

J. H. L.

TO: M. M. Jones
FROM: R. C. Daley
DATE: February 14, 1969
SUBJECT: Configuration of the Multics Development Machine

Introduction

This document proposes a series of changes in the configuration of the Multics development machine in an attempt to minimize the cost to Project MAC and maximize the usefulness of the machine. These changes are described in terms of the four steps outlined below.

Step 1 - The development GIOC is immediately stripped down to development status by removing a number of specialized communication line adapters leaving only two typewriter adapters of 16 channels each. This will give us enough capability for development work and provide a limited form of backup for the other GIOC. As a result the development GIOC cannot support ARDS terminals or remote computers and displays (e. g., IMP, PDP-8 display monitor etc.) and will only be able to handle 2 classes of typewriters (e. g., 133 and 150 baud).

Step 2 - As soon as possible the development machine is augmented with an additional memory controller and 64K of memory for the duration of the file system performance improvement effort which is expected to be terminated before June 1. This augmentation assures that all development work may continue on the development machine while the larger Multics machine is being used to replace CTSS as the primary service machine for the Multics effort. Due to the reduced core requirement of the new file system, the additional core may be released as soon as the new file system is installed without impairing development work significantly.

Step 3 - Once the system maintenance and MST generation activities have been successfully moved from CTSS/GECOS to Multics, the lower speed Univac drum (and its associated channel) can be released. Since this drum is only useful to improve the performance of GECOS (Multics has no use for it), it should be released by April 1. In addition, the high speed tape drives should be replaced by lower speed drives at this time.

Step 4 - Once the new file system is operational (before June 1), the additional memory controller and 64K of memory can be released.

Hardware to be Released Immediately

Immediate

1/2	MSC388	- Mass Storage Controller (RACE)	418
1/2	MSU388	- Mass Storage Unit	1510
1	HPC600	- High Performance Channel (No longer required after RACE removed).	680
1	CAA600	- Character Asynchronous Adapter	195
82	CAC600	- Character Asynchronous Channels	255
1	CSA600	- Character Synchronous Adapter	195
3	CSC600	- Character Synchronous Channels	255
1	DGA600	- Dialing Adapters	130
8	DGC600	- Dialing Channels	280
Note: We may also release the 2-801ACU (automatic calling units) to the phone company.			
1	TTA600	- Typewriter Adapter	420
2	TTC600	- Typewriter Channel Groups (8-channel)	250
2	TTL600	- Typewriter Channel Group Extensions	130
1	OPT815	- Interrupt Cell Groups	105

May 14

Total Saved

4823

Hardware to be Acquired as Soon as Possible

March 4, 1969

1	MM8030	- Memory Controller (w. 32K)	6760
5	OPT802	- Active Unit Ports (2 included)	252
1	OPT815	- Interrupt Cell Groups (1 included)	NC
1	AMM600	- Added Memory (32K)	<u>4475</u>

Total Price

11487

Hardware to be Released and Acquired on April 1

Release:

May 1, 1969

1	MDU200	- Magnetic Drum Unit	3435
1	MDC200	- Magnetic Drum Controller	NC
1	HPC600	- High Performance Channel (for Drum)	680
4	MTH373	- MT Handlers (120KC, 7 trk)	<u>3580</u>

Total Price

7695

Acquire:

4	MTH301	- MT Handlers (60KC, 7 trk)	<u>-2460</u>
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Total Saved

5235

July 1, 1969

Hardware to be Released on June 1

P
at M.I. request

1	MM8030 - Memory Controller (w. 32K)	6760
5	OPT802 - Active Unit Ports (2 included)	252
1	OPT815 - Interrupt Cell Groups (1 included)	NC
1	AMM600 - Added Memory (32K)	<u>4475</u>

Total Saved 11487

Hardware Rental

<u>Step</u>	<u>Price</u>	<u>- Discount</u>	<u>= Subtotal</u>	<u>+ Use*</u>	<u>= Rent</u>
0 (Now)	68512	13702	54810	2741	57551
1 (Feb.)	63689	12736	50953	2548	53501
2 (March)	75176	15034	60142	3007	63149
3 (April)	69941	13988	55953	3798	58751
4 (June)	58454	11690	46764	2338	49102

*Second shift maintenance charge.

Rental 52521
+DSIO 5780

58301
11660 -207

46641
2332 +57

48973
1077

50050

FHD maintenance

1347
- 2076

1077

cc: C. T. Clingen
F. J. Corbató
J. C. R. Lickliger
J. H. Saltzer

12K

MIT GE-645 DEVELOPMENT SYSTEM CONFIGURATION

MODEL	QTY	MO. RENT
CP8031 - A or B CPU	1	\$ 14,560
MM8030 - A or B Mem w/32K	1	6,760
OPT802 - Active unit Ports	1 + 2 incl	64
OPT815 - Interrupt Cell groups	1 + 1 incl	105
AMM600 - 32K memory	1	4,475
CAB601 - extra mem heat	1	260
CLK600 - system clock	1	760
AMM600 - 32K	1	4,475
AUM600 - 32K	1	4,475
? MSW600 - Memory switch	1	50
EMU302 - FHD	1	0
DC8031 - A or B GIOC	1	5,620
? HPC600 - HPC	1 + 1 incl	680
TIA600 - TTY adapters	2	840
TTA600 - TTY chan groups	4	500
TTL600 - TTY group ext	4	260
CAA600 -	1	195
CAC600 -	1	85
CO8030 - Master Console	1	420
MTC404 - Mag tape control	1/2	772
MTH301 - 60K Controller	4	2,460
PRT202 - PR	1	1,665
CPZ201 - PU	1	860
CRZ201 - CR	1	680
MG8031 - Motor Gen	1/2	160
OPT825 - power sequencer	1/2	9
PLP600 - priority leveler	1 (additional)	65
MIP600 - GIOC Port pair	1	260
OPT802 - Active unit port	1	84
CPP600 - Processor port pair	1	260
APP302 - additional port pair	1	260
PSC200 - peripheral switch	1/2	87
OPT510 - switch unit	15/2	315
TOTAL		\$ 52,521

19.5 85
 258 3
 450 255
 150
 61900
 50

12430

By special agreement, MIT has agreed to pay maintenance on EMU302. So total price for maintenance price computation is \$52,521 + \$12,430 = \$64,951. As per previous arrangements, maintenance charge is computed at .5% of system rental.

Equipment + maintenance = 52,521 + 2,626 =
 Less 20% Educational Discount -- monthly rental =
 Plus 5% Extended Use -- monthly rental =

42016 2100
 2101
 44017
 1078
 45195
 4624
 49819
 55147
 44117 5780
 570
 46323 1156
 5780
 1156
 41011

1680
 4100
 5780

5830
 5230

Basic Agreement between General Electric Company and
Massachusetts Institute of Technology dated April 22, 1968.

AMENDMENT NO. 1
June 9, 1969

1. Paragraph 2, entitled PERIOD OF AGREEMENT, is amended as follows:

This Basic Agreement when executed, shall become effective as of ^{1 Jan 1968} ~~1 April 1968~~ and shall remain in effect until December 31, 1969, unless otherwise extended by subsequent mutual agreement of the parties. ?

2. Subparagraph B of Paragraph 3, DELIVERY & INSTALLATION OF EQUIPMENT, is deleted in its entirety.
3. Subparagraph B of Paragraph 4, RENTAL CHARGES, is amended as follows:

(1) Rental charges for each item of the installed System 1 equipment listed in Exhibit I shall commence as of ~~1 April 1968~~. Rental charges for subsequent additional System 1 shall commence as of the date that the equipment is installed and ready for use as certified by General Electric in writing and mutually acceptable to MIT. Rental charges for the installed System 1 equipment listed in Exhibit I and such subsequent additional System 1 equipment shall terminate 31 January 1969 and the equipment released to General Electric. Effective February 1, 1969, rental charges for the installed System 2 shall commence.

System 2, effective 1 February 1969, is as shown on Attachment A to this amendment, excluding Items No. 45, 46, 47 and 48.

- (2) Effective March 4, 1969, rental charges commence for Items No. 45; 46 and 47.
 - (3) Effective April 1, 1969, the rental charges for Items No. 15, 34, 35 and 44 terminate and such items are released to General Electric Company. Also effective April 1, 1969, the rental charge for Item No. 48 commences.
 - (4) Effective June 1, 1969, rental charges for Items No. 5 (qty. 1) 45, 46 and 47 terminate and such items of equipment are released to General Electric Company.
 - (5) Charges for a fractional part of a calendar month shall be computed at the rate of 1/30 of the basic monthly rental per day.
4. Subparagraph C of Paragraph 4, RENTAL CHARGES, is deleted in its entirety.
 5. Subparagraph F of Paragraph 6, MAINTENANCE, is deleted in its entirety.

Title

Large Systems Department
Information Systems Equipment Division
General Electric Company

Title

Massachusetts Institute of Technology

Attachment A

GE-645 System 2 (Site Code BAJ4)

MIT-GE Development System

Item	Model No.	Description	Qty.	Remarks	Unit Mo. Rental	Mo. Rental
1	CP8031A ✓	Central Processor (Mod. A)	1		\$14,560	\$14,560
2	CPP600 ✓	Processor Port Pair	2	1 included in CP8031 price	260	260
3	MM8030 ✓	Memory Controller (w. 32K)	1		6,760	6,760
4	OPT802 ✓	Active Unit Ports	84 *	2 included in MM8030 price	84	252
5	OPT815 ✓	Interrupt Cell Groups	2	1 included in MM8030 price	105	105
6	AMM600 ✓	Added Memory (32K)	1		4,475	4,475
7	CAB601 ✓	Additional Memory Cabinet	1		260	260
8	AUM600 ✓	Auxiliary Memory (32K)	1		4,475	4,475
9	AMM600 ✓	Added Memory (32K)	1		4,475	4,475
10	XCLK60 ✓	System Clock	1		760	760
11	DC8031A ✓	General I/O Controller (Mod. A)	1		5,620	5,620
12	MIP600 ✓	GIOC Port Pairs	2	1 included in GIOC price	260	260
13	PLP600 ✓	Priority Level Group	2 *	2 included in GIOC price	65	130
14	CAB600 ✓	Adapter Cabinet	1	1 included in GIOC price	N/C	N/C
15	HPC600 ✓	High Performance Channel	1	1 included in GIOC price	680	680
16	IPA600 ✓	Indirect Peripheral Adapter	1	1 included in GIOC price	N/C	N/C
17	IPC600 ✓	Indirect Peripheral Adapter	1	1 included in GIOC price	N/C	N/C
18	CAA600 ✓	Character Asynch Adapter	1		195	195
19	CAC600 ✓	Character Asynch Channels	81 *		85	255
20	TTA600 ✓	Teletype Adapter	2		420	840
21	TTC600 ✓	TTA Channel Groups (8 ch. ea.)	4		125	500
22	TTL600 ✓	TTA Extensions	4		65	260
23	APP302 ✓	Additional Port Pair for EMU302	1		260	260

* = May 14, 1969

Attachment A (cont'd)

GE-645 System 2

MIT-GE Development System

Item	Model No.	Description	Qty.	Remarks	Unit Mo. Rental	Mo. Rental
24	CAB600	Adapter Cabinet	1		990	990
29	DDA600	Direct Disc Adapter	1		680	680
30	DSC11F	Disc Storage Controller	1/2		3,360	1,680
31	DSU10F	Disc Storage Unit (Disc File)	1		4,100	4,100
32	DEU11F	Disc Electronics Unit (Logic)	1/2		N/C	N/C
33	DCU10F	Disc Compressor Unit	1/2		N/C	N/C
34	MDU200	Magnetic Drum Unit	1		3,435	3,435
35	MDC200	Magnetic Drum Controller	1		N/C	N/C
36	CO8030	Master Console	1		420	420
37	MTC404	Magnetic Tape Controller	1/2		1,545	773
39	CR2201	Card Reader	1		680	680
40	CP2201	Card Punch	1		860	860
41	PRT202	Printer, Extended Char. Set	1		1,665	1,665
44	MTH373	Magnetic Tape Handler (120KC 7 Track)	4	replace 373 July 2, 1969.	895	3,580
45	MM8030	Main Memory w/Controller	1		1,760	1,760
46	AMM600	Additional Memory	1		4,475	4,475
47	OPT802	Memory Port	3		84	252
48	MTH301	Magnetic Tape-Handler	4		615	2,460
49	MSW600	Memory switch	1/2		50	50
50	MGT031	Motor Gen	1/2		320	160
51	OPT825	Power Regulator	1/2		18	9
52	RSC200	Peripheral switch	1/2		17.5	8.75
53	OPT510	Printed Unit	15 1/2		42	645
54	ENM1302	FHD				

MIT GE-645 DEVELOPMENT SYSTEM CONFIGURATION

<u>MODEL</u>	<u>QTY</u>	<u>MO. RENT</u>	
CP8031 — A MB CPU	1	\$ 14,560	} up grade to B, no change in price
MM8040 — A MB Mem w/32K	1	6,760	
OPT802 — Active unit ports	1 + 2 incl	64	
OPT815 — Interrupt Cell groups	1 + 1 incl	105	} receive interrupts + remove
AMM600 — 32K memory	1	4,475	
CAB601 — extra mem/heat	1	260	
CLK600 — system clock	1	760	
AMM600 — 32K	1	4,475	
AUM600 — 32K	1	4,475	
? — MSW600 — Memory switch	1	50	- needed for clock
EMU302 — FHD	1	0	
DC8031 — A MB GIOC	1	5,620	
? — HPC600 — HPC	1 + 1 incl	680	
TTA600 — TTY adapters	2	840	
TTC600 — TTY channel groups	4	500	} minimum would be +400
TTL600 — TTY group ext	4	260	
CAA600 — } ACD	1	195	} but backup station would be less:
CAC600 — }	1	85	
CO8030 — Master Console	1	420	
MTC404 — Mag tape control	1/2	772	250
MTH301 — VDU Controller	4	2,460	130
PRT202 — PR	1	1,665	1266
CPZ201 — PU	1	860	
CRZ201 — CR	1	680	+ 1646
MG8031 — Master Gen	1/2	160	
OPT825 — power regulator	1/2	9	
PLP600 — priority leveler	1 (additional)	65	
MIP600 — GIOC port pair	1	260	
OPT802 — Active unit port	1	84	} backup 1266
CPP600 — Processor port pair	1	260	
APP302 — Addition port pair	1	260	
PSC200 — Peripheral switch	1/2	87	
OPT510 — switch unit	15/2	315	
<u>TOTAL</u>		<u>\$ 52,521</u>	

Should be DCA 600

FAD monthly is 12430

By special agreement, MIT has agreed to pay maintenance on EMU302. So total price for maintenance price computation is \$52,521 + \$12,430 = \$64,951. As per previous arrangements, maintenance charge is computed at 5% of system rental.

Equipment + maintenance =	52,521 + 2,626 =	55,147	
Less 20% Educational Discount -- monthly rental =		44,117	42,016
Plus 5% Extended Use -- monthly rental =		46,323	2101
			<u>44,117</u>
			1078
			<u>45,195</u>

FAD maintenance from Feb. 1