
OPERATING SYSTEMS

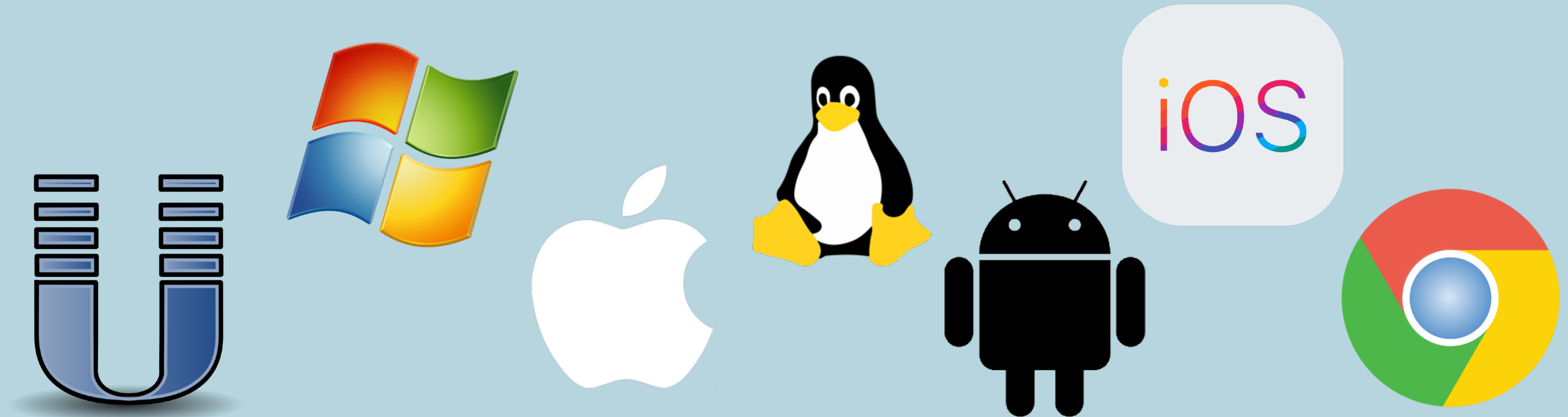
What is an Operating System?

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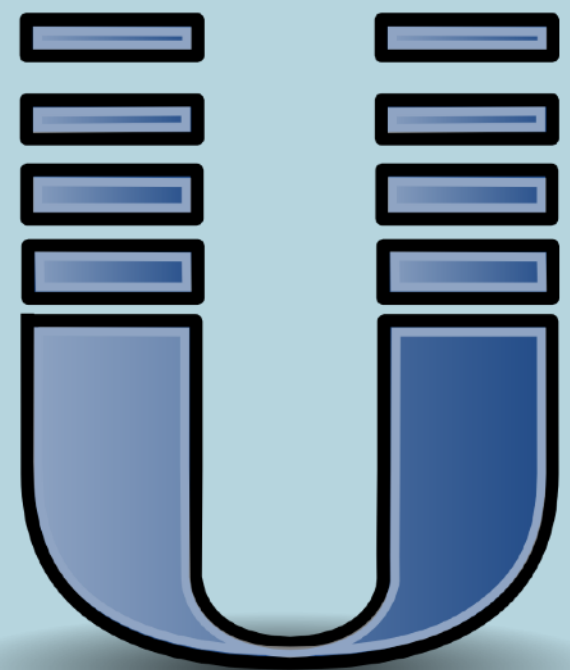
- ▶ The Software platform that supports your computer's basic functions, such as running applications and managing peripherals (mouse, keyboard, etc.)

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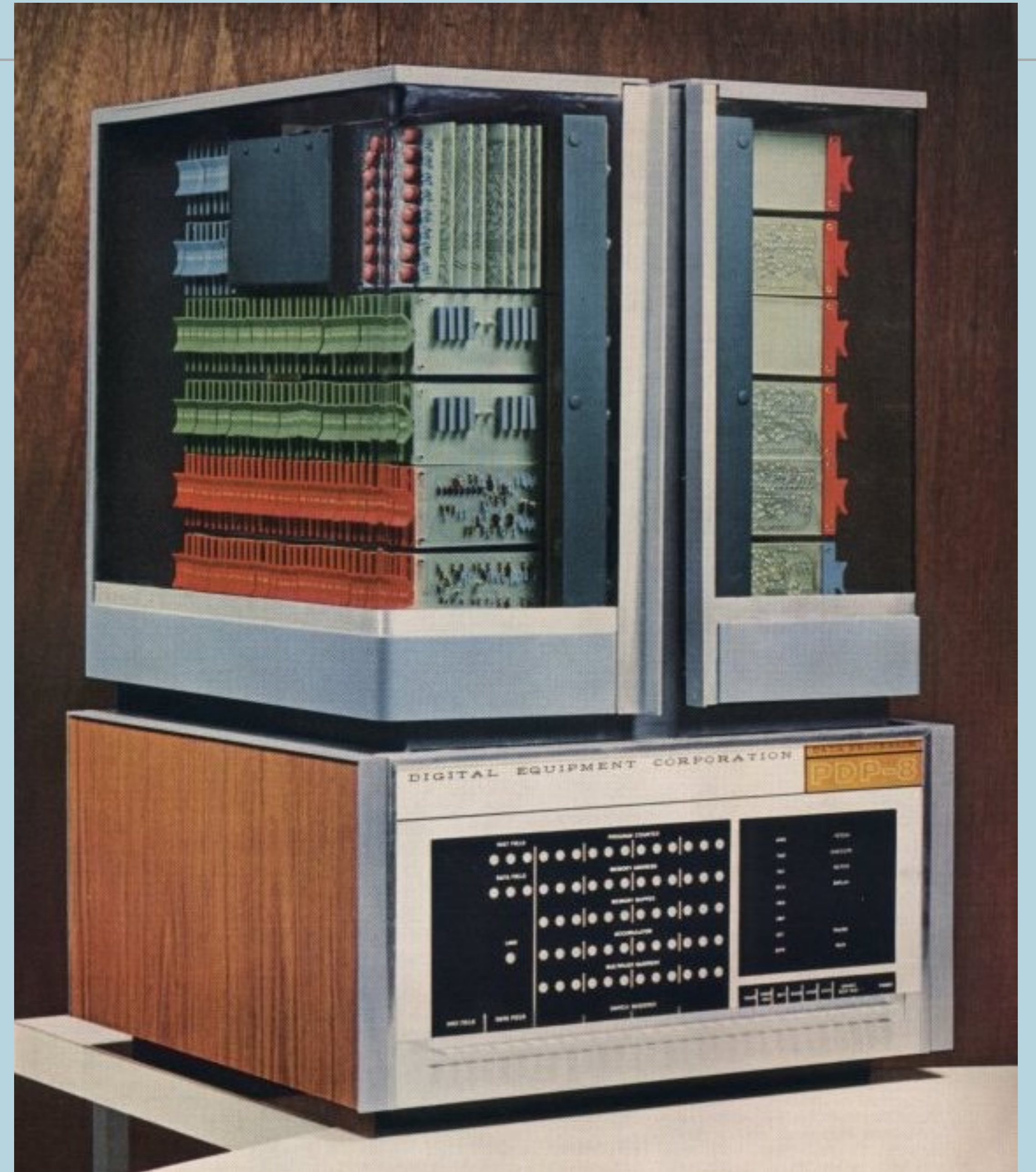


Life Before UNIX



Life Before UNIX

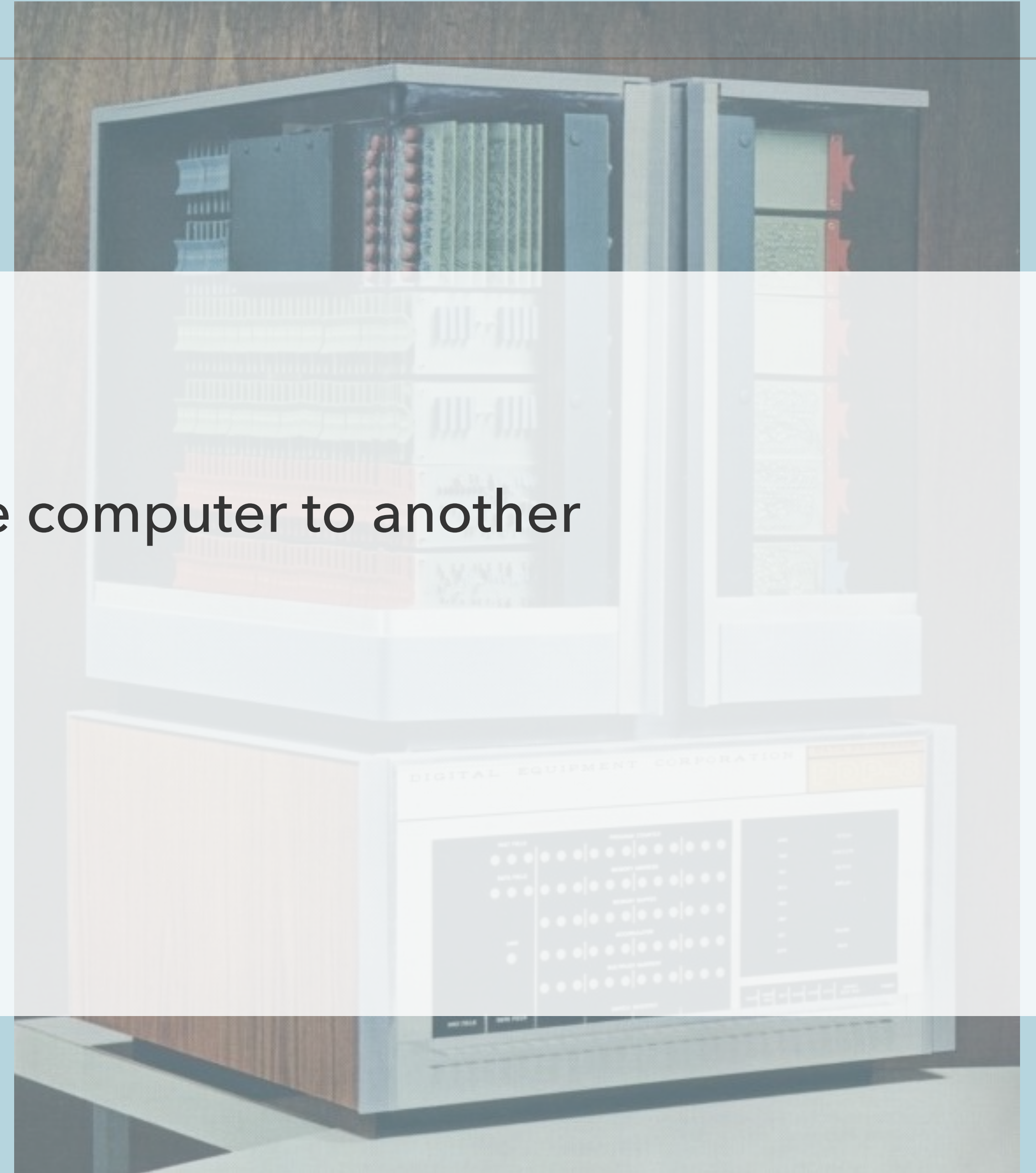
EARLY SOFTWARE



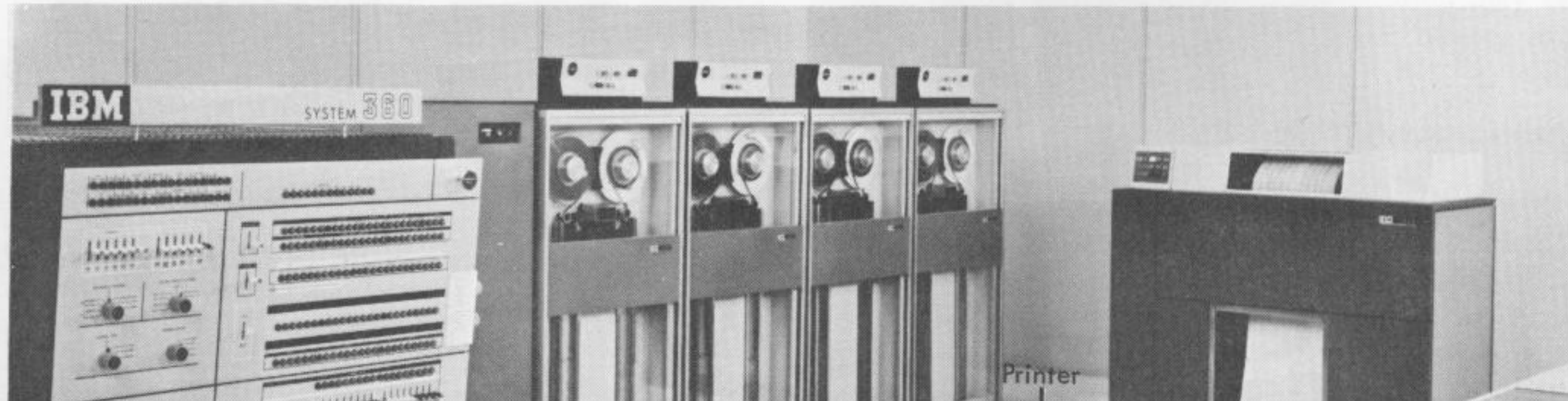
Life Before UNIX

EARLY SOFTWARE

- ▶ Software was **designed for hardware**
- ▶ Software **could not be moved** from one computer to another
- ▶ **One user at a time**
- ▶ Computers operated like **appliances**
- ▶ **Source code** was not available



IBM SYSTEM/360



IBM SYSTEM/360

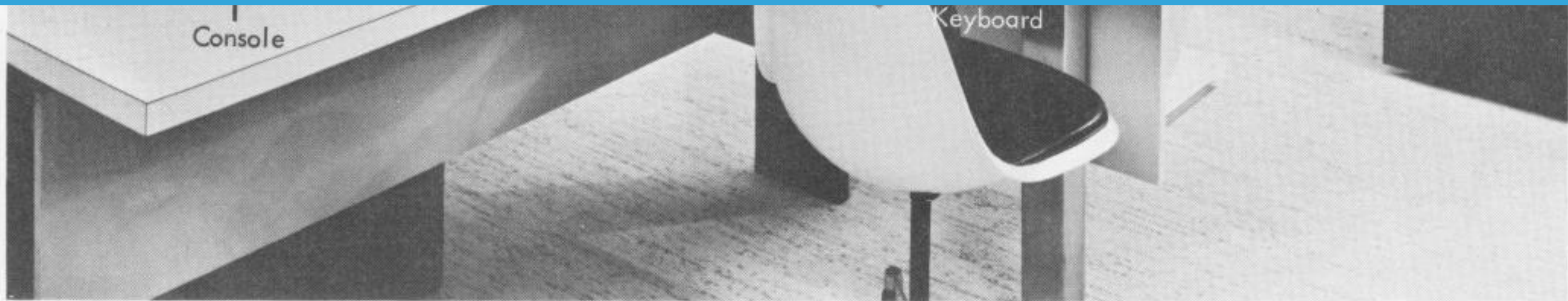


Figure 12. IBM System/360 Model 40 Console, Console Printer, and Keyboard

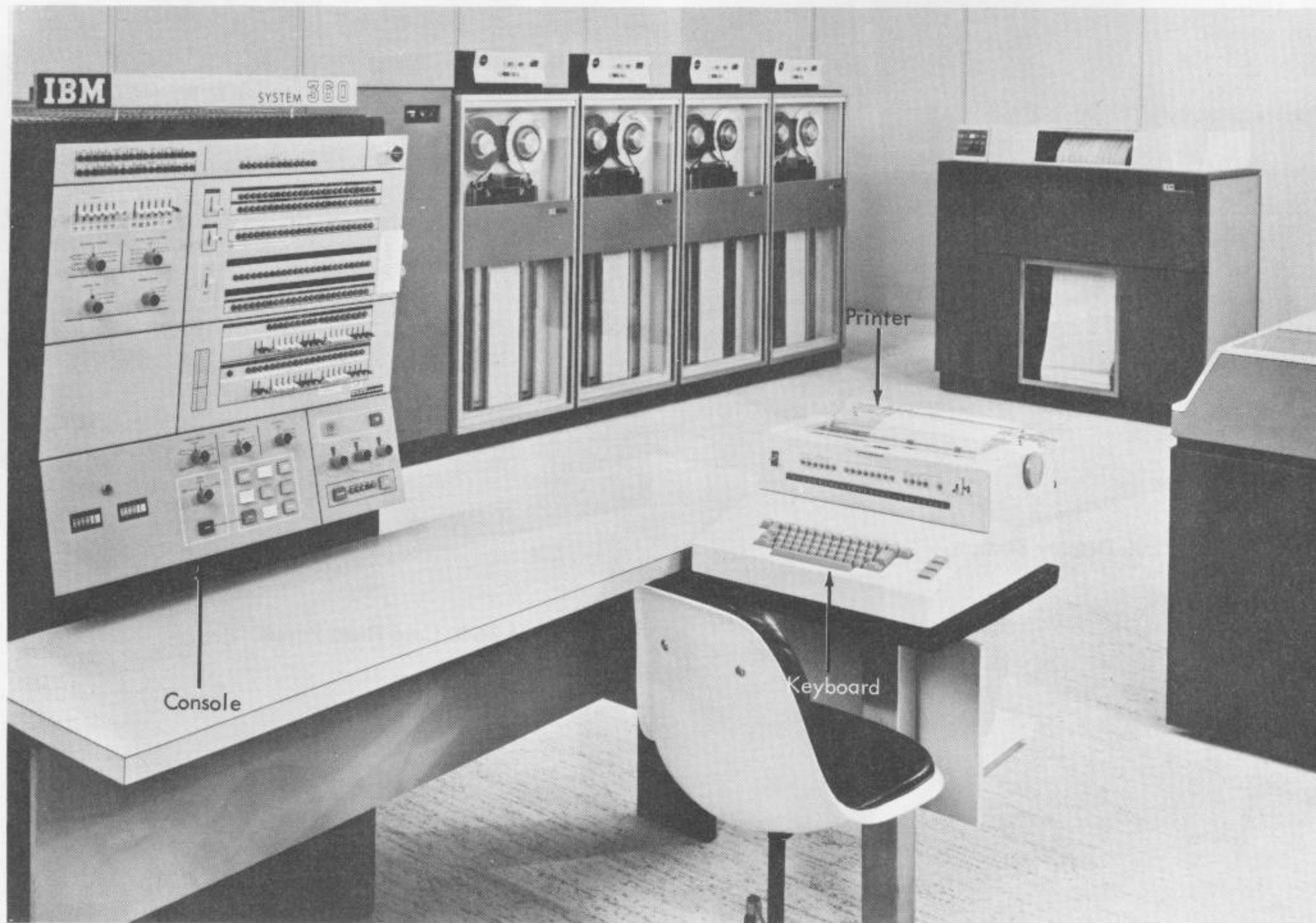


Figure 12. IBM System/360 Model 40 Console, Console Printer, and Keyboard

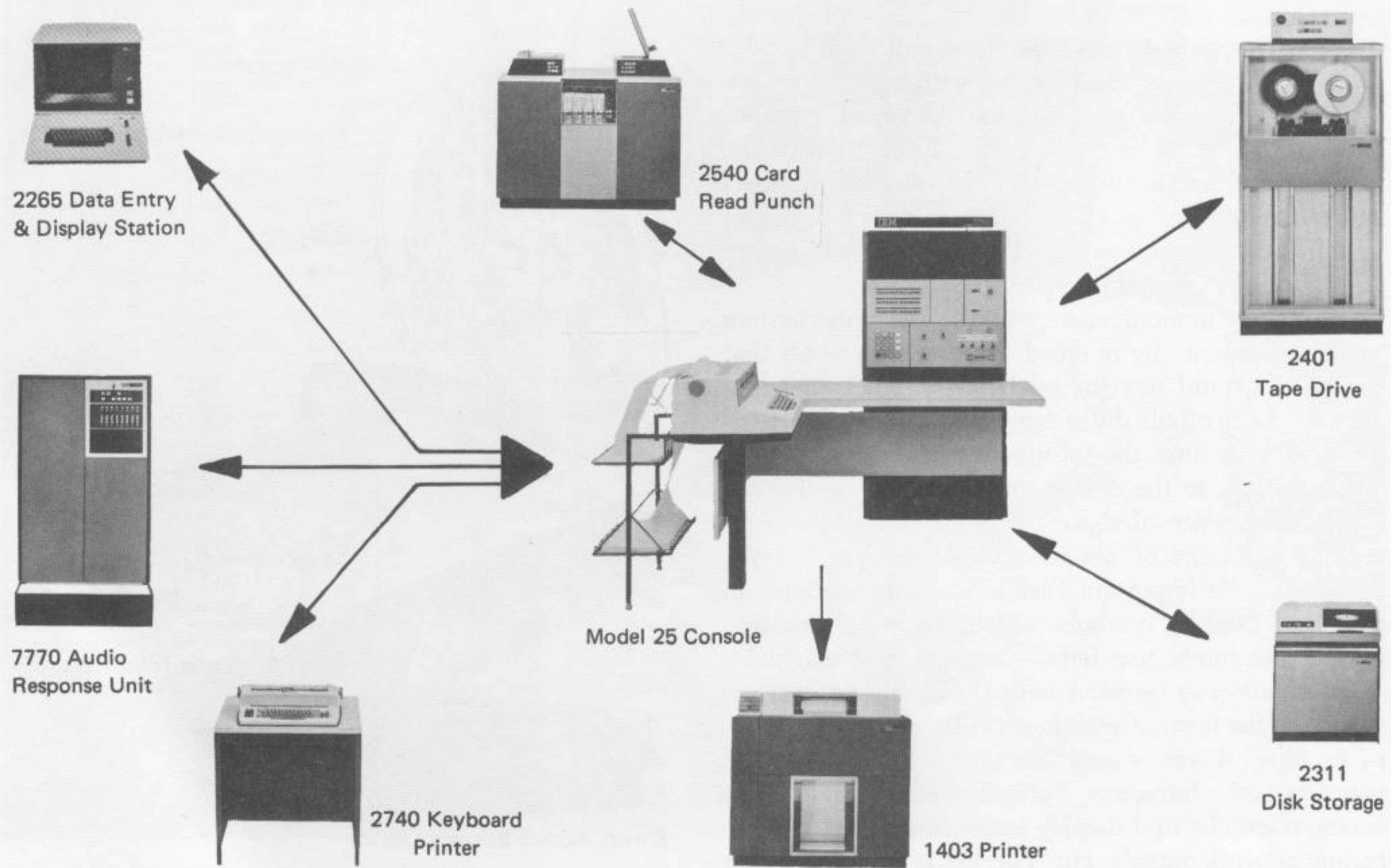
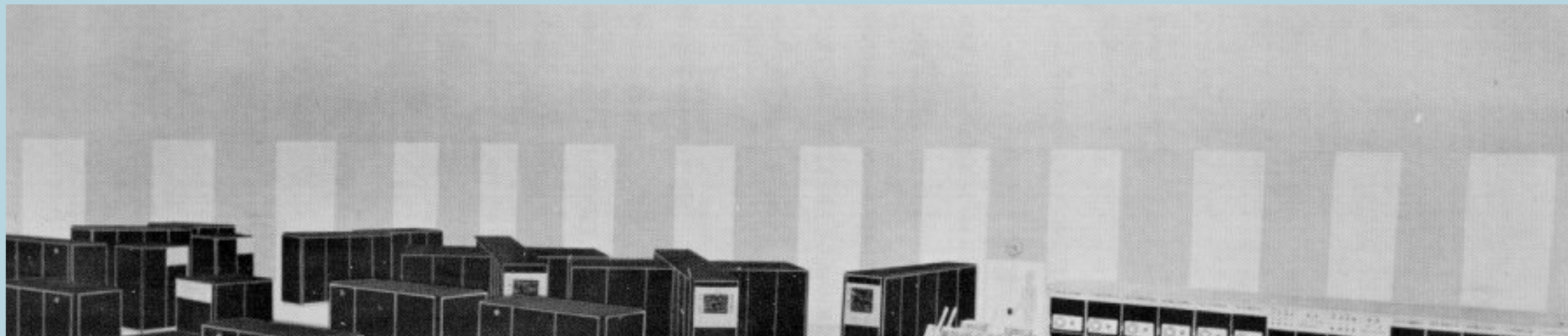
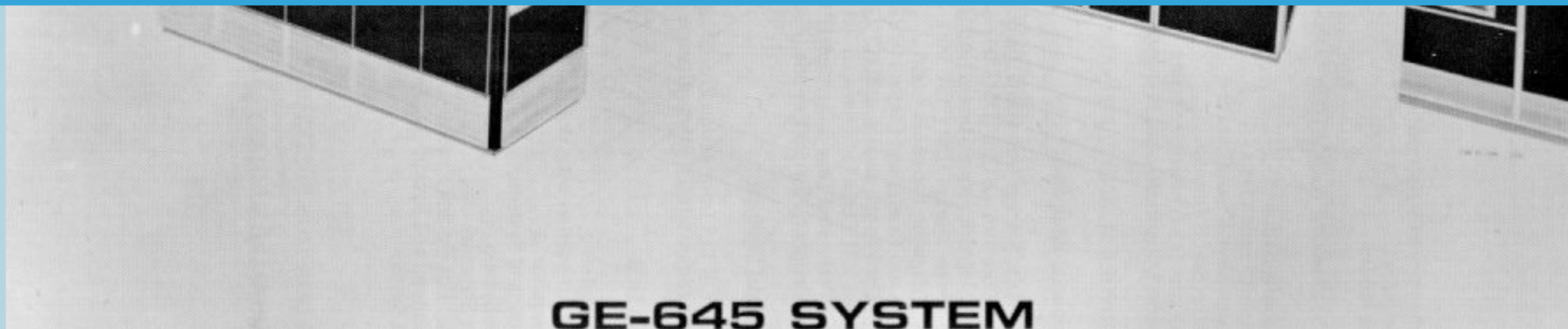


Figure 16. Machine-to-machine communication



MULTICS/GE-645





GE-645 SYSTEM



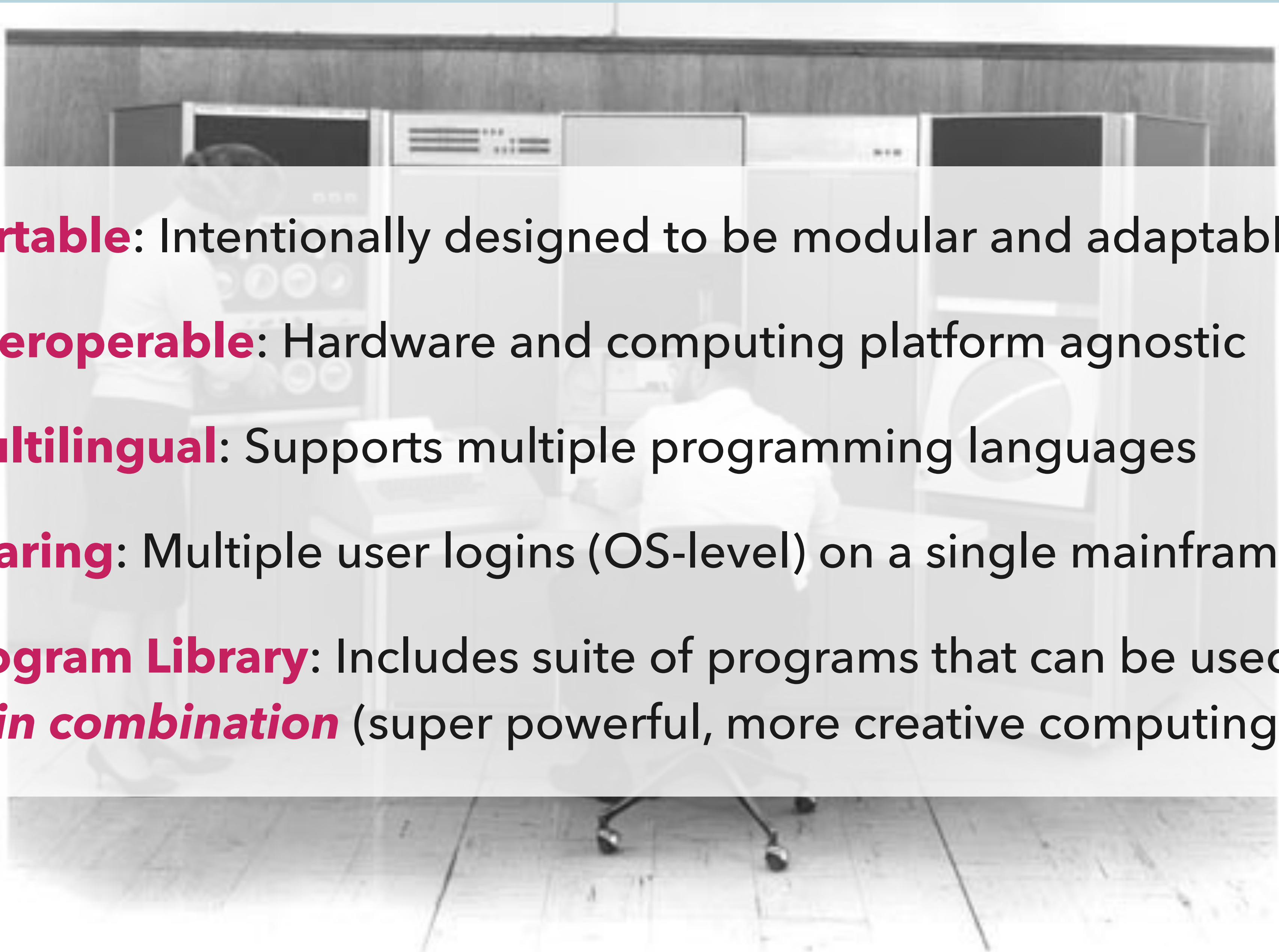


UNIX

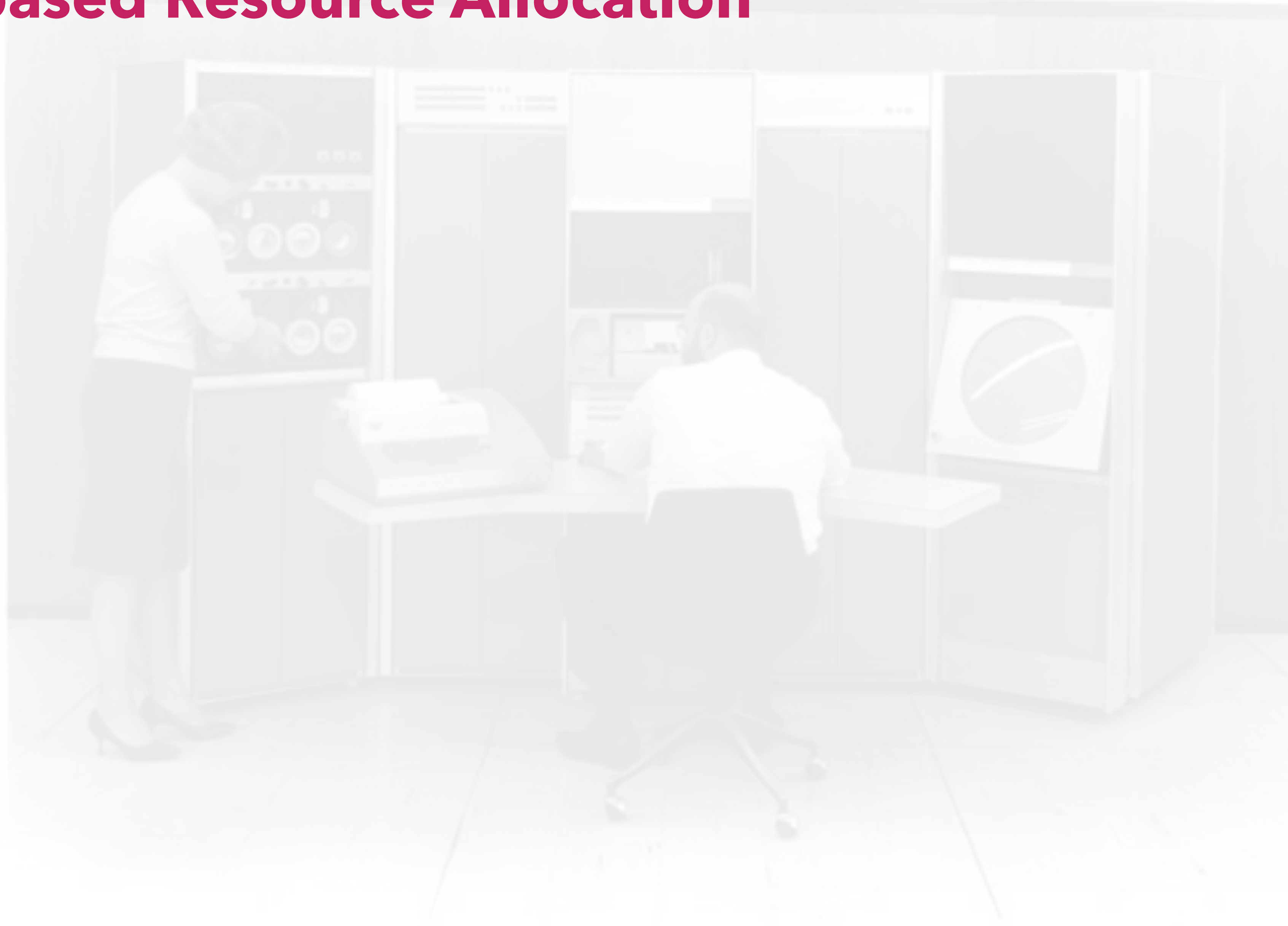




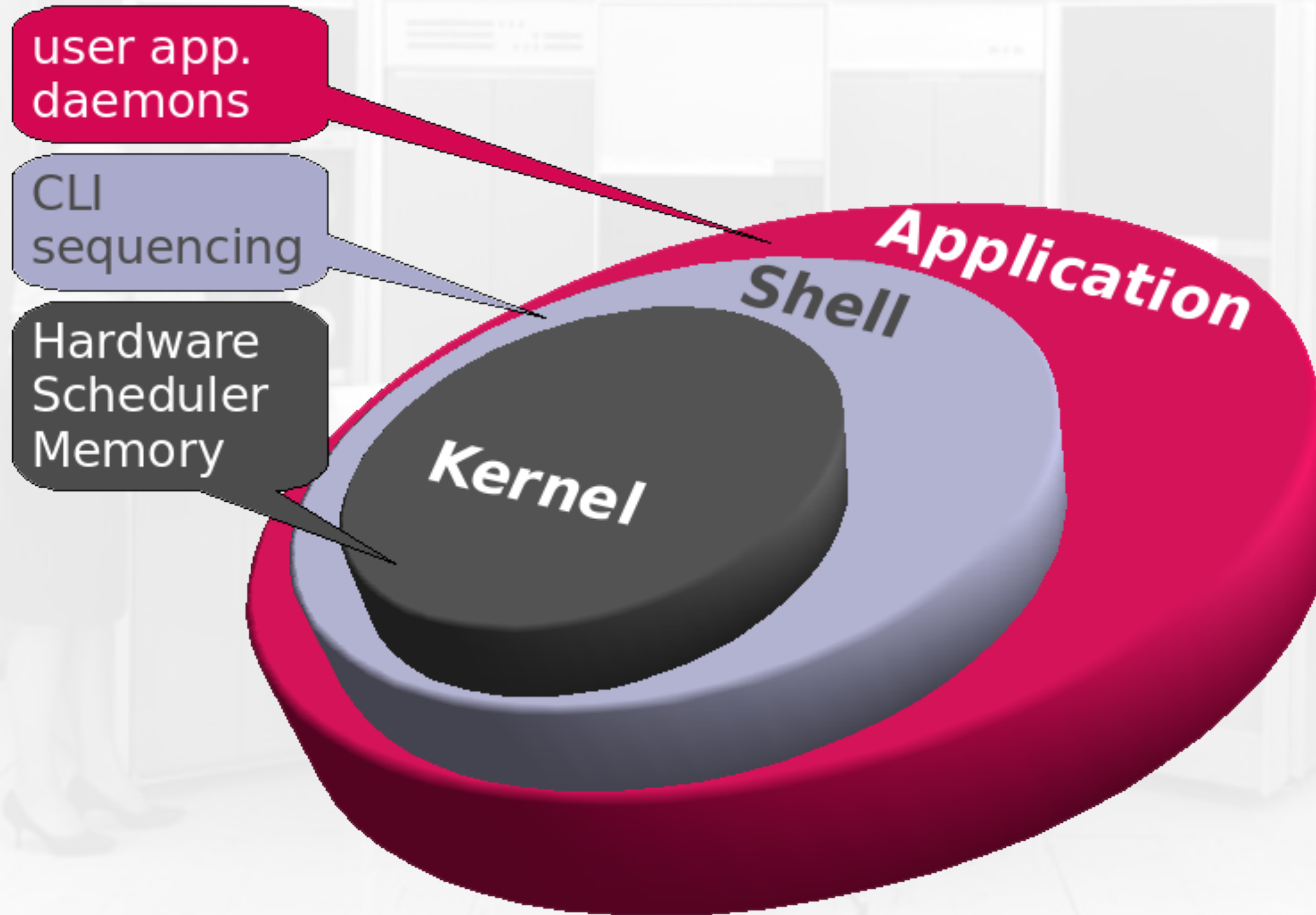


- 
- A black and white photograph of a large mainframe computer system. The system consists of several tall, vertical cabinets or modules. In the foreground, two people are visible: one standing on the left and another sitting on a stool in the center. The background shows a tiled floor and some equipment on the wall.
- ▶ **Portable:** Intentionally designed to be modular and adaptable
 - ▶ **Interoperable:** Hardware and computing platform agnostic
 - ▶ **Multilingual:** Supports multiple programming languages
 - ▶ **Sharing:** Multiple user logins (OS-level) on a single mainframe
 - ▶ **Program Library:** Includes suite of programs that can be used alone or *in combination* (super powerful, more creative computing)

Kernel-based Resource Allocation



Kernel-based Resource Allocation

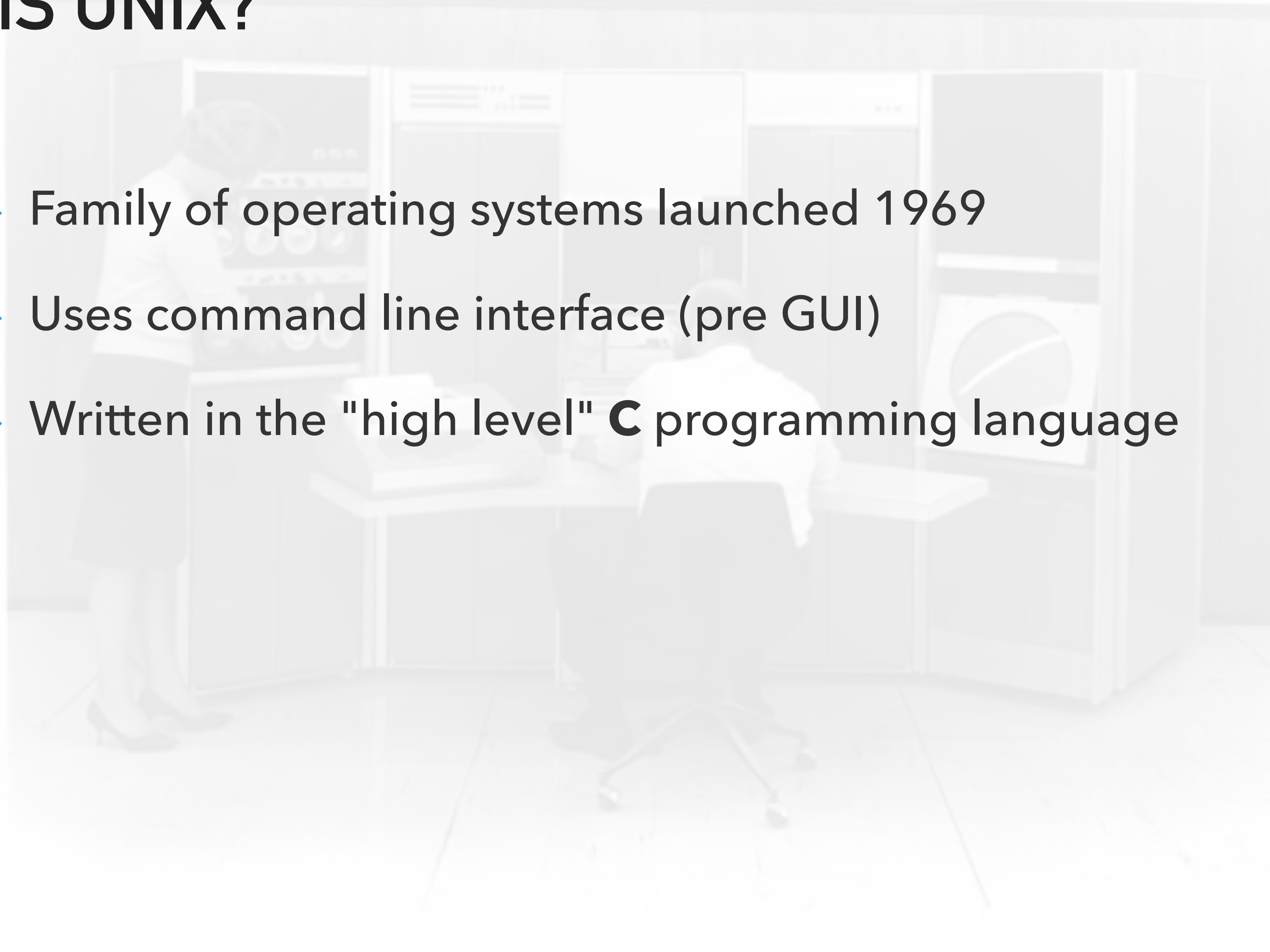


WHAT IS UNIX?

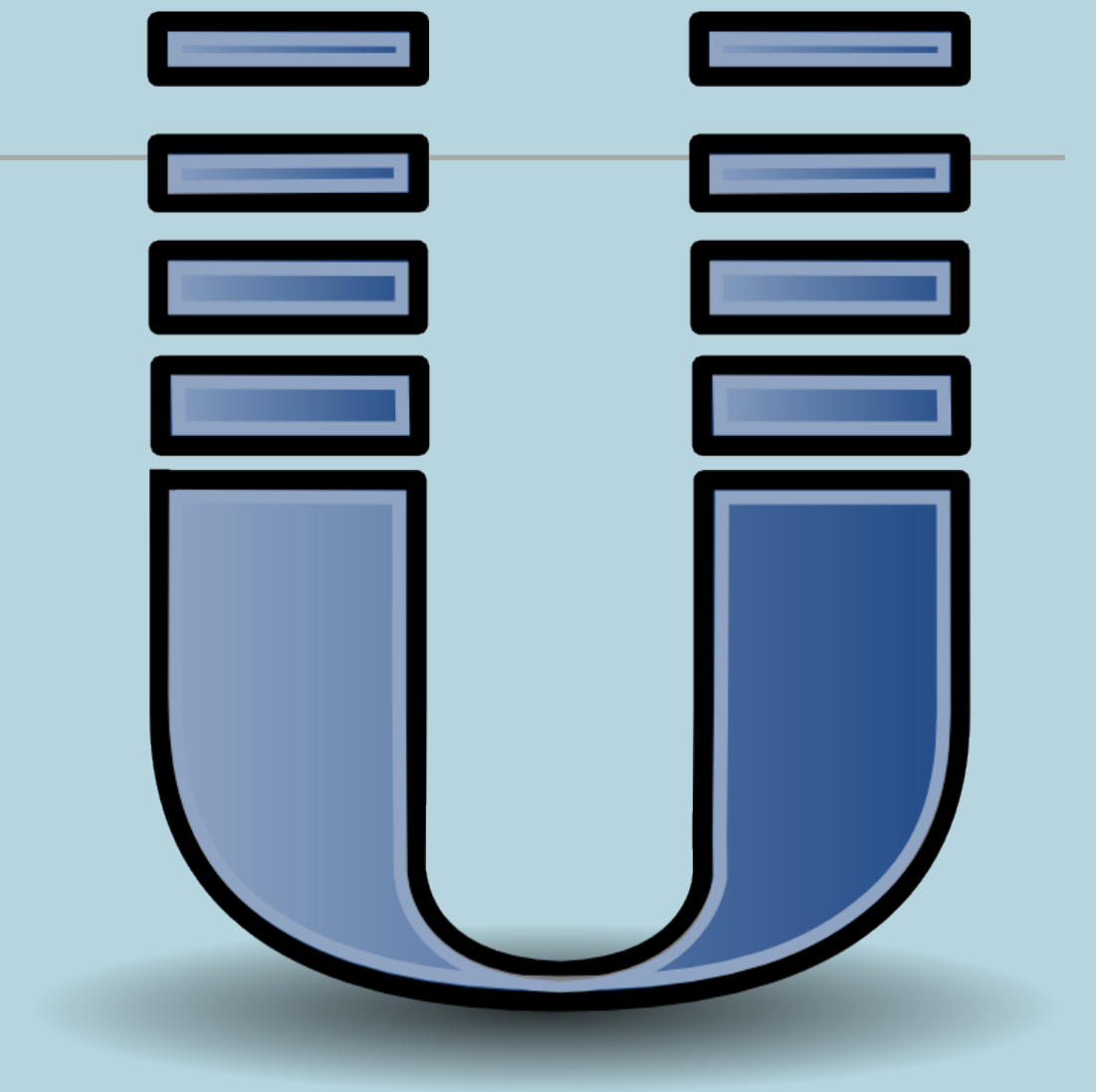


WHAT IS UNIX?

- ▶ Family of operating systems launched 1969
- ▶ Uses command line interface (pre GUI)
- ▶ Written in the "high level" **C** programming language

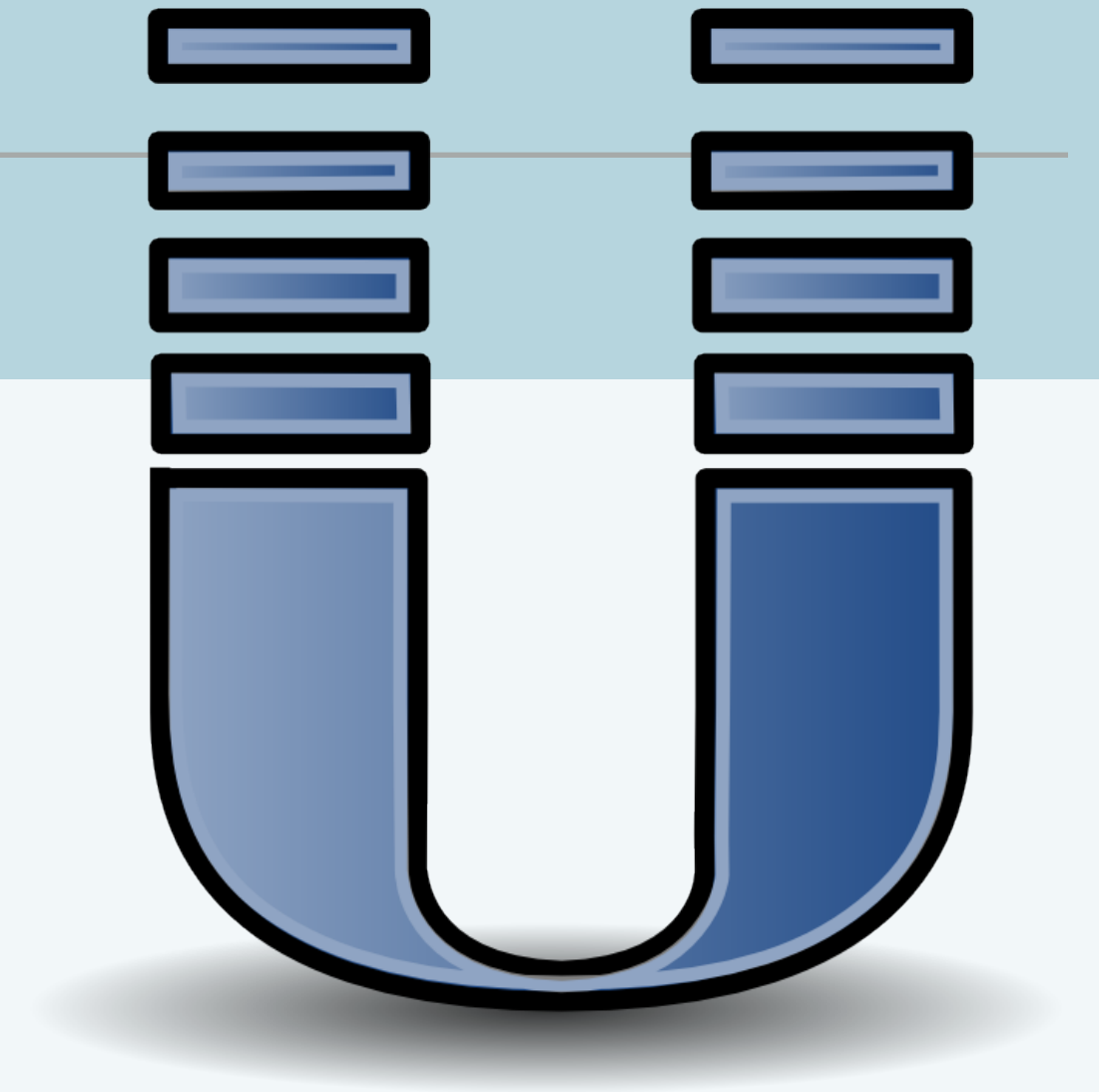


WHO USED UNIX?



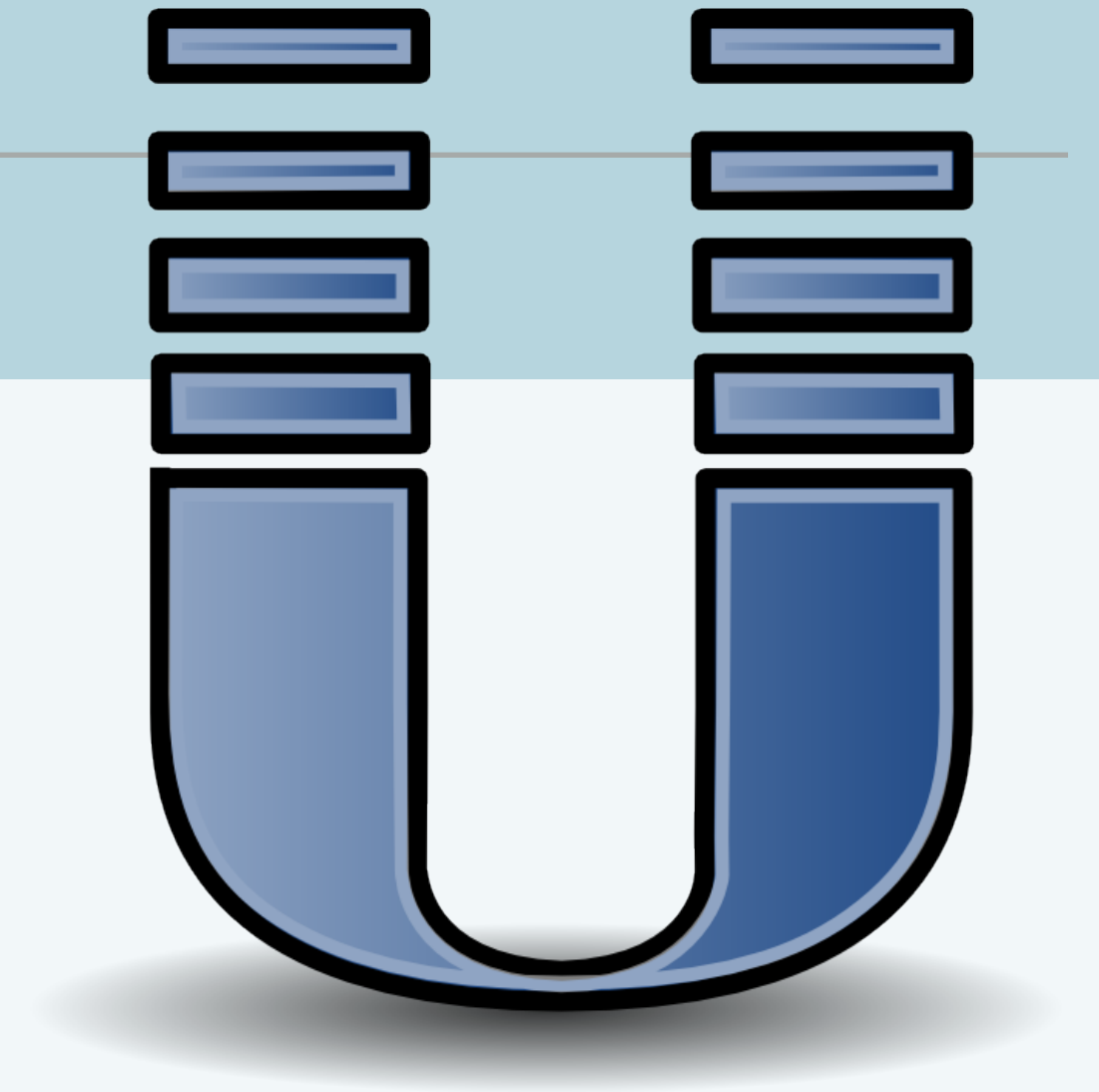
WHO USED UNIX?

- ▶ Hackers on the PDP-7 (MIT, Berkeley, etc.)
- ▶ Universities (University of Illinois, Stanford, UC Berkeley)
- ▶ Corporations (Microsoft, IBM and Sun Microsystems)
- ▶ Government (Department of Defense, National Science Foundation)
- ▶ ARPANET



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- ▶ ARPANET
- ▶ **Bell Labs (creators of UNIX)**



BELL LABS

- ▶ Founded in late 1800s by Alexander Graham Bell
- ▶ Purchased by AT&T in 1921
- ▶ Located in Murray Hill, NJ



BELL LABS

INVENTIONS



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- ▶ 1947: The Transistor
- ▶ 1969: C programming language
- ▶ 1983: C++ programming language



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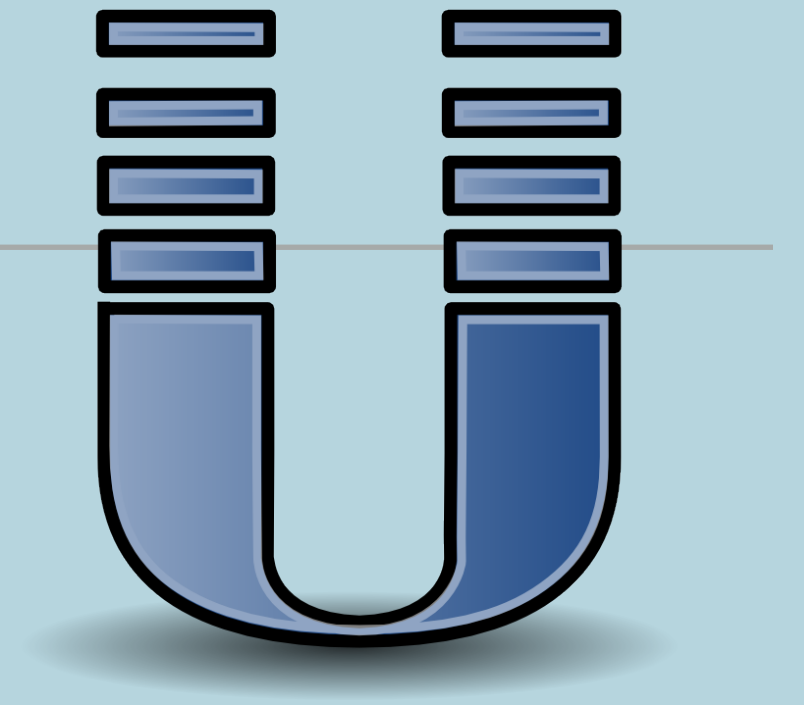
INVENTIONS

- ▶ 1947: The Transistor
- ▶ 1969: C programming language
- ▶ 1983: C++ programming language
- ▶ 1960(ish): Lasers



UNIX: PRICE

HOW MUCH DID IT COST?



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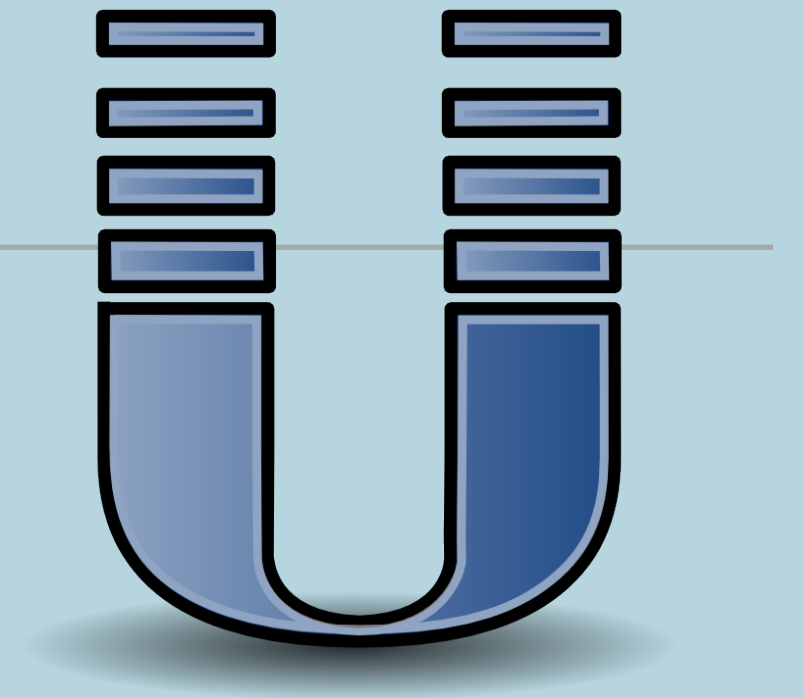
HOW MUCH DID IT COST?



(for educational users)

UNIX: PRICE

HOW MUCH DID IT COST?



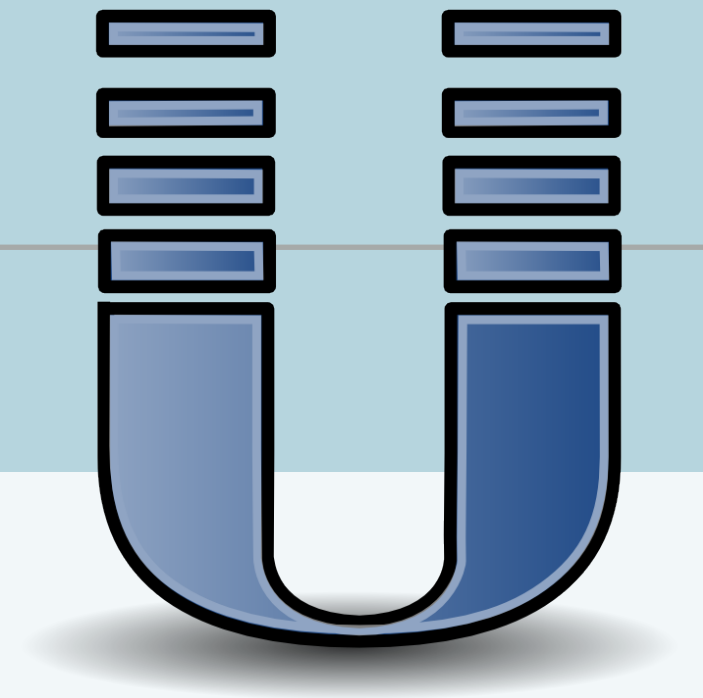
(for educational users)

Corporate license is \$20,000

UNIX: LICENSING

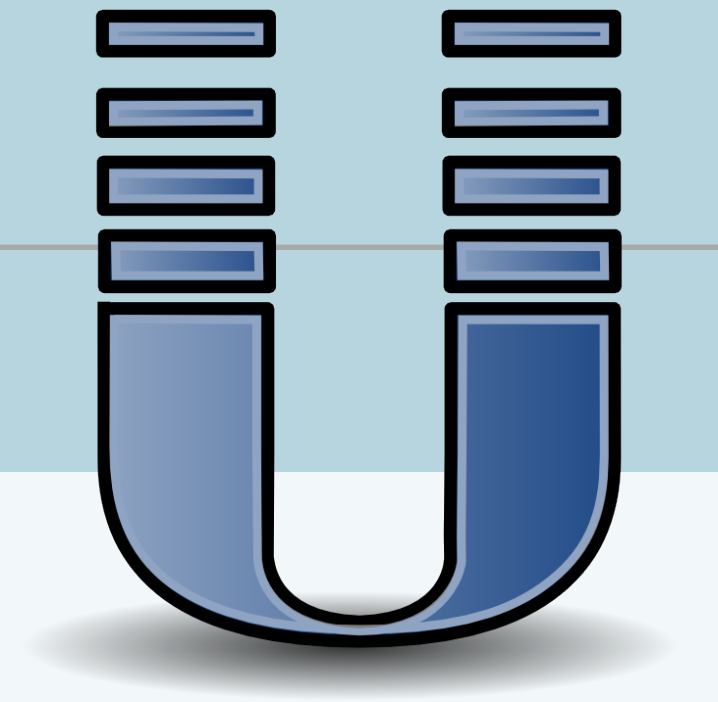


UNIX: LICENSING



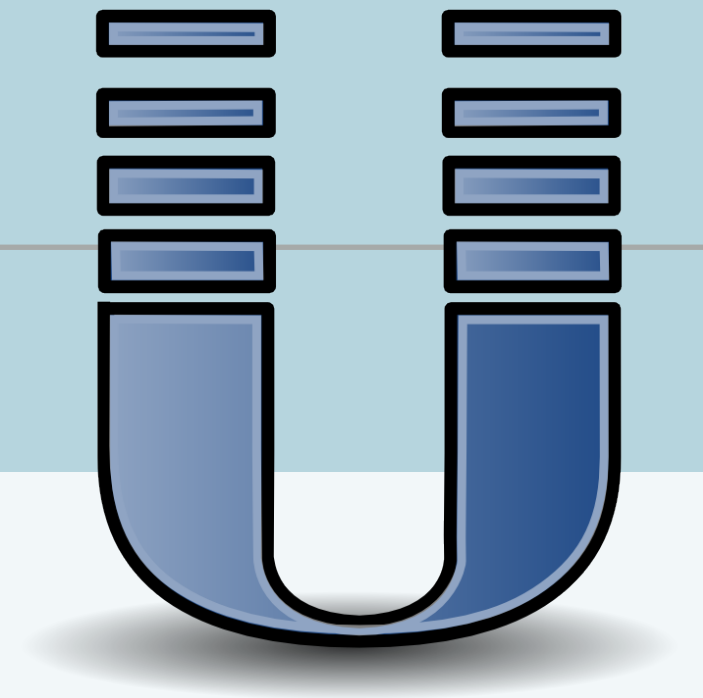
- ▶ Initially proprietary: Owned by AT&T/Bell Labs
- ▶ 1956 Antitrust case: AT&T can't exploit software for commercial gain
- ▶ DoJ Mandate: Software must be sold at cost (materials & shipping)
 - ▶ 1973: Bell Labs releases UNIX for *educational* use

UNIX: LICENSING



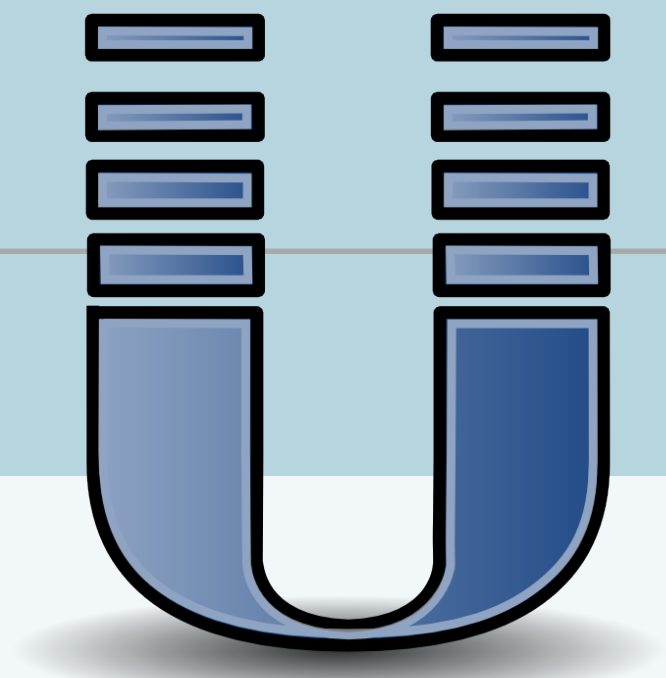
Everyone steals UNIX

UNIX: LICENSING



- ▶ 1979: AT&T attempts to license UNIX for commercial use
 - ▶ Forks by **UC Berkeley**, Sun Microsystems, Hewlett Packard and Microsoft already in wide use and can legally be redistributed for free
 - ▶ AT&T's UNIX has no commercial value
 - ▶ Berkeley releases the code under its own "**BSD**" license

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BSD & UNIX



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- ▶ BSD: Berkeley Software Distribution
- ▶ UNIX operating system released for **FREE** in 1977
- ▶ Contains code from AT&T's UNIX
- ▶ Codebase of proprietary UNIX-like systems:



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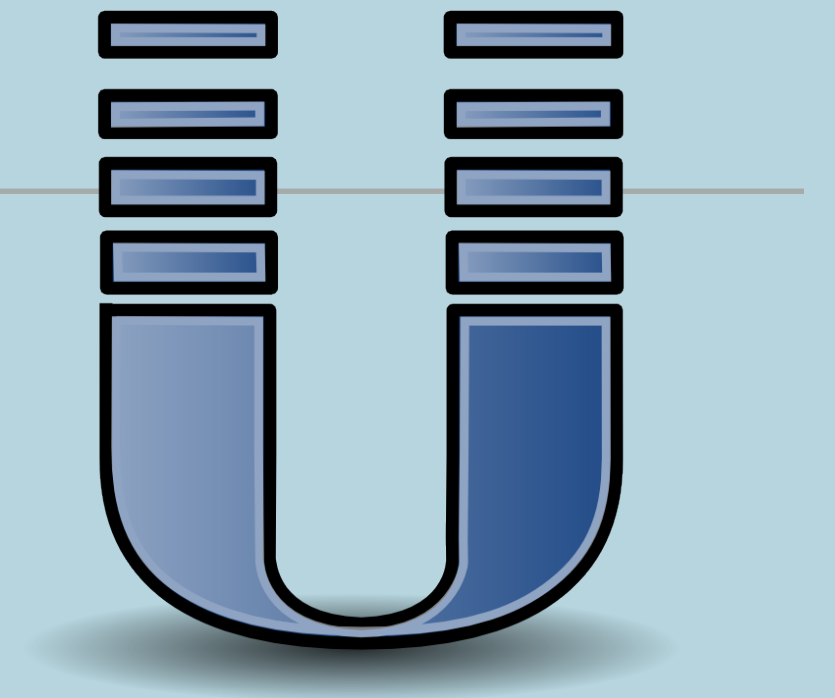
DIGITAL PRESERVATION

SUSTAINABILITY



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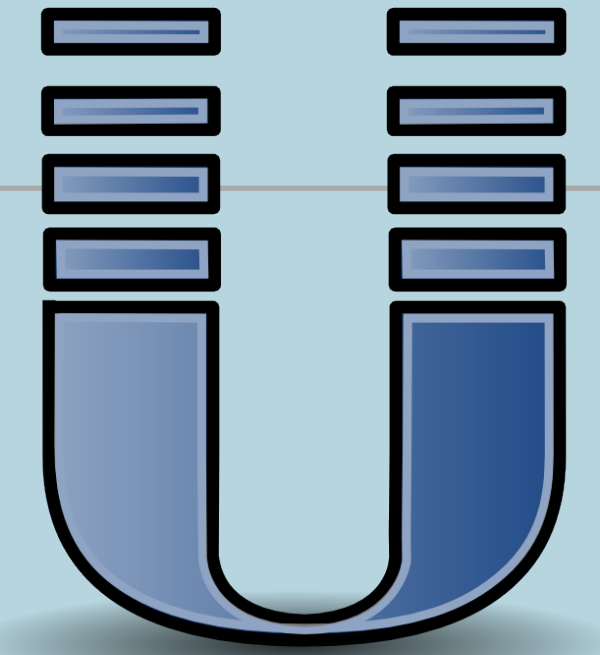


- ▶ **Longevity, interoperability:** UNIX is a **45 year old** standard
- ▶ **Stable:** platform for storage, management and long-term preservation
- ▶ **Control:** Source code is available. Ability to use the operating system via GUI *and* manipulate it manually via the command-line
- ▶ **Proliferation:** Thousands of "UNIX-like" derivative operating systems (including GNU and Linux)



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SUSTAINABILITY

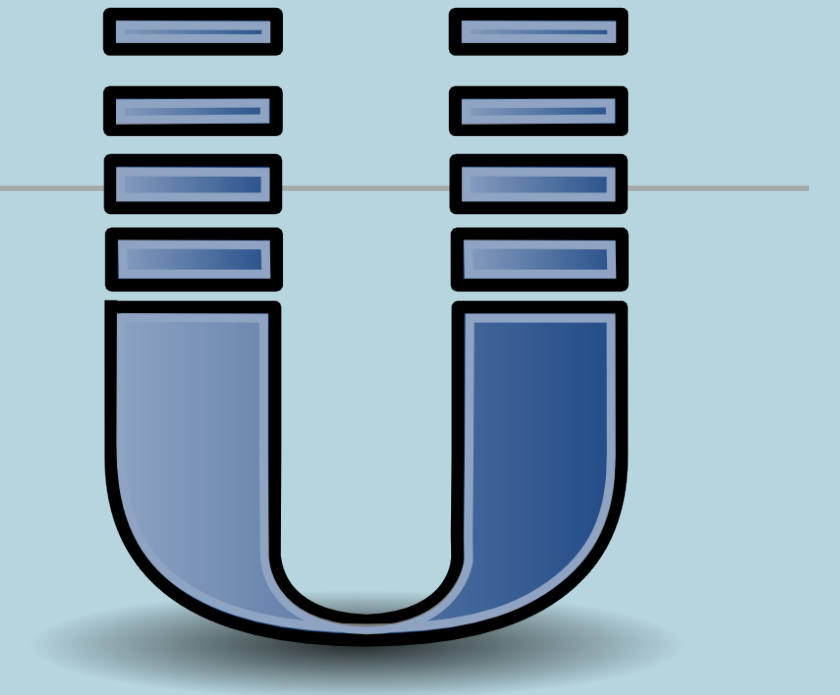


- ▶ Most computers that **store** data are run on a UNIX or UNIX-like operating system (Linux-based)
 - Network storage: servers in your office
 - Cloud storage: servers *not* in your office
- ▶ Many of the systems used to **manage** data run on a UNIX or GNU/Linux operating system (DAMS, etc.)



DIGITAL PRESERVATION

SUSTAINABILITY



- ▶ Over 70% of web servers and network servers
- ▶ 98% of supercomputers (molecular dynamics, nuclear test sim.)
- ▶ 89% of mobile operating systems (Android, iOS)



THE

END

