



Licensed Program Specifications

IMS Version 9 Program Number 5655-J38

Information Management System (IMS™) Version 9 is a licensed program that operates under the IBM z/OS® operating system. IMS includes an enterprise database server that provides hierarchical database management services and a strategic enterprise transaction server that provides data communications and transaction management services.

The IMS Version 9 Database Manager (IMS DB) provides database management for transaction managers such as IMS Version 9 Transaction Manager and Customer Information Control System (CICS®). The IMS Version 9 Database Manager processes concurrent database calls for a wide variety of applications.

Application programs access databases through IMS DB and its data manipulation language, Data Language/I (DL/I).

The IMS Version 9 Transaction Manager (IMS TM) provides a database-independent, transaction processing environment for database managers such as IMS Version 9 Database Manager and DATABASE 2™ for z/OS™ (DB2® for z/OS, hereafter referred to as DB2).

The IMS Version 9 Transaction Manager:

- Manages an IMS TM terminal network
- Stores and shares IMS message queues among multiple IMS TM systems and routes messages between terminals and applications
- Provides connectivity to other IMS TM subsystems and non-IMS TM subsystems
- Provides connectivity and Web solutions by working with:
 - WebSphere® Application Server Enterprise Edition V4.0.1
 - WebSphere Studio Application Developer Integration Edition V4.1.1

- Schedules application programs to access IMS DB databases or DB2 databases (or both), and non-database files through the Generalized Sequential Access Method (GSAM)
- Provides system control facilities for system definition, restart, recovery, performance, and tuning
- Runs continuously through the year with no required shutdown for Daylight Saving Time

Highlights of New Function

The following sections describe the new major functions of IMS Version 9.

Information Integration and Open Access Enhancements

This section describes the major IMS Version 9 enhancements to IMS DB and TM that affect information integration.

Greater than 255 Transaction Classes: You can assign scheduling-class values for a transaction. These values allow you to isolate, organize, or retrieve certain transactions based on the class value. Prior to IMS Version 9, the maximum number of transaction-scheduling-class values was 255. The maximum value is now 999.

IMS Java Remote Database Services: IMS Version 9 provides IMS Java application programs distributed access to IMS databases through the IMS Java Remote Database Services. Your non-z/OS application programs can access IMS DB data over the Internet using a secure protocol with local or global transaction semantics and a standard application programming interface (API).

The IMS Java Remote Data Services allow you to deploy a client application program on a distributed WebSphere server that can access IMS DB data. The distributed WebSphere server can run on any platform, such as Linux or Windows.

IMS Web Services Support: The IBM WebSphere family of products provide Web services support that enables you to publish existing IMS transactions, including MFS-based IMS transactions, to the Internet as Web services, and connect to IMS using Simple Object Access Protocol (SOAP) and Enterprise JavaBean (EJB) bindings.

Web services are language- and platform-independent network-accessible programs that provide application-to-application communication using the Internet. With the WebSphere Studio Application Developer Integration Edition Web services support, you can transform existing IMS application programs into Web services. These application programs can be written in C, COBOL, or they can be MFS-based. You deploy IMS Web services to a WebSphere Application Server.

Integrated IMS Connect Support: As of IMS Version 9, the functionality of the IMS Connect product (program number 5655-K52), Version 2.2, is included as part of IMS.

IMS Connect 2.2 will continue to be supported for IMS Version 7 and IMS Version 8 clients, but future enhancements to the Connect functionality will be made available only with IMS Version 9 or later.

LU 3 Devices with ETO: With IMS Version 9, the Initialization exit routine (DFSINTX0) has new parameters to allow an ETO logical unit type 3 (LU 3) device can log on to IMS as either a secondary LU type 1 (SLU 1) or a 3270 printer (3270P) device.

MNPS Replacement of XRF USERVAR: IMS Version 9 provides an alternative to using an IBM 3745 Controller for XRF class-1 terminal support. IMS XRF users can now use VTAM multinode persistent session (MNPS) support for takeover of VTAM terminals in an XRF tracking environment. If your XRF environment uses MNPS, you can also use VTAM Generic Resources for that environment.

In the case of an operating system failure, MNPS performs a forced takeover of active sessions and reopens the sessions for the alternate IMS system. Forced Takeover support requires z/OS 1.6 or later.

OTMA Serviceability and Usability Enhancements: IMS provides the following new functions for OTMA:

- OTMA clients can now set the ACEE security aging value for user IDs in the OTMA message prefix without requiring the client to reconnect to OTMA.
- The OTMT table-trace entries for the OTMA user exit routines OTMA Prerouting Exit Routine (DFSYPX0) and OTMA Destination Resolution Exit Routine (DFSYDRU0) are now standardized.
- The DFSYPX0 user exit routine for OTMA can set the OTMA destination TPIPE name.

RACF Enhancements to Replace SMU: IMS provides support for security features that are currently available through Security Maintenance utility (SMU) security, but were not available through the SAF interface. With these enhancements, you can convert completely to using RACF (or an equivalent product), and eliminate the use of SMU security.

Attention: IMS Version 9 is the last IMS release that will support SMU security.

Sharing TM Resources in an IMSplex with RM: IMS Version 9 adds a new STM= keyword to the DFSDCxxx PROCLIB member. STM=YES (the default value) indicates that IMS is to share IMS Transaction Manager resources when a resource structure is being used by Resource Manager (RM) in an IMSplex. These resources include terminals, users, user IDs, LTERMs, MSNAMEs, and APPC descriptors. Including the STM=YES keyword is equivalent to prior-release IMS function, which enabled TM resource sharing automatically if a structure exists.

STM=NO indicates that IMS is not to share IMS Transaction Manager resources when a resource structure is being used by RM in an IMSplex.

XML Database Support: IMS Version 9 allows you to store and retrieve XML data in IMS databases using a predefined mapping between the elements and attributes of an XML document and the hierarchic structure of the IMS database. Using the XML database support provided by IMS Version 9, you can:

- Compose XML documents from data in existing IMS databases, including HDAM,

HIDAM, HISAM, PHDAM, and PHIDAM databases.

- Store XML documents into new or existing IMS databases.

You can write IMS Java applications to compose and receive XML documents in all of the environments that are supported by IMS Java: IMS Java JMP or JBP application programs, WebSphere EJBs, CICS application programs, or DB2 stored procedures.

XML Transaction Support: IBM WebSphere Studio Enterprise Edition Version 5 can generate XML converters that allow IMS COBOL applications to transform and generate XML documents. The IBM Enterprise COBOL and PL/I compilers provide a PARSE keyword that allows new or modified COBOL or PL/I application programs to parse incoming XML documents. IMS Java application programs can use the XML Toolkit for OS/390 to parse XML documents.

You can send and receive XML documents in IMS transactions and process these XML documents in IMS COBOL or PL/I application programs. An XML transaction for IMS must have an EBCDIC transaction code.

Scalability Enhancements

This section describes the major IMS Version 9 enhancements to IMS DB and TM that affect scalability.

DBRC Enhancements: There are seven major DBRC enhancements for IMS Version 9:

- Command authorization for /RM commands
This enhancement extends the command authorization that is currently available for batch DBRC commands to the online (/RMxxxxxx) commands. Namely, you now have the ability to use a security product (such as RACF), a security exit routine, or both, for /RMxxxxxx commands.
- Move DBRC modules above the 16 MB line
This enhancement consists of moving two DBRC load modules (DSPCINT1 and DSPURX00) into private and common storage above the 16 MB line.
- Eliminate the DSPSLDRC part from DBRC

This enhancement is mostly an internal IMS code cleanup. It is the combination of two similar DSECTs into one. As of IMS Version 9, DBRC uses PRILOG RECON record mapping instead of PRISLD RECON record mapping.

- Provide support for large block sizes on tape

This enhancement provides support for tape block sizes greater than 32 760 bytes for the output from the Database Image Copy utility (DFSUDMP0) and the Online Database Image Copy utility (DFSUICP0). There is a hardware dependency for this enhancement.

- Allow IMS to use an OLDS for restart when ERROR=CLOSE

This enhancement allows IMS to restart using DBRC to tell IMS which log in an online log data set (OLDS) to read next, even if that OLDS is marked ERROR=CLOSE and might not yet be closed. This enhancement removes an internal error condition. You must still process the OLDS using the Log Recovery utility (DFSULTR0) before you can archive it or use it as input to any utility.

- Check secondary WADS at restart

This enhancement causes IMS, during restart, to check the secondary WADS for additional information that might not be in the primary WADS.

- DBRC Application Programming Interface (API)

The DBRC API is a release-independent, assembler macro interface to DBRC that customer-written application programs use to obtain services from DBRC. The application programs obtain these services by issuing DBRC API requests to IMS. IMS passes these requests to DBRC and returns the results to an area in storage where the application can retrieve them. The services available through the DBRC API are to:

- Initialize the API and start DBRC
- Obtain information that DBRC maintains in the RECON data sets
- Return buffer storage
- Shutdown DBRC and the API

For batch and utility regions that do not use DBRC, a new module, DFSIDEF0, is required for these regions. This module contains the batch and utility region installation default for DBRC, and

is optional for regions that already use DBRC. IMS provides a sample module for DFSIDEF0.

External Subsystem Attach Facility Indoubt

Notification: This enhancement provides the identity of indoubt IMS External Subsystem Attach Facility (ESAF) UOWs to an optional user exit routine (DFSFIDN0) during the recovery phase of an FDBR system or an emergency restart of an IMS system (including an XRF alternate subsystem), thus enabling you to resolve the indoubt UOW earlier than the restart of the IMS system.

Fast Path Area Open/Close Enhancements:

These enhancements provide the ability to reopen DEDB areas automatically after IMS emergency restart or IRLM reconnect.

At the end of IMS emergency restart, all areas that were open when IMS failed are reopened if these enhancements are enabled. This reopen processing runs asynchronously with normal online activity. However, if an area is not yet reopened when an IMS application program requests access, it is reopened immediately, as in earlier releases of IMS. You enable this automatic reopen with a new parameter for the IMS procedure, FPOPEN.

During IRLM reconnect, all areas that were started when IMS failed are restarted if these enhancements are enabled. This restart processing runs asynchronously with IRLM reconnect and normal online activity. However, you can still use the /START AREA command to start an area immediately. You enable this automatic restart with a new IMS startup parameter, FPRLM.

IMS Fast Path uses up to 10 task control blocks (TCBs) to open, preopen, or close DEDB areas, thus parallelizing the processing for each task.

Fast Path Multiple Areas Shared VSO Structures: IMS Version 9 enhances the support for sharing VSO DEDB areas by allowing more than one VSO DEDB area in a coupling facility structure.

Multiple DEDB areas can share a single coupling facility structure. These structures are called multi-area structures. Because of this support, you do not need to define as many coupling facility structures as before.

This enhancement enables you to have more shared VSO DEDB areas while using fewer coupling facility structures.

IMS Java Enhancements: IMS Version 9 adds the XPLINK= dependent region parameter for Java Message Processing (JMP) regions and Java Batch Processing (JBP) regions. This parameter allows IMS Java dependent regions to use the IBM Language Environment Extra Performance Linkage (XPLINK) runtime option.

If you use IBM SDK for z/OS, Java Technology Edition, Version 1.4.1 or later, you must specify XPLINK=Y for a JMP region or a JBP region. However, if you use Version 1.3.1 of the SDK, you should specify XPLINK=N or allow IMS to use XPLINK=N as the default.

Integrated HALDB Online Reorganization

Support: The integrated HALDB Online Reorganization (OLR) function provides non-disruptive reorganization of HALDB PHDAM and PHIDAM partitions. HALDB Online Reorganization addresses the planned data outage time, that to date has constituted the largest amount of time that data was unavailable.

Optional EMHQ Structure for Shared Queues:

Using IMS shared queues with IMS Fast Path installed, you are no longer required to allocate an Expedited Message Handler Queue (EMHQ) structure and its associated log structure data set, checkpoint data set, and structure recovery data set. Users who use only Fast Path DEDBs or local EMH processing in a shared queues environment do not use these resources and are no longer required to create and manage them.

Tracing Enhancements: For IMS Version 9, the DL/I trace and the lock trace are both on by default. To deactivate either trace, use the /TRACE command.

VSCR Enhancements: During dynamic allocation for full-function or Fast Path databases, IMS tells z/OS to create the Data Set Association Blocks (DSABs) above the 16 MB line. Thus, if you allocate a large number of data sets, you can gain a substantial amount of storage in the low private storage area.

Manageability Enhancements

This section describes the major IMS Version 9 enhancements to IMS DB and IMS TM that affect manageability.

CRC Registration: With IMS Version 9, during initialization of the IMS control region, IMS uses the CRC= execution parameter to register the IMS command recognition character (CRC) with the sysplex (if IMS is running in a sysplex) or with the z/OS system. If the CRC is not unique, IMS issues message DFS1946W and continues with initialization.

Thus, all IMS systems in the sysplex should have a unique CRC. With a unique CRC, a console operator can issue IMS commands from any system in the sysplex and z/OS will route it to the appropriate system for execution.

Database Parallel Open: IMS Version 9 adds a new control statement to the DFSVSMxx PROCLIB member to allow you to disable the full-function database parallel open functionality. This control statement is NOPDBO.

Ending APPC/OTMA Conversations: IMS Version 9 adds the LUNAME and TMEMBER TPIPE keywords to the /EXIT command to allow you to terminate APPC/OTMA conversations. You can use the /DISPLAY CONVERSATION command to display the TMEMBER name for OTMA so that you can identify the conversations.

IMS Version 9 also adds a second time-out parameter to the APPCIOT keyword of the DFSDCxxx member of IMS.PROCLIB. This new parameter specifies the number of minutes that an APPC conversation can be inactive since its last APPC call.

ETO Feature Checking: With IMS Version 9, IMS system definition no longer validates that the ETO feature has been installed. During IMS system definition, IMS ignores the first two sub-parameters that are specified on the ETOFEAT keyword of the IMSCTRL macro.

Instead, during initialization of the IMS Transaction Manager, IMS validates that the ETO feature is installed when you specify the ETO=Y startup parameter. If the feature is not installed, IMS issues a DFS3676I error message, followed by an ABENDU3476.

FDBR WTO Message: In IMS Version 8, when the IMS system that an FDBR system is tracking is not running, the FDBR system issued a write-to-operator-with-reply (WTOR) message that indicated that there was no active system; the reply required the operator to indicate what action to take.

For IMS Version 9, this message, DFS4172I, is a write-to-operator (WTO) message, with no reply required. The FDBR system waits for the MVS Cross-System Coupling Facility (XCF) Group exit routine to indicate a change in status of a member of the group. That is, the FDBR system waits for the active IMS system to rejoin the group.

Fewer SNAP Dumps on Log: IMS now takes SVC dumps for some pseudoabends that caused IMS to log SNAP dumps with associated buffer pools. By taking SVC dumps, IMS Version 9 reduces the logging volume considerably in certain cases. You can use IPCS to view the SVC dumps.

HALDB Specific Partition Initialization: The HALDB specific partition initialization enhancement provides the ability to initialize specified HALDB partitions without first using DBRC CHANGE.DB commands to record INIT REQUIRED in the RECON data sets.

IMS Application Menu: The IMS Application Menu provides a common interface to IBM-supplied IMS applications that run on TSO and ISPF, such as the Single Point of Control (SPOC), the HALDB Partition Definition utility, the IMS Syntax Checker, the Installation Verification Program (IVP), and the IVP Export utility. Using the IMS Application Menu, you can start any of the ISPF applications by selecting the application and pressing the Enter key.

IMS Availability Enhancements: IMS Version 9 provides two major enhancements for availability:

- IMS dynamically installs its Resource Manager cleanup routine; you do not need to install the DFSMRCL0 module as part of the IMS installation. Registration of the IMS Resource Manager cleanup routine with the operating system is done automatically during IMS startup.
- The Dynamic SVC (DFSUSVC0) utility dynamically updates the DBRC type-4 SVC module. Thus, you can apply maintenance to the DBRC

type-4 SVC module without having to restart z/OS after each update.

IMS Database Recovery Facility Command

Support: The IMS /RECOVER command starts the address space of the IMS Database Recovery Facility for z/OS tool, if the tool has been successfully installed. Otherwise, IMS sends a DFS4273I error message to the MTO.

IMS /DIAGNOSE Command for Serviceability:

IMS provides a new SNAP function for the /DIAGNOSE command. Using this function, you can take a snapshot of system resources at any time without impacting IMS operations. This function provides a non-intrusive alternative to a console dump.

IMS Enhanced Command Environment: IMS Version 9 provides the IMS Enhanced Command Environment, a simplified IMS configuration that does not require the Resource Manager. If you want to use the IMS type-2 command format, but do not need the Resource Manager, you can group your systems into a generic IMSplex and use the IMS Enhanced Command Environment. Examples of environments that can benefit from the IMS Enhanced Command Environment include:

- Standalone IMS subsystems
- IMS DBCTL subsystems that are involved in data sharing, but that do not use online change

IMS Type-2 Database Commands: IMS Version 9 adds new commands to allow users to issue commands for database resources in the IMS type-2 command format. These commands are routed to one or more IMSs in the IMSplex, and the output is consolidated with each response line encapsulated in XML tags.

These commands allow you to manage database resources for the IMSplex environment and to use the IMS Operations Manager and Systems Management functions.

Knowledge-Based Log Analysis: IMS Version 9 provides a set of new functions that greatly simplify the interpretation and analysis of IMS log data. These functions:

- Allow you to extract an interpreted version of IMS log records to produce easy-to-read output.

- Allow you to produce output that contains all related log records for a unit of work.
- Simplify JCL stream creation to help prevent JCL errors. The necessary control statements are created in a syntax-correct form, so that you can focus on diagnosis rather than on how to extract log records.
- Provide a simple, quick, and automated method to sort a set of log data sets to verify the completeness of a list of logs (created manually or by DBRC), to sort the logs into the proper sequence by IMS image, to determine where log data sets might be missing in the sequence, and to determine the number of missing records and the time range that is missing to help identify the missing logs.
- Reduce problem turnaround time with IBM Support by reducing the number and the size of log data sets, and by ensuring the appropriateness of log data sets that are sent to Support.

Notify CQS Outage to Terminal Users: With IMS Version 9, if the CQS address space is unavailable, a static non-set-and-test-sequence-numbers (STSN) terminal that requires signon receives message DFS3649A, with RC=436, and the terminal session is terminated.

This change does not impact a static terminal that does not require signon, or a static STSN terminal. That is, the session persists even if the CQS address space is unavailable.

Removal of Restriction for Separate IMS.SDFSRESL Libraries: With IMS Version 9, you do not need separate IMS.SDFSRESL libraries for system definition of any of the following environments:

DB/DC
DBCTL
DCCTL
Fast Path

Prior to IMS Version 9, these definitions had to reside in separate IMS.SDFSRESL (or RESLIB) libraries. With IMS Version 9, you can use separate IMS.SDFSRESL libraries or combine them, as needed for your environment.

To support the unique initialization of DFSVC000 for each defined IMS instance, IMS Version 9 introduces the following parameters for the IMS

procedure, the DFSPBxxx PROCLIB member, and for execution JCL:

- DESC=*n* — The message descriptor code for IMS system console messages.
- MCS=(*x,y*) — The MVS routing code or codes for the IMS system console.
- SVC2=*nnn* — The type-2 SVC numbers reserved for use by the IMS subsystem.

For IMS batch and utility regions, IMS Version 9 adds support for the RGSUF=, PARM1= and PARM2= parameters that are already available for online regions.

Support for IEBCOPY Parameters in the Online Change Copy Utility: With IMS Version 9, the IMS Online Change Copy utility (DFSUOCU0) supports the z/OS IEBCOPY utility parameters WORK, SIZE, and LIST. The IMS utility passes the values for these parameters to the IEBCOPY utility.

Syntax Checker Enhancements: The Syntax Checker provides an ISPF user interface that enables you to define, verify, and validate parameters and their values in IMS.PROCLIB members. IMS Version 9 Syntax Checker enhancements include:

- The DFSPBxxx members are updated to reflect the IMS Version 9 changes to the parameters.
- The Syntax Checker can process DFSDCxxx and DFSSQxxx members.
- The Syntax Checker can display the default values for parameters.
- You can interrupt the processing of the current member and begin processing a member pointed to by the current member.

Highlights of Existing Function

The following sections cover the major existing functions of both IMS DB and IMS TM.

Advanced Program-to-Program Communications for IMS (APPC/IMS)

APPC/IMS provides the ability to develop distributed and cooperative (client/server) IMS TM applications to communicate with programmable workstations and other systems using APPC/MVS and the LU 6.2 protocol. IMS TM allows you to use the Common Programming Interface for Communications (CPIC) or the IMS DL/I programming interface to communicate with LU 6.2 systems.

IMS TM supports network-qualified names for APPC/IMS environments. IMS MSC supports transactions from APPC/IMS subsystems. You can include IMS MFS message formats with APPC/IMS transactions.

APPC/OTMA

Prior to IMS Version 8, implicit APPC/OTMA messages could only use shared queues for synchronous messages if the transaction was processed by the front-end IMS.

Both asynchronous and synchronous transactions now can use shared queues and you now can input a message on any of the external interfaces and have that message distributed and executed on any IMS system within the sysplex.

Common Queue Server (CQS)

CQS manages shared queues in a sysplex for multiple IMS TM subsystems. CQS receives, maintains, and distributes data objects from a shared queue on behalf of these TM subsystems or clients.

Control Center for IMS

The Control Center for IMS provides a graphical interface for the Operations Manager through IMS Connect, greatly easing IMS operations. The Control Center provides a single user interface from which you can control both IMS and DB2. The IMS Control Center capability is integrated with the DB2 Universal Database (UDB) administrative tools.

The administrative tools include a Control Center for navigating IMSplex systems, wizards for creating the IMS IMSplex commands, and a results window for sorting and filtering single-image command results. The tools also include a

Command Center for typing and executing both type-1 and type-2 IMS commands.

Coupling Facility Duplexing Support

IMS provides support for z/OS Coupling Facility (CF) Duplexing function for IMS Shared Message Queue structures and IMS Fast Path Expedited Message Handler (EMH) structures. When CF Duplexing is enabled, z/OS creates a duplex copy of the structure for failure recovery. If the IMS Shared Queues structure or the EMH structure fails or if a connection to the structure is lost, z/OS switches to the unaffected structure instance without the overhead of a structure rebuild.

CF Duplexing also enables System-Managed Rebuild. z/OS does the structure rebuild for a planned reconfiguration (that does the structure copy) even if no IMS Common Queue Server (CQS) is currently running. IMS CQS-managed rebuild is still needed to address Coupling Facility failure, structure failure, or loss of connectivity.

Database Control (DBCTL)

DBCTL is an IMS DB operating environment that consists of the IMS DB product connected to a transaction management subsystem other than the IMS Transaction Manager. With DBCTL, transaction management subsystems (such as CICS) can have online access to full function databases and Fast Path DEDBs.

Database Recovery Control (DBRC)

DBRC helps automate the recovery of databases by keeping track of the database image copies and logs that are needed for recovery. DBRC also helps ensure database integrity in a data-sharing or Remote Site Recovery environment.

Additionally, DBRC commands are provided to aid in database administration with the RECON data set for HALDBs. This is done by creating a master template in a single editable file that can be geographically propagated and tailored to different sites or systems and by creating the definitions that can be executed in batch to create and restore partitions should they be unavailable from the RECON.

Data Communications Control (DCCTL)

DCCTL is an IMS TM operating environment that can connect to a database management subsystem other than the IMS Database Manager. With DCCTL, database management subsystems such as DB2 can have access to IMS transaction management without a prerequisite for the IMS DB. So, DCCTL can provide a database-independent, transaction processing environment for DB2.

Data Compression

IMS DB supports eServer zSeries data compression hardware. This support provides storage (DASD) savings and improved transaction response time because hardware data compression uses fewer processor resources than software data compression and because I/O operations are reduced for compressed data.

Data Sharing

IMS DB can concurrently access and share databases with other IMS DB subsystems in database/data communications (DB/DC), DBCTL, or batch environments.

IMS data sharing is improved by using zServer parallel processing technology. In a sysplex that includes a coupling facility and the IBM Internal Resource Lock Manager (IRLM) Version 2, IMS can share data at the block level among as many as 32 systems. In a sysplex, IMS is no longer limited by IRLM to two central processor complexes (CPCs) in its data sharing.

Lock management and serialization for multi-system data sharing is handled by IRLM Version 2 using a coupling facility.

IMS multisystem data sharing can be used whether you have IMS TM or CICS as your transaction manager.

Distributed Syncpoint

Distributed Syncpoint support allows advanced program-to-program communications (APPC) and DCE/RPC (distributed computing environment/remote procedure call) application programs and DCE/RPC remote application programs to participate with IMS in protected conversations with coordinated resource updates. The z/OS Resource Recovery Services/MVS

(RRS/MVS) manages the syncpoint process on behalf of the conversation participants: the application program and IMS acting as resource manager. Application programs can access and update resources of multiple participating resource managers with integrity.

Extended Markup Language (XML)

IMS supports XML through interoperability with the OS/390 XML Parser, Java Edition. The XML parser's application programming interfaces (APIs) can be used with the High Performance Java Compiler shipped as part of VisualAge for Java, Enterprise Edition for OS/390 to develop new IMS Java programs running in IMS. IMS Java application programmers can thus invoke the APIs (DOM APIs and SAX APIs) of the OS/390 XML Parser, Java Edition, to convert an XML document from its stream form into a "parsed" form for reading, editing, or updating an XML document.

Extended Recovery Facility (XRF)

XRF provides a local alternate IMS subsystem that monitors the status of an active IMS subsystem so that the alternate subsystem can take over the active subsystem's workload in the event of an outage. XRF can be used to minimize the impact to end users of planned and unplanned IMS subsystem or OS/390 system outages.

Extended Terminal Option (ETO)

ETO is a separately priced feature of IMS TM. It is designed to provide a significant continuous availability enhancement by allowing changes to the IMS VTAM terminal network to be made online, without the need for a planned outage for IMS system generation. ETO is designed to provide improved network and system security by controlling system access and message delivery for each user ID (which can be shared by more than one user) rather than for each terminal.

Fast Database Recovery (FDBR)

Using the Fast DB Recovery function, you can also restore database resources from a failed subsystem in a sysplex data-sharing environment more quickly. This function monitors another IMS DBCTL or IMS TM/DB subsystem in the Sysplex and in the event of a problem, restores the databases locked by the failed system. Other IMS subsystems release the locks held by the failed

system and allow processing to continue. This increases availability.

Fast Path Expedited Message Handler (EMH)

Fast Path EMH supports applications requiring fast response times.

Fast Path High Availability Databases

IMS Fast Path Data Entry Databases (DEDBs) are designed to provide continuous availability with high performance for large databases. IMS utilities can reorganize or image copy a DEDB without disrupting its availability to the end user. DEDBs can have up to 2048 areas and can be defined as "non-recoverable" in DBRC.

You can add, change, and delete Fast Path DEDBs at the database or area level without shutting down and restarting IMS. The IFP or MPP regions that access the DEDBs need not be stopped during online-change processing. DEDB online change can be used in XRF, RSR, and sysplex environments.

Fast Path Virtual Storage Option

The IMS Fast Path Virtual Storage Option (VSO) enables portions of data entry databases (DEDBs) to be stored in an OS/390 data space, so that DEDBs can have performance similar to IMS Main Storage databases (MSDBs). DEDBs support segment-level locking and database field calls. MSDB applications can use DEDBs (especially VSO DEDBs) instead of MSDBs.

VSO DEDBs can be shared in an IMSplex environment. The coupling facility structures for shared-VSO DEDBs can be system managed, including rebuild, altering, and duplexing.

IMS provides a utility to migrate non-terminal-related MSDBs to DEDBs, regardless of whether you use VSO. Migrating MSDBs to VSO DEDBs improves data availability for MSDB applications.

Front-End Switching

IMS TM can be a front-end network manager connected to a back-end application processing subsystem, which can be another IMS TM subsystem or a non-IMS TM subsystem. ISC (LU 6.1), LU 0, and LU 2 communications protocols are supported between the front and back-end subsystems.

Full Function Database

IMS full function databases support complex data structures such as logical relationships and secondary indexes.

High Availability Large Databases (HALDB)

The HALDB function delivers enhancements to capacity, availability, manageability, and usability by enabling partitioning for IMS Full Function databases. HALDB supports as many as 1,001 partitions (each partition having a maximum capacity of 40 gigabytes). This means customers can have over 40 terabytes of OSAM and VSAM data sets. A single HALDB partition has the capacity of an entire IMS Full Function database from some earlier releases of IMS.

HALDB support also allows a partition to be taken offline, have something done to it, and be independently brought back online. This means each partition can be individually unloaded and reloaded, and while offline, have a batch reorganization done to it. Or the entire database can be taken offline and each partition reorganized in parallel, speeding up the offline reorganization process. Thus, HALDB improves database availability because multiple partitions decrease the amount of data unavailable if a partition fails or is taken offline.

HALDB partitions can be processed in parallel, reducing the total time required for batch workload or utility processing. Reorganized HALDBs are immediately usable after image copies can be created because Prefix Resolution or Prefix Update utility processing is no longer required. A series of ISPF panels, with imbedded help screens, provide an interface for creating and migrating databases.

IMS External Subsystem Attach Facility (ESAF)

ESAF allows other products to attach to IMS. It allows IMS application programs, running in IMS dependent regions, to access resources owned by the attached products, for example, DB2 resources and IMS resources.

IMS Java Application Development

Java application development support enables IMS applications to be written in Java and executed in IMS dependent regions. IBM VisualAge® and WebSphere® workstation tools, as well as host tools, can be used for development and testing. IMS Java applications have access to IMS message queues and databases through the use of IMS Java classes. Additionally, the JDBC interface can be used to access both IMS databases and DB2 data. IMS also includes a utility called DLIModel, which automatically constructs the required IMS Java “metadata class” from PSB and DBD source. The IMS Java support enhances the ability of customers and business partners to provide integrated e-business application development for IMS.

IMS Logger

While IMS is running, all information necessary to restart the system in the event of hardware or software failure is recorded on a system log data set. Users can change the number of log records produced between system checkpoints without needing to perform a system generation.

In an online environment, log records are stored on DASD, instead of being written to tape. Logging to DASD simplifies recovery of the IMS subsystem, reduces operator involvement, and improves system availability.

IMSplex

Prior to IMS Version 8, the IMS subsystems that were in sharing groups had to be managed individually. IMS Version 8 built upon the idea of an IMS sysplex (known hereafter as an IMSplex) to help reduce the complexity of managing multiple IMS subsystems in a sysplex environment.

Definition: An IMSplex is one or more IMS address spaces (control, manager, or server) that work together as a unit. Typically (but not always), these address spaces:

- Share either databases or resources or message queues (or any combination)
- Run in a S/390® Sysplex environment
- Include an IMS Common Service Layer (CSL - new for IMS Version 8)

The address spaces that can participate in the IMSplex are:

- Control region address spaces
- IMS manager address spaces: Operations Manager (OM), Resource Manager (RM), Structured Call Interface (SCI)
- IMS server address spaces (CQS)

Examples: Examples of IMSplexes are:

- A set of IMS control regions at the V7 or V8 or V9 level without a CSL that are sharing data or sharing message queues
- A set of IMS control regions at the V8 or V9 level with a CSL that are sharing data or sharing message queues
- A single IMS control region at the V8 or V9 level with a CSL (for example, you might want the CSL for commands or the new DBRC function). This still qualifies as an IMSplex because it is a set of IMS address spaces (IMS control, OM, RM, SCI, CQS) working together.

To support IMSplexes, some existing IMS functions were enhanced and some new functions were added.

- A new component, the Common Service Layer (CSL), was introduced consisting of the following three subcomponents:
 - Operations Manager (OM).
 - Resource Manager (RM).
 - Structured Call Interface (SCI).
- A TSO-based single point of control (SPOC) application program is shipped with IMS.
- The IMS terminal management function of IMS TM was enhanced.
- A new coordinated online change function (of the Resource Manager) was added to coordinate global online change activities of all the IMS subsystems in the IMSplex.

The following sections briefly describe the enhancements that support the new IMSplexes.

Common Service Layer: The CSL's components (the OM, RM, and SCI) provide the infrastructure for an IMSplex. Each OM, RM, and SCI runs in a separate address space.

Operations Manager: The Operations Manager (OM) provides a single system image for system operations in an IMS Version 8 IMSplex. OM performs the following functions:

- Routes IMS commands to IMSplex members that are registered to process those commands
- Consolidates command responses from individual IMSplex members into a single response for presentation to the command originator
- Provides an application programming interface (API) for the automated control of commands to the IMSplex
- Provides user exits for command and response edit and command security reasons

Resource Manager: The Resource Manager (RM) helps manage resources that are shared by multiple IMS systems in an IMSplex. RM provides an infrastructure for managing global resources and coordinating processes across the IMSplex. RM maintains resource information using a resource structure on a coupling facility.

Structured Call Interface: The Structured Call Interface (SCI) is the part of the CSL that provides the communications infrastructure of the IMSplex. Using SCI, IMSplex components can communicate with each other within a single OS/390 image or from multiple OS/390 images. Individual IMSplex members do not need to know where the other members are running. SCI is responsible for routing requests and messages between the IMS control regions, OMs, RMs, CQs, and other IMSplex members in the IMSplex.

Coordinated Online Change: One of the complexities of running multiple IMS systems in an IMSplex is managing online change processing for all of those IMS systems. Prior to IMS Version 8, you had to perform online change to each IMS in the IMSplex. An important part of managing an IMSplex from a single point of control is to be able to coordinate global online change processing among all the IMS systems in the IMSplex. This enhancement allows you to do just that.

Local Online Change: As a result of the System Management enhancements:

- When you perform a local online change and have IMS Version 8 or Version 9 running with a CSL (and a resource structure is defined), changes to resources will occur and be logged in RM and the local IMS.
- The QUERY MEMBER command can show local online change status.

Syntax Checker: The Syntax Checker is an IMS ISPF application that assists you in defining and maintaining the IMS DFSPBxxx PROCLIB members. It checks the validity of parameters and their values based on what version of IMS you run it on. In addition, it provides detailed help text at the parameter level, identifies new and obsolete parameters, and helps determine that parameter information is valid before either the initial IMS startup or an IMS restart.

TSO Single Point of Control Application: One of the new functions delivered with IMS Version 8 is the ability to manage a group of IMS subsystems (an IMSplex) from a single point of control (SPOC) application. With IMS Version 8, IBM delivered a TSO SPOC application. Using the ISPF-based TSO SPOC application, you can:

- Issue commands to all the IMSplex components
- Display consolidated responses from those commands
- Send a message (using the /BROADCAST command) to an IMS terminal that is connected to any IMS in the IMSplex

Sysplex Terminal Management: For IMS Version 8, IMS TM was enhanced to use the Resource Manager (RM) to maintain IMS resource information in a sysplex environment. By having the resource information available to other IMS subsystems in the sysplex, the following is achievable:

- Resume work for VTAM® terminals and users if their local IMS fails
- Eliminate VTAM Generic Resources terminal affinities
- Provide resource type consistency
- Provide name uniqueness
- Provide global callable services for node, LTERM, and user resources

Installation Verification Program (IVP)

The IVP (Installation Verification Program) is an ISPF dialog that is used to initially verify (test) the installation of IMS using a sample IMS system.

Intersystem Communication (ISC)

ISC enables communication between IMS TM and another subsystem (such as CICS), a user-written subsystem, or another IMS TM subsystem using the LU 6.1 protocol.

Message Format Service (MFS)

MFS allows application programs to handle logical messages, so they do not need to handle device-specific characteristics of input or output messages. MFS distributed presentation management (DPM) supports ISC and secondary logical units type P (SLU P) for a user-written program in a SLU P controller or in another subsystem connected with ISC. MFS DPM enables device-independent data streams to be transmitted between IMS and a remote program. MFS DPM also enables the application program to use a single data structure, regardless of the data source or destination.

Multiple Systems Coupling (MSC)

MSC permits message and transaction routing between two or more IMS TM subsystems in one or more OS/390 systems or processors. Whether a transaction is processed on a local IMS TM subsystem or on a remote one is transparent to the user entering the transaction. So, MSC provides a single-system image to the end user. MSC supports transactions (messages), responses, program-to-program switches, and fixed-length conversational scratch pad areas on two or more IMS systems.

The IMS Multiple Systems Coupling (MSC) facility has been enhanced to support the Fiber Connection (FICON™) channel-to-channel (CTC) hardware support on zSeries processors. When multiple IMS subsystems are connected by the FICON CTC hardware, the volume of IMS messages that can flow between the IMS systems can increase significantly, as opposed to the volume that is possible on the Enterprise System Connection (ESCON®) hardware.

MVS Automatic Restart Manager

In a Parallel Sysplex environment, IMS supports the MVS Automatic Restart Manager. This support improves the availability of IMS systems.

MVS OpenEdition Enablement

IMS supports MVS OpenEdition and the support services it provides. These services, when used with other selected products, conform to approved standards or provide an implementation for appropriate draft standards. Using such services as the portable operating system interface for computer environments (POSIX) and DCE/RPC standards enables application portability for MVS and IMS.

IMS applications can use POSIX threads support on MVS. Using threads support makes it easier to write multitasking applications, such as server applications. Application programmers and system programmers can use callable services to utilize many of the POSIX-related services. These services make it easier to code certain tasks in assembler language.

POSIX.1 support provides a standard interface that is available on a wide range of IBM and non-IBM operating systems. Programs that conform to the POSIX.1 standard can be more easily ported to and from MVS. Programmers with UNIX™ and C language skills can develop programs for MVS and IMS™ using their current skills.

POSIX.2 shell and utilities provide a user interface that is familiar to UNIX programmers, improving their productivity when using MVS.

With a growing number of transmission control protocol/Internet protocol (TCP/IP), RPC, and POSIX-conforming applications available commercially, your application needs can often be met more quickly with off-the-shelf software that conforms to POSIX, reducing the cycle time from identification of a need to delivery of a solution. These solutions can complement and use existing IMS applications and data.

For Open Access to IBM and non-IBM Networks: Using MVS OpenEdition facilities, current data and logic can be made available to heterogeneous clients by using a single set of standardized interfaces. For example, you can use an RPC from a local area network (LAN) or workstation to access IMS™ applications. OpenEdition DCE and the OpenEdition DCE Application Server/IMS provide application access to IMS™ host applications from workstations and LANs. The Applica-

tion Server is a bridge between the new, heterogeneous world of DCE to the more traditional world of MVS. It allows a new class of workstation products to access IMS using a standard method of heterogeneous interoperability.

MVS Resource Management

IMS supports MVS Workload Management by allowing it to monitor IMS transactions or batch jobs while they are running. Workload Management determines if the active IMS transactions or batch jobs are meeting the response time and performance goals, and can adjust MVS resources that are assigned to help IMS achieve its goals. By using MVS Workload Management, operations and systems management personnel can make more informed decisions in controlling the workload mix and prioritization to meet their business objectives (for example, system performance goals).

IMS enables workload balancing for transaction processing work in a Parallel Sysplex™ with enhancements to certain Multiple Systems Coupling (MSC) exit routines. You can define all transactions as local for each system and use the exit routines to control routing between systems.

Online Change

Online change improves the availability of an online IMS subsystem by allowing non-disruptive changes to the IMS subsystem. Resources such as database definitions, transaction definitions, application definitions, MFS formats, and security definitions can be added, deleted, or changed without bringing down the IMS subsystem.

Online Recovery Service (ORS)

ORS, a separately priced facility for IMS, provides database recovery processing in an online IMS environment. This facility enables a customer to recover multiple database data sets simultaneously. ORS also enables you to recover databases to any point in time. ORS reads image copies, logs, and Change Accumulation data sets in parallel. It reads each input only once, even when it is used in the recovery of multiple data sets. ORS applies the database changes to multiple data sets simultaneously. This speeds recoveries through the reduction of I/Os and the use of parallel processes.

Open Transaction Manager Access

IMS Open Transaction Manager Access (OTMA) is a client/server protocol for IMS transactions. In a client/server environment, the IMS Transaction Manager is the high-performance server, and with the OTMA feature you can attach many different MVS client subsystems. An OTMA client acts as a gateway between IMS TM and a heterogeneous network. TCP/IP, RPC, MQSeries, and IMS TM systems can be used across their appropriate platforms in conjunction with each other, taking advantage of existing applications, data, and programmer skills. IMS also provides a callable interface for OTMA that allows access to IMS applications from other z/OS subsystems.

Rapid Network Reconnect (RNR)

RNR utilizes the facilities of VTAM's Multinode Persistent Session Services to improve system availability by allowing IMS TM to automatically reconnect terminal sessions following any kind of IMS failure and subsequent restart. RNR reduces network reconnect time after an IMS, z/OS, or VTAM, or CPC failure in a sysplex environment.

Remote Site Recovery

The Remote Site Recovery (RSR) feature lets you recover quickly from an interruption of computer services at an active site. The RSR feature allows you to maintain a geographically remote secondary IMS site that tracks the activity of the primary site and that can take over the active workload in the event of an outage. Because RSR maintains copies of your active resources at the remote site, including shadow databases and remote logs, you significantly enhance your ability to protect your investment in applications and data.

The IMS Remote Site Recovery (RSR) function has been enhanced to provide coordinated disaster recovery for IMS and DB2.

Shared Message Queues and Shared EMH Queues

Using a z/OS coupling facility, IMS can store and share IMS message queues among multiple IMS TM systems. Incoming messages from one IMS TM in a sysplex can be placed on the shared queue by IMS TM's Common Queue Server for

processing by any other IMS TM that has access to the shared queue. Using shared queues enables automatic workload balancing across all IMS subsystems in the sysplex, thus providing increased capacity and availability for the IMS system. Shared queues also provide an alternative to using MSC to transfer messages across a sysplex.

Asynchronous APPC/OTMA input messages can run on any IMS system in the shared queues group that is available for processing.

64-bit Real Support

For IMS I/O operations, above-the-bar 64-bit real storage is used for IMS page-fixed storage, freeing up below-the-bar real storage for customer use.

Support for Data Facility Storage Management Facility (DFSMS) Constructs

This support makes installation easier for sites that use SMS-managed volumes. HALDB sample applications are also provided.

VTAM Generic Resource (VGR) Support

The installation can choose to have VTAM, instead of IMS, manage the generic resource affinity. This means that when any session outage occurs, whether a CPC, z/OS, VTAM, or IMS failure, a new terminal session can be immediately established with any available IMS system.

Application Programming Interface

Application programmers can write IMS application programs in Java, COBOL, PL/I, the C language, Pascal, ADA, REXX, or IBM High Level Assembler (HLASM) language. IMS also provides an interface to the IBM Language Environment for MVS and VM.

The IMS application programming interface (xxxTDLI) has no direct dependency on language compiler release levels. Older IMS application programs that have not been modified (for example, by linking them with Language Environment routines) will continue to run as expected, regardless of current language compiler support.

Support Discontinuances

IMS does not support the following:

- Assembler H
You should migrate to the High Level Assembler (HLASM) product.
- The following basic telecommunications access method (BTAM) devices:
 - LINEGRP UNITYPE=1050, 2260, 2265, 2770, 2980, 3741, 7770, TWX, 3614, 3767, 3770, and 3790
 - MSPLINK TYPE=BSC
 - TYPE UNITYPE=SLUTYPE4
- The RECOVCTL parameter for the IMS Database Recovery Control (DBRC) CHANGE.RECON and INIT.RECON commands.

Softcopy Publications

All IMS Version 9 publications are available in softcopy format (PDF and BookManager®) on the IMS Licensed Product Kit CD (LK3T-7213) and on the Internet (at www.ibm.com/ims).

The IMS Version 9 information is also available as part of the DB2 Information Management Software Information Center for z/OS Solutions, available at publib.boulder.ibm.com/infocenter/db2zhlp.

The PDF books can be read online using the Adobe® Reader. The BookManager books can be read online using BookManager READ on MVS, VM, OS/2®, DOS, Microsoft® Windows®, or AIX®.

Specified Operating Environment

Hardware Requirements

IMS Version 9 executes on all IBM processors that are capable of running z/OS System Product (z/OS) Version 1 Release 4 or later. IMS Version 9 can run on either 64-bit processors or 32-bit processors.

The processors must have sufficient real storage to satisfy the combined requirements of IMS, the operating system, IMS batch requirements, and other customer-required applications.

The configuration must include sufficient I/O devices to support the requirements for system

output, system residence, and system data sets. Sufficient direct access storage must be available to satisfy information storage requirements and can consist of any direct access facility supported by the system configuration and the programming system.

System Console: The console requirements of z/OS Version 1 Release 4, or later, apply.

Tape Units: At least one IBM 3420, 3480, or 3490 tape unit is required for installation and maintenance. The DBRC tape large block size support enhancement requires the large block interface on one of the following IBM tape devices, or equivalent products: 3480 Magnetic Tape Subsystem, 3490 and 3490F Tape Subsystem, or IBM TotalStorage Enterprise Tape System 3590.

Direct Access Devices: During the binding of the IMS control blocks load modules, both the binder work data set SYSUT1 and IMS.SDFSRESL library must reside on a device that supports a record size of 18 KB or greater. For all other system libraries and working storage space, any device that is supported by the operating system is allowed.

For IMS database storage, any device that is supported by the operating system is allowed within the capabilities and restrictions of Basic Sequential Access Method (BSAM), Queued Sequential Access Method (QSAM), Overflow Sequential Access Method (OSAM), and Virtual Storage Access Method (VSAM).

The Database Image Copy 2 utility (DFSUDMT0) requires concurrent-copy capable DASD controllers.

Non-Sysplex Data Sharing Requirements: The hardware requirements for single-LPAR inter-processor block-level data sharing between IMS Version 7 (with IRLM Version 2.1), IMS Version 8 (with IRLM 2.1), and IMS Version 9 (with IRLM Version 2.1) are the same requirements as for the base IMS Version 9.

Sysplex Data Sharing: For data sharing in a sysplex environment (using IRLM Version 2.1 or later), the following are required:

- An IBM S/390 9674 Coupling Facility level 9, or later
- One of the following with its related hardware:

- A 9037 Sysplex Timer®
- An IBM S/390 9674
- An IBM S/390 9672 Transaction Server
- An IBM S/390 Parallel Enterprise Server or IBM eServer zSeries 900 (z900) processor
- A coupling facility (logical partition), if you are using multinode persistent session Rapid Network Reconnect, MADS I/O Timing, shared message queues, IRLM structures, cache structures, list structures, or log structures.

Shared Message Queues and Shared EMH

Queues: For sharing message queues and sharing EMH queues in a sysplex environment, one of the following is required with related hardware:

- An IBM S/390 9674
- An IBM S/390 9672 Transaction Server
- An IBM S/390 Parallel Enterprise Server or IBM eServer zSeries 900 (z900) processor

System-Managed Duplexing requires CF-to-CF links (such as HiperLink, ICB link, or IC link).

DFSMS Concurrent Copy Support: Databases and area data sets that are to be copied using the Database Image Copy 2 utility (DFSUDMT0) must reside on hardware that supports the DFSMS concurrent copy feature (such as a 3990 Storage Control Model 3, extended function with licensed internal code, or an equivalent device).

Remote Site Recovery Features: IMS Remote Site Recovery requires:

- A Sysplex Timer (if data sharing or if the workload is spread across multiple CPCs)
- A high bandwidth control unit (such as a 3172)
- At least one tape unit (3420, 3480, 3490) at the tracking site

Coordinated Disaster Recovery support for IMS and DB2 requires that the DB2 logs reside on devices supporting eXtended Remote Copy.

Multiple Systems Coupling Requirements:

When the physical link is channel-to-channel and it is dedicated to IMS, the System/370™ channel-to-channel (CTC) adapter or a logical channel on the IBM 3088, ESCON, or fiber channel connection (FICON) is required.

MSC FICON CTC support requires that at least one side of the MSC link be an IBM zSeries™

machine with the FICON channel and FICON CTC microcode. The other side (IMS) can be any processor with a FICON channel.

Shared VSO Coupling Facility Requirements:

To use Coupling Facility System-Managed Rebuild, Auto Alter, and System-Managed Duplexing functions for Shared VSO functions, you must have a processor that supports these Coupling Facility functions and capabilities. A Coupling Facility level 9 is required for the Auto Alter function and a Coupling Facility level 11 is required for System-Managed Duplexing of VSO structures.

Supported Terminals: See the IMS Version 9 *Release Planning Guide* (GC17-7831) for a list of the communications devices supported by IMS Version 9.

Software Requirements

This section describes the software requirements for IMS Version 9 and the major enhancements for IMS Version 9.

Operating Systems: IMS Version 9 operates in z/OS Version 1 Release 4 (or later) configurations, unless otherwise stated, and requires the following minimum version, release, or modification levels:

- z/OS Version 1 Release 4 (5694-A01).
 - SMP/E*
 - DFSMS*
 - JES2*
 - JES3*
 - TSO/E*

* - These items are base elements of the z/OS operating environment that cannot be ordered separately.

- IBM High-Level Assembler Toolkit (5696-234), a separately orderable feature of z/OS

Restriction: IMS Version 9 does not support Assembler H. IMS Version 5 was the last version to do so.

- RACF (available with the IBM SecureWay Security Server for z/OS and OS/390 RACF product) or equivalent product, if security is used
- ISPF Version 4 Release 2 (5655-042)

– e-Network Communications Server for z/OS, if IMS Transaction Manager is used

- IRLM 2.1 (5655-DB2) or later, if data sharing is used.
- Coupling Facility (logical partition). In general, IMS Version 9 requires a Coupling Facility level 9, or later.

IMS Version 9 can run on either 64-bit processors or 32-bit processors.

IMS Version 9 also operates in a virtual machine (VM) under control of z/OS Version 1 Release 4. This environment is intended for use in a program development, testing, and non-XRF production environment.

Restriction: In a VM environment, be aware that:

- If you use BTAM binary synchronous terminals, expect communication line timeouts. Terminal timeouts are not limited to VM, but, when they occur, they affect communication line recovery because polling is inconsistent when BTAM operates under VM.
- The Log Analysis utilities might yield inaccurate time-stamp oriented results.
- If you operate the IMS Version 9 Transaction Manager under VM for production purposes and have specific throughput or terminal response-time requirements, plan to benchmark under VM to ensure that the proposed configuration meets your performance needs.

System-Managed CF Structure Duplexing is recommended, though not required, for the Resource Manager structure.

The z/OS Communications Server Affinity enhancement can be used, optionally, with the IMS Sysplex Terminal Management for enhanced usability.

To take full advantage of Coordinated Disaster Recovery support for IMS and DB2, Sysplex Terminal Management, the Operations Manager, and the Resource Manager, IMS Version 9 should be on all sysplex systems involved.

Coordinated Disaster Recovery support for IMS and DB2 requires the IMS Version 9 Remote Site

Recovery (RSR) Recovery Level Tracking (RLT) feature.

Data Sharing: For block-level sharing, the IRLM 2.1 or later is required. The IRLM is an independent component shipped with IMS Version 9. The IRLM must be defined as a z/OS subsystem. Block-level data sharing of full-function databases is supported between all in-service levels of IMS.

IMS sysplex data sharing (including data caching, shared SDEPs, and shared VSO DEDB areas) requires IRLM Version 2.1 or later.

Database Recovery Utilities: The PTF needed for IMS Version 7 change accumulation migration to IMS Version 9 is UQ99327.

DBRC: IMS Version 9 DBRC requires that the Migration/Coexistence SPE be applied to the IMS Version 7 or IMS Version 8 DBRC:

- IMS Version 7: PQ72838
- IMS Version 8: PQ72840

Fast Database Recovery: Fast database recovery support requires:

- IRLM Version 2.1 or later
- Sysplex environment with cross-system coupling facility (XCF)
- IMS DB/DC or DBCTL subsystem
- A shared-database resource (full-function database or DEDB)

IMS Control Center: The software requirements for using the IMS Control Center with IMS Version 9 are:

- DB2 Universal Database Version 8.2 or later
- IMS Connect Version 1.2 (with the following APARs applied: PQ62379, PQ69527, and PQ70216) or later
- IMS Version 9

The IMS Control Center also supports IMS Version 8.

IMS Java: IMS Java application support (Java dependent regions) has the following requirements:

- IBM SDK for z/OS, Java 2 Technology Edition, Version 1.3.1 or later (5655-I56).
- Java 2 Technology Edition (5655-D35), with a special enhancement referred to as the Persistent Reusable Java Virtual Machine (JVM).

Note: IMS Version 7 was the last release of IMS to support the High Performance Java (HPJ) compiler. Customers using HPJ-compiled applications should migrate to the Persistent Reusable JVM support.

- z/OS UNIX System Services (USS).
- JDBC access to IMS DB for DB2 UDB Stored Procedures requires DB2 Universal Database Server for z/OS and OS/390, Version 7 (5675-DB2) with APARs PQ46673 and PQ50443 applied. You must also have the DB2 SQLJ/JDBC driver with APAR PQ48383 applied.
- JDBC access to IMS DB for CICS applications requires CICS Transaction Server for z/OS Version 2.2 (5697-E93).
- JDBC access to IMS DB for WebSphere applications requires WebSphere Application Server z/OS Version 4.0.1, and additional WebSphere Application Server z/OS Connection Management support.
- Java-COBOL Interoperation requires the object-oriented syntax for Java interoperability that is provided in IBM Enterprise COBOL for z/OS and OS/390 Version 3 Release 2.

IMS Java Remote Database Services: In addition to the requirements for IMS Java, IMS Java Remote Database Services also requires:

- WebSphere Application Server for z/OS Version 5.0.2
- WebSphere Application Server for Windows Version 5.0.2
- Secure Sockets Layer (SSL)
- z/OS Resource Recovery Services (RRS)

IMS Web Services Support: IMS Web Services Support requires:

- Service definition creation for MFS-based applications requires WebSphere Studio Application Developer Integration Edition Version 5.0 or later.
- Service definition deployment of IMS MFS WebServices support requires WebSphere Application Server Enterprise Edition Version 5.0 or later.

Integrated IMS Connect Support: In addition to the requirements for IMS Version 9, the integrated IMS Connect support has the following requirements:

- TCP/IP Version 1.4 or later
- If you plan to use SSL (Secure Sockets Layer), z/OS Version 1.4 System SSL, a subcomponent of z/OS Cryptographic System Services, is required.
- If you plan to use the IMS Connect IMSplex support, DB2 UDB Version 8.2 or later is required.

IRLM: The following versions of the internal resource lock manager (IRLM) support IMS Version 9:

- IRLM 2.1 (5655-DB2)
- IRLM 2.2 (5625-DB2)

IMS Version 9 includes both versions of the IRLM.

MNPS Replacement of XRF USERVAR: MNPS Forced Takeover support requires z/OS 1.6 or later.

RACF Enhancements to Replace SMU: RACF (or equivalent product) must include the following four new RACF security classes as default classes:

- IIMS - Program Specification Block (PSB)
- JIMS - Grouping class for PSB
- LIMS - Logical terminal (LTERM)
- MIMS - Grouping class for LTERM

If these RACF resource classes are not already included in the default list of classes for RACF, or if you want to use class names that are different from the default names, you need to define them in the resource class descriptor table (CDT).

XML Enhancements: XML Database Support requires:

- IMS Java Version 9
- IBM SDK for z/OS, Java 2 Technology Edition, Version 1.3.1 or later

XML Transaction Support requires:

- WebSphere Studio Enterprise Edition Version 5 or later
- Enterprise COBOL for z/OS and OS/390 Version 3.1 or later
- PL/I for z/OS and OS/390 Version 3.1 or later

- XML Toolkit for z/OS and OS/390 Version 1.5 or later

Small Programming Enhancements (SPEs):

The following SPEs are required for coexistence:

- DBRC SPEs for IMS Version 7 and IMS Version 8, to allow them to coexist with IMS Version 9:
 - IMS Version 7: PQ72838
 - IMS Version 8: PQ72840
- The OLR Coexistence SPE for IMS Version 8 systems that participate in data sharing with IMS Version 9 systems that allow HALDB online reorganization.
- APAR PQ58631 for IMS Version 7 systems that share OTMA messages with IMS Version 8 or IMS Version 9 systems.
- APAR PQ32932 for IMS Version 7 systems that share messages with IMS Version 8 or IMS Version 9 systems using MSC, QCF, or shared queues.

Sysplex Data Sharing: IMS sysplex data sharing (including data caching, shared SDEPs, and shared VSO DEDB areas) requires IRLM Version 2.1 or later.

CICS Subsystems Supported: IMS DB Version 9, using the Database Resource Adapter (DRA), can be connected to any of the following CICS subsystems:

- CICS Transaction Server for z/OS Version 2.2 (5697-E93)
- CICS Transaction Server for OS/390 Version 1.3 (5655-147)
- User-written software

IMS TM Version 9, using the appropriate TM interface, can be connected to any of the following CICS subsystems:

- CICS Transaction Server for z/OS Version 2.2 (5697-E93)
- CICS Transaction Server for OS/390 Version 1.3 (5655-147)

DB2 Subsystems Supported: IMS TM Version 9 can be connected to any of the following DB2 subsystems:

- DB2 UDB for z/OS Version 8 (5625-DB2)
- DB2 for z/OS and OS/390 Version 7 (5675-DB2)
- DB2 Universal Database for OS/390 Version 6 (5645-DB2)

IMS/DB2 Coordinated Disaster Recovery Support requires the IMS V9 Remote Site Recovery (RSR) feature, and requires the databases to be registered with Recovery Level Tracking (RLT).

Intersystem Communications Subsystems

Supported: IMS TM Version 9, using ISC, can be connected to any of the following products:

- IMS Version 9 (5655-J38)
- IMS Version 8 (5655-C56)
- IMS Version 7 (5655-B01)
- CICS Transaction Server for z/OS Version 2.2 (5697-E93)
- CICS Transaction Server for OS/390 Version 1.3 (5644-147)
- User-written software

Multiple Systems Coupling: IMS TM Version 9, using MSC, can be connected to the following IMS subsystems:

- IMS Version 9 (5655-J38)
- IMS Version 8 (5655-C56)
- IMS Version 7 (5655-B01)

Extended Terminal Option (ETO) Feature: The ETO feature requires one of the following subsystems:

- IMS Version 9 Transaction Manager
- IMS Version 9 Database/Transaction Manager

Remote Site Recovery (RSR) Features: The RSR features, recovery-level tracking (RLT) and database-level tracking (DLT), each require one of the following subsystems:

- IMS Version 9 Database Manager
- IMS Version 9 Database/Transaction Manager

Programming Languages Supported: Application programmers can write IMS application programs in the following languages:

- ADA
- COBOL for OS/390 & VM
- Enterprise COBOL for z/OS and OS/390
- High Level Assembler for MVS & VM & VSE Version 1 Release 4.0
- IBM SDK for z/OS Java 2 Technology Edition, Version 1.3.1
- PL/I for z/OS and OS/390
- TSO/E REXX
- VS Pascal
- WebSphere Studio Site Developer Version 5.0
- z/OS C/C++

Requirement: The following languages require the IBM Language Environment for z/OS:

COBOL for OS/390 & VM
PL/I for z/OS and OS/390

Application Programs Supported: All application programs supported under IMS Version 7 and IMS Version 8 are still supported under IMS Version 9.

Requirement: IMS Version 7 was the last version to support HPJ-compiled application programs. If you use HPJ-compiled applications, you must migrate to using the JVM support.

Compatibility

Customer applications written for currently supported versions of are upwardly compatible with IMS Version 9, allowing existing applications and data to be used without change. Migration, coexistence, and maintenance support is provided for IMS V7 and V8 with V9.

IMS V7 introduced a new combined MSC exit routine (DFSMSCE0). IMS V7 was the last release to support the old MSC exits routines: Terminal Routing (DFSCMTR0), Input Message Routing (DFSNPRT0), Link Receive Routing ((DFSCMLR0/DFSCMLR1), or Program Routing (DFSCMPR0).

For IMS Version 7 systems to be compatible with the OTMA function in IMS V9, customers must apply APAR PQ58631.

IMS Web was provided as an early tool for Internet use by customers preparing for and providing access to IMS applications across the Internet. IMS Web is no longer available. Replacement solutions for accessing IMS from the Web are provided through:

- IMS Connect Version 2, Release 1 (5655-K52) or later
- IBM SDK for z/OS, Java 2 Technology Edition, Version 1.3.1 or later (5655-I56)
- WebSphere Application Server Enterprise Edition V5.0 or later
- WebSphere Studio Application Developer Integration Edition V5.0 or later

Service for the IMS TCP/IP OTMA Connection (IMS TOC), which provided early IMS TCP/IP access, has been discontinued. IMS Connect provides enhanced IMS TCP/IP support and requires the IMS TM feature.

Future enhancements to IMS TCP/IP support will be provided only through IMS Connect. For customers who use IMS TOC, IBM recommends migrating to IMS Connect.

IMS V7 was the last release to support the High Performance Java Compiler. Customers using HPJ-compiled applications should migrate to the Persistent Reusable JVM support.

IMS V8 was the last release to support the IMS V5 SDEP CI format.

IMS V8 was the last release to support Basic Telecommunications Access Method (BTAM). Customers using BTAM are encouraged to migrate to Virtual Telecommunications Access Method (VTAM) or Transmission Control Protocol/Internet Protocol (TCP/IP). User code or tools dependent on BTAM should migrate to VTAM or TCP/IP.

IMS V9 is the last release to support the Security Maintenance Utility (SMU). Customers using SMU should migrate to the Resource Access Control Facility (RACF) or an equivalent product.

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The source licensed program materials are available as optional materials. They are written in Assembler and PL/I.

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Designated Machine Identification Required: Yes.

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- DSLO License: None

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October 2004

Printed in U.S.A.

GC18-7825-00

