



CSE 536 Fall 2026

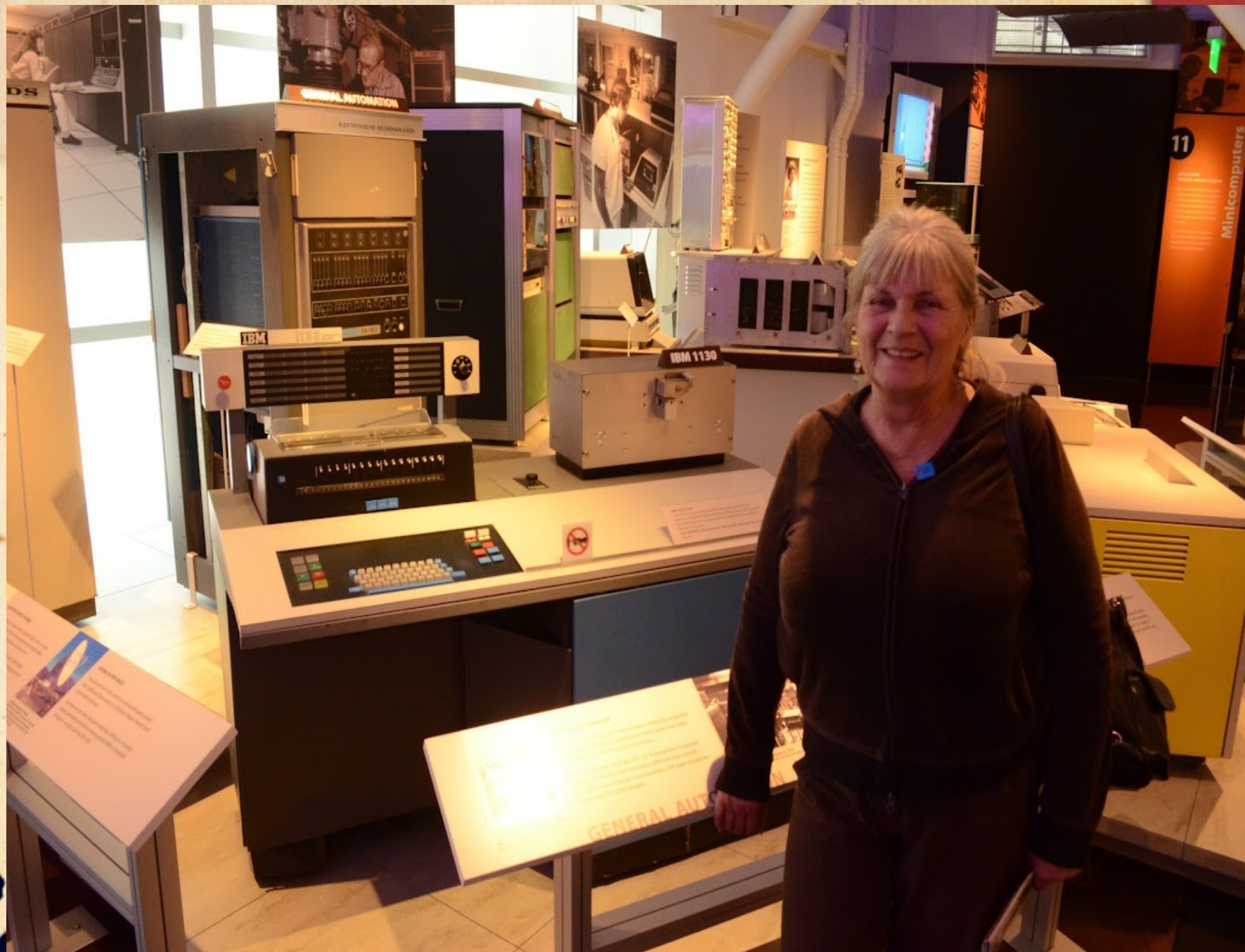
Jed Crandall

jedimaestro@asu.edu



A bit about me...

- Associate Professor, SCAI *and* Biodesign Center for Biocomputation, Security, and Society
- Research is about Internet freedom, including:
 - Internet censorship and censorship evasion
 - Machine-in-the-middle attacks, adversarial networking
 - Privacy, forensics, and a few other things





IBM 1130, U.S. 1965
The 1130 was unusual in offering removable disk storage and a full line of peripherals including card readers and printers. IBM also offered over 50 in-house developed tools, such as highway alignment, bridge design, and software for customers.
Base: 124,000 with disk. Memory size: 16 words. Memory type: Core. Memory width: 16 bits.

GENERAL AUTOMATION

Not every minicomputer company was created by engineers jumping ship. A marketing executive and a salesperson at Honeywell founded General Automation.





Welcome to Debian Linux 1.1!

This is the Debian Linux Boot Disk. On most systems, you can go ahead and press <ENTER> to begin installation. You will probably want to try doing that before you try anything else. If you run into trouble, or if you already have questions, press the function key <F1> for quick installation help.

WARNING: You should completely back up all of your hard disks before proceeding. The installation procedure can completely and irreversibly erase them! If you haven't made backups yet, remove the floppy from the disk drive and press <RESET> or <Control-Alt-Del> to get back to your old system.

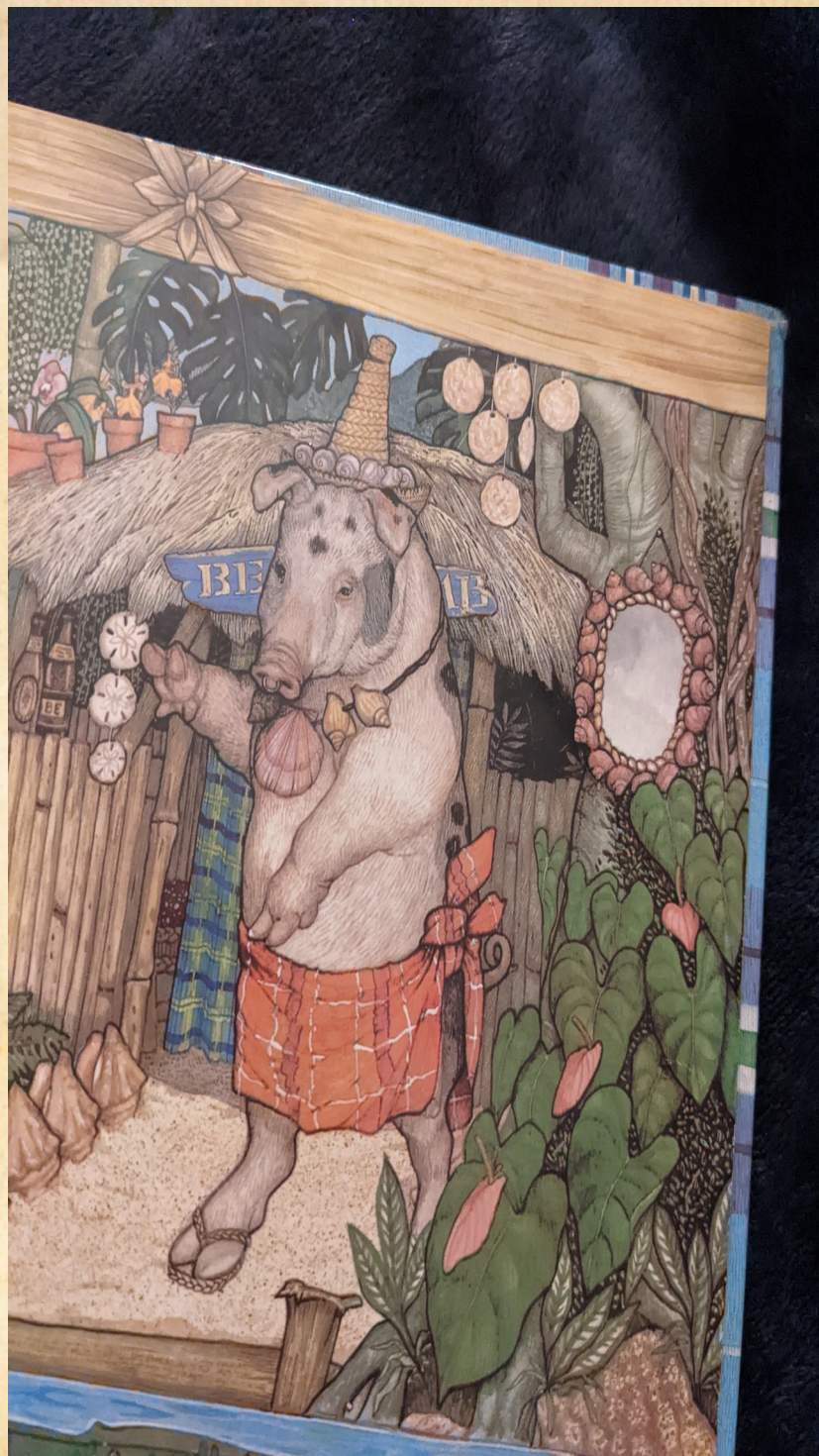
Debian Linux comes with ABSOLUTELY NO WARRANTY, to the extent permitted by applicable law. For copyright information, press <F5>.

This boot floppy installs the Linux kernel version 2.0.0.

Press <F1> for help, or <ENTER> to boot!

boot: _

https://archive.org/details/debian_1.1





Terminal



```
jedi@mariposa:~$ cat /usr/share/dict/american-english | tr [a-z] [A-Z] | grep "MB$" | head -n 20
```

COULOMB

HOLCOMB

LAMB

LIPSCOMB

MB

MB

APLOMB

BENUMB

BOMB

CATACOMB

CLIMB

COCKSCOMB

COMB

COXCOMB

CRUMB

CURRYCOMB

DUMB

ENTOMB

FIREBOMB

HONEYCOMB

```
jedi@mariposa:~$
```

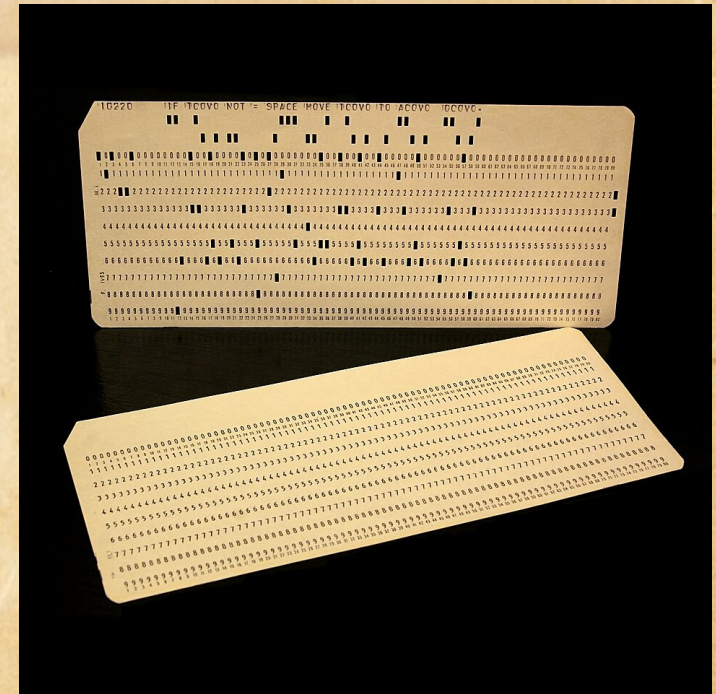
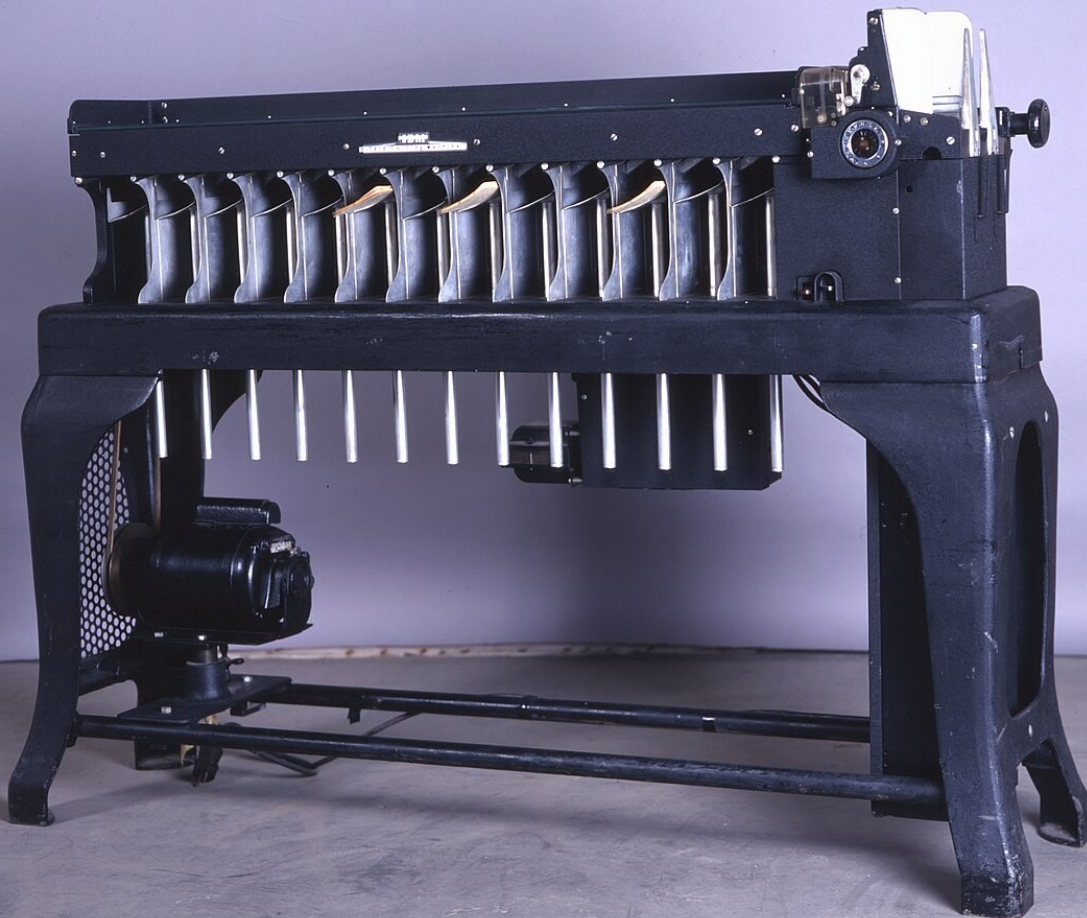


What do you hope to learn
about advanced operating
systems this semester?





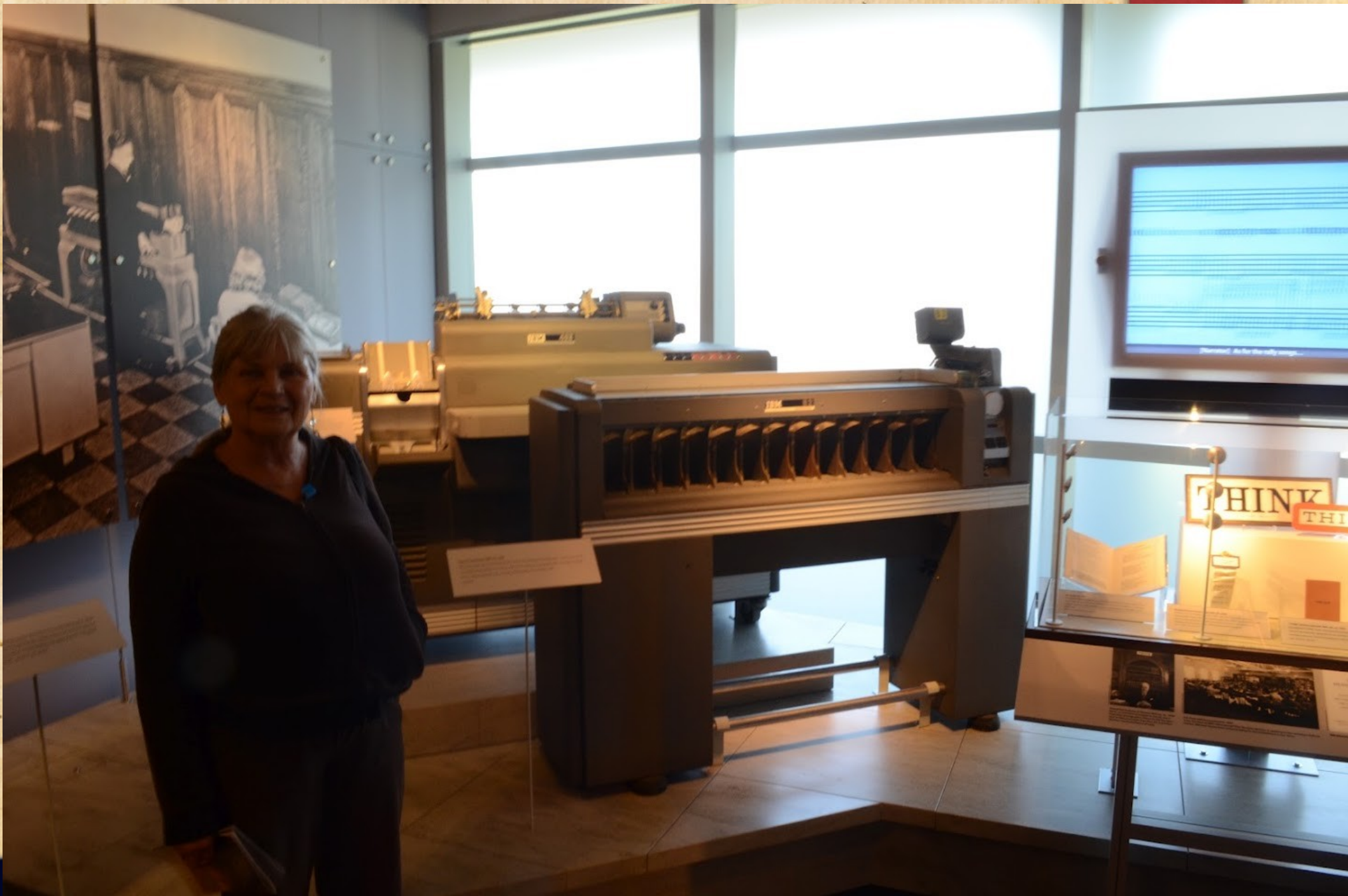
First, we'll start with UNIX as an example of a time sharing system. From the dawn of computing until the late 1960s we mostly had batch systems. Then along came time sharing systems, and that's still what you have in your pocket today.

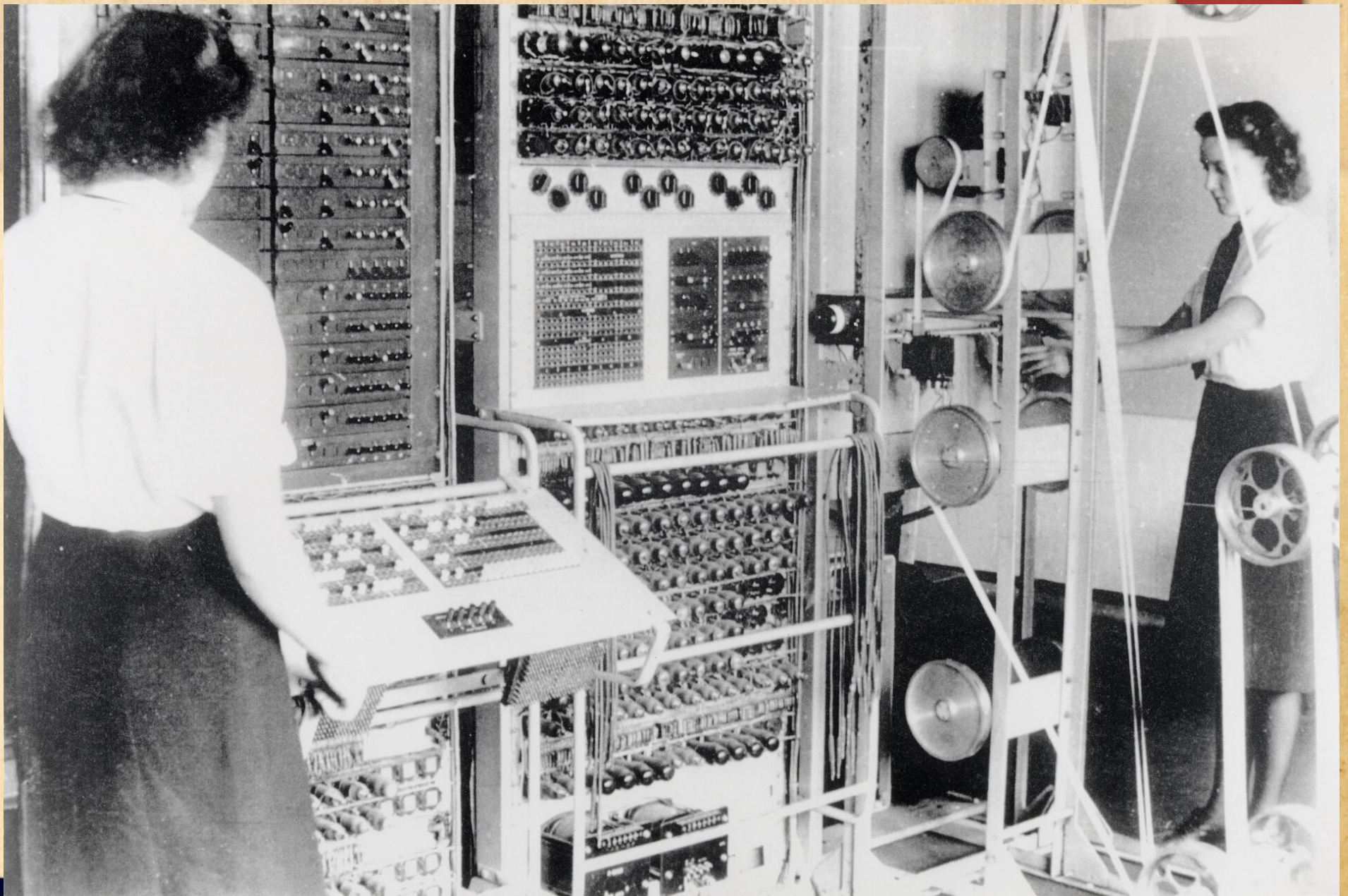


https://en.wikipedia.org/wiki/Punched_card

https://www.youtube.com/watch?v=7FL_DsUjWlc
(René Carmille)

https://en.wikipedia.org/wiki/Punched_card_sorter





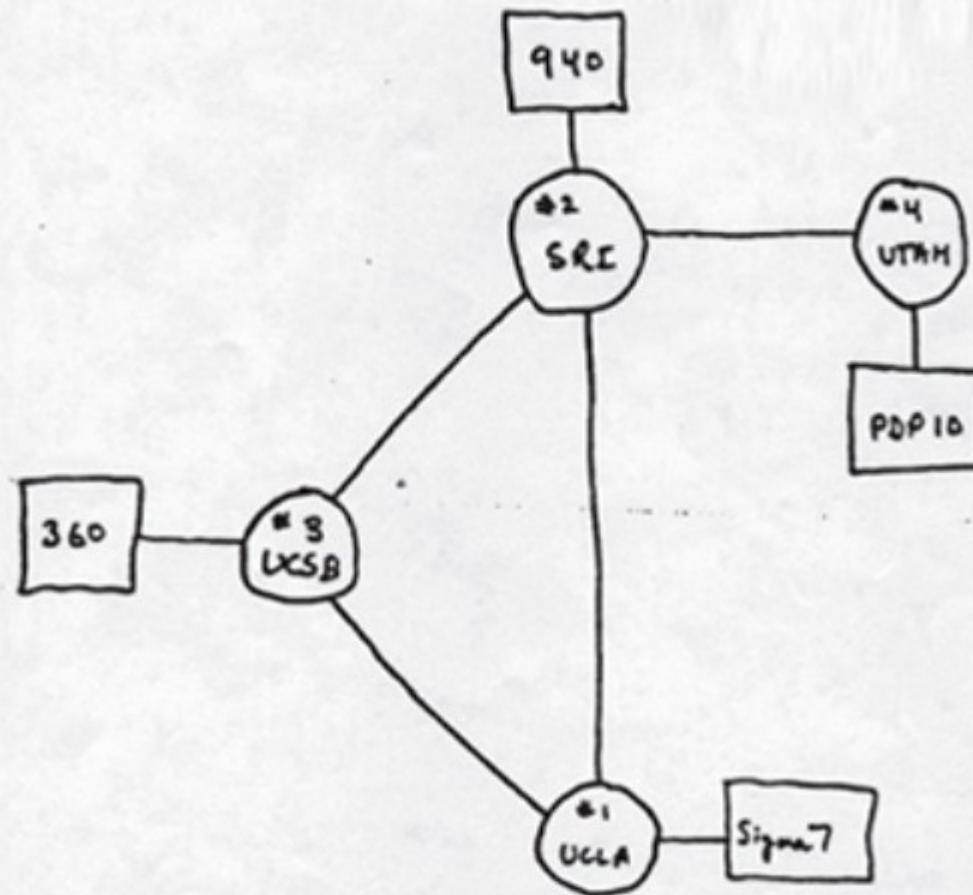
https://en.wikipedia.org/wiki/Colossus_computer



<https://en.wikipedia.org/wiki/UNIVAC>

https://en.wikipedia.org/wiki/Electrologica_X8





THE ARPANET

DEC 1969

4 NODES



Location	Machine and OS
UCLA	SDS Sigma 7 running SEX (<i>Sigma Experimental</i>)
SRI	SDS 940 running Genie (<i>process isolation, hyperlink history, influenced UNIX</i>)
University of Utah	DEC PDP-10 running TENEX (<i>email, first worm, influenced TOPS-10, CP/M, DOS, and Windows</i>)
UCSB	IBM 360 running OS/MVT (<i>basically OS/360</i>)



By Joe Mabel, CC BY-SA 3.0, <https://commons.wikimedia.org/w/index.php?curid=31996455>



<https://www.rickcrandall.net/assets/media/uploads/pdf/3%20SDS%20940%20and%20Internet.pdf>







<https://www.nokia.com/bell-labs/about/dennis-m-ritchie/hist.pdf>

not exist. What we wanted to preserve was not just a good environment in which to do programming, but a system around which a fellowship could form. We knew from experience that the essence of communal computing, as supplied by remote-access, time-shared machines, is not just

to type programs into a terminal instead of a keypunch, but to encourage close communication.

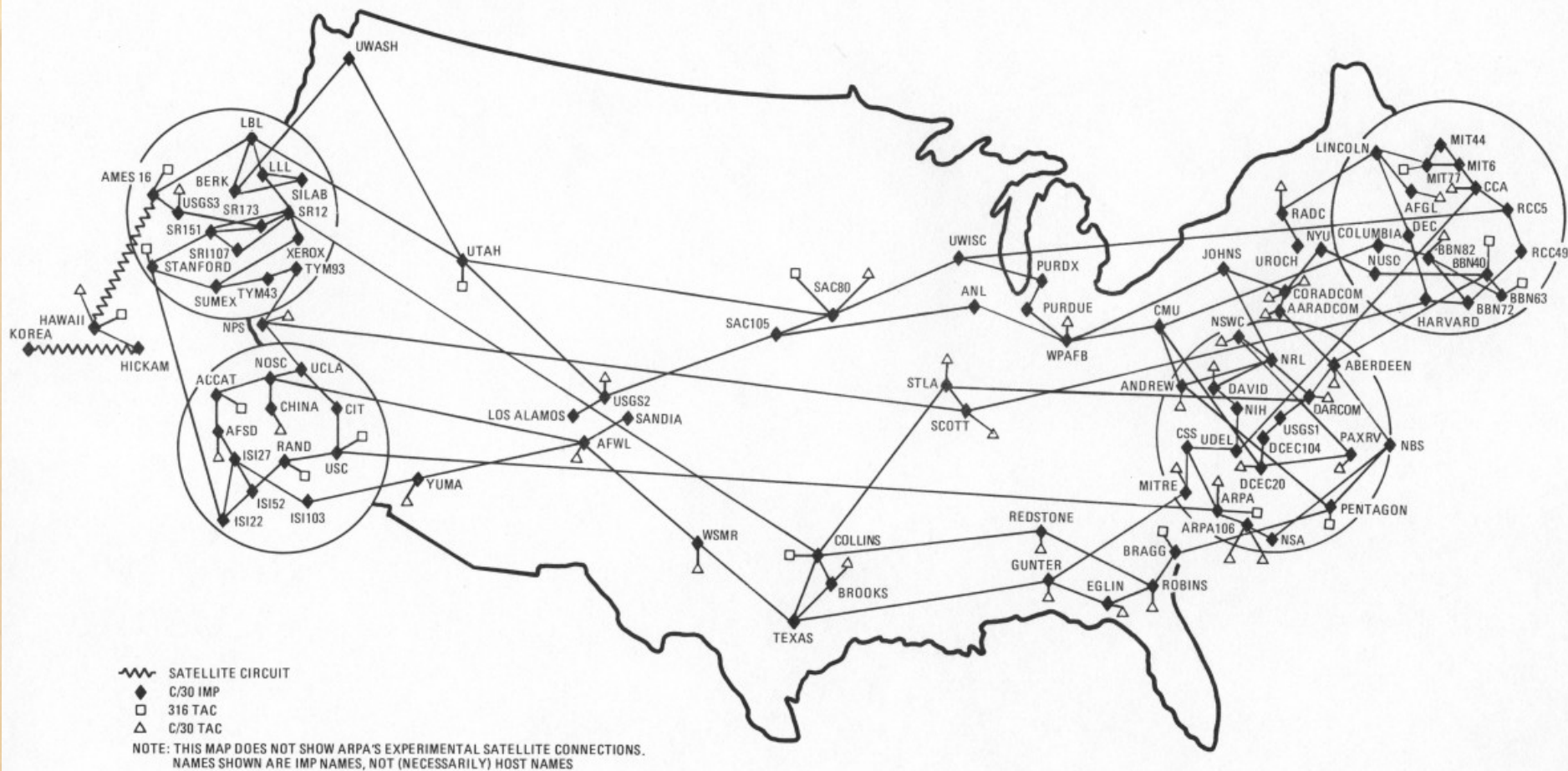
Thus, during 1969, we began trying to find an alternative to Multics. The search took several forms. Throughout 1969 we (mainly Ossanna Thompson Ritchie) lobbied intensively for the





<https://www.computerhistory.org/revolution/minicomputers/11/337/1934>

ARPANET/MILNET GEOGRAPHIC MAP, JANUARY 1984





Minicomputer K1840
VEB Robotron-Elektronik Dresden, 1988

Minicomputer VAX 11/780
Digital Equipment Corporation (DEC)
Maynard/USA 1977-1984
Monitor und Diskettenlaufwerke
VAX 11/780
Terminal VT 100
VAX 11/780



<https://hampage.hu/vax/kepek/sokvax.jpg>

```
Accounting information:
Buffered I/O count:      1266      Peak working set size: 1560
Direct I/O count:       558        Peak page file size:  5526
Page faults:            4630        Mounted volumes:      0
Charged CPU time:       0 00:00:10.35  Elapsed time:      0 00:00:14.36
```

Welcome to OpenVMS (TM) VAX Operating System, Version V7.3

Username: system

Password:

%LICENSE-I-NOLICENSE, no license is active for this software product

%LOGIN-S-LOGOPRCON, login allowed from OPA0:

Welcome to OpenVMS (TM) VAX Operating System, Version V7.3

Last interactive login on Thursday, 31-DEC-2020 23:08

\$ show system

```
OpenVMS V7.3 on node VAX 31-DEC-2020 23:10:02.28 Uptime 0 00:00:45
  Pid  Process Name  State Pri  I/O      CPU      Page flts  Pages
00000201 SWAPPER      HIB    16      0  0 00:00:00.14      0      0
00000205 CONFIGURE    HIB     8      5  0 00:00:00.02     112     175
00000206 LANACP      HIB    13     54  0 00:00:00.10     372     537
00000208 IPCACP      HIB    10      6  0 00:00:00.03      99     177
00000209 ERRFMT      HIB     9     17  0 00:00:00.05     130     211
0000020B OPCOM      HIB     9     37  0 00:00:00.08     201     251
0000020C AUDIT_SERVER HIB     9     43  0 00:00:00.16     564     742
0000020D JOB_CONTROL  HIB     8     15  0 00:00:00.04     191     342
0000020E SECURITY_SERVER HIB    10     22  0 00:00:00.19     740    1204
0000020F SYSTEM      CUR     7     93  0 00:00:00.41     837     546
```

\$ show time

31-DEC-2020 23:10:05

\$ set def [000000]

\$ dir

Directory SYS\$SYSROOT:[000000]

```
DATEI.TXT;2      DATEI.TXT;1      MOM$SYSTEM.DIR;1  SYS$I18N.DIR;1
SYS$LDR.DIR;1    SYS$STARTUP.DIR;1  SYSCBI.DIR;1     SYSCOMMON.DIR;1
SYSERR.DIR;1     SYSEXEC.DIR;1     SYSHLP.DIR;1     SYSLIB.DIR;1
SYSMAINT.DIR;1   SYSMGR.DIR;1     SYSMMSG.DIR;1    SYSTEST.DIR;1
SYSUPD.DIR;1     TCPIP$ETC.DIR;1   TNT.DIR;1
```

Total of 19 files.

Directory SYS\$COMMON:[000000]

```
DECW$DEFAULTS.DIR;1  MOM$SYSTEM.DIR;1  SYS$I18N.DIR;1    SYS$KEYMAP.DIR;1
SYS$LDR.DIR;1        SYS$STARTUP.DIR;1  SYS$ZONEINFO.DIR;1  SYSCBI.DIR;1
SYSERR.DIR;1         SYSEXEC.DIR;1     SYSFONT.DIR;1      SYSHLP.DIR;1
SYSLIB.DIR;1         SYSMAINT.DIR;1    SYSMGR.DIR;1       SYSMMSG.DIR;1
SYSTEST.DIR;1        SYSUPD.DIR;1      TCPIP$LIB.DIR;1     TNT.DIR;1
VUE$LIBRARY.DIR;1
```

Total of 21 files.

Grand total of 2 directories, 40 files.

\$ █

<https://www.facebook.com/groups/retrocomputers/posts/8698955203467617/>

RP0: No File System found on 'disk.hp', skipping autosizing
/home/zerocool32/Downloads/sysvr1/boot.ini-5> att tm0 dist.tape
TM0: Tape Image 'dist.tape' scanned as SIMH format
#0=unix

UNIX/sysV: unixgdtm
real mem = 262144 bytes
avail mem = 185280 bytes

INIT: SINGLE USER MODE
init 2

INIT: New run level: 2
Is the date Wed Dec 1 15:21:37 EST 1982 correct? (y or n) y
Do you want to check the file systems? (y or n) n
-su: /usr/lib/acct/startup: cannot execute
process accounting started
errdemon started
cron started

Console Login: root
UNIX System V
█



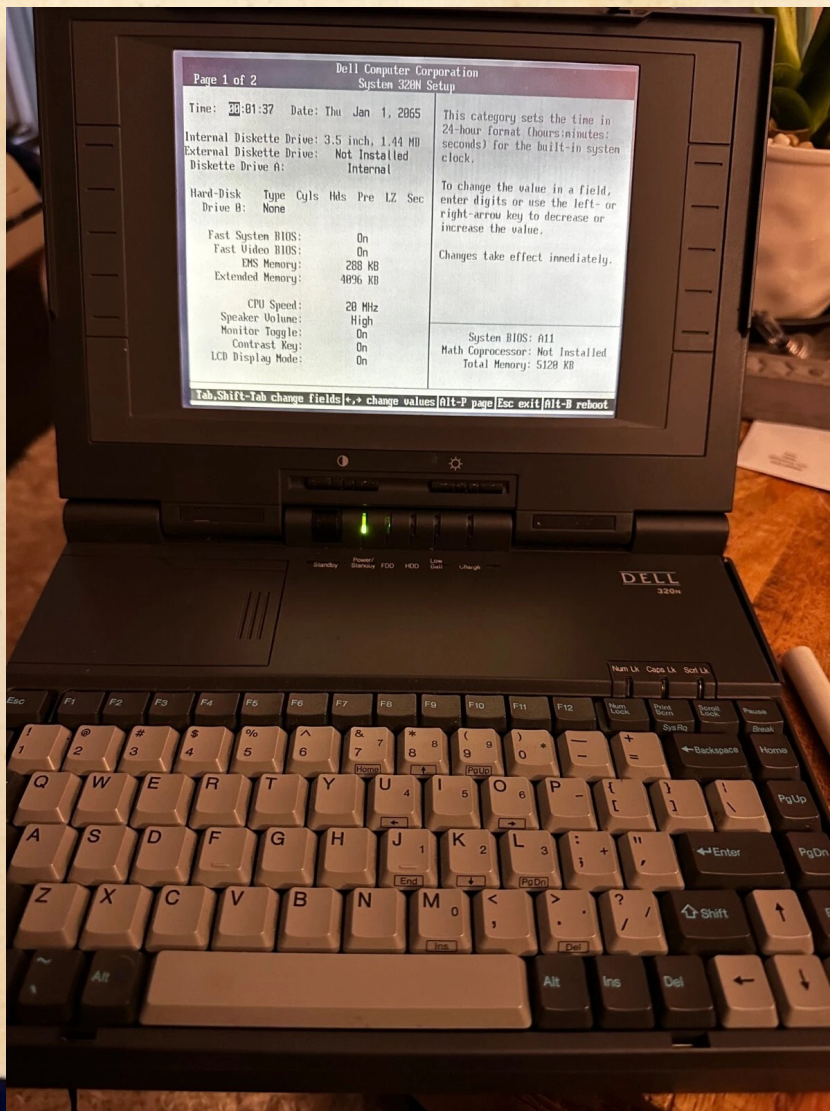
<https://en.wikipedia.org/wiki/PRIMOS>

parmaster



you cannot do it. You have to commit a
crime to connect

<https://www.youtube.com/watch?v=BkeXk9rBBrs>



<https://www.ebay.com/itm/205569580792>



https://en.wikipedia.org/wiki/Data_General_Walkabout



<https://en.wikipedia.org/wiki/TRS-80>



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We also supply GSS-KERNEL[™], a library of graphic commands for drawing lines, polygons, and text according to the emerging ISO standard: GKS (Graphical Kernel System). We also offer GSS-PLOT[™], a library designed to let you create bar graphs, pie charts, histograms, and scatter plots. Both of these libraries can be linked with CBASIC[®] Compiler, Pascal/MT +[™] PL/I and FORTRAN on 8- and 16-bit systems. When you put it all together, the

Digital Research graphics family is the most complete system you can buy for development and execution of graphic-oriented applications. Whether you're an application developer, OEM or user of microcomputers, call Digital Research for your ticket to graphic success. (408) 649-5500, 160 Central Ave. Pacific Grove, California 93950.

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GSS-KERNEL GSS-PLOT

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https://upload.wikimedia.org/wikipedia/commons/5/50/Bill_Gates_mugshot.png



<https://www.paulgraham.com/bluebox.html>



Plagiarized from
<https://sites.psu.edu/thedeepweb/2015/09/17/captain-crunch-and-his-toy-whistle/>

<https://archives.phrack.org/issues/7/3.txt>

==Phrack Inc.==

Volume One, Issue 7, Phile 3 of 10

The following was written shortly after my arrest...

\\The Conscience of a Hacker\\

by

+++The Mentor+++

Written on January 8, 1986

Yes, I am a criminal. My crime is that of curiosity. My crime is that of judging people by what they say and think, not what they look like. My crime is that of outsmarting you, something that you will never forgive me for.

I am a hacker, and this is my manifesto. You may stop this individual, but you can't stop us all... after all, we're all alike.

<https://archives.phrack.org/issues/7/3.txt>

==Phrack Inc

Volume One, Issue 7, Ph

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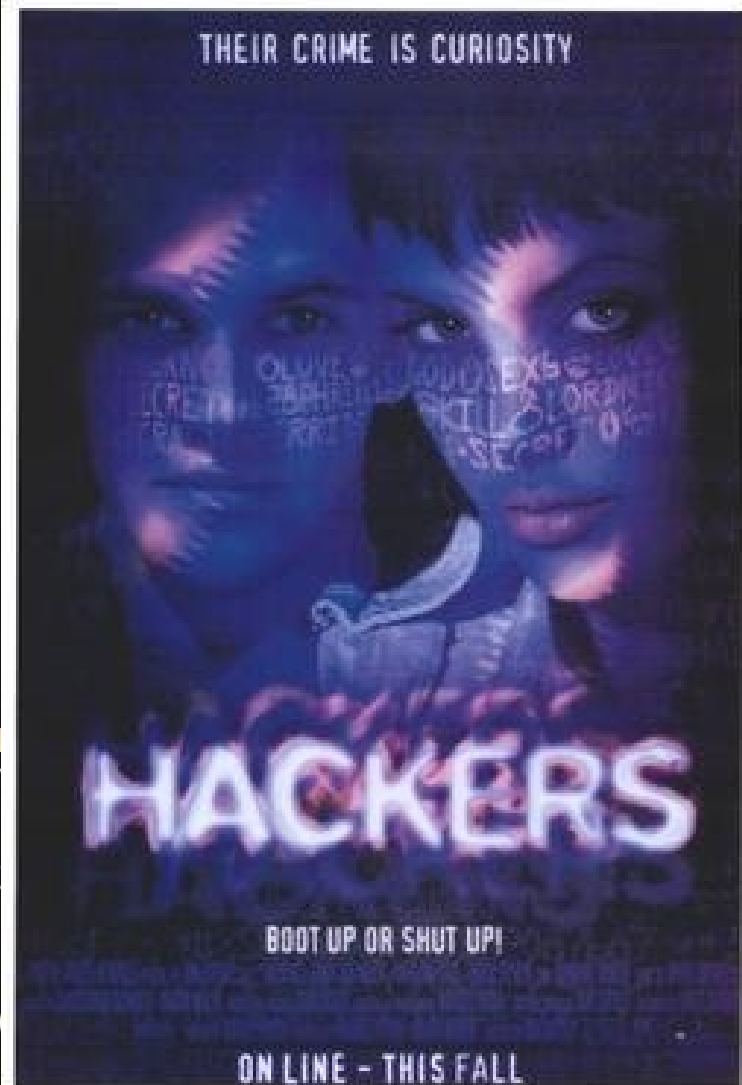
by

+++The Mento

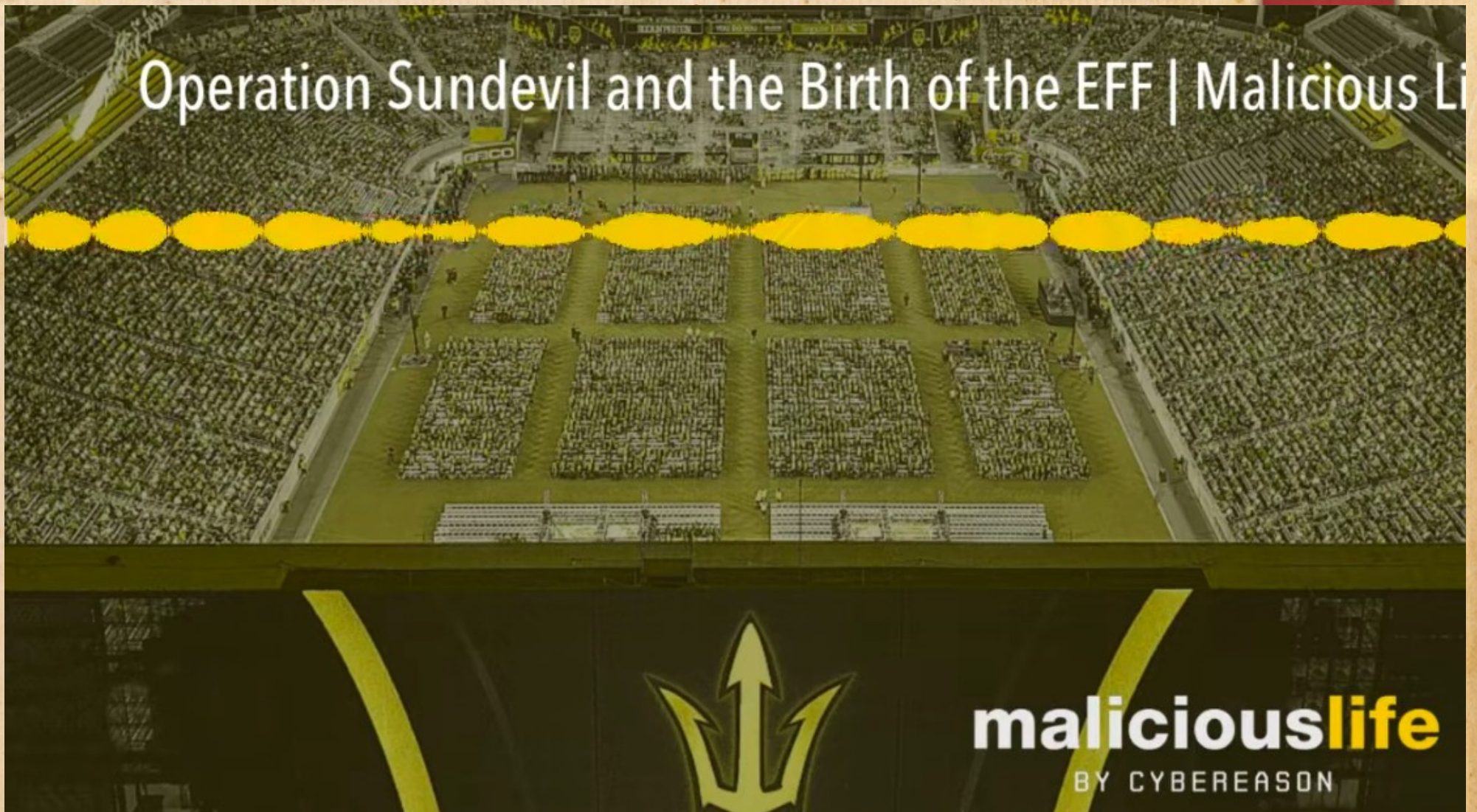
Written on Januar

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but you can't stop us all... after all, we'



Operation Sundevil and the Birth of the EFF | Malicious Life



https://www.youtube.com/watch?v=Mookr_VrhyU



- 
- May 8th, 1990 – Operation SunDevil raids
 - August 6th, 1991 – Tim Berners-Lee announces the World Wide Web on **alt.hypertext** on Usenet
 - August 25th, 1991 – Linus Torvalds announces Linux on **comp.os.minix** on Usenet
 - July 24th, 1992 – Unix System Laboratories (USL) sues Univ. of California related to BSD



https://en.wikipedia.org/wiki/Linus_Torvalds



Thanks to Linux, we don't have to commit a crime to play with advanced operating systems, chat with people from all over the world, or do many other things that we take for granted.

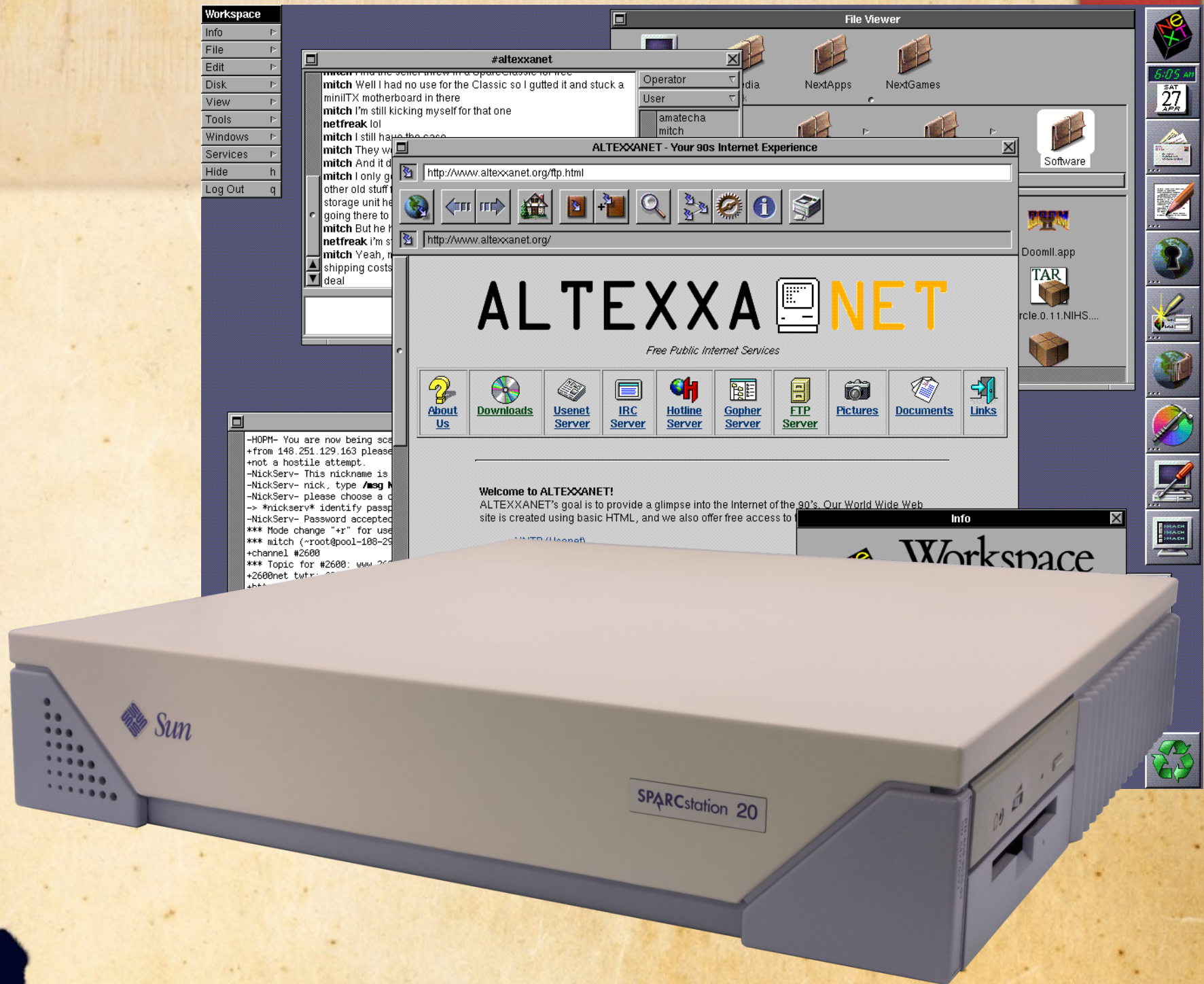




After we're done with UNIX, we'll study Linux, alternative ideas to UNIX (e.g., capabilities, message passing, and microkernel concepts), and how those ideas made their way into Linux (e.g., as Wayland, D-Bus, and **sched_ext**).

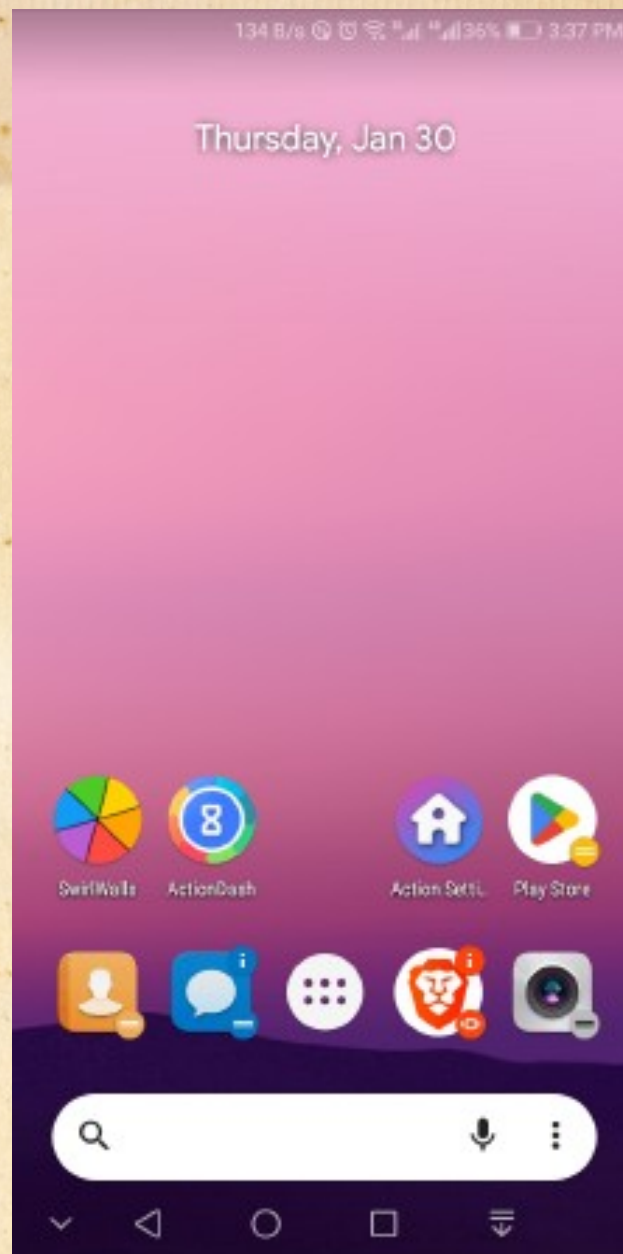
https://en.wikipedia.org/wiki/CAP_computer







Third, we'll cover distributed systems. And then, last, we'll take a deep dive into the Linux kernel's relatively new CPU scheduler called EEVDF.



https://en.wikipedia.org/wiki/File:Action_Launcher_screenshot.png

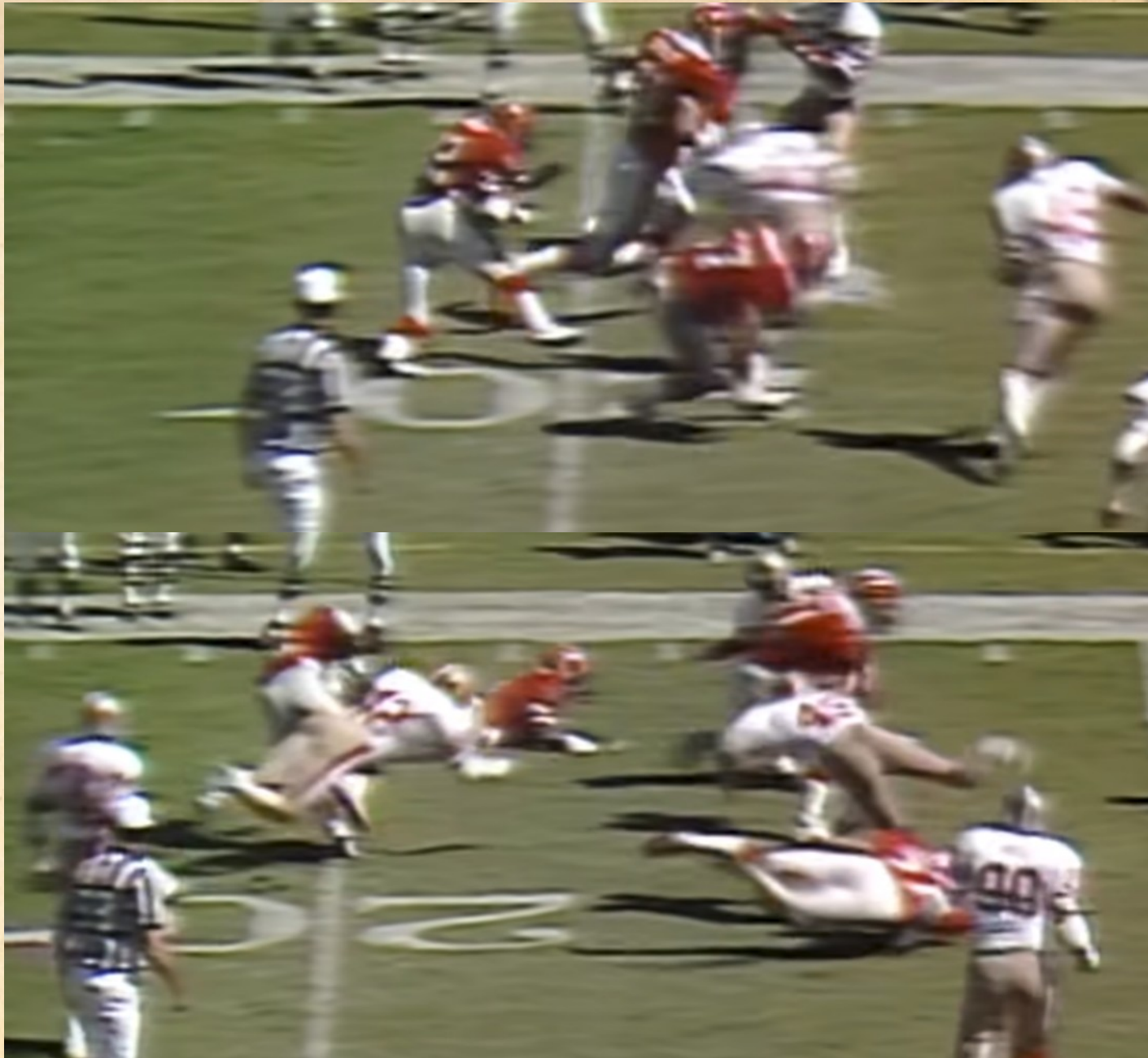


“It doesn't matter how beautiful your theory is, it doesn't matter how smart you are. If it doesn't agree with experiment, it's wrong.”

— Richard Feynman



Advanced OSes is a contact sport!



https://www.youtube.com/watch?v=IxtlkJV_teg

Expectations



- Don't expect to get away with just sitting and passively memorizing some facts
 - You should be questioning everything, debating in Canvas, playing (and trying to break) other students' games, *etc.*
 - Have conversations with each other and with AI
 - You have to be present in contact sports
 - You can't ask a question that helps fill in gaps in other students' understanding, learn something cool about how to use a part of Linux your project didn't touch on, *etc.* if you're just not there
- 

SUELETTE DREYFUS & JULIAN ASSANGE



**'GRIPPING ... THE BIZARRE LIVES
AND CRIMES OF AN EXTRAORDINARY
GROUP OF TEENAGE HACKERS'
ROLLING STONE**

<https://www.underground-book.net/download.php3>



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