB, followed by the addresses of any alternate PCBs, followed by the addresses of the DB PCBs.

Batch programs: Alternate PCBs are always returned to batch programs irrespective of whether you have specified CMPAT=Y. The I/O PCB is returned depending on the CMPAT option, as follows:

- EXEC DLI and CALL DL/I

  If you specify CMPAT=Y, the PCB list contains the address of the I/O PCB, followed by any alternate PCBs, and then the DB PCBs.

If you do not specify CMPAT=Y, the PCB list contains the addresses of any alternate PCBs followed by the addresses of the DB PCBs.

Table 6 summarizes the I/O PCB and alternate PCB information.

Table 6. PCB summary

Environment	EXEC DLI		CALL DL/I	
	I/O PCB count included in PCB(n)	**Alternate PCB count included in PCB(n)**	**I/O PCB address returned**	**Alternate PCB address returned**
CICS local DL/I	No	No	No	No
CICS DBCTL (1)	No	No	No	No
CICS DBCTL (2)	No	No	Yes	Yes
Shared database (3)	No	No	No	No
Shared database (4)	Yes	No	Yes	No
BMP	Yes	Yes	Yes	Yes
Batch (3)	No	Yes	No	Yes
Batch (4)	Yes	Yes	Yes	Yes

Notes:

1. SCHD request issued without the IOPCB or SYSSERVE option.
2. SCHD request issued with the IOPCB or SYSSERVE for a CICS DBCTL request or for a function shipped request which is satisfied by a CICS system using DBCTL.
3. CMPAT=N specified.
4. CMPAT=Y specified.

PSB schedule command and call

The format of the schedule ***command*** is:

```
EXEC DLI SCHD PSB(name)[SYSSERVE]
```

Specifying SYSSERVE does not affect the PCB number you specify in the USING PCB keyword because PCB(1) will always refer to the first DB PCB. The application program must establish addressability to the I/O PCB. See the *IMS/ESA Application Programming: Design Guide* for further guidance on doing this.

The format of the schedule ***call*** is:

```
CALL 'CBLTDLI' USING PCBb,psbname,uibptr[,sysserve]
```

where sysserve is an optional 8-byte variable, set to either IOPCB or NOIOPCB.

Almost all the new DL/I calls supported in the CICS-DBCTL environment require an I/O PCB. The two exceptions are the ROLS call, which can use a DB PCB, and the POS call, which uses a DEDB PCB.

Preventing DHxx abends after EXEC DLI SCHD PSB failure: When a PSB schedule request fails (for example, because a database is unavailable), CICS abends the transaction with a DHxx abend code. In a production system, PSB schedule request failures are more likely to be caused by unavailability of a database than by application coding errors, which means that end users may see DHxx abends unnecessarily. To prevent this happening, you can use the EXEC DLI SCHD PSB keyword, NODHABEND, which specifies that no DHxx abends are issued for that PSB schedule request. Instead, the xx value is returned to the application program in DIBSTAT, enabling the application to deal with the situation in a more user-friendly way, and avoiding the need to code global HANDLE ABENDs (EXEC DLI does not support HANDLE CONDITION).

DEQ command and call

The DEQ (dequeue) request releases segments that were retrieved using the LOCKCLASS keyword or the Q command code.

The LOCKED keyword cannot take an argument, and cannot be used with DEQ. (Segments locked using the LOCKED keyword are released when a SYNCPOINT is taken.) Instead, you use LOCKCLASS with DEQ, which can take a 1-character argument in the range B to J inclusive. (These keywords correspond to the Q command code, which you can associate with a 1-character field in the range A to J.) You cannot use LOCKED and LOCKCLASS for the same segment. Using LOCKCLASS or Q on retrieval requests enables you to reserve segments for exclusive use by your transaction. No other transaction is allowed to update these reserved segments until your transaction reaches a syncpoint, or the DEQ request has been issued, when the reserved segments are released. This means that your application can leave these segments and retrieve them later without them being changed in the meantime.

The format of the DEQ ***command*** is:

```
EXEC DLI DEQ LOCKCLASS(data_value)
```

where data_value is a 1-byte alphabetic character in the range B to J.

The format of the DEQ ***call*** is:

```
CALL 'CBLTDLI' USING function,i/o pcb,i/o_area
```

where function is the address of a 4-byte area that contains the value of the DEQb function, i/o pcb is the name of the I/O PCB (mandatory), and i/o_area is a 1-byte alphabetic character in the range A to J.

LOG command and call

You can use the LOG request ***online*** when you want a record to be written from an application program to the IMS log. Your program can specify whatever information you want to be on the log. You may prefer to use it instead of EXEC CICS journal commands so that all your DBCTL information will be on the IMS log instead of the CICS log. IMS uses different log codes to distinguish different types of log record. All user log records in the IMS log have the same code. Records logged using the LOG request will not be backed out if synchronization fails and the LUW is aborted.

The format of the LOG ***command*** is:

```
EXEC DLI LOG FROM(area) LENGTH(expression)
```

The format of the LOG ***call*** is:

```
CALL 'CBLTDLI' USING LOGb,i/o-pcb,data-area
```

where LOGb is the address of a 4-byte area that contains the value of the LOGb function.

Defining intermediate backout points for DBCTL resources

The SETS and ROLS requests enable you to define multiple points at which to preserve the state of DL/I full function databases and to return to these points later. The backout points are ***not*** CICS syncpoints, they are intermediate backout points that apply only to DBCTL resources. For example, you can use them to allow your program to handle the consequences of PSB scheduling having completed without all of the referenced DL/I databases being available.

The SETS and ROLS requests apply to DL/I full function databases only. If an LUW is updating recoverable resources other than full function databases, for example, DEDBs and VSAM files, the SETS and ROLS requests have no effect on the non-DL/I resources. You should therefore take steps to ensure the consistency of other resources involved, if any. See “Summary of abends and return codes” on page 119 for explanations of relevant return codes.

SETS command and call: You can use a SETS request to define points in your application at which to preserve the state of DL/I databases before initiating a set of DL/I calls to perform a function. Your application can issue a ROLS request later if it cannot complete that function.

The format of the SETS ***command*** is:

```
EXEC DLI SETS [TOKEN(mytoken) AREA(data-area)]
```

where mytoken is a 4-byte token associated with the current processing point.

data-area is an area to be restored to the program when a ROLS request is issued. The first two bytes of the data-area field contain the length of the data-area, including the length itself. The second two bytes must be set to X'0000'.

The format of the SETS ***call*** is:

```
CALL 'CBLTDLI' USING SETS,i/o_pcb[,i/o_area,token]
```

TOKEN(mytoken) AREA(data-area) in the command version and i/o_area,token in the call version are optional, but if you do omit them, this cancels any intermediate backout points set in previous SETS requests and ROLS backs out to the last commit point.

ROLS command and call: You can use the ROLS request to backout to the state all full function databases were in before: (a) a specific SETS request or (b) the most recent commit point.

The format of the ROLS ***command*** is:

```
EXEC DLI ROLS [TOKEN(mytoken) AREA(data-area)]
```

The format of the ROLS ***call*** is:

```
CALL 'CBLTDLI' USING ROLS,pcb[,i/o_area,token]
```

i/o_area and token on the call, and TOKEN(mytoken) AREA(data-area) on the command are optional. If you include them, ROLS backs out to the SETS ***you specified***. If you omit them, ROLS backs out to the ***most recent*** SETS.

The ROLS ***command*** has a second format, the purpose of which is to backout to ***before*** an ACCEPT STATUSGROUPA request:

```
EXEC DLI ROLS [USING(PCB(n)]
```

where n is the name of a database PCB that has received a “data” unavailable status code. This causes the same action to take place that would have occurred had the program not issued an ACCEPT STATUSGROUPA request. (See “Accepting database availability status codes” on page 106.)

Comparing EXEC DLI commands and DL/I calls

Table 7 lists corresponding EXEC DLI and CALL DL/I requests and their functions.

Table 7 (Page 1 of 2). EXEC commands and DL/I calls

EXEC DLI	CALL DL/I	Function
GU, GN, and GNP	GU, GN, and GNP	Retrieving segments from the database
GU, GN, and GNP	GHU, GHN, and GHNP	Retrieving segments from database for updating
DLET	DLET	Deleting segments from a database
REPL	REPL	Replacing segments in a database
ISRT	ISRT	Adding segments to a database
ISRT	LOAD	Initially loading a database
SCHD	PCB	Scheduling a PSB
TERM	TERM	Terminating a PSB
CHKP	CHKP (basic)	Issuing a basic checkpoint
SYMCHKP	CHKP (extended)	Issuing a symbolic checkpoint
XRST RETRIEVE	XRST	Issuing an extended restart
-----[1]	SYNC	Requesting syncpoint processing
DEQ	DEQ	Releasing segments retrieved using Q command code
-----[1]	GSCD	Retrieving system addresses
LOG	LOG	Writing a message to the system log
ROLL or ROLB	ROLL or ROLB	Dynamically backing out changes
STAT	STAT	Obtaining system and buffer pool statistics (see also Table 8 on page 115)
REFRESH ACCEPT QUERY[2]	INIT	Refreshing, accepting and querying data availability status codes

Table 7 (Page 2 of 2). EXEC commands and DL/I calls		
EXEC DLI	**CALL DL/I**	**Function**
SETS	SETS	Setting a backout point
ROLS	ROLS	Backing out to a previously set backout point
-----[1]	GSAM	Issuing requests to GSAM databases
POS	POS	Retrieving positioning and/or space usage information in a DEDB area

Notes:

1. No EXEC DLI equivalent. Use a DL/I CALL, but note that you cannot mix EXEC and CALL in the same LUW.
2. Status codes are available directly to CALL DL/I applications. EXEC DLI QUERY corresponds to code in the CALL DL/I program instructing it to examine the PCB.

DL/I requests supported

Table 8 summarizes the DL/I requests you can use and the environments in which they apply.

Table 8 (Page 1 of 2). DL/I requests supported					
Request type	**CICS and DBCTL**[1]	**CICS and local DL/I**[2]	**CICS shared database**[4]	**Batch**	**BMP**
Get commands and calls (GU, GHU, GN, GHN, GNP, GHNP)	Yes	Yes	Yes	Yes	Yes
DLET command and call	Yes	Yes	Yes	Yes	Yes
REPL command and call	Yes	Yes	Yes	Yes	Yes
ISRT command and call	Yes	Yes	Yes	Yes	Yes
ISRT call (initial load)	No	No	No	Yes	No
LOAD command	No	No	No	Yes	No
PCB call	Yes	Yes	No	No	No
SCHD command	Yes	Yes	No	No	No
TERM command and call	Yes	Yes	No	No	No
CHKP command and call (basic)	No	No	Yes	Yes	Yes
CHKP call (extended)	No	No	No	Yes	Yes
SYMCHKP command	No	No	No	Yes	Yes
XRST command and call	No	No	No	Yes	Yes
RETRIEVE command	No	No	No	Yes	Yes
SYNC call	No	No	No	No	Yes
DEQ command and call	Yes	No	No	Yes	Yes
GSCD call	No	No	No	Yes	No
LOG call	Yes	No	Yes	Yes	Yes
LOG command	Yes	No	No	Yes	Yes
ROLL call	No	No	Yes	Yes	Yes

Table 8 (Page 2 of 2). DL/I requests supported					
Request type	**CICS and DBCTL**[1]	**CICS and local DL/I**[2]	**CICS shared database**[4]	**Batch**	**BMP**
ROLL command	No	No	No	Yes	Yes
ROLB command and call	No	No	No	Yes	Yes
STAT command and call	Yes[3]	Yes[3]	No	Yes[3]	Yes[3]
INIT call	Yes	No	No	Yes	Yes
REFRESH command	Yes	No	No	Yes	Yes
ACCEPT command	Yes	No	No	Yes	Yes
QUERY command	Yes	No	No	Yes	Yes
SETS command and call	Yes	No	No	Yes	Yes
ROLS command and call	Yes	No	No	Yes	Yes
GSAM calls	No	No	No	Yes	Yes
POS command and call	Yes	No	No	No	Yes

Notes:

1. Requests are also supported with ***function shipping*** to a remote CICS that uses ***DBCTL***.
2. Requests are also supported with ***function shipping*** to a remote CICS that uses ***local DL/I***.
3. Enhancements to the STAT ***call*** are available in IMS/ESA 3.1, via an SPE, and in IMS/ESA 4.1. For programming information on keywords used to request the enhanced statistics, see the *IMS/ESA Application Programming: DL/I Calls* manual. (If you do not have the correct level of IMS installed, and request the enhanced statistics, the transaction will receive a PCB status code indicating an invalid DL/I call, as shown in Table 9 on page 120.)
4. If you use the REPL command with remote DL/I or shared database and concatenated or logically dependent segments, you must also specify the SEGLENGTH option.

Migrating programs to DBCTL

Considerations for migrating programs to DBCTL include using your existing local DL/I programs with DBCTL, and changing CICS shared database programs and “native” IMS batch jobs to run as BMPs.

Migrating a DL/I program to a DBCTL program

Your existing CICS application programs should not require any changes in order to run in the DBCTL environment.

The schedule of your PSB, with DBCTL, may not fail, as happened previously with local DL/I, because of Enhanced scheduling, see “Enhanced scheduling” on page 105. As a migration aid, you can use the global user exit XDLIPOST to simulate how it worked with local DL/I, see “Global user exits XDLIPRE and XDLIPOST” on page 51.

However, you must define the names of all DMBs to be owned by DBCTL to DBCTL using system definition DATABASE statements (which are equivalent to DFHDLDBD in local DL/I). Make sure that you have defined the names of all PSBs to be used by application programs when accessing DBCTL databases using

system definition APPLCTN statements (which are equivalent to DFHDLPSB in local DL/I). All DMBs to be owned by a given PSB must be owned by the same DBCTL ***or*** by the same local DL/I. See the *IMS/ESA Application Programming: Design Guide* for further guidance on defining PSBs.

Your applications may receive some different abend codes. You may also get a message that DL/I is not available. This may occur because DBCTL can be disconnected dynamically from CICS, using the CDBC transaction, and because, unlike local DL/I, a failure in DBCTL should not cause CICS to fail, but merely leaves it without DL/I services. New abend codes are summarized in "Summary of abends and return codes" on page 119.

An application program that updates DL/I databases owned by DBCTL and has activated an exit to use HANDLE ABENDs, should terminate the abend exit routine with an ABEND request.

Apar PQ18904

Documentation for Apar PQ18904 added 05/11/98

We recommend that applications that have read-only access to the database and an abend exit active, should not attempt to reschedule a PSB as part of abend processing. This is because if the high order bit of PAPLRETC, the DBCTL return code, is on the DBCTL thread has been withdrawn from use by the transaction and any further DBCTL request will abend with a code of AEY9. The only exception to this is if the abending request was a schedule, this is because the thread is not obtained until the schedule completes successfully.

Migrating CICS shared database batch jobs to BMPs

Shared database continues to work in CICS/ESA 4.1, as long as local DL/I is available in the system. (For more information, see "Support for existing methods of DL/I" on page 16.) However, shared database does not work if directed to DBCTL. So, to obtain the benefits of DBCTL, and to position for future releases, we recommend that you migrate any batch jobs that currently use the CICS shared database facility to BMPs so that they communicate directly with the DBCTL address space. BMPs perform batch processing and are started with job control language (JCL) like programs in a batch environment. The JCL for this is in the IMS procedure IMSBATCH. (For further guidance on IMSBATCH, see the *IMS/ESA System Definition Reference* manual.) Migrating these batch jobs gives you:

- A performance advantage, because BMPs communicate directly with DBCTL instead of accessing databases through CICS. For more information on BMP performance, see Chapter 11, "Statistics, monitoring, and performance" on page 177.
- The ability to use system service requests, such as symbolic checkpoint (CHKP) and extended restart (XRST).
- Access to DEDBs.
- Access to GSAM databases.
- Logging to the IMS log (so there is no need for multiple logs).
- Automatic restart from last checkpoint without requiring JCL changes.

Automatic backout, which you will already be using for your shared database programs, also applies to BMPs.

With BMPs, the PCB always includes an I/O PCB. If you have specified CMPAT=Y in the JCL to execute your CICS shared database job, need not change any source code in your application. If you have specified CMPAT=N, change your code to allow for the addition of an I/O PCB. For example, in COBOL, you do this by changing the ENTRY statement in the PROCEDURE division to include the I/O PCB. For guidance on doing this, in COBOL, PL/I and assembler language, see the *IMS/ESA Application Programming: EXEC DLI Commands* or the *IMS/ESA Application Programming: DL/I Calls* manuals.

Migrating native IMS batch jobs to BMPs

We also recommend that you migrate “native” IMS batch jobs to BMPs that use DBCTL. This will give you:

- Logging to the IMS log (no need for multiple logs)
- Automatic restart from the last checkpoint (no JCL changes required)
- Concurrent access to databases
- Automatic backout. (You may already have this for your batch programs if you use disk logging.)

General design considerations for BMPs

Your applications must take checkpoints and must be restartable from the last checkpoint (also known as checkpoint restart). This is particularly important for batch programs migrated to BMPs. A disconnection request cannot complete until a BMP checkpoint occurs if a CICS thread is waiting for a lock held by a BMP.

We recommend that you generally design and code your batch programs to be restartable from checkpoints, even if you have no immediate intention of running them as BMPs. This is because it is simpler to design batch programs with checkpoint restart than to introduce it to existing programs, if you do decide to migrate them later.

The following is a summary of what you should bear in mind when designing BMPs and applications to run in a DBCTL environment:

- All BMPs and applications should issue frequent checkpoints to avoid locking out other resource users.
- All BMPs and applications must be restartable from last checkpoint. This is because records in the same database may have since been updated, and these updates would be lost if the database were restored from a previous backup.
- BMPs and applications should not hold on to locks for long periods without issuing checkpoints or syncpoints (either explicitly or implicitly).
- Beware of long-running applications that do not issue syncpoints or that hold data over terminal conversations.
- Be aware that small but very frequently updated databases may cause contention for resources.
- Review the use of control records; that is, records that are accessed by most applications. If they have to be updated, it is important to remember that the CI

or physical block is locked from other subsystems until the updates are committed.

Summary of abends and return codes

With DBCTL, as in local DL/I, your PSB scheduling request might fail either because DBCTL is not available, or because the PSB could not be found. However, after a successful PSB schedule, CICS might be disconnected from DBCTL for some reason, and subsequent DBCTL requests will fail. This situation, which is unique to a DBCTL environment, causes an ADCJ abend to be issued. Table 9 on page 120 summarizes the schedule failure codes and abends in a DBCTL environment, and the conditions that can arise on a PSB schedule request because DBCTL is not available or the PSB cannot be found.

Table 9 (Page 1 of 2). Summary of abends and return codes

Request	EXEC abend	CALL UIBDLTR	CALL UIBFCTR	CALL abend	Explanation
PSB schedule request	DHTA	X'01' (PSBNF)	X'08' (INVREQ)	----	PSB not found[1].
PSB schedule request	DHTC	X'03' (PSBSCH)	X'08' (INVREQ)	----	PSB already scheduled detected in CICS.
PSB schedule request	DHTE	X'05' (PSBFAIL)	X'08' (INVREQ)	----	PSB initialization failed in DBCTL only.
PSB schedule request	DHTJ	X'FF' (DLINA)	X'08' (INVREQ)	----	DBCTL not available on PSB scheduling[2].
PSB schedule request	DHTQ	X'10' (INVPSB)	X'08' (INVREQ)	----	SYSSERVE IOPCB specified for local DL/I.
PSB schedule request	ADCC	----	----	ADCC	PSB already scheduled detected in DBCTL.
PSB schedule request	ADCP	----	----	ADCP	The user is not authorized to use the PSB.
PSB schedule request	ADCQ	----	----	ADCQ	The SYSSERVE keyword or the I/O PCB option was not specified, and the PSB does not contain any DB PCBs.
PSB schedule request	ADDA	----	----	ADDA	An error response from the storage domain.
DL/I request	DHTH	X'08' (FUNCNS)	X'08' (INVREQ)	----	PSB not scheduled, detected by CICS.
DL/I request	ADCB	----	----	ADCB	PSB not scheduled.
DL/I request	ADCD	----	----	ADCD	Deadlock detected.
DL/I request	ADCI	----	----	ADCI	Lock outstanding.
DL/I request	ADCJ	----	----	ADCJ	DBCTL not available on DL/I request[3].
DL/I request	ADCR	----	----	ADCR	DL/I request (other than PSB schedule) issued when DBCTL not connected.
Terminate request	DHTG	X'07' (TERMNS)	X'08' (INVREQ)	----	PSB not scheduled.

Table 9 (Page 2 of 2). Summary of abends and return codes

Request	EXEC abend	CALL UIBDLTR	CALL UIBFCTR	CALL abend	Explanation
PSB schedule, DL/I, and terminate requests	DHxx	----	----	----	Many reasons. xx is the PCB status code[4] (see also "Preventing DHxx abends after EXEC DLI SCHD PSB failure" on page 112).
PSB schedule or DL/I request	----	X'00' (INVARG)	X'08' (INVREQ)	----	Invalid argument.
PSB schedule or DL/I request	---- TR status code in DIB-STAT	X'04' (NOTDONE)	X'08' (INVREQ)	----	Global user exit XDLIPRE indicates that DL/I request should not be executed.
PSB schedule or DL/I request	ADCA	----	----	ADCA	Error, detected in DBCTL.
PSB schedule or DL/I request	ADCE	----	----	ADCE	Bad response code has been returned from DFHDBAT.
PSB schedule or DL/I request	ADCN	----	----	ADCN	FORCEPURGE issued while executing in DBCTL.

Notes:

1. The PSB was not found in PDIR and DBCTL was not ready. Alternatively, the PSB was not found in PDIR and DBCTL was ready but the PSB was not found in DBCTL APPLCTN.
2. DLI=NO was specified in the CICS SIT and DBCTL was not ready at the time of the DL/I request.
3. DBCTL is in use, and a PSB has been scheduled. However, the connection between CICS and DBCTL has since been broken.
4. For guidance on interpreting the status code, see the *IMS/ESA Messages and Codes* manual.

If you use local or remote DL/I (or both) with DBCTL, you may also receive Axxx and DHxx abends not listed here because they are not new. See the *CICS/ESA Messages and Codes* manual for details of Axxx abends.

Chapter 8. Extended recovery facility (XRF)

Considerations for using DBCTL with the extended recovery facility (XRF) are:

- Tracking, causes of CICS and IMS XRF takeovers, defining your configuration, and the global user exits used
- How DBCTL works with CICS and IMS XRF
- How to define system resources for CICS XRF
- The actions taken by global user exits in different takeover situations
- Operations for CICS XRF with DBCTL
- How takeover occurs with CICS XRF and IMS XRF in single- and multi-MVS environments.

If you are not familiar with XRF, see:

- The *CICS/ESA 3.3 XRF Guide* for information on the CICS XRF environment
- The *IMS/ESA System Administration Guide* for guidance on defining an XRF environment for IMS.

Note that the CICS XRF support described does not apply to IMS/VS DB/DC or IMS/ESA DM/TM without the XRF option.

Overview

XRF can provide you with automatic switching from a failing DBCTL subsystem to another, preinitialized, DBCTL subsystem. The failing DBCTL subsystem must be connected to CICS when the failure occurs. CICS performs all the XRF-related functions and coordinates activities so that if DBCTL or CICS gets switched in one MVS image, a related CICS or DBCTL can also be switched. After the switch has taken place, CICS and DBCTL automatically reconnect by either of the following means:

- Using standard DBCTL, in which the active is a standard DBCTL subsystem. The “alternate” is simply another standard DBCTL subsystem that is preinitialized and waiting for a restart command. You can use this method with or without full CICS XRF support, and you can have more than one preinitialized DBCTL in the same MVS image. This is for users who do not have an IMS/VS DB/DC or IMS/ESA DM/TM system, and is referred to as “DBCTL using CICS XRF” or “CICS XRF with DBCTL”.
- If your CICS system is connected to an IMS/VS DB/DC or IMS/ESA DM/TM system to obtain DBCTL support, you can use IMS XRF facilities. In this case your active and alternate DBCTL subsystems are the standard IMS active and alternate. This is referred to as “IMS XRF.”

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Tracking — the CICS and MVS availability managers

Tracking is not unique to DBCTL, but is a part of the CICS XRF environment in general, and is performed by CICS. The CICS availability manager (CAVM) passes the status of the DBCTL connection to the alternate subsystem just as CICS status information is passed. See the *CICS/ESA 3.3 XRF Guide*. for further guidance on the CAVM. The MVS availability manager (AVM) handles communication between IMS actives and alternates in the same MVS image.

Causes of a takeover

A takeover may be needed because there is a failure (or a planned unavailability for system maintenance or upgrade) of one of the following:

- Processor
- MVS/ESA
- VTAM
- IMS
- DBCTL — including DLISAS, DBRC, and IRLM (if used)
- CICS.

Defining your configuration

You must define the relationships between your DBCTL subsystems and CICS systems. To do this, you use the CICS recoverable service table (RST). The RST is a suffixable table constructed during installation using the DFHRST macro, which is described in “Defining the CICS recoverable service table (RST)” on page 128.

The RST consists of a set of recoverable service elements (RSEs). Each RSE contains a set of DBCTL subsystem identifiers of equivalent DBCTL subsystems, (that is, subsystems that belong to the same DBCTL RSE), together with their associated job names, and the specific APPLIDs of the CICS systems that will use them.

CICS can use the RST when connecting to a DBCTL system, or when a connection to a DBCTL system fails.

When CICS attempts to connect to DBCTL using a particular DRA startup parameter table, it attempts to connect using the specific subsystem ID associated with that startup table, or any other DBCTL subsystem ID in the RSE to which the specific subsystem ID belongs. This enables CICS to reconnect to an equivalent DBCTL after a DBCTL failure. A CICS alternate can also use the RST to determine whether it is authorized to cancel a particular DBCTL subsystem.

You must specify the RST in the system initialization table (SIT) to enable this connection mechanism. (This is described in “Defining the CICS system initialization table (SIT)” on page 129.) Specifying an RST in the SIT means that you have specified some form of takeover whether or not you have also requested XRF support (by specifying XRF=YES in the SIT). You can, if you want, specify an RST without XRF support, but you will then have takeover support for DBCTL only, and you will not be able to use the surveillance mechanisms provided by XRF. If general system availability is an important consideration to you and, in particular, if you are using a multi-MVS environment, specify XRF=YES. For the purposes of this discussion, we assume you have specified XRF=YES.

Global user exits used

There are three CICS global user exits relevant to XRF (XXDFA, XXDFB, and XXDTO). Their purpose is to enable you to establish a takeover decision mechanism for DBCTL failures in different situations by:

- Choosing to switch to a preinitialized DBCTL
- Abending CICS with, or without, a dump
- Taking no action.

When you initialize CICS, these exits are enabled in the PLT, but they can be invoked only if you have specified an RST. The situations that cause each of these user exits to be invoked, and the actions that each one can take are described in detail in “Actions taken by global user exits” on page 131.

How a DBCTL system works with XRF

This section gives an ***overview*** of how a DBCTL subsystem works with XRF. See “DBCTL takeover situations using CICS XRF” on page 134 and “IMS XRF takeover situations” on page 139 for ***step-by-step descriptions*** of different takeover situations involving DBCTL and IMS in single- and multi-MVS environments using XRF.

Takeover actions

Basically, any failing subsystem that has an alternate should switch to that alternate. However, actions taken when a failure occurs depends on which of the following configurations you are using:

- CICS with DBCTL in a single-MVS environment
- CICS with DBCTL in a multi-MVS environment
- IMS XRF in a single-MVS environment
- IMS XRF in a multi-MVS environment.

Overview of CICS using DBCTL in a single-MVS environment

In Figure 31 on page 126, CICS XRFA is active, and DBCTLA is currently connected to it. CICS XRFB is the alternate CICS within the same MVS image, and DBCTLB is a preinitialized DBCTL. DBCTLB is an equivalent DBCTL to DBCTLA in the RST.

All active and alternate CICS and DBCTL subsystems are within the same MVS image. Any failing subsystem that has an alternate should switch to that alternate, leaving all other subsystems unaffected. The fact that you can have more than one DBCTL in a MVS image means that if DBCTL fails, CICS activity does not have to move to another MVS image.

The takeover occurs as the result of a CICS subsystem connected to a failing DBCTL automatically issuing an IMS master terminal emergency restart command to the alternate DBCTL. This relies on at least one CICS subsystem being connected to the active DBCTL at the time of failure. If there is no such connection, then takeover will not be automatic, and the operator will have to enter the restart command.

If CICS fails, DBCTL is not involved. CICS takeover is as described in the *CICS/ESA 3.3 XRF Guide*. The CICS alternate automatically reconnects to DBCTLA after takeover.

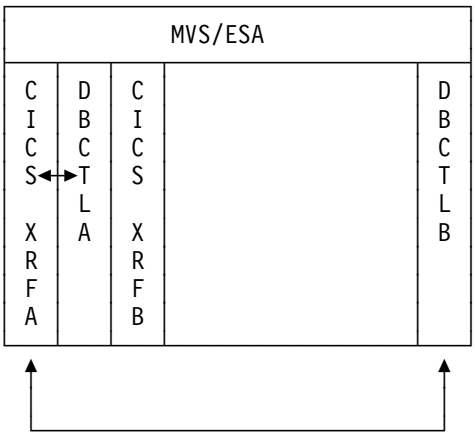

Figure 31. DBCTL in a single-MVS environment

Overview of CICS using DBCTL in a multi-MVS environment

Figure 32 on page 127 shows a possible configuration CICS using DBCTL in a multi-MVS environment using XRF. You can have more than one preinitialized DBCTL; for example, one in the active MVS image and one in the alternate MVS image. CAVM is the CICS availability manager, which handles communication between CICS actives and alternates.

In Figure 32 on page 127, CICS XRFA is in the active MVS image, which contains two DBCTL subsystems — DBCTLA, which is currently connected to CICS XRFA, and DBCTLB, which is preinitialized. The alternate MVS contains CICS XRFB, and DBCTLBB, which is preinitialized.

In this environment, if a DBCTL subsystem fails, takeover may be within the same MVS image or in the other. We assume you will usually want takeover to be in the same MVS image; for example, if DBCTLA fails, but CICS XRFA is still active, it connects to DBCTLB. A switch within the same MVS image is effectively the same as for a failure in a single-MVS environment. However, you will want to be able to set up preinitialized DBCTLs in both MVS images and be able to choose where takeover happens, to suit the needs of each situation when it arises. For example, if CICS XRFA fails, you need DBCTLBB for when CICS XRFB takes over.

When takeover takes place in an alternate MVS image for either a DBCTL or a CICS failure, the CICS system and any other related systems should also transfer to the alternate. You can direct DBCTL takeover from the alternate CICS as part of its takeover procedure. CICS takeover is as described in the *CICS/ESA 3.3 XRF Guide*. and the alternate CICS automatically connects to DBCTLBB after takeover.

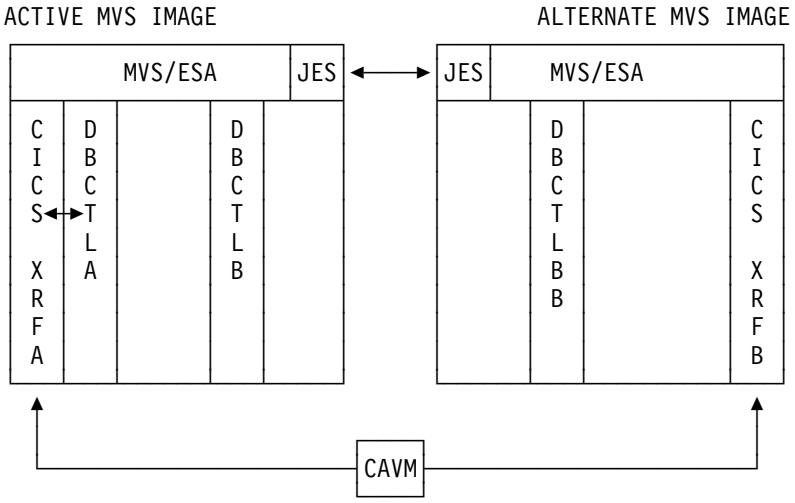

Figure 32. DBCTL in a multi-MVS environment

Overview of processor or MVS failure in a multi-MVS environment

This is effectively the same as a CICS failure. CICS subsystem switching takes place as described in the *CICS/ESA 3.3 XRF Guide*.

Overview of IMS XRF in a single-MVS environment

In the configuration shown in Figure 33, the active CICS (CICS XRFA) communicates with the alternate CICS (CICS XRFB) and the two IMS systems (IMS XRFA and IMS XRFB) are aware of each other's existence.

If there is an IMS failure in a single MVS environment, the active IMS automatically switches to the alternate IMS if AUTO=YES was specified in the XRF definition for IMS. If AUTO=NO was specified, reconnection takes place when initiated by the operator. CICS automatically reconnects to the new active IMS. Also, if CICS XRFA fails and CICS XRFB takes over, CICS XRFB automatically reconnects to the active IMS.

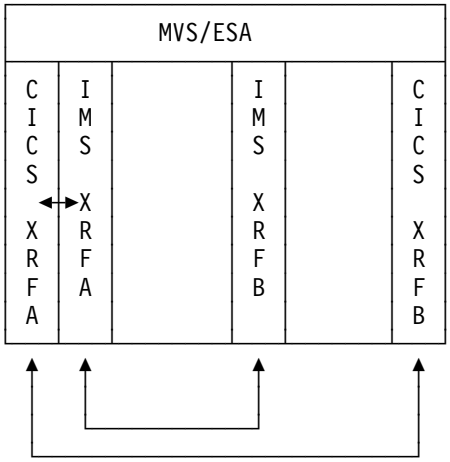

Figure 33. IMS XRF in a single-MVS environment

Overview of IMS XRF in a multi-MVS environment

Figure 34 shows a possible configuration for IMS in a multi-MVS environment. AVM is the MVS availability manager, which handles communication between IMS actives and alternates. If both CICS and IMS XRF alternates are in the alternate MVS image, you will usually want to transfer to that MVS image. If the IMS XRF system has specified AUTO=YES in the XRF definition for IMS, takeover occurs automatically.

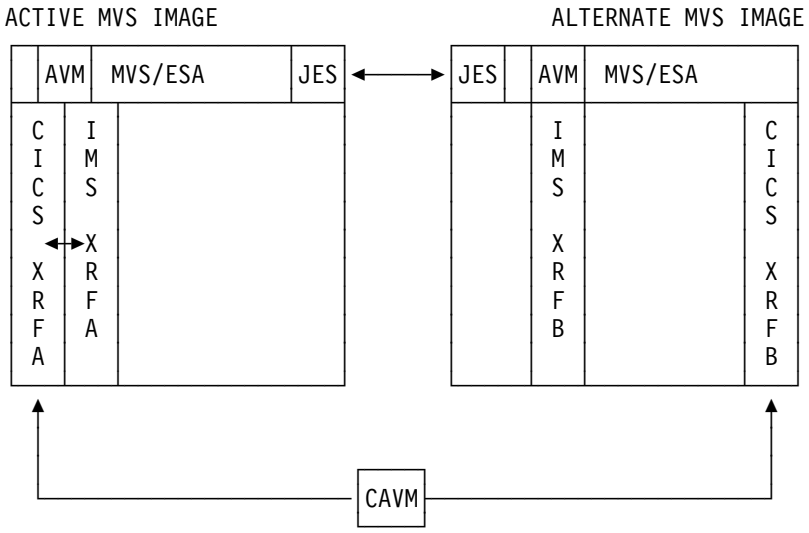

Figure 34. IMS XRF in a multi-MVS environment

Overview of IMS XRF and a processor or MVS failure in a multi-MVS environment

If there is a processor failure, the actions are similar to those for an IMS failure. Any active IMS XRF subsystems that have AUTO=YES specified in the XRF definition for IMS automatically switch to an alternate. CICS can issue a SWITCH command to make the transfer take place for IMS XRF subsystems that have AUTO=NO specified. CICS takeover is as described in the *CICS/ESA 3.3 XRF Guide*.

Defining system resources for XRF

The tasks involved in setting up an XRF environment for DBCTL are:

- Defining the CICS recoverable service table (RST)
- Defining the CICS system initialization table (SIT)
- Establishing overseer extensions (optional).

Defining the CICS recoverable service table (RST)

As mentioned in “Defining your configuration” on page 124, the CICS recoverable service table (RST) describes DBCTL subsystems to CICS. You define the RST using a single DFHRST TYPE=INITIAL macro, followed by zero or more RSE definitions, followed by a single DFHRST TYPE=FINAL macro. Each RSE definition consists of a single DFHRST TYPE=RSE macro followed by a DFHRST TYPE=SUBSYS macro defining the DBCTL subsystems that belong to the RSE. These macros are described below. For more details, see the *CICS/ESA Resource Definition Guide*.

You must, for security reasons, link-edit the RST into an appropriate APF-authorized library, as reentrant, and with a MODE control statement that specifies AMODE(31),RMODE(ANY).

DFHRST TYPE=INITIAL

This macro establishes the entry point of an RST.

```
[label]  DFHRST  TYPE=INITIAL
               [,SUFFIX=xx]
```

SUFFIX=xx is the RST suffix. It is used to name the module on the linkage editor output library. The default value is blank.

DFHRST TYPE=RSE

This macro defines the start of a RSE.

```
[label]  DFHRST  TYPE=RSE
               [,CTLAPPLS=(applid1,applid2,...)]
```

CTLAPPLS=(applid1,applid2,...) contains the specific APPLIDs of the CICS systems to provide XRF support for DBCTL subsystems in this group. The list of CICS APPLIDs is known as the **authorized list**.

DFHRST TYPE=SUBSYS

This macro defines one of the DBCTL subsystems in a group of equivalent DBCTL subsystems.

```
[label]  DFHRST  TYPE=SUBSYS
               ,SUBSYSID=subsystem-identifier
               [,JOBNAME=(jobid1,jobid2,...)]
```

SUBSYSID=subsystem-identifier is the 4-character DBCTL subsystem identifier, as specified in the DBCTL startup parameter IMSID. A check is made to ensure that the identifier is unique within the RST.

JOBNAME=(jobid1,jobid2,...) contains the job names that can be associated with this DBCTL subsystem. It authorizes CICS to cancel DBCTL, if necessary, using the appropriate job name.

DFHRST TYPE=FINAL

This macro indicates the end of the RST.

```
[label]  DFHRST  TYPE=FINAL
```

Defining the CICS system initialization table (SIT)

To invoke the switching or reconnection mechanism, specify an RST in the SIT, so some form of CICS XRF support is present whether or not you have also specified XRF=YES.

```
[label]  DFHSIT  ...
                    [,RST={YES|NO|xx}]
```

The 1- or 2-character suffix (xx) specifies the RST to be used by the system. See the *CICS/ESA 3.3 XRF Guide* for guidance on other CICS XRF options for the SIT.

What happens when CICS uses the RST to connect to DBCTL

Connection to DBCTL in an XRF environment is similar to connection in a non-XRF environment except that, in an XRF environment, connection can be to any DBCTL in the same RST as the one actually named, instead of a specific DBCTL.

In an XRF environment, the control exit is invoked as for any connection attempt. (See “Connection to DBCTL” on page 157 for an illustration of activity traced during connection.) However, instead of returning control directly to the DRA, the control transaction invokes DFHDXAX, the DBCTL control exit for XRF. DFHDXAX checks to see if it is being invoked for a failing connection to a DBCTL that is in the RST. If it is not, DFHDXAX does not attempt to connect and passes control back. The process from this point is as described in “What happens when you have requested connection to DBCTL” on page 58. If it is, what DFHDXAX does next depends on whether all DBCTL subsystem IDs in the RSE have already been tried for connection.

- If not all the DBCTL subsystem IDs in the RSE have been tried, DFHDXAX issues a connection attempt for the next DBCTL subsystem ID in the RSE.
- If all the DBCTL subsystem IDs in the RSE have been tried, DFHDXAX's actions depend on which of the following applies:
  - If a DBCTL subsystem in the RSE is currently restarting, and has issued a return code indicating that connection should be attempted, DFHDXAX waits for five seconds to allow this to happen and then makes a further connection attempt to each DBCTL subsystem ID in the RSE.
  - If each member of the RSE has not already been tried at least twice, DFHDXAX waits for five seconds to allow DBCTL to restart and then makes a further connection attempt to each DBCTL subsystem ID in the RSE.
  - If no DBCTL subsystem is restarting, and DBCTL has been given more than 10 seconds to change states, the DFHDXAX module does not make any further connection attempts, and returns (with return code 0). This causes IMS to ask for operator intervention by issuing the DFS690 message. (See “What happens when you have requested connection to DBCTL” on page 58.) If the operator replies CANCEL, no further connection attempt is made. If the operator replies WAIT, connection attempts are made to each DBCTL subsystem ID in the RST (or the original DBCTL ID if there is no RST) at the interval specified in the DRA startup parameter TIMER. (See “Defining the IMS DRA startup parameter table” on page 45.)
  - Otherwise, CICS waits for five seconds (to allow any DBCTL restarts to make some progress) and then makes a further connection attempt to each DBCTL subsystem ID in the RST (or the original DBCTL ID if there is no RST). If a DBCTL region is restarting, but the connection to CICS is not completing, CICS issues a warning message (DFHDX8304 when there is an RST or DFHDB8297 when there is no RST) to the operator every minute (while DBCTL is still restarting) until the connection is complete.

  In all other cases, the DFHDXAX module cleans up and resets its history of any previous actions.

Using the CICS overseer with DBCTL

The overseer is supplied as an optional sample program with CICS. The *CICS/ESA Customization Guide* contains programming information on using the overseer with a CICS system as a whole. However, there are a number of DBCTL-related aspects, which are described here. The overseer interfaces with the RSE entries, which contain status information on the XRF subsystems and updates those data sets whenever the active CICS:

- Establishes a connection to a DBCTL subsystem
- Disconnects normally from a DBCTL subsystem
- Loses connection to a DBCTL subsystem.

You may want to update the overseer to make use of the information that CICS provides about the DBCTL connection. For instance, you can have the overseer submit DBCTL jobs to preinitialize new DBCTLs after a DBCTL failure. You may find the overseer particularly useful if you have a large and complex installation with many interconnected XRF address spaces.

Information passed to the overseer is defined in the copybook DFHDXGHD. The *CICS/ESA Customization Guide* contains programming information on defining the active and alternate CICS systems to the overseer, and on extending it to meet your installation's requirements.

DBCTL data sharing with another IMS subsystem

If the DBCTL subsystem is data sharing with another IMS subsystem, (including local DL/I with CICS) and the preinitialized DBCTL is on a different MVS image, start a special type of DL/I batch job called an IMS RDI job (sometimes known as the IMS **ready region**). This is an IMS batch job, which you define with a type code RDI in a PARM parameter on the EXEC statement. It always remains ready and identified to the IRLM in the same MVS image as the one on which the alternate CICS is started. It runs all the time the alternate CICS is in standby mode, and ensures that the IRLM running in the alternate MVS image retains any locks that are held when the active CICS fails. See the *CICS/ESA Operations and Utilities Guide* for help on using an RDI region.

Actions taken by global user exits

CICS provides three global user exits, XXDFA, XXDFB, and XXDTO, which it invokes only if you have specified RST=YES or RST=xx, where xx is the RST suffix. The subsystem ID of the failing DBCTL must be in the RST, and the active CICS's APPLID must be in the RST's authorized list for this DBCTL subsystem.

There is an extra DFHUEPAR parameter with each of these exits:

```
UEPDBXR  DS  A  Address of DBCTL XRF information
```

If you are running CICS/ESA 3.3 or later with MVS/ESA SP 4.1, or later, in a multi-MVS environment, the DBCTL global user exits XXDFA, XXDFB, and XXDTO are passed the following additional information:

- SYSPLEX name
- MVS system name
- MVS system instance token of the active DBCTL's MVS image

- An indicator that the active is running in an MVS/ESA SP 4.1 environment, and therefore the above values are meaningful.

  For guidance on using CICS/ESA 3.3 with MVS/ESA SP 4.1, see the *CICS/ESA 3.3 XRF Guide*.

This parameter is in the copybook DFHDXUEP. See the *CICS/ESA Customization Guide* for programming information on the standard parameter list, DFHUEPAR and on the use of global user exits.

XXDFA exit

The XXDFA exit is invoked by an active CICS when its connection to DBCTL fails. Your exit program is invoked after the active CICS has informed the alternate of the failure, and must issue one of the return codes listed in Table 10.

Note: Instead of using numeric return codes, we recommend that you use return code "equates," such as UERCNOAC, for "take no action," as shown in the tables below. You generate them using DFHUEXIT TYPE=EP,ID=(XXDxx), where xx completes the name of the global user exit. See the *CICS/ESA Customization Guide* for programming information on DFHUEXIT.

Table 10. XXDFA actions

Return code	Action taken
UERCNOAC	None
UERCSWCH	Switch to preinitialized DBCTL
UERCABNO	ABEND CICS without a dump
UERCABDU	ABEND CICS with a dump

With a return code of UERCSWCH, CICS waits for the failing DBCTL job to terminate and then issues a emergency restart command to the preinitialized DBCTL, if:

- The failing DBCTL subsystem was running under the same JES as CICS.
- There is a preinitialized DBCTL subsystem whose ID is in the same group as the failing DBCTL subsystem.

With a return code of UERCABNO or UERCABDU, the active CICS terminates abnormally and the alternate CICS performs takeover.

XXDFB exit

The XXDFB exit is invoked by the alternate CICS when it receives a message from the active CICS in a different MVS image indicating that connection to DBCTL has failed. XXDFB is only invoked when the active CICS and alternate CICS are in different MVS images.

Your exit program must issue one of the return codes shown in Table 11 on page 133.

Table 11. XXDFB actions	
Return code	**Action taken**
UERCNOAC	None
UERCSWCH	Switch to alternate MVS image
UERCABNO	ABEND alternate CICS without a dump
UERCABDU	ABEND alternate CICS with a dump

With a return code of UERCSWCH, CICS initiates a takeover if:

- The failing DBCTL subsystem is running under the same JES as CICS
- A DBCTL subsystem exists whose ID is in the same RST group as the failing system
- The active CICS did not switch to a preinitialized DBCTL in the active MVS image.

With a return code of UERCABNO or UERCABDU, the alternate CICS terminates abnormally.

XXDTO exit

The XXDTO exit is invoked by an alternate CICS when takeover has occurred under the following conditions:

- The active and alternate CICS systems are in different MVS images.
- The active CICS was connected to, or trying to connect to, a DBCTL subsystem. (This does not include disconnecting from one DBCTL and reconnecting to another.)
- The takeover was not initiated by XXDFB exit or, if it was, the active reestablished a DBCTL connection before takeover occurred and XXDTO was invoked for a new DBCTL takeover decision.

Your exit program must issue one of the return codes shown in Table 12.

Table 12. XXDTO actions	
Return code	**Action taken**
UERCNOAC	None
UERCSWCH	Switch to a preinitialized DBCTL
UERCABNO	ABEND alternate CICS without a dump
UERCABDU	ABEND alternate CICS with a dump

With a return code of UERCSWCH, CICS switches DBCTL subsystems if:

- The failing DBCTL subsystem is running under the same JES as CICS
- A DBCTL subsystem exists whose ID is in the same RST group as the failing system.

With a return code of UERCABNO or UERCABDU, the alternate CICS terminates abnormally.

Operating a CICS XRF system in a DBCTL environment

You will need to set up procedures for operators in situations where manual intervention is needed. For example, when a DBCTL subsystem fails and there is no CICS connection to it, the decision making mechanism cannot influence events and manual intervention is required. You will also need to establish procedures that allow new DBCTL subsystems to be started after a takeover has occurred and former preinitialized subsystems have been terminated.

When the preinitialized DBCTL subsystem attempts a takeover, it tries to sign on to DBRC. Each DBCTL has its own DBRC, which will abend if DBCTL abends. When this happens, DBRC must update the RECON to indicate that there has been an abnormal termination. If it does not do this, because the former active DBCTL subsystem failed to sign off from DBRC (for example, due to an abnormal end-of-memory) the alternate is not able to sign on, and takeover is stopped. In this situation the operator must reinitiate the restart manually, using an /ERESTART command with the OVERRIDE keyword to indicate that the operator knows the active IMS job has completed.

Note that a DBCTL UNAVAILABLE condition may be returned to a transaction if a CICS takeover has completed in a different MVS image but the preinitialized DBCTL is not yet connected.

DBCTL takeover situations using CICS XRF

This section describes a number of takeover situations and how the mechanisms provided support switching to alternates.

DBCTL in a single-MVS environment using CICS XRF

In the example shown in Figure 35, which applies to a single-MVS environment, suppose you have specified an RST with an active CICS (CICS XRFA), which is currently connected to DBCTLA. There is an alternate CICS (CICS XRFB) and a preinitialized DBCTL (DBCTLB), which is equivalent to DBCTLA.

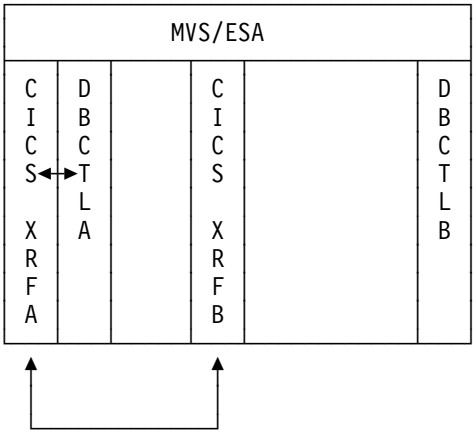

Figure 35. DBCTL in a single-MVS environment

DBCTL failure in a single-MVS environment

If DBCTLA fails, the failure is reported to CICS XRFA (which was connected to it) via the DRA control exit.

1. Because you defined an RST, CICS XRFA attempts to reconnect to any member of the same RSE. These are: DBCTLA, (which has failed) and DBCTLB (which is preinitialized and waiting for a restart command). If you had not specified an RST, CICS XRFA would attempt to connect to the same DBCTL.
2. At the same time, the global exit XXDFA is invoked and told that DBCTLB is available as an alternate. XXDFA returns code UERCSWCH indicating that CICS is to attempt a restart for DBCTLB.
3. When CICS XRFA detects that the DBCTLA job has ended, it issues a restart command (/ERESTART) to DBCTLB via the MVS subsystem interface. If multiple CICS subsystems are connected to the DBCTL that was active when the failure occurred, each of them executes this step. Depending on the action of the global exit XXDFA, this may result in several restart commands being issued to the preinitialized DBCTL. This does not matter, because any commands after the first are ignored.
4. Because CICS XRF=YES was specified, CICS XRFA writes records on the CAVM data set to inform the alternate CICS (CICS XRFB) of the DBCTLA failure and its action. An overseer, if used, will also be able to see the CAVM DBCTL records.

   CICS XRFB does not invoke global user exit XXDFB, even if enabled, because CICS XRFA is in the same MVS image.
5. DBCTLB receives the restart command and attempts to sign on to DBRC. If the failing DBCTLA signed off successfully, DBCTLB becomes ready and CICS XRFA's repeated attempts to reconnect succeed. (These attempts result from a WAIT command entered in response to a DFS690A message issued at Step 1 when the first connection request to DBCTLB was made. The first connect request would not have been successful because DBCTLB would not have completed its /ERESTART.)

   However, if DBCTLA failed to sign off from DBRC, the restart fails, and must be reinitiated manually, as described in "Operating a CICS XRF system in a DBCTL environment" on page 134.
6. CICS XRFA writes records on the CAVM data set to inform CICS XRFB and the overseer, if used, of the connection to DBCTLB.
7. At this point, you may want to use an overseer program to note that DBCTLA failed and DBCTLB has taken over, and to submit a job to reestablish DBCTLA as the preinitialized DBCTL to back up DBCTLB.

CICS failure in a single-MVS environment

If the active CICS (CICS XRFA) fails, the alternate (CICS XRFB) takes over as described in the *CICS/ESA 3.3 XRF Guide*. CICS XRFB automatically attempts to reconnect to the DBCTLA using the same DRA startup table suffix that was used by DBCTLA, which was active when the failure occurred. This happens only if the DBCTL initialization program (DFHDBCON) is invoked in the second stage of PLTPI processing, as described in "Program list table (PLT)" on page 35.

DBCTL in a multi-MVS environment using CICS XRF

This example, shown in Figure 36, applies to a multi-MVS environment in which you have specified CICS XRF. Suppose you have specified an RST with CICS XRFA, which is currently connected to DBCTLA. In the same MVS image, there is a preinitialized DBCTL, DBCTLB. In the alternate MVS image, there is CICS XRFB, and another preinitialized DBCTL, DBCTLBB, which is equivalent to DBCTLA.

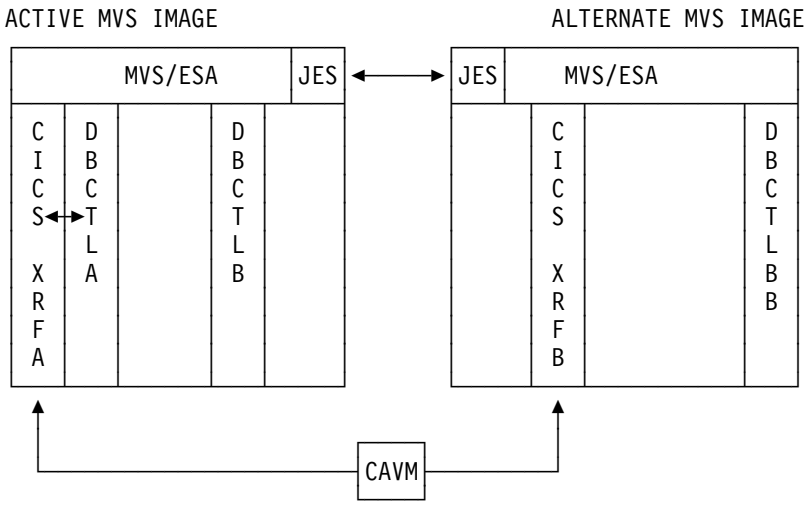

Figure 36. DBCTL in a multi-MVS environment

DBCTL failure in a multi-MVS environment

What happens if the active DBCTL (DBCTLA) fails depends on the state of DBCTLB and DBCTLBB.

If both DBCTLB (on the active MVS image) and DBCTLBB (on the alternate MVS image) are initialized, the most likely course of action is the same as a DBCTL failure in a single-MVS environment (as described in "DBCTL failure in a single-MVS environment" on page 135).

In this case, the user exit XXDFA chooses to transfer to DBCTLB, which is in the same MVS image, using the return code UERCSWCH and no other subsystem has to move. The only difference from the single-MVS environment is that, because CICS XRFB is in a separate MVS image, the user exit XXDFB is invoked but, even if it returns with return code UERCSWCH, no transfer is attempted because the active has already indicated that it is trying to restart.

If DBCTLB is not initialized, CICS XRFA could be transferred to CICS XRFB and restart DBCTLBB. You may prefer not to do this if you want to avoid a CICS takeover.

1. DBCTLA fails and the failure is reported to CICS XRFA (which was connected to it) via the DRA control exit.
2. CICS XRFA attempts to reconnect to each DBCTL subsystem with an entry in the RSE: DBCTLA (which has failed), DBCTLB (which is not initialized) and DBCTLBB (which is not in this MVS image) respectively.
3. At the same time, the global exit XXDFA is invoked and told that there is no DBCTL available as an alternate (with UEPDXBDB=X'4040....'). XXDFA

returns with code UERCNOAC, which indicates that no action is taken. The alternate (if any), or an overseer (if any), can make the decision to attempt a takeover or not. However, if your installation's normal procedure is to take over at this point you may prefer to speed the process by having XXDFA return a code UERCABNO indicating that CICS is to abend without a dump. If you do this, you should bear in mind that the active CICS does not know the state of either the alternate CICS or the preinitialized DBCTL at this point, but assumes that they are both present in the alternate MVS image.

4. If you have not specified UERCABNO or UERCABDU in XXDFA, CICS XRFA writes records on the CAVM data set to inform CICS XRFB and the overseer, if used, of the DBCTL failure and the action taken.
5. If you have not specified UERCABNO or UERCABDU in XXDFA, CICS XRFB is informed via the CAVM that DBCTLA has failed, and that CICS XRFA has not attempted to reconnect. Because CICS XRFB is in a separate MVS image from CICS XRFA, it invokes user exit XXDFB and indicates that DBCTLBB is present. The exit should return with code UERCSWCH requesting a takeover. If the exit returns with code of UERCNOAC, CICS XRFB takes no further action. If this happens, you need to have taken the following steps to start a new DBCTL in the active MVS image.

   a. If you have specified UERCABNO or UERCABDU in XXDFA, this appears as a CICS failure. XXDTO is invoked and makes the takeover decision.

   b. If you have not specified UERCABNO or UERCABDU in XXDFA, CICS XRFB takes over, as described in Step 4 and Step 5. It does not invoke exit XXDTO because XXDFB has already been invoked and made the decision to switch.

   c. CICS XRFB waits for DBCTLA to terminate and then issues a restart command via the MVS subsystem interface to DBCTLBB. It does not issue an MVS CANCEL in this case, because DBCTLA has failed. DBCTL is presumed to be terminating and an MVS CANCEL could cause diagnostic information to be lost.

   If the exit had returned with code UERCNOAC, DBCTL would have to have been restarted in the active MVS image.

6. When CICS completes takeover processing, it runs the DFHPLT user initialization programs, in which you should include DFHDBCON. DFHDBCON attempts to connect to DBCTL using the DRA suffix that was being used by the CICS that was active when the failure occurred.

   If the connection fails because the requested IMSID is present but is not yet available (for example, IMS XRF takeover is not yet complete), but connection looks likely, CICS can make repeated connection attempts until connection either completes or fails. "What happens when CICS uses the RST to connect to DBCTL" on page 130 describes what happens.

CICS failure in a multi-MVS environment

Note: The following applies to CICS XRF with DBCTL in a multi-MVS environment. When running in a JES3 multi-MVS environment, only the JES3 global processor can send commands to other processors. This means that if there is a CICS takeover, where the alternate CICS is not on the global processor, CICS cannot cancel the former active DBCTL in the former active MVS image (by XXDTO requesting CANCEL and emergency restart). In this case, the operator must intervene to cancel the former active DBCTL.

The CICS subsystem can be restarted in the same MVS image, for example by an overseer program, as described in the *CICS/ESA 3.3 XRF Guide*. The connected DBCTL subsystem continues running, and the new active CICS eventually connects to it.

If the CICS subsystem transfers to a new MVS image, we assume you will also want the DBCTL subsystem to transfer and the former active to be canceled automatically. The following steps assume that the alternate CICS takes over.

1. The CICS alternate (CICS XRFB) takes over, and invokes the XXDTO user exit indicating that the failed CICS (CICS XRFA) was connected to DBCTLA, and the preinitialized DBCTLBB is available in the same MVS image as CICS XRFB. XXDTO returns with code UERCSWCH indicating that CICS is to attempt a restart for DBCTLBB.
2. CICS XRFB issues an MVS CANCEL command (routed via JES) to cause DBCTLA, which was connected to CICS XRFA, to be canceled without a dump. The command includes the address space ID (ASID) of the DBCTL job, to ensure that the correct job is canceled in case another job with the same name happens to be running.
3. CICS XRFB waits until the active DBCTL has terminated, then issues a restart command to DBCTLBB.

   If XXDTO had returned with code UERCNOAC, the DBCTL subsystems would have remained on the active MVS image.
4. When CICS completes takeover processing, it runs the DFHPLT user initialization programs, which should include the DBCTL connection program, DFHDBCON. DFHDBCON attempts to connect to DBCTL with the DRA suffix used by CICS XRFA.

   If the attempt fails, and if the DBCTL system referred to by CICS XRFB's DRA startup parameter table is specified in the RSE and has received a restart command, CICS XRFB system attempts to connect to each DBCTL in the RSE until:

   - None of the IMS systems in the RSE is restarting, in which case the message DFS690A is issued; or
   - The CICS operator issues a CDBC DISCONNECT IMMEDIATE command, in which case the connection attempts are abandoned, and the interface is terminated.

   If the connection fails because the requested IMSID is present but is not yet available (for example, IMS XRF takeover is not yet complete), CICS can retry after an interval you have specified. See "What happens when CICS uses the RST to connect to DBCTL" on page 130 for information about how to do this.

IMS XRF takeover situations

This section describes a number of takeover situations and how the mechanisms provided by IMS XRF support switching to alternates.

IMS XRF in a single-MVS environment

In the example shown in Figure 37, which applies to a single-MVS environment, suppose you have specified an RST with an active CICS (CICS XRFA), which is connected to IMS XRFA. There is an alternate CICS (CICS XRFB) and an alternate IMS XRF (IMS XRFB), which is equivalent to IMS XRFA.

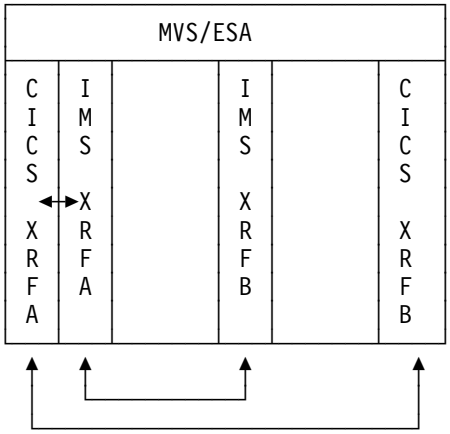

Figure 37. IMS XRF in a single-MVS environment

IMS XRF failure in a single-MVS environment

IMS XRFA fails and the failure is reported to CICS XRFA via the DRA control exit.

If you have AUTO=YES specified in the XRF definition for IMS, the transfer to the alternate (IMS XRFB) happens automatically. The rest of this situation is the same as in “DBCTL failure in a single-MVS environment” on page 135, except that CICS does not have to issue a restart command. IMS initiates the takeover when AUTO=YES is specified, and no operator intervention is needed.

IMS XRF in a multi-MVS environment

The example shown in Figure 38 on page 140 applies to a multi-MVS environment in which you have specified XRF support; suppose you have specified an RST with an active CICS (CICS XRFA), which is connected to an active IMS XRF (IMS XRFA). There is an alternate CICS (CICS XRFB) and an alternate IMS XRF (IMS XRFB), which is equivalent to IMS XRFA.

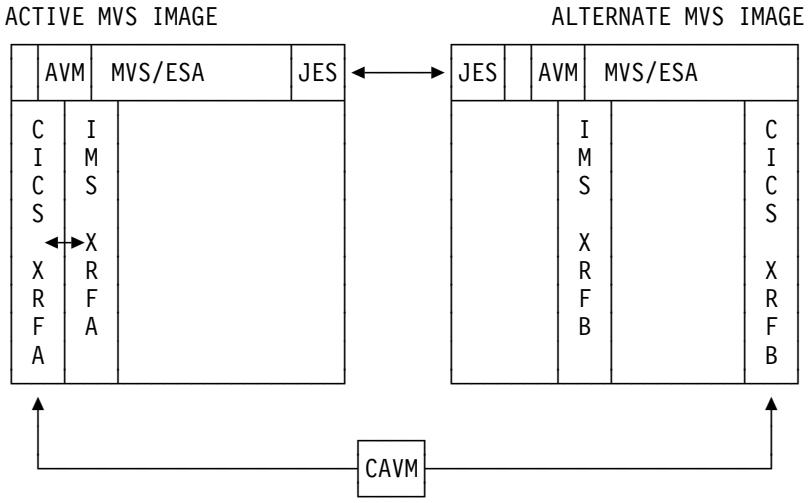

Figure 38. IMS XRF in a multi-MVS environment

IMS XRF failure in a multi-MVS environment

If both CICS and IMS XRF alternates are on the alternate MVS image, we assume that you will normally want to transfer to the alternate MVS image.

If IMS XRFA fails, the failure is reported to CICS XRFA via the DRA control exit. If the IMS XRF system had AUTO=YES specified, it switches automatically to IMS XRFB but, in any case, subject to installation control, CICS issues the IMS operator command /SWITCH SYSTEM FORCE command as part of its takeover process. (See the *IMS/ESA Operator's Reference* manual for further guidance on this command.)

You have the option of starting a new IMS XRF subsystem, as described for DBCTL in "DBCTL failure in a multi-MVS environment" on page 136. However, if you do this, beware that you cannot restart an active IMS XRF subsystem without first shutting down the alternate IMS. To switch to an alternate IMS XRF other than the alternate system, you must shut down the alternate (on the alternate MVS image), start a new active IMS (on the active MVS image), and then submit a new alternate IMS (on the alternate MVS image). You must also coordinate the sequence carefully, or you may have data availability problems. You would also have to have specified the IMS XRF AUTO=NO option to suppress automatic IMS XRF switching. However, this means that you lose any VTAM terminal switching benefit, which is one reason for having used IMS XRF.

If no CICS is connected to the failing IMS XRF, then no CICS takeover occurs and IMS XRF transfers only if AUTO=YES was specified. CICS and IMS takeovers are independent if they are not connected to each other at the time of the failure. They are as described in the *CICS/ESA 3.3 XRF Guide* and the *IMS/ESA System Administration Guide*. When CICS is connected, it switches the DBCTL.

The sequence of actions is very similar to those for a DBCTL failure in a multi-MVS environment and a transfer is made to the alternate MVS image. See "DBCTL failure in a multi-MVS environment" on page 136. The only difference is that CICS XRFB issues a /SWITCH SYSTEM FORCE command without waiting for IMS XRFA to terminate. (See the *IMS/ESA Operator's Reference* manual for further guidance on this command.)

CICS failure in a multi-MVS environment with IMS XRF

If CICS XRFA fails, CICS XRFB takes over as described in the *CICS/ESA 3.3 XRF Guide*. CICS XRFB is aware that CICS XRFA was connected to IMS at the time CICS XRFA failed, and looks for a suitable IMS alternate in the same MVS image as CICS XRFB. As part of the takeover process, XXDTO is invoked in CICS XRFB with the information that its active counterpart was connected to IMS XRFA, and that IMS XRFB is ready. XXDTO returns code UERCSWCH indicating that IMS XRFB is to be restarted. From then on, processing is the same as in "CICS failure in a multi-MVS environment" on page 137, except that, in the case of a takeover, CICS XRFB issues a /SWITCH SYSTEM FORCE command, instead of the CANCEL, WAIT, and /ERESTART sequence of commands taking place.

Processor or MVS failure in a multi-MVS environment with IMS XRF

If there is a processor or MVS failure, CICS subsystem switching is as described, for guidance, in the *CICS/ESA 3.3 XRF Guide*.

As part of the takeover process, XXDTO is invoked in CICS XRFB with the information that its active counterpart was connected to IMS XRFA, and that the alternate IMS XRFB is ready.

XXDTO returns code UERCSWCH indicating that the alternate CICS and IMS are to be restarted. From then on, processing is the same as in the case of a CICS failure in a multi MVS environment, except that CICS XRFB issues a /SWITCH SYSTEM FORCE command instead of an MVS CANCEL and a restart command. See "CICS failure in a multi-MVS environment" on page 137.

Chapter 9. Security checking with DBCTL

Considerations for using security checking with DBCTL are:

- The different types of security checking you may need
- Migration

When using CICS with DBCTL, you may want to use one or more of the following ***optional*** security facilities:

- PSB authorization checking by CICS
- Resource access security checking by DBCTL, which comprises checks at:
  - Connect time
  - PSB scheduling time.

  For more information, see also the information on defining resource security checking for PSBs in the *CICS/ESA CICS-RACF Security Guide*.
- Password security checking by DBCTL for /LOCK and /UNLOCK commands.

Of the resources you can protect using IMS security, you need be concerned only with PSBs, databases, and commands.

PSB authorization checking by CICS

At PSB scheduling time, CICS invokes security checking to find out whether the terminal user is authorized to access the PSB. The actual check is carried out by an external security manager, which can be RACF or your own security program.

Although PSB scheduling requests are sent to DBCTL for processing, CICS does PSB authorization checking in exactly the same way as with local DL/I. See the *CICS/ESA Customization Guide* for programming information on writing your own security program.

Resource access security checking by DBCTL

DBCTL views all the resources that can be accessed by one particular CICS system or BMP as a single entity. Resources in this context means one or more PSBs. The set of PSBs that one CICS or BMP can access are grouped together in an entity called an **application group**. Each application group has a name — its AGN, and the AGNs are defined in **matrix data sets**.

Application groups, and the names of the resources within those groups, are placed in tables in DBCTL's security matrix data set(s) using the IMS security maintenance utility. You can use the IMS online change facility to bring new security tables online.

The AGN that CICS intends to use is specified in the DRA startup table referenced by CICS when it attempts to connect to DBCTL. You can assign the same AGN to different CICS systems, if you need to.

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DBCTL resource access security checking provides the following:

- Checking at connect time

  When CICS or a BMP connects to DBCTL, DBCTL initiates a check to find out if CICS or the BMP is authorized. The check is carried out either by RACF in conjunction with DBCTL or by a user exit routine (DFSISIS0):

  1. RACF and DBCTL

     This check has two parts:

     – RACF checks whether the userid supplied in the JOB statement of the CICS startup job (or in the started procedure table), or BMP JCL, is authorized to access the AGN supplied by CICS or the BMP during the connect request.

     – If the above check is successful, DBCTL carries out the second part of the check. This involves verifying that the supplied AGN is in the matrix data sets used for this DBCTL startup.

  2. User exit routine (DFSISIS0), which gives or refuses authorization by setting the appropriate return code.

     If you use DBCTL connect-time checking, you must also use DBCTL PSB schedule-time checking. That is, you can use both of these checks, or neither, but you cannot use only one of them.

     See the *IMS/ESA System Administration Guide* for guidance on specifying security, and the *IMS/ESA Utilities Reference: Database* manual for guidance on the security maintenance utility.

- Checking at PSB scheduling time

  This is completely unrelated to and independent of the PSB authorization checking by CICS, which is described in “PSB authorization checking by CICS” on page 143.

  This check is carried out by DBCTL and involves verifying that the PSB belongs to the AGN specified during the connection process.

Relationships between AGNs, PSBs, and DBCTL ID in security checking

Figure 39 summarizes the relationships between AGNs, PSBs, and the DBCTL ID in security checking.

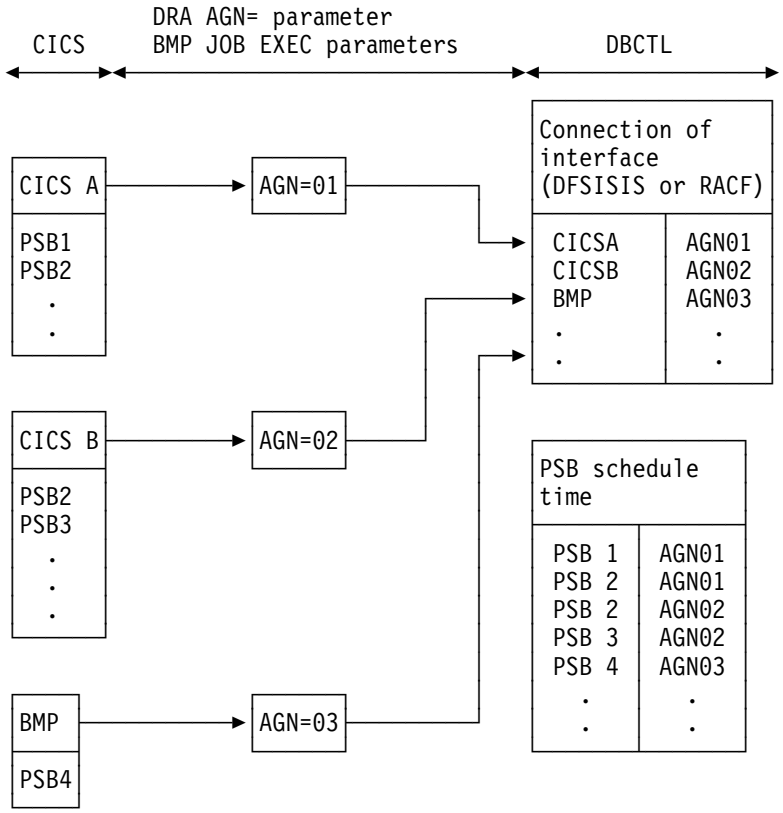

Figure 39. Relationships between AGNs, PSBs and DBCTL ID in security checking

The two levels of security mean that if a new PSB is introduced, there are two kinds of table that you must update:

- The RACF table that defines the CICS PSB resource class
- The security management utility AGN definition.

If the AGN is changed in the DRA startup parameter table, update the following tables:

- The RACF table that defines the AGN resource class
- The security management utility AGN definition.

Parameters for DBCTL resource access security

You specify the kind of security checking you want by using either the DBCTL system generation macro SECURITY or the DBCTL startup parameter ISIS. See the *IMS/ESA System Definition Reference* manual for further guidance on this parameter.

For guidance on the RACF aspects of implementing DBCTL security, see the *Resource Access Control Facility (RACF) Security Administrator's Guide*.

DBCTL password security checking

You can protect DBCTL against unauthorized /LOCK and /UNLOCK commands for certain PSBs (referred to as “programs” in the IMS publications) and databases by establishing passwords for these PSBs and databases. The IMS security maintenance utility is used to place the definitions needed into DBCTL’s matrix data sets:

```
)( PROGRAM  PSB11
  PASSWORD PWP11
)( PROGRAM  PSB12
  PASSWORD PWP12
)( DATABASE DB21
  PASSWORD PWD21
)( DATABASE DB22
  PASSWORD PWD22
```

Note: The parentheses shown in the above example are used by the security maintenance utility to recognize input commands.

Security considerations for using BMPs with DBCTL

In most cases, PSB authorization checking by CICS provides sufficient security. The fact that CICS and DBCTL run in the same MVS image, and that the connection parameters (in the DRA startup table) have to be in an authorized library should usually allow you enough control over the connection process, and you will not need to implement the DBCTL security checking described in “Resource access security checking by DBCTL” on page 143. However, these considerations do not apply if you are using BMPs with DBCTL. To provide security control for BMPs, we strongly recommend you use DBCTL resource access security checking. This is because DBCTL resources, such as PSBs, can be accessed by programs that operate in dependent regions. To MVS, these dependent regions are normal MVS jobs that anyone can initiate using the MVS job entry subsystem. This means that a user who is not authorized to access a database using a RACF-protected CICS transaction could access that database by submitting a BMP region with the correct parameters in the EXECUTE statement. (See “Making DBCTL resources available” on page 72 for information on starting BMP JCL using a DBCTL operator command.)

Migration considerations for security with DBCTL

Before migrating, review the security facilities available and decide which ones you want to use in a CICS-DBCTL environment — in particular, whether you need to use the additional DBCTL checks.

Security migration scenarios

Figure 40 and Figure 41 on page 147 show considerations for migrating installations that already use PSB security checking.

CICS PSB authorization checking

Figure 40 shows migration from a CICS system with local DL/I to a CICS system with DBCTL. In this situation, you can retain all existing security-related definitions.

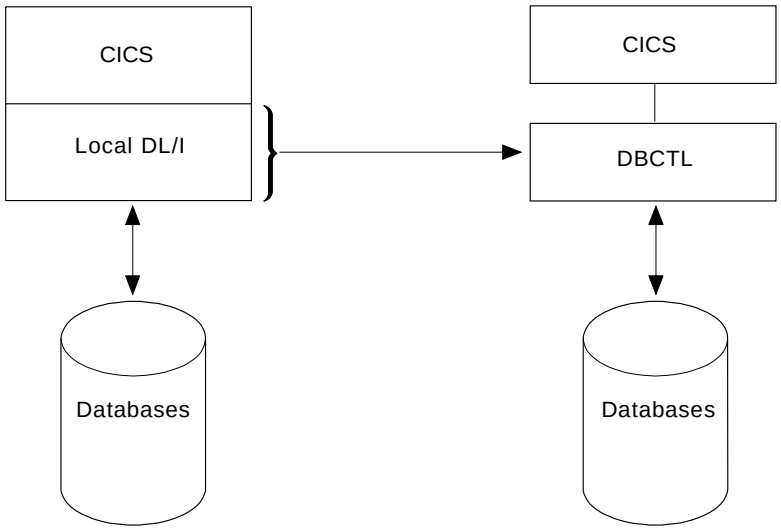

Figure 40. CICS with local DL/I to CICS with DBCTL

Figure 41 shows migration from a multiregion operation (MRO) installation with a CICS database-owning region (DOR) and local DL/I to DBCTL, which replaces local DL/I and the DOR. If you already use PSB security checking in the CICS application-owning regions (AORs), you do not need any security-related changes.

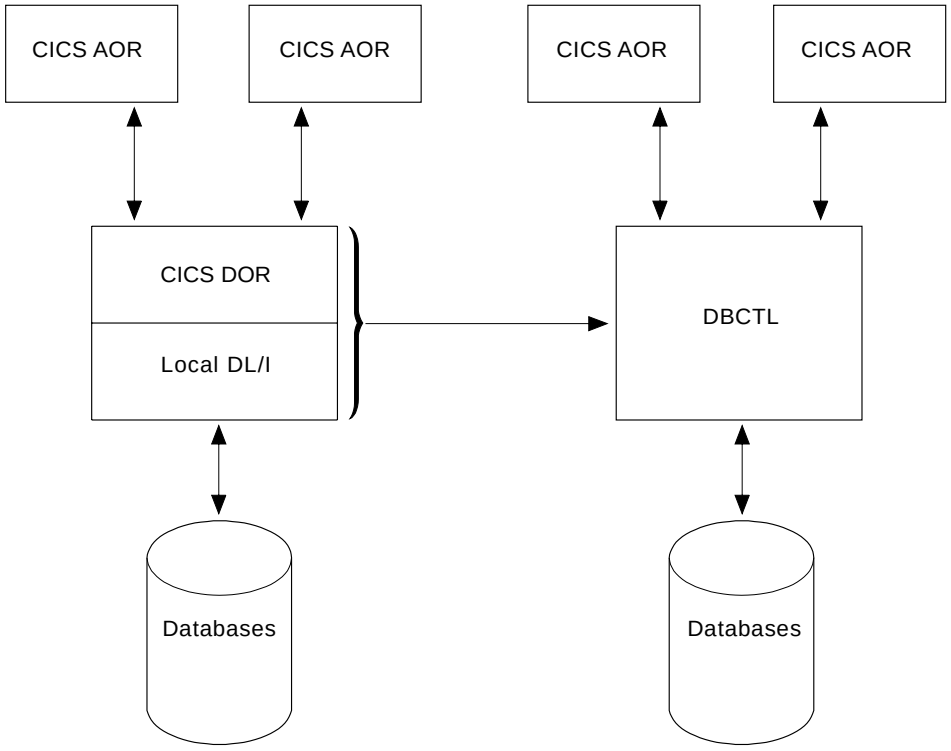

Figure 41. MRO installation with CICS DOR with DBCTL replacing local DL/I

Figure 42 shows PSB RACF checking being done in the CICS DOR.

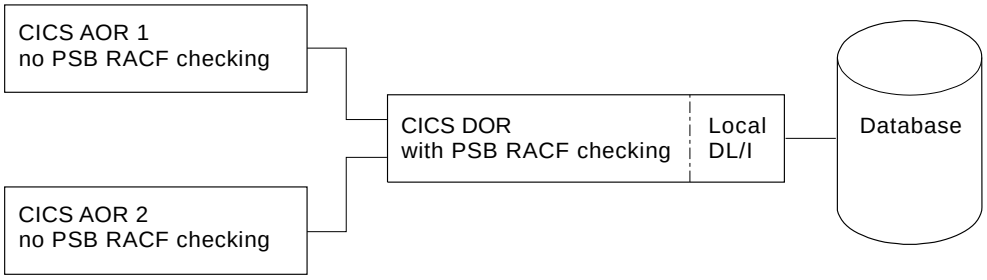

Figure 42. Local DL/I environment — PSB RACF checking in CICS DOR

If you want this kind of checking after replacing the DOR with DBCTL, it must be done in the CICS AORs that use DBCTL, as shown in Figure 43.

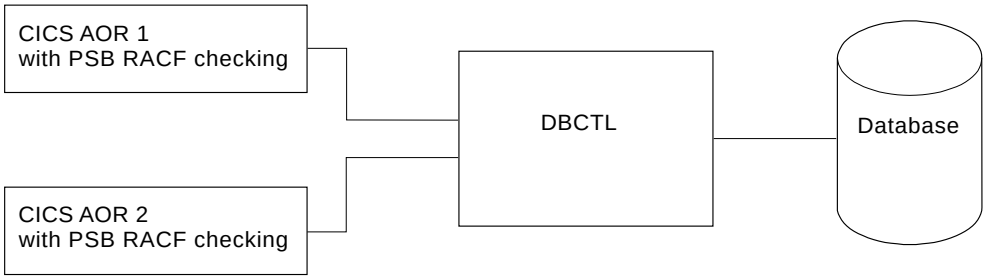

Figure 43. DBCTL environment — PSB RACF checking in CICS AOR

Decide whether you want to keep your previous setup with respect to grouping PSBs, and using or not using prefixes.

Review the CICS SIT parameters SEC, XPSB, and PSBCHK for each CICS AOR. Depending on any changes you make to these parameters, you may also need to change the corresponding RACF definitions (CDT class names, RDEFINE, and PERMIT).

DBCTL resource access security checking

Follow the steps below only if you have decided to use the additional DBCTL checks.

1. DBCTL system generation

   Select the appropriate macros and parameters:

   - IMSGEN PSWDSEC=...
   - SECURITY TYPE=...,PASSWD=...,RCLASS=...

2. Application group name (AGN)

   For multiple CICS systems connected to DBCTL, first decide whether you want to use the same, or different, AGNs.

   Specify the appropriate AGN in the DRA startup parameter table for each CICS, or by a BMP JCL parameter (AGN=).

3. Allocate MATRIX data set, and

   If you want to use online change, you must also define MATRIXA and MATRIXB.

For further guidance on space calculations, see the section on establishing IMS security in *IMS/ESA System Administration Guide*.

4. Define AGNs and their PSBs using the IMS security maintenance utility, DFSISMP0.

   Note that you can run DFSISMP0 only after DBCTL system generation has completed.

5. For password security checking, define the PSBs (or programs) and/or databases and the passwords to be used with /LOCK and /UNLOCK in the MATRIX data set.

6. Specify the value of the DBCTL startup parameter ISIS. Values are as follows:

   ```
   ISIS=0 - no checks
   ISIS=1 - checks using RACF
   ISIS=2 - checks using an installation exit (DFSISIS0)
   ```

RACF preparations

1. CICS P/QCICSPSB definitions.

   - CICS with local DL/I to CICS with DBCTL (Figure 40 on page 147) — no modifications required.
   - MRO installation with CICS DOR with DBCTL replacing local DL/I (Figure 41 on page 147) — depending on whether you decided to differentiate or not, you may have to adjust the RDEFINEs and PERMITs accordingly.

2. Specify RDEFINE for AGNs in RACF CLASS AIMS.

3. Specify PERMIT for CICS USERIDs.

   Before CICS or a BMP can connect to DBCTL, the USERID from the JOB statement of the CICS startup job or the BMP JCL must be authorized to access its AGN.

4. You may want to write a simple program to list existing RACF profiles for PCICSPSB and QCICSPSB and construct the control statements needed for the IMS security maintenance utility. The group structure for PSBs within RACF (QCICSPSB) will probably be the same as that required within DBCTL AGN groups, plus the additional groups needed for BMPs.

Chapter 10. Problem determination

This chapter contains Diagnosis, Modification, or Tuning information.

This discussion of problem determination with DBCTL includes information on:

- Possible error situations, and how to go about solving them
- Traces and dumps produced
- Sources and destinations of messages and abend codes
- Using the CICS command-level execution diagnostic facility (EDF) with DBCTL.

In a CICS-DBCTL environment, you need to correlate information produced by the CICS system with information produced by the DBCTL system. This information includes:

- Trace entries produced by CICS and DBCTL
- Dumps produced by CICS, the DRA, and DBCTL
- Messages produced by CICS, the DRA, and DBCTL.

The link between CICS and DBCTL in all the above cases is the recovery token. It appears in trace entries, in dumps (including the dump header), and in messages issued by CICS and DBCTL.

See the *CICS/ESA Problem Determination Guide* for more detailed help on dealing with problems, beginning from symptoms through to identification and solution. The *CICS/ESA Problem Determination Guide* also includes information on debugging local DL/I. For detailed component descriptions of DBCTL and local DL/I, which you may find useful in debugging, see the *CICS/ESA Diagnosis Reference*. See the *CICS/ESA Messages and Codes* manual for help on interpreting, and suggested responses to, messages and abend codes that are issued by the CICS system. See the *IMS/ESA Messages and Codes* manual for similar guidance on messages and abend codes issued by the DRA and by DBCTL.

Interactions between CICS and DBCTL

Errors can occur at any of the following stages in a CICS-DBCTL environment.

Interactions between CICS and DBCTL at the interface level

- Connection to DBCTL.

  See “Connection to DBCTL has failed to complete” on page 152.

- Disconnection from DBCTL. (This includes intentional operator-requested disconnection, and unintentional disconnections caused by failures of the system, or parts of the CICS-DBCTL interface.)

  See “Disconnection from DBCTL has failed to complete” on page 153.

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Interactions between CICS and DBCTL caused by requests

- Requests that are issued by applications:
  - Waits or failures during PSB scheduling.

    See “Failures during PSB scheduling” on page 154.
  - Waits or failures during the processing of a DL/I request.

    See “Failures during DL/I request processing” on page 154.
- Requests that are issued as a result of task termination, including syncpoint processing:
  - Failures during PREPARE processing
  - Failures during COMMIT processing (TERM call or task termination)
  - Failures during resynchronization of LUWs.

  In all these cases, see “Thread termination” on page 166.

DBCTL error scenarios

The headings that follow describe a number of DBCTL error situations and tell you how to go about solving them.

Connection to DBCTL has failed to complete

In this situation, the DRA may be in a “wait” state because you attempted to connect CICS to DBCTL using the CDBC transaction, but the connection process failed to complete.

Connection to DBCTL using the CICS-supplied transaction CDBC takes place in two phases. In phase 1, CDBC passes the request for connection to IMS, and returns. In phase 2, IMS processes the request asynchronously, and returns to CICS when connection is complete. To discover where the problem occurred, try to find out how far the connection attempt has progressed by:

- Pressing PF2 on the CDBC menu panel to refresh this display, as described in “CDBC transaction for connect and disconnect” on page 56; or
- Using the CDBI inquiry panel, as described in “CDBI transaction for inquiry” on page 60.

If connection is in phase 1, the following message is issued:

```
DFHDB8291 I DBCTL CONNECT PHASE 1 IN PROGRESS
```

It is very unlikely that a wait will occur during this phase, unless there is a problem with the CICS transaction.

If connection is in phase 2, the following message is issued:

```
DFHDB8292 I DBCTL CONNECT PHASE 2 IN PROGRESS
```

If phase 2 fails to complete, the failure is associated with IMS. This may be because:

- The DRA startup table is pointing to the wrong system because the DBCTL subsystem ID is incorrect. If this is so, CICS issues a WTO message saying:

  ```
  SUBSYSTEM xxxx NOT ACTIVE.  REPLY WAIT OR CANCEL
  ```

  where xxxx is the subsystem ID indicated on the CDBC panel.

  See “Defining the IMS DRA startup parameter table” on page 45 for information on specifying the DBCTL subsystem ID.

- DBCTL has been initialized, but no restart command has been issued. Remember that DBCTL needs a restart command unless you are using AUTO start. See “Connection to DBCTL” on page 53 and “Restarting DBCTL” on page 79 for information on restarting DBCTL and on the implications of different restart options.

If neither of the above situations applies, the problem is in IMS; see the *IMS/ESA Diagnosis Guide and Reference* manual for further guidance.

For an example of the trace entries produced by CICS for a successful connection to DBCTL, see “Connection to DBCTL” on page 157.

Disconnection from DBCTL has failed to complete

In this case, the DRA may be in a wait state because you attempted to disconnect CICS from DBCTL using the CDBC transaction, but the disconnection process failed to complete.

For an example of the trace entries produced by CICS for a successful disconnection from DBCTL, see “Disconnection from DBCTL” on page 160.

When you use CDBC to disconnect from DBCTL, it invokes another CICS transaction, CDBT. CDBT makes the disconnection request to DBCTL, and is suspended by CICS while DBCTL services the request asynchronously.

If disconnection fails to complete, you can inquire on CDBT using CEMT INQ TASK to see how far disconnection has progressed. You will probably find CDBT is waiting on resource name DLSUSPND and resource type DBCTL, which means the request is being processed by DBCTL. For an illustrated example, see the description of CEMT INQ TASK in “Purging a transaction that is using DBCTL” on page 73.

- If CDBT is waiting on DLSUSPND, what you do next depends on whether the disconnection requested was orderly or immediate. (Use the CDBI inquiry panel, as described in “CDBI transaction for inquiry” on page 60, if you need to find out.)
  - If you have requested orderly disconnection, it is likely that DBCTL is waiting for a task issuing many DL/I requests, or for a conversational task, perhaps one that is waiting for input from an unattended terminal.

    You can, if necessary, override an orderly disconnection by requesting immediate disconnection, in which case the process should conclude at once. However, you should be aware that immediate disconnection can cause in-doubt LUWs, and leave database records unavailable to other

CICS systems using that DBCTL until it is reconnected, as described in “Deciding whether to use orderly or immediate disconnection” on page 60.

  - If you have requested immediate disconnection, and it has not taken place, it is likely that an unexpected wait within IMS has occurred. See the *IMS/ESA Diagnosis Guide and Reference* manual for further guidance.

- If CDBT is not waiting on DLSUSPND, this indicates a problem in CICS. See the *CICS/ESA Problem Determination Guide* for information on dealing with it.

Failures during PSB scheduling

For examples of trace entries produced by CICS during PSB scheduling (both successful and failed), see “PSB schedule” on page 163 and “PSB scheduling failure” on page 164.

Use the DBCTL operator command /DISPLAY as follows:

- /DISPLAY PROGRAM psbname to check that the ACB is valid. A status of “invalid” means that the PSB was not defined during IMS system generation. A status of “notinit” means that the ACB is not in the ACBLIB. A status of “stopped” means an error has caused DBCTL to stop the PSB, or that a /STOP command has been issued for the PSB. Investigate the cause of this error. When resolved, use /START PROGRAM psbname to start the PSB again.
- /DISPLAY DATABASE dbname to check that the databases are valid.

If you are running DBCTL and local DL/I together, check whether the PSB you have specified is named in the PDIR for CICS and IMS. If a PSB appears in the PDIR and contains references to databases that are not allocated to the CICS system (for example, because they are DBCTL databases), the PSB schedule fails, because the request has gone to local DL/I and the application cannot proceed any further. To avoid failures for this reason, make sure that the PDIR does not contain entries for PSBs that reference databases owned by DBCTL.

Conversely, if you do not have an entry in the PDIR for PSBs that reference databases owned by local DL/I the first DL/I request will fail, as mentioned in “Failures during DL/I request processing.”

Failures during DL/I request processing

The DRA may have entered a “wait” state because you have a CICS task in a wait state.

For an example of the trace entries produced by CICS during DL/I request processing, see “CICS task issuing DL/I requests to be processed by DBCTL” on page 165. For an example of the trace entries produced by DBCTL during DL/I request processing, see “Trace entries produced by DBCTL” on page 167.

If a task appears to have “hung,” query it using CEMT INQ TASK, as for any CICS task. If you have a task waiting on a resource name of DLSUSPND and resource type DBCTL, the task has made a DL/I request and has been suspended in CICS while DBCTL services that request. If repeated use of CEMT INQ TASK shows the task still waiting on DLSUSPND, it has “hung” in DBCTL. If you want to purge the task, you must use DBCTL operator commands to do so. See “Purging a transaction that is using DBCTL” on page 73 for an illustrated example of using CEMT INQ TASK and the relevant DBCTL operator commands in this way.

If the task is not waiting on DLSUSPND, this may indicate a problem in CICS. See the *CICS/ESA Problem Determination Guide* for information about dealing with it.

If you are running DBCTL and local DL/I together, check whether the PSB you have specified is named in the PDIR for CICS and IMS. If a PSB that contains references to a local DL/I database is not named in the PDIR, the schedule request goes to DBCTL. However, the database is not allocated to DBCTL and does not have a DD statement in DLISAS, nor in DFSMDA members. In this case, the PSB schedule request succeeds, but the first request made using the database PCB fails with a status code indicating that the database could not be opened. To avoid failures for this reason, make sure that the PDIR contains entries for PSBs that reference databases owned by local DL/I.

Conversely, if a PSB that references databases owned by DBCTL is named in the PDIR, the PSB schedule request fails, as mentioned in "Failures during PSB scheduling" on page 154.

Correlating activity in DBCTL and CICS

Using the /DISPLAY command to display DBCTL activity and the CEMT INQ TASK to display CICS activity are useful means of correlating what is happening on each side of the interface. Check to see that the recovery token matches in CICS and DBCTL. If it does not, this may indicate a thread hanging. /DISPLAY CCTL ALL displays all the threads associated with CICS tasks in DBCTL. If you enter /DISPLAY ACTIVE ALL, region and DC activity is also displayed, enabling you to find out if a BMP is waiting in DBCTL.

Trace

When examining traces entries produced by CICS and DBCTL, you need to relate them according to whether they are produced at the same time in CICS and in DBCTL, or at different times. You also need to know how to find the relevant parts of each trace and use them to correlate what is happening in CICS and in DBCTL.

Trace entries produced by CICS

From CICS/ESA Version 3 onwards, you can use the CICS-supplied transaction CETR to trace DL/I (including DBCTL) activity. For DBCTL, CETR traces DL/I requests until they leave DFHDBAT. See the *CICS/ESA CICS-Supplied Transactions* manual for information on using CETR.

The sections that follow give examples of CICS trace entries produced at the following points:

- Connection to DBCTL
- Disconnection from DBCTL
- PSB schedule time
- DL/I request issued
- Thread termination after DL/I requests.

These trace examples were produced using abbreviated auxiliary trace with file control level 1 trace points selected. You will probably find this amount of information sufficient. If it is not, selecting file control level 2 will give you more details on, for example, entry to and exit from DFHDBAT and DFHERM.

See the *CICS/ESA Problem Determination Guide* for details of the general format of CICS trace entries, how to select trace options for component and task tracing, whether to use “standard” or “special” tracing, and how to start and stop tracing selectively. Trace point IDs are listed in the *CICS/ESA Diagnosis Reference*. See the *CICS/ESA Operations and Utilities Guide* for help on formatting and printing trace entries, including a sample job you can use to do so.

The numbers in the margin to the left of the example traces point to things that you may find useful in correlating CICS and DBCTL activity, but please note that these additional numbers are ***not*** part of the trace output. You should also note that we have omitted some trace entries for brevity. This is indicated by the following symbol:

.
.

Connection to DBCTL

Figure 44 shows an example of the CICS trace entries produced when CICS connects to DBCTL.

```
1                                                .
                                                 .
2     00031 1 AP 00E1 EIP   ENTRY LINK                                          0004,0560D6D8 .-OQ,08000E02 ....
      00031 1 PG 1101 PGLE  ENTRY LINK_EXEC             DFHDBCON,0560D300 , 00000014
      00031 1 DD 0301 DDLO  ENTRY LOCATE                05200FB0,001164D0,PPT,DFHDBCON
      00031 1 DD 0302 DDLO  EXIT  LOCATE/OK             D7D7E3C5 , 0527BB70
      00031 1 LD 0001 LDLD  ENTRY ACQUIRE_PROGRAM       0564A3A0 , 00000001
                                                 .
                                                 .
      00031 2 LD 1003 LDLD1 EVENT PRE-SVC-CALL          LOAD,DFHDBCON,05541D00
      00031 2 LD 1004 LDLD1 EVENT POST-SVC              LOAD,OK,DFHDBCON,05541D00
                                                 .
                                                 .
      00031 1 LD 0002 LDLD  EXIT  ACQUIRE_PROGRAM/OK    85541D48,05541D00,1968,E77,REUSABLE,ERDSA,NEW_COPY
                                                 .
                                                 .
3     00031 1 XM 1101 XMAT  ENTRY ATTACH                CDBO,0560EC38 , 00000004,0,NONE,C,NO,YES,NO,0
      00031 1 XM 0401 XMLD  ENTRY LOCATE_AND_LOCK_TRANDEF CDBO
      00031 1 DD 0301 DDLO  ENTRY LOCATE                05200040,0560EF2C,TXD,CDBO
      00031 1 DD 0302 DDLO  EXIT  LOCATE/OK             05278990 , D7000000
                                                 .
                                                 .
4     00031 1 LD 0001 LDLD  ENTRY ACQUIRE_PROGRAM       DFHDBSPX,YES
      00031 1 LD 0002 LDLD  EXIT  ACQUIRE_PROGRAM/OK    854B5D60,054B5D40
                                                 .
                                                 .
                                                 .
                                                 .

5     00031 1 AP 00E1 EIP   ENTRY ENABLE                                        0004,0560E8EC .-Y.,08002202 ....
                                                 .
                                                 .

      00031 1 PG 0C01 PGEX  ENTRY INITIALIZE_EXIT       DFHDBAT,NO,NO
      00031 1 DD 0301 DDLO  ENTRY LOCATE                05200FB0,0560EB14,PPT,DFHDBAT
      00031 1 DD 0302 DDLO  EXIT  LOCATE/OK             D7D7E3C5 , 0527BB28
     1CICS/ESA - AUXILIARY TRACE FROM 09/16/93 - APPLID IYAHZCAA - TIME OF FIRST ENTRY ON THIS PAGE 10:04:38.7258694455
                                                 .
                                                 .
7     00031 1 AP 00E7 ERM   EVENT PASSING-CONTROL-TO-RM DBCTL                   4004,A8185401 y...,6E724D20 >.(.,DBCTL
8     00031 1 AP 0314 DBAT  EVENT DRA-ROUTER-LOAD       , LOAD-RESPONSE-CODE (00000000)
9     00031 1 AP 0315 DBAT  EVENT ABOUT-TO-INVOKE-DRA   FOR INTERFACE REQUEST , 0100
10    00031 1 AP 0316 DBAT  EVENT RECEIVES-CONTROL-FROM-DRA FOR INTERFACE REQUEST , 00000000
11    00031 1 AP 00E7 ERM   EVENT REGAINING-CONTROL-FROM-RM DBCTL                4104,A8185401 y...,6E724D20 >.(.,DBCTL
      00031 1 AP 00E7 ERM   EXIT  APPLICATION           DBCTL                    1104,A8185401 y...,6E724D20 >.(.,DBCTL
12    00031 1 ME 0301 MEME  ENTRY SEND_MESSAGE          1FB4,0567D408 , 00000004,05679060 , 00000002,DB
      00031 1 ME 0501 MEIN  ENTRY INQUIRE_MESSAGE_DATA  85197680,DFHMET1E,1FB4,05678988 , 00000000 , 0000001C,05678922 , 00000000
      00031 1 KE 0101 KETI  ENTRY INQ_LOCAL_DATETIME_DECIMAL
      00031 1 KE 0102 KETI  EXIT  INQ_LOCAL_DATETIME_DECIMAL/OK 09161993,100438,917324,MMDDYYYY
      00031 1 KE 0401 KEGD  ENTRY INQUIRE_KERNEL
      00031 1 KE 0402 KEGD  EXIT  INQUIRE_KERNEL/OK     IYAHZCAA,CIAA
      00031 1 ME 0502 MEIN  EXIT  INQUIRE_MESSAGE_DATA/OK 05197934,0519FEC1,0519FED5,0519FF34,,I,100438,16091993,M,CIAA,IYAHZCAA
                                                 .
                                                 .
13    00031 1 DU 0500 DUDT  ENTRY INQUIRE_SYSTEM_DUMPCODE DB8116
      00031 1 DU 0600 DUTM  ENTRY INQUIRE_SYSTEM_DUMPCODE DB8116
      00031 1 DU 0601 DUTM  EXIT  INQUIRE_SYSTEM_DUMPCODE/EXCEPTION DUMPCODE_NOT_FOUND,0,0,,
      00031 1 DU 0501 DUDT  EXIT  INQUIRE_SYSTEM_DUMPCODE/EXCEPTION DUMPCODE_NOT_FOUND,0,0,,
      00031 1 ME 0401 MEBU  ENTRY BUILD_MESSAGE         0519FEC1,05197934,16091993,M,100438,CIAA,IYAHZCAA,05678659 , 00000009,056

      00031 1 ME 0402 MEBU  EXIT  BUILD_MESSAGE/OK      0
                                                 .
                                                 .
14    00031 1 AP F600 TDTD  ENTRY WRITE_TRANSIENT_DATA  CDBC,056789B6 , 00000001,NO
      00031 1 AP 00F6 TDP   ENTRY CTYPE-PUT             CDBC                     FC03,05678540 ..e ,00000000 ....,CDBC
      00031 1 AP EA00 TMP   ENTRY LOCATE                DCT,CDBC
      00031 1 AP EA01 TMP   EXIT  LOCATE                DCT,CDBC,05242A9C,NORMAL
                                                 .
                                                 .
      00031 1 AP F601 TDTD  EXIT  WRITE_TRANSIENT_DATA/OK
                                                 .
                                                 .
```

Figure 44 (Part 1 of 2). CICS trace entries produced during connection to DBCTL

```
15    00031 1 DU 0500 DUDT  ENTRY INQUIRE_SYSTEM_DUMPCODE DB8210
                                                .
                                                .
16    00031 1 DU 0500 DUDT  ENTRY INQUIRE_SYSTEM_DUMPCODE DB8292
17                                              .
                                                .
      00032 1 DS 0005 DSSR  EXIT  WAIT_MVS/OK
18    00032 1 AP 0306 DBCT  EVENT POSTED               FOR CONNECTION COMPLETE
19    00032 1 ME 0301 MEME  ENTRY SEND_MESSAGE         1FA5,051ED4B8 , 00000004,05679060 , 00000002,DB
      00032 1 ME 0501 MEIN  ENTRY INQUIRE_MESSAGE_DATA 85197680,DFHMET1E,1FA5,050D7A18 , 00000000 , 0000001C,050D79B2 , 00000000
                                                .
                                                .
      00032 1 DU 0500 DUDT  ENTRY INQUIRE_SYSTEM_DUMPCODE DB8101
                                                .
                                                .
20    00032 1 GC 2010 CCCC  ENTRY WRITE                00017DA4 , 00000008,DBCTL,STATUS
                                                .
                                                .
      00032 1 GC 2050 CCCC  EXIT  WRITE/OK
                                                .
                                                .
21    00032 1 PG 0A01 PGLU  ENTRY LINK_URM             DFHDBUEX,00017E00 , 0000000B,NO
      00032 1 DD 0301 DDLO  ENTRY LOCATE               05200FB0,00018220,PPT,DFHDBUEX
      00032 1 DD 0302 DDLO  EXIT  LOCATE/OK            D7D7E3C5 , 0527BD68
                                                .
                                                .
22    00032 1 AP 0064 USER  EVENT APPLICATION-PROGRAM ENTRY CONNECT DBCTL HAS JUST BEEN CONNECTED
                                                .
                                                .
      00032 1 AP 1941 APLI  EXIT  START_PROGRAM/OK     ,DFHDBUEX
      00032 1 LD 0001 LDLD  ENTRY RELEASE_PROGRAM      0564A870 , 00000001,8534D308
      00032 1 LD 0002 LDLD  EXIT  RELEASE_PROGRAM/OK   0534D2E0,110,ERDSA
                                                .
                                                .
23    00032 1 AP D802 SPP   ENTRY RESYNC               REQUEST
                                                .
                                                .
      00032 1 AP 00E1 EIP   EXIT  RESYNC               OK                            00F4,00000000 ....,00001604 ....
      00032 1 AP 00E1 EIP   ENTRY SYNCPOINT                                          0004,000182CC ..b.,08001602 ....
                                                .
                                                .
      00032 1 AP 00E1 EIP   EXIT  SYNCPOINT            OK                            00F4,00000000 ....,00001602 ....
                                                .
                                                .
24    00031 1 ME 0301 MEME  ENTRY RETRIEVE_MESSAGE     2065,0005A487 , 00000000 , 00000033,E,DB
      00031 1 ME 0501 MEIN  ENTRY INQUIRE_MESSAGE_DATA 85197680,DFHMET1E,2065,0560E1C0 , 00000000 , 0000001C,0560E15A , 00000000
                                                .
                                                .
      00031 1 DU 0500 DUDT  ENTRY INQUIRE_SYSTEM_DUMPCODE DB8293
```

Figure 44 (Part 2 of 2). CICS trace entries produced during connection to DBCTL

Notes:

1. Phase 1 of connection begins.
2. Locating DFHDBCON and loading if not already loaded. (In this example, CICS and DBCTL have already been connected during this CICS session, so DFHDBCON has already been loaded.)
3. The control transaction, CDBO, is attached. CDBO enables the DRA to pass information from itself and DBCTL independently of CICS. It is invoked whenever the DRA needs to determine whether to continue processing, which is when:
   - The DRA has successfully connected to DBCTL
   - DBCTL has been terminated normally using /CHECKPOINT FREEZE or /CHECKPOINT PURGE
   - Connection to DBCTL has failed
   - A CICS request to connect to DBCTL has been canceled
   - The DRA fails
   - DBCTL fails.
4. Loading programs needed: DFHDBSPX (shown in example), plus DFHDBCX, DFHDBMOX, DFHDBREX, DFHDBSTX, DFHDBSSX, DFHDBTOX, and DFHDBAT.
5. DFHDBCON enables DFHDBAT.

6. A timestamp is included in the header line of every page of CICS abbreviated auxiliary trace output to help you match trace entries with external events.
7. DFHERM invokes DFHDBAT for connection request.
8. DRA router module DFSPRRC0 loaded.
9. DRA is invoked for interface request. The type of interface request is indicated by request type from the PAPL — 0100 is a CONNECT request. (See "PAPL request and return codes" on page 173.)
10. DBCTL return code (00000000). See "Return codes in DBCTL" on page 172.
11. Control is passed back to DFHERM.
12. Phase 1 of connection has ended at this point. Message DFHDB8116 is issued confirming that connection is proceeding. The message includes the DBCTL identifier and the DRA suffix used.
13. When a message has been issued, the CICS dump domain checks to see if the user has requested any action for that message (using the CEMT SET SYDUMPCODE, as described in the *CICS/ESA CICS-Supplied Transactions* manual or the EXEC CICS SET SYSDUMPCODE commands, as described for programming purposes in the *CICS/ESA System Programming Reference* manual). (In this case, no dump has been requested, as indicated by DUMPCODE_NOT_FOUND.) However, when you are using abbreviated trace, entries such as INQUIRE_SYSTEM_DUMPCODE DB8116 (in which the system dump code is the message number without the characters "DFH") are useful in indicating which messages have been issued. (Complete message numbers are included in full trace.)
14. Message DFHDB8116 is sent to transient data destination CDBC.
15. Message DFHDB8210 is issued confirming that connection to DBCTL is proceeding.
16. Message DFHDB8292 is issued indicating that CICS is in phase 2 of connecting to DBCTL.
17. At this point, DBCTL exits are loaded, which causes I/O activity. The task is suspended, and the control transaction, CDBO, starts. This is indicated by the task number changing (from 00031 to 00032). Control transaction enters a series of waits. CDBO invokes the CICS-DBCTL interface control program (DFHDBCT).
18. DBCTL notifies CICS that CICS-DBCTL connection is complete.
19. Message DFHDB8101 is issued.
20. A record is written to the global catalog, indicating which DBCTL should be reconnected to if there is a CICS failure. (See "Program list table (PLT)" on page 35 and "Connecting DBCTL to CICS automatically" on page 54.)
21. DFHDBUEX, the CICS-supplied user replaceable program for use with DBCTL, is linked. Trace entries following invocation of DFHDBUEX depend on what you have coded in your own version. (See "DFHDBUEX" on page 51.)
22. In this example, the user has coded DFHDBUEX to issue a trace entry stating that DBCTL has just been connected.
23. CICS issues an EXEC CICS RESYNC command to resynchronize any outstanding DBCTL in-doubt LUWs. (See Chapter 6, "Recovery and restart operations" on page 77.)
24. Control transaction waits have ended — task number changes back again (from 00032 to 00031). Message DFHDB8293 is issued confirming that DBCTL is connected and ready.

Disconnection from DBCTL

Figure 45 shows some examples of CICS trace entries produced at disconnection from DBCTL.

```
                                                .
                                                .
1    1CICS/ESA - AUXILIARY TRACE FROM 09/16/93 - APPLID IYAHZCAA - TIME OF FIRST ENTRY ON THIS PAGE 10:05:17.2844895708
2                                               .
                                                .
      00034 1 AP 00E1 EIP   ENTRY START                                          0004,0560D6D8 .-OQ,08001008 ....
3     00034 1 XM 0401 XMLD  ENTRY LOCATE_AND_LOCK_TRANDEF CDBT
      00034 1 DD 0301 DDLO  ENTRY LOCATE               05200040,0560DA98,TXD,CDBT
      00034 1 DD 0302 DDLO  EXIT  LOCATE/OK            05278A08 , D7000000
                                                .
                                                .

4     00034 1 ME 0501 MEIN  ENTRY INQUIRE_MESSAGE_DATA  85197680,DFHMET1E,2013,0560E1C0 , 00000000 , 0000001C,0560E15A , 00000000
                                                .
                                                .
      00034 1 DU 0500 DUDT  ENTRY INQUIRE_SYSTEM_DUMPCODE DB8211
                                                .
                                                .
      00034 1 ME 0502 MEIN  EXIT  INQUIRE_MESSAGE_DATA/OK 05197934,051A14A6,051A14BA,051A14E6,I,,100517,16091993,M,CIAA,IYAHZCAA
                                                .
                                                .
5     00034 1 DU 0500 DUDT  ENTRY INQUIRE_SYSTEM_DUMPCODE DB8294
                                                .
                                                .
6     00035 1 PG 0901 PGPG  ENTRY INITIAL_LINK          DFHDBDSC
                                                .
                                                .
7     00035 1 AP 00E1 EIP   ENTRY ADDRESS                                        0004,000643F0 ...0,08000202 ....
                                                .
                                                .
8     00035 1 PG 0A01 PGLU  ENTRY LINK_URM              DFHDBUEX,000644A4 , 0000000B,NO
      00035 1 DD 0301 DDLO  ENTRY LOCATE                05200FB0,0006483C,PPT,DFHDBUEX
                                                .
                                                .
      00035 1 DD 0302 DDLO  EXIT  LOCATE/OK             D7D7E3C5 , 0527BD68
      00035 1 LD 0001 LDLD  ENTRY ACQUIRE_PROGRAM       0564A870 , 00000001
      00035 1 LD 0002 LDLD  EXIT  ACQUIRE_PROGRAM/OK    8534D308,0534D2E0,110,0,REUSABLE,ERDSA,OLD_COPY
9     00035 1 AP 1940 APLI  ENTRY START_PROGRAM         DFHDBUEX,NOCEDF,FULLAPI,URM,NO,0528FA80,000644A4 , 0000000B,2
      00035 1 AP 1941 APLI  EXIT  START_PROGRAM/OK      ,DFHDBUEX
                                                .
                                                .
      00035 1 AP 0064 USER  EVENT APPLICATION-PROGRAM-ENTRY DISCONN DBCTL HAS JUST BEEN DISCONNECTED
                                                .
                                                .
10    00035 1 LD 0001 LDLD  ENTRY RELEASE_PROGRAM       0564A870 , 00000001,8534D308
      00035 1 LD 0002 LDLD  EXIT  RELEASE_PROGRAM/OK    0534D2E0,110,ERDSA
      00035 1 PG 0A02 PGLU  EXIT  LINK_URM/OK
                                                .
                                                .
      00035 1 AP 00E7 ERM   ENTRY APPLICATION           DBCTL                    0104,A818542B y...,C4AAEE24 D...,DBCTL
                                                .
                                                .
      00035 1 AP 00E7 ERM   EVENT PASSING-CONTROL-TO-RM DBCTL                    4004,A818542B y...,C4AAEE24 D...,DBCTL
11    00035 1 AP 0315 DBAT  EVENT ABOUT-TO-INVOKE-DRA   FOR INTERFACE REQUEST , 0400
12    00035 1 AP 0304 DBSPX EVENT ABOUT-TO-ISSUE-WAIT   FOR DISCONNECTION REQUEST
      00035 1 DS 0004 DSSR  ENTRY WAIT_MVS              DLSUSPND,DBCTL,000644CC,NO,OTHER_PRODUCT
      00035 1 DS 0005 DSSR  EXIT  WAIT_MVS/OK
      00035 1 AP 0305 DBSPX EVENT POSTED                FOR DISCONNECTION REQUEST
13    00035 1 AP 0316 DBAT  EVENT RECEIVES-CONTROL-FROM-DRA FOR INTERFACE REQUEST , 00000000
14    00035 1 ST 0003 STST  ENTRY RECORD_STATISTICS     05607790 , 00000054,USS
                                                .
                                                .
      00035 1 ST 0004 STST  EXIT  RECORD_STATISTICS/OK
      00035 1 AP 00E7 ERM   EVENT REGAINING-CONTROL-FROM-RM DBCTL                4104,A818542B y...,C4AAEE24 D...,DBCTL
      00035 1 PG 0700 PGHM  ENTRY FREE_HANDLE_TABLES
      00035 1 PG 0701 PGHM  EXIT  FREE_HANDLE_TABLES/OK
      00035 1 AP 00E7 ERM   EXIT  APPLICATION           DBCTL                    1104,A818542B y...,C4AAEE24 D...,DBCTL
15    00035 1 GC 2010 CCCC  ENTRY WRITE                 0006449C , 00000008,DBCTL,STATUS
16                                              .
                                                .
17    00032 1 AP 0306 DBCT  *EXC* EVENT                 POSTED FOR DFHDBCT SHOULD TERMINATE
      00032 1 AP 00E1 EIP   ENTRY START                                          0004,000182CC ..b.,08001008 ....
```

Figure 45 (Part 1 of 2). CICS trace entries produced during disconnection from DBCTL

```
      00032 1 XM 0401 XMLD  ENTRY LOCATE_AND_LOCK_TRANDEF CDBD
      00032 1 DD 0301 DDLO  ENTRY LOCATE               05200040,050D72F0,TXD,CDBD
      00032 1 DD 0302 DDLO  EXIT  LOCATE/OK            052787B0 , D7000000
                                                     .
                                                     .
      00032 1 AP 00F3 ICP   ENTRY INITIATE             CDBD                          4003,0000000C ....,00000000 ....,CDBD
      00032 1 XM 0201 XMXD  ENTRY INQUIRE_TRANDEF      CDBD
      00032 1 DD 0301 DDLO  ENTRY LOCATE               05200040,050D775C,TXD,CDBD
      00032 1 DD 0302 DDLO  EXIT  LOCATE/OK            052787B0 , D7000000
      00032 1 XM 0202 XMXD  EXIT  INQUIRE_TRANDEF/OK   CDBD,DFHCICST,NO,NO,....
                                                     .
                                                     .
      00036 2 LD 1003 LDLD1 EVENT PRE-SVC-CALL         LOAD,DFHDBDI,0554DBD0
      00036 2 LD 1004 LDLD1 EVENT POST-SVC             LOAD,OK,DFHDBDI,0554DBD0
      00036 1 AP 00E1 EIP   ENTRY DISABLE                                            0004,0560A2D8 .-sQ,08002204 ....
      00036 1 PG 0500 PGIS  ENTRY INQUIRE_PROGRAM      DFHDBAT
                                                     .
                                                     .
      00036 1 AP 00E1 EIP   EXIT  DISABLE              OK                            00F4,00000000 ....,00002204 ....
                                                     .
                                                     .
18    00036 1 LD 0001 LDLD  ENTRY RELEASE_PROGRAM      DFHDBSPX,854B5D60
      00036 1 LD 0002 LDLD  EXIT  RELEASE_PROGRAM/OK
                                                     .
                                                     .
19    00036 1 ME 0501 MEIN  ENTRY INQUIRE_MESSAGE_DATA 85197680,DFHMET1E,1FA6,0560ADC0 , 00000000 , 0000001C,0560AD5A , 00000000
                                                     .
                                                     .
      00036 1 DU 0500 DUDT  ENTRY INQUIRE_SYSTEM_DUMPCODE DB8102
```

Figure 45 (Part 2 of 2). CICS trace entries produced during disconnection from DBCTL

Notes:

1. Timestamp, as mentioned in “Connection to DBCTL” on page 157.
2. Phase 1 of disconnection begins at this stage.
3. The CICS-DBCTL interface disconnection transaction, CDBT, is attached.
4. Message DFHDB8211 is issued to confirm that orderly disconnection is proceeding. This message is issued in response to the user pressing PF5 on the CDBC screen. (For an immediate disconnection, message DFHDB8212 is issued.)
5. Message DFHDB8294 is issued confirming that orderly disconnection is in progress. (If immediate disconnection had been requested, message DFHDB8295 would have been issued.)
6. CDBT invokes CICS-DBCTL interface disconnection program, DFHDBDSC. A wait is entered (task number changes, from 00034 to 00035).
7. The EXEC interface program, DFHEIP, links to the CICS-DBCTL user-replaceable program, DFHDBUEX.
8. DFHDBUEX is loaded.
9. Trace entries at this point depend on what, if anything, you have coded in your own version of DFHDBUEX. (See “DFHDBUEX” on page 51.) In this example, DFHDBUEX has been coded to issue a trace entry stating that DBCTL has just been disconnected.
10. DFHDBUEX is released and control is passed back to DFHDBDSC.
11. The DRA is invoked for an interface request. (PAPL request type 0400 indicates the request is a DISCONNECT. See “PAPL request and return codes” on page 173.)

    If there is DL/I activity at the time of the disconnect, and the disconnect is orderly (not immediate) DFHDBAT links to DFHDBSPX (the CICS-DBCTL suspend exit) to wait for all DL/I activity to complete. In this example, there was no DL/I activity at the time the disconnect was issued.
12. The DRA links to DFHDBSPX to cause the CICS task to wait while the DRA processes the disconnect request.
13. DBCTL return code (00000000). (See “Return codes in DBCTL” on page 172.)

14. Statistics for this session are recorded. (See “DBCTL statistics” on page 178.)
15. DFHDBDSC writes a record to the CICS global catalog, to indicate that CICS is no longer connected to DBCTL.
16. Phase 2 of disconnection begins.
17. DFHDBDI’s associated transaction, CDBD, runs and disables DFHDBAT to make it unavailable. (The transaction number changes from 00035 to 00032.)
18. Programs loaded at startup are disabled. This example shows DFHDBSPX. A complete trace should also include similar entries for other programs loaded at startup, as listed in “Connection to DBCTL” on page 157.
19. Message DFHDB8102 is issued confirming that disconnection from DBCTL is complete.

PSB schedule

Figure 46 shows an example of some CICS trace entries produced at PSB schedule time.

```
                                                .
                                                .
1    1CICS/ESA - AUXILIARY TRACE FROM 09/20/93 - APPLID IYAHZCAA - TIME OF FIRST ENTRY ON THIS PAGE 11:23:22.9626168215
                                                .
                                                .
      00035 1 AP 00E1 EIP   ENTRY CALLDLI                                        0004,00181D20 ....,00004000 .. .
2,3   00035 1 AP 0328 DLI   ENTRY FUNCTION_CODE(PCB )   00180F34,MPP03
                                                .
                                                .
      00035 1 AP 0330 DLIDP ENTRY DBCTL
                                                .
                                                .
      00035 1 AP 00E7 ERM   ENTRY APPLICATION          DBCTL                      0104,A81D6D16 y._.,0B8B5C25 ..*.,DBCTL
                                                .
                                                .
      00035 1 AP 00E7 ERM   EVENT PASSING-CONTROL-TO-RM DBCTL                     4004,A81D6D16 y._.,0B8B5C25 ..*.,DBCTL
4,5   00035 1 AP 0311 DBAT  EVENT ABOUT-TO-INVOKE-DRA   FOR THREAD REQUEST , C9E8C1C8E9C3C1C1A81D6D160B8B5C25,0301
6     00035 1 AP 0304 DBSPX EVENT ABOUT-TO-ISSUE-WAIT   FOR THREAD REQUEST
      00035 1 DS 0004 DSSR  ENTRY WAIT_MVS             DLSUSPND,DBCTL,0561101C,NO,OTHER_PRODUCT
      00035 1 DS 0005 DSSR  EXIT  WAIT_MVS/OK
      00035 1 AP 0305 DBSPX EVENT POSTED               FOR THREAD REQUEST
4,7   00035 1 AP 0312 DBAT  EVENT RECEIVES-CONTROL-FROM-DRA FOR THREAD REQUEST , C9E8C1C8E9C3C1C1A81D6D160B8B5C25,00000000
      00035 1 AP 00E7 ERM   EVENT REGAINING-CONTROL-FROM-RM DBCTL                 4104,A81D6D16 y._.,0B8B5C25 ..*.,DBCTL
                                                .
                                                .
      00035 1 AP 00E7 ERM   EXIT  APPLICATION          DBCTL                      1104,A81D6D16 y._.,0B8B5C25 ..*.,DBCTL
                                                .
                                                .
      00035 1 AP 0331 DLIDP EXIT  DBCTL
      00035 1 AP 0329 DLI   EXIT  IMS_PCB_FORMAT       0000,PCB
8     00035 1 AP 00E1 EIP   EXIT  CALLDLI              OK                         00F4,00000000 ....,00004000 .. .
```

Figure 46. CICS trace entries produced for successful PSB schedule

Notes:

1. Timestamp, as mentioned in “Connection to DBCTL” on page 157.
2. DL/I command or call type — PCB indicates a schedule request using the DL/I call interface.
3. PSB name (MPP03).
4. Recovery token (C9E8C1C8E9C3C1C1A81D6D160B8B5C25).
5. The DRA is invoked for a thread request — 0301 is a PSB schedule request. (See “PAPL request and return codes” on page 173.)
6. DFHDBAT must wait, because the request has entered IMS code.
7. The DFHDBAT wait ends and DBCTL return code (00000000) is issued. The DBCTL return code is 00000000 because the PSB was successfully scheduled. See Figure 47 on page 164 for an example of the DBCTL return code in the case of a PSB scheduling failure. See “Return codes in DBCTL” on page 172 for an explanation of DBCTL return codes.
8. 00 in the UIBFCTR, and 00 in the UIBDLTR (underscored in this example) indicate that the PSB was scheduled successfully. See “PSB scheduling failure” on page 164 for an example of the contents of these fields, PSB scheduling fails. See “Summary of abends and return codes” on page 119 for information on the UIBFCTR and UIBDLTR.

PSB scheduling failure

Figure 47 shows an example of the trace entries produced if PSB scheduling fails.

```
                                                .
                                                .
1    1CICS/ESA - AUXILIARY TRACE FROM 09/20/93 - APPLID IYAHZCAA - TIME OF FIRST ENTRY ON THIS PAGE 11:25:04.6182399462
                                                .
                                                .
      00036 1 AP 00E1 EIP   ENTRY CALLDLI                                        0004,00181D20 ....,00004000 .. .
2,3   00036 1 AP 0328 DLI   ENTRY FUNCTION_CODE(PCB )   00180F34,MPP03
                                                .
                                                .
      00036 1 AP 0330 DLIDP ENTRY DBCTL
                                                .
                                                .
      00036 1 AP 00E7 ERM   ENTRY APPLICATION           DBCTL                     0104,A81D6D77 y._.,078EDB20 ....,DBCTL
                                                .
                                                .
      00036 1 AP 00E7 ERM   EVENT PASSING-CONTROL-TO-RM DBCTL                     4004,A81D6D77 y._.,078EDB20 ....,DBCTL
4,5   00036 1 AP 0311 DBAT  EVENT ABOUT-TO-INVOKE-DRA   FOR THREAD REQUEST , C9E8C1C8E9C3C1C1A81D6D77078EDB20,0301
6     00036 1 AP 0304 DBSPX EVENT ABOUT-TO-ISSUE-WAIT   FOR THREAD REQUEST
      00036 1 DS 0004 DSSR  ENTRY WAIT_MVS              DLSUSPND,DBCTL,0561101C,NO,OTHER_PRODUCT
      00036 1 DS 0005 DSSR  EXIT  WAIT_MVS/OK
      00036 1 AP 0305 DBSPX EVENT POSTED                FOR THREAD REQUEST
      00036 1 AP 0312 DBAT  EVENT RECEIVES-CONTROL-FROM-DRA FOR THREAD REQUEST , C9E8C1C8E9C3C1C1A81D6D77078EDB20,880001C8
      00036 1 AP 00E7 ERM   EVENT REGAINING-CONTROL-FROM-RM DBCTL                  4104,A81D6D77 y._.,078EDB20 ....,DBCTL
      00036 1 PG 0700 PGHM  ENTRY FREE_HANDLE_TABLES
      00036 1 PG 0701 PGHM  EXIT  FREE_HANDLE_TABLES/OK
      00036 1 AP 00E7 ERM   EXIT  APPLICATION           DBCTL                     1104,A81D6D77 y._.,078EDB20 ....,DBCTL
      00036 1 ME 0301 MEME  ENTRY SEND_MESSAGE          1FAD,000558B0 , 00000004,00115450 , 00000005,000558F0 , 00000008,00115320
      00036 1 ME 0501 MEIN  ENTRY INQUIRE_MESSAGE_DATA  85197680,DFHMET1E,1FAD,0560AA18 , 00000000 , 0000001C,0560A9B2 , 00000000
                                                .
                                                .
7     00036 1 DU 0500 DUDT  ENTRY INQUIRE_SYSTEM_DUMPCODE DB8109
                                                .
                                                .
      00036 1 AP 0331 DLIDP EXIT  DBCTL
8     00036 1 AP 0329 DLI   EXIT  IMS_PCB_FORMAT        0805,PCB
      00036 1 AP 00E1 EIP   EXIT  CALLDLI               OK                        00F4,00000000 ....,00004000 .. .
```

Figure 47. CICS trace entries produced for failed PSB schedule

Notes:

1. Timestamp, as explained in “Connection to DBCTL” on page 157.
2. DL/I command or call — PCB indicates a schedule request using the DL/I call interface.
3. PSB name (MPP03).
4. Recovery token (C9E8C1C8E9C3C1C1A81D6D77078EDB20).
5. The DRA is invoked for a thread request — 0301 is a PSB schedule request. (See “PAPL request and return codes” on page 173.)
6. The reason for the PSB scheduling failure is in the DBCTL return code (880001AC). In this case, it is X'1AC', indicating an IMS user abend U0428 (decimal), which was issued because the PSB was not defined to DBCTL.
7. Message DFHDB8109 is issued. It contains the IMS user abend, the recovery token, and the DBCTL ID. (For an example and explanation of how messages are displayed in abbreviated trace, see “Connection to DBCTL” on page 157.)
8. 0805 (underscored in this example) indicates that a PSB scheduling failure has occurred. 08 is in the UIBFCTR, and 05 in the UIBDLTR. (See “Summary of abends and return codes” on page 119 for information on the UIBFCTR and UIBDLTR.)

CICS task issuing DL/I requests to be processed by DBCTL

Figure 48 shows an example of CICS trace entries produced when a DL/I request is issued. For an example of trace entries produced by DBCTL for processing of a DL/I request, see “Trace entries produced by DBCTL” on page 167.

```
1    1CICS/ESA - AUXILIARY TRACE FROM 09/20/93 - APPLID IYAHZCAA - TIME OF FIRST ENTRY ON THIS PAGE 11:23:23.4780451328
      00035 1 AP 00E1 EIP   ENTRY CALLDLI                                              0004,00181D20 ....,00004000 .. .
2,3   00035 1 AP 0328 DLI   ENTRY FUNCTION_CODE(GU  )   8000D518,DI21PART
      00035 1 AP 0330 DLIDP ENTRY DBCTL
      00035 1 AP 00E7 ERM   ENTRY APPLICATION           DBCTL                          0104,A81D6D16 y._.,0B8B5C25 ..*.,DBCTL
      00035 1 AP 00E7 ERM   EVENT PASSING-CONTROL-TO-RM DBCTL                          4004,A81D6D16 y._.,0B8B5C25 ..*.,DBCTL
4,5   00035 1 AP 0311 DBAT  EVENT ABOUT-TO-INVOKE-DRA   FOR THREAD REQUEST , C9E8C1C8E9C3C1C1A81D6D160B8B5C25,0303
      00035 1 AP 0304 DBSPX EVENT ABOUT-TO-ISSUE-WAIT   FOR THREAD REQUEST
      00035 1 DS 0004 DSSR  ENTRY WAIT_MVS              DLSUSPND,DBCTL,0561101C,NO,OTHER_PRODUCT
      00035 1 DS 0005 DSSR  EXIT  WAIT_MVS/OK
      00035 1 AP 0305 DBSPX EVENT POSTED                FOR THREAD REQUEST
4,6   00035 1 AP 0312 DBAT  EVENT RECEIVES-CONTROL-FROM-DRA FOR THREAD REQUEST , C9E8C1C8E9C3C1C1A81D6D160B8B5C25,00000000
      00035 1 AP 00E7 ERM   EVENT REGAINING-CONTROL-FROM-RM DBCTL                      4104,A81D6D16 y._.,0B8B5C25 ..*.,DBCTL
      00035 1 PG 0700 PGHM  ENTRY FREE_HANDLE_TABLES
      00035 1 PG 0701 PGHM  EXIT  FREE_HANDLE_TABLES/OK
      00035 1 AP 00E7 ERM   EXIT  APPLICATION           DBCTL                          1104,A81D6D16 y._.,0B8B5C25 ..*.,DBCTL
      00035 1 AP 0331 DLIDP EXIT  DBCTL

6     00035 1 AP 0329 DLI   EXIT  IMS_PCB_FORMAT       0000,,GU
      00035 1 AP 00E1 EIP   EXIT  CALLDLI              OK                             00F4,00000000 ....,00004000 .. .
```

Figure 48. CICS trace entries produced for a DL/I request

Notes:

1. Timestamp, as mentioned in “Connection to DBCTL” on page 157.
2. DL/I command or call — GU indicates a GET UNIQUE request. (See “Comparing EXEC DLI commands and DL/I calls” on page 114 and “DL/I requests supported” on page 115.)
3. DBD name (DI21PART).
4. Recovery token (C9E8C1C8E9C3C1C1A81D6D160B8B5C25).
5. The DRA is invoked for a thread request — 0303 is a DL/I request. (See “PAPL request and return codes” on page 173.)
6. DBCTL return code (00000000). (See “Return codes in DBCTL” on page 172.)
7. Status code in the DIBSTAT (underscored in this example) is 0000, indicating that the request was successful. See “Summary of abends and return codes” on page 119 for the contents of DIBSTAT in the case of an unsuccessful request.

Thread termination

Figure 49 shows example trace entries produced during PREPARE, COMMIT, and TERMINATE request processing. See “Two-phase commit” on page 83 for a description of PREPARE and COMMIT request processing.

```
                                                .
                                                .
1    1CICS/ESA - AUXILIARY TRACE FROM 09/20/93 - APPLID IYAHZCAA - TIME OF FIRST ENTRY ON THIS PAGE 11:23:23.5035898828
2     00035 1 AP 00E7 ERM   ENTRY SYNCPOINT-MANAGER     DBCTL                          0204,A81D6D16 y._.,0B8B5C25 ..*.,DBCTL
      00035 1 AP 00E7 ERM   EVENT PASSING-CONTROL-TO-RM DBCTL                          4004,A81D6D16 y._.,0B8B5C25 ..*.,DBCTL
3,4   00035 1 AP 0311 DBAT  EVENT ABOUT-TO-INVOKE-DRA   FOR THREAD REQUEST , C9E8C1C8E9C3C1C1A81D6D160B8B5C25,0304
      00035 1 AP 0304 DBSPX EVENT ABOUT-TO-ISSUE-WAIT   FOR THREAD REQUEST
      00035 1 DS 0004 DSSR  ENTRY WAIT_MVS              DLSUSPND,DBCTL,0561101C,NO,OTHER_PRODUCT
      00035 1 DS 0005 DSSR  EXIT  WAIT_MVS/OK
      00035 1 AP 0305 DBSPX EVENT POSTED                FOR THREAD REQUEST
3,5   00035 1 AP 0312 DBAT  EVENT RECEIVES-CONTROL-FROM-DRA FOR THREAD REQUEST , C9E8C1C8E9C3C1C1A81D6D160B8B5C25,00000000

      00035 1 AP 00E7 ERM   EVENT REGAINING-CONTROL-FROM-RM DBCTL                      4104,A81D6D16 y._.,0B8B5C25 ..*.,DBCTL
                                                .
                                                .
      00035 1 AP 00E7 ERM   EXIT  SYNCPOINT-MANAGER                                   1204,A81D6D16 y._.,0B8B5C25 ..*.,DBCTL
                                                .
                                                .
      00035 1 AP 00E7 ERM   ENTRY SYNCPOINT-MANAGER     DBCTL                          0204,A81D6D16 y._.,0B8B5C25 ..*.,DBCTL
      00035 1 AP 00E7 ERM   EVENT PASSING-CONTROL-TO-RM DBCTL                          4004,A81D6D16 y._.,0B8B5C25 ..*.,DBCTL
3,6   00035 1 AP 0311 DBAT  EVENT ABOUT-TO-INVOKE-DRA   FOR THREAD REQUEST , C9E8C1C8E9C3C1C1A81D6D160B8B5C25,0307
      00035 1 AP 0304 DBSPX EVENT ABOUT-TO-ISSUE-WAIT   FOR THREAD REQUEST
      00035 1 DS 0004 DSSR  ENTRY WAIT_MVS              DLSUSPND,DBCTL,0561101C,NO,OTHER_PRODUCT
      00035 1 DS 0005 DSSR  EXIT  WAIT_MVS/OK
      00035 1 AP 0305 DBSPX EVENT POSTED                FOR THREAD REQUEST
3,5   00035 1 AP 0312 DBAT  EVENT RECEIVES-CONTROL-FROM-DRA FOR THREAD REQUEST , C9E8C1C8E9C3C1C1A81D6D160B8B5C25,00000000
      00035 1 MN 0201 MNMN  ENTRY MONITOR               1,DBCTL,5611034,100
      00035 1 MN 0202 MNMN  EXIT  MONITOR/OK
3,7   00035 1 AP 0311 DBAT  EVENT ABOUT-TO-INVOKE-DRA   FOR THREAD REQUEST , C9E8C1C8E9C3C1C1A81D6D160B8B5C25,030F
      00035 1 AP 0304 DBSPX EVENT ABOUT-TO-ISSUE-WAIT   FOR THREAD REQUEST
      00035 1 DS 0004 DSSR  ENTRY WAIT_MVS              DLSUSPND,DBCTL,0561101C,NO,OTHER_PRODUCT
      00035 1 DS 0005 DSSR  EXIT  WAIT_MVS/OK
      00035 1 AP 0305 DBSPX EVENT POSTED                FOR THREAD REQUEST
3,5   00035 1 AP 0312 DBAT  EVENT RECEIVES-CONTROL-FROM-DRA FOR THREAD REQUEST , C9E8C1C8E9C3C1C1A81D6D160B8B5C25,00000000
      00035 1 AP 00E7 ERM   EVENT REGAINING-CONTROL-FROM-RM DBCTL                      4104,A81D6D16 y._.,0B8B5C25 ..*.,DBCTL
                                                .
                                                .
8     00035 1 AP 00E7 ERM   EXIT  SYNCPOINT-MANAGER     DBCTL                          1204,A81D6D16 y._.,0B8B5C25 ..*.,DBCTL
```

Figure 49. CICS trace entries produced during thread termination after DL/I request

Notes:

1. Timestamp, as mentioned in “Connection to DBCTL” on page 157.
2. Enters syncpoint manager.
3. Recovery token (C3C9C3E2E6D2C1F1A38283C1E1CB4100). (C9E8C1C8E9C3C1C1A81D6D160B8B5C25).
4. The DRA is invoked for a thread request — 0304 is a PREPARE request. See “PAPL request and return codes” on page 173.
5. DBCTL return code (00000000), one for each of the requests PREPARE, COMMIT, and TERMINATE THREAD.
6. The DRA is invoked for a thread request — 0307 is a COMMIT request. See “PAPL request and return codes” on page 173.
7. The DRA is invoked for a thread request — 030F is a TERMINATE THREAD request. See “PAPL request and return codes” on page 173.
8. Leaves syncpoint manager. (See “Return codes in DBCTL” on page 172.)

Trace entries produced by DBCTL

In DBCTL, tracing is started by specifying an option in member DFSVSMxx in the IMS.PROCLIB (where xx is the suffix specified by VSPEC= in the DBCTL startup JCL). See the *IMS/ESA System Definition Reference* manual for guidance on the DFSVSMxx member. Alternatively, you can start tracing dynamically with the /TRACE command. (See the *IMS/ESA Operator's Reference* manual for guidance on the /TRACE command and its keywords.)

If you use local DL/I without the IRLM, you may already be familiar with using program isolation (PI) tracing. If you are not using the IRLM, DBCTL also uses PI locking, and so you may want to use PI trace with DBCTL.

In a local DL/I-only environment, you control the PI trace using the CEMT transaction, and the DL/I and LOCK traces are specified in the DFSVSAMP DD statement and can only be set for the entire CICS session.

In DBCTL, you can start PI tracing in the DFSVSMxx member of the IMS.PROCLIB, as explained above. Alternatively, you can start PI tracing in DBCTL by issuing the command:

```
/TRACE SET ON PI
```

DBCTL produces an external trace when DL/I requests are issued to be processed by DBCTL. This trace corresponds to the CICS trace for a DL/I request being processed by DBCTL, as shown in Figure 48 on page 165. (DBCTL does not produce any external traces that correspond with the other CICS trace examples given.)

Figure 50 shows an example of the trace records produced when you use the DL/I trace table. To start the DL/I trace table, DLI=ON must have been specified in the DFSVSMxx member of IMS.PROCLIB. Specifying DLI=ON also enables program isolation and lock trace. For guidance on specifying DLI=ON, see the *IMS/ESA System Definition Reference* manual. Alternatively, you can start DL/I tracing dynamically using the /TRACE command, as follows:

```
/TRACE SET ON TABLE DL/I
```

For a more detailed example, see the *IMS/ESA Operator's Reference* manual, example 8.

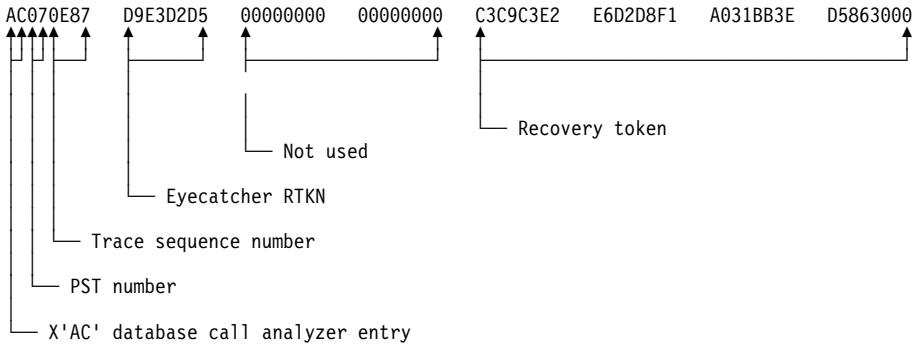


Figure 50. X'AC' trace entry

The DBCTL trace entry shown in Figure 50 on page 167 includes:

- X'AC' — the database call analyzer entry, which is only present for DBCTL.
- The partition specification table (PST) number. The PST number is equivalent to a particular DL/I thread number, as displayed using the /DISPLAY command, and can be used to find all DBCTL trace records for a particular thread. (For an example of a thread number being displayed, see "Purging a transaction that is using DBCTL" on page 73.)
- The trace sequence number.
- An "eyecatcher" recovery token. This is the actual characters "RTKN," used to draw attention to the recovery token in the same line, and is the same in every X'AC' entry.
- The recovery token that is passed from CICS via DFHDBAT.

You can print and format the above data using the IMS/ESA file select and formatting print utility, DFSERA10. You would typically print and format several log types, plus the X'AC' records to enable you to correlate the DBCTL activity with your CICS trace for a DL/I request.

Printing and formatting IMS X'67FA' log records

Figure 51 shows an example of JCL and DD statements that you can use to print and format IMS X'67FA' log records. For further examples, see the *IMS/ESA Utilities Reference: Database* manual.

```
//LOGPRINT JOB 1,PGMERID,MSGCLASS=A,MSGLEVEL=(1,1),
//         CLASS=A
//ERA10     EXEC PGM=DFSERA10,REGION=4096K
//STEPLIB   DD DISP=SHR,DSN=IMS.RESLIB
//SYSPRINT  DD SYSOUT=*,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1330)
//LOGIN     DD DISP=SHR,DSN=IMS.SLDS.OLDS00
//SYSIN     DD *
CONTROL  CNTL  DDNAME=LOGIN
OPTION   PRINT OFFSET=5,FLDLEN=2,VALUE=67FA,COND=E,EXITR=DFSERA60
END
/*
//
```

Figure 51. Example JCL to print and format IMS '67FA' log records

The output should contain the following:

- The request type.
- The recovery token, plus an eyecatcher (GRTKN) to indicate presence of the recovery token, which includes the CICS APPLID.
- The database name.

See the *IMS/ESA Utilities Reference: Database* manual for examples of formatted DL/I trace tables.

Dumps

The headings that follow describe dumps produced by CICS, the DRA, and DBCTL.

CICS transaction dump

This dump is produced whenever a CICS task terminates abnormally. For a CICS-DBCTL task, that is, a task which has issued a DFHRMCAL request to DFHDBAT, this dump includes:

- The CICS-DBCTL global and task local areas
- DFHDBAT's global and task local areas.
- PCBs.

The recovery token for the task at the point of abnormal termination appears in the TCA (TCARTKN).

The EXEC CICS SET TRANDUMPCODE command and the CEMT SET TRANDUMPCODE transaction enable you to change some of the values recorded in entries in the transaction dump code table, to add new entries to the table, and to remove existing entries from the table. For example, you can specify an action for a particular CICS message, as mentioned in Figure 44 on page 157.

For information about transaction dump codes, and interpreting CICS dumps, see the *CICS/ESA Problem Determination Guide*.

CICS system dump

This dump is produced when a CEMT PERFORM DUMP|SNAP or an EXEC CICS DUMP SYSTEM command is issued, or when CICS abends. CICS specifies all options when issuing this type of dump, for example, CSA and NUC. All MVS control blocks appear in this type of dump, including those corresponding to any subordinate TCBs. You can format and analyze this type of dump using the interactive problem control system (IPCS). For guidance on using IPCS, see the *MVS/ESA Interactive Problem Control System User's Guide*.

The EXEC CICS SET SYSDUMPCODE command and the CEMT SET SYSDUMPCODE transaction enable you to change some of the values recorded in entries in the transaction dump code table, to add new entries to the table, and to remove existing entries from the table. For example, you can specify an action for a particular CICS message, as mentioned in Figure 44 on page 157.

For information about system dump codes, and interpreting CICS dumps, see the *CICS/ESA Problem Determination Guide*.

Determining whether a problem is occurring in CICS or DBCTL

To help you determine whether a problem is occurring in DBCTL or CICS, examine the CICS transaction or system dump. These dumps include indications of the point at which DFHDBAT passes control to DBCTL and the point at which DBCTL returns control to DFHDBAT. Correlating this with the time at which the problem occurred should tell you whether it was in CICS or DBCTL.

Each page of auxiliary trace output also includes a timestamp, as mentioned in "Connection to DBCTL" on page 157. These timestamps should also help you correlate events in CICS with events in DBCTL.

DRA snap data set

The DRA's snap data set is dynamically allocated to the CICS address space when DBCTL is connected. The SYSOUT class used is determined by a parameter in the DRA startup table. The DRA dumps its control blocks (those associated with its own work unit and that of DBCTL) to this data set whenever a high order bit is set in PAPLRETC. (The participant adapter parameter list (PAPL) is a part of the DRA. For guidance on the PAPL and its contents, see the *IMS/ESA Customization Guide: Database* manual.) The high order bit is set on if a thread is terminating. It then closes the snap file. The recovery token appears in the dump produced.

What is provided in a CICS dump

When a transaction abends or requests a dump, the following areas are written to the CICS dump data set(s):

- The TCA representing the task.
- The CSA and CSA optional feature list (CSAOPFL) table. The CSAOPFL points to DFHDLPDS, the CICS-DL/I interface parameter block.
- The internal trace table, if CICS trace was active.
- Any areas acquired.

Dumps produced by the DRA

DBCTL creates an SDUMP containing diagnostic information for a DL/I request failure from CICS using the system dump data sets from the CICS job.

The DRA produces an SDUMP in the following situations:

- If the DRA fails
- If a thread fails
- If DL/I set a high order bit in PAPLRETC for a thread request.

  However, the DRA does not always take a dump if DL/I sets the high order bit in PAPLRETC. If it does not, it sets the second high order bit on to indicate this. For example:
  - If PAPLRETC is 1000 0000 3 2 4 0 0 0, a dump was taken
  - If PAPLRETC is 1000 1000 3 2 4 0 0 0, a dump was not taken.

  (See "Return codes in DBCTL" on page 172, "Using return codes to find out what kind of dump has been produced" on page 173 and "PAPL request and return codes" on page 173 for information on interpreting these return codes.)

An SDUMP is created in a terminate address space request or a terminate thread request while running in DBCTL and under the DRA TCB.

An SDUMP contains:

- DBCTL address space
- DLISAS address space
- A storage list for the DRA area on the request
- Key 0 and key 7 CSA storage for the request processing
- MVS storage blocks — address space control block (ASCB), TCB, and RBS for the failing DRA TCB
- The local system queue area (LSQA).

If the SDUMP request fails, a SNAP dump (which contains a subset of the information in an SDUMP) is produced instead. (See “Return codes in DBCTL” on page 172.) The SNAP contains the following subset of the information produced in an SDUMP:

- MVS storage blocks — address space control block (ASCB), TCB, and RBS for the failing DRA TCB
- A storage list for the DRA area on the request.

Because the DRA runs in problem state, it cannot access other storage areas, such as CSA or DBCTL storage. This may mean that the SNAP does not contain enough information, and you may have to recreate the failure and use the DBCTL address space dump.

See the *IMS/ESA Diagnosis Guide and Reference* manual for a further comparison of the information produced in SDUMPs and SNAP dumps, which you may find useful in diagnosis. The *IMS/ESA Diagnosis Guide and Reference* manual also contains information on the IMS offline dump formatter (ODF) which you can use to show the layout of IMS blocks referred to in these dumps.

Dumps produced by DBCTL

The formatted dump feature of IMS is available with DBCTL. This feature formats the system, database, and data communication areas of IMS. It formats the control blocks and data areas in an IMS region.

See the *IMS/ESA Diagnosis Guide and Reference* manual for guidance information on the areas that are dumped.

Control blocks generated by DBCTL have an “eyecatcher” for visual identification. For example:

- **SCD — system contents directory area
- **SSA — SAP and save area
- **DSP — dispatcher area.

The recovery token is included in dumps produced by DBCTL. Output is to the IMS log.

Messages

DBCTL-related messages fall into the following categories:

- Messages issued by the CDBC transaction and displayed on your screen. These messages relate to the end user’s interaction with the transaction and they do not appear on CSMT. Any CDBC type messages issued from the initialization transaction, when it is running from the PLT during CICS startup, are issued as writes-to-operator (WTOs).
- Messages that appear on the status line of the CDBC and CDBI transaction screens.

CICS and IMS messages relating to CICS tasks that issue DL/I requests include the recovery token. See also “Dealing with messages from DBCTL and CICS” on page 75.

CICS messages relating to DBCTL begin with DFHDB81 or DFHDB82. CICS messages relating to DBCTL with XRF begin with DFHDX83. See the *CICS/ESA Messages and Codes* manual for help on interpreting, and responding to, DFHDBnnnn and DFHDXnnnn messages.

All DBCTL-related messages are routed to a separate destination called CDBC. If you prefer, you can direct them elsewhere (for example to CSMT), as specified in the CICS destination control table (DCT).

From CICS/ESA Version 3 onwards, you can suppress or reroute messages sent to transient data queues such as CDBC. You can reroute from CDBC to a list of consoles, from CDBC to a different transient data queue, or reroute console messages to CDBC. For programming information on coding the CICS-supplied user exit used to re-route messages and on the sample user exit provided to help you do so, see the *CICS/ESA Customization Guide*.

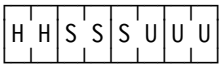
Messages produced with DBCTL dumps and traces are sent to the DBCTL master terminal operator. IMS messages begin with “DFS”. See the *IMS/ESA Messages and Codes* manual for guidance on interpreting, and responding to, IMS messages.

Return codes in DBCTL

When DBCTL responds to CICS with a return code, this can be an MVS system abend code, an IMS user abend code, or a DBCTL return code. The return code includes an indicator to help you determine what kind of abend it is. The DBCTL return code (also known as the PAPLRETC) displayed in the CICS trace can contain:

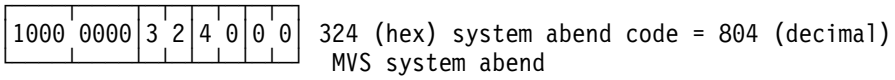
- An MVS system abend code
- A user abend code (also known as a pseudo abend code)
- A DBCTL return code (also known as a DBCTL DRA return code).

The return code is 4 bytes long and is in the following form:



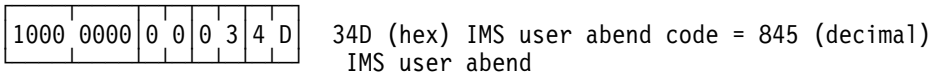
If the top bit (bit 0 of the HH byte) is set, then:

- SSS is a nonzero hexadecimal return code, for example:



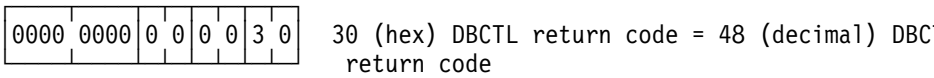
which indicates an MVS system abend code (as explained in the *MVS/ESA Message Library: System Codes* manual), or

- UUU is a nonzero hexadecimal, for example:



which indicates a user abend code (as explained, for guidance, in the section on user abend codes in the *IMS/ESA Messages and Codes* manual).

If the top bit (bit 0 of the HH byte) is ***not*** set, and the DBCTL return code in the CICS trace is nonzero, then UUU is a DBCTL nonzero return code, for example:



as explained, for guidance, in the DBCTL return codes section of the *IMS/ESA Messages and Codes* manual.

Using return codes to find out what kind of dump has been produced

The top byte of the return codes indicates whether a dump has been produced and, if so, whether it is an SDUMP or a SNAP dump.

- X'80' means that an SDUMP or SNAP dump will be produced. (A SNAP dump is produced if the SDUMP request fails.)
- X'84' means that a SNAP dump only is produced.
- X'88' and X'00' both mean that neither an SDUMP nor a SNAP dump is produced.

See the *IMS/ESA Messages and Codes* manual for guidance on interpreting IMS return codes and DBCTL return codes (also known as DRA return codes). Messages issued by CICS also distinguish the kind of return code you are receiving. See the *CICS/ESA Messages and Codes* manual for help on interpreting and responding to CICS messages.

PAPL request and return codes

The trace examples given contain a number of 4-digit hexadecimal request codes issued by the participant adapter parameter list (PAPL). These request codes are a concatenation of a 2-digit PAPL function code and a 2-digit PAPL subfunction code. For further guidance on the contents of the PAPL, see the *IMS/ESA Customization Guide: Database* manual.

Table 13 on page 174 summarizes the PAPL request codes that are sent from CICS to the DRA, and are displayed in CICS trace output as 4-digit request codes.

See “Trace entries produced by CICS” on page 155 for examples of traces containing these request codes.

Table 13. PAPL request codes

Event	Request code
Connection	0100
Disconnection	0400
Disconnection due to CICS failure	0404
PSB schedule	0301
DL/I request	0303
COMMIT request	0307
PREPARE request	0304
ABORT request	030D
Terminate thread	030F
COMMIT request during resynchronization	0201
ABORT request during resynchronization	0202
Lost because CICS was cold started before resynchronization	0203
DBCTL should not be in-doubt	0204

Table 14 summarizes the PAPL return codes that are sent from the DRA to CICS. CICS intercepts these return codes and displays them as explanatory text in trace output.

Table 14. PAPL return codes

Event	Return code
Connection complete	0500
Identify failure	0501
Connection request (DRA INIT) canceled in reply to DFS690 message	0502
DBCTL has terminated abnormally	0503
The DRA has terminated abnormally	0504
/CHECKPOINT FREEZE or /CHECKPOINT PURGE command was issued to terminate DBCTL normally	0505

Using CICS EDF to debug application programs in DBCTL

You can use the CICS execution (command-level) diagnostic facility (EDF), with local and remote application programs that access databases controlled by DBCTL. EDF supports the additional EXEC DLI commands and keywords that you can use with DBCTL, and the additions to the DL/I interface block (DIB) mentioned in "QUERY and REFRESH DBQUERY commands" on page 105.

However, a number of storage areas that reside in the CICS address space with local DL/I are outside the CICS address space with DBCTL. These areas include the PDIR, DDIR, the PSB pool, and the DMB pool. You cannot access these areas using the WORKING STORAGE option of the CEDF transaction that invokes EDF. Instead, you use the DBCTL operator command /DISPLAY (with the keywords PSB, DBD, or POOL) to display the corresponding DBCTL information.

For information on using EDF, see the *CICS/ESA Application Programming Guide*.

Chapter 11. Statistics, monitoring, and performance

Performance considerations in a CICS-DBCTL environment include:

- Statistics produced for a CICS-DBCTL system
- Lists of some tools available for monitoring and how they apply to a DBCTL environment
- Tuning considerations for CICS, DBCTL, and IMS to enhance the performance of your CICS-IMS interface using DBCTL.

Note: In CICS and IMS, the term **statistics** means data produced concerning timing and resources used by the system as a whole over a specified period of time. Additionally, in CICS, **monitoring** means data produced concerning timing and resources used by a task or a logical unit of work (UOW). IMS does not make this distinction — all data returned is referred to as statistics. Here, we use the terms statistics and monitoring in the CICS sense.

For programming information on monitoring in CICS, see the *CICS/ESA Customization Guide*. For information on statistics and on CICS performance and tuning, see the *CICS/ESA Performance Guide*. For information on IMS performance and tuning, see the *IMS/ESA System Administration Guide* or the *IMS/ESA Administration Guide: System*.

Data available for a CICS-DBCTL system

As with your CICS or IMS system, observing the performance of DBCTL involves collecting and interpreting data gathered by various CICS and IMS performance tools. The difference with DBCTL is that you need to keep an eye on events taking place in separate address spaces. Figure 52 on page 178 gives an overview of where DBCTL monitoring and statistics data is sent to and the tools you can use to produce output from this data. The data and tools mentioned are described in the sections that follow.

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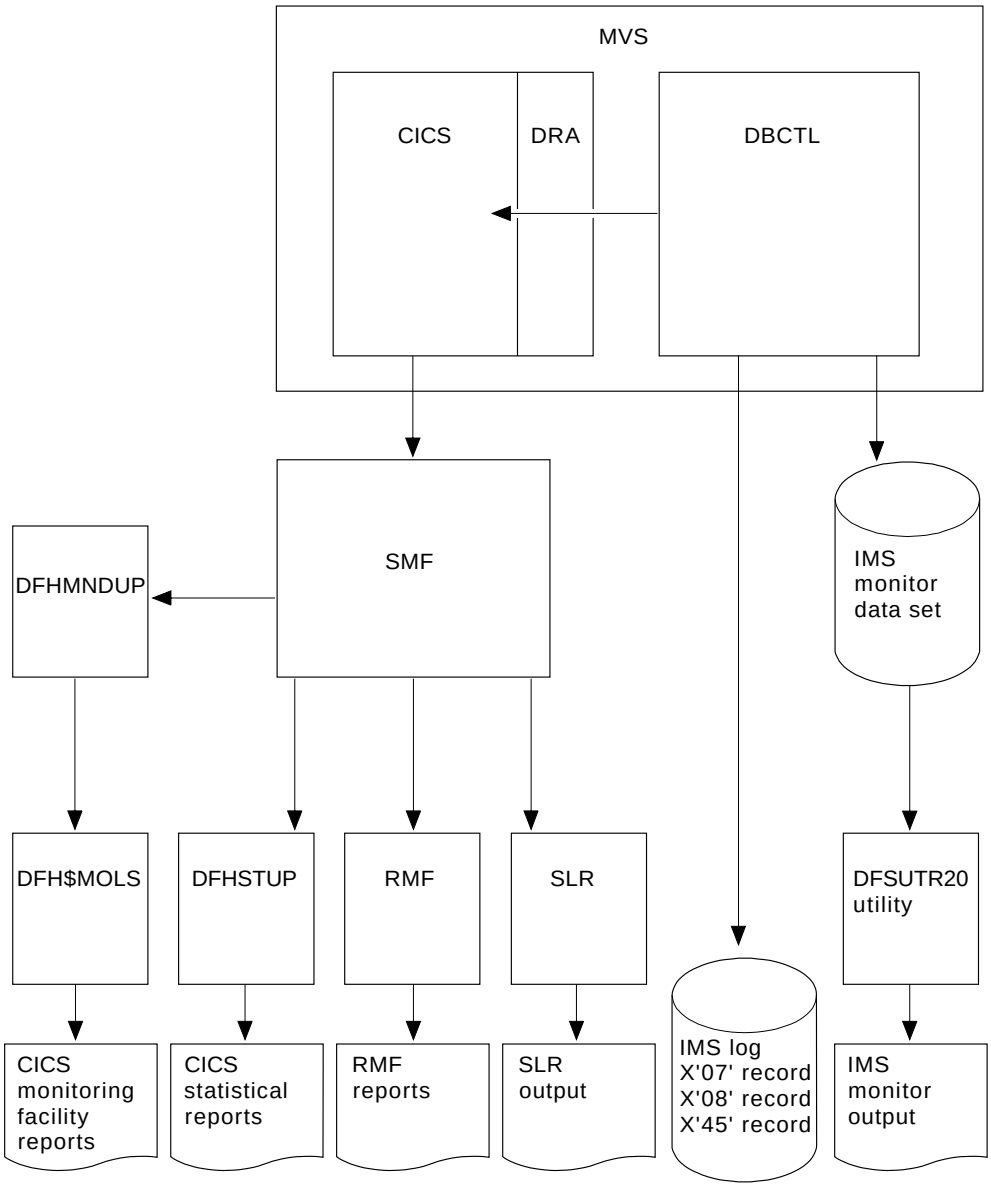

Figure 52. Overview of DBCTL statistics and monitoring data

DBCTL statistics

DBCTL supplies CICS with statistics information when CICS disconnects from DBCTL. These are known as **unsolicited** statistics, because they are not produced as part of normal internal processing, but are produced as a USS statistics record.

APAR PN65335

APAR PN65335 added, 7th November, 1996

The statistics are written to SMF regardless of the status of statistics recording.

CICS-DBCTL statistics are collected whenever DBCTL is disconnected as a result of:

- An orderly or immediate disconnection of DBCTL
- An orderly termination of CICS.

CICS-DBCTL statistics are ***not*** collected if there is an immediate shutdown or abend of CICS.

When statistics are to be collected, the following happens:

1. The DRA returns statistics for the CICS-DBCTL session that has just ended to DFHDBAT.
2. DFHDBAT invokes the CICS statistics exit for DBCTL statistics (DFHDBSTX).
3. DFHDBSTX invokes the CICS statistics domain.
4. The CICS statistics domain writes the statistics to the SMF data set.

CICS-DBCTL session statistics are contained in the DFHDBUDS DSECT, which you can generate from the copybook DFHDBUDS. DFHDBUDS includes the following information, which is returned from the DRA for that CICS session:

- DBCTL identifier for the CICS-DBCTL session (STATDBID).
- DBCTL recoverable service element (RSE) name (STARSEN). (For more information about RSEs, see Chapter 8, “Extended recovery facility (XRF)” on page 123.)
- Time CICS connected to DBCTL (STACTIME).
- Time CICS disconnected from DBCTL (STADTIME).
- Minimum number of threads specified in the DRA startup table (STAMITHD).
- Maximum number of threads specified in the DRA startup table (STAMATHD).
- Number of times that the CICS-DBCTL session “collapsed” threads down to the minimum thread value specified in the DRA startup table (STANOMITHD).
- Number of times that the CICS-DBCTL session reached the maximum thread value specified in the DRA startup table (STANOMATHD).
- Elapsed time, expressed in hours, minutes, and seconds, for which the CICS-DBCTL session ran at the maximum thread value (STAELMAX).
- Largest number (also known as the “high-water mark”) of threads used during the CICS-DBCTL session (STHIWAT).
- Total number of times this CICS-DBCTL session successfully scheduled a PSB (STAPSBSU).

For information on DBCTL statistics see the *CICS/ESA Performance Guide*.

To extract and print a report from these statistics, run the CICS-supplied statistics utility program (DFHSTUP), specifying the ***specific*** APPLID of the relevant CICS system. The output will include CICS-DBCTL session statistics provided DBCTL was connected to CICS when the statistics were collected. For information about other parameters needed to run DFHSTUP, and a sample job stream you can use, see the *CICS/ESA Operations and Utilities Guide*. Figure 53 shows an example of a report produced by running DFHSTUP.

```
Unsolicited Statistics Report      Collection Date-Time 09/16/93-15:16:18  Last Reset 15:06:46  Applid IYAHZCD2  Jobname CI13JTD5
-------------------------------------------------------------------------------------------------------------------------------
DBCTL SESSION TERMINATION STATISTICS
-----------------------------------
  CICS DBCTL Session Number           :             2
    DBCTL identifier                  :          SYS2
    DBCTL RSE name                    :      DBCTLSY2
    Time CICS connected to DBCTL      : 15:14:02.8506
    Time CICS disconnected from DBCTL : 15:16:18.3689
    Minimum number of threads         :             1
    Maximum number of threads         :             3
    Times minimum threads hit         :             1
    Times maximum threads hit         :             1
    Elapsed time at maximum threads   : 00:00:09.4371
    Peak number of threads            :             3
    Successful PSB schedules          :             9
```

Figure 53. Example of CICS-DBCTL session statistics output

Note: The statistics report produced by running DFHSTUP (shown in Figure 53) displays the times at which CICS connected to and disconnected from DBCTL in hours, minutes, and seconds (hhmmss) format in **local** time. The DBCTL USS record mapped by the DFHDBUDS DSECT contains the connect and disconnect times as four 8-byte store clock (STCK) values. These are: connect and disconnect time expressed in local time and connect and disconnect time in Greenwich Mean Time (GMT).

CICS statistics that contain the number of DL/I requests by type, issued against each DL/I database are ***not*** produced by CICS in the DBCTL environment. Instead, DBCTL produces this type of information. You can obtain DBCTL buffer pool utilization information from the DBCTL /DISPLAY command, or from the IMS log records of type X'45'.

Monitoring DBCTL—transaction level data

Monitoring data for DBCTL is passed to CICS and IMS components. (See Figure 52 on page 178.) See the *CICS/ESA Operations and Utilities Guide* for help on switching monitoring on, and on printing and formatting the data.

DBCTL monitoring data returned to CICS

Monitoring data at the transaction level is passed back to CICS by DBCTL whenever a TERM request occurs, either explicitly, or implicitly at the end of task termination. The data is appended to the CICS monitoring facility performance record of the issuing task. The data returned is as follows:

- PSB name.
- Elapsed wait time for pool space. In a PSB schedule, when the pool space is insufficient for PSB/DMB blocks, the schedule request is put on a wait queue. The total wait time for it is in this field.
- Elapsed wait time for intent conflict. In a PSB schedule, when an intent conflict is detected, the schedule request is put on a wait queue. The total wait time for it is in this field.
- Elapsed time for the schedule request.
- Elapsed wait time for database I/O.
- Elapsed wait time for locking. The total wait time to get the PI locks which are local segment level locks.
- Total number of database I/O counts.

- Number of DL/I requests for each of the following:

  Get unique
  Get next
  Get next within parent
  Get hold unique
  Get hold next
  Get hold next within parent
  Insert requests
  Delete requests
  Replace requests.
- Total number of DL/I database requests.
- Number of test enqueues.
- Number of times requesting the PI locks on segments.
- Number of waits on test enqueues.
- Number of times requesting the PI locks on segments.
- Number of dequeues.
- Number of times PI locks are released.
- Number of update enqueues.
- Number of times the update locks are not available for a request and requires a wait.
- Number of update dequeues.
- Number of times requesting the exclusive lock.
- Number of waits on exclusive enqueues.
- Number of times the exclusive locks are released.
- Number of exclusive dequeues.
- Number of times the exclusive locks are released.
- DEDB statistics:

  Number of DEDB requests
  Number of DEDB I/Os
  Number of overflow buffers used
  Number of waits for DEDB buffer
  Number of unit of work contentions.
- Date of schedule start.
- Time of schedule start.
- Date of schedule end.
- Time of schedule end.
- Elapsed UOW CPUTIME for DRA thread (see note below).

Note: The elapsed CPUTIME field was introduced by IMS APAR PL83370. The CPUTIME represents the time spent in the DRA Thread TCB from the time the PSB is scheduled, to the time the PSB is terminated. CICS always terminates the PSB at the end of the Unit of work (UOW). The CPUTIME does not include any time spent in the DBCTL region.

Obtaining DBCTL monitoring data sent to CICS

DBCTL supplies CICS with monitoring data, which is then output to the CICS monitoring domain in the following cases:

- When CICS receives the response to a PSB schedule request from DBCTL, it checks whether this task has already been scheduled successfully to DBCTL. If it has, CICS forces the monitoring data from the previous PSB schedule out; that is, it writes the performance class record for the task and resumes monitoring that task. If it has not been scheduled before, no monitoring processing is done.
- When CICS receives a response from the DBCTL as a result of a COMMIT or ABORT request, CICS outputs the monitoring data, but does not write it.
- In the case of the final PSB schedule for a task, the monitoring data is automatically written at the end of a task.

To obtain the monitoring data that DBCTL returns to CICS, code two additional event monitoring points (EMPs) in your CICS monitoring control table (MCT). DBCTL EMPs can be found in CICS410.SDFHSAMP member DFH$MCTD.

For programming information on EMPs, and the format of monitoring records, see the *CICS/ESA Customization Guide*.

When you have obtained the monitoring data, you can use monitoring tools such as the CICS monitoring facility and the Service Level Reporter (SLR) with the data supplied to tune your CICS-DBCTL environment. See the *CICS/ESA Customization Guide* for programming information on using the CICS monitoring facility.

Service Level Reporter (SLR)

Service Level Reporter (SLR) is an IBM database and reporting program that collects and analyzes data from CICS and other IBM systems and products. SLR collects CICS data from CICS monitoring records and from a subset of CICS statistics on the SMF log data set. It then analyzes the data, summarizes the results, and stores the data in the SLR database.

The DBCTL data in the CICS monitoring records is output as one 256-byte block, and is written by the EMP DBCTL.2, as defined in CICS410.SDFHSAMP member DFH$MCTD. The DSECT for this 256-byte block of data is mapped by the DFSDSTA macro in the IMS GENLIBs. The SLR tables CICSTRANSLOG and CICSTRANSNUM contain the fields in this block.

During SLR installation, you must specify whether you want DBCTL data. For guidance on the format of this data, see the description of the DFSDSTA macro in the appropriate *&icg.*. For information on SLR data in CICS and IMS, see the *CICS/ESA Performance Guide* and the *IMS/ESA System Administration Guide* or the *IMS/ESA Administration Guide: System*. For help on using SLR, including examples of SLR reports and how to make use of them, see the *Service Level Reporter Version 3 General Information* manual.

IMS monitor reports with DBCTL

This section summarizes DBCTL-related data in IMS monitor reports. (This information also applies if your CICS system is connected to an IMS/ESA DM/TM system to obtain DBCTL support.)

IMS monitor reports that apply to DBCTL

- Call summary
- Program I/O
- DB buffer pool
- VSAM buffer pool
- Program summary.

Note: In a DBCTL environment, interpret the terms “program” and “transaction” in these reports as “PSB” and “PSB scheduling,” respectively.

IMS monitor reports that apply partially to DBCTL

- Region summary
- Region IWAIT

  (An IWAIT occurs when a DBCTL request causes I/O activity. IWAIT time denotes the time DBCTL spends waiting for IMS resources, in addition to the number of I/Os.)
- Any other region based reports.

Note: In a DBCTL environment, interpret the term “region” in these reports as the representation of a CICS thread or a BMP region in DBCTL, but beware that a DBCTL region may represent different CICS threads or BMP regions during a monitor run.

IMS monitor reports that do not apply to DBCTL

The following reports, related to transaction management and communication, do not apply to DBCTL, and either do not appear, or are shown as headings without any data:

- Communication wait
- Communication summary
- Line functions
- Message format buffer pool
- Message queue pool
- MSC queuing summary
- MSC summaries
- MSC traffic.

Data contained in relevant IMS monitor reports

This section tells you what kind of data you can find in the IMS monitor reports that apply to DBCTL.

General wait time events

All threads built for a CICS system have the same job name as that CICS system. They are shown in the jobnames for regions in the “General reports.”

General reports

The “general reports” include the “Regions and jobname” report and the “Region summary report.”

Regions and jobname report

Within a trace interval, a thread can be assigned to multiple CICS systems but it can only be assigned to one CICS at any one time. So, depending on the number of CICS systems connected to DBCTL, the regions and jobname report can show:

- One region with only one jobname
- One region with multiple jobnames
- Multiple regions with multiple jobnames where some regions have the same jobname, and some have multiple jobnames
- Multiple regions with only one jobname.

Any monitor report for a ***region*** is a summary for all connected CICS systems that a ***thread*** has served during the trace interval. For example, the elapsed time of schedule end to first call means the sum of this elapsed time for all CICS systems that a thread has been assigned to during the trace interval.

Depending on the workload of a CICS system, a trace interval may be a relatively short period of time, and thread switching between depending regions may not occur very often. However, the more the workload fluctuates, the more frequently threads are likely to be assigned amongst connected CICS systems.

Region summary report

A region summary report can show:

- **Scheduling and termination**, including:
  - The time from PSB schedule request being received by DBCTL to when the request is completed by DBCTL. This includes the time spent by DBCTL allocating IMS resources and does not include any schedule time spent in CICS or being processed by the DRA.
  - The time from when a PSB unschedule request is received by DBCTL to when the request is completed by DBCTL. This request could be an unschedule PSB request, or a request imbedded in any synchronization type terminate request, or a terminate thread request.
- **Schedule to first call** is the time from when DBCTL completed the PSB schedule to when DBCTL received the first DL/I request. This time includes all time spent processing in CICS, including application program, CICS itself, and DRA processing. (Because CICS is the transaction manager, how and when its own applications are loaded or scheduled cannot be interpreted by DBCTL in the IMS monitor reports.)
- **Elapsed execution** is the time between the completion of the DBCTL PSB schedule request and when DBCTL receives the PSB unschedule request. It indicates the amount of time IMS resources were allocated to a CICS thread.
- **Region occupancy** is the ratio of the elapsed time when a thread is active (that is, with IMS resources allocated) to the trace interval.
- **DL/I calls** is the time between DBCTL receiving the DL/I request and the request being completed in DBCTL.

Program summary

DBCTL does not process any messages. For the purpose of using the DC monitor report, it counts each PSB schedule as one message dequeued. Because DBCTL is not the transaction manager, it has to assume a one-to-one relation between a CICS transaction and a PSB schedule. This is shown in **program summary**, where the number of transactions dequeued is the same as the number of scheduled requests. "Per transaction" means requests per schedule, and "elapsed time per transaction" means elapsed time per schedule.

Run profile

In **run profile**, the number of messages dequeued means the number of scheduled PSBs and transactions per second means PSB schedules per second.

Transaction queuing report

The **transaction queuing report** can include a list of "transactions" for DBCTL. Each transaction name is an 8-byte transaction ID specified by CICS on the schedule request. A transaction ID from CICS comprises of a 4-byte CICS transaction name, plus a 4-byte CICS identifier. If CICS does not specify a transaction ID, DBCTL takes the CICS region ID, obtained at connection time. In this report, for DBCTL, the transaction "number dequeued" means number of PSB schedules. The "on queue when scheduled" in this report is always zero because the IMS message queues do not apply to DBCTL.

For examples of IMS monitor reports and detailed guidance on interpreting their contents, see the *IMS/ESA Utilities Reference: Database* manual.

Using the IMS monitor

DBCTL enables CICS users who do not have an IMS/VS DB/DC or IMS/ESA/DM/TM system to use the IMS monitor ***online***. The IMS monitor is the main tool provided by IMS for monitoring. It collects data from the system while it is running. It formats and records significant events during execution, and is useful in tuning constrained systems.

Monitoring data is written to a separate data set or tape defined by the IMSMON DD statement in the DBCTL JCL. To define this data set or tape and to run the IMS monitor with DBCTL, add an IMSMON DD statement to your DBCTL JCL. For further guidance on doing so, see the *IMS/ESA System Definition Reference* manual or *IMS/ESA Installation Volume 2: System Definition and Tailoring*.

To allocate an IMSMON data set, use the IEFBR14 utility to allocate a data set without any DCB parameters; for example:

```
//ALLOC     EXEC PGM IEFBR14
//IMSMON DD DISP=(NEW,CATLG),UNIT=3380,VOL=SER=xxxxxx,SPACE=(CYL,(5,5))
```

You can start and stop the IMS monitor dynamically using the /TRACE command with the MON keyword. For example:

```
/TRACE SET ON MON ALL
```

gives you all the activity that the monitor collects. For guidance on using the /TRACE command and its keywords more selectively, see the *IMS/ESA Operator's Reference* manual.

The IMS monitor has two phases:

- During the first phase, the monitor programs collect the data and store it on either disk or tape.
- During the second, the data is retrieved from the data set, and is organized and printed.

The data collected by the monitor (also known as DFSMNTR0) is organized and printed by the IMS monitor report print program, DFSUTR20. See the *IMS/ESA Utilities Reference: Database* manual for guidance on using the IMS monitor report print utility, DFSUTR20, and for information on using the IMS monitor to identify constraints.

DBCTL data returned to IMS log

In addition to the information returned to the monitor, as described in “IMS monitor reports with DBCTL” on page 183, IMS writes some monitoring information to the log records. This information is always recorded; you do not have to request it. IMS appends the following information to the X'08' log records during ***scheduling***.

- Total elapsed wait time due to intent conflict
- Total elapsed wait time due to pool space not being available
- Total elapsed time for a schedule request.

IMS appends the following information to the X'07' log records at PSB ***termination***:

- Total number of databases used involved in I/O
- Total number of DL/I database requests
- Total elapsed wait time due to databases involved in I/O
- Total elapsed wait time due to locking
- Total number of gets
- Total number of inserts
- Total number of replace
- Total number of deletes.

Program isolation trace

For full function DL/I databases, you can use the program isolation (PI) trace to get records that indicate queueing activity taking place for program isolation. The PI trace records are written to the IMS log. You can then print them using the IMS file select and formatting utility. See the *IMS/ESA System Administration Guide* for further guidance on using PI trace.

DL/I trace

For full function databases, you can use DL/I trace with DBCTL by enabling the DL/I trace table in the DFSVSMxx member or by issuing the /TRACE command, as described in “Cold start” on page 79. Using the /TRACE command enables you to turn DL/I trace on and off while the system is running. Output is to the IMS log as type X'67FA' records. See the *IMS/ESA Diagnosis Guide and Reference*manual for guidance on using DL/I trace for diagnosis, the *IMS/ESA Operator’s Reference* manual for guidance on the commands needed to invoke it, and the *IMS/ESA Utilities Reference: Database* manual for guidance on printing its output.

Using the IMS log statistics utilities

You can use the following IMS log statistics utilities to process the information from the IMS log. See “DBCTL data returned to IMS log” on page 186 for a list of the data returned to the IMS log.

- File select and formatting print utility, DFSERA10, formats and prints selected records from the IMS log data set. The active OLDS must have been archived before you can access the log data. You normally specify the SLDS to DFSERA10. You can also use DFSERA10 with the program isolation trace record format and print module, DFSERA40, to format PI trace.
- DEDB log analysis utility, DBFULTA0, prepares statistical reports for DEDBs based on data recorded on the IMS system log.
- IMS program isolation trace report utility, DFSPIRP0. If you use program isolation (PI), you can use DFSPIRP0 with the IMS log to obtain information about deadlocked tasks. DFSPIRP0 prints a report that shows only those enqueue requests that required a wait because the resource was not immediately available.

See the *IMS/ESA Utilities Reference: Database* manual for guidance on using these utilities.

Trace facilities

CICS trace facilities are intended primarily as debugging tools. However, because they record all requests for CICS, you can use them to analyze the performance of individual transactions. See “CICS failure in a multi-MVS environment” on page 137 for information on trace entries produced in a DBCTL environment. See the *CICS/ESA Problem Determination Guide* for information about specifying CICS trace parameters.

CICS auxiliary trace facility

The CICS auxiliary trace facility enables you to record trace entries on a separate data set to be analyzed later. Trace entries are time-stamped and they can provide very detailed information for analyzing constraints or other problems that may occur while CICS is running. For examples of CICS auxiliary trace output, see “Processor or MVS failure in a multi-MVS environment with IMS XRF” on page 141.

However, consider carefully how often you need to use CICS auxiliary trace because it generates a large volume of entries, which means that there may be a considerable overhead if you run it all the time. Also, you may find it difficult to make effective use of too large a volume of such data. See the *CICS/ESA Performance Guide* for information on using auxiliary trace as a performance tool.

Additional performance tools

The following are additional performance tools that you may want to consider using with DBCTL if you already have them or are considering adding them to your system.

Generalized trace facility (GTF)

If you use the IRLM as your locking manager, you can use the generalized trace facility (GTF) to provide a trace of its activity. It traces request handler request completions, the PTB input/output buffers, and statistical data relevant to the IRLM. You can print the records GTF produces offline. Output is collected in a data set specified by its user in the GTF job. For guidance on using GTF, which you may find of use in debugging, see the *IMS/ESA Diagnosis Guide and Reference* manual.

MVS/ESA Resource Measurement Facility (RMF)

The MVS/ESA Resource Measurement Facility (RMF) is a measurement tool designed to meet the needs of performance management in the large systems environment that MVS/ESA supports. Its primary purpose is to reduce the amount of system programmer time and expertise required to identify and to diagnose system tuning problems. It is designed to monitor selected areas of system activity and present the data collected in the form of SMF records and/or formatted reports. Display reports are also available for some system activities. For more details, see the *CICS/ESA Performance Guide*, and the *Resource Measurement Facility User's Guide*.

Tuning a CICS-DBCTL system

This section describes how you tune your CICS-DBCTL setup to make efficient use of resources to help you reach performance objectives.

Performance parameters in CICS

System design considerations for CICS with DBCTL are similar to those that applied to local DL/I. For example, do not allow excessive database accesses or updates in a single UOW.

However, there are some differences.

The fact that DBCTL is structured to have one TCB per thread is an additional consideration for CICS. This allows more concurrent processing, but you must be aware of the need to specify minimum and maximum numbers of threads that are consistent with your system's needs. For more information, see "Specifying numbers of threads" on page 189.

The storage specified in CICS system initialization parameters DSALIM and EDSALIM is used for different resources in a CICS-DBCTL environment. DSALIM is used to specify the upper limit of the total amount of storage within which CICS can allocate the individual DSAs **below** the 16MB line. EDSALIM is used to specify the upper limit of the total amount of storage within which CICS can allocate the individual EDSAs **above** the 16MB line. Local uses DSA for PSB and DMB pools, but with DBCTL, these blocks are stored outside CICS. Instead, you need to allow for the storage DBCTL needs in CICS for DRA code when specifying DSALIM and EDSALIM. This storage is allocated in the CICS region, but not from DSA or EDSA storage. See the *CICS/ESA System Definition Guide* and the *CICS/ESA Performance Guide* for information about specifying DSALIM and EDSALIM, and the *IMS/ESA System Administration Guide* or the *IMS/ESA Administration Guide: System* for guidance on DBCTL storage estimates.

Performance parameters in IMS

From an IMS point of view, tuning DBCTL is much like tuning an IMS system. Additional considerations are DRA threads, described in "Specifying numbers of threads," and DEDBs, described in "DEDB performance and tuning considerations" on page 191.

Response time—assigning job dispatching priorities

To minimize response times, we recommend that you assign a higher dispatching
priority to the CICS address space than to the DBCTL address spaces (DBCTL,
DLISAS, DBRC). Although CICS can be regarded as a "front-end" to DBCTL, you
should be aware that CICS also has to manage the network and the application
environment for non-DLI transactions such as DB2 or VSAM. This means that it
has very different CPU requirements from other front ends to DBCTL such as a
BMP or a MPP. For example, when a CICS transaction is waiting for a response to
a DBCTL request, CICS dispatches other CICS transactions.

| We recommend that if IRLM is assigned a priority of **n**, CICS should have a priority
| of **n-1**, DBRC a priority of **n-2**, and DBCTL and DLISAS a priority of **n-3**.

For further guidance on assigning priorities, see the *IMS/ESA System Administration Guide* or the *IMS/ESA Administration Guide: System*.

Specifying numbers of threads

The DRA startup parameters MINTHRD and MAXTHRD specifies the minimum and maximum numbers of threads that can process DBCTL DL/I or DEDB requests. (See "Deciding whether to use orderly or immediate disconnection" on page 60 for information on DRA startup parameters.)

The IMS system generation parameter MAXREGN specifies the number of regions (or threads), to be allocated at startup, that DBCTL can handle for all connected CICS systems and BMPs. The number can increase dynamically, to a limit of 255, as needed. (See "Recovery tokens" on page 86 for information on system generation parameters.)

The number you specify for MAXREGN should be no less than the sum of MINTHRDs specified for active CICS systems, and for BMPs.

In Figure 54 on page 190, the following threads are in use: one from BMPA, one from BMPB, five from CICSA and three from CICSB, making a total of 10 threads. A MAXREGN of 10 has therefore been specified for DBCTLA.

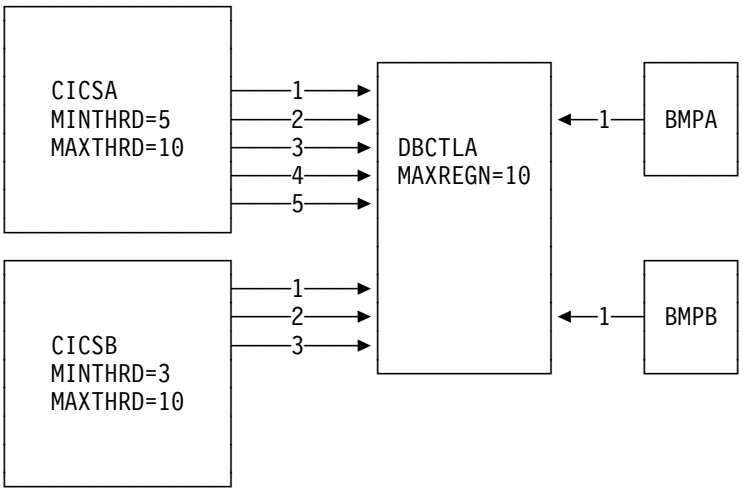

Figure 54. Interaction of MAXREGN, MINTHRD, and MAXTHRD

The maximum number of threads you can specify in DBCTL is 255. One thread is equivalent to one MVS TCB. The number you specify must be large enough for your system's needs, but if you specify a number that exceeds those needs, this will have an adverse effect on the performance of the DRA. If you specify a minimum thread value that is higher than your system's actual minimum activity, this will tie up threads unnecessarily, preventing DBCTL from allocating them to other CICS systems or BMPs. If you specify a minimum thread value that is too low, this can also affect performance; if the level of thread activity falls, this could cause the DRA to release threads down to the minimum value. These threads would then have to be reestablished if the thread requests increased again.

The number you specify for MAXTHRD should reflect what you consider to be the peak load of DBCTL threads needed. The number of threads you specify will affect performance. The larger the number you have preallocated, the more storage is needed. However, if threads are preallocated, the time needed to allocate them on demand is saved, thus improving response time and throughput. So, if your system is storage constrained, specify a lower value for MINTHRD, and use MAXTHRD as a "safety valve." If response time and throughput are more important than storage requirements, specify a higher number for MINTHRD so that more threads are ready to be used.

Also bear DBCTL thread activity in mind when specifying the MXT system initialization parameter. You use MXT to specify the maximum number of tasks that CICS will allow to exist at any time. With DBCTL, MXT should be enough to allow for the number specified in MINTHRD, plus the number you need for "standard" CICS tasks. With DB2, there is no minimum number of threads. See the *CICS/ESA Performance Guide* for general help on MXT.

To help you decide on the optimum values for minimum and maximum numbers of DBCTL threads, monitor thread usage and IMS task throughput (to see if tasks are being delayed), and IMS I/O rates. For details of thread statistics produced, including maximum and minimum thread usage, see "DBCTL statistics" on page 178. See "DBCTL data returned to IMS log" on page 186 for details of data produced for monitoring IMS I/O rates. You can also use CICS auxiliary trace to check for queueing for threads and PSBs.

DEDB performance and tuning considerations

If you use DEDBs, you must define the characteristics and usage of the IMS DEDB buffer pool. You do this by specifying parameters (including DRA startup parameters, as described in “Deciding whether to use orderly or immediate disconnection” on page 60) during IMS system definition or execution.

The main concerns in defining DEDB buffer pools are the total number of buffers in the IMS region and how they are shared by CICS threads. You use the following parameters on the IMS FPCTRL macro to define the number of buffers:

- DBBF—total number of buffers
- DBFX—number of buffers used exclusively for DEDB overflow threads.

The number of buffers available for the needs of CICS threads is the number remaining when you subtract the value specified for DBFX from DBBF. In this discussion, we have assumed a fixed number for DBFX. DBBF must therefore be large enough to accommodate all BMPs and CICS systems that you want to connect to a particular DBCTL.

When a CICS thread connects to IMS, its DEDB buffer requirements are as specified using a normal buffer allocation (NBA) parameter. For a CICS system, there are two NBA parameters in the DRA startup table:

- CNBA—total buffers needed for the CICS system. This is taken from the total specified in DBBF.
- FPBUF—number of buffers to be given to each CICS thread. This is taken from the number specified in CNBA. FPBUF is used for each thread that requests DEDB resources, and so should be large enough to handle the requirements of any application that can run in that CICS system.

A CICS system may fail to connect to DBCTL if its CNBA value is more than that available from DBBF. An application attempting to schedule PSBs that contains references to DEDBs may receive a schedule failure if the FPBUF value is more than that available from CNBA.

When a CICS system has successfully connected to DBCTL, and the application has successfully scheduled a PSB containing DEDBs, the DRA startup parameter FPBOF becomes relevant. FPBOF specifies the number of overflow buffers each thread will get if it exceeds FPBUF. These buffers are not taken from CNBA. Instead, they are buffers that are ***serially*** shared by all CICS applications or other dependent regions that are currently exceeding their NBA allocation.

Because overflow buffer allocation (OBA) usage is serialized, thread performance can be affected by NBA and OBA specifications. If FPBUF is too small, more applications need to use OBA, which may cause delays due to contention. If both NBA and OBA are too small, the application fails. If FPBUF is too large, this affects the number of threads that can concurrently access DEDB resources, and increases the number of schedule failures.

In a CICS-DBCTL environment, the main performance concern is the trade-off between speed and concurrent access. The size of this trade-off is dictated by the kind of applications you are running in the CICS system. If the applications have approximately the same NBA requirements, there is no trade-off. You can specify a FPBUF large enough to never need OBA. This speeds access and there is no waste of buffers in CNBA, thus enabling a larger number of concurrent threads using DEDBs. The more the buffer requirements of your applications vary, the greater the trade-off. If you want to maintain speed of access (because OBAs are not being used) but decrease concurrent access, you should increase the value of FPBUF. If you prefer to maintain concurrent access, do not increase the value of FPBUF. However, speed of access will decrease because this and possibly other threads will need to use the OBA function.

For information on specifying the parameters CNBA, FPBOF, and FPBUF, see “Deciding whether to use orderly or immediate disconnection” on page 60. For further guidance on DEDB buffer specification and tuning, see sections on DEDBs in the *IMS/ESA Database Administration Guide* and the *IMS/ESA System Administration Guide*, or, for Version 5, the *IMS/ESA Administration Guide: Database Manager* and the *IMS/ESA Administration Guide: System*.

Using DEDBs

Using DEDBs can give you performance improvements in the following areas:

- Reduced path length
  - DEDBs use Media Manager for more efficient control interval (CI) processing, which can reduce pathlength.
  - DEDBs have their own resource manager, which means:
    - Less interaction with whichever lock manager you are using (PI or the IRLM), provided you are not using block level sharing.
    - Simplified buffer handling (and reduced pathlength) because DEDBs have their own buffer pool.
- Parallel processing

  DEDB writes are not done during the life of the transactions but are kept in buffers. Actual update operations are delayed until a synchronization point and are done by asynchronous processing using output threads in the control region. The output thread runs as a service request block (SRB)—a separate dispatchable MVS task. You can specify up to 255 output threads. This means that:
  - The CICS task can be freed earlier
  - Parallel processing is increased and throughput on multiprocessors is improved.
- Less I/O

  The cost of I/O per SDEP segment inserted can be very low because SDEP segments are gathered in one buffer and are written out only when it is full. This means that many transactions can “share the cost” of SDEP CI writes to a DEDB. SDEPs should have larger CIs to reduce I/Os.
- Reduced logging overhead.

  DEDB log buffers are written to OLDS only when they are full. This means less I/O than would be needed with full function databases.

High speed sequential processing (HSSP)

Using DBCTL enables you to use high speed sequential processing (HSSP), which is available from IMS/ESA Version 3. HSSP is useful with applications that do large scale sequential updates to DEDBs, which may require an image copy after the DEDBs are updated. Using HSSP provides the following major benefits:

- DEDB processing time can be improved by using the IBM 3990 Storage Control Model 3 Fast Write capability and the IBM 3990 Storage Control Model 3 Sequential Mode for both READs and WRITEs.
- You can take an HSSP image copy during a sequential update job. This avoids having to make a subsequent sequential pass through the DEDB areas to take an image copy.
- HSSP reduces elapsed DEDB processing time by using private buffer pools and optimizing locking.
- Only a minimum amount of log data is written to the IMS system log when you request an HSSP image copy. This reduces the large amount of logging that such large scale sequential runs usually involve.

For further guidance on HSSP, see the *IMS/ESA Release Planning Guide*.

IMS asynchronous database buffer purge facility

IMS/ESA 4.1 includes the asynchronous database buffer purge facility. At syncpoint time, when database buffers are to be flushed, buffers that are to be written to different devices are written concurrently, rather than serially, as in earlier releases of IMS. (For further guidance, see the *IMS/ESA System Administration Guide* or the *IMS/ESA Administration Guide: System*).

The asynchronous database buffer purge facility should improve response time for transactions that update databases on multiple devices in a single UOW.

Virtual storage usage

CICS regions that previously used local DL/I can obtain considerable virtual storage constraint relief because the following storage areas reside in the DBCTL address spaces:

- All DL/I and DBRC code and control blocks
- OSAM and VSAM buffer pools and related control blocks
- PSB, DMB, and ENQ pools.

However, DBCTL requires some MVS CSA storage, which may lower the maximum available region size in the MVS system. See the *CICS/ESA Performance Guide* and the *IMS/ESA System Administration Guide* or the *IMS/ESA Administration Guide: System* for details of CSA and other DBCTL storage requirements.

Improved throughput on multiprocessors

You can obtain throughput improvements on multiprocessors because the CICS-DBCTL interface resides in multiple address spaces and because it uses separate MVS subtasks to manage threads.

If you currently use MRO function shipping, converting the CICS DOR to use DBCTL should result in improved throughput due to multiprocessor exploitation and the reduced instruction pathlength of the CICS-DBCTL interface. DBCTL provides a separate TCB for each CICS application thread, which significantly improves the amount of concurrent processing.

You can obtain further performance improvements by using DEDBs instead of full-function databases. See “DD statements removed from CICS JCL in a DBCTL-exclusive environment” on page 33 for introductory guidance on DEDBs, and “Using DEDBs” on page 193 for information on the performance aspects.

CICS shared database jobs and IMS batch jobs run as BMPs

When you migrate your CICS shared database batch and IMS batch jobs to use BMPs, this will simplify log management. Although a BMP may run more slowly than the same job running as an IMS batch job, performance for CICS shared database jobs running as BMPs should be improved. Observations show that the elapsed time for CICS shared database job converted to run as a BMP job is considerably shorter, and the CICS degradation of the CICS online workload in terms of transaction response and throughput is significantly less.

Appendix A. Migration task summary and fallback considerations

This summary:

- Lists the tasks involved in migration to DBCTL and makes cross references to further information in the main body of this book.
- Describes how to remove support for DBCTL to "fall back" to your previous DL/I setup, should you need to.

Education

You should plan the kind of education necessary before implementing DBCTL. You will probably find that it is most needed in the areas of operations and system programming.

Operator topics include:

- DBRC
- DBCTL console operator
- Log archiving
- Recovery and restart
- Monitoring and statistics.

System programmer topics include:

- DBCTL system definition
- DBRC
- Log archiving
- Recovery and restart
- Debugging
- Monitoring and statistics
- Tuning.

Application programmer topics include:

- New function
- New transaction abends
- Dump analysis (CICS-DBCTL correlated information).

There is a certain amount of new vocabulary, which is explained in context, and, for quick reference, in "Glossary" on page 217.

Installation, system and resource definition

See Chapter 4, "Installing DBCTL, and defining CICS and IMS system resources" on page 27. The following considerations apply:

- CICS installation is simplified, because there is no need to do a partial system generation if you are not using local DL/I.

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- In CICS resource definition, there are changes to:
  - System initialization table (SIT) parameters.
  - Monitoring control table (MCT) entries.
  - CICS system definition (CSD) file entries.
  - Program list table (PLT).
  - Some DD statements are removed from CICS JCL if you do not use local DL/I, and some are changed because of DBCTL.
  - PDIRs are not needed for DBCTL. You define PSBs using IMS APPLCTN macros.
  - DDIRs are not needed for DBCTL. You define DBDs using IMS DATABASE macros.
  - New DBCTL startup parameters.
  - DRA startup table parameters.
  - Customization — user-replaceable program DFHDBUEX and DL/I global user exits XDLIPRE and XDLIPOST. If you use CICS support for XRF, global user exits XXDFA, XXDFB, and XXDTO are available to enable you to establish takeover decision mechanisms for DBCTL.

System programmers should also:

- Set up procedures for operations and recovery
- Review use of DBRC
- Review use of data sharing
- Check exits
- Consider new problem determination techniques
- Consider new performance tuning techniques.

Operations

There are many changes to CICS operations for operators who are not familiar with IMS/ESA DM/TM. See Chapter 5, “Operations with DBCTL” on page 53.

- Starting and stopping DBCTL.

  The DBCTL address space starts the DBRC and DLISAS address spaces automatically. Each address space issues messages. (See also Appendix C, “Messages issued during DBCTL startup and termination” on page 203 for examples of these messages.)

- New and changed CICS and DBCTL messages.

- DBCTL is operated via an operating system console, if not using the CICS-supplied transaction, CDBM. (See “CDBM operator transaction” on page 64.)

- New DBCTL operator commands (a subset of IMS operator commands). (See also Appendix D, “Summary of DBCTL operator commands” on page 207 for tables comparing CICS and DBCTL operator commands, and listing keywords of IMS operator commands valid for DBCTL users.)

- Changes to CICS master terminal operator transactions.

- New CICS master terminal operator transactions to connect to and disconnect from DBCTL dynamically, and to inquire on the status of the interface.
- Additional considerations for XRF. (See also “Defining system resources for XRF” on page 128.)
- Online change using the /MODIFY command. This is very different to CICS resource definition online (RDO).
- Use of recovery token to correlate CICS tasks with DBCTL threads using CICS recovery token. (See also “Recovery tokens” on page 86.)
- High speed sequential processing (HSSP), if used. (See “DBCTL data returned to IMS log” on page 186 and the *IMS/ESA Release Planning Guide*.)

Recovery and restart

See Chapter 6, “Recovery and restart operations” on page 77.

- Use emergency restart, not cold start after a DBCTL failure.
- Log management — CICS system log and DBCTL (IMS) log.
- DBCTL uses two-phase commit, for which CICS system log is needed.
- Implementing DBRC.
- Resolving in-doubt threads, using the pseudo recovery token and DBCTL CHANGE CCTL command.
- High speed sequential processing (HSSP) and image copy, if used. (See “DBCTL data returned to IMS log” on page 186 and the *IMS/ESA Release Planning Guide*.
- Online image copy.

Application programming

See Chapter 7, “Application programming considerations” on page 99.

- Data availability is always active. This means that a transaction can fail after PSB schedule because of unavailable data.
- New CICS transaction abend codes and messages.
- Access needed to an MVS console (referred to in this book as DBCTL console — see also “Operator communication with DBCTL” on page 62) to take databases offline.
- Migrating CICS shared database and “native” IMS batch programs to use BMPs.
- New DL/I requests.
- DEDB subset pointers.
- Batch programs migrated to DBCTL must issue checkpoints and be restartable from the last checkpoint. You will have to change any existing batch jobs to do this before you can run them on DBCTL.

Security

See Chapter 9, “Security checking with DBCTL” on page 143.

- CICS/ESA Version 3 and later invoke PSB security checking by RACF (or an equivalent external security manager), as with local DL/I in this and previous versions of CICS.
- Optional DBCTL resource security checking, which you may ***require*** if you decide to use BMPs. It also includes DBCTL password security checking.
- Migrating security definitions from CICS system with local DL/I to CICS system with DBCTL.
- Database security, for example, SENSEG and PROCOPT still apply with DBCTL.

Problem determination

See Chapter 10, “Problem determination” on page 151.

The following considerations apply:

- Correlation of CICS and DBCTL problem determination information.
  - CICS trace, transaction dump, system dump, and log.
  - DRA dump.
  - DBCTL dump, trace, and log.

Monitoring, statistics, and performance

See Chapter 11, “Statistics, monitoring, and performance” on page 177.

- Monitoring:
  - New format of monitoring data returned with DBCTL
  - New DBCTL monitor reports from IMS monitor online.
- Statistics:
  - Data returned at the end of a CICS-DBCTL session
  - DL/I statistics summary by ***database*** no longer available at CICS shutdown.
- Performance, tuning, and resource utilization:
  - You have new parameters to tune, for example DBCTL and DRA startup table parameters.
  - There should be enough space to increase number of buffers and pool sizes.
  - SIT parameters DSALIM and EDSALIM are used to store different resources.
  - Adapt MINTHRD, MAXTHRD, MAXREGN, and MXT for each CICS connected to DBCTL. You can have up to 255 threads in a single DBCTL.

You may need more common storage area (CSA) if you have:

- Regions that already have constrained virtual storage
- Local DL/I running and DBCTL
- Test and production DBCTL subsystems in the same MVS image
- XRF in a single-MVS environment (which means two DBCTL subsystems in the same MVS image).

Fallback

The headings that follow list the steps you will need to take if, for any reason, you need to "fall back" to your previous level of DL/I support. (In all the following scenarios, MRO complexes may be involved, and DB2 or VSAM files may be used.)

CICS-DBCTL back to CICS-local DL/I

- Specify DLI=YES in CICS SIT.
- Change PDIR SIT parameter to specify a PDIR with local PSB entries.
- Change DDIR SIT parameter to specify a DDIR with database entries.
- Review all other DL/I-related SIT parameters including: DBP, DBBUFSZ, DLDBRC, DLIRLM, DLLPA, DLMON, DLTHRED, DLXCPVR, DMBPL, ENQPL, PISCHD, PSBCHK, PSBPL, and XPSB.
- Review DSALIM and EDSALIM SIT parameters.
- Ensure DBRC RECON data sets appear in the CICS JCL, if appropriate.
- Change the CICS JCL to include the DFSRESLB, DFSVSAMP, IMSACB and the DL/I database DD statements.
- Remove DBCTL connection program, DFHDBCON, from the PLT.
- Ensure the appropriate MCT entries for local DL/I appear.
- Revert to data sharing, if used before migration to DBCTL.
- Revert to previous operating procedures.
- Convert JCL for BMPs back to CICS shared database, or batch if using data sharing.

At this stage, CICS and BMP applications that have been written to use new DBCTL facilities will fail.

CICS-DBCTL with CICS-local back to CICS-local

- Change PDIR SIT parameter to specify a PDIR with additional local PSB entries.
- Change DDIR SIT parameter to specify a DDIR with additional database entries.
- Review other DL/I-related SIT parameters including: DBP, DBBUFSZ, DLIRLM, DLMON, DLTHRED, DLXCPVR, DMBPL, ENQPL, PSBCHK, and PSBPL.
- Review DSALIM and EDSALIM SIT parameters.
- Ensure the CICS IMSACB contains the appropriate ACBs.

- Ensure the DFSVSAMP specification is appropriate.
- Change the CICS JCL to include the DL/I database statements.
- Remove DBCTL connection program, DFHDBCON, from the PLT.
- Revert to data sharing, if used before migration to DBCTL.
- Revert to previous operating procedures.
- Convert JCL for BMPs back to shared database, or batch, if using data sharing.

At this stage, CICS and BMP applications that have been written to use new DBCTL facilities will fail.

CICS-DBCTL back to CICS DOR and CICS AOR(s)

- Set up CICS DOR job.
  - Specify DLI=YES in CICS SIT.
  - Change PDIR SIT parameter to specify a PDIR with local PSB entries.
  - Change DDIR SIT parameter to specify a DDIR with database entries.
  - Review all other DL/I-related SIT parameters including: DBP, DBBUFSZ, DLDBRC, DLIRLM, DLLPA, DLMON, DLTHRED, DLXCPVR, DMBPL, ENQPL, PISCHD, XPSBCHK, PSBPL, and XPSB.
  - Review DSALIM and EDSALIM SIT parameters.
  - Ensure DBRC RECON datasets appear in the CICS JCL, if appropriate.
  - Change the CICS JCL to include the DFSRESLB, DFSVSAMP, IMSACB and the DL/I database DD statements.
  - Ensure the appropriate MCT entries for local DL/I appear.
- Set up CICS AOR job(s).
  - Specify DLI=REMOTE in CICS SIT.
  - Change PDIR SIT parameter to specify a PDIR with remote PSB entries.
  - Review other DL/I-related SIT parameters including: PSBCHK and XPSB.
  - Review DSALIM and EDSALIM SIT parameters.
  - Remove DBCTL connection program, DFHDBCON, from the PLT.
  - Revert to data sharing, if used before migration to DBCTL.
  - Revert to previous operating procedures.
  - Convert JCL for BMPs back to CICS shared database, or batch if using data sharing.

At this stage, CICS and BMP applications that have been written to use new DBCTL facilities will fail.

Appendix B. Illustration of DBCTL startup parameter creation and selection

Figure 55 on page 202 shows how DBCTL startup parameters are created and selected during startup. If you are new to IMS system definition, you will probably find it helpful to refer to this figure while reading “Generating DBCTL” on page 35.

Note: “OCU” in Figure 55 on page 202 refers to the IMS online change utility.

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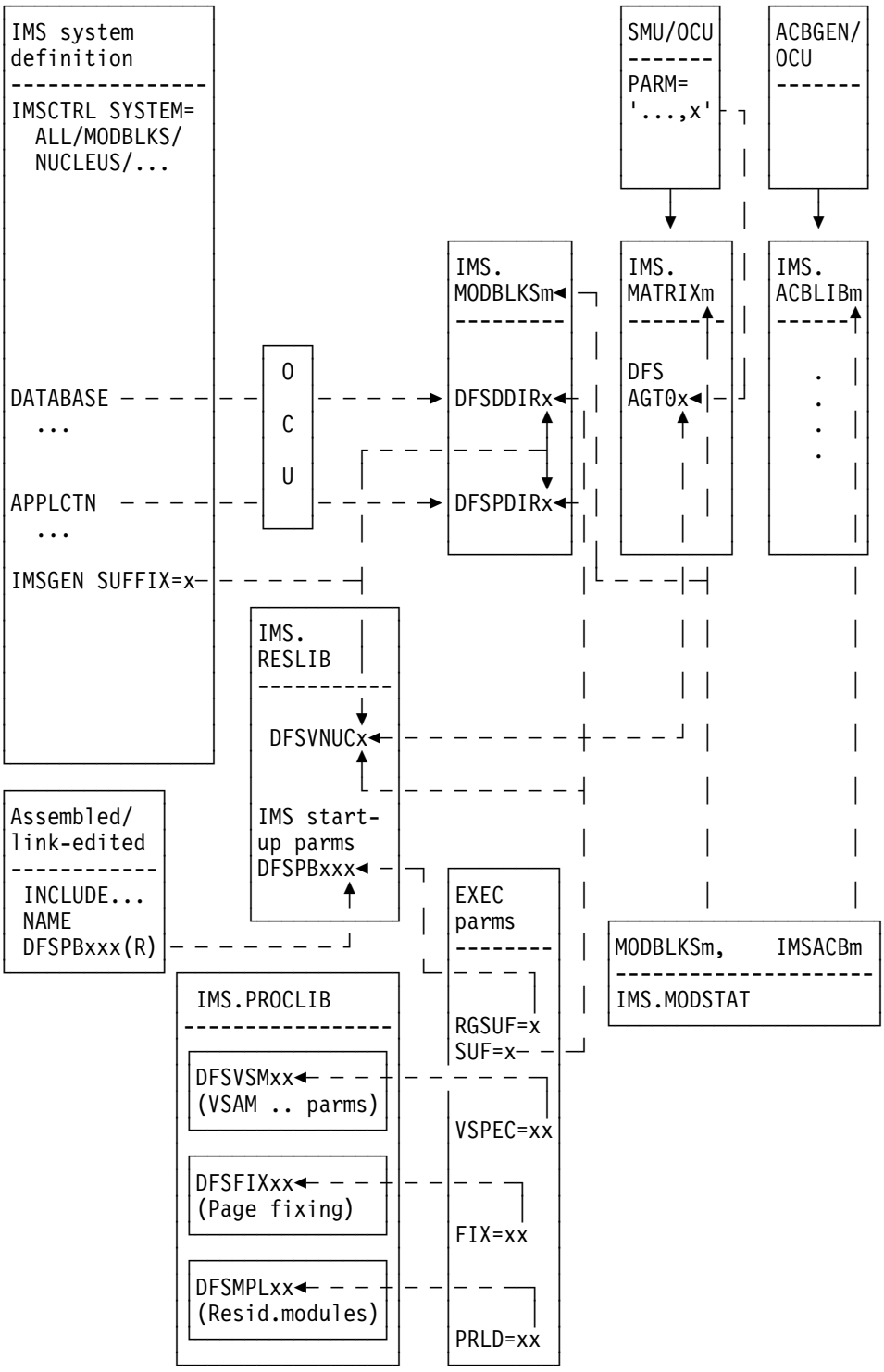

Figure 55. Creating and selecting DBCTL startup parameters

Appendix C. Messages issued during DBCTL startup and termination

These examples show the messages you should expect to see during a successful startup and normal termination of DBCTL. Messages are issued separately by each of the three address spaces involved (DBCTL, DLISAS, and DBRC). As you can see from the timestamp in the messages, they are issued at varying times; that is, DBCTL does not complete its startup before DLISAS and DBRC begin. (The same applies at termination time.) The numbers prefixed with STC that are displayed after the timestamp and before the message number indicate which address space issued which message. In these examples, 9303 indicates messages issued by DBCTL, 9573 indicates DLISAS messages, and 9574 indicates DBRC messages. See the *CICS/ESA Operations and Utilities Guide* for similar information on CICS startup messages.

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Messages issued by DBCTL during startup

```
17.00.00 STC 9303  $HASP373 DBCTL   STARTED
17.00.03 STC 9303  IEF188I PROBLEM PROGRAM ATTRIBUTES ASSIGNED
17.00.06 STC 9303  DFS0578I - READ SUCCESSFUL FOR DDNAME PROCLIB  MEMBER = DFSVSM00  IMSA
17.00.15 STC 9303  DFS3410I DATASETS USED ARE IMSACBA FORMATA MODBLKSB P=89107 1148431 C=89107 1148431  IMSA
17.00.17 STC 9303  START DLIS
17.00.19 STC 9303  START DBRC
17.00.20 STC 9303  DFS3613I - STM TCB INITIALIZATION COMPLETE  IMSA
17.00.20 STC 9303  DFS3613I - MOD TCB INITIALIZATION COMPLETE  IMSA
17.00.22 STC 9303  DFS3613I - STC TCB INITIALIZATION COMPLETE  IMSA
17.00.22 STC 9303  DFS3613I - RDS TCB INITIALIZATION COMPLETE  IMSA
17.00.22 STC 9303  DFS3613I - DYC TCB INITIALIZATION COMPLETE  IMSA
17.00.23 STC 9303  DFS3613I - RST TCB INITIALIZATION COMPLETE  IMSA
17.00.24 STC 9303  DFS2208I DUAL LOGGING IN EFFECT ON IMS LOG DATA SET IMSA
17.00.24 STC 9303  DFS2208I DUAL LOGGING IN EFFECT ON WRITE AHEAD DATA SET IMSA
17.00.24 STC 9303  DFS2207I IMS LOG(S) BLOCKSIZE=18432, BUFNO=005 IMSA
17.00.24 STC 9303  DFS3613I - DLG TCB INITIALIZATION COMPLETE IMSA
17.00.35 STC 9303  DFS0759I THE FOLLOWING VIRTUAL ADDRESSES HAVE BEEN FIXED IMSA
17.00.35 STC 9303  DFS0759I     ESCD      00BE8428-00BE8CAC  IMSA
17.00.35 STC 9303  DFS0759I     LBUF      0296B5A8-0296D5A8  IMSA
17.00.35 STC 9303  DFS0760I THE FOLLOWING FIX OPERANDS WERE NOT FIXED IMSA
17.00.35 STC 9303  DFS0760I     DMHR     OTHR     DEDB     IMSA
17.00.35 STC 9303  DFS3613I - FP TCB INITIALIZATION COMPLETE IMSA
17.00.35 STC 9303 *DFS227A - CTL REGION WAITING FOR DLS REGION (DLIS   ) INIT - IMSA
17.02.47 STC 9303  DFS3613I - CTL TCB INITIALIZATION COMPLETE  IMSA
17.02.47 STC 9303 *DFS989I IMS (DBCTL) READY (CRC=X) - IMSA
17.02.48 STC 9303  DFS000I MESSAGE(S) FROM ID=IMSA
                   DFS3136I NORMAL RESTART IN PROCESS.
17.02.49 STC 9303  DFS000I MESSAGE(S) FROM ID=IMSA
                   DFS680I USING CHKPT 89111/171600
17.02.49 STC 9303  DFS000I MESSAGE(S) FROM ID=IMSA
                   DFS2591I NO MSDB HEADERS FOUND, IMAGE COPY LOAD IGNORED
17.02.49 STC 9303  DFS000I MESSAGE(S) FROM ID=IMSA
                   DFS2500I DATASET  DFSOLP01 SUCCESSFULLY ALLOCATED
17.02.51 STC 9303  DFS000I MESSAGE(S) FROM ID=IMSA
                   DFS3257I ONLINE LOG NOW OPENED ON DFSOLS01
17.02.51 STC 9303  DFS000I MESSAGE(S) FROM ID=IMSA
                   DFS3257I ONLINE LOG NOW OPENED ON DFSOLS01
17.02.51 STC 9303  DFS000I MESSAGE(S) FROM ID=IMSA
                   DFS3261I WRITE AHEAD DATA SET NOW ON DFSWADS0
17.02.51 STC 9303  DFS000I MESSAGE(S) FROM ID=IMSA
                   DFS3261I WRITE AHEAD DATA SET NOW ON DFSWADS1
17.02.51 STC 9303  DFS000I MESSAGE(S) FROM ID=IMSA
                   DFS994I *CHKPT 89114/170251**SIMPLE*
17.02.51 STC 9303  DFS000I MESSAGE(S) FROM ID=IMSA
                   DFS3499I ACTIVE DDNAMES: MODBLKSB IMSACBA  FORMATA  MODSTAT ID:    4
17.02.51 STC 9303  DFS000I MESSAGE(S) FROM ID=IMSA
                   DFS3804I LATEST RESTART CHKPT: 89114/170251
17.02.51 STC 9303  DFS000I MESSAGE(S) FROM ID=IMSA
                   DFS994I WARM START COMPLETED.
```

Figure 56. Messages issued by DBCTL during startup

Messages issued by DLISAS during startup

```
17.02.12 STC 9573  $HASP373 DLIS STARTED
17.02.41 STC 9573  IEF188I PROBLEM PROGRAM ATTRIBUTES ASSIGNED
17.02.42 STC 9573  DFS0578I - READ SUCCESSFUL FOR DDNAME PROCLIB  MEMBER = DFSVSM00  IMSA
17.02.45 STC 9573  DFS228I - DLS REGION STORAGE COMPRESSION INITIALIZED  IMSA
17.02.45 STC 9573  DFS228I - DLS REGION DYNAMIC ALLOCATION INITIALIZED  IMSA
17.02.47 STC 9573  DFS228I - DLS REGION INITIALIZATION COMPLETE  IMSA
```

Figure 57. Messages issued by DLISAS during startup

Messages issued by DBRC during startup

```
17.02.17 STC 9574  $HASP373 DBRC    STARTED
17.02.18 STC 9574  IEF188I PROBLEM PROGRAM ATTRIBUTES ASSIGNED
17.02.24 STC 9574  DFS3613I - DRC TCB INITIALIZATION COMPLETE  IMSA
```

Figure 58. Messages issued by DBRC during startup

Messages issued by DBCTL during normal termination

```
17.08.51 STC 9303  DFS000I MESSAGE(S) FROM ID=IMSA
                   DFS058I CHECKPOINT COMMAND IN PROGRESS
17.08.52 STC 9303  DFS000I MESSAGE(S) FROM ID=IMSA
                   DFS994I *CHKPT 89114/170852**FREEZE*
17.08.52 STC 9303  DFS000I MESSAGE(S) FROM ID=IMSA
                   DFS3499I ACTIVE DDNAMES: MODBLKSB IMSACBA  FORMATA  MODSTAT ID:    4
17.08.52 STC 9303  DFS000I MESSAGE(S) FROM ID=IMSA
                   DFS3804I LATEST RESTART CHKPT: 89114/170852
17.08.53 STC 9303  DFS000I MESSAGE(S) FROM ID=IMSA
                   DFS3257I ONLINE LOG CLOSED ON DFSOLP01
17.08.53 STC 9303  DFS000I MESSAGE(S) FROM ID=IMSA
                   DFS3257I ONLINE LOG CLOSED ON DFSOLS01
17.08.55 STC 9303  DFS000I MESSAGE(S) FROM ID=IMSA
                   DFS2484I JOBNAME=ARCHJOB  GENERATED BY LOG AUTOMATIC ARCHIVING
17.08.55 STC 9303  DFS000I MESSAGE(S) FROM ID=IMSA
                   DFS092I IMS LOG TERMINATED
17.08.55 STC 9303  DFS000I MESSAGE(S) FROM ID=IMSA
                   DFS2091I IMS TIMER SERVICE SHUTDOWN COMPLETED
17.08.57 STC 9303  DFS994I IMS (DBCTL) SHUTDOWN COMPLETED  IMSA
17.08.57 STC 9303  DFS627I IMS RTM CLEANUP ( EOT ) COMPLETE FOR JS DBCTL  .IEFPROC .DBCTL      ,RC=00
17.08.58 STC 9303      DBCTL      IEFPROC     DFSMVRC0    0000
17.08.58 STC 9303  $HASP395 DBCTL   ENDED
```

Figure 59. Messages issued by DBCTL during normal termination

Messages issued by DLISAS during normal termination

```
17.08.52 STC 9573  DFS603I IMS DLS CLEANUP ( EOT ) COMPLETE FOR JS DLIS   .DB1ADLIS.           ,RC=00
17.08.52 STC 9573      DLIS       DB1ADLIS    DFSMVRC0    0000
17.08.52 STC 9573  $HASP395 DLIS    ENDED
```

Figure 60. Messages issued by DLISAS during normal termination

Messages issued by DBRC during normal termination

```
17.08.57 STC 9574      DBRC       IEFPROC     DFSMVRC0    0000
17.08.57 STC 9574  $HASP395 DBRC    ENDED
```

Figure 61. Messages issued by DBRC during normal termination

Appendix D. Summary of DBCTL operator commands

Table 15 and Table 16 on page 209 list:

- CICS operator commands, corresponding DBCTL operator commands, and which DBCTL commands can be issued using the CICS-supplied transaction CDBM.
- IMS operator commands and keywords valid with DBCTL.

Chapter 5, “Operations with DBCTL” on page 53 and Chapter 6, “Recovery and restart operations” on page 77 contain information on using operator commands with DBCTL. For further guidance on the syntax of DBCTL operator commands, see the *IMS/ESA Operator's Reference* manual.

Note: The / used in these commands is the **default** command recognition character (CRC). For information on the usage of CRCs, see “Operator communication with DBCTL” on page 62.

Table 15 (Page 1 of 2). DBCTL operator commands and CICS equivalents

DBCTL operator command	CICS equivalent	Valid with CDBM
/CHANGE	None	Yes
/CHECKPOINT (simple form)	ACTIVITY KEYPOINT	Yes
/CHECKPOINT FREEZE or /CHECKPOINT PURGE (See Note 1)	CEMT PERFORM SHUTDOWN	No
/CHECKPOINT STATISTICS	CEMT PERFORM STATISTICS RECORD	Yes
/DBDUMP	CEMT SET DLIDATABASE DUMPDB	Yes
/DBRECOVERY	CEMT SET DLIDATABASE RECOVERDB	Yes
/DELETE	None	Yes
/DEQUEUE	None	Yes
/DISPLAY ACTIVE or /DISPLAY CCTL	CEMT INQUIRE TASK	Yes
/DISPLAY DATABASE	CEMT INQUIRE DATABASE	Yes
/DISPLAY DBD, /DISPLAY POOL, and /DISPLAY PSB	None	Yes
/ERESTART	SIT with START=AUTO resulting in EMER restart	No
/LOCK	None	Yes
/LOG	None	Yes
/MODIFY	None	No
/NRESTART CHECKPOINT 0	SIT START=COLD	No
/NRESTART (without CHECKPOINT 0)	SIT with START=AUTO resulting in WARM start	No
/PSTOP	None	Yes
/RMCHANGE	CBRC CHANGE	Yes
/RMDELETE	CBRC DELETE	Yes
/RMGENJCL	CBRC GENJCL	Yes

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Table 15 (Page 2 of 2). DBCTL operator commands and CICS equivalents

DBCTL operator command	CICS equivalent	Valid with CDBM
/RMINIT	CBRC INIT	Yes
/RMLIST	CBRC LIST	Yes
/RMNOTIFY	CBRC NOTIFY	Yes
/SSR	None	No (See Note 4)
/START DATABASE	CEMT SET DLIDATABASE . . . STARTED	Yes
/STOP DATABASE	CEMT SET DLIDATABASE . . . STOPPED	Yes
/STOP THREAD	CEMT SET TASK PURGE	Yes
/SWITCH OLDS (IMS/ESA 4.1, or later)	CEMT SET JOURNALNUM ADVANCE	Yes
/TRACE SET PI	CEMT INQUIRE|SET PITRACE	Yes
/UNLOCK	None	Yes
/VUNLOAD (IMS/ESA Version 5.1 or later)	None	Yes
MVS MODIFY jobname,RECONNECT	CEMT PERFORM RECONNECT	N/A — MVS command
MVS MODIFY jobname,STOP|DUMP	CEMT PERFORM SHUTDOWN IMMEDIATE	N/A — MVS command

Table 16. DBCTL operator commands and keywords

DBCTL operator command	Keyword(s)
/CHANGE	CCTL, PASSWORD, SUBSYS
/CHECKPOINT	FREEZE, PURGE, ABDUMP, SNAPQ
/DBDUMP	DATABASE
/DBRECOVERY	AREA, DATABASE
/DELETE	DATABASE, PASSWORD, PROGRAM
/DISPLAY	ACTIVE, AREA, CCTL, DATABASE, DBD, INDOUBT, MODIFY, OASN SUBSYS, OLDS, POOL, PROGRAM, PSB, SHUTDOWN STATUS, STATUS, TRACE
/ERESTART	CHECKPOINT, COLDBASE, COLDCOMM, COLDSYS, FORMAT, NOBMP
/LOCK	DATABASE, PROGRAM
/LOG	None
/MODIFY	ABORT, COMMIT, PREPARE
/NRESTART	CHECKPOINT 0, FORMAT, NOPASSWORD, PASSWORD
/PSTOP	REGION
/RMCHANGE	DBRC modifier
/RMDELETE	DBRC modifier
/RMGENJCL	DBRC modifier
/RMINIT	DBRC modifier
/RMLIST	DBRC modifier
/RMNOTIFY	DBRC modifier
/SSR	Commands and keywords from appropriate subsystem (for example, DB2)
/START	AREA, AUTOARCH, DATABASE, OLDS, PROGRAM, REGION|THREAD[1], WADS
/STOP	ADS, AREA, AUTOARCH, DATABASE, OLDS, PROGRAM, REGION|THREAD[1], WADS
/SWITCH	OLDS
/TRACE	SET, MONITOR, PI, PSB, TABLE
/UNLOCK	DATABASE, PROGRAM
/VUNLOAD	AREA

Note: THREAD is a synonym for REGION.

Appendix E. Using global user exit XDLIPRE to change PSB to be scheduled

This chapter contains Product-sensitive Programming Interface information.

To help with migration of applications from local DL/I to DBCTL, you can use the global user exit XDLIPRE to change the PSB name that the application program has scheduled at execution time. Figure 62 contains an example of XDLIPRE that you can copy and modify. Note that this example is provided for guidance only. See the *CICS/ESA Customization Guide* for programming information on global user exits.

```
*****************************************************************
* This is an example for global user exit XDLIPRE               *
*                                                               *
* It is invoked prior to any DLI call being passed to           *
* the local, remote, or DBCTL processors.                       *
*                                                               *
* A check is made for the presence of a PSB.                    *
* If not, a normal return is made                               *
*                                                               *
* If the PSB is in a predefined table, it is changed to a       *
* different value, and a normal return is made.                 *
*                                                               *
# * If not, set PSB name to blanks and normal return             *
*                                                               *
* In all cases,a trace entry is written describing the action   *
* taken, using TRACE-POINT 384  (hex '0180')                    *
*                                                               *
*****************************************************************
*                                                               *
* The first few instructions set up the global user exit        *
* environment, identify the user exit point, prepare for the use of*
* the exit programming interface, and copy in the definitions that *
* are to be used by the XPI function.                           *
*                                                               *
*****************************************************************
*
         DFHUEXIT TYPE=EP,ID=XDLIPRE    PROVIDE DFHUEPAR PARAMETER
*                                       LIST AND LIST OF EXITID
*                                       EQUATES
*
         DFHUEXIT TYPE=XPIENV           SET UP ENVIRONMENT FOR
*                                       EXIT PROGRAMMING INTERFACE
*                                       MUST BE ISSUED BEFORE ANY
*                                       XPI MACROS ARE ISSUED
*
```

Figure 62 (Part 1 of 6). Example of XDLIPRE user exit to change PSB names

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```
         COPY  DFHTRPTY                 DEFINE PARAMETER LIST FOR
*                                       USE BY DFHTRPTX MACRO
*
         COPY  DFHSMMCY                 DEFINE PARAMETER LIST FOR
*                                       USE BY DFHSMMCX MACRO
*
*****************************************************************
*The following DSECT maps a storage area to be used as work area *
*for the information in the TRACE entry.                        *
*****************************************************************
*
DSA      DSECT                          DSECT FOR GETMAINED STORAGE
         USING DSA,R7
*
RETCODE  DS    F                        store return code
MESSAGEA DS    F                        message address for trace
MESSAGEL DS    F                        message length for trace
MESSAGE  DS    0CL37
OLDPSB   DS    CL8
MESS1    DS    CL21
NEWPSB   DS    CL8
*
*****************************************************************
*The next  instructions  form  the  normal  start  of a global user *
*exit program, setting the program addressing mode to 31-bit, saving*
*the calling program's registers, establishing base addressing, and *
*establishing the addressing of the user exit parameter list.       *
*****************************************************************
*
DLIPR    CSECT
DLIPR    AMODE 31
*
         SAVE (14,12)                   SAVE CALLING PROGRAM'S RGSTRS
*
         LR    R11,R15                  SET UP USER EXIT PROGRAM'S
         USING DLIPR,R11                BASE REGISTER
*
         LR    R2,R1                    SET UP ADDRESSING FOR USER
         USING DFHUEPAR,R2              EXIT PARAMETER LIST -- USE
*                                       REGISTER 2 AS XPI CALLS USE
*                                       REGISTER 1
*
*****************************************************************
*Before issuing an XPI function call, set up addressing to XPI     *
*parameter list.                                                   *
*****************************************************************
*
         L     R5,UEPXSTOR              SET UP ADDRESSING FOR XPI
*                                       PARAMETER LIST
```

Figure 62 (Part 2 of 6). Example of XDLIPRE user exit to change PSB names

```
*********************************************************************
*  Before issuing an XPI function call, you must ensure that register*
*  13 addresses the kernel stack.                                    *
*********************************************************************
*
         L     R13,UEPSTACK            ADDRESS KERNEL STACK
*
*********************************************************************
*  Issue a GETMAIN to get storage for work area                     *
*********************************************************************
*
         USING DFHSMMC_ARG,R5          MAP PARAMETER LIST
*
         DFHSMMCX CALL,                                             X
               CLEAR,                                               X
               IN,                                                  X
               FUNCTION(GETMAIN),                                   X
               GET_LENGTH(100),                                     X
               STORAGE_CLASS(USER),                                 X
               SUSPEND(NO),                                         X
               OUT,                                                 X
               ADDRESS((R7)),                                       X
               RESPONSE(*),                                         X
               REASON(*)
*
*********************************************************************
*  SET UP THE NORMAL RETURN CODE                                    *
*********************************************************************
*
         LA    R6,UERCNORM
         ST    R6,RETCODE
*
*********************************************************************
*  See if a PSB exists                                              *
*********************************************************************
*
         L     R6,UEPPSBNX             PSB EXISTENCE FLAG
         TM    0(R6),UEPPSB1           PSB EXISTS?
         BO    PSBCALL                 YES
         MVC   MESSAGE,MESS3T          NO-MOVE MESSAGE TO DSA
         B     TRACE
*
*********************************************************************
*  See if we want to change a PSB name                              *
*********************************************************************
*
PSBCALL  EQU   *
         L     R6,UEPPSBNM             ADDRESS OF PASSED PSB NAME
         LA    R8,PSBS                 ADDRESS OF table of PSB pairs
         CLC   0(8,R6),0(R8)           SAME?
```

Figure 62 (Part 3 of 6). Example of XDLIPRE user exit to change PSB names

```
         BE    FOUND                    YES
         LA    R8,16(R8)                BUMP TO NEXT PAIR
         CLC   0(8,R6),0(R8)
         BE    FOUND
         LA    R8,16(R8)                BUMP TO NEXT PAIR
         CLC   0(8,R6),0(R8)
         BE    FOUND
         B     NOTFOUND                 NO MATCH - END
*
*********************************************************************
*  Move new PSB name in                                             *
*********************************************************************
*
FOUND    EQU   *
         MVC   0(8,R6),8(R8)
*
*********************************************************************
*  SET UP MESSAGE BLOCK FOR TRACE ENTRY FOR CHANGED NAME            *
*********************************************************************
*
         MVC   MESS1,MESS1T             SET UP MESSAGE
         MVC   NEWPSB,8(R8)             NEW PSB NAME
         MVC   OLDPSB,0(R8)             OLD PSB NAME
         B     TRACE                    GO PUT TRACE ENTRY
*
*********************************************************************
*  SET UP MESSAGE BLOCK FOR TRACE ENTRY FOR PSB NOT FOUND           *
#        *  SET UP THE NORMAL RETURN CODE                            *
*********************************************************************
*
NOTFOUND EQU   *
#        MVC   0(8,R6),DUMMYPSB
         MVC   MESS1,MESS2T             SET UP MESSAGE
         MVC   OLDPSB,0(R6)             SUPPLIED PSB NAME
         MVC   NEWPSB,=CL8' '           CLEAR FIELD
#        LA    R1,UERCNORM              SET UP NORMAL RETURN CODE
         B     TRACE                    GO PUT TRACE ENTRY
*
*********************************************************************
*  Issue trace put macro                                            *
*********************************************************************
*
TRACE    EQU   *
         LA    R6,MESSAGE               STORE ADDRESS...
         ST    R6,MESSAGEA              ...INTO BLOCK DESCRIPTOR
         LA    R6,L'MESSAGE             STORE LENGTH...
         ST    R6,MESSAGEL              ...INTO BLOCK DESCRIPTOR
         LA    R8,384                   SET UP TRACE-ID
*
```

Figure 62 (Part 4 of 6). Example of XDLIPRE user exit to change PSB names

```
         DROP  R5                       REUSE R5 TO MAP DFHTRPT
         USING DFHTRPT_ARG,R5           XPI PARAMETER LIST
*
         DFHTRPTX CALL,                                                X
               CLEAR,                                                  X
               IN,                                                     X
               FUNCTION(TRACE_PUT),                                    X
               POINT_ID((R8)),                                         X
               DATA1(MESSAGEA,MESSAGEL),                               X
               OUT,                                                    X
               RESPONSE(*)
*
*****************************************************************
*When the rest of the exit program is complete, free the storage   *
*and return.                                                       *
*****************************************************************
*
         DROP  R5                    REUSE REGISTER 5 TO MAP DFHSMMC
         USING DFHSMMC_ARG,R5        XPI PARAMETER LIST
*
*****************************************************************
*  Issue the DFHSMMCX macro call                                  *
*  Store the return code in register 6                            *
*****************************************************************
*
         L     R6,RETCODE              PICK UP SAVED RETURN CODE
*
         DFHSMMCX CALL,                                                X
               CLEAR,                                                  X
               IN,                                                     X
               FUNCTION(FREEMAIN),                                     X
               ADDRESS((R7)),                                          X
               STORAGE_CLASS(USER),                                    X
               OUT,                                                    X
               RESPONSE(*),                                            X
               REASON(*)
*
*****************************************************************
*Restore registers, set return code, and return to user exit handler*
*****************************************************************
*
         L     R13,UEPEPSA
         ST    R6,16(13)               STORE INTO R15 SLOT OF SA
         RETURN (14,12)
*
*****************************************************************
*old and new PSB names, in pairs                                  *
*****************************************************************
*
```

Figure 62 (Part 5 of 6). Example of XDLIPRE user exit to change PSB names

```
PSBS     EQU   *
         DC    CL8'PC3CONEW'            VALID
         DC    CL8'PC3CONE2'            VALID
         DC    CL8'PC3FRED'             INVALID
         DC    CL8'PC3CONEW'            VALID
         DC    CL8'PC3JOE'              INVALID
         DC    CL8'PC3JOEX'             INVALID
*
MESS1T   DC    CL21' HAS BEEN CHANGED TO '
MESS2T   DC    CL21' WAS NOT FOUND'
MESS3T   DC    CL37'THIS WAS NOT A DLI SCHEDULE CALL'
#        DUMMYPSB DC    CL8' '
         LTORG
         END   DLIPR
```

Figure 62 (Part 6 of 6). Example of XDLIPRE user exit to change PSB names

Glossary

ABORT. Two-phase commit consists of the PREPARE and COMMIT phases. Within the COMMIT phase, there are two possible actions: COMMIT and ABORT. The ABORT action for data belonging to full function DL/I databases is **backout**. There is no backout for data belonging to DEDBs, because it has not been written to the database before the COMMIT phase. The effect of an ABORT on DEDBs is also referred to as an **undo**. Because a CICS thread may be accessing data belonging to both full function DL/I databases and DEDBs, we use the term ABORT to refer to both backout and undo.

ACB (application control block). Created from the output of DBDGEN and PSBGEN and placed in the ACB library (ACBLIB) for use during online and DBD region type execution of IMS.

active. In an XRF environment, active describes the system that is currently supporting processing requests.

ADS (area data set). A copy of a DEDB area. You can have up to seven copies of the same area, which are all automatically maintained in synchronization.

AGN (application group name). DBCTL views the set of PSBs that can be accessed by one particular CICS system or BMP as a single entity, known as an **application group**. Application groups, and the names of the resources within those groups, are placed in tables in DBCTL's security matrix data set(s) using the IMS security maintenance utility. An AGN for a CICS system is specified in the DRA startup table. When a CICS system requests connection to DBCTL, RACF checks against its resource class table to ensure that the AGN being specified authorizes it to connect to that DBCTL subsystem.

alternate. In an XRF environment, alternate describes system that is standing by waiting to take over the workload when the active system fails or a takeover is initiated.

alternate TP PCB. An alternate TP (transaction processing) PCB defines an alternate destination (a logical terminal or a message program) and can be used instead of the I/O PCB when it is necessary to direct a response to a terminal. Alternate TP PCBs appear in PSBs used in a CICS-DBCTL environment, but are used only in an IMS/VS DC or IMS/ESA TM environment. CICS applications using DBCTL cannot successfully issue requests that specify an alternate TP PCB, an MSDB PCB, or a GSAM PCB. However, a PSB that contains PCBs of these types can be scheduled successfully in a CICS-DBCTL environment. Alternate PCBs are included in the PCB address list returned to a call level application program The existence of alternate PCBs in the PSB affects the PCB number used in the PCB keyword in an EXEC DLI application program.

AMODE (addressing mode). Refers to whether program addresses are 24 or 31 bits.

AOR (application-owning region). A CICS address space whose primary purpose is to manage application programs. It receives transaction routed requests from a terminal-owning region (TOR). It may also contain file related resources in a system that does not have a database-owning region (DOR). See also **DOR (database-owning region)** and **TOR (terminal-owning region)**.

APPLID. Operand of the CICS system initialization table that specifies the 1- to 8-character application name of a CICS system. It is the name by which the CICS system is to be known to other systems or regions.

AVM (MVS availability manager). Handles communication between active and alternate IMS XRF systems. See also **CAVM (CICS availability manager)**.

BMP (batch message processing program). BMPs are application programs that perform batch type processing online and can access databases controlled by DBCTL. You can run the same program as a BMP or as a batch program.

call. An instruction in COBOL, assembler, or PL/I that is used by an application program to request DL/I services. It does not require translation. Contrast with **command**.

CAVM (CICS availability manager). Handles communication between active and alternate CICS systems in a CICS system with XRF. See also **AVM (MVS availability manager)**.

CCTL (coordinator control subsystem). This refers to the transaction management subsystem that communicates with the DRA, which in turn communicates with DBCTL. In a CICS-DBCTL environment, the CCTL is CICS. The term is used in a number of IMS operator commands that apply to DBCTL, and in the IMS manuals.

checkpoint. For ***applications***, a point at which the program commits that the changes it has made to the database are consistent and complete, and releases database segments for use by other programs. You can request checkpoints at appropriate points in a

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program to provide places from which you can restart that program if it, or the system, fails.

For ***systems***, a point in time from which IMS can start again if a failure makes recovery necessary. The checkpoint is performed by IMS itself.

CI (control interval). The unit of information transmitted to or from auxiliary storage by VSAM, independent of logical record size.

CICS monitoring facility. The CICS monitoring facility gives a comprehensive set of operational data for CICS, using a data recording program. Data is normally output to the system in SMF data sets.

cold start. The standard initialization sequence that is performed by the system initialization program without regard for prior system activity.

command. In CICS, an instruction similar in format to a high-level programming language statement. CICS commands usually include the verb EXECUTE (abbreviated to EXEC), and can be issued by an application program to make use of CICS facilities. With DL/I, the format of the command is EXEC DLI. Commands require processing by the CICS translator. Contrast with **call**.

CRC (command recognition character). A character that denotes a DBCTL operator command. DBCTL operator commands have / as their default CRC. You can override the default CRC on the DBCTL job, but remember that ***each DBCTL subsystem within an MVS image must have a unique CRC*** and that CRC must be unique with respect to every other subsystem on the processor, not just DBCTL subsystems. If you are using the CICS-supplied operator transaction, CDBM, to issue operator commands to DBCTL, you must use the default CRC, even though your DBCTL is using some other CRC.

CRLP (card reader/line printer). Or in-stream sequential terminal. Can be used as a means of automating connection to a different DBCTL or to connect automatically when CICS was not connected to DBCTL at shutdown.

data availability. Data availability is an IMS enhancement available with DBCTL. It allows PSB scheduling to complete successfully even if some of the full function databases it requires are not available.

database integrity. The protection of data items in a database while they are available to any application program. Protection includes isolating the effects of concurrent updates to a database by two or more application programs.

database organization. The physical arrangement of related data on a storage device. DL/I database organizations are hierarchical.

database record. (1) A collection of DL/I data elements known as **segments** that are hierarchically related to a single root segment. (2) In a DL/I or IMS database, a root segment and all its descendant segments.

database reorganization. The process of unloading and reloading a database to optimize physical segment adjacency, or to modify the DBD.

data sharing. An IMS term. Data sharing can be done at:

- **Block level**, which allows multiple subsystem access to the same database, controlled by means of a lock manager.
- **Database level**, which allows application programs in one IMS subsystem to read data while another program in another IMS subsystem reads from, or updates, the same database.

DBCTL. DBCTL is an interface between CICS/ESA and IMS/ESA that allows access to IMS DL/I full function databases and to Data Entry Databases (DEDBs) from one or more CICS systems without the need for data sharing. It also provides release independence, virtual storage constraint relief, operational flexibility, and failure isolation.

DBD (database description). In IMS, the collection of macro parameter statements that describes an IMS database. These statements describe the hierarchical structure, IMS organization, segment length, sequence fields, and alternate search fields. They are assembled to produce database description blocks.

DB PCB (database PCB). A PCB that supports communication between an application program and a database.

DBRC (database recovery control). An IMS facility that maintains information needed for database recovery, generates recovery control statements, verifies recovery input, maintains a separate change log for database data sets, and supports sharing of IMS DL/I database by multiple IMS systems.

DDIR (database directory). A list of data management blocks (DMBs) that define for DL/I the physical and logical characteristics of databases that are used by application programs. A CICS SIT parameter of the same name specifies a suffix to identify a DDIR.

DEDB (data entry database). In IMS, a direct-access database originally provided in the Fast Path feature. DEDBs can be divided into ***independent*** areas, which

increases availability of data. DEDBs provide a high level of availability for, and efficient access to, large volumes of data. They are hierarchic structures that contain a special type of segment called a sequential dependent segment (SDEP) that is used for fast collection of information and is useful, for example, in journaling and auditing applications. Applications that access DEDBs can also use subset pointers, which allow more efficient processing of long segment chains. The database is accessed using Media Manager, which is a component of Data Facility Product (DFP).

DFHDBAT. The interface between the DRA and CICS. DFHDBAT adapts CICS's calls to the DRA's interface when accessing DBCTL databases. See also **DRA (database resource adapter)**.

DFHDBCON. DFHDBCON, the DBCTL connection program, is invoked during connection to DBCTL.

DFHDLI. The CICS DL/I router module. Determines whether a DL/I request should be processed by local DL/I, remote DL/I, or passed to DBCTL.

DFH$INDB. DFH$INDB, the CICS-supplied sample in-doubt resolution program helps you decide whether to commit or backout updates that are in-doubt after CICS has disconnected abnormally from DBCTL. DFH$INDB produces a list of in-doubts, plus the action needed to resolve each one.

DIB (DL/I interface block). Whenever you issue an EXEC DLI command, DL/I responds by storing the information in the DIB in your program. It is inserted automatically into your program by the CICS translator. See also **DIBSTAT**.

DIBSTAT. The DL/I status code, which is contained in the DIB. It indicates the success (or otherwise) of your EXEC DLI command.

DL/I (Data Language/I). A high-level interface between applications and IMS. It is invoked from PL/I, COBOL, or Assembler language, or (for command-level only) C language. by means of ordinary subroutine calls. DL/I enables you to define data structures, to relate structures to the application, and to load and reorganize these structures. It enables applications programs to retrieve, replace, delete and add segments to databases. See also **command**.

DMB (data management block). An IMS control block that resides in main storage and describes and controls a physical database. It is constructed from information obtained from the application control block (ACB) library or the database description (DBD) library.

domain. A logical grouping of CICS function; for example, the storage domain or the monitoring domain.

DOR (database-owning region). A CICS address space whose primary purpose is to manage files and databases. See also **AOR (application-owning region)** and **TOR (terminal-owning region)**.

DRA (database resource adapter). The architected interface that enables DBCTL databases to be accessed from CICS.

DRA control exit. Enables the DRA to pass information from itself and DBCTL independently of CICS. It is invoked whenever the DRA needs to determine whether to continue processing, as follows:

- The DRA successfully connects to DBCTL
- DBCTL is terminated normally using /CHECKPOINT FREEZE or /CHECKPOINT PURGE
- An attempt to connect to DBCTL fails
- A CICS INIT request is canceled
- The DRA fails.

DRA startup parameter table. The DRA startup parameter table provides the parameters needed to define a DBCTL subsystem.

equivalent. In an XRF environment, equivalent describes DBCTL subsystems that are defined as members of the same RSE. See also **RSE (recoverable service element)** and **RST (recoverable service table)**.

full function databases. Full function databases are hierarchic databases that can be accessed using DL/I and can be processed by batch programs and BMPs.

function shipping. The process by which CICS accesses resources on another CICS system. The process is transparent to application programs. See also **remote DL/I**.

generic APPLID. The name by which the active-alternate pair of CICS systems is known to other systems or regions.

gigabyte. The exact value 1 073 741 824.

global user exit. A global user exit is a point in a CICS module at which CICS can pass control to a program that you have written (known as an **exit** program), and then resume control when your program has finished. When an exit program is enabled for a particular exit point, the program is called every time the exit point is reached. Global user exits used with DBCTL are: XDLIPRE and XDLIPOST, XRMIIN and XRMIOUT; plus XXDFA, XXDFB, and XXDTO, which are used with XRF. See also **task-related user exit**.

HSSP (high speed sequential processing). An IMS/ESA Version 3 facility. HSSP is useful with applications that do large scale sequential updates to DEDBs. It can reduce DEDB processing time, enables

an image copy to be taken during a sequential update job, and minimizes the amount of log data written to the IMS log. See also **DEDB (data entry database)**.

IMS monitor. An IMS monitoring tool, which can be run online, unlike the IMS DB monitor which can be run in batch only. DBCTL enables CICS users who do not have an IMS/ESA DM/TM system to use the IMS monitor.

in-doubt. Refers to a piece of work that is pending during commit processing. If commit processing fails between polling of subsystems and the decision to execute the commit, recovery processing must resolve the status of any work that is in-doubt.

in-flight. Refers to a piece of work that is being processed when a system failure occurs.

I/O PCB. An input/output PCB that is needed to issue DBCTL service requests.

IRLM (internal resource lock manager). A global lock manager that resides in its own address space, and gives the option of keeping most of its control blocks in local storage instead of in the common storage area (CSA). You must use the IRLM to maintain data integrity if you are sharing databases at block level. (For VSAM databases, a block is a control interval (CI); for any other kind of database, it is a physical block.) You also need the IRLM to process a set of common databases from multiple IMS/ESA (or CICS/ESA) subsystems. You may optionally use the IRLM in a database level sharing environment for improved integrity for read-only subsystems. The IRLM is also the lock manager used by DATABASE 2 (DB2).

JES (job entry subsystem). The subsystem used in CICS with XRF to route commands and queries from the alternate to the active system.

journal. A set of one or more data sets to which records are written during a CICS run:

- By CICS to implement user-defined resource protection (logging to the system log)
- By CICS to implement user-defined automatic journaling (to any journal, including the system log)
- Explicitly by JOURNAL command (or macro) from an application program (user journaling to any journal including the system log).

KB (kilobyte). The abbreviation KB (as in 1KB) represents the exact value of 1024.

linkage editor. A processing program that prepares the output of language translators for execution. It combines separately produced object modules, resolves symbolic cross-references among them, and produces executable code that is ready to be fetched or loaded into virtual storage.

local DL/I. DL/I residing in the CICS address space.

LP (logical partition). A partition, in a CEC, capable of running its own MVS image. It comprises a set of hardware resources (processors, storage, channels, and so on, sufficient to allow a system control program such as MVS to execute.

LUW (logical unit of work). In CICS, a sequence of processing actions (for example, database changes) that must be completed before any of the individual actions can be regarded as committed. An LUW begins when a task starts or at a **syncpoint** you specified, and ends at a syncpoint you specified or when a task ends. If you do not specify any syncpoints, an entire task will be an LUW.

If changes are committed when the LUW completes successfully and the syncpoint is recorded on the system log, these changes do not need to be backed out if there is a subsequent failure of the task or system. See also **unit of recovery** and **syncpoint**.

MB (megabyte). The abbreviation MB (as in 1MB) represents the exact value of 1 048 576.

monitoring. In CICS, data produced on timing and resources used by ***a task or a logical unit of work (LUW)***. Note that CICS distinguishes between monitoring and statistics, but IMS does not. See also **statistics**.

multi-MVS environment. An environment that supports more than one MVS image. See also **MVS image**.

MVS image. Can be a physical processing system (such as an IBM 3090), which can be partitioned. Each partition, which has one or more processors, is an MVS image.

NODHABEND. A keyword on the EXEC DLI SCHD PSB command. Used to prevent DHxx abends being issued after PSB schedule request failures that may have been caused by unavailable databases. Prevents end users seeing abends unnecessarily, enables the application to deal with the situation in a more user-friendly way, and avoids the need to code global HANDLE ABEND commands.

OASN (origin application schedule number). An IMS recovery element in an external subsystem (for example, DB2). The OASN is equivalent to the unit of recovery ID in the CICS recovery token. It is coupled with the IMS ID to become the recovery token for LUWs in external subsystems. You can display it using the DBCTL operation command /DISPLAY and then use the /CHANGE SUBSYS OASN RESET command to purge incomplete LUWs.

OLDS (online log data set). A data set on direct access storage that contains the log records written by DBCTL. When the current OLDS is full, IMS continues logging to a further available OLDS.

overseer. A CICS program running in its own address space that provides status information about active and alternate CICS systems. You can use it to automate a restart of failed regions.

PAPL (participant adapter parameter list). A component of the DRA. See also **DRA (database resource adapter)**.

PAPLRETC. The response code field from the DRA.

PCB (program communication block). An IMS control block that describes an application program's interface to an IMS database or, additionally, for message processing and batch message processing (BMP) programs, to the source and destination of messages. See also **PSB (program specification block)**.

PDIR (PSB directory). Contains entries defining each PSB to be accessed using local DL/I. Also contains entries for remote PSBs, to which requests are function-shipped using remote DL/I. A CICS SIT parameter of the same name specifies a suffix for the PDIR.

physical partition. Part of a CEC that operates as a CEC in its own right, with its own copy of the operating system.

PI (program isolation). An IMS facility that protects all activity of an application program from any other active application program until that application program indicates, by reaching a syncpoint, that the data it has modified is consistent and complete.

PSB (program specification block). An IMS control block that describes databases and logical message destinations used by an application program. A PSB consists of one or more program communication blocks (PCBs). See also **PCB (program communication block)**.

pseudo recovery token. A pseudo recovery token consists of 8 decimal characters, which can be used in place of the recovery token in certain circumstances. For example, a pseudo recovery token is displayed when the status of an application thread is in-doubt. It is made shorter so that it is easier to make note of and enter, for example, in certain DBCTL commands. See also **recovery token**.

PST (partition specification table). An IMS control block that contains information about a dependent region; for example, type of region, data transferred by DL/I, and status codes. In a CICS-DBCTL environment, the dependent region is CICS.

RDS (restart data set). An IMS direct access data set used to contain system checkpoint ID information written during the logging process. The information is used when restarting IMS (DBCTL). This checkpoint information is contained in a table called the checkpoint ID table, which contains an entry for each checkpoint taken. During restart, IMS uses the table to determine from which checkpoint restart should take place. IMS finds the information it needs and uses it automatically. If the RDS is not available at restart, you can obtain the checkpoint information needed from the log, but this may lengthen the restart process.

(RECON) recovery control data sets. DBRC automatically records information in dual recovery control (RECON) data sets. Both data sets contain identical information, and so are usually referred to as one — the RECON. You need the information from the RECON during warm and emergency restarts. DBRC selects the correct data sets to be used by a recovery utility for you when you enter a GENJCL command. For a restart, the RECON shows which data set — the OLDS or the SLDS — contains the most recent log data for each database data set (DBDS) you have registered with DBRC. For the OLDS, the RECON shows whether the OLDS has been closed and whether it has been archived. The RECON contains timestamp information for each log data set and volume. You use this information to determine which data set and volume contain the checkpoint information needed to restart DBCTL.

recovery token. A recovery token is a 16-byte unique identifier that is created by CICS (and passed to DBCTL) for each LUW. Its lifetime is the same as the LUW. The first 8 bytes are the CICS APPLID (in an XRF environment, this is the generic APPLID) and the second 8 bytes are a unit of recovery ID. (CICS creates a unit of recovery ID for every LUW.) DBCTL validates the recovery token to protect against duplication of units of recovery. The DBCTL operator can display the recovery token by using the /DISP CCTL command. It is also displayed in a number of CICS and IMS messages. See also **pseudo recovery token**.

redo. A DEDB term, which is more or less analogous to the full function DL/I term COMMIT. It has the same aim, but the means of achieving it are different. For DEDBs, if phase two action is COMMIT, the changes must be written to the database using REDO, because the DEDB changes have only been made in main storage.

REDO is also used to refer to the action required for committed DEDBs during emergency restart of IMS. You can determine from the log that a COMMIT was

initiated, but that phase two is not indicated as complete. In this case, DEDB updates must be REDOne.

remote DL/I. Done by means of function shipping, in which CICS sends a DL/I request to another CICS system. See also **function shipping**.

return code equate. An alphameric equivalent of a numeric return code, such as UERCNOAC for "take no action." In DBCTL, return code equates are used in the XRF global user exits XXDFA, XXDFB, and XXDTO.

RMI (resource manager interface). A program or a group of programs that enable you to structure calls from your CICS system in such a way that they can access non-CICS resources, such as databases, that you would not normally be able to access. An RMI is written using the CICS task-related user exit interface. DBCTL is accessed by means of a CICS-supplied RMI. See also **task-related user exit**.

RMODE (residency mode). Specifies where a program is expected to reside in virtual storage. RMODE 24 indicates that a program is coded to reside in virtual storage below the 16MB line. RMODE ANY indicates that a program is coded to reside anywhere in virtual storage.

RIS (recoverable in-doubt structure). When a failure occurs, an RIS is constructed for each unit of recovery and is written to the IMS log. Its contents include the recovery token, the changed data records, and the identity of the data block that cannot be accessed because of unresolved in-doubts.

RSE (recoverable service element). Each recoverable service element (RSE) contains a set of DBCTL subsystem identifiers of equivalent DBCTL subsystems together with their associated job names, and the specific APPLIDs of the CICS systems that will use them.

When CICS attempts to connect to DBCTL using a particular startup table, it attempts to connect using the specific subsystem ID associated with that startup table, or any other DBCTL subsystem ID in the RSE to which the specific subsystem ID belongs. See also **equivalent** and **RST (recoverable service table)**.

RST (recoverable service table). A suffixable table, specified in the CICS system initialization table (SIT). You use the CICS RST to define the relationships between your DBCTL subsystems (DBCTL is a subsystem to MVS) and CICS systems. The RST consists of a set of recoverable service elements (RSEs).

CICS can use the RST when connecting to a DBCTL system, or when a connection to a DBCTL system fails. A CICS alternate can also use the RST to determine whether it is authorized to cancel a particular DBCTL subsystem. See also **equivalent** and **RSE (recoverable service element)**.

SCHEDULE PSB. An application schedules a PSB to obtain access to PCBs. See also **PCB (program communication block)** and **PSB (program specification block)**.

scheduling. Selecting jobs or tasks that are to be run.

single-MVS environment. An environment that supports one MVS image. See also **MVS image**.

SIT (system initialization table). A CICS table that contains user-specified information to initialize and control system functions, module suffixes for selection of user-specified versions of CICS modules and tables, and information used to control the initialization process. You can generate several SITs and then select the one that best meets your current requirements at initialization time.

SLDS (system log data set). When the OLDS is full, it is archived as an SLDS. An SLDS can be on DASD or tape. The contents are used as input to the database recovery process. See also **OLDS (online log data set)** and **WADS (write ahead data set)**.

snap dump. A snap (or snapshot) dump can be requested by a task at any time during which that task is being processed.

startup job stream. A set of job control statements used to initialize CICS.

statistics. In CICS and IMS, data produced on timing and resources used by the system as a whole over a specified period of time. Note that CICS distinguishes between monitoring and statistics, but IMS does not. See also **monitoring**.

subsystem. A secondary or subordinate system of the main system; for example, DBCTL, which is a subsystem to MVS.

SVC (supervisor call). An instruction that interrupts the program being executed and passes control to the supervisor so that it can perform a specific service indicated by the instruction.

syncpoint. A syncpoint (or synchronization point) is a logical point in execution of an application program where the changes made to the databases by the program are consistent and complete and can be committed to the database. The output, which has been held up to that point, is sent to its destination(s), the input is removed from the message queues, and the database updates are made available to other applications. CICS recovery and restart facilities do not

backout updates prior to a syncpoint if the program has terminated abnormally.

A syncpoint is created by any of the following:

- A DL/I CHECKPOINT command or CHKP call
- A DL/I TERMINATE command or TERM call
- A CICS syncpoint request
- An end of task or an end of program.

See also **LUW (logical unit of work)**.

SYSPLEX (systems complex). In an MVS/ESA SP 4.1 (or later) environment, a set of one or more MVS systems given an XCF name and in which programs in these systems can then use XCF services.

takeover. In XRF, the shift of workload from the active to the alternate CICS system, and the switching of resources needed for this to happen.

task-related user exit. A task-related user exit enables you to write a user exit program that is associated with specified events in a particular task, rather than with every occurrence of a particular event in CICS processing (as is the case with global user exits). Task-related user exits can be used to build a resource manager interface (RMI) that enables you to access non-CICS resources, such as databases. DBCTL is accessed by means of a CICS-supplied RMI. See also **global user exit** and **RMI (resource manager interface)**.

TCB (task control block). An MVS concept. Anything in the operating system needs a TCB to execute. In a non-DBCTL environment, CICS needs only one TCB. DBCTL provides a separate TCB for each CICS application thread, which significantly improves the amount of concurrent processing. See also **thread**.

thread. A CICS application thread provides a two-way link between an application and DBCTL. It is the representation in DBCTL of a CICS transaction when that transaction issues a DL/I request to DBCTL. The DRA creates a thread for each transaction when it first schedules a PSB. The thread is terminated and made available for other work at syncpoint or when an abend occurs. It identifies the transaction's existence, traces its progress, sets aside the resources it needs to be processed, and delimits its accessibility to other resources. You can display and stop threads using IMS operator commands. You can use them in problem determination and in performance tuning, because they are displayed (as recovery tokens) in various messages, traces, dumps, and thread activity is included in DBCTL statistics. See also **recovery token** and **TCB (task control block)**.

TOR (terminal-owning region). A CICS address space whose primary purpose is to manage terminals. See also **AOR (application-owning region)** and **DOR (database-owning region)**.

tracking. In XRF, monitoring of terminals in the active CICS system by the alternate CICS system.

two-phase commit. A two-step process by which recoverable resources in an IMS system and a CICS system are committed. During the first step, the subsystems are polled to ensure that they are ready to commit. If they all respond positively, they are then instructed to execute commit processing.

UIB (user interface block). Whenever you issue an DL/I call, DL/I responds by storing the information in the UIB in your program. You should only include the UIB in your application program if it is to be referenced. The UIB is acquired by the interface routine when an application issues a schedule request specifying a pointer reference to be set with the address of the UIB. Information on the success (or otherwise) is returned to UIBFCTR and UIBDLTR.

undo. A DEDB term, which is more or less analogous to the full function DL/I term BACKOUT. It has the same aim, but the means of achieving it are different. The difference is in the stage at which updates are written to the database. For DEDBs, if phase two action of two-phase commit is ABORT, no changes have to be made to the database, because the changes are still in main storage, and can be UNDOne from there.

unit of recovery. In DBCTL, a unit of recovery is created for each processing request when the first DL/I update request is received from CICS and is kept until a two-phase commit is complete. A unit of recovery is more or less synonymous with a CICS LUW, except that it begins when the first DL/I request is received from CICS, and not when the CICS task begins. See **LUW (logical unit of work)**.

user-replaceable program. A CICS-supplied program that is always invoked at a particular point in CICS processing as if it were part of CICS code. The program contains points at which you can enter your own code. DFHDBUEX is a user-replaceable program for use with DBCTL.

WADS (write ahead data set). A data set that contains log records that reflect committed operations but are not yet written to an **OLDS (online log data set)**.

XCF (Cross Systems Coupling Facility). A facility of MVS/ESA SP 4.1 (or later) that provides some initial MVS services needed to support a multisystem environment while still maintaining a single system image. Systems coupled using XCF are known as an XCF **SYSPLEX**.

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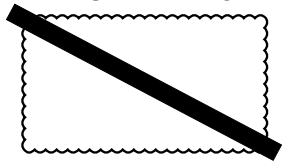

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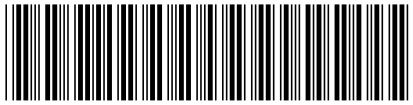

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