

AccessionIndex: TCD-SCSS-T.20150615.001

Accession Date: 15-Jun-2015

Accession By: Paul Harrington

Object name: DEC PDP 11/34

Vintage: c.1976

Synopsis: Rackmounted minicomputer with octal keypad, with RL01 disk drive and LA36 DECwriter printer, from the first dedicated TCD Library computer system.

S/N: ???.

### **Description:**

Digital Equipment Corporation was set up by Ken Olsen and Harlan Anderson of MIT in 1957 in Maynard, Massachusetts, USA. Although it had a number of very successful products like the PDP-8, PDP-10 and PDP-20, it was the PDP-11 family [1], designed by Harold McFarland, Gordon Bell, Roger Cady, et al, that became their signature products, highly popular 16-bit minicomputers, beginning with the PDP 11/15 and 11/20 in 1970 and ending with the PDP 11/93 and 11/94 in 1990, when they sold the product family to Mentec in Ireland. DEC's equally successful VAX-11 family were the immediate successors to the PDP-11 family.

The most memorable features of the PDP-11 architectures were memory-mapped I/O, and the register set of six general-purpose registers R0-5, the stack pointer SP and the instruction pointer IP. From the 2<sup>nd</sup>-generation PDP 11/45 there were dual register sets that supported Kernel, Supervisor and User privilege levels. Most models were able to run the DOS-11, RT-11, RSX-11, RSTS and MUMPS operating systems.

The PDP 11/34 [2] was introduced in 1976 as a successor to the PDP 11/05.

*Trivial1: The first official UNIX ran on a PDP 11/20 in 1970*

*Trivial2: The PDP 11/34 is a direct descendant the PDP 11/15 and 11/20:*

- The PDP 11/05 was an inexpensive (and slow) successor to the PDP 11/20.
- The PDP 11/34 was a successor to the PDP 11/05.

*Trivial3: The PDP 11/34 console used an Intel i8008 microprocessor with 1kB of ROM*

The 11/34 CPU was implemented over two hex-size boards. It had unique MTPS and MFPS instructions, semiconductor memory with 18-bit addressing, and a Unibus backplane [3]. Its performance was about 0.13 MIPS. It evolved to an 11/34A to be compatible with an optional bit-slice FPU using 16 x Am2901. A later 11/34C version included a CPU cache; ironically, the CPU clock was slowed to accommodate the cache timing. An optional quad-size card could be added to run a seven segment display and keypad console [6]; this was a very widely purchased option.

Unibus [3] was an asynchronous bus with 18-bit address and 16-bit data designed c.1969 by Gordon Bell and Harold McFarland. All DMA I/O devices used the Unibus, employing memory-mapped I/O registers in the top 8kB of address space.

As indicated in the Computer Lab annual reports (see below), the PDP 11/34 in this collection had a rackmounted CPU, initially with 128K (but ultimately 256K) of memory, an octal keypad Programmer's Console, eight serial asynchronous terminal lines, initially 3 x RL01 disk drives (but ultimately 2 x RL01 and 1 x RL02), and an LA36 DECwriter console printer.

The CPU chassis contained a Unibus cardcage plus a H740 'Modular Regulator' (switchmode power supply).

**Warning: the H740 is a 110VAC power supply !!!**

One curiosity is that when the chassis was fully extended from the rack, the front could be rotated upwards through 45 degrees or 90 degrees to allow the Unibus wiring to be modified. The slider mechanism for this rotation, and the chassis exterior panels, are now badly corroded, and both need urgent rust control treatment to prevent further deterioration.

The cardcage had slots in six segments, so cards of single, double, quad or hex width could be accommodated. The 11/34 in this collection contains the following modules:

Slot	Type	Width	Function	Comment
1	M8265	hex	KD11-EA CPU control module	
2	M8266	hex	KD11-EA CPU datapath module	
3	M7859	quad	KV11-LB console interface	for connection to KY11-LB Programmer's Console
4			<??> 256K DRAM	
5				
6				
7	M7762	hex	Unibus RL11 disk controller	for RL01 and/or RL02 drives
8				
9				

This system used an RL11 disk controller [4] for 1-4 RL01 or RL02 disk drives, possibly the first disk drives with an embedded sector servo positioning system that mixed data sectors with positioning sectors, enabling simplified head alignment and increased track density, and hence greater capacity. This technology is now universal in disk drives. An RL01 disk drive formatted single-platter cartridges (RL01K) with 256byte sectors, 40 sectors/track, 256 tracks/side, for a total capacity of 5MB; an RL02 drive doubled the tracks/side for 10MB capacity [5]. With two RL01 and one RL02 this 11/34 system had a total of 10MB online disk capacity.

The LA36 DECwriter [7] was a typical 1970s-vintage tractor-feed printer introduced in Aug-1975, an extremely successful product. Its 9-pin 132-column 7x7 dot-matrix print head printed on 14-inch wide paper. Pulses from a slotted wheel fed an analog servo print head positioning motor, while a stepper motor rotated the line feed mechanism, which also advanced the print ribbon. It used a 20mA current-loop RS232C serial line interface at 100, 150 or 300 baud, with a character buffer so line feed would not delay printing (it could print 30 characters/second at 300 baud).

The unit in this collection was the TCD Library's first dedicated computer system. The Library had already intensively used the TCD computing systems, including those of the Dept.Computer Science, since the early days of computing in TCD (e.g. they were significant users of the department's IBM 360/44), but this was their first dedicated computer system, specifically for the Library's real-time Circulation Control System. It was located at and operated by the TCD's *Computer Laboratory* (now *IT Services*) in Pearse Street.

The history of this item can be seen in the annual reports of the Computer Lab, see the *History of the Computer Laboratory* elsewhere in this catalog. The earliest mention is in the 1979/1980 report:

**excerpt from Section 4.1:**  
*A Digital PDP 11/34 system, funded by the Library, was also installed in the Laboratory. This machine will be used exclusively for a library circulation control system which is under development.*

**excerpt from Appendix A:**  
*Digital PDP 11/34:*  
*For real-time Library Circulation Control system:*  
 -CPU with 128K memory  
 -8 asynchronous lines  
 -3 x RL01 Disc drives  
 -1 x LA36 Console

A systems diagram (Fig.1) shows the new dedicated Library DEC PDP 11/34, which was, as was then typical but now atypical, isolated (standalone) from other systems.

The next mention in the 1980/1981 report shows one RL01 replaced by an RL02:

**excerpt from Section 3.2:**  
*Work continued throughout the year on the other main Library development Project, a real-time circulation control system using a dedicated PDP 11/34 computer, and it is hoped that this will go into limited operation during the next academic year.*

**excerpt from Appendix A:**  
*Digital PDP 11/34:*  
*For real-time Library Circulation Control system:*  
 -CPU with 128K memory  
 -8 asynchronous lines  
 -2 x RL01 Disc drives  
 -1 x RL02 Disc drive  
 -1 x LA36 Console

There is no systems diagram in this report.

Then from the 1981/1982 report it can be seen the system been introduced by the Library into active usage for circulation control:

**excerpt from Section 2:**

<b>PDP 11/34</b>	<b>Library</b>	<b>Academic</b>	<b>Admin</b>	<b>Outside</b>	<b>Support</b>	<b>Total</b>
<b>IR£ of Annual Use</b>	3081	0	0	0	0	3081
<b>% Cost of Annual Use</b>	0.72	0	0	0	0	0.72

**excerpt from Section 3.2:**  
*The completion and commissioning of the first phase of the circulation control system covering the Lecky Library was the main development in library computing during the year. The system completed its tests during the summer in readiness for Michaelmas Term 1982.*

**excerpt from Section 3.3**  
*The Student Records system was modified to print machine readable bar codes on student identification cards for use in connection with the library circulation control system which obtains borrowers' identification from the Student Records computer.*

**Appendix A:** [configuration of Digital PDP 11/34 unchanged]

The systems diagram represents the PDP 11/34 as unchanged, and still isolated.

In the 1982/1983 report it can be seen the system is actively used by the Library:

<i>excerpt from Section 2:</i>						
<b>PDP 11/34</b>	<b>Library</b>	<b>Academic</b>	<b>Admin</b>	<b>Outside</b>	<b>Support</b>	<b>Total</b>
<i>IR£ of Annual Use</i>	4853	0	0	0	0	4853
<i>% Cost of Annual Use</i>	0.98	0	0	0	0	0.98

***excerpt from Section 3.2***

*The newly developed circulation control system satisfactorily completed its first full year of operation in the Lecky Library although plans to implement the next phase of the system in the Science Library were delayed because Post Office data lines were not available.*

***Appendix A: [configuration of Digital PDP 11/34 unchanged]***

Again the systems diagram represents the PDP 11/34 as unchanged, and still isolated.

In the 1983/1984 report it can be seen the system is heavily used by the Library, and has been upgraded to 256K of memory:

<i>excerpt from Section 2:</i>						
<b>PDP 11/34</b>	<b>Library</b>	<b>Academic</b>	<b>Admin</b>	<b>Outside</b>	<b>Support</b>	<b>Total</b>
<i>IR£ of Annual Use</i>	18933	0	0	0	0	18933
<i>% Cost of Annual Use</i>	3.03	0	0	0	0	3.03

***excerpt from Section 3.2***

*In the Library area, the circulation control system, which was introduced initially in the Lecky Library last year, was extended to the Science Library during the year.*

***excerpt from Appendix A:***

*Digital PDP 11/34:*

*For real-time Library Circulation Control system:*

- CPU with 256K memory*
- 8 asynchronous lines*
- 2 x RL01 Disc drives*
- 1 x RL02 Disc drive*
- 1 x LA36 Console*

Again the systems diagram (Fig.2) represents the PDP 11/34 as unchanged, and still isolated, and the surrounding environment only slightly changed (DEC 2040 upgraded to DEC 2060, Burroughs 1714 decommissioned, experimental WAN via NBST).

In the 1984/1985 report it can be seen the system is more heavily used by the Library:

<i>excerpt from Section 2:</i>						
<b>PDP 11/34</b>	<b>Library</b>	<b>Academic</b>	<b>Admin</b>	<b>Outside</b>	<b>Support</b>	<b>Total</b>
<i>IR£ of Annual Use</i>	28943	0	0	0	0	28943
<i>% Cost of Annual Use</i>	4.17	0	0	0	0	4.17

***Appendix A: [configuration of Digital PDP 11/34 unchanged]***

Again the systems diagram (Fig.3) represents the PDP 11/34 as unchanged, and still isolated, but the surrounding environment is beginning to change (new ICL 2966 and ICL Series 39, and the beginnings of local area networking [LAN and OSLAN], and the creation of HEAnet for wide area networking [WAN]).

In the 1985/1986 report it can be seen the system is much less used by the Library; it is not clear why, although the report highlights the sharply increasing use of PCs, and the shift of applications to these, so this may be pertinent:

<i>excerpt from Section 2:</i>						
<i>PDP 11/34</i>	<i>Library</i>	<i>Academic</i>	<i>Admin</i>	<i>Outside</i>	<i>Support</i>	<i>Total</i>
<i>IR£ of Annual Use</i>	10676	0	0	0	0	10676
<i>% Cost of Annual Use</i>	1.44	0	0	0	0	1.44

**Appendix A:** *[configuration of Digital PDP 11/34 unchanged]*

By then the systems diagram (Fig.4) shows the PDP 11/34 has acquired remote access through a Gandalf PACX via 5 dedicated communication lines, in an environment of expanding communications that took place over this period.

In the 1986/1987 report it can be seen the system is even less used by the Library, and again the report highlights the sharply increasing use of PCs, especially in the Finance Office and Library:

<i>excerpt from Section 2:</i>						
<i>PDP 11/34</i>	<i>Library</i>	<i>Academic</i>	<i>Admin</i>	<i>Outside</i>	<i>Support</i>	<i>Total</i>
<i>IR£ of Annual Use</i>	6731	0	0	0	0	6731

**Appendix A:** *[configuration of Digital PDP 11/34 unchanged]*

Again the systems diagram (Fig.5) shows the PDP 11/34 with remote access through a Gandalf PACX via 5 dedicated communication lines, and the continued expansion of communications that took place over this period.

In the 1987/1988 report it can be seen the system usage by the Library is winding down, indicating an approach to the end of its useful life, and the report highlights a number of new developments, including Library hardware and software, networking, and a pending move to the new O'Reilly Institute (then under construction):

<i>excerpt from Section 2:</i>						
<i>PDP 11/34</i>	<i>Library</i>	<i>Academic</i>	<i>Admin</i>	<i>Outside</i>	<i>Support</i>	<i>Total</i>
<i>IR£ of Annual Use</i>	4679	0	0	0	0	4679

**excerpt from Section 1:**

*From the standpoint of the College computing service, 1987/88 will be remembered for the following events:*

- The signing of a contract for the replacement of the DECsystem-2060 by a new VAX system.*
- The delivery of a new turn-key Library system to replace the existing one.*
- The ordering of new equipment and software to replace the existing computer systems used for student and graduate records.*
- The installation of major data communications facilities, the Ericsson MD110 Data feature and the fibre optic Ethernet LAN backbone, which will set the standard for development for several years to come.*

**excerpt from Section 2.1:**

*The first of the two new VAX systems, the VAX 8350 for the Library, was installed in mid-April and used for development purposes only for the remainder of the year.*

**excerpt from Section 2.3.1:**

*... the forthcoming move to the O'Reilly Institute, ...*

***excerpt from Section 4:***

*Other developments in the near future will include the full implementation of the new Library software.*

***Appendix A: [configuration of Digital PDP 11/34 unchanged]***

Again the systems diagram (Fig.6) shows the PDP 11/34 with remote access through a Gandalf PACX via 5 dedicated communication lines, and the further expansion of communications that took place over this period.

In the 1988/1989 report it can be seen the PDP 11/34 is not mentioned, indicating it has been decommissioned and disposed of (to Paul Harrington) when the Computer Lab moved to the newly completed O'Reilly Institute:

***excerpt from Section 1:***

*1988/89 was a particularly eventful and busy year for the Computer Laboratory. Highlights of the year include:*

- The move to new accommodation in the O'Reilly Institute.*

***excerpt from Section 2:***

*The ICL Series 39 and the new VAX6230 carried the bulk of the academic mainframe workload during the year with the VAX8350 catering for the Library and the ICL processing most of the administrations mainframe work.*

***Appendix 2:***

*PDP 11/34 is absent*

This is confirmed by the absence of the PDP 11/34 from the systems diagram (Fig.7).

When the PDP 11/34 was decommissioned, immediately afterwards it was saved by Paul Harrington (BA Mod Computer Science 1990), with permission from Michael Doherty of the Computer Lab. The intention was to install it in his former secondary school (Marymount College, now closed) in Carrick-on-Shannon, so secondary school students could experience a UNIX shell on 1200 baud terminals. However, the school was not so enthusiastic when they saw the size of the machines, the noise they generated and the power that they consumed! Instead it was held in store for him by his mother Mrs. Agnes Harrington at her home in Boyle, County Roscommon, for over 25 years until the CPU and a disk drive and printer were finally delivered to Trinity College Dublin in Jun-2018.

Sadly the iconic PDP-11 rack and its power supplies were not able to be preserved in this collection, but its PDP-11 logo panel was. At least one RL01 disk cartridge for this system was also preserved.

Special thanks to Paul Harrington for preserving these historically significant items, his mother Mrs. Agnes Harrington for storing them (and her repeated hospitality), and his family for their supporting efforts, especially John O'Toole without whose help the PDP 11/34 itself could not have been extracted from its rack.

Given the fragility of 40 year-old equipment, many thanks to David McLoughlin of McLoughlin Transport (brother of Des, 1978 BAI graduate taught by Prof. J.G. Byrne) for carefully delivering and decanting these items in person.



The homepage for this catalog is at: <https://www.scss.tcd.ie/SCSSTreasuresCatalog/>  
Click '*Accession Index*' (1st column listed) for related folder, or '*About*' for further guidance.  
Some of the items below may be more properly part of other categories of this catalog, but are listed here for convenience.

Accession Index	Object with Identification
<a href="#">TCD-SCSS-T.20150615.001</a>	DEC PDP 11/34. Rackmounted minicomputer with octal keypad, with RL01 disk drive and LA36 DECwriter printer, from the first dedicated TCD Library computer system, S/N: ???, 1976.
<a href="#">TCD-SCSS-T.20150615.001.01</a>	DEC PDP 11/34. Rackmounted minicomputer with octal keypad. S/N: ???
<a href="#">TCD-SCSS-T.20150615.001.02</a>	DEC RL01 Disk Drive. Model: RL01-A, Ser.No.: CX33604. 27-Jun-1986.
<a href="#">TCD-SCSS-T.20150615.001.03</a>	TCD Library DEC PDP 11/34 System Disk. Labelled: 5/5/82 DL0, 3/10/84 T.L. off 24/11/86, Servo Computer Services Ltd, Date: 2-OCT-1985, Tel: Dublin 0565-854191 2.
<a href="#">TCD-SCSS-T.20150615.001.04</a>	DEC LA36 DECwriter. S/N: ???
<a href="#">TCD-SCSS-X.20180907.001</a>	History of TCD Library computing, Trinity College Dublin. The evolution of TCD Library computing, c.1968.
<a href="#">TCD-SCSS-X.20180907.002</a>	History of computerisation of TCD Library's 1872 Printed Accessions Catalogue. The long personal campaign by Prof.J.G.Byrne, Dept.Computer Science, c.2005.
<a href="#">TCD-SCSS-T.20211003.001</a>	DEC PDP 11/34 Rack Unit. Rackmountable minicomputer with octal keypad, Model: 11/34A DC, S/N: AG18812. c.1976.
<a href="#">TCD-SCSS-T.20150615.002</a>	DEC PDP 11/24. Rackmounted minicomputer, with associated cartridge disks and documentation. S/N: GA06424. c.1981.
<a href="#">TCD-SCSS-T.20151118.003</a>	DEC PDP 11/84. Late model of the popular PDP-11 series made by DEC, with two RL02 disk drives and THR7000 external drive unit. S/N: ???, c.1985.
<a href="#">TCD-SCSS-T.20151118.004</a>	DEC M792E Unibus Boot ROM Board. Early diode-array ROM for booting the popular PDP-11 series made by DEC. Date-stamped 18-Sep-1974. c.1974.
<a href="#">TCD-SCSS-T.20191104.002</a>	DEC MINC-11 laboratory minicomputer. Lab computer plus instrument chassis successor to the original MIT LINC, Model: MINC11-AB, CAB 0, S/N: WF05524. c.1981.
<a href="#">TCD-SCSS-T.20121208.036</a>	DEC VAX 11/780 LA120 Console Processor. LSI-11 based PDP11 console processor from VAX mainframe used by Dept.Computer Science from 1979-1988. c.1978.
<a href="#">TCD-SCSS-T.20191104.001</a>	DEC PDP-8/e minicomputer. Legendary 12-bit minicomputer. c.1970.
<a href="#">TCD-SCSS-T.20191108.001</a>	DEC PDP-8/I replica front panel. PiDP-8/I, modern replica of the PDP-8/I minicomputer front panel, with emulation by a Raspberry Pi. c.2019.
<a href="#">TCD-SCSS-T.20191108.002</a>	DEC PDP-11/70 replica front panel. PiDP-11/70, modern replica of the PDP-11/70 minicomputer front panel, with emulation by a Raspberry Pi. c.2019.

## References:

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10. EEVblog Electronics Community Forum, *Digital Equipment Corporation PDP-11/04 H777 Power supply testing*, see:  
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11. EEVblog Electronics Community Forum, *DEC PDP11/34 Power Supply Check, Fix & Test, plus some Tips*, see:  
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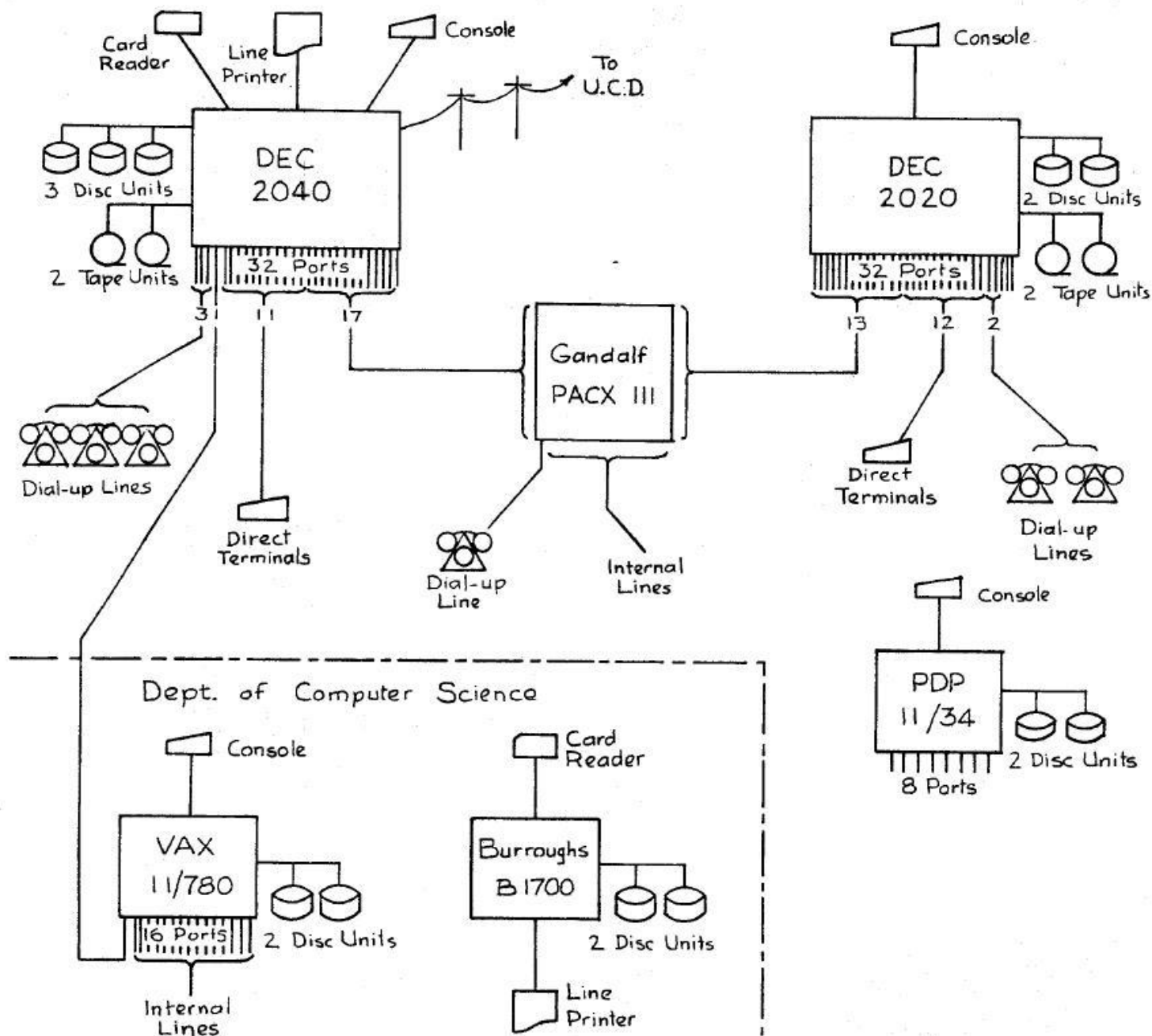


Figure 1: 1979/1980 TCD Computer Lab Report showing new dedicated Library DEC PDP 11/34, isolated (standalone) from other systems

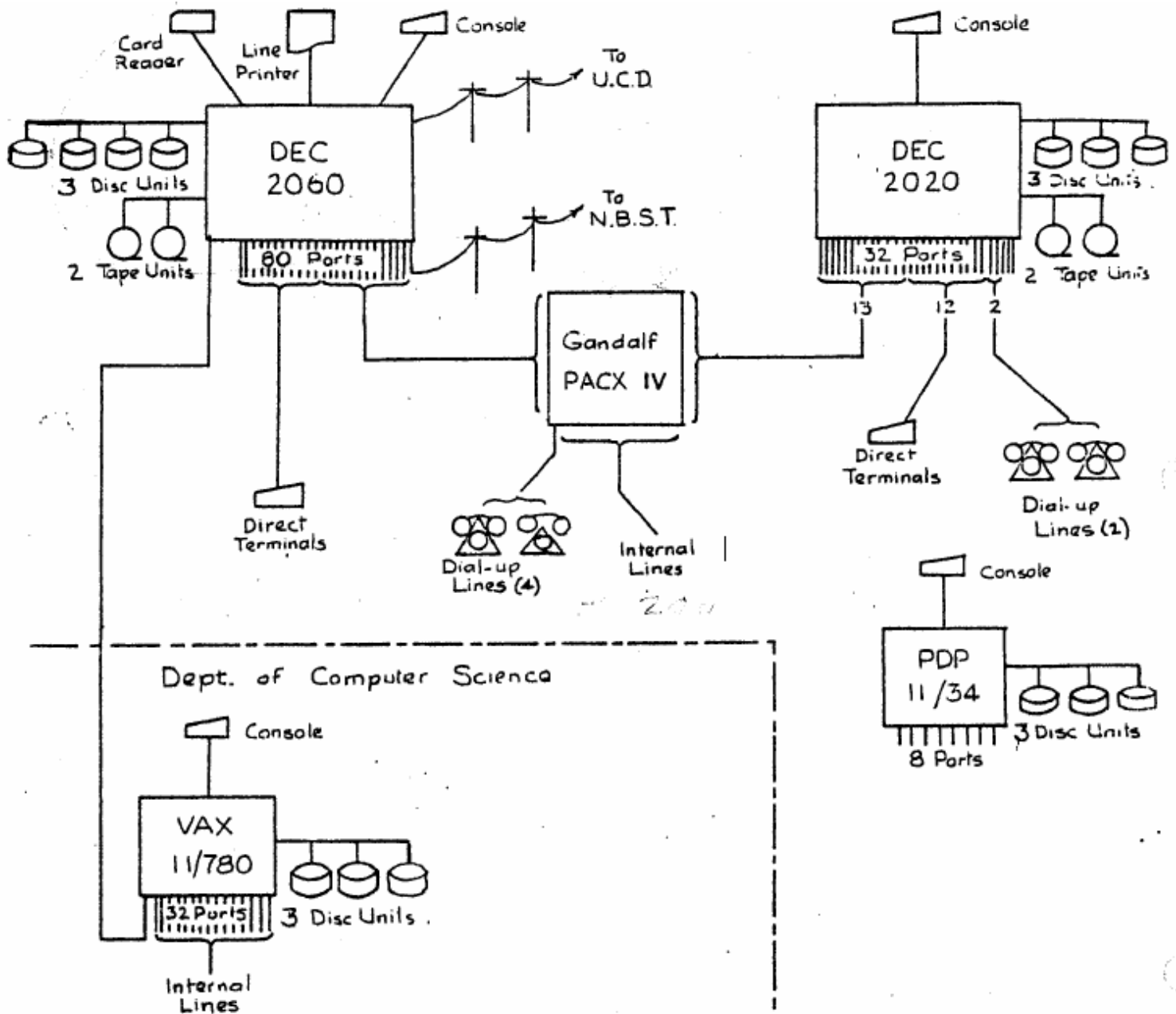


Figure 2: 1983/1984 TCD Computer Lab Report showing dedicated Library DEC PDP 11/34, still isolated from other systems; note the DEC 2040 has become a DEC 2060, the Burroughs 1714 is absent

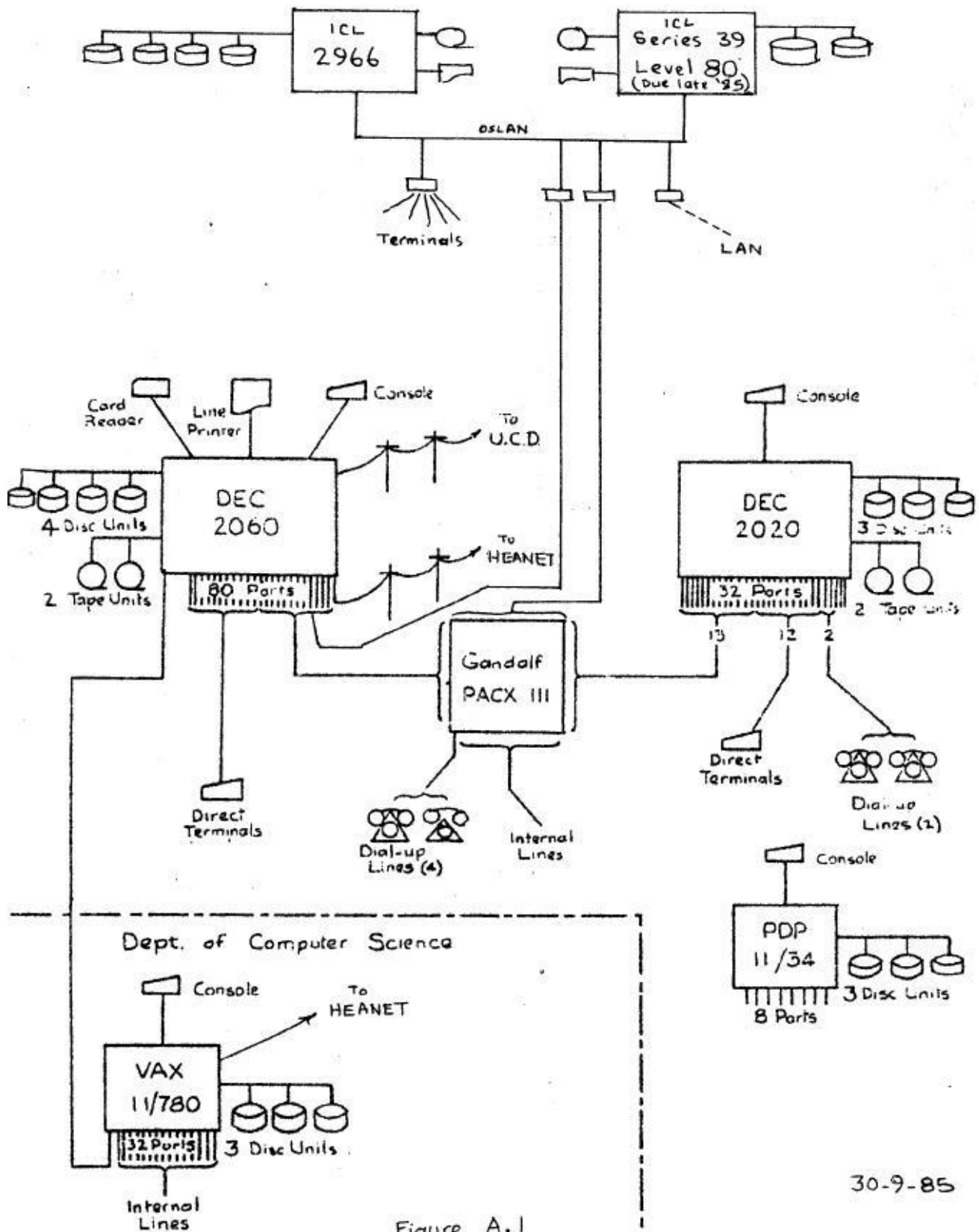


Figure A.1

Figure 3: 1984/1985 TCD Computer Lab Report showing dedicated Library DEC PDP 11/34, still isolated (standalone) from other systems; note the new ICL 2966 and ICL Series 39, and the beginnings of local area networking (LAN and OSLAN), and HEANet instead of NBST



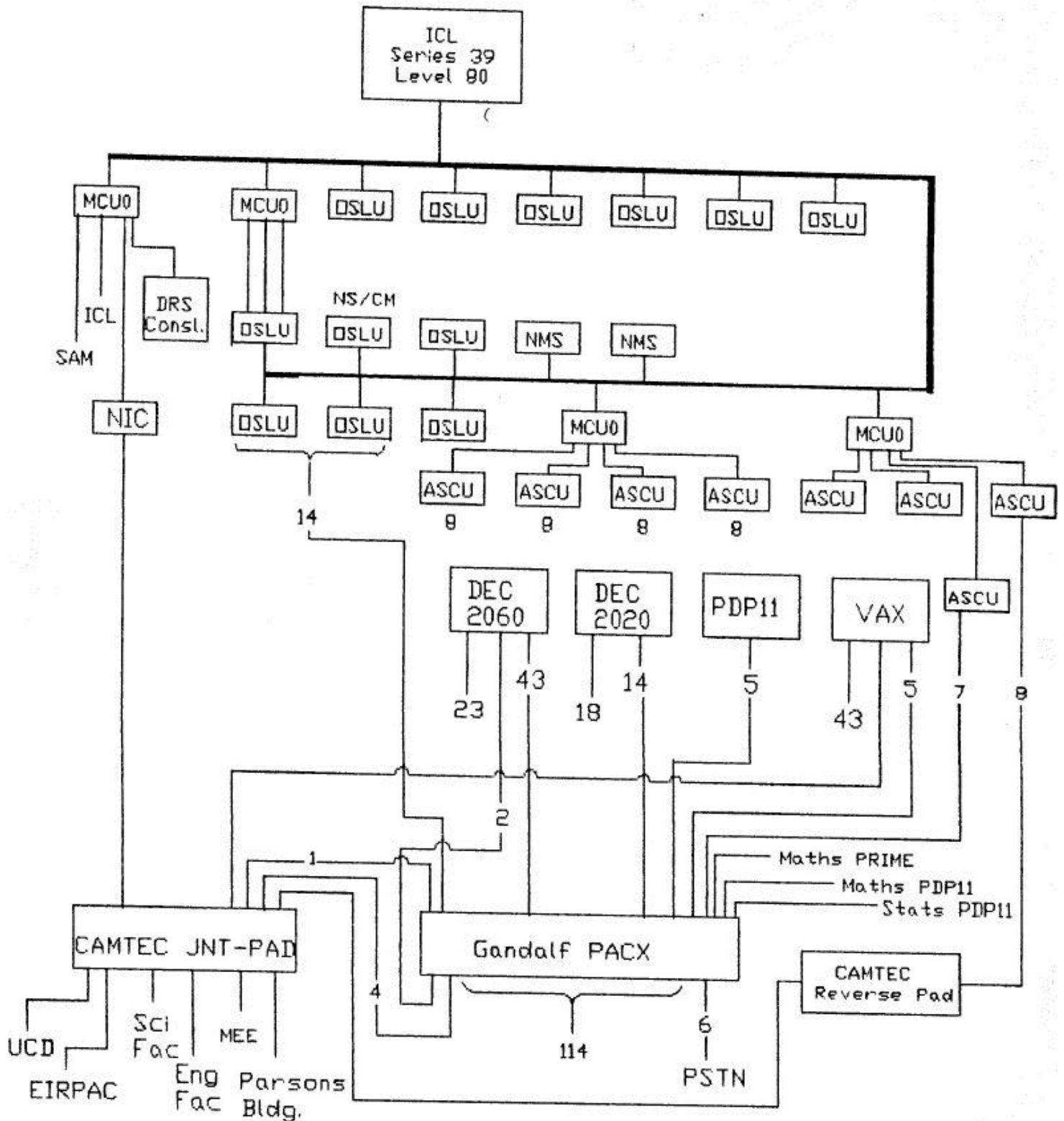


Figure 5: 1986/1987 TCD Computer Lab Report showing dedicated Library DEC PDP 11/34 with remote access through Gandalf PACX via 5 dedicated communication lines, also note continued expansion of communications that took place over this period



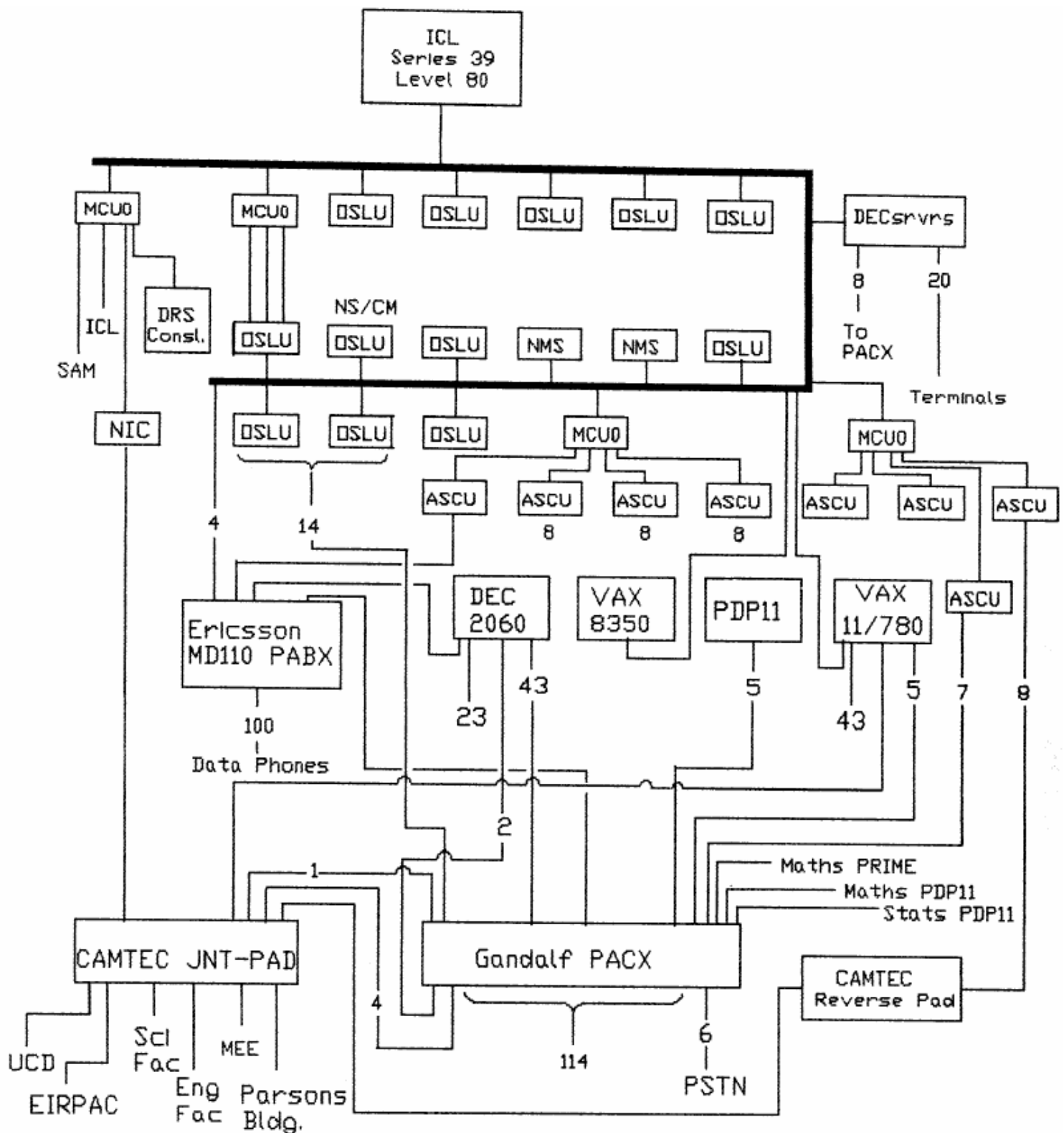


Figure 6: 1987/1988 TCD Computer Lab Report showing dedicated Library DEC PDP 11/34 again with remote access through Gandalf PACX via 5 dedicated communication lines, again note further expansion of communications that took place over this period

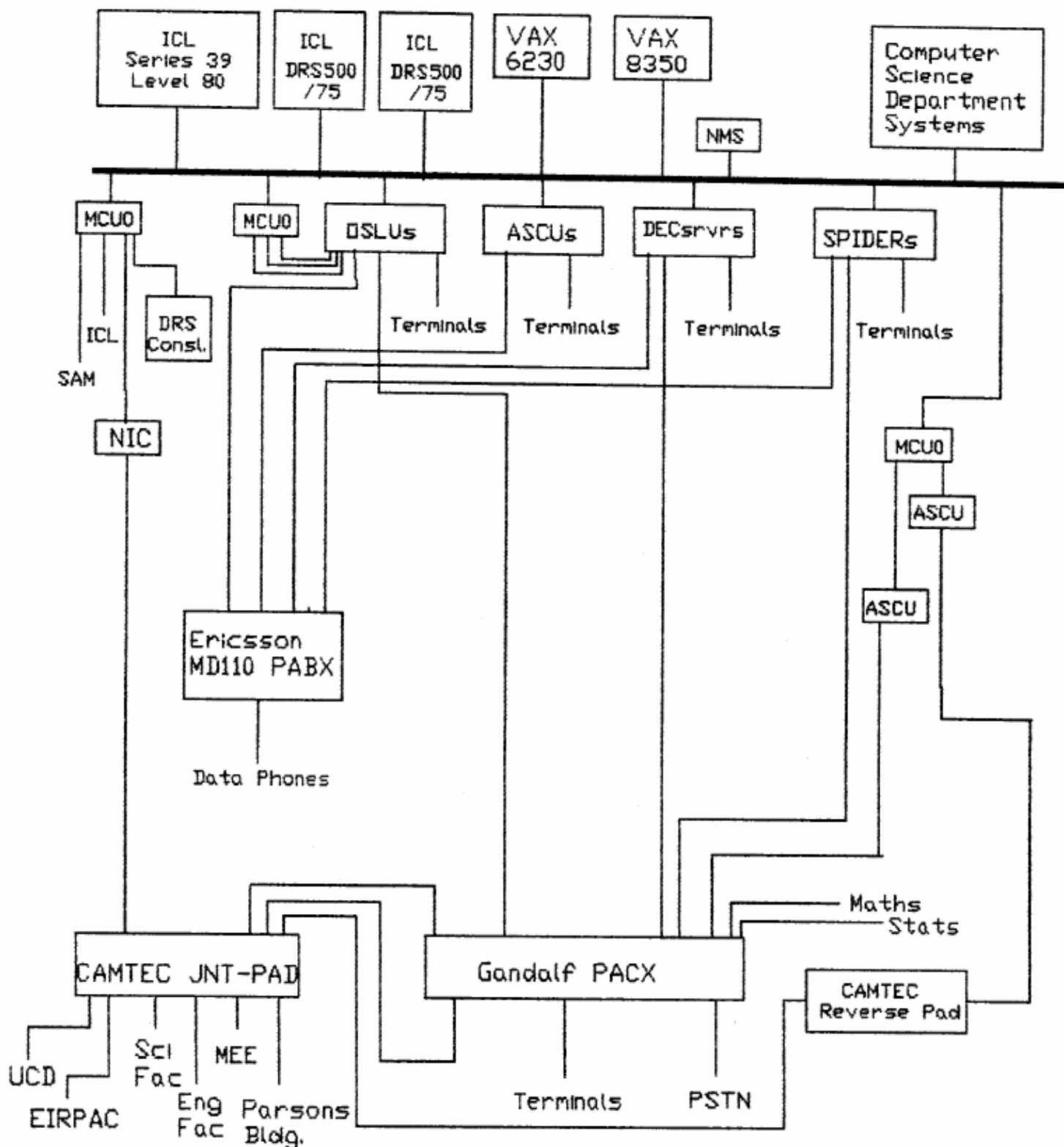


Figure 7: 1988/1989 TCD Computer Lab Report showing absence of dedicated Library DEC PDP 11/34



*Figure 8: DEC PDP 11/34 and DECwriters in Boyle  
(the far DECwriter is a DECwrite-II from a PDP 11/24 system, see elsewhere in this catalog)*



*Figure 9: DEC PDP 11/34 and DECwriters in Boyle  
(the DECwriter-II at left is from a PDP 11/24 system, see elsewhere in this catalog)*





*Figure 10: DEC PDP 11/34 in Boyle, front panel, note corrosion*



*Figure 11: DEC LA36 DECwriter in Boyle*





*Figure 12: DEC PDP 11/34 and DECwriter in Boyle packaged for transport*



*Figure 13: DEC PDP 11/34 and DECwriter in Boyle packaged for transport*





*Figure 14: DEC RL01 disk drive in Boyle*



*Figure 15: iconic DEC PDP-11 logo panel safely in the Collection*



*Figure 16: DEC PDP 11/34 safely in the Collection, front three-quarter view*





*Figure 17: DEC PDP 11/34 safely in the Collection, front view*



*Figure 18: DEC PDP 11/34 front panel*





Figure 19: DEC RL01 Disk Drive safely in the Collection, right and left side views



Figure 20: DEC RL01 Disk Drive, manufacturing labels.  
 “UK PRC., RA: 2933-04, Date: 27-06-86  
 Digital, Model: RL01-A, Ser.No.: CX33604”





*Figure 21: DEC LA36 DECwriter safely in the Collection, front three-quarter view*



*Figure 22: DEC LA36 DECwriter keyboard*





*Figure 23: DEC LA36 DECwriter tractor-feed mechanism*



*Figure 24: DEC RL01K-DC Disk Cartridge front view, beside Irish 1-pound (IR£1.00) note*

*“System Disk 5/5/82 DL0, 3/10/84 T.L. off 24/11/86”*

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