

To: Distribution
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Subject: MR8.0 MCS Testing

PURPOSE:

The effort had a threefold purpose:

1. Basic performance data for MR8.0 MCS,
2. Performance comparison to previous releases,
3. Indication of areas of future improvement.

BACKGROUND:

About a year ago a similar effort was mounted on behalf of MR6.0 (MTB 399). Enough changes were incorporated into the MR8.0 testing environment and procedures to invalidate any useful comparison of the two projects. It is meaningful only to point out the significant improvements in overall performance and connectability. In the process of completing these tests MR7.0 was used for comparison. The results for MR7.0 are published here in addition to the MR8.0 data. These results will be used as baseline data for analysis of future releases.

ENVIRONMENT:

MULTICS:

The same Multics configuration (see appendix) was used for all testing. It was deliberately large in hopes of eliminating the central system as a limiting factor.

MCS:

Two DN6678's were used in all testing. One was used exclusively for test traffic, the other for system functions and test control. Two core images for the test FNP were employed, one for 96 asynchronous lines, the other for 20 bisynchronous lines. In all cases the images were pared to a minimum to allow maximum buffer availability.

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CUESTA:

In an attempt to eliminate the driver system as a throughput limitation, two FNP's were used to drive the test FNP with equally divided loading.

NETWORK:

For the asynchronous portion of the tests speeds of 1200, 4800, and 9600 baud were used. For the bisynchronous tests all connections were at 9600 baud. In all cases hardwired connections were used. For the asynchronous tests the connections were from the two cuesta FNP's to the single test FNP. For the bisynchronous tests the connections were wrapped between subchannels on the test FNP.

SCRIPTS:

Asynchronous Interactive -- was a simple interactive user process. The transactions consisted of 13 chars input and 150 chars output.

Asynchronous Output -- after login each user requested printing of pl1_operators_list

Bisynchronous -- this employed the test_bisynchronous program and the block size was set to 290-char blocks.

The values used for the interactive and bisynchronous message sizes were chosen to optimize throughput.

PROCEDURE:

Based on our experiences with the MR6.0 testing, one of the prime objectives was to establish connectability limits and stress test the system. These had been major limitations under MR6.0. We were able to connect and operate 96 lines successfully. and we did not experience system interruption that could not be resolved by normal system tuning. Our attention then, was given solely to establishing maximum throughput rates for the three scripts.

Only two parameters were changed to accomplish all tests. These were transaction rate (think time and/or number of users) and line speed.

RESULTS:

Interactive

MR8.0 showed marked improvement over previous releases in terms of sustained connectability. In all phases of testing

MR8.0 was able to maintain activity on all 96 lines. The average buffer utilization showed a large surplus, indicating that the core image could be significantly increased without sacrificing connectability. It is important also to note that driving the system beyond the saturation point did not degrade total throughput, and of course, did not break the system as had been seen in previous releases.

During the MR8.0 interactive testing we did not see a single occasion of status queue overflow (sometimes called bell/quit). The interactive throughput for MR8.0 was some 25% below MR7.0. The reason for this lower level of throughput was not identified. In all, connectability and reliability show MR8.0 to be a superior interactive system. It is also meaningful to note that the system (MCS) will sustain transaction rates in excess of 30 per/sec (where a transaction equals 13 chars in and 150 chars out).

Output Only

Clearly, in in the output only case, MR8.0 is far superior to previous releases, showing over twice the throughput of MR7.0, and six times the throughput observed on MR6.0. While the results carried here are for 50 users, the system was able to maintain 96 users, and again without sacrificing total throughput. The 19KC accomplishments must be credited to Bob Mullen. Through his efforts we were able to show almost double the traffic that we initially observed. Where feasible, his changes will be incorporated into MR8.0 as released. The remainder will be merged with already planned improvements for future release.

Bisync

There is little to be said on the bisynchronous testing. The results for MR7.0 and MR8.0 are for all practical purposes identical. No testing was done in this area on previous releases. The 11KC figure seems to be respectable, and again the system was able to maintain this value when driven into saturation. It is interesting to note that the bisynchronous script was the only one that was able to saturate the FNP hardware.

CONCLUSIONS:

1. MR8.0 is reliable. We did not see a single instance of a system crash or the bell/quit problems.
2. Connectability is superior to any previous release. In fact given reasonable image sizes, it is probable that

we can plan on 96 usable channels for all reasonable applications.

4. In as far as performance goes, there seems to be nothing to indicate any significant failings. If we see a trend toward large REMOTE COMPUTER applications then perhaps the synchronous/bisynchronous functions should be evaluated. However, at this point, customer needs do not seem to justify this effort.

	<u>NO. OF USERS</u>	<u>LINE SPEED (baud)</u>	<u>THRUPUT k char/sec</u>	<u>XACT/SEC</u>	<u>FNP IDLE</u>	<u>FREE BUFS</u>
Interactive						
7.0	51	4800	6.7	41	N/A	
8.0	96	4800	5.2	33	<15%	200
Output						
7.0	60	4800	7.2	--	N/A	N/A
8.0	50	4800	19.5	--	40%	50
Bisync						
7.0	12	9600	11.3	--	N/A	>200
8.0	12	9600	11.4	--	<2%	200

TABLE OF MAX THRUPUT

INTERACTIVE

	<u>NO. OF USERS</u>	<u>THNK</u>	<u>THRUPUT k chars/sec</u>	<u>FNP IDLE</u>	<u>FREE BUFS</u>
7.0	96	10	1.5		
	81	5	2.5		
	81	3	3.8		
	65	1	5.8		
	51	0	6.7		
8.0	96	10	1.5	80%	350
	96	5	3.0	65%	350
	96	3	3.6	50%	330
	96	1	5.3	15%	225
	96	0	5.3	15%	185

LINE SPEED IN ALL CASES WAS 4800-BAUD

BISYNC

	<u>NO. OF USERS</u>	<u>THRUPUT K chars/sec</u>	<u>FNP IDLE</u>	<u>FREE BUFS</u>
7.0	6	6.0	N/A	250
	12	11.3	N/A	248
	18	11.0	N/A	212
8.0	6	6.0	50%	236
	12	11.4	<2%	193
	18	11.2	<2%	163

APPENDICES:

The following sheets are the output of `tty_meters` and `debug_fnp`. Each of the scripts (interactive, output and bisync) are represented, for both MR8.0 and MR7.0.

The meters values are shown for a period during which throughput was at maximum, to support the figures previously presented.

For specific information on the tools used for metering, please refer to the manuals AN85 and AN52.

CONFIGURATION FOR MCS TESTING

r1 -a
r 2305 0.089 0.420 20

ec meter7
end

clock 7 met
iom a 0
iom b 1
vart boe daka 1
vart dumg daka 1
vart loa daka 1
intk warm 7 star
fnp a a 31.
fnp b b 31.
root daka 1
erph daka a 8. 2 451. 5
mec a 8. 2
mec a 24. 4
mec a 22. 2
erph taqa a 22. 601. 2 1 3 1 9.
erph erta a 24. 1600. 600. 136.
erph erte a 25. 1200. 600. 136.
erph ope a 28. emc
ceu b 6 on
ceu a 5 on
ceu d 4 on
mem a 512. on
mem b 512. on
mem c 512. on
mem d 512. on
mem e 512. on
mem f 512. on
schd 400000 4 1 100 2 6
set 1110. 550. 300. 75.
ted 150. 300.
tbls str 64. sstrn 64.
parm ttyb 20480. ttya 1024.

Multics hardware, load 60.0/125.0: 60 users, 53 interactive, 7 daemons.
Absence users 0/3
tty meters -ls

Total metering time 0:04:00

FNP A: >udd>m>jeb>scripts>mcs>fnp_a>a 4.0

FNP B: >udd>m>jeb>scripts>mcs>async>b 4.0

65.65 terminal hr
min output msg size to cause block 3 chars.
ave output msg to cause block - no meter data.
ave output message 149.6 chars
ave interrupt time 6.836 ms. 66.0% of system
max interrupt time 227.952 ms.
ave input message 5.0 chars
buffer pool size 19392
ave # free words 15489
% buffer space used 20.1
ave circ queue size - no meter data.
circ. queue full cnt 0
ATB reads 0.03 sec.
ave r-a message - no meter data.

complete input messages in buffer: current 0, ave 0.00
0.0% characters input in read-ahead
45 channels reading, 52 processes blocked on read
9 channels writing, 0 processes blocked on write
0 terminals in read-ahead, 0 complete messages
1,442,527 chars output, 48,060 chars input

	Per-sys	per-terminal
ATB output blocks - no meter data.		
ATB interrupts	0.010	10.163 sec.
ATB quits - no meter data.		
ATB dialues	30.1	29543.7 sec.
ATB cycle	0.0	24.6 sec.
ATB writes	0.02	24.51 sec.
ATB read ahead - no meter data.		

conversion factors
output 1.03 (converted/ascii)
input 0.38 (ascii/raw)

0 input characters preconverted

input restarts 0
output restarts 0
output space overflows 0
cur # dialed 54
ave # dialed 981.4
input rate 0.2 chars/sec
output rate 6.1 chars/sec
tty_meters -rs

Total metering time 0:04:01

debug_fnp
fnp b
d 652
00652 000120

7.0 INTERACTIVE
51 USERS @ 4800 BAUD
0 THINK TIME

```

39.48 terminal hr
min output msg size to cause block      0 chars.
ave output msg size to cause block - no meter data.
ave output message                       150.8 chars
-----
ave interrupt time                       5.63 ms. 223.3% of system
max interrupt time                       39.719 ms.
ave input message                         5.0 chars
buffer pool size                         19376
ave # free words                         14700
% buffer space used                       24.1
ave circ queue size - no meter data.
ave # free buffers in FNP A              403
ave # free buffers in FNP B              198
circ. queue full cnt                     0
ATB reads                                0.03 sec.
ave rna message                          1.9 chars

```

```

complete input messages in buffer: current 0, ave 0.06
0.0% characters input in read-ahead
41 channels reading, 98 processes blocked on read
58 channels writing, 0 processes blocked on write
0 terminals in read-ahead, 0 complete messages
1,129,198 chars output, 37,458 chars input

```

	Per-sys	per-terminal
ATB output blocks - no meter data.		
ATB interrupts	0.007	4.323 sec.
ATB quits - no meter data.		
ATB dials - no meter data.		
ATB cycle	0.0	9.5 sec.
ATB writes	0.03	18.82 sec.
ATB read-ahead	243.57	142135.65 sec.

```

conversion factors
output      1.03 (converted/ascii)
input      0.38 (ascii/raw)

```

0 input characters preconverted

```

input restarts      0
output restarts     0
output space overflows 0

```

	# interrupts	interrupts/minute
FNP A	938	231.06
FNP B	288782	71135.97
Totals:	289720	71367.03

```

Characters per millisecond interrupt time
Input      0.023
Output     0.698
Total      0.721

```

	# calls	avg. time	chars./msec.
read:	14973	3.329	0.752
write:	7552	7.617	19.805

```

cur # dialed      99
ave # dialed     583.5
input rate       0.3 chars/sec
output rate      8.0 chars/sec
tty m...rs -rs

```

```

Idle time: 15.8%
ic_sample hist 0.9
sked100      25.4 *****
sked1200     1.0 ****
sked12000    1.2 ****
sked12200    0.5 **
intr114      1.3 ****
intr1314     4.2 *****
intr1514     0.8 ***
intr12214    1.1 ****
intr13614    0.6 **
dial60       1.4 *****
dial160      2.2 *****
dial260      1.6 *****
dial560      4.1 *****
dial1060     1.6 *****
dial1460     0.6 **
dial4160     3.4 *****
dial5060     3.2 *****
dial5160     0.5 **
dial6160     0.6 **
dial6260     0.5 **
hslal120     1.0 ****
hslal220     1.0 ****
hslal320     1.7 *****
hslal720     4.1 *****
hslal1620    1.3 ****
hslal2720    4.7 *****
hslal3120    2.3 *****
hslal3320    5.7 *****
hslal4120    0.8 ***
hslal4220    0.5 **
hslal4320    1.6 ****
hslal6520    1.2 ****
util11340    0.8 ***
util11540    1.2 ****
util11640    1.8 *****
util11740    0.9 ***
util12140    1.5 ****
util12240    0.7 ***
util13140    0.9 ***
util14240    0.5 **
ic_sample module
sked      23.9%
inte      7.7%
dia       18.2%
hsla     26.2%
util      8.2%

idle      15.9%
ic_sample reset

```

8.0 INTERACTIVE
96 USERS @ 4800
0 THINK TIME

Multics hardcore, load 68.0/125.0: 68 users, 62 interactive, 6 daemons.
Absentee users 0/3
tty_meters -ls

Total metering time 0:04:05

FNP A: >udd>m>jpb>scripts>mcs>fnp_a>a 4.0

FNP B: >udd>m>jpb>scripts>mcs>async>b 4.0

38.26 terminal hr
min output msg size to cause block 3 chars.
ave output msg size to cause block 517638 chars.
ave output message 848.3 chars
ave interrupt time 15.655 ms, 38.2% of system
max interrupt time 192.115 ms.
ave input message 12.0 chars
buffer pool size 19392
ave # free words 2605
% buffer space used 86.6
ave circ queue size - no meter data.
circ. queue full cnt 0
ATB reads 49.16 sec.
ave rna message - no meter data.

complete input messages in buffer: current 0, ave 0.00
0.0% characters input in read-ahead
19 channels reading, 1 processes blocked on read
44 channels writing, 60 processes blocked on write
0 terminals in read-ahead, 0 complete messages
2,045,203 chars output, 60 chars input

	Per-sys	per-terminal
ATB output blocks	0	100 sec.
ATB interrupts	0.041	23.356 sec.
ATB quits - no meter data.		
ATB dialups - no meter data.		
ATB cycle	0.2	120.4 sec.
ATB writes	0.10	58.03 sec.
ATB read ahead - no meter data.		

conversion factors
output 0.86 (converted/ascii)
input 1.00 (ascii/raw)

0 input characters preconverted

input restarts 0
output restarts 22
output space overflows 21
cur # dialed 63
ave # dialed 569.2
input rate 0.0 chars/sec
output rate 14.6 chars/sec
tty_meters -rs

Total metering time 0:04:06

debug_fnp
fnp b
d 4.52
00652 000046

7.0 OUTPUT ONLY
60 USERS @ 4800 BAUD

```

73.21 terminal hr
min output msg size to cause block 9 chars.
ave output msg size to cause block 545777 chars.
ave output message 1512.1 chars
ave interrupt time 7.71 ms. 190.1% of system
max interrupt time 67.585 ms.
ave input message - no meter data.
buffer pool size 19376
ave # free words 10657
% buffer space used 45.0
ave circ queue size - no meter data.
ave # free buffers in FNP A 402
ave # free buffers in FNP B 51
circ. queue full cnt 0
ATB reads - no meter data.
ave r-a message - no meter data.

```

```

complete input messages in buffer: current 0, ave 0.00
% char in read ahead - no meter data.
32 channels reading, 16 processes blocked on read
36 channels writing, 36 processes blocked on write
0 terminals in read-ahead, 0 complete messages
7.679.891 chars output, 0 chars input

```

	Per-sys	per-terminal
ATB output blocks	0	54 sec.
ATB interrupts	0.008	7.584 sec.
ATB suits - no meter data.		
ATB dialups - no meter data.		
ATB cycle	0.1	62.6 sec.
ATB writes	0.06	51.89 sec.
ATB read ahead - no meter data.		

Idle time: 41.4%

ic_sample hist 0.9

```

sked:100 41.9 *****
sked:200 0.8 **
inte:304 1.5 ****
inte:3604 1.4 ***
dial:60 1.4 ***
dial:160 4.7 *****
dial:260 2.8 *****
dial:560 4.7 *****
dial:1060 2.5 *****
dial:1460 1.0 **
dial:4160 1.7 ****
dial:4760 0.8 **
dial:5060 8.8 *****
dial:5160 0.8 **
hsla:320 0.8 **
hsla:720 1.7 ****
hsla:2720 3.3 *****
hsla:3120 2.3 *****
hsla:3320 4.9 *****
hsla:4120 0.8 **
hsla:6220 0.8 **
hsla:6520 1.7 ****

```

ic_sample module

```

sked 25.9%
inte 2.5%
dia 18.5%
hsla 12.7%
util 0.0%

```

idle 4%

ic_sam reset

```

conversion factors
output 0.72 (converted/ascii)
ERROR - no meter data.

```

0 input characters preconverted

```

input restarts 0
output restarts 0
output space overflows 0

```

	# interrupts	interrupts/minute
FNP A	449	94.88
FNP B	209598	44291.21

Totals:	210047	44386.09

Characters per millisecond interrupt time

```

Input 0.000
Output 4.741
Total 4.741

```

	# calls	avs. time	chars./msec.
read - no meter data.			
write:	5079	107.232	14.101

```

cur # dialed 68
ave # dialed 928.2
input rate 0.0 chars/sec
output rate 29.1 chars/sec
tty_meters -rs

```

8.0 OUTPUT ONLY
SAMPLE TIME 4:43
50 USERS @ 4800 BAUD

date_time
12/05/79 2018.1 mst Wed
tty_meters

Total metering time 0:01:00

FNP A: >udd>m>Jpb>scripts>mcs>fnp...a>a 4.0

FNP B: >udd>m>Jpb>scripts>mcs>sync>b 4.0

0.00 terminal hr
min output msg size to cause block 0 chars.
ave output msg to cause block - no meter data.
ave output message 249.9 chars
ave interrupt time 7.578 ms. 66.5% of system
max interrupt time 47.226 ms.
ave input message 252.9 chars
buffer pool size 19392
ave # free words 17364
% buffer space used 10.5
ave usage of circ. queue 64
ave # free buffers in FNP A 447
ave # free buffers in FNP B 248
circ. queue full cnt 0
ATB reads 0.05 sec.
ave r-a message - no meter data.

complete input messages in buffer: current 0, ave 0.00
0.0% characters input in read-ahead
340,095 chars output, 339,112 chars input

	Per-sys	per-terminal
ATB output blocks - no meter data.		
ATB interrupts	0.011	0.000 sec.
ATB quits - no meter data.		
ATB dialups - no meter data.		
ATB cycle	0.0	0.0 sec.
ATB writes	0.04	0.00 sec.
ATB read ahead - no meter data.		

conversion factors
output 1.00 (converted/ascii)
input 1.00 (ascii/raw)

0 input characters preconverted

input restarts 0
output restarts 0
output space overflows 0

```
*****  
LINE      SEQ CHARS SECONDS  CPS BAUD  
b.h200    644 54180   60.0  901 7212  
b.h201    644 54180   60.0  901 7212  
b.h202    643 54180   60.0  901 7212
```

```
*****  
LINE      SEQ CHARS SECONDS  CPS BAUD  
b.h205    2721 55440   60.0  922 7380  
b.h206    2721 55440   60.0  922 7380  
b.h207    2721 55440   60.0  922 7380
```

7.0 BISYNC

12 USERS @ 9600 BAUD

