OLD COMPUTERS

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1930-1944 - largest calculator

On August 7, 1944, IBM dedicated the Automatic Sequence Controlled Calculator (ASCC), better known as the Harvard Mark I, to Harvard University.

Mark I was the largest electromechanical calculator ever built and the first automatic digital calculator in the United States at the time.

As with many moments in tech history, the dedication was shadowed by disagreement.

As the story goes, the machine was born out an idea for a large-scale digital calculator conceived by Howard H Aiken, a graduate student in theoretical physics at Harvard University, in 1930. IBM liked the idea and set its engineers to work with Aiken during World War II on the device.

By the time of dedication, IBM had spent approximately $200,000 on the project and donated an additional $100,000 to Harvard to cover the ASCC's operating expenses.

It is said that prior to dedication Aiken published a press release announcing the Mark I and listing himself as the sole inventor, only noting IBM's James W Bryce in the release, despite IBM putting several other engineers, some of which were among IBM's top talent at the time, on the project. Reports state that IBM CEO Thomas J Watson was enraged and only reluctantly attended the dedication ceremony and for a short time.

The First "Computer"

WWII was the driving force for building "automatic calculators" or "computers" for ballistics computation. The US claims the first computer was built and deployed in 1944 as "ENIAC" -- Electronic Numerical Integrator And Calculator".

The UK/Britain was on a parallel track with its 1944 introduction of its "Project Whirlwind" computer.

The "ENIAC" was developed as a project by J. Presper Eckert and John Mauchly at the University of Pennsylvania's Moore School of Electrical Engineering running between 1943 and 1946.
From Wikipedia:

"A 1946 patent rights dispute with the university led Eckert and Mauchly to depart the Moore School to form the Electronic Control Company, later renamed Eckert-Mauchly Computer Corporation (EMCC), based in Philadelphia, Pennsylvania. That company first built a computer called BINAC (BINary Automatic Computer) for Northrop Aviation (which was little used, or perhaps not at all)."

"Afterwards began the development of UNIVAC. UNIVAC was first intended for the Bureau of the Census, which paid for much of the development, and then was put in production."

(It is interesting that still today ballistics technology is being improved with laser rangefinders coupled with wind measurement for ballistics correction software being mounted as laser scopes on sniper rifles for $25,000 each by the US Army et al.)

1950s - First Decade

In the 1950s, a nascent computer industry was forged.

The decade of the 1950s saw the introduction of "mainframe" computers for business (IBM, Honeywell, Sperry-Rand/Univac, GE) and scientific computing (CDC, Burroughs). These very large sized systems included refrigerator sized CPUs with a collection of storage and printing devices.

In 1951, a Univesity of Illinois team designed and built the "ILLIAC" series of large computers, based on the Von Neumann-Princeton architecture.
From Wikipedia:
ILLIAC (***Illi**nois **A**utomatic **C**omputer*) was a series of supercomputers built at a variety of locations, some at the University of Illinois at Urbana-Champaign. In all, five computers were built in this series between 1951 and 1974. Some more modern projects also use the name.

But the ENIAC evolved into the famous "UNIVAC", as above, which was introduced also in 1951.
From Wikipedia:
"EMCC was sold to typewriter maker Remington Rand on February 15, 1950. Eckert and Mauchly now reported to Leslie Groves, the retired army general who had managed the Manhattan Project. Remington Rand had its own calculating machine lab in Norwalk, Connecticut, and later bought Engineering Research Associates (ERA) in St. Paul, Minnesota. In 1953 or 1954 Remington Rand merged their Norwalk tabulating machine division, the ERA "scientific" computer division, and the UNIVAC "business" computer division into a single division under the UNIVAC name."

"The most famous UNIVAC product was the UNIVAC I mainframe computer of 1951, which became known for predicting the outcome of the U.S. presidential election the following year." The UNIVAC (UNIVersal Automatic Computer I) was "the second commercial computer made in the United States. The main memory consisted of tanks of liquid mercury implementing delay line memory, arranged in 1000 words of 12 alphanumeric characters each. The first machine was delivered on 31 March 1951."

"The UNIVAC II was an improvement to the UNIVAC I that UNIVAC first delivered in 1958. The improvements included magnetic (non-mercury) core memory of 2000 to 10000 words, UNISERVO II tape drives which could use either the old UNIVAC I metal tapes or the new PET film tapes, and some circuits that were transistorized (although it was still a vacuum tube computer)."

"In 1955 Remington Rand merged with Sperry Corporation to become Sperry Rand. The UNIVAC division of Remington Rand was renamed the Univac division of Sperry Rand. General Douglas MacArthur was chosen to head the company."

These early computers used IBM punch cards, and later, paper tape as input storage devices for both programs and data. But the history of the IBM punch card dates back to 1889, and to the beginning of IBM itself.

IBM and Punch Cards
The picture below is of a so-called IBM punch card, used for storage of computer programs and data,

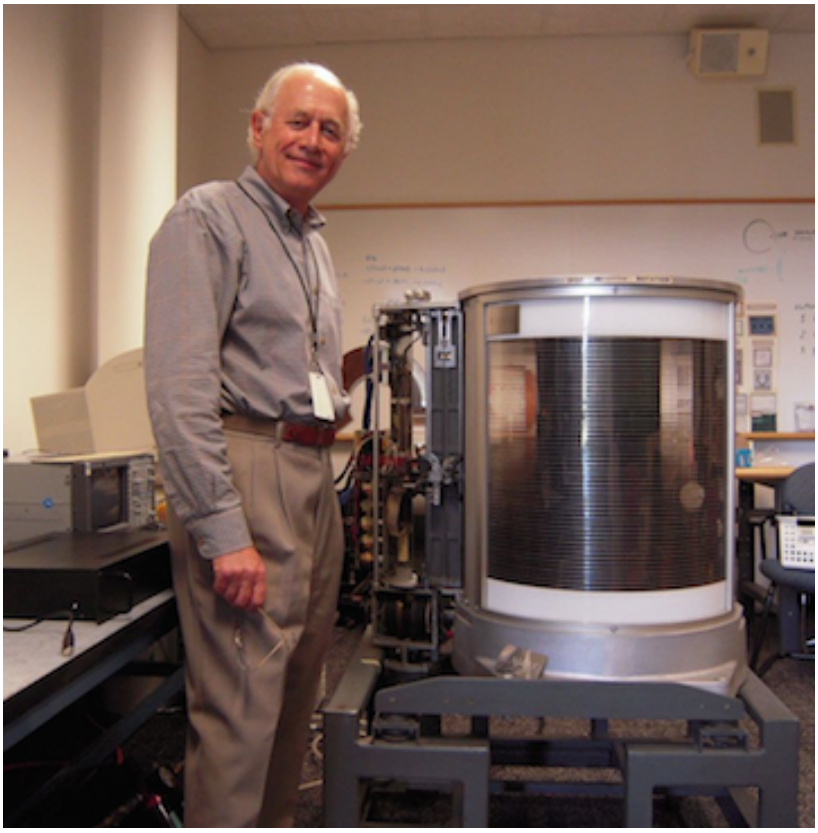
during the early era of computing (1944-1972). It was invented much earlier by later IBM scientist Herman Hollerith in 1889 (US Patent 395,782) -- long before the first computer. It was first used to store and tabulate data for the 1890 census. Hollerith also invented the first automatic card-feed mechanism and the first key punch machine.

From Wikipedia:
"In 1911, four corporations, including his firm, merged to form the Computing Tabulating Recording Corporation (CTR). Under the presidency of Thomas J. Watson, it was renamed IBM in 1924."
(Actually, it was named "International Business Machines"; it did not become simply "IBM" until relatively recently.)

IBM or "Hollerith" codes were invented to represent alphanumeric characters. These codes were physically punched into the card, one character per card column (and printed in human readable form across the top of the card). There were/are 12 rows per column (2 rows above the 0 row), and 80 columns (hence 80 characters per card). For example, an "A" was coded with a punch in row 12 (2 rows above the 0 row), plus a punch in row 1 (row 2 would be a "B", etc.).

Also the 1950s saw the introduction of the first disk drives (multi-platter). Here are specs and photo of the IBM Ramac disk drive (ca. 1955):

Disk diameter: 24 inches; Tracks per disk side: 100; Number of disks: 50; Total capacity: 5 Megabytes; Seek time: 0.6 seconds.



1960s

This decade saw the evolution and shakeout of the "big iron" computer industry.

From Wikipedia:

"UNIVAC was one of the eight major American computer companies in an industry then referred to as *IBM and the seven dwarfs:* Burroughs, Univac, NCR, CDC, GE, RCA and Honeywell."

"In the 1970s, after GE sold its computer business to Honeywell and RCA sold its to Univac, the analogy to the seven dwarfs became less apt and the remaining small firms became known as the "BUNCH" (**B**urroughs, **U**nivac, **N**CR, **C**ontrol Data, and **H**oneywell)."

Sperry and its Univac division continued to evolve in name. Sperry Rand spun off Sperry Univac, later Sperry Corporation, and then in 1986 it merged with Burroughs to become *Unisys*.

The Technology
The decade of the 1960s also saw the massive introduction of ICs, starting with small (SSI) ICs in 1960, medium (MSI) by 1965, and large (LSI) by 1968 (Intel). This game changing technology led to a rapid improvement in large-scale computer evolution. "SSI" and "MSI" ICs were used in the logic sections of the CPUs, but there was still no "solid-state" (IC) memory (until the first DRAM by Intel in 1969). (The 1970 decade would see the rapid employment of DRAM ICs for the "RAM" portion of computers.)

CDC (160A)

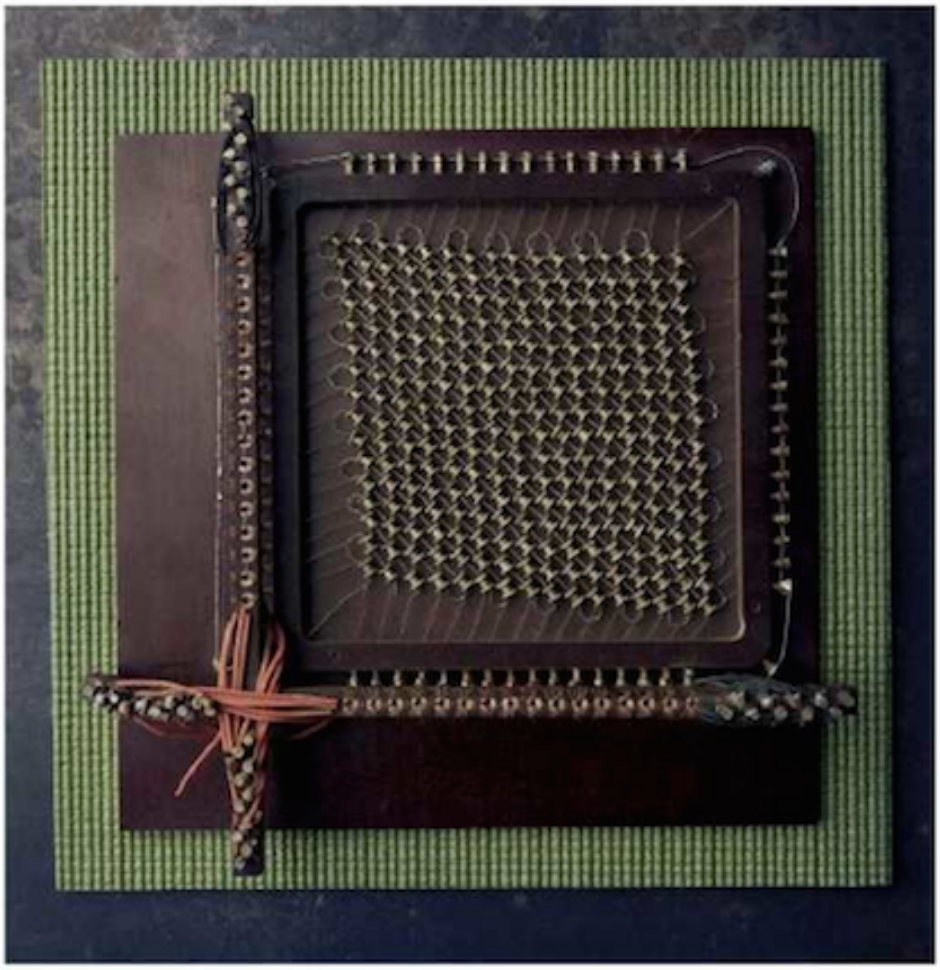
“The 160 was designed by Seymour Cray - reportedly over a long three-day weekend (about 1962) . It fit into the desk where its operator sat” per wiki.

IBM

IBM was the leading pioneer in this revolution. IBMs leading computer system model in the early

1960s was the IBM 704 (partly shown below).

IBM followed that system with a seminal new system architecture: the IBM "System 360", which sported many models of ever-increasing performance. The 360 was the first to use ICs for its CPU, but still used magnetic "core" memory, along with very large sized drum, tape and disk drives. The IBM OS crashed frequently (every few hours), and it took a long time to reboot them. The models varied from a small System 360/20 to a large System 360/91. (We had 2 of the 3 System 360/91s ever built at UCLA, starting in 1968 -- see more below.) A System 360/30 is shown below.



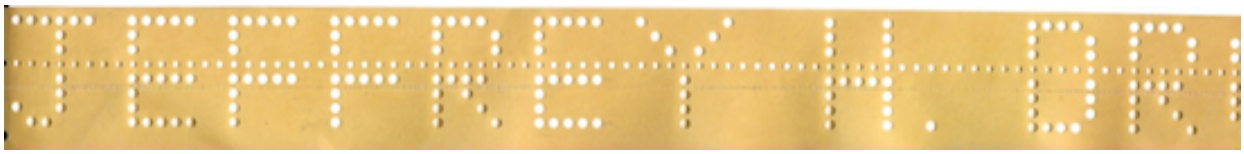
256-bit magnetic core memory (c. 1952) Slow data retrieval and storage speeds limited the utility of early computers. RCA researcher Jan Rajchman's solution was a memory array consisting of a wire matrix with doughnut-shaped magnetic cores at each intersection. By applying a current to a given set of horizontal and vertical wires, you could select a specific core and quickly change the direction of its magnetic field.

By 1970, *paper tape* was being used as a storage medium for the Teletype machines that were ubiquitous in offices of the era.

Paper tape was used to replace punch cards, while itself being replaced first by magnetic tape cassettes, then later by 8-inch floppy diskettes. Codes similar to punch cards were employed.

The advantage of paper tape over cards was that it was a continuous roll, not a deck of cards (that could be dropped). However, it was easier to edit cards, as tapes had to be completely re-generated. Note that there are only 7 rows on a paper tape, thus a max of 128 characters could be coded.

(The example shown is not realistic -- in that "Dr Jeff" was fabricated using known codes for other characters. A real paper tape would not be human readable.)



1970s -- Decade of the Mini-computer

The decade of the 1970s saw the introduction of "LSI" IC memory chips, starting with the 256-bit (not "K bit") Intel 1101A, and moving soon to the 1K-bit Intel 1103 by 1972. Logic ICs moved from MSI to LSI (>1000 transistors). the new IC architecture of that decade was the introduction of microprogrammable CPU "bit slices" -- from 2-bit to 4-bit slices -- that could be cascaded into 16-bit CPUS. That gave spectacular rise to a whole new class of computer: the "mini-computer"; along with a whole new order of computer manufacturers, led by DEC (PDP-8 and 11 minis) and Data General (Nova minis).

DEC PDP

The very first model in the DEC PDP series was the model 1 (shown below), with a surprisingly early introduction in 1959.

The release of the PDP-1 computer in 1959 was a landmark in computing. It was the first commercial computer whose design prioritised usability - starting the journey towards affordable and intuitive computing.

After this early PDP-1, the first *mini-computer* model introduced by DEC was the PDP-8 series in the late 1960s. The first mini-computer series based on the microprogrammable CPU "bit slices" introduced by DEC was the 16-bit CPU PDP-11 series. Here is a picture of the first model, a PDP-11/05.

"The DEC PDP-11 mini-computer pictured here is a good example of computing before the advent of the PC. DEC (Digital Equipment Corp.) was, at the time, second only to IBM as a computer manufacturer. (It was eventually absorbed by Compaq which was eventually absorbed by HP.) In those days, the PDP-11 was the world's biggest selling computer with thousands finding homes in labs around the world and many more incorporated into end-use systems like telephone switches and nuclear power plants. UNIX and the C programming language were developed on these machines. PDP-11's were instrumental in developing the Internet."

Considered cheap in 1975, a basic unit with a 16bit CPU, 32KB of memory and a 5MB hard drive ran about $35,000. Today, a personal computer with dual 64 bit CPUs, 2GB of memory and a 500GB

hard drive has 100,000 times higher performance for about $500. (In 1975, a new Mercedes-Benz cost about $15,000 and $35,000 was well beyond the average annual salary of an engineer.)

The DEC PDP-11 architecture was replaced in the mid-1970s by their 32-bit "VAX" series. It also employed microprogrammable CPU "bit slices". Doing so enabled both a customizable ISA and a faster CPU than any of the microprocessors of that era.

The End of the Mini
At some point in time (ca. 1978), standard 32-bit microprocessors using "RISC" architecture became much more powerful than any of the mini-computers. These microprocessors were the death knell for the mini-computer.

Anecdotal History

The PDP-16 from AMD's Tony DiColli tony.dicolli@gmail.com

I saw another reference to the PDP-11 in the most recent weekly review and it reminded me of the PDP-16 (circa ~1973). For anyone that is not familiar with this version, this was a DEC marketing program to get the PDP-11 architecture into an embedded environment, in my opinion. I complied by using the PDP-16 to do the specialized math and closed loop control for a non-contacting gauging system (used the measurement of beta radiation attenuation as its basis) for a process that added a precise layer of adhesive (glue/plastic back then was very expensive) to a 16 foot wide web of plastic. The PDP-16 was a basic PDP-11 chassis and core with specialized I/O, user interface and memory.

P.S. The DEC folks were so anxious to make this a success they would pick up their customers, me included, for the PDP-16 at Logan and fly them via the company chopper to/from the main facility located in a former wool mill (civil war era building) in Maynard, Massachusetts, since renamed Clock Tower Place and now home to multiple companies. For an engineer working in a bullpen, this was pretty exciting. Just a funny side note, one of the chopper pilots was fresh out of the military and not familiar with the area so when he would get lost, he dropped down to highway level and read the signs to get a fix on his position. I kid you not, it was an E ticket ride!

1973 - The PDP-16/M combined the programmable capability of a minicomputer with the proven reliability of the PDP-16 controller (RTM). The machine incorporated a programmable read-only memory and a variety of options to make a versatile device for the OEM, educator and systems designer.