Development Of Computers And Technology Essay, Research Paper

Development of Computers and Technology

Computers in some form are in almost everything these days. From

Toasters to Televisions, just about all electronic things has some form of

processor in them. This is a very large change from the way it used to be, when

a computer that would take up an entire room and weighed tons of pounds has the

same amount of power as a scientific calculator. The changes that computers

have undergone in the last 40 years have been colossal. So many things have

changed from the ENIAC that had very little power, and broke down once every 15

minutes and took another 15 minutes to repair, to our Pentium Pro 200’s, and the

powerful Silicon Graphics Workstations, the core of the machine has stayed

basically the same. The only thing that has really changed in the processor is

the speed that it translates commands from 1’s and 0’s to data that actually

means something to a normal computer user. Just in the last few years,

computers have undergone major changes. PC users came from using MS-DOS and

Windows 3.1, to Windows 95, a whole new operating system. Computer speeds have

taken a huge increase as well, in 1995 when a normal computer was a 486

computer running at 33 MHz, to 1997 where a blazing fast Pentium (AKA 586)

running at 200 MHz plus. The next generation of processors is slated to come

out this year as well, being the next CPU from Intel, code named Merced, running

at 233 MHz, and up. Another major innovation has been the Internet. This is a

massive change to not only the computer world, but to the entire world as well.

The Internet has many different facets, ranging from newsgroups, where you can

choose almost any topic to discuss with a range of many other people, from

university professors, to professionals of the field of your choice, to the

average person, to IRC, where you can chat in real time to other people around

the world, to the World Wide Web, which is a mass of information networked from

places around the world. Nowadays, no matter where you look, computers are

somewhere, doing something.

Changes in computer hardware and software have taken great leaps and

jumps since the first video games and word processors. Video games started out

with a game called Pong…monochrome (2 colors, typically amber and black, or

green and black), you had 2 controller paddles, and the game resembled a slow

version of Air Hockey. The first word processors had their roots in MS-DOS,

these were not very sophisticated nor much better than a good typewriter at the

time. About the only benefits were the editing tools available with the word

processors. But, since these first two dinosaurs of software, they have gone

through some major changes. Video games are now placed in fully 3-D

environments and word processors now have the abilities to change grammar and

check your spelling.

Hardware has also undergone some fairly major changes. When computers

entered their 4th generation, with the 8088 processor, it was just a base

computer, with a massive processor, with little power, running at 3-4 MHz, and

there was no sound to speak of, other than blips and bleeps from an internal

speaker. Graphics cards were limited to two colors (monochrome), and RAM was

limited to 640k and less. By this time, though, computers had already undergone

massive changes. The first computers were massive beasts of things that weighed

thousands of pounds. The first computer was known as the ENIAC, it was the size

of a room, used punched cards as input and didn’t have much more power than a

calculator. The reason for it being so large is that it used vacuum tubes to

process data. It also broke down very often…to the tune of once every fifteen

minutes, and then it would take 15 minutes to locate the problem and fix it.

This beast also used massive amount of power, and people used to joke that the

lights would dim in the city of origin whenever the computer was used.

The Early Days of Computers

The very first computer, in the roughest sense of the term, was the

abacus. Consisting of beads strung on wires, the abacus was the very first

desktop calculator. The first actual mechanical computer came from an

individual named Blaise Pascal, who built an adding machine based on gears and

wheels. This invention did not become improved significantly until a person

named Charles Babbage came along, who made a machine called the difference

engine. It is for this, that Babbage is known as the ?Father of the Computer.”

Born in England in 1791, Babbage was a mathematician, and an inventor.

He decided a machine could be built to solve polynomial equations more easily

and accurately by calculating the differences between them. The model of this

was named the Difference Engine. The model was so well received that he began

to build a full scale working version, with money that he received from the

British Government as a grant.

Babbage soon found that the tightest design specifications could not

produce an accurate machine. The smallest imperfection was enough to throw the

tons of mechanical rods and gears, and threw the entire machine out of whack.

After spending 17,000 pounds, the British Government withdrew financial support.

Even though this was a major setback, Babbage was not discouraged. He came up

with another machine of wheels and cogs, which he would call the analytical

engine, which he hoped would carry out many different kinds of calculations.

This was also never built, at least by Babbage (although a model was put

together by his son, later), but the main thing about this was it manifested

five key concepts of modern computers –

? Input device ? Processor or Number calculator ? Storage unit to hold number

waiting to be processed ? Control unit to direct the task waiting to be

performed and the sequence of calculations ? Output device

Parts of Babbage’s inventions were similar to an invention built by

Joseph Jacquard. Jacquard, noting the repeating task of weavers working on

looms, came up with a stiff card with a series of holes in it, to block certain

threads from entering the loom and blocked others from completing the weave.

Babbage saw that the punched card system could be used to control the

calculations of the analytical engine, and brought it into his machine.

Ada Lovelace was known as the first computer programmer. Daughter of an

English poet (Lord Byron), went to work with Babbage and helped develop

instructions for doing calculations on the analytical engine. Lovelace’s

contributions were very great, her interest gave Babbage encouragement; she was

able to see that his approach was workable and also published a series of notes

that led others to complete what he prognosticated.

Since 1970, the US Congress required that a census of the population be

taken every ten years. For the census for 1880, counting the census took 7?

years because all counting had to be done by hand. Also, there was considerable

apprehension in official society as to whether the counting of the next census

could be completed before the next century.

A competition was held to find some way to speed the counting process.

In the final test, involving a count of the population of St. Louis, Herman

Hollerith’s tabulating machine completed the count in only 5? hours. As a

result of his systems adoption, an unofficial count of the 1890 population was

announced only six weeks after the census was taken. Like the cards that

Jacquard used for the loom, Hollerith’s punched cards also used stiff paper with

holes punched at certain points. In his tabulating machine, roods passed

through the holes to complete a circuit, which caused a counter to advance one

unit. This capability pointed up the principal difference between the

analytical engine and the tabulating machine; Hollerith was able to use

electrical power rather than mechanical power to drive the device.

Hollerith, who had been a statistician with the Census Bureau, realized

that the punched card processing had high potential for sales. In 1896, he

started the Tabulating Machine Company, which was very successful in selling

machines to railroads and other clients. In 124, this company merged with two

other companies to form the International Business Machines Corporation, still

well known today as IBM.

IBM, Aiken & Watson

For over 30 years, from 1924 to 1956, Thomas Watson, Sr., ruled IBM with

an iron grip. Before becoming the head of IBM, Watson had worked for the

Tabulating Machine Company. While there, he had a running battle with Hollerith,

whose business talent did not match his technical abilities. Under the lead of

Watson, IBM became a force to be reckoned with in the business machine market,

first as a purveyor of calculators, then as a developer of computers.

IBM’s entry into computers was started by a young person named Howard

Aiken. In 1936, after reading Babbage’s and Lovelace’s notes, Aiken thought

that a modern analytical engine could be built. The important difference was

that this new development of the analytical engine would be electromechanical.

Because IBM was such a power in the market, with lots of money and resources,

Aiken worked out a proposal and approached Thomas Watson. Watson approved the

deal and give him 1 million dollars in which to make this new machine, which

would later be called the Harvard Mark I, which began the modern era of

computers.

Nothing close to the Mark I had ever been built previously. It was 55

feet long and 8 feet high, and when it processed information, it made a clicking

sound, equivalent to (according to one person) a room full of individuals

knitting with metal needles. Released in 1944, the sight of the Mark I was

marked by the presence of many uniformed Navy officers. It was now W.W.II and

Aiken had become a naval lieutenant, released to Harvard to help build the

computer that was supposed to solve the Navy’s obstacles.

During the war, German scientists made impressive advances in computer

design. In 1940 they even made a formal development proposal to Hitler, who

rejected farther work on the scheme, thinking the war was already won. In

Britain however, scientists succeeded in making a computer called Colossus,

which helped in cracking supposedly unbreakable German radio codes. The Nazis

unsuspectingly continued to use these codes throughout the war. As great as

this accomplishment is, imagine the possibilities if the reverse had come true,

and the Nazis had the computer technology and the British did not.

In the same time frame, American military officers approached Dr.

Mauchly at the University of Pennsylvania and asked him to develop a machine

that would quickly calculate the trajectories for artillery and missiles.

Mauchly and his student, Presper Eckert, relied on the work of Dr. John

Atanasoff, a professor of physics at Iowa State University.

During the late ?30’s, Atanasoff had spent time trying to build an

electronic calculating device to help his students solve complicated math

problems. One night, the idea came to him for linking the computer memory and

the associated logic. Later, he and an associate, Clifford Berry, succeeded in

building the ?ABC,” for Atanasoff-Berry Computer. After Mauchly met with

Atanasoff and Berry, he used the ABC as the basis for the next computer

development. From this association ultimately would come a lawsuit, considering

attempts to get patents for a commercial version of the machine that Mauchly

built. The suit was finally decided in 1974, when it was decided that Atanasoff

had been the true developer of the ideas required to make an electronic digital

computer actually work, although some computer historians dispute this decision.

But during the war years, Mauchly and Eckert were able to use the ABC principals

in dramatic effect to create the ENIAC.

Computers Become More Powerful

The size of ENIAC’s numerical “word” was 10 decimal digits, and it could

multiply two of these numbers at a rate of 300 per second, by finding the value

of each product from a Multiplication table stored in its memory. ENIAC was

about 1000 times faster than the previous generation of computers. ENIAC used

18,000 vacuum tubes, about 1,800 square feet of floor space, and consumed about

180,000 watts of electrical power. It had punched card input, 1 multiplier, 1

divider/square rooter, and 20 adders using decimal ring counters, which served

as adders and also as quick-access (.0002 seconds) read-write register storage.

The executable instructions making up a program were embodied in the separate

“units” of ENIAC, which were plugged together to form a “route” for the flow of

information. The problem with the ENIAC was that the average life of a vacuum

tube is 3000 hours, and a vacuum tube would then burn out once every 15 minutes.

It would take on average 15 minutes to find the burnt out tube and replace it.

Enthralled by the success of ENIAC, the mathematician John Von Neumann

undertook, in 1945, a study of computation that showed that a computer should

have a very basic, fixed physical construction, and yet be able to carry out any

kind of computation by means of a proper programmed control without the need for

any change in the unit itself. Von Neumann contributed a new consciousness of

how sensible, yet fast computers should be organized and assembled. These ideas,

usually referred to as the stored-program technique, became important for future

generations of high-speed digital computers and were wholly adopted. The Stored-

Program technique involves many features of computer design and function besides

the one that it is named after. In combination, these features make very high

speed operations attainable. An impression may be provided by considering what

1,000 operations per second means. If each instruction in a job program were

used once in concurrent order, no human programmer could induce enough

instruction to keep the computer busy. Arrangements must be made, consequently,

for parts of the job program (called subroutines) to be used repeatedly in a

manner that depends on the way the computation goes. Also, it would clearly be

helpful if instructions could be changed if needed during a computation to make

them behave differently. Von Neumann met these two requirements by making a

special type of machine instruction, called a Conditional control transfer –

which allowed the program sequence to be stopped and started again at any point

- and by storing all instruction programs together with data in the same memory

unit, so that, when needed, instructions could be changed in the same way as

data.

As a result of these techniques, computing and programming became much

faster, more flexible, and more efficient with work. Regularly used subroutines

did not have to be reprogrammed for each new program, but could be kept in

“libraries” and read into memory only when needed. Hence, much of a given

program could be created from the subroutine library. The computer memory

became the collection site in which all parts of a long computation were kept,

worked on piece by piece, and put together to form the final results. When the

advantage of these techniques became clear, they became a standard practice. The

first generation of modern programmed electronic computers to take advantage of

these improvements was built in 1947. This group included computers using

Random- Access-Memory (RAM), which is a memory designed to give almost constant

access to any particular piece of information. . These machines had punched-card

or tape I/O devices. Physically, they were much smaller than ENIAC. Some were

about the size of a grand piano and used only 2,500 electron tubes, a lot less

then required by the earlier ENIAC. The first-generation stored-program

computers needed a lot of maintenance, reached probably about 70 to 80%

reliability of operation (ROO) and were used for 8 to 12 years. This group of

computers included EDVAC and UNIVAC, the first commercially available computers.

Early in the 50’s two important engineering discoveries changed the

image of the electronic-computer field, from one of fast but unreliable hardware

to an image of relatively high reliability and even more capability. These

discoveries were the magnetic core memory and the Transistor – Circuit Element.

These technical discoveries quickly found their way into new models of digital

computers. RAM capacities increased from 8,000 to 64,000 words in commercially

available machines by the 1960’s, with access times of 2 to 3 MS (Milliseconds).

These machines were very expensive to purchase or even to rent and were

particularly expensive to operate because of the cost of expanding programming.

Such computers were mostly found in large computer centers operated by industry,

government, and private laboratories — staffed with many programmers and

support personnel. This situation led to modes of operation enabling the sharing

of the high potential available. During this time, another important

development was the move from machine language to assembly language, also known

as symbolic languages. Assembly languages use abbreviations for instructions

rather than numbers. This made programming a computer a lot easier.

After the implementation of assembly languages came high-level languages.

The first language to be universally accepted was a language by the name of

FORTRAN, developed in the mid 50’s as an engineering, mathematical, and

scientific language. Then, in 1959, COBOL was developed for business

programming usage. Both languages, still being used today, are more English

like than assembly. Higher level languages allow programmers to give more

attention to solving problems rather than coping with the minute details of the

machines themselves. Disk storage complimented magnetic tape systems and

enabled users to have rapid access to data required.

All these new developments made the second generation computers easier

and less costly to operate. This began a surge of growth in computer systems,

although computers were being mostly used by business, university, and

government establishments. They had not yet been passed down to the general

public. The real part of the computer revolution was about to begin.

One of the most abundant elements in the earth is silicon; a non-metal

substance found in sand as well as in most rocks and clay. The element has

given rise to the name ?Silicon Valley? for Santa Clara County, about 50 km

south of San Francisco. In 1965, Silicon valley became the principle site of

the computer industry, making the so-called silicon chip.

An integrated circuit is a complete electronic circuit on a small chip

of silicon. The chip may be less than 3mm square and contain hundreds to

thousands of electronic components. Beginning in 1965, the integrated circuit

began to replace the transistor in machines was now called third-generation

computers. An Integrated Circuit was able to replace an entire circuit board of

transistors with one chip of silicon much smaller than one transistor. Silicon

is used because it is a semiconductor. It is a crystalline substance that will

conduct electric current when it has been doped with chemical impurities shot

onto the structure of the crystal. A cylinder of silicon is sliced into wafers,

each about 76mm in diameter. The wafer is then etched repeatedly with a pattern

of electrical circuitry. Up to ten layers may be etched onto a single wafer.

The wafer is then divided into several hundred chips, each with a circuit so

small it is half the size of a fingernail; yet under a microscope, it is complex

as a railroad yard. A chip 1 centimeter square it is so powerful that it can

hold 10,000 words, about the size of an average newspaper.

Integrated circuits entered the market with the simultaneous

announcement in 1959 by Texas Instruments and Fairchild Semiconductor that they

had each independently produced chips containing several complete electronic

circuits. The chips were hailed as a generational breakthrough because they had

four desirable characteristics. ? Reliability – They could be used over and over

again without failure, whereas vacuum tubes failed ever fifteen minutes. Chips

rarely failed — perhaps one in 33 million hours of operation. This reliability

was due not only to the fact that they had no moving parts but also that

semiconductor firms gave them a rigid work/not work test. ? Compactness -

Circuitry packed into a small space reduces equipment size. The machine

speed is increased because circuits are closer together, thereby reducing the

travel time for the electricity. ? Low Cost – Mass-production techniques has

made possible the manufacture of inexpensive integrated circuits. That is,

miniaturization has allowed manufacturers to produce many chips inexpensively. ?

Low power use — Miniaturization of integrated circuits has meant that less

power is required for computer use than was required in previous generations.

In an energy-conscious time, this was important.

The Microprocessor

Throught the 1970’s, computers gained dramatically in speed, reliability,

and storage capacity, but entry into the fourth generation was evolutionary

rather than revolutionary. The fourth generation was, in fact, furthering the

progress of the third generation. Early in the first part of the third

generation, specialized chips were developed for memory and logic. Therefore,

all parts were in place for the next technological development, the

microprocessor, or a general purpose processor on a chip. Ted Hoff of Intel

developed the chip in 1969, and the microprocessor became commercially available

in 1971.

Nowadays microprocessors are everywhere. From watches, calculatores and

computers, processors can be found in virtually every machine in the home or

business. Environments for computers have changed, with no more need for

climate-controlled rooms and most models of microcomputers can be placed almost

anywhere.

New Stuff

After the technological improvements in the 60’s and the 70’s, computers

haven’t gotten much different, aside from being faster, smaller and more user

friendly. The base architecture of the computer itself is fundementally the

same. New improvements from the 80’s on have been more ?Comfort Stuff?, those

being sound cards (For hi-quality sound and music), CD-ROMs (large storage

capicity disks), bigger monitors and faster video cards. Computers have come a

long way, but there has not really been alot of vast technological improvements,

architecture-wise.

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