CICS TS System
Problem Determination
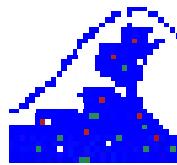
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CICS/VSE	VSE/ESA
COBOL/370	Language Environment
VTAM	

Topics

- **What's new**
  - Restructured CICS
  - Problem Determination facilities
- **CEMT and CETR transactions**
- **CICS TS Trace**
- **CICS TS System Dumps**
- **Summary**

What's New

- **CICS Transaction Server for VSE/ESA 1.1**
  - Restructured CICS product
    - New domain structure
  - Based on CICS for MVS/ESA 4.1 + function from CICS TS for OS/390
    - Code base ported from OS/390
    - Uses OS/390 "family" API

What's New...

- Restructure of CICS into domains
    - More 31-bit exploitation
    - Standardized interfaces
    - Improved CICS code quality
    - Better serviceability and problem determination
    - Enhances CICS use of extended architecture
    - Object code only (OCO) modules

What's New...

- CICS TS Problem Determination Facilities
  - Enhanced in CICS TS
  - More information in trace and dumps
  - More user controls for trace and dumps
  - New dump and trace utility programs
  - New and changed debugging transactions

Restructured CICS

- Standard interfaces between domains
  - Each domain responsible for specific functions and associated data
  - Domain gate is entry point into a domain
  - "Domain calls" used for communication and transfer of data between domains
  - Kernel linkage routines used for routing calls

Restructured CICS...

Application domain (AP)	Lock manager domain (LM)

Monitoring domain (MN)

Program manager domain (PG)

CICS catalog domains (GC/LC)

Security manager domain (XS)

Directory manager domain (DD)

Statistics domain (ST)

Dispatcher domain (DS)

Kernel linkage routines

Storage manager domain (SM)

Domain manager domain (DM)

Timer domain (TI)

Dump domain (DU)

Trace domain (TR)

Kernel domain (KE)

Transaction mgr. domain (XM)

Loader domain (LD)

Message domain (ME)

Parameter manager domain (PA)

User domain (US)

Restructured CICS...

▮ Standard interfaces between domains

  ▮ Two character domain identifier used in CICS trace, formatted dumps, and messages

```
                        Trace Example


05045 1 AP 0590 APXM   ENTRY  TRANSACTION_TERMINATION

XM     1 AP 0591 APXM   EXIT   TRANSACTION_TERMINATION/OK
 |         |                 Application domain
 |         |_____ 
 |_____ Transaction manager domain
```

Restructured CICS...

```
                     Formatted dump Example


===AP: AP DOMAIN TRANSACTION SUMMARY

       .

===DS: DISPATCHER DOMAIN - SUMMARY

       .

===KE: Kernel Domain KE_TASK Summary

       .

==KE: KE Domain Error Table Summary

       .

===XM: TRANSACTION MANAGER DOMAIN - SUMMARY

       .

==XM: GLOBAL STATE SUMMARY

       .

==XM: TRANSACTION SUMMARY
```

Restructured CICS...

```
                        Message Examples


F2 0096 DFHAP1203I DBDCCICS Language Environment for VSE/ESA is being
          initialized.
F2 0096 DFHSI8430I DBDCCICS About to link to PLT programs during the third
          stage of initialization.
F2 0096 DFHSI8434I DBDCCICS Control returned from PLT programs during the
          third stage of initialization.
F2 0096 DFHSI1517 DBDCCICS Control is being given to CICS.
             |
             |
             |_____ Domain identifier
```

Restructured CICS...

- Kernel domain
  - Main CICS control structure
  - Tracks existence and status of domains
  - Involved in every domain call
  - Intercepts errors and invokes error recover routines for all domains
    - Program checks, runaway tasks, operating system abends, internal errors

Restructured CICS...

- **Kernel domain**
  - Manages tasks in task table
    - Kernel number assigned to each system task, user task and TCB
      - Different number than transaction number
    - Linkage stack for each task
      - Calls to programs
      - Link and return register save areas

Restructured CICS...

▊ Transaction manager domain

   ▊ Controls creation, termination, inquire and purging of tasks

   ▊ Assigns transaction number to task

   ▊ Manages transaction definitions and transaction classes

Restructured CICS...

- Dispatcher domain
  - Controls attaching, running and detaching of user and system tasks
    - Attaches tasks to dispatcher and kernel domains
    - User task attached only to dispatcher domain if at MXT limit
    - Handles task priority, suspend and resume
  - Schedules VSE subtasks

Restructured CICS...

- **Application domain**
  - Where application programs run
  - Contains parts of CICS that are not restructured
  - New interfaces between unrestructured components and other domains
    - Example: KC interface for task control program (DFHKCP) to issue dispatcher and transaction manager domain calls

Restructured CICS...

■ Application domain
  ■ Familiar control blocks
    ❙ Common Systems Area (CSA)
    ❙ Common Work Area (CWA)
    ❙ Task Control Area (TCA)
    ❙ Task Work Area (TWA)
    ❙ TCT Terminal Entry (TCTTE)
    ❙ TCT User Area (TCTUA)
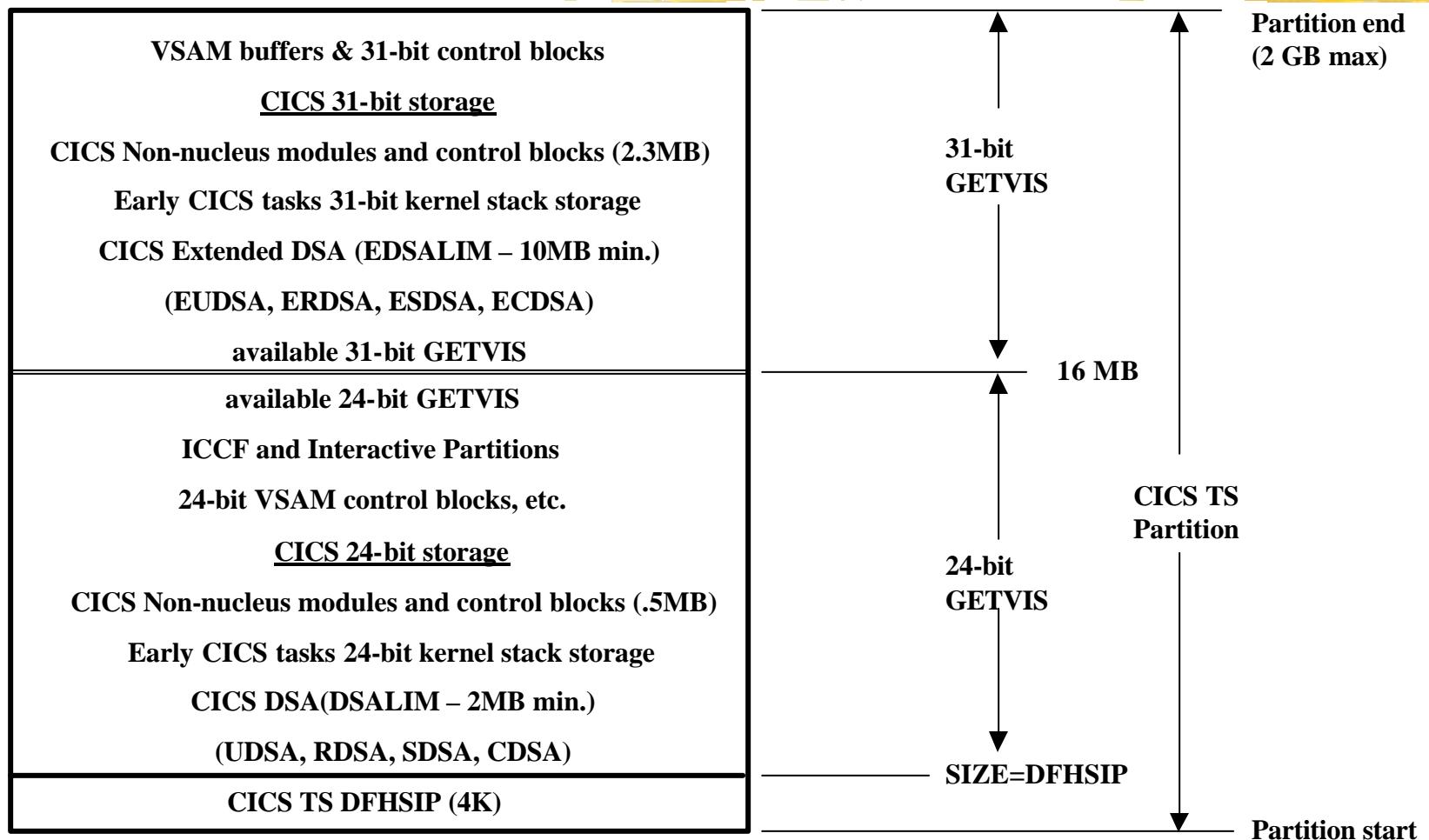   ❙ Terminal Input/Output Area (TIOA)
    ❙ Most have changed

Restructured CICS...

■ CICS TS Partition Storage

  ■ Most of CICS nucleus above 16 MB line

  ■ All major CICS control blocks above 16 MB line

  ■ 8 Dynamic Storage Areas (DSA)

    ▌ 4 DSAs above 16 MB line in extended (31-bit) DSA (EDSA)

    ▌ 4 DSAs below 16 MB line in 24-bit DSA

Restructured CICS...

CICS Transaction Server Partition		
VSAM buffers & 31-bit control blocks		Partition end (2 GB max)
CICS 31-bit storage		
CICS Non-nucleus modules and control blocks (2.3MB)	31-bit GETVIS	
Early CICS tasks 31-bit kernel stack storage		
CICS Extended DSA (EDSALIM – 10MB min.)		
(EUDSA, ERDSA, ESDSA, ECDSA)		
available 31-bit GETVIS		
available 24-bit GETVIS		16 MB
ICCF and Interactive Partitions		
24-bit VSAM control blocks, etc.		CICS TS Partition
CICS 24-bit storage		
CICS Non-nucleus modules and control blocks (.5MB)	24-bit GETVIS	
Early CICS tasks 24-bit kernel stack storage		
CICS DSA(DSALIM – 2MB min.)		
(UDSA, RDSA, SDSA, CDSA)		
CICS TS DFHSIP (4K)		SIZE=DFHSIP
		Partition start

CICS Transaction Server Partition

Restructured CICS...

- **Dynamic Storage Areas**
  - CDSA and ECDSA
    - CICS-key non-reentrant programs, control blocks and task-lifetime storage
  - UDSA and EUDSA
    - User-key task-lifetime storage
  - SDSA and ESDSA
    - User-key non-reentrant programs and EXEC CICS GETMAIN....SHARED storage
  - RDSA and ERDSA
    - All SVA-eligible programs not in SVA

Restructured CICS...

- **Dynamic Storage Areas**
  - Short-on-Storage (SOS) condition
    - Insufficient storage in DSA to satisfy unconditional GETMAIN request
    - Can occur in any of DSAs
    - DFHSM0131 - SOS in 24-bit DSAs
    - DFHSM0133 - SOS in 31-bit DSAs

CEMT Transaction

- System and DSA settings
  - CEMT INQ SYSTEM
  - CEMT INQ DSA
- Information about tasks
  - CEMT INQ TASK
- Request CICS system dump
  - CEMT PERFORM SNAP
- Control system dumps

CEMT Transaction...

CEMT INQUIRE SYSTEM

```
I SYS
STATUS:  RESULTS - OVERTYPE TO MODIFY
  AGing( 05000 )                    PROGAUTOCtlg( CTLGALL )
  AKp( 00000 )                      PROGAUTOExit( DFHPGADX )
  CDsasize( 00524288 )              PROGAUTOInst( AUTOINACTIVE )
  CIcstslevel( 010100 )             RDsasize( 00524288 )
  CMDPROTEct( CMDPROT )             REENTPROTEct( REENTPROT )
  DFltuser( CICSUSER )              RELease( 0410 )
  DSalimit( 05242880 )              RUnaway( 0020000 )
  DTrprogram( DFHDYP   )            SCandelay( 0200 )
  DUmping( SYSDUMP )                SDsasize( 01048576 )
  ECdsasize( 0003145728 )          SOSStatus( NOTSOS )
  EDsalimit( 0026214400 )          SToreprotect( INACTIVE )
  ERdsasize( 0005242880 )          Time( 0001000 )
  ESdsasize( 0001048576 )          Udsasize( 00262144 )
  EUdsasize( 0001048576 )
  MAxtasks( 050 )
  MRobatch( 001 )
  OPRel( 64 )
  OPSys( E )


                                          SYSID=CIC1 APPLID=DBDCCICS
  RESPONSE: NORMAL                        TIME:  11.58.24  DATE: 04.28.00
PF 1 HELP       3 END                7 SBH 8 SFH 9 MSG 10 SB 11 SF
```

CEMT Transaction...

CEMT INQUIRE DSA

```
 I DSA
 STATUS:  RESULTS - OVERTYPE TO MODIFY
    SOSStatus( NOTSOS )

  Dsalimit( 05242880  )
   Cdsasize( 00524288 )
   Rdsasize( 00524288 )
   SDsasize( 01048576 )
   Udsasize( 00262144 )

  EDsalimit( 0026214400  )
   ECdsasize( 0003145728 )
   ERdsasize( 0005242880 )
   ESdsasize( 0001048576 )
   EUdsasize( 0001048576 )




                                          SYSID=CIC1 APPLID=DBDCCICS
   RESPONSE: NORMAL                        TIME:  11.49.53  DATE: 04.28.00
 PF 1 HELP        3 END             7 SBH 8 SFH 9 MSG 10 SB 11 SF
```

CEMT Transaction...

- CEMT INQ TASK
  - Status of task
    - RUN (running)
    - DIS (dispatchable)
    - SUS (suspended)
  - Principal facility
    - TER (terminal), TAS(non-terminal task)

CEMT Transaction...

- **CEMT INQ TASK**
  - Suspended task information
    - Name of resource transaction is waiting on - Hva
    - Resource type suspend is waiting on - Hty
    - How long suspended - Hti
  - How the transaction was started
    - STA(C|T|TT|QD|S|SD|SZ|DF)

CEMT Transaction ...

- **CEMT INQ TASK**
  - How the transaction was started (STA)

    C   CICS internal attach

    T   terminal input attach

    TT   permanent transaction terminal attach

    QD transient data trigger level attach

    S   START command without any data

    SD START command with data

    SZ FEPI attach

    DF   Start code not yet known-to be set later

CEMT Transaction...

```
   IN TAS
 SYNTAX OF SET COMMAND
  Tas(0025814) Tra(TELW) Fac(NB02) Sus Ter Pri( 001 )
     Hty(ZCIOWAIT) Hva(DFHZARQ1) Hti(590068) Sta(SD)
     Use(SYSA    ) Rec(X'B47665E905237B00')
  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
```

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CETR Transaction

- Online transaction for control of CICS TS tracing facilities

- Status of internal and auxiliary trace

- Trace settings for CICS components

- Standard, special, and suppressed trace settings for terminals and transactions

CETR Transaction...

```
CETR                         CICS Trace Control Facility                    CIC1 DBDCCICS

Type in your choices.

Item                                  Choice          Possible choices

Internal Trace Status        ===>     STARTED         STArted, STOpped
Internal Trace Table Size    ===>     80        K     16K - 1048576K

Auxiliary Trace Status       ===>     STOPPED         STArted, STOpped, Paused
Auxiliary Trace Dataset      ===>     A               A, B
Auxiliary Switch Status      ===>     NO              NO, NExt, All

Master System Trace Flag     ===>     ON              ON, OFf
Master User Trace Flag       ===>     ON              ON, OFf

When finished, press ENTER.

PF1=Help      3=Quit        4=Components        5=Ter/Trn      9=Error List
```

CETR Transaction...

```
CETR                         Component Trace Options                    CIC1 DBDCCICS

Over-type where required and press ENTER.                               PAGE 1 OF 3
Component Standard                                        Special
--------  -----------------------------        -----------------------------
   AP     1                                        1
   BF     1                                        1
   BM     1                                        1
   CP     1                                        1
   DC     1                                        1
   DD     1                                        1
   DI     1                                        1
   DM     1                                        1
   DS     1                                        1
   DU     1                                        1
   EI     1                                        1
   FC     1                                        1
   GC     1                                        1
   IC     1                                        1
   IS     1                                        1
   JC     1                                        1
   KC     1                                        1


PF:  1=Help     3=Quit     7=Back   8=Forward   9=Messages    ENTER=Change
```

CETR Transaction...

```
CETR                         Transaction and Terminal Trace            CIC1 DBDCCICS

Type in your choices.


Item                                    Choice        Possible choices


Transaction ID                 ===>     CESN          Any valid 4 character ID
Transaction Status             ===>     STANDARD      STandard, SPecial, SUppressed


Terminal ID                    ===>     NB05          Any valid Terminal ID
Netname                        ===>     TELNB05       Any valid Netname
Terminal Status                ===>     STANDARD      STandard, SPecial


Terminal ZCP Trace             ===>     OFF           ON, OFf





When finished, press ENTER.




PF1=Help       3=Quit                               9=Error List
```

CICS TS Trace

- **Trace Recording Facilities**
  - CICS internal trace
    - Allocated in CICS partition 31-bit GETVIS
    - Written in system dumps
  - CICS auxiliary trace
    - Written to sequential dataset
      - SAM dataset, VSAM-managed SAM or tape
  - CICS transaction trace (new in CICS TS)
    - Allocated in CICS partition 31-bit GETVIS
    - Written in transaction dumps

CICS TS Trace...

- **Types of trace**
  - **Standard trace**
    - Predefined trace points in CICS modules
    - Trace of all tasks and functions in CICS
  - **Special trace**
    - Tracing by specific task and terminal
    - Controlled by CETR transaction

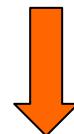# CICS TS Trace...

- Types of trace...
  - Exception trace
    - First failure data capture points in CICS logic
    - Cannot be suppressed
  - User trace
    - User application requested trace entries
      - EXEC CICS ENTER TRACENUM
    - User application exception trace entries
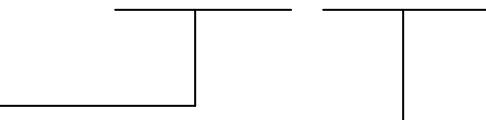   - EXEC CICS ENTER TRACENUM EXCEPTION
      - Cannot be suppressed

CICS TS Trace...

- **Exception trace entries**

```
14404 1 AP 0001 USER   *EXCU APPLICATION-PROGRAM-EXCEPTION MAPKEY 111111
14404 1 AP 1942 APLI   *EXC* Program-Check            START_PROGRAM,SAMPASRA,CEDF,…
14404 1 AP 0781 SRP    *EXC* ABEND_ASRA               SAMPASRA,000009D4,CICS
```

Failing Program

Displacement into
Program of failing instruction

CICS TS System Dumps

▌ Created by system abend or CEMT request
  ▌ Dump of CICS partition storage
▌ Written to VSE dump library SYSDUMP
▌ Written to SYSLST if dump library full
  ▌ Suppress with OPTION SYSDUMPC on VSE/ESA 2.4 and above
▌ Formatted by Info/Analysis and CICS dump exit program

CICS TS System Dumps...

- New CICS dump exit program
  - DFHPD410 replaces DFHDAP from CICS/VSE
  - Formats CICS TS dumps only
  - Formatting levels
    - Default level for all components (DEF={0|1|2|<u>3</u>})
    - Selective by CICS component
      - Suppress formatting (xx=0)
      - Summary information (xx=1)
      - Full formatting of control blocks (xx=2)
      - Both summary and full formatting (xx=3)

CICS TS System Dumps...

```
// JOB DFHPD410  ANALYZE CICS TS DUMP

// EXEC PROC=DTRINFOA

// EXEC INFOANA,SIZE=INFOANA,OS390
   SELECT DUMP MANAGEMENT
     DUMP NAME SYSDUMP.F2.DF200012

           RETURN

   SELECT DUMP VIEWING

           CALL DFHPD410 DATA KE=3,DS=3,TR=3,LD=3

           RETURN

     DUMP NAME SYSDUMP.F2.DF200012
   SELECT DUMP VIEWING

           PRINT FORMAT

           RETURN

   SELECT END
/*

/&
```

CICS TS System Dumps...

- **CICS dump tables**
  - Defined with CEMT and EXEC CICS SET
    - CEMT or EXEC CICS INQ|SET TRDUMPCODE
    - CEMT or EXEC CICS INQ|SET SYDUMPCODE
  - Options based on dump codes
    - Suppress dump
    - Maximum number of dumps CICS will take
    - Terminate CICS after occurrence

CICS TS System Dumps...

■ What to format
  ■ Start with summary (xx=1)
  ■ Trace, Kernel and Transaction manager domains (KE=1, XM=1, TR=1)
  ■ Hung tasks or system
    ▎ Dispatcher domain (DS=1) and other related areas
  ■ Storage problems
    ▎ Application (AP=) and storage manager (SM=) domains

CICS TS System Dumps...

```
===KE: Kernel Domain KE_TASK Summary

KE_NUM KE_TASK  STATUS        TCA_ADDR TRAN_# TRANSID DS_TASK   KE_KTCB  ERROR

0001   034F5880 KTCB Step     00000000                00000000 034D90B0
0002   034F5500 KTCB QR       00000000                034F5000 034DB020
0003   034F5180 KTCB RO       00000000                034D9000 034DA068
0004   034FCC80 Not Running   01B73080 00022  CSNE    0340B080 034DB020
0005   034FC900 Unused
0006   034FC580 Not Running   01B72680 TCP    CSTP    0340BD80 034DB020
0007   034FC200 Not Running   00000000                03400380 034DB020
0008   034DFC80 Unused
0009   01BF5780 Not Running   00493080 00006  CSSY    0340B580 034DB020
000A   01B33400 Unused
000B   01B33780 Unused
000D   01B33B00 Unused
000E   01BC1080 Unused
000F   01BF5B00 ***Running** 00493680 00007  ABCD    0340B680 034DB020 *YES*
0010   01BC1400 Unused
0014   01BC1780 Unused
```

CICS TS System Dumps...

```
===DS: DISPATCHER DOMAIN - SUMMARY


 KEY FOR SUMMARY


    TY = TYPE OF TASK            SY=SYSTEM   NS=NON-SYSTEM
    S  = STATE OF TASK           DIS=DISPATCHABLE   SUS=SUSPENDED   RUN=RUNNING
    P  = PURGEABLE WAIT/SUSPEND  Y=YES   N=NO
    PS = PURGE STATUS            OK=NO PURGE   PU=PURGED   PP=PURGE PENDING
    TT = TIMEOUT TYPE            IN=INTERVAL   DD=DEADLOCK DELAYED   DI=DEADLOCK
    ST = SUSPEND TYPE            EXT=WAIT_EXTERNAL   SUSP=SUSPEND   OLDC=WAIT_OLD
    DTA= DISPATCHER TASK AREA
    AD = ATTACHING DOMAIN
    MO = TASK MODE               QR=QUASI-REENTRANT  RO=RESOURCE OWNING  SZ=FEP


 DS_TOKEN KE_TASK   TY S    P PS TT RESOURCE RESOURCE ST   TIME OF     TIMEOUT
                                    TYPE     NAME         SUSPEND     DUE


 00000003 034FCC80 SY SUS N OK -  ZC       DFHZNAC1 SUSP 11:46:44.330    -
 00060005 01E6A080 SY SUS N OK -  KCCOMPAT SINGLE   OLDW 10:14:05.781    -
 008C0001 01B33080 SY SUS N OK IN SMSYSTEM          SUSP 11:54:51.635 11:59:51.63
 010E03DB 01BDB780 NS SUS N OK -  EKCWAIT  SINGLE   OLDW 11:57:14.966    -
```

CICS TS System Dumps...

```
==XM: TCLASS SUMMARY

  Tclass      Max      Purge    Current   Current     Total    Queuing  Queuing
   Name      Active   Threshld   Active    Queued    Attaches  TranNum  Transid
 --------   --------  --------  --------  --------   --------   -------   ----

 DFHCOMCL      10        0         0         0          0
 DFHTCL01       1        0         0         0          0
 DFHTCL02       1        0         0         0          0
 DFHTCL03       1        0         0         0          0
 DFHTCL04       1        0         0         0          0
 DFHTCL05       1        0         0         0          0
 DFHTCL06       1        0         0         0          0


==XM: MXT SUMMARY

    Maximum user tasks (MXT):              20
    System currently at MXT:               No
    Current active user tasks:             5
    Current queued user tasks:             0
  * Peak active user tasks:                7
  * Peak queued user tasks:                0
  * Times at MXT limit:                    0
```

CICS TS System Dumps...

```
===SM: STORAGE MANAGER DOMAIN - SUMMARY


   SM Domain status:                    INITIALISED
   Storage recovery:                    YES
   Storage protection requested:        NO
   Storage protection active:           NO
   Reentrant program option:            PROTECT
   Current DSA limit:                      5120K
   Current DSA total:                      2048K
   Currently SOS below 16M:                   NO


   Current EDSA limit:                       25M
   Current EDSA total:                       10M
   Currently SOS above 16M:                   NO
```

Summary

- More functions in CICS TS to facilitate system problem determination
- New trace and dump options
- New and changed control transactions
- More user controls
- More granularity
- Knowledge of tools will help resolve problems faster

Available CICS TS Classes

▌ CICS TS Tuning and Problem Determination - A3732

  ▌ Getting the best performance from CICS TS

  ▌ Handling dumps, abends, traces, and so forth

  ▌ Hands-on machine labs

  ▌ 3 day class
    WAVV   4/17-19
    Dallas   6/19-21
    Atlanta   8/12-14

Available CICS TS Classes...

- **CICS TS Under the Covers - A3733**
  - Using new function in CICS TS
  - Understanding more about how it works
  - Hands-on machine labs
  - 2 day class
    Dallas   6/17-18
    Atlanta   8/15-16

Available CICS TS Classes...

- **CICS TS Migration - A3731**
  - What you need to know to migrate to CICS TS
  - Hands-on machine labs
  - 3 day class
Chicago	5/6-8
Atlanta	7/17-19

Other Sources of Information

- IBM Redbooks
  - Migration to VSE/ESA 2.4 and CICS Transaction Server for VSE/ESA 1.1   (SG24-5595)
  - Implementation of VSE/ESA 2.4 and CICS Transaction Server for VSE/ESA 1.1   (SG24-5624)
- CICS Transaction Server Website   www-4.ibm.com/software/ts/cics
  - Manuals, flyers, brochures, etc.