

PILOT/CICS

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Preface

This publication contains information necessary for the operation of PILOT, a family of proprietary program products used for performance management and capacity planning. It provides data processing managers, system programmers, and capacity planners with information required to use this product.

Information in this publication is subject to significant change.

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This edition applies to Version 1.7 of the PILOT program products and to all subsequent versions and modifications until otherwise indicated in new editions or newsletters.

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PILOT/CICS For CMF

Introduction

PILOT/CICS allows you to format CICS CMF (SMF Type 110) records for capacity planning and performance tuning on the global system and transaction levels. The program SMFPC110 executes as a stand-alone program to process Type 110 records.

SMFPC110 has two input files:

SMFIN

This DD statement specifies the input file. This file is required.

SMFCTL

This DD statement specifies a control card file to control the transactions to be processed. If this file is omitted, all transactions are processed.

SMFPC110 has at least two output files:

SMFLOG

This file provides information on the data processed. The file is always required.

SMF110S

This file is optional. It provides summary information for CICS on a global level. When this file is omitted, a file for downloading data is not created.

SMF110SR

This file is optional. It provides summary information for each transaction processed containing response times. When this file is omitted, a file for downloading data is not created.

Control Cards and Parameters

Keywords for SMFPC110 may be specified in free format control statements. The keywords are separated from other parameters with a space. All other parameters are separated by commas. Keywords and parameters may appear between columns one and seventy-one inclusive. The statement may be continued on the next card. No special continuation character is required.

Comments may be specified on any control card by placing an asterisk in column one, making the entire card a comment, or by leaving at least one blank on any control card past column seventeen. If the asterisk is omitted or incorrectly specified, the step will be terminated with a completion code of 16.

Example:

```

      1      2      3      4      5
123456789012345678901234567890123456
78901234567890
```

```
EXCLUDE=(CSSN,TRAN05) NO STATS
FOR THESE TRANS
```

Note that the parameters start in column two and that "NO STATS FOR THESE TRANS" is a comment.

EXCLUDE=(Tran1,Tran2,Tran3,...)

(E=)

Specifies a group of transactions that are to be excluded from processing. Up to 50 transactions may be specified.

INCLUDE=(Tran1,Tran2,Tran3,...)**(I=)**

Specifies a group of transactions that are to be included for processing. Up to 50 transactions may be specified.

IREGS=(Reg1,Reg2,Reg3,Reg4,...)

Specifies a group of CICS regions (VTAM ACB name is used) to be included for processing. Up to 50 regions may be specified.

EREGS=(Reg1,Reg2,Reg3,Reg4,...)

Specifies a group of CICS regions (VTAM ACB name is used) to be excluded for processing. Up to 50 regions may be specified.

Parameters on the JCL EXEC Card

GDATE

Specifies that the date is to be printed in MM/DD/YY format instead of Lotus 1-2-3 (D1) format.

COMREGS

Specifies that all input data found is to be processed as one output file combining all regions found.

SEPREGS

Specifies that data is divided by regions found on the input file.

DLI

Specifies that DLI statistics will be included if the user fields are defined as stated in the CICS Resource Definition Guide.

JCL

SMFPC110 is a stand-alone program:

```
//PCFMT EXEC
PGM=SMFPC110,REGION=1720K
//STEPLIB DD
DSN=TSU01.MYLIB,DISP=SHR
//SMFIN DD
DSN=BACKUP.SMFWKLY.G0001V00,
// VOL=SER=123456,DISP=OLD,
// UNIT=TAPE
//SMFLOG DD SYSOUT=A
//SMF110S DD DSN=TSU01.CICSSU
M.PRN,
// DISP=(,CATLG),
// SPACE=(TRK,(4,4),RLSE)
//SMF110SR DD
DSN=TSU01.CICSRSP.PRN,
// DISP=(,CATLG),
// SPACE=(TRK,(4,4),RLSE)
//SMFCTL DD *
*
* COLLECT CICS TRANS. EXCEPT SIGN
ON AND CMF TRANS.
*
EXCLUDE=(CCMF,CSSN)
/*
```

Notes:

1. STEPLIB
Used if SMFPC110 is not in the Link List.
2. SMFIN
Input data set of SMF records.
3. SMFLOG
Statistics on the run.

4. SMF110S
CICS summary file to transfer to a PC.
5. SMF110SR
CICS summary response time file to transfer to a PC.
6. SMFCTL
Control card data set.

Spreadsheets

There are two spreadsheets available for the analysis of CICS performance data. The Summary spreadsheet data is obtained from the file created in the SMF110S file, and is illustrated in **Figure 1** on page 5. The following information is provided in the SMF110S file for each hour:

DATE

Specifies the date CICS was executing. The format can be mm/dd/yy or Lotus 1-2-3 date format (D1, D2, or D3).

TIME

Specifies the time of day.

CID

Specifies the CICS ID. The first four bytes of the NETNAME are used.

#TASK

The number of transactions processed for this period.

AVG RSP

The average response time for all transactions.

AVG WAIT

The average wait time for all transactions.

AVG CPU

The average CPU time for all transactions.

OSTOR

The average amount of storage used by all transactions, in 1024 byte units.

AMC

The total number of access method calls for all transactions.

I/O

The Total amount of I/O processing all transactions performed. This includes access method calls, journal puts, synchpoints, BMS In, BMS Out, Temporary Storage AUX count, and Transient Data get and put counts.

%CPU CICS

The total percentage of the CPU used by the CICS region.

%CPU APPL

The percentage of the CPU used by the application programs running within the CICS region.

PAGE IN

The page in rate (pages per second) for the CICS region.

PAGE OUT

The page out rate (pages per second) for the CICS region.

COMPS

The number of storage bytes compressed during the period.

PCP RSP

The average time for loading a program during the period

PCP

The number of program loads during the period.

DLI RSP

The average response time for a DLI call (if DLI is installed).

DLI

The number of DLI calls during the period (if DLI is installed).

DB2 RSP

The average response time for a DB2 call (if DB2 is installed). **This field is not available in CMF. This field is provided for compatibility with TMON 8.2.**

DB2

The number of DB2 calls during the period (only for the DB2 option). **This field is not available in CMF. This field is provided for compatibility with TMON 8.2.**

UDB RSP

The average response time for a User Database. **This field is not available in CMF. This field is provided for compatibility with TMON 8.2.**

UDB

The number of User Database calls during the period. **This field is not available in CMF. This field is provided for compatibility with TMON 8.2.**

The Response spreadsheet data is obtained from the file created in the SMF110R file, and is illustrated in **Figure 2** on page 7. The following information is provided in the SMFPC110R file for each transaction processed:

DATE

Specifies the date the transaction was initiated by CICS. The format can be mm/dd/yy or Lotus 1-2-3 date format (D1, D2, or D3).

TIME

Specifies the time of day the transaction was initiated by CICS in hhmm format.

TRAN

The transaction name.

T

Transaction types as follows:

- A Auto initiated transaction.
- P Printer transaction.
- T Terminal initiated transaction.
- Z Conversational transaction.

#TASK

The number of transactions processed for this period.

95% RSP

The 95th percentile of the transaction response time for this transaction code. This means that the value reported is higher than 95 percent of the transactions processed for this period.

75% RSP

The 75th percentile of the transaction response time for this transaction code.

50% RSP

The 50th percentile of the transaction response time for this transaction code.

25% RSP

The 25th percentile of the transaction response time for this transaction code.

MIN RSP

The minimum transaction response time for this transaction code.

Specifies the CICS ID. The first four bytes of the NETNAME are used.

MAX RSP

The maximum transaction response time for this transaction code.

95% WT

The file control wait time of the 95th percentile value as described above.

50% WT

The file control wait time of the 50th percentile value as described above.

MIN WT

The minimum file control wait time for this transaction code.

MAX WT

The maximum file control wait time for this transaction code.

CPU

The average amount of CPU time used by the transaction.

STOR

The average amount of storage the transaction used, in 1024 byte units.

AVG I/O

The average amount of I/O processing the transaction performed. This includes access method calls, journal puts, synchpoints, BMS In, BMS Out, Temporary Storage AUX count, and Transient Data get and put counts.

PAGEIN

The average number of page faults for this transaction.

CID

```

A1: [W9]
MENU
IMPORT  GRAPHS  PRINT  RETURN  SAVE  SETUP  EXIT
Load a ".PRN" file for a CICS Summary Report
      A      B      C      D      E      F      G      H      I      J
1
2                               Spreadsheet  Version
3                               SUMCICS      V1L5.0
4
5                PILOT/CICS Summary Template
6
7  AXIOS PRODUCTS, INC.  PILOT/CICS (C) 1993  TMV8  KLM Technical
Specialti
8  CICS REGIONS:TS04
9  DATE      TIME CID #TASKS  AVG_RSP  AVG_WAIT  AVG_CPU  OSTOR DSA  AMC
10 07/14/93 1900 TS04    129    0.089    0.038    0.0124  678 11268
267
11 07/14/93 2000 TS04    184    0.055    0.022    0.0055  678 11268
109
12 07/14/93 2100 TS04    300    0.093    0.023    0.0092  678 11268
1334
13 07/14/93 2200 TS04    403    1.295    1.058    0.9881  678 11268
9514
14 07/14/93 2300 TS04    192    0.253    0.143    0.1019  678 11268
1994
15 07/15/93   0 TS04    218   55.875    0.746    0.0192  616 4952
277
16 07/15/93  100 TS04    183    0.177    0.065    0.0173  616 6744
850
17 07/15/93  200 TS04    737    0.201    0.064    0.0488  616 7404
5344
18 07/15/93  300 TS04   1925    0.136    0.017    0.0151  616 7536
12343
19 07/15/93  400 TS04    284    0.971    0.746    0.6741  616 9180
5208
20 07/15/93  500 TS04    339    0.801    0.606    0.5528  676 9180
6190
23-Nov-93  03:18 PM                                CMD

```

Figure 1 Summary Template for CMF

```
A1:
MENU
IMPORT  GRAPH  PRINT  RETURN  SAVE  SETUP  EXIT
Load a ".PRN" file for a CICS Response Time Report
      A      B      C      D      E      F      G      H      I
1          Spreadsheet      Version
2          RSPCICS          V1L5.0
3
4
5
6          CICS Response Time Template
7
8          PILOT/CICS (C) 1986-1993
9  Notes:
10         There are macros you can use to return to the menus.
11         Press:
12         ALT-A to bring up the query menu
13         ALT-G to bring up the graphs menu
14         ALT-M to bring up the main menu (this screen)
15         ALT-P to bring up the print menu
16         (Use CTRL in the Windows version of Lotus)
17
18
19
20
23-Nov-93  03:20 PM          CMD
```

Figure 2 Response Template for CMF

PILOT/CICS for The Monitor™

Introduction

SMFLOG

PILOT/CICS allows users to format The Monitor™ detail records for capacity planning and performance tuning on the system and transaction level. Two versions of the program are provided. The program MONPCLMK executes as a stand-alone program to process the records created by The Monitor™ Version 8. The program SMFPCLMK executes as a stand-alone program to process records created by Landmark's database utility program \$DBUTIL, and supports all earlier versions of The Monitor™. Both programs read The Monitor's™ detail and system interval records.

MONPCLMK and SMFPCLMK have two input files:

LMKIN

Specifies the input file that contains The Monitor™ records. SMFIN data files are not processed when this DD statement is included.

SMFCTL

Specifies a control card file to indicate the regions and transactions to be processed. If this file is omitted, all regions and transactions are processed.

MONPCLMK and SMFPCLMK have at least two output files:

This file is always required. This file provides information on the data processed.

SMFMONS

This optional file provides summary information for each region processed. When this DD statement is omitted, a file for downloading is not created.

SMFMONSR

This optional file provides summary information for each transaction processed. When this DD statement is omitted, a file for downloading is not created.

Do not run these programs as user exits of READSMF when processing non-SMF data.

Control Cards and Parameters

There is one keyword with three operands that may be specified in the SIMCTL file. The REGION keyword must start between columns 2 and 71 and be followed by a blank. Operands for these control cards must be separated by a comma. The REGION control card is needed to reduce output.

The format of the control card follows.

```
REGION      INCL=(t1,t2,t3,...),  
            IREG=(r1,r2,r3..),  
            EREG=(r1,r2,r3..),
```

The statement may be continued on the next card. No special continuation character is required.

Example:

```

      1      2      3      4
123456789012345678901234568
9012345

```

REGION EXCLUDE=(CSSN,TRAN05) NO
STATS

EXCL=(TRN1,TRN2,TRN3,TRN4,...)

Where "TRNx" represents a transaction code to be excluded from processing. An "*" may be used as a mask in the last three positions. Up to 50 transactions may be specified.

INCL=(TRN1,TRN2,TRN3,TRN4,...)

Where "TRNx" represents a transaction code. Specifies a group of transactions that are to be included for processing. An "*" can be used as a mask in the last three positions. Up to 50 transactions may be specified.

The EXCL and INCL keywords can be specified using an "*" as a mask for transaction names. For example, INCL=(TR*,TI*) will include all transactions that start with TR or TI only.

IREG=(CID1,CID2,CID3,CID4,...)

Specifies a group of CICS regions to be included for processing. Up to 50 CICS IDs maybe specified.

EREG=(CID1,CID2,CID3,CID4,...)

Specifies a group of CICS regions to be excluded from processing. Up to 50 CICS IDs maybe specified.

Parameters on the JCL EXEC Card

GDATE

Specifies that the date be printed in mm/dd/yy format instead of Lotus 1-2-3 (D1) format.

COMREGS

Specifies that all input data found is to be processed as one output file combining all regions found.

SEPREGS

Specifies that data is divided by regions found on the input file.

JCL

PILOT/CICS for The Monitor™ is a stand-alone program:

```

//PCFMT EXEC      PGM=SMFPCLMK,
                  REGION=1720K
                  or
//PCFMT EXEC      PGM=MONPCLMK,
                  REGION=1720K
//STEPLIB DD      DSN=TSU01.MYLIB
                  ,DISP=SHR
//LMKIN DD DSN=BACKUP.LANDMAR
                  K.DATA.G0001V00,
//                  UNIT=TAPE,
//                  VOL=SER=123456,DISP=O
                  LD
//SMFLOG DD      SYSOUT=A
//SMFMONS DD      DSN=TSU01.CICSS
                  UM.PRN,
//                  DISP=(,CATLG),
//                  SPACE=(TRK,(4,4),RLSE)
//SMFMONS DD      DSN=TSU01.
                  CICS RSP.PR
                  N,

```



```
//          DISP=(,CATLG),
//          SPACE=(TRK,(4,4),RLSE)
//SMFCTL   DD      *
*
* COLLECT CICS TRANS. EXCEPT
SIGNON, SIGNOFF TRANS.
*
                R E G I O N
EXCL=(CSSN,CSSF),IREG=(PRD1)
/*
```

Notes:

1. STEPLIB
Used if SMFPCLMK is not in the link list.
2. LMKIN
The input data set, containing TMON records.
3. SMFLOG
Statistics on the run.
4. SORTIN
Used as a workfile to calculate percentiles.
5. SMFMONS
CICS summary file to transfer to a PC.
6. SMFMONSr
The CICS summary response time file to transfer to a PC.
7. SMFCTL
Control card data set.

Spreadsheets

There are two spreadsheets available for the analysis of CICS performance data. The Summary spreadsheet data is obtained from the file created in the SMFMONS file, and is illustrated in **Figure 3** on page 14. The following information is provided in the SMFMONS file for each hour:

DATE

Specifies the date CICS was executing. The format can be mm/dd/yy or Lotus 1-2-3 date format (D1, D2, or D3).

TIME

Specifies the time of day in hhmm format.

CID

CICS system identifier specified in DFHSIT (1.7), DFHTCT (2.1) SYSIDNT parameter.

#TASK

The number of transactions processed for this period.

AVG RSP

The average response time for all transactions.

AVG WAIT

The average wait time for all transactions.

AVG CPU

The average CPU time for all transactions.

STOR

The amount of operating system storage available (OSCOR) in 1024 byte units.

AMC

The total number of access method calls for all transactions.

I/O

The total amount of I/O processing all transactions performed. This includes access method calls, journal puts, synchpoints, BMS In, BMS Out, Temporary Storage AUX count, and Transient data get and put counts.

%CPU CICS

The total percentage of the CPU used by the CICS region. Sum of TCB and SRB CPU time. TMON collection option "REALCPU" must be set to "Y".

%CPU APPL

The percentage of the CPU used by the application programs running within the CICS region. TMON collection option "REALCPU" must be set to "Y"

PAG IN

The page in rate (pages per second) for the CICS region.

PAG OUT

The page out rate (pages per second) for the CICS region.

COMPS

The number of program subpool compressions during the period.

PCP_RSP

The average time for loading a program during the period.

PCP

The number of program loads during the period.

DSA_HWM

The highest amount of storage allocated from dynamic storage area during the period. In 1024 byte units.

DLI_RSP

The average response time for a DLI call (if DLI is installed).

DLI

The number of DLI calls during the period (if DLI is installed).

DB2_RSP

The average response time for a DB2 call (if DB2 is installed).

DB2

The number of DB2 calls during the period (if DB2 is installed).

UDB_RSP

The average response time for a user database (IDMS, ADATABASE, etc.) call.

UDB

The number of user database (IDMS, ADATABASE, etc.) calls during the period.

INTVL

The number of seconds in the period.

The Response spreadsheet data is obtained from the file created in the SMFMONSr file, and is illustrated in **Figure 4** on page 14. The following information is provided in the SMFMONSr file for each transaction processed:

DATE

Specifies the date the transaction was initiated by CICS. The format can be mm/dd/yy or Lotus 1-2-3 date format (D1, D2, or D3).

TIME

Specifies the time of day the transaction was initiated by CICS, in hhmm format.

TRAN

The transaction name.

T

Transaction types as follows:

A Auto initiated transaction.

P Printer transaction.

T Terminal initiated transaction.
 Z Conversational transaction.
 R Inter-region transaction.
 I Inter-system transaction.

#TASK

The number of transactions processed for this period.

95% RSP

The 95th percentile of the transaction response time for this transaction code. This means the value reported is higher than 95 percent of the transactions processed for this period.

75% RSP

The 75th percentile of the transaction response time for this transaction code.

50% RSP

The 50th percentile of the transaction response time for this transaction code.

25% RSP

The 25th percentile of the transaction response time for this transaction code.

MIN RSP

The minimum transaction response time for this transaction code.

MAX RSP

The maximum transaction response time for this transaction code.

95% WT

The file control wait time of the 95th percentile value as described above.

50% WT

The file control wait time of the 50th percentile value as described above.

MIN WT

The minimum file control wait time for this transaction code.

MAX WT

The maximum file control wait time for this transaction code.

CPU

The average amount of CPU time the transaction used.

STOR

The average amount of storage the transaction used in 1024 byte units.

AVG I/O

The average amount of I/O processing the transaction performed. This includes access method calls, journal puts, synchpoints, BMS In, BMS Out, Temporary Storage AUX count, and Transient Data get and put counts.

DLI_RSP

The average response time for a DLI call (if DLI is installed).

DLI

The number of DLI calls during the period (if DLI is installed).

DB2_RSP

The average response time for a DB2 call (if DB2 is installed).

DB2

The number of DB2 calls during the period (if DB2 is installed).

UDB_RSP

The average response time for a user database (IDMS, ADATABASE, etc.) call.

UDB

The number of user database (IDMS, ADATABASE, etc.) calls during the period.

PGIN

The average number of page faults for this transaction.

PGOUT

The average number of page outs for this transaction.

CID

CICS system identifier specified in the DFHSIT (1.7) or DFHTCT (2.1) SYSIDNT parameter.

```

A1: [W9]
MENU
IMPORT  GRAPHS  PRINT  RETURN  SAVE  SETUP  EXIT
Load a ".PRN" file for a CICS Summary Report
      A      B      C      D      E      F      G      H      I      J
1
2                               Spreadsheet  Version
3                               SUMCICS      V1L5.0
4
5                PILOT/CICS Summary Template
6
7  AXIOS PRODUCTS, INC.  PILOT/CICS (C) 1993  TMV8  KLM Technical
Specialti
8  CICS REGIONS:TS04
9  DATE      TIME CID #TASKS  AVG_RSP  AVG_WAIT  AVG_CPU  OSTOR DSA  AMC
10 07/14/93  1900 TS04    129    0.089   0.038   0.0124  678 11268
267
11 07/14/93  2000 TS04    184    0.055   0.022   0.0055  678 11268
109
12 07/14/93  2100 TS04    300    0.093   0.023   0.0092  678 11268
1334
13 07/14/93  2200 TS04    403    1.295   1.058   0.9881  678 11268
9514
14 07/14/93  2300 TS04    192    0.253   0.143   0.1019  678 11268
1994
15 07/15/93   0 TS04    218   55.875   0.746   0.0192  616 4952
277
16 07/15/93  100 TS04    183    0.177   0.065   0.0173  616 6744
850
17 07/15/93  200 TS04    737    0.201   0.064   0.0488  616 7404
5344
18 07/15/93  300 TS04   1925    0.136   0.017   0.0151  616 7536
12343
19 07/15/93  400 TS04    284    0.971   0.746   0.6741  616 9180
5208
20 07/15/93  500 TS04    339    0.801   0.606   0.5528  676 9180
6190
23-Nov-93  03:18 PM                                CMD

```

Figure 3 Summary Template for The Monitor™

```
A1:
MENU
IMPORT  GRAPHS  PRINT  RETURN  SAVE  SETUP  EXIT
Load a ".PRN" file for a CICS Response Time Report
      A      B      C      D      E      F      G      H      I
1          Spreadsheet      Version
2          RSPCICS          V1L5.0
3
4
5
6          CICS Response Time Template
7
8          PILOT/CICS (C) 1986-1993
9  Notes:
10         There are macros you can use to return to the menus.
11         Press:
12         ALT-A to bring up the query menu
13         ALT-G to bring up the graphs menu
14         ALT-M to bring up the main menu (this screen)
15         ALT-P to bring up the print menu
16         (Use CTRL in the Windows version of Lotus)
17
18
19
20
23-Nov-93  03:20 PM          CMD
```

Figure 4 Response Template for The Monitor™

Modeling

Introduction to Modeling

PILOT/CICS provides two models. The first, **MODLCICS**, is an analytic queuing model to calculate average response times based upon 9 input parameters. The second, **SIMCICS**, is a model used to simulate a multi-tasking operating system by defining transaction/request-oriented workloads.

MODLCICS executes under Lotus 1-2-3 and can be used to model simple CICS environments. More complex environments require more knowledge about the expected results and the input factors can be difficult to estimate.

SIMCICS has two components, a mainframe model generator, and the actual simulator that executes on the PC. The simulator can model more complex environments.

MODLCICS Spreadsheet

The spreadsheet MODLCICS provides an automated tool for capacity planning and performance analysis of the CICS environment. This program is an analytic queuing model which calculates average CICS response times based on 9 input parameters. These parameters represent average utilization factors affecting memory, the DASD subsystem, and CPU use. The model was originally introduced in an article appearing in the December, 1982 issue of the IBM Systems Journal.

The value of using an analytic queuing model for capacity planning is twofold:

- First, an analytic model consists of equations which yield a single result (i.e., response time) when executed. Analytic models can be run over and over with a minimal use of CPU cycles. This is very important when you are examining many alternatives and playing the what/if game; and
- Second, a queuing model produces a non-linear result of response time versus resource utilization. This is, in fact, how real on-line systems behave. Models based on linear approximations are generally only accurate for a narrow range of resource utilization.

MODLCICS provides 5 user options. A list of these options is displayed when the user menu is invoked. This is done by pressing the Alt and M keys at the same time. Together, these options provide the tools for automating a capacity planning methodology for CICS.

Model Parameters

The nine input parameters for the MODLCICS spreadsheet are:

CPUR

The average CPU service time for CICS transactions. This value is expressed in

seconds and can be calculated by dividing the total CPU seconds used by CICS by the total number of completed transactions. These measurements should be made for a reasonable period of time (1 hour is recommended). This value is obtained from the PILOT/CICS summary spreadsheet.

TP

The average service time for the paging packs. Also expressed as seconds, this value is obtained from the PILOT/MVS Page data set spreadsheet or can be read from an RMF disk subsystem report. Since there will probably be more than one page pack defined, this value should represent a composite of all the active page packs.

UP

The average utilization of the paging packs. This value represents the fraction of time the pack is busy (i.e., .30 for a pack which averages 30% busy.)

TD

The average service time for the data base packs. Similar to TP above, this value represents a composite service time for all the packs used by CICS for data base disk I/O. This data can be obtained from the PILOT/MVS DASD spreadsheet, which can selectively choose packs.

UD

The average utilization of the data base packs. Similar to UP above.

IOR

The average I/O rate for CICS transactions. This value represents the number

of real disk I/Os executed on behalf of a CICS transaction. This value can be calculated by dividing the total number of disk I/Os issued by CICS to the data base packs by the total number of completed transactions.

UH

The average utilization of the CPU by tasks which run at a higher dispatching priority than CICS. Expressed as a fraction, this value measures the CPU capacity which is not available to CICS. Tasks running at a higher priority than CICS are typically VTAM, JES, and the operating system. Unique installation conditions may require that another subsystem (e.g., IMS) run at a higher priority than CICS. This value can be estimated by examining the PILOT/MVS workload activity reports or RMF. Tasks which run at a higher priority than CICS can be identified by their performance group number. The RMF reported CPU service times can be converted to CPU seconds by using the appropriate conversion factor. Dividing the CPU seconds used by the elapsed time yields the utilization by higher priority tasks. In addition, the utilization of the operating system which has not been included in a reported performance group must be added to this number. This can be estimated by comparing the total CPU utilization reported by RMF with the total number of CPU seconds reported for all performance groups. The difference between the total utilization and the total reported utilization for all performance groups is the unreported utilization charged to system overhead.

PFR

The average page fault rate for the CICS task. Expressed as page faults per second, this number represents the number of times each second that CICS must stop to wait for a page fault to be resolved. This value can be obtained from the PILOT/CICS summary spreadsheet.





XR

The average CICS transaction rate expressed as transactions per second. This value is obtained from the PILOT/CICS summary spreadsheet or it can be calculated by dividing total number of CICS completed transactions by the elapsed time.

The input parameters can be produced by the model generator program SIMBUILD. Depending on the options selected, the user may change one or more of the 9 parameters to alter the model. Some of the options will allow the user to select a starting CICS transaction rate (XR) and a delta transaction rate (DXR). This will allow the model to vary the transaction rate evenly, beginning with XR and incrementing by DXR to provide a smooth curve.

Spreadsheet Features

Options

The MODLCICS spreadsheet includes 5 user options. A list of these options can be displayed by pressing the   keys at the same time. Please note that the Lotus 1-2-3 **Calc** () key must be used when the values are changed. If the **Calc** indicator is displayed on the bottom line of the display, then the spreadsheet needs to be recalculated. Press **Calc** to do this. If you are in a menu, first press  to get to a READY prompt.

A sample of the template's main panel can be seen in **Figure 5** on page 29.

The 5 options are:

RESPONSE

Calculates the average CICS response times for a range of CICS transaction rates. A sample of the template's Response panel and menu can be seen in **Figure 6** on page 29.

SLOPE

Calculates the slope of response time versus transaction rate for a range of transaction rates. These values can be used to estimate the breaking point (out of capacity condition) of the response time/transaction rate curve. A sample of the template's Response/Slope panel and menu can be seen in **Figure 6** on page 29.

FACTORS

Calculates sensitivity factors for each model input parameter. The sensitivity factor for each parameter represents the percent change in response time caused by a 1 percent increase in the input parameter. For example, a sensitivity factor of 5 for page fault rate (PFR) means that a 1 percent increase in page fault rate will cause a 5 percent increase in response time. A sample of the template's Factors panel and menu can be seen in **Figure 7** on page 30.

BEST/WORST


Calculates a best/worst case capacity plan based on a 12 month projection of transaction rates. Best/worst case conditions are expressed as 2 sets of model parameters. Transaction rates are projected over 12 months and the model

calculates both best and worse case response times. You can also enter a maximum allowable response time value. This value will be graphed along with the best/worse case response times to show where the capacity of the CICS system is exceeded. A sample of the template's Best/Worst Case panel and menu can be seen in **Figure 8** on page 30.


Additional information on the use of this option can be found in methodology discussion on page 22.


OPTIONS

Calculates 1 to 4 sets of response times for a range of transaction rates. Each set of response times is derived from a different set of model parameters. Up to 4 configurations may be specified. The graphs of response times versus transaction rates can be used to judge the relative improvement in one option over another. Each option is expressed as a set of model input parameters. Once again, a maximum allowable response time can be input to show the capacity limits of each option. A sample of the template's Options panel and menu can be seen in **Figure 9** on page 31.



Each option can be selected from the command menu using the first letter of the option (i.e., F for FACTORS), or by pressing the cursor keys to highlight the option and then pressing the  key. A description of each highlighted option will appear on the second line. When an option is selected, a sub-menu will appear. All of the sub-menus are the same. They provide 2 user options. These are: CHANGE and GRAPH.

CHANGE

Alter one or more of the input parameters for the currently selected option. Lotus 1-2-3 will automatically position the cursor at the first model input parameter for this option. This will typically be the CPUR value. At the same time, the user menu will be erased from the command line. This means the full facilities of Lotus 1-2-3 are available to change the input parameters. To display the menu again you must press .

The spreadsheet has been initially set with the protection switch enabled. This means that only the fields marked as unprotected can be changed. These fields will show up as high intensity on a monochrome display and as white on a color display. Attempting to change a protected field will produce a beep as an error indication. The auto-recalculation switch has been set off, so be sure to press the  (Recalculate or Calc) key after all changes. This will recalculate all the dependent cells. Above each set of input cells is an unprotected cell called TITLE which will appear as a title of the graph created for this option.

GRAPH





Produces a graph of the results calculated by CHANGES. These graphs will differ depending on the option chosen. The GRAPH option requires a graphic display and adapter. See the Lotus 1-2-3 manual for a description of the supported displays. To save the graph for a printer or plotter output, type:  (graph save) and give it a name as described in the Lotus 1-2-3 manual. Once a graph has been selected it can be displayed again by simply pressing the  (GRAPH) key. If a model parameter is




changed, first press  to recalculate and then press  to graph. The new results will be displayed.




Using the Spreadsheet

This section describes how to use the options provided in the MODLCICS spreadsheet.

Using the Response option:

- Invoke the user menu by pressing the  keys.
- Press  to select the Response option.
- Press  to select the Change option.
- Change one or more model input parameters. The XR value is the starting transaction rate. The DXR value will be used to increment the transaction rate.
- Change the cell to the right of the label TITLE to describe this modeling run. It will appear as a title in the graph.
- Press the  key to recalculate the dependent cells. This causes several model values to be recalculated. First, the transaction rate column is recalculated, starting with the XR value and incremented by DXR. Next, the response time values are recalculated based on the selected model input parameters and the calculated transaction rates. To the right of the response time column is the slope of response time versus transaction rate. These cells are also recalculated. Finally, the sensitivity factors for each model input parameter are recalculated. These values are stored in a different part of the

spreadsheet. This data can be viewed by pressing the  (GOTO) key, then SF and then . To return to the input area, press the  key.

- To display a graph of response time versus transaction rate, press  then press  to select the Response option, then press  to select Graph.


Using the Slope and Factors Options

- If you select either SLOPE or FACTORS and then the CHANGE option, you will be positioned over the same input area used by the RESPONSE option. These three options use the same set of model input values.
- Selecting GRAPH for the SLOPE option will display a graph of both response time and slope of response time versus transaction rate. This provides a visual perspective of how transaction rate affects response time and where the knee of the curve appears. For example, a value of slope equal to 2 means that the average CICS response time is increasing twice as fast as transaction rate. A rule of thumb is to call this point the knee of the curve.

See the methodology discussion on page 22 for additional advice on how to use this data.

- The values for slope are displayed in a column to the right of the response times. The sensitivity factor values are displayed in a different part of the spreadsheet, as described above.

Using Best/Worst and Options

- Selecting BEST/WORST or OPTIONS and then CHANGE will position the cursor over the input values for these options. BEST/WORST case input values consist of two sets of model input parameters. Any of the model parameters can be changed to indicate a best and worst case set of conditions. Values can also be selected for transaction rates corresponding to twelve month's growth.
- Pressing  will recalculate the response times for each of the twelve months for both best and worst case values.
- By changing the value for MAX RSP (maximum acceptable response time) the capacity limitations can be forecasted. Displaying a graph of BEST/WORST will show the average response time for both best and worst case values plotted along with MAX RSP. The intersection of the BEST/WORST lines with the MAX RSP line represents the month when CICS capacity for each option is exceeded.
- The input area for OPTIONS is similar to BEST/WORST but includes four sets of input values. These correspond to the four options that can be modeled (i.e., different CPU, more memory, etc.). The values for transaction rate are calculated from a starting value of XR and incremented by DXR.
- Displaying a graph of OPTIONS shows the curves of response time versus transaction rate for each of the four options. The intersection of each curve with MAX RSP can be defined as the capacity limit for that option. The value of transaction

rate at the point of intersection can be defined as the maximum load that option can sustain with acceptable performance.

Methodology

This section describes a step-by-step methodology which can be used to create a capacity plan for CICS. The steps that follow use the capabilities provided in the five user options which make up the MODLCICS spreadsheet.

Calibrating the Model

Calibrating the model means testing the model's ability to predict the current environment. This is done by tracking model input parameters using one or more tools (i.e., PILOT/CICS, PILOT/MVS, CICS PARS and RMF) and using the RESPONSE option to compare predicted response times against measured values. Measurements should be made for a peak hour of CICS use and should include at least five days of data. This will ensure that you are not measuring an unusual day or spike condition. If the CICS system makes use of conversational mode transactions, then the tracking tool must report transactions and response time accordingly. This means that a long conversational mode transaction must be reported as several shorter transactions. These values should represent internal response time and should not include think time or terminal network delay.

If the model's predicted response time falls within 20% of measured response time, the model can be considered calibrated. An error greater than 20% can be caused by several factors. First, ensure that the input

parameters and CICS response time were measured correctly. A misplaced decimal point or wrong use of units (i.e., transactions per minute not per second) will certainly invalidate the model.

Another cause may be an internal bottleneck within CICS. Internal bottlenecks represent conditions which degrade CICS performance despite the availability of CPU cycles, memory, and DASD resources. Some examples are improperly set values of MAXTASK, VSAM buffers, and IMS/DATABASE strings. These represent artificial constraints to performance and cannot be accounted for in the model. In a sense, these bottlenecks represent tuning problems and must be separated from capacity planning issues.

Calculate the Maximum Acceptable Response Time

Before creating a capacity plan one must define and quantify "capacity exceeded." This can be done by calculating the maximum acceptable response time for your installation. A good rule of thumb is to locate the knee of the curve of response time versus transaction rate. If the previous rule of thumb is used, this occurs where the slope of response time equals 2. As noted earlier, this represents that point on the response time/transaction rate curve where response time is growing twice as fast as transaction rate. Since this is an exponential curve, the expected response times become unstable from this point forward. Use the SLOPE option to calculate response times and slope of response time for varying transaction rates. The response time value which corresponds to a slope of 2 is the value to look for. In plain language, this value

represents the maximum acceptable response time for your installation. This value is installation dependent. If the base values of the model input parameters are changed, the value of response time which corresponds to a slope of 2 will also change.

Create a Capacity Plan Based On Expected Transaction Rate Growth

A capacity plan can be created which will identify the capacity limits of your current installation. This is done by projecting transaction rate growth over a twelve month interval. Start with a base value for the transaction rate (equal to the average measured XR for the peak hours of CICS activity). Project the transaction rate growth based on your installation's plans. These plans should include the following:



- New CICS applications;
- Growth in the use of existing applications due to new users; and
- Growth in the use of existing applications due to increased activity by existing users.

If CICS usage data has been tracked, this data can be used to help in your projections. Use the BEST/WORST option to calculate CICS response times for the twelve months of projected transaction rates. Model input parameters for best case should be set to the base values currently measured in your installation. Worst case values should be set to reflect possible growth in one or more model parameters over the next twelve months. For example, if the page fault rate varies from 2 to 4 pages per second on a daily basis, use the following technique. Set

the best case value of page fault rate (PFR) to 2 and set the worst case value to 4. This assumes that over time the average PFR may grow from 2 to 4 pages per second. This approach can be used with other model parameters as well. Be sure to input the maximum acceptable response time (MAX RSP) calculated in step 2. When a graph of BEST/WORST is displayed, the response times are plotted over the twelve month period for both best and worst case input. The intersection of maximum acceptable response time and these two lines represents the point where your installation's capacity is exceeded. The time of year corresponding to these two points can be defined as the best case and worst case limits of CICS capacity. Another way to define these times is to expect response time to begin to degrade at the worst case limit and to certainly become unacceptable at the best case limit. If a twelve month projection fails to exceed your capacity limit, then double the interval by treating each monthly value as a two month step.

Identify Performance Bottlenecks

Once the capacity limits for the installation have been defined, different configuration changes can be put into the model to fix the problem (increase the limits). These changes are generally limited to increasing one or more computer resources. These include: adding real memory; upgrading the DASD sub-system; and installing a faster CPU. Before selecting changes, try to determine the primary bottleneck affecting response time. This can be done by using the Factors option to calculate sensitivity factors. Select the Factors option and select the Change sub-option from the user menu. The input parameters should be entered to reflect the model input values at the point of unaccept-

able performance. These values can be taken from the point where either best case or worst case projections cross the maximum acceptable response time line. Press  to recalculate the sensitivity factors for each model input parameter. These values can be viewed by selecting the GRAPH option or can be displayed by pressing  (GOTO), type SF, then press enter. The sensitivity factors (SF) represent the percent increase in response time caused by a 1 percent increase in each input parameter. The higher the sensitivity factor, the more sensitive is response time to that input parameter. These values can be used to identify which computer resource is the dominant cause of poor performance. For example, a high value for the page fault rate SF would indicate a real memory constraint. High SF values for disk service times and disk utilization parameters (TD and UD) would indicate a problem with the DASD subsystem. And a high value of SF for CPU service time (CPUR) would certainly indicate that response time is sensitive to the speed of the CPU. You can use the model to examine the effects of relieving these bottlenecks. For example, if a real memory constraint is indicated, reduce the page fault rate (PFR) parameter in the input field and calculate the new response time. A sharp reduction in response time will verify the bottleneck caused by excessive paging.

Compare Configurations to Solve Capacity Problems

Based on the calculation of sensitivity factors, resources affecting performance can be determined and consequently a solution may be found to the problem. It is possible to examine configuration changes to extend CICS capacity. Selecting Options allows you

to model up to four configuration changes at the same time. The graph produced for this option allows you to compare the relative benefits of each option. The intersection of maximum acceptable response time and each response time/transaction rate curve indicates the capacity limits for each option. The transaction rate below each intersection is the maximum CICS load supported by that option. The percent increase in the transaction rate limit for option two over option one represents the percent increase in capacity of option two over option one. If you divide this number by the cost of option two, you have the percent increase in capacity per dollar spent. Comparing these numbers will show you the relative cost of each option. Assuming more than one option meets your objective for extending CICS capacity, the most cost effective option can be chosen.

Choosing the Model Input Parameters

The value of the CICS model is its ability to predict response time for a variety of configuration changes. But before the model can be used, you must be able to translate these changes into the input parameters understood by the model. This section will offer advice on how that is done.

Adding Real Memory

Adding real memory will affect CICS response time in proportion to the page fault rate. In other words, if the page fault rate is low (i.e., 1 to 2 pages per second) then the effect of adding real memory will be minimal. If the page fault rate is high, the addition of real memory can have a major impact on performance. Since you typically

add real memory in large blocks (4 or more megabytes), one can assume that page fault rates will be dramatically reduced. If the current rate is 5 to 7 page faults per second, adding 4 or more megabytes of memory will initially reduce the page fault rate to 2 or less.

Changing the DASD Subsystem

Changes to the DASD subsystem can be modeled by changing the following model input parameters: page pack service time and utilization (TP & UP); and data base pack service time and utilization (TD & UD). DASD changes can include adding additional disk control units, channels, disk packs, or cache controllers. Choosing model input values to model these changes will require intelligent "guestimates" based on a good understanding of the differences between the current DASD subsystem and the proposed changes.

As an example, assume the current subsystem consists of 3350 disks and that you wish to model the effects of converting to 3380s. Also, assume the base value of TD, UD, TP, and UP are .035, .40, .030, and .36 respectively. With the knowledge that average seek times should improve from .025 to .015 seconds and the data transfer rates improve from 1.2 to 3.0 megabytes per second (3350 vs 3380), the estimated new parameters are follows: TD (from .035 to .020), UD (.40 to .25), TP (.030 to .018), and UP (.36 to .20). These reductions are estimates based on both a knowledge of the current environment as well as an understanding of the proposed changes. In most installations, the 4 DASD parameters will not have a large impact on performance and errors in these estimates will have a small

effect on calculated response time. If the impact of a DASD change is uncertain, assume a conservative decrease in these parameters and examine the sensitivity factors to measure their impact on response time. If the sensitivity factors are low, then the effect will be minimal.

Changing the CPU

Probably the most important change to an installation's capacity will be an upgrade to a faster CPU. Modeling the replacement of a uni-processor with another uni-processor is fairly straight forward. The parameters affected by this kind of change will be CICS CPU service rate (CPUR) and utilization of the CPU by tasks running higher priority than CICS (UH). Changes in these parameters should be scaled to the ratio of internal speed of the 2 CPUs. These numbers are published by IBM as tables of MIPS (Machine instructions per second). A ratio of 2 to 1 (new CPU MIPS to old CPU MIPS) indicates the new CPU is twice as fast as the old CPU. This means we can reduce the base value of CPUR by a like factor. For example, if the new CPU is 3 times faster than the current CPU we can calculate the new CPUR as old CPUR divided by 3.

The same logic can be applied to the UH parameter, but in real life a faster CPU will probably be executing more work. This means the UH value will probably be reduced, but not as much as was CPUR. A conservative approach would be to scale UH by the ratio of MIPS and then add back in 10-20% of its new value. For example, modeling UH on a CPU which is 3 times faster than the current CPU can be done as follows: assuming the current UH=.15, let the new UH=.15/3 plus (20% of .05) =.06.

When modeling a new CPU which is a multi-processor, a different approach is taken. First, consider that CICS is a single-tasking system. This means that CICS can only execute on one processor at a time. The value of CPUR must be computed as if the speed of the new CPU is equal to the speed of a single processor, not the combined speed of all the processors. High priority utilization (UH), however, can be spread over all the processors so we can divide this value by the number of processors.

As an example, assume a base value of CPUR=.24 and UH=.18. Assume an upgrade to a dyadic processor with an aggregate MIPS equal to 4 times the current CPU. Model this upgrade by again changing the values of CPUR and UH. Assuming that the memory size is not changing, the page fault rate is ignored. Since CPUR is only affected by the speed of one processor, set the new CPUR = old CPUR/2 = .24/2 = .12. By dividing the higher priority work over both CPUs we can expect the CPU running CICS to experience a UH equal to old UH/4 (half as much work on a CPU which is twice as fast). Once again to be conservative add back 20 percent of the new number:

$$UH = .18/4 + .20(.18/4) = .054$$

If these numbers are put in the model it will show CICS capacity is not dramatically improved. This is caused by taking advantage of one half of the multi-processor. To optimize CICS capacity on a multi-processor you must run more than one copy of CICS. A second copy of CICS can be modeled as if it was running independent of the first copy (one copy per processor with equal priority). Assuming that CICS can be divided evenly, you may run twice the maximum transaction rate calculated for a single copy of CICS.

But this is probably an unrealistic assumption. Dividing a production copy of CICS into 2 equal parts is just not possible. Even with the facilities of MRO (Multiple Region Option) it is difficult to create 2 equal parts from one CICS system. The effective maximum transaction rate possible on a dyadic processor will be something less than twice the transaction rate calculated for a single copy of CICS. The degree of asymmetry between the 2 copies of CICS as well as the overhead introduced by MRO will tend to reduce the factor to a value less than one half. If an upgrade to a multi-processor (2 processors) is to be considered and if it is expected to run 2 copies of CICS, calculating the maximum transaction rate possible with one copy of CICS is done by multiplying the transaction rate by 2, and then reducing this number by a factor of half the original transaction rate. As an example, assume the transaction rate on a single processor is 18 transactions per second. Assume an upgrade to add a processor with the same MIP speed. The maximum transaction rate possible is:

$$18 \cdot 2 - 18/2 = 25 \text{ transactions per second.}$$

Model Description

The following equations are used to calculate the average CICS response time (RSP) as a function of the 9 independent parameters in the CICS analytic queuing model. These parameters are described in Model Parameters.

$$RSP = \frac{CPUR}{(1-UGE)} + \frac{PTD \cdot UGT \cdot IOR}{(1-UGE)(1-UGT)} + IODT$$

where:

$$IODT = IOR \cdot \left(\frac{.75 \cdot UD \cdot TD}{(1-UD)} + TD \right)$$

$$PDT = .75 \cdot UP \cdot \frac{TP}{(1-UP)} + TP$$

$$UGT = UH + (PFR \cdot PDT) \cdot (UH \cdot PFR \cdot PDT)$$

$$UGE = (XR \cdot CPUR) + UGT$$

```

A1: [W10]
MENU
RESPONSE  FACTORS  BEST/WORST  OPTIONS  MIPS  RETURN  SETUP  EXIT
Calculate the slope of response times for varying transaction rates
      A          B          C          D          E          F          G          H          I
1          Model Spreadsheet          Spreadsheet  Version
2          MODELICIC          V1L5.0
3  The following short-cuts are available:
4          ALT-M This Menu          ALT-B Best Case/Worst Case
5          ALT-R Response Time          ALT-O Option Comparison
6          ALT-F Sensitivity Factors  ALT-C CPU MIPS Conversion
7          Use CTRL-x in the Windows version of Lotus.
8
9  Model Input Parameters:
10 CPUR - CPU Service Time          UP - Page Busy          UH - Super. Overhead
11 TP - Page Service Time          UD - Data Busy          PFR - Page Fault Rate
12 TD - Data Service Time          IOR - I/O Rate          XR - Arrival Rate
13
14          TITLE:          Current System          Delta of Arrival Rate
15          0.1
16
17          CPUR          TP          UP          TD          UD          IOR          UH          PFR          XR
18          0.100          0.035  0.150          0.035  0.300  5.000          0.200  2.2          6.0
19          6.1
20          6.2
23-Nov-93  03:30 PM          CMD

```

Figure 5 MODLCICS Template (Main Panel)

```

A1: [W10]
MENU
CHANGE  RSP_XRATE  SLOPE_XRATE  SAVE_GRAPH  PRINT  RETURN
Change model input parameters for current system. Press CALC ALT-R for
menu.
      A          B          C          D          E          F          G          H          I
1          Model Spreadsheet          Spreadsheet  Version
2          MODELICIC          V1L5.0
3  The following short-cuts are available:
4          ALT-M This Menu          ALT-B Best Case/Worst Case
5          ALT-R Response Time          ALT-O Option Comparison
6          ALT-F Sensitivity Factors  ALT-C CPU MIPS Conversion
7          Use CTRL-x in the Windows version of Lotus.
8
9  Model Input Parameters:
10 CPUR - CPU Service Time          UP - Page Busy          UH - Super. Overhead
11 TP - Page Service Time          UD - Data Busy          PFR - Page Fault Rate
12 TD - Data Service Time          IOR - I/O Rate          XR - Arrival Rate
13
14          TITLE:          Current System          Delta of Arrival Rate
15          0.1
16
17          CPUR          TP          UP          TD          UD          IOR          UH          PFR          XR
18          0.100          0.035  0.150          0.035  0.300  5.000          0.200  2.2          6.0
19          6.1
20          6.2
23-Nov-93  03:31 PM          CMD

```

Figure 6 MODLCICS Template Response Panel

```

A1: [W10]
MENU
CHANGE GRAPH SAVE_GRAPH PRINT RETURN
Change one or more model input parameters. Press CALC ALT-F for the menu.
      A          B          C          D          E          F          G          H          I
1          Model Spreadsheet          Spreadsheet  Version
2          MODEL C I C          V1L5.0
3  The following short-cuts are available:
4          ALT-M This Menu          ALT-B Best Case/Worst Case
5          ALT-R Response Time          ALT-O Option Comparison
6          ALT-F Sensitivity Factors ALT-C CPU MIPS Conversion
7          Use CTRL-x in the Windows version of Lotus.
8
9  Model Input Parameters:
10 CPU R - CPU Service Time          UP - Page Busy          UH - Super. Overhead
11 TP - Page Service Time          UD - Data Busy          PFR - Page Fault Rate
12 TD - Data Service Time          IOR - I/O Rate          XR - Arrival Rate
13
14          TITLE:          Current System          Delta of Arrival Rate
15          0.1
16
17          CPU R          TP          UP          TD          UD          IOR          UH          PFR          XR
18          0.100          0.035  0.150  0.035  0.300  5.000  0.200  2.2  6.0
19
20
21
22
23-Nov-93  03:32 PM          CMD

```

Figure 7 MODLCICS Template Factors Panel

```

AL13:
MENU
CHANGE GRAPH SAVE_GRAPH PRINT RETURN
Change parameters for Best/Worst Case. Press CALC ALT-B to return to menu.
      AL          AM          AN          AO          AP          AQ          AR          AS          AT          AU
13          Best/Worst Case Capacity Plan
14
15          Title:          Sample Best/Worst Case Plan
16
17          CPU R          TP          UP          TD          UD          IOR          UH          PFR
18 Best          0.100  0.035  0.150  0.035  0.150  5.000  0.200  2.0
19 Worst          0.230  0.035  0.150  0.035  0.150  5.000  0.200  5.0
20
21          XR RSP-B RSP-W MAX-RSP
22 Nov-93          2.0  0.4  1.6  2.0
23 Dec-93          2.1  0.4  1.8  2.0
24 Jan-94          2.2  0.4  2.1  2.0
25 Feb-94          2.3  0.4  2.4  2.0
26 Mar-94          2.4  0.4  3.0  2.0
27 Apr-94          2.5  0.4  4.0  2.0
28 May-94          2.6  0.4  6.0  2.0
29 Jun-94          2.7  0.4 12.5  2.0
30 Jul-94          2.8  0.4 252.3  2.0
31 Aug-94          2.9  0.5 252.3  2.0
32 Sep-94          3.0  0.5 252.3  2.0
23-Nov-93  03:34 PM          CMD

```

Figure 8 MODLCICS Template Best/Worst Case Panel

```

BF13:
MENU
CHANGE GRAPH MOVE SAVE_GRAPH PRINT RETURN
Change model input parameters for different configurations. Press CALC
ALT-O.
      BF      BG      BH      BI      BJ      BK      BL      BM      BN
13          Comparison of Different Configurations
14
15          Title: Sample Comparison Graph
16
17          CPUR      TP      UP      TD      UD      IOR      UH      PFR
18 OPT 1      0.100    0.035  0.150  0.035  0.300  5.000  0.200  2.2
19 OPT 2      0.071    0.030  0.150  0.035  0.300  5.000  0.110  2.0
20 OPT 3      0.100    0.030  0.150  0.035  0.300  5.000  0.150  0.0
21 OPT 4      0.100    0.015  0.100  0.025  0.200  5.000  0.170  2.2
22
23          RESPONSE TIMES FOR EACH OPTION
24 DXR      XR  OPT 1  OPT 2  OPT 3  OPT 4  MAX RSP
25 1.0      2.0  0.4   0.4   0.4   0.4   2.0
26          3.0  0.5   0.4   0.4   0.5   2.0
27          4.0  0.6   0.4   0.5   0.5   2.0
28          5.0  0.7   0.5   0.6   0.6   2.0
29          6.0  1.1   0.5   0.7   0.8   2.0
30          7.0  4.0   0.6   1.0   1.4   2.0
31          8.0 114.9  0.7   2.5  114.9  2.0
32          9.0 114.9  0.8  114.9  114.9  2.0
23-Nov-93 03:35 PM                                CMD

```

Figure 9 MODLCICS Template Options Panel

```

CC13: [W8] 'TABLE OF RELATIVE CPU PERFORMANCE
MENU
VIEW CHANGE_VALUE MODEL1 MODEL2 OTHER RETURN
View the CPU table of values. Press ALT-C to return to this menu.
      CC      CD  CE   CF   CG      CH   CI   CJ   CK   CL
13  TABLE OF RELATIVE CPU PERFORMANCE
14  (MULTI-PROCESSORS ARE RATED AT SINGLE PROCESSOR VALUES)
15  To help convert CPU Seconds on existing CPU to new CPU.
16          CONVERT CPUR1 ON CPU1 TO CPUR2 ON CPU2 AS FOLLOWS:
17          CPUR2=CPUR1xMIPS1/MIPS2
18  CPU
19  MODEL      MIPS PRS          After selecting the values choose "Other",
20  3031        1.19  1          then Hit {CALC} KEY [F9]. Then hit ALT-C.
21  3031-AP    1.00  2
22  3032        2.74  1
23  3033-AP    4.75  2
24  3033-MP    4.75  2          MODEL1  CPUR1  MIPS1  MIPS2  CPUR2
25  3033-N     4.43  1          4381-2  0.220  2.84   4.03  0.155
26  3033-S     2.67  1
27  3033-U     5.15  1          MODEL2
28  3033-U     5.15  1          3083-EX
29  3081-D     5.00  2
30  3081-G     5.00  2
31  3081-GX    5.45  2
32  3081-K     7.00  2
23-Nov-93  03:37 PM                                CMD

```

Figure 10 MODLCICS MIPS Conversion Panel

SIMCICS Simulator

Introduction

The simulator SIMCICS provides an innovative and interactive tool for capacity planning and performance analysis of complex online environments. The simulator basically works (dispatches workloads) in much the same matter as a multi-tasking operating system. Workloads such as CICS regions, database managers external to CICS, or other CICS terminal-owning regions can be analyzed using this tool.

The value of using a simulator is that it will take the average arrival rate of the transactions and produce random values above and below the average rate to behave more like a typical online environment. Using a simulator will provide non-linear results. In the past, this technique would use an enormous amount of resources and time. Today personal computers can be used to run a simulator obtaining good results.




The results of the simulator is a snapshot of the CPU utilization of each processor, the response times for each transaction or request processed, the number of transactions or requests processed, and the queue length for each workload.

SIMCICS has two components: a mainframe model generator; and the actual simulator which executes on the PC.

Parameters

After the base line model is created on the mainframe, it must be downloaded to the PC. For further information on downloading, refer to file transfer section in this guide. Refer to the Methodology and Model generator sections of this guide for Base line models.

To start SIMCICS on the PC:

1. Ensure that you are in the correct DOS directory:
`CD `
2. To change directories:
`CD \PILOT `
3. To execute the simulator SIMCICS type:
`SIMCICS `
4. Enter the first screen option (C)olor or (M)onochrome.

Parameter Selection Screen

The first screen presented to you is the Parameter Selection Screen. A sample of this screen can be found in Appendix A in **Figure 11** on page 45. The fields of this screen are defined here.

TITLE FOR THIS RUN:

This is a 40 character field to describe the model simulation.

TOTAL RUN TIME (sec):

The total wall time to be simulated. The default is 180 seconds. This should be

enough time to model most environments. More time may be required to simulate a low volume (small transaction rate) with CPU's of MIP rates 3 or less. NOTE: the program is simulating a CPU wall second, this may in fact take more or less actual time to generate the results.

TIME INTERVAL (SEC):

The time slice chosen to take a snapshot to simulate the given environment. The smaller the value the more accurate the results. The recommended values are:

CPU SPEED	VALUE
> 3 MIPS but < 7 MIPS	.0001
Greater than 7 MIPS	.0005

OF INTERVALS/REPORT:

The number of time slices before a status line is written to the terminal. This is used to monitor the execution of the simulator. The default is 200.

CPU DESCRIPTION:

The CPU model name of the processor. A table of models and speeds are provided. This field can be edited for processors not yet included in the table.

CPU SPEED(mips):

The machine instructions per second of the processor chosen. This field represents the speed per processor, not the combined speed of multiple processors.

OF CPUs:

The number of processors for the CPU model.

OF WLS:

The number of workloads to model. Only workloads with higher priorities

need to be entered even though a lower priority workload may be the particular workload to be modeled. Lower priority workloads below the workload of interest need not be modeled.

PAGE PACK SERVICE TIME

The average service time, in seconds, for all paging devices for the system on which the workloads execute.

PAGE PACK BUSY

The average percent busy of all paging devices for the system on which the workloads execute.

Function Key Definitions

F1 - HELP

Help screens with brief descriptions of fields.

F2 - NEXT

Page forward to the workload definition screen.

F3 - SAVE

Save the current values in a configuration file.

F4 - RETRIEVE

Retrieve a previously saved configuration file.

F5 - CPUTABLE

Pick a new CPU to run with the model.

F10 - END PGM

End execution and return to DOS.

Workload Definition Screen

The next screen presented to you is the Workload Definition Screen. A sample of this screen can be found in Appendix A in **Figure 12** on page 46. The fields of this screen are defined here.

WORKLOAD

The name assigned to each workload. This name can be typed by you, created by the SIMBUILD program from the control cards entered, or created by the SIMBUILD program from the Control Performance Group number.

PRTY

The dispatching priority assigned to a workload (1-20) with 1 being the first to be dispatched.

PATH LNTH

The average number of instructions required per transaction or service request.

ARRIV RATE

The arrival rate of transactions or requests for service.

The following parameters account for the delays a workload may encounter while processing a transaction or request.

I/O RATE

The average number of EXCPs completed per transaction or request.

PF RATE

The average page fault rate of the workload in pages per second.

DISK SRV

The average disk service time, in seconds, for the workload.

DISK BUSY

The average percent disk busy for the workload.

#TERMINALS

The maximum number of terminals for a workload. This parameter, when specified, will cause the simulator to act like a closed queuing system. If the default of zero is specified, the simulator will act like an open queuing system. The simulator generates transactions according to the arrival rate specified. If the system being modeled becomes constrained, the number of requests on the queue for that workload will continue to grow as the transaction rate is maintained. For example, if a workload is defined with a #TERMINALS set to 100, the simulator will stop generating new transactions when the number transactions on the queue reaches 100. When the number of transactions on the queue drops below 100, the simulator will generate a new transaction for this workload.

Workloads are defined as either CICS, IMS, DB2, ADATABASE, IDMS, or any other transaction/request workloads. Workloads are specified as up to 8 characters.

Each Workload is assigned a priority(1-20). A priority of 1 is the highest or 1st on the dispatch queue. If two workloads have the same priority then their requests for resources will be equal.

The path length is defined for each workload as follows:

$$\text{Path length} = \frac{10^6 * \text{MIP rate} * \text{CPU seconds}}{\text{\#Transactions or requests}}$$

where:

MIP rate

is the relative speed of the processor on which the CPU time was collected.


CPU Seconds

Is the total CPU time in seconds (TCB and SRB) the workload being measured consumed during the period.

Example:

Assume a CICS region used 30.5 mins of TCB time, 5.1 mins of SRB time and did 2,300 transactions in one hour. The total time is 35.6 minutes. If the current system on which the region executed has a MIP Rate of 5 then we multiply 35.6 * 5,000,000 = 178,000,000 and divide by the number of transactions (2,300) to get 773,913, which is the path length.

Executing The Model

After all parameters are provided, the simulator is started by pressing the F6 function key when the workload definition screen is displayed. Once the model simulator initializes and begins execution, a series of messages is displayed. Each message provides information about the current snapshot of the model execution. An intermediate report can be generated by pressing . This is recommended in order to verify the model parameters are correct. For example, a number which should have been entered as .025 and was incorrectly entered as .250 will have a significant effect on the results obtained.

TO FREEZE THE DISPLAY PRESS





or

!!!

After the intermediate report is reviewed, execution is resumed by pressing the space bar. The intermediate report and the final report have the same format. A sample of the intermediate or final report is provided in Appendix A on page 47.

Methodology

The following methodology can be used to create a capacity plan for an online environment. The purpose of this function is to predict future hardware requirements due to the increase in workload resource consumption. This is only one component of a complete capacity management discipline. Creating models are useful when the analyst knows the questions. A complete approach to capacity management and performance management are discussed in the techniques section of this manual.

Workload Characterization

First, one needs to understand the present resource consumption of the workload being modeled and other workloads that use a significant amount of resources. We begin by developing profiles of the current workload resource usage. This will help you determine the resources required by these workloads in the future. The model generator, provided in PILOT/CICS, will build a profile of the workloads you have defined (SIMBUILD program). In order to profile these workloads, various sources of data must be analyzed. Using PILOT/MVS and PILOT/CICS together will provide the data needed for this process. If PILOT/MVS was

not purchased, this data can be obtained from RMF or other tools that provide similar reporting capabilities.

Creating the Base Line Model

The second step in the methodology is the creation of a base line model. This means defining the input values such that the simulator will act like the current environment. Although the input to the simulator contains average values (such as average path length, average arrival rate, etc.), the simulator uses a randomizing technique so that different values are chosen for each sample or time slot. Over time, the average values for these parameters will approach the values you chose as your input. This technique is required to simulate real systems with random patterns of demand and service requests.

Identify Peak Periods

A time frame to model must be chosen. Choosing a time frame of 24 hours is not going to give an accurate picture of the system's behavior during times of peak usage. Since most on-line systems show an uneven pattern of demand and performance, it would not be productive to average these peaks and valleys over 24 hours. Most systems are at their peak usage only once or twice a day and these periods are generally an hour or less in duration. If you choose to model a long period of time where resource consumption is not consistent, then some additional analysis must be done to account for the peak periods during that time frame. Sometimes it is useful to see how a system will run during non-peak times as well as during peak periods. If this is required, then two models should be used

and analyzed separately. Peak period time frames can be identified through the use of PILOT/MVS and PILOT/CICS. If PILOT/MVS was not purchased then the data needed can be obtained from RMF or other tools that provide similar reporting capabilities. Once your peak periods have been identified, you need to measure average resource consumption during these periods. At least 5 days (a week) of data, preferably 20 days (a month) should be summarized to get this data.

Tracking Data

Much of the data required as input to the simulator is reported by PILOT/CICS. By analyzing trends and variations in this data over several peak periods you will be better able to choose the proper input. PILOT/CICS reports the response time as an internal response time. This does not include individual think time or network and terminal delay time. This is the same value reported by the simulator. Reviewing response times and online system behavior during peak times makes the calibration step easier.

Model Generator

The model generator can generate most of the parameters required as input to the simulator. Information will have to be added for workloads not supported by PILOT/MVS or PILOT/CICS. For example, if ADATABASE is used as a database manager, the number of requests for ADATABASE services can be added into the simulator at execution time.

Calibrating the Model

Calibrating the model means testing the model's ability to predict the current environment. This is done by comparing the base line values to the results from the simulator. For example, the CPU utilization of the workload generated by SIMCICS should match the CPU utilization as measured from PILOT/CICS, or PILOT/MVS. The total CPU usage from the simulator will match only if all workloads were grouped as "OTHER" in the workload for the model generator. The response times should match the measured response times from PILOT/CICS. The results should be within 10%. If the results vary by more than 20%, first ensure that the input parameters and CICS response time were measured correctly. A misplaced decimal point or wrong use of units (i.e., transactions per minute instead of per second) will certainly invalidate the model.

Another cause may be an internal bottleneck within CICS. Internal bottlenecks represent conditions which degrade CICS performance despite the availability of CPU cycles, memory, and DASD resources. Some examples are improperly set values of MAXTASK, VSAM buffers, and IMS/DATABASE strings. These represent artificial constraints to performance and cannot be accounted for in the model. In a sense, these bottlenecks represent tuning problems and must be separated from capacity planning issues. The process of calibration must be completed before forecast analysis can be done.

Forecasting Future Hardware Requirements

After the model is calibrated, you are ready to play the "What if..." game. There are two

categories of questions capacity planners are most often asked. They are direct hardware questions (easiest to answer) and application growth questions. This section will deal with hardware questions. Refer to the techniques section for application growth questions. Regardless of the initial question, all capacity planning issues reduce to the following questions: "What impact will this have on my current environment?"; "Will this affect response time?" and "By how much?"; and finally, "How much longer will it be before I will be out of capacity?". Unless you can answer these questions you will find yourself putting out fires instead of planning to meet your company's business needs with data processing solutions.

Identify Resource Utilization by Business Usage.

Forecasting existing workload growth and its impact on current hardware configurations is the most time-consuming process of forecast analysis. There are two approaches you can take. First, study historical data and look for patterns in workload volume growth. If you have the data, look at what happened when a new on-line application was implemented. Did the transaction rate go up? How much? Similarly, look at the effects caused by adding new users or new terminals for existing applications. Historical data is often the most reliable measure of predicting future trends. Second, talk to end users, development groups, and strategic planners for future business needs (refer to technique section of this manual). The latter approach is more time-consuming but may yield better results. The first approach can yield good results if historical data is maintained and you are familiar with the company's growth patterns. A combination of the two

approaches may be used to obtain good results. PILOT/CICS can be used to analyze data from a year ago to be compared to the volume usage today. Also notice the resource consumption of the system at the time. PILOT/MVS's workload analysis makes this task trivial. Do not be discouraged if your first predictions are wrong. Instead, study why they are inaccurate and adjust those factors into your next forecast analysis. For example, take notes on when new applications are implemented. Did the application use as much resources as planned? Did the user do twice as many transactions as anticipated? These are usually the causes of inaccurate forecasts.

Adding A New CPU

This is the most significant change to a computer configuration that will yield the greatest impact on capacity and performance. In addition to the speed of the computer, usually the amount of memory is also increased. Sometimes additional channels and strings are added, thus giving better I/O response times for workloads. Each of these will be discussed separately. After the model is calibrated, a new CPU can be chosen from the list of processors provided with the simulator or a processor can be added if the MIP speed is known. There are different MIP speeds reported for the same machines from various sources. The main difference in the reported speeds is the relative performance of the computer to be considered 1 MIP. The table used by the simulator is compiled from each vendor and other public information sources. The relative speed at which the model was calibrated should be the same as the machine being replaced in the model. Now execute the simulator with the new processor. One if

the advantages of the simulator is that machines can be compared with the same MIP speed and a different number of processors. For example, a 6.6 MIP uni-processor will yield better results than a 6.6 machine with two processors if only one big CICS region accounts for majority of the resource consumption. This of course is only one factor, memory, and I/O still need to be analyzed as well as cost.

Adding New Memory

Modeling memory is one of the most difficult tasks because there are a number of factors that effect memory management in a processor. These factors include:

- User storage fences via IPS parameters.
- Program working set sizes.
- Multi-programming levels.
- Paging data set placement.
- The number of Paging data sets.
- OPT SRM parameters.

Each of the above mentioned parameters can cause bottlenecks in the system and may cause a system to appear to be out of capacity. Usually this is the first sign of a machine's need to be tuned. As mentioned earlier, performance bottlenecks are a separate issue and are not addressed in this section. The simulator's parameters for modeling memory changes are the page fault rate (demand) for each workload, the service time and the utilization of the paging subsystem.

The approach is simple, but effective results are obtained. Each workload must be reviewed in the baseline model. Predicting a paging rate is difficult but some basic assumptions can be made. Memory today is

bought in at least 4 megabyte increments which can have a significant impact on overall performance. Aside from storage fences, the higher a workload's dispatching priority, the more likely the effect of real memory will be to reduce the paging rate. This is obvious because the pages will be referenced more often and not be candidates to be paged out. As the paging rate overhead is reduced, the utilization and service times should improve. Be conservative in reducing the paging rates and paging subsystem parameters in relationship to the amount of memory being added. For example: your main workload being modeled is experiencing a page fault rate of 12 pages per second; the paging subsystem has an average service time of 40 ms.; and 35 percent utilization (3350's). Further, assume the machine is a 4381-2 with 12 megabytes of memory and you wish to add 4 megabytes (total of 16 megabytes). A conservative approach to this upgrade would be to reduce the page rate in half and the service time to some reasonable values such as 30 ms, 20 percent utilization. This is only one configuration, other solutions can be easily modeled. Model at least three possible scenarios with new memory to get good results.

Changing DASD Devices

The simulator can be used to model DASD changes on workloads. Modeling an upgrade of DASD can be done by changing the average service times and utilization of the devices of the workloads effected by the change. Do not change the I/O rate of the workload; this can skew your results. Do not forget to change the paging subsystem's parameters if it is upgraded as well. The methodology is similar to that of the paging subsystem mentioned in the last section. In

general, when upgrading to a faster device, the service times can be reduced. If a device is being changed from a single density to double density, the utilizations and service times will probably increase due to the nature of the architecture. If two single density devices with utilizations of 20% used in random access (online data bases) are combined to a double density drive, the utilization will more than double. There will be a significant increase in the amount of arm movement over the previous configuration. These are some of the factors one must consider when modeling DASD.

Model Generator

Introduction

The program SIMBUILD will generate a model for the simulator SIMCICS and the input parameters for the analytic model (MODLCICS). The model generator will use control cards, RMF, CMF, and The Monitor records as input. The output of the model generator must be down-loaded to the PC in order for SIMCICS to process it. Additional input is needed for records not supported by SIMBUILD.

Creating a Baseline Model

This step is straight forward if all the data is available for the time frame being analyzed. First, the peak period(s) must be identified. This can be done by using PILOT/MVS and PILOT/CICS to choose the correct time period and at least 5 days (1 week) of data, preferably 20 days (1 month). Tracking the data and choosing the trend as the input into the simulator is of prime importance. The model generator can generate most of the parameters for the simulator. Information will have to be added for workloads not supported by PILOT/MVS or PILOT/CICS. For example, if ADABASE is used as a database manager, the number of requests can be added into the simulator at execution time.

SIMBUILD Parameters

SIMBUILD is a mainframe program to create model parameters for PILOT/CICS' SIMCICS and PILOT/MVS' SIMMVS programs. The more information available as input for a workload, the less manual input required.

There are three control card functions that may be specified in the SIMCTL file. The CPU and WKLD keywords must start between columns 2 and 71 and be followed by a blank. Operands for these control cards must be separated by a comma. The CPU control is needed to calculate the fields derived from the SRM constants in MVS.

The format of the control cards follows.

```
CPU  MODEL=name,
      SPEED=sss.ss,
      PROCS=n,
      MIPS=mm.mm,
      ICS=nn
```

where:

CPU

Is the control card keyword. If this control card is omitted, calculations based upon processor speed will be invalid. Other fields not effected by speed will be correct. Only the model name is needed if the processor is included in the PILOT's internal table.

MODEL

Is the name of the CPU model (i.e., 4341-12,3090-200,3084-QX, etc). Up to 8 characters can be specified. A list of

the models in the supplied table is provided in the Techniques section of this User's Guide. When you use the name of a supplied model, the other parameters are obtained from the table automatically.

SPEED

The processor MSU value used by the SRM.

PROCS

The number of processors for the model specified.

MIPS

Millions of instructions per second for this processor.

ICS

The suffix value for the IEAICSxx member to be processed. This member is read from the PARMLIB DD statement and is used to relate RPGN (Report Performance Group Numbers) to the associated CPGN (Control Performance Group Numbers) when the workloads are characterized.

WKLD **WL**=(name,pg...),
OTHER={Y|N},
APPLID=aaaaaaaa,
JOBNAME=jjjjjj,
PRTY=nn,
DISKS=(vol1,vol2,...)

where:

WKLD

Is the control card keyword. If this control card is omitted, a workload will be defined for each control performance group. Up to 1,000 workloads may be defined for analysis.

WL

The name operand is the Workload name, pg is the Performance Group number(s) describing this workload.

OTHER

SIMBUILD will create a separate workload to combine all workloads not defined when OTHER=Y. All performance groups not previously used will be combined in a workload called "OTHER". This operand can be specified on any of the control cards but will only create one workload.

PRTY

The dispatching priority (1-20) of this task. Two or more workloads can have the same priority.

APPLID

VTAM applid used to identify CICS regions when SMF 110 records are input into the model generating program. The four character TCT id is used to identify CICS regions when The Monitor records are used for input.

DISKS

Where vol1, vol2,... are the disk packs used by the workload. Disk pack names can be generic by specifying an '*'. This parameter is used to calculate the average device service time and average device utilization.

PEAK **TIME**=(HHMM,hhmm),
WKDAYS={Y|N}

where:

PEAK

Is the control card keyword.

TIME

The start and end time of the peak period being processed across the entire input file. This parameter is optional.

WKDAYS

This parameter controls the inclusion of weekends to average the values across the input file. The default is "Y", meaning to *omit* weekend data.

SIMBUILD JCL

The example below shows the creation of a baseline model using RMF, SMF, and TMON data as input into the module generator program SIMBUILD. Each file type must be separate. The RMF records must be read first so that the program SIMBUILD can build a table in storage and match the CICS data to the RMF control performance groups. Ensure that the time period of the input data from RMF matches the CICS monitor data. Please note that RMF records are handled by the RMF start interval time stamp. A separate step using PILOT/SMF prior to model generation is recommended to select the correct RMF intervals using the "TIME=M" parameter. Also, the multiple output function can be used to split the RMF and SMF 110 records if needed.

```
//BUILD      JOB
//SIMCICS    EXEC
PGM=SIMBUILD,REGION=1500K
//STEPLIB   DD
DSN=PILOT.V1M5.LOADLIB,DISP=SHR
//SMFIN     DD
DSN=RMF.DATA,DISP=SHR (SMF 70-75)
//          DD
DSN=CMF.DATA,DISP=SHR (SMF 110)
```

```
//MONIN     DD
DSN=TMON.DATA,DISP=SHR (TMON
USED)
//PARMLIB   DD
DSN=SYS1.PARMLIB,DISP=SHR
//SIMOUT    DD
DSN=TSU.MODEL.FILE,
//
DISP=(,CATLG),SPACE=(TRK,1),
//          UNIT=SYSDA
//SIMLOG    DD  SYSOUT=*
//SIMCTL    DD  *
*
* Create baseline model for a CICS/IMS
environment.
*
      CPU      MODEL=4381-2
      WKLD
WL=(MVSPGN,0,5,9),PRTY=1
      WKLD
WL=(PRODCICS,07),PRTY=2,APPLID=N
ODE25,
      DISKS=(VSAM1,INV*,PAY*)
      WKLD
WL=(PRODIMS,08),PRTY=2,DISKS=(IM
S*),
      DISKS=(IMSRES,IMSQ*)
      WKLD
WL=(IMSREG1,09),PRTY=3,(IMSDB*),
      DISKS=(IMS0*,INV*,MFG*)
      WKLD
WL=(IMSREG2,10),PRTY=3,(IMSDB*),
      DISKS=(IMS0*,MFG*,INV*)
      PEAK TIME=(1400,1600)
/*
```

1. Job card.
2. EXEC card with the program name.
3. STEPLIB provides the name of the PILOT load library if it is not in the system's LINKLIST.
4. SMFIN is the input file for RMF type 70-75 and CICS CMF (SMF type 110)

records. The RMF records must be concatenated before the CICS records.

5. MONIN is the input file for monitor data which is not in a SMF format. This file can be in compressed or uncompressed format.
6. PARMLIB is the library that contains the ICS identified by the ICS= control card parameter. The member IEAICSxx may be stored in any library; SYS1.PARMLIB is only used here as an example.
7. SIMOUT is the output file formatted for SIMCICS on the PC. This file must be downloaded to the PC.
8. SIMLOG contains the input parameters for the analytic model (MODLCICS). There is no file to download. Just enter the nine numbers as shown.
9. SIMCTL is the control file for input parameters.

Appendix A

The following is a sample of the Simulator's Parameter Selection Screen.

```

                                PILOT/SIMCICS PARAMETER SELECTION SCREEN

CONFIGURATION FILENAME:      CONFIG
TITLE FOR THIS RUN:         PILOT/CICS SIMBUILD MODEL GENERATOR
TOTAL RUN TIME (sec):       180
TIME INTERVAL (sec):       0.0100
# OF INTERVALS PER REPORT:  100
CPU DESCRIPTION:           4381-2
CPU SPEED (mips):          2.6      # OF CPUs:  1      # OF WLS:  4
PAGE PACK SERVICE TIME (sec): .0440      PAGE PACK BUSY: .1280

PILOT/CICS SIMCICS MODEL (C) 1986
Axios Products, Inc.

PF1-HELP   PF2-NEXT   PF3-SAVE   PF4-RETRIEVE   PF5-CPU TABLE   PF10-END
PGM
```

Figure 11 Simulator Parameter Selection Screen

The following is a sample of the Simulator's Workload Definition Screen.

PILOT/SIMCICS WORKLOAD DEFINITION SCREEN										
task	WORKLOAD	PRTY	PATH	ARRIV	I/O	PF	DSK	DSK	# OF	S-single
			LENGTH	RATE	RATE	RATE	SERV	BUSY	TERMINALS	
1	SYS OVHD	1	101520	0.1	0	0	.0000	.0000	0	
2	CICS1	2	908673	4.0	11	2	.0276	.1853	100	
3	CICS2	2	288850	2.3	6	1	.0286	.2553	40	
4	CICS3	3	3030	0.1	2	1	.0225	.1075	20	

F1-HELP F2-BACK F3-SAVE F4-RETRIEVE F5-CPU TABLE F6-RUN F10-END PGM

Figure 12 Simulator Workload Definition Screen

The following is a sample of the Simulator report. The format of the intermediate and final reports is the same.

```

PILOT/CICS SIMCICS

TITLE FOR THIS RUN: PILOT/CICS SIMBUILD MODEL GENERATOR

TOTAL RUN TIME (sec): 180
TIME INTERVAL (sec): .01
# OF INTERVALS PER REPORT : 100
CPU DESCRIPTION: 4381-2
CPU SPEED (mips): 2.6           # OF CPUs: 1           # OF WLs: 4
PAGE PACK SERVICE TIME (sec): .044       PAGE PACK BUSY: .128

                ***** RESULTS *****
TIME USED (sec): 180.00 CPU 1 = 92.42
Workload      X Count    CPU (%)    Page Flts    CPUR    NQ    Resp(C)    Resp(I)
1 SYS OVHD      20         0.49         0      0.0424    0        0.04        0.00
2 CICS1         320        67.01        377     0.3758   99       36.57        0.37
3 CICS2         414        24.90        175     0.1080    0         0.42        0.23
4 CICS3          24         0.01          2      0.0008    0         0.48        0.05

F9-PRINT RESULTS                                F10-RETURN TO START

```

Figure 13 Simulator Intermediate or Final Report

Notes

1. Time Used

The total run time.

CPUn The CPU utilization of each processor. When modeling multi-processors the percent busy may not be even. Extensive design in the model attempts to even out the usage across all processors. When modeling light loads the first processor may show a higher value when the model execution time is very short. The actual percent busy on a live system would be even due to the micro code in multi-processors.

2. Workload

The workload and its priority.

X Count The number of requests or transactions processed. If X Count is divided by the time used the result should equal the arrival rate.

- CPU%** The percentage of all processors kept busy to execute the workload.
- Page Flts** The total number of page faults for the workload during simulation.
- CPUR** The CPU time (in seconds) the workload used for this configuration.
- NQ** The total number of requests that had to be queued during the simulation.
- Resp(C)** The average internal response time used to process one request or transaction within the CPU.
- Resp(I)** The average response time used to process the I/O for a request or transaction.

The last two fields, added together, yield the average total internal response time for a request or transaction within the workload.

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