

History of Communications Media

Class 8

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What We Will Cover Today

- Computers
- Internet
- Cell Phones

Origins of Computers

- Persons who made the computer possible
 - Gottfried Leibnitz – binary numbering system
 - Charles Babbage – the “analytical engine”
 - Herman Hollerith – the punch card
 - Lee De Forest – the audion tube
 - Claude Shannon – the idea that relay circuits could perform arithmetic, logical, and comparison functions

Leibnitz - Gottfried Leibnitz was an 18th century mathematician and philosopher. Along with Isaac Newton, he originated calculus. He also contributed the realization that all numbers could be represented by a combination of ones and zeroes – the binary numbering system.

Babbage – Charles Babbage contributed the concept of a mechanical computing device that could perform all four arithmetic functions.

Hollerith – It had taken the Census Bureau 7 years to complete its tabulation of the 1880 census. To speed up data tabulation, Hollerith, then a Census Bureau employee, came up with the punch card and a tabulating machine to count the cards and the data contained within.

De Forest – the audion tube not only made voice radio broadcasting feasible but also function as a boolean logic device

Shannon – In 1938, Shannon published what was probably the most important masters thesis ever published, “A Symbolic Analysis of Relay and Switching Circuits.” In it, Shannon made three major contributions to the development of the computer. First, the idea that relay circuits could perform binary arithmetic operations. Second, the idea that logical operations such as true and false could be represents by binary digits. Third, the realization that switching circuits could make logical “if-then” comparisons. He saw the possibility of a device that could take alternative courses of action according to circumstances-as in, "if the number X equals the number Y then do operation A " Shannon gave a simple illustration

The First Computers

- John V. Atanasoff – first working model of a data processing unit and computer memory at the Univ of Iowa
- Alan Turing – Colossus, the first working digital computer, created to crack Nazi codes
- J. Presper Eckert & John Mauchly – ENIAC, developed at the Univ of Pennsylvania in 1946 to do ballistics calculations

Atanasoff - In 1937, John Atanasoff, a young physics instructor at Iowa State University, was struggling with the problem of mechanizing computation. One night in frustration, he jumped in his car and drove 200 miles to Illinois, where he pulled up at a roadhouse to rest. There it came to him. If computations were done in the either-or number base of two, instead of the conventional base ten, a machine could do calculations naturally. Two years later, Atanasoff and a colleague started to build a computer. But in 1942, both were drafted and the almost complete computer was set aside without being patented. Meanwhile, one of the inventors of ENIAC, John Mauchly, had known Atanasoff and had even visited Atanasoff for a week in 1941. In the end it was clear that the ideas that resulted in ENIAC actually were Atanasoff's.

Turing - The British mathematician Alan Turing followed close on the heels of Atanasoff, developing "Colossus," the first working digital computer, during World War II to crack Nazi war codes

Eckert & Mauchly - During World War II, vast numbers of guns were being manufactured for use on battleships, tanks, and field artillery. To use these guns properly, gunners had to aim the gun and elevate the barrel to the right angle, taking into account not only the location and distance of the target but also air temperature and wind characteristics. This meant that every gun had to have its own firing table. These tables were difficult to compute since each required the solution of several thousand equations. Thus, each table took a mathematician three months to compute. In 1942, John Mauchly, an engineer on the faculty of the Moore School of Engineering at the University of Pennsylvania, suggested to the Army Ordnance Department that he could build an electronic calculator based on high-speed vacuum tube devices that would solve the trajectory equations in seconds rather than hours. In 1943, a contract was awarded to Mauchly and his colleague, J. Presper Eckert. The result was ENIAC which was completed by early 1946 and had more than 17,000 vacuum tubes, weighed 30 tons, occupied a full room, and cost roughly \$450,000 to build. But it worked and was used to make the complex calculations needed to

Computers

- Computers have gone through five major computer ages – each of which differed in their basic technology and capabilities
 - 1st Generation – vacuum tubes
 - 2nd Generation – transistors
 - 3rd Generation – integrated circuits
 - 4th Generation – microprocessors
 - 5th Generation – advanced microprocessors & the Internet

ENIAC contained 17,000 vacuum tubes, weighed thirty tons, and occupied 15,000 feet of floor space. ENIAC and other first generation computers used vacuum tubes to perform their calculations. Although first generation computers were a significant step forward, the vacuum tubes upon which they were based generated considerable heat, could not be miniaturized, and often burned out. In addition, insects or “bugs” sometimes infested the machines (attracted by the heat thrown off) causing the computer to malfunction and making it necessary to “debug” the computer.

First Computer Age

– 1940-56: Vacuum Tubes

- Used vacuum tubes for circuitry and magnetic drums for memory
- Very expensive and took up large rooms
- Programmed in machine language
- Input was on punch cards and paper tape
- Output displayed on printouts
- UNIVAC I, UNIVAC 1103, and IBM 704

Marriage of tubes & punch cards - The modern digital commercial data processing computer was a marriage in the 1950s of the punched-card tabulating technology with that of the electronic tube and then the transistor. The U.S. companies that successfully made the transition from making computers for military and defense to producing them for the commercial market were the business-machine makers that had had prewar experience or at least an awareness of punched-card tabulating technology. These were National Cash Register (NCR), Burroughs Adding Machine, Remington-Rand (merged with Sperry in 1955), and Honeywell. Since IBM accounted for nearly 90 percent of the punched card tabulator market before World War II, IBM understandably jumped ahead of its competitors in the new computer industry.

Military Impacts - While minimal in impact in comparison with fourth and fifth generation computers, first generation computers did have some economic and social impact. ENIAC had been used to make the calculations as to whether the Hydrogen Bomb could be built. In the 1950s, government contracts for the SAGE air defense system provided almost half of IBM's computer revenues. SAGE, fully-developed by 1963, involved 24 air defense centers -- each with two computers that each had 60,000 vacuum tubes and occupied an acre of floor space. Not until 1959 did IBM's revenues from commercial computers exceed those of SAGE and the other military computer projects.

Civilian Impacts - UNIVAC was acquired by the Census Bureau to help tabulate the 1950 Decennial Census. By 1954, computers were already making inroads into American business, especially in areas where data processing was very intense, such as banking and insurance. To facilitate bank computer processing of checks, banks began to print data in magnetic ink upon the checks. But they were huge and hugely expensive, kept in special air-conditioned rooms and tended by men in white coats. Very few Americans had actually seen one.

Second Computer Age

– 1956-1963: Transistors

- Used transistors for circuitry and magnetic core for memory
- Programmed in assembly language and early versions of COBOL and FORTRAN
- Input and output as in 1st Computer Age
- IBM 1401

Transistors were the result of advances in semiconductor physics following experiments at Bell Laboratories and elsewhere. In 1947, John Bardeen, Walter Brattain, and William Shockley (who became Nobel Prize-winners three years later) devised solid state amplifying devices made out of germanium. Interestingly enough, the first customers for transistors were hearing aid manufacturers followed by Sony which used them in its famous “Walkman” radio. Gordon Teal, who had moved from Bell Labs to Texas Instruments, replaced germanium with silicon – i.e. what came to be called the silicon 'chip'. Texas Instruments had started as an oil service supplier, but in October 1954, it began selling tiny silicon chips about the size of a fingernail. After other technological advances at the Fairchild Semiconductor Company introduced photolithography into the process of chip production, miniaturization became cheaper and transistors more reliable.

Third Computer Age

- 1964-1971 Integrated Circuits
 - Used integrated circuits (small transistors on silicon chips) for circuitry
 - Users could interact via keyboard and monitor as well as with punch cards
 - Users interfaced with an operating system which allowed the computer to run different applications at one time
 - IBM 360 series & 370 series
 - IBM 360s & 370s were scalable

Integrated circuits - In 1959, an engineer working for Texas Instruments, Jack Kilby, and Robert Noyce, a founder of Fairchild and later of Intel, applied for a patent in 1959 for the integrated circuit, 'a body of semi-conductor material... wherein all the components of the electronic circuit are completely integrated'. The first Integrated Circuits contained just a few transistors per wafer; by the dawn of the 1970s, production techniques using photolithography [remember Joseph Nicephore Niepce] allowed for thousands of transistors per wafer. Observing this trend, Fairchild Semiconductor's director of Research & Development Gordon Moore observed in 1965 that the density of elements in ICs was doubling annually, and predicted that the trend would continue for the next ten years. With certain amendments, this came to be known as Moore's Law.

IBM 360 & 370 - Until 1964, each computer model, even from the same manufacturer, had a unique design and had its own operating system and applications software. Under Tom Watson, jr. IBM gambled \$5 Billion on the novel notion of scalable architecture -- all components of the six models in the System 360 family, no matter what size, would respond to the same set of instructions. They would all use the same input/ output equipment, tapes, disk storage, terminals, and other peripherals so that customers could move their applications and peripherals from one model to the next. Thus, scalable architecture completely reshaped the industry. In 1967 the System 360 began to appear in volume. Its arrival quickly determined the continuing mainframe path of learning, not only in the United States, but worldwide. In addition to the core competitors NCR, Burroughs, Remington-Rand, and Honeywell, two others—the nation's leaders in electronics, General Electric and RCA—went all-out to build similar systems. Both GE and RCA had the potential in terms of technical and managerial capabilities and the financial resources to attempt to produce a comparable line of products—a potential no other company in the world enjoyed at the time. Nevertheless, with IBM's announcement in 1970 of its next generation, the System 370, both gave up their attempts after investing an inordinate amount of time and expending massive funds in research and development

A Note on the Impact of the Integrated Circuit

- Once invented, the IC proved useful to other industries besides the computer industry
 - While the computer industry was the largest user of ICs, demand for them was also extensive in other industries
- In 1994, IC sales by industry were as follows:
 - Computers – 47.9%
 - Industrial & Instrument Manufacturers – 10.3%
 - Communications – 14%
 - Consumer Electronics – 21.9%
 - Automotive – 4.9%
 - This was the largest growth area in the 1980s
 - Government & Military – 1.0%

This was the beginning of the embedding of intelligence in everyday devices. Now, computer chips are embedded in everything from electronic devices to dogs.

A Note about 2nd & 3rd Generation Computers

- Computers were divided into three categories
 - Mainframes - a large digital computer serving 100-400 users and occupying a special air-conditioned room
 - Minicomputer - a medium-scale, centralized computer that supported multiple users. It was roughly the size of a refrigerator and fell between the early microcomputer and the mainframe in terms of memory size and disk space
 - Dumb Terminals - a terminal which can display and input data; but which lacks any significant local programmable data processing capability

Mainframe – Historically, mainframes have been associated with centralized rather than distributed computing, although that distinction is blurring as smaller computers become more powerful and mainframes become more multi-purpose. Today, [IBM](#) emphasizes that their mainframes can be used to serve distributed users and smaller servers in a computing network. The mainframe is sometimes referred to as a "dinosaur" not only because of its size but because of reports, going back many years, that it's becoming extinct. In 1991 Stewart Alsop, the editor of *InfoWorld*, predicted that the last mainframe would be retired by 1996. However, in February 2008 [IBM](#) released a new mainframe, the z10. Steve Lohr wrote about the mainframe as "the classic survivor technology" in *The New York Times* ("Why old technologies are still kicking"): I.B.M. overhauled the insides of the mainframe, using low-cost microprocessors as the computing engine. The company invested and updated the mainframe software, so that banks, corporations and government agencies could still rely on the mainframe as the rock-solid reliable and secure computer for vital transactions and data, while allowing it to take on new chores like running Web-based programs. The original mainframes were housed in room-sized metal frames, which is probably where the name derives from. In the past, a typical mainframe might have occupied 2,000 - 10,000 square feet. Newer mainframes are about the same size as a large refrigerator. In the "ancient" mid-1960s, all computers were mainframes, since the term referred to the main CPU cabinet. Today, it refers to a class of ultra-reliable medium and large-scale servers designed for enterprise-class and carrier-class [operations](#).

Mini-computer - The minicomputer [industry](#) was launched in 1959 after Digital Equipment Corporation introduced its PDP-1 for \$120,000, an unheard-of low price for a computer in those days. Subsequently, a variety of minicomputer systems became available from HP, Data General, Wang, Tandem, Datapoint, Prime Computer, Varian Data and Scientific Data Systems. The single user mini evolved into a centralized system with dumb terminals for departmental use. During the 1980s and early 1990s, most centralized minicomputers migrated from their dumb terminal architecture into servers for PC networks. The terms "midrange [computer](#)" and "server" replaced the venerable minicomputer designation.

Dumb terminals - the term dumb terminal is sometimes used to refer to *any* type of traditional computer terminal that communicates serially over a [RS-232](#) connection that does not locally process data or execute user programs. One consequence of the dumb terminal was that it replaced the punch card and paper tape as dominant modes of input and often the printout as the dominant form of output.

Fourth Computer Age

- 1971-1991: Microprocessors
 - Microprocessors are ICs that incorporate most or all of the functions of the CPU on a single chip.
 - Before the microprocessor, the CPU was built with many chips
- Microprocessors made possible the Personal Computer (PC)

Microprocessor – As an ever-increasing number of integrated circuits became embedded on a single silicon chip, it was only a matter of time before someone thought of the idea of putting most or all of the central processing unit functions that a computer performs onto a single silicon chip. Thus, a microprocessor is an integrated circuit that incorporates most or all of the functions of a [central processing unit](#) (CPU) on a single silicon chip - the CPU being that part of the computer that carries out the instructions contained in the computer program.

First microprocessors – The first microprocessors were the Central Air Data Computer (CADC), the Intel® 4004, and the Texas Instruments TMS 1000. The CADC was completed for the Navy's "TomCat" fighter jets in 1970 but its top secret security classification kept it under wraps until 1998. The TI TMS 1000 was used in pocket calculators but not in computers. The Intel 4004, which came out in 1971, thus is credited with being the first computer microprocessor. It was soon, however, superseded by the Intel 8008. The first microprocessors emerged in the early 1970s and were used for electronic [calculators](#), using [binary-coded decimal](#) (BCD) arithmetic on 4-bit [words](#). It was only a matter of time before someone would use this capacity to put an entire computer on a chip, and several someones, indeed, did just that.

PCs - The personal computer (PC) era began in 1977 when Apple, Commodore, and Tandy introduced the first commercial microcomputers, which quickly replaced the pioneering kits assembled by hobbyists for hobbyists. But the PC industry's explosive growth began with IBM's entry in 1980.

Origins of the PC

- Had its origins in the computer hobby culture
 - Its members were engineers who worked in either the computer or electronics industries .
 - The culture included the Homebrew Computer Club of Silicon Valley
- In 1977 when Apple, Commodore, and Tandy introduced the first commercial PCs
- The success of Apple and Commodore led IBM to enter the PC market

Computer hobbyists - To the computer buffs, the Altair 8800, unveiled in January 1975, was a godsend a primitive microprocessor computer that could be built from a kit for less than \$400. Soon dozens of firms were competing for the hobbyist market. The Altair 8800 was the first affordable computer, and MITS, the company that produced it, also pioneered computer shows, computer retailing, computer company magazines, users groups, software exchanges, and many hardware and software products. Altair's success had prompted competition: by end-1977, rivals had emerged like mushrooms all over the country. MITS eventually failed because its founder and creator of the Altair 8800 alienated key people like Paul Allen and others crucial to the company's initial success.

Homebrew Computer Club - The members of the Homebrew Computer Club, which held its first meeting in March 1975 in the garage of microcomputer enthusiast Gordon French in Menlo Park, eventually launched no less than twenty-two companies, of which twenty were still in operation in the mid-1980s, some of them leading companies like Apple, Cromenco, and North Star. When founded it had a regular membership of 500 (including Paul Wozniak and Steve Jobs), mostly young and male; the name came from the fact that then all home computers were assembled from kits.

Apple - Apple was a venture that combined the complimentary talents of Stephen Wozniak, a brilliant engineer, and Steve Jobs, a charismatic salesman who envisioned the Apple II as a self-contained unit in a plastic case with accompanying keyboard, screen, and printer that, aided by word processing and spreadsheet software, could be used for accounts and correspondence. This, Wozniak designed and Jobs launched in the spring of 1977. ***The success of Apple Computer led IBM to belatedly enter the PC market. Its PC, launched in August 1981, both legitimized the personal computer and changed the course of the PC revolution***

Origins of the PC - 2

- The PC market really took off when IBM introduced its “open architecture” PC in October 1981
 - It had an Intel 8088 microprocessor and a Microsoft MS-DOS operating system
- IBM’s entry into the PC market had profound consequences
 1. It revealed a mass market for computers. Before, the market had been institutional – corporations, government offices, universities, businesses, etc
 2. By making its PC an open system, IBM enabled existing and startup companies to enter this new market
 - By 1986, over 200 companies were producing IBM PC clones. Among the new entrants were Dell, Compaq, Gateway, and Hewlett Packard
 - Conversely, it reduced PC manufacturers with proprietary operating systems to minor niche status

Origins of the IBM PC - The PC age really took off when the laboratory director of IBM’s Entry Level Systems Unit, William C. Lowe, at the explicit direction of IBM’s senior management, sent a task force to Boca Raton, Florida. His charge to the task force was to design a microcomputer, build a factory to produce it in volume, and create a national and worldwide marketing and advertising organization for the mass produced consumer product—and all this was to be accomplished within a year. To meet the assigned schedule, the new computer would have an “open architecture,” not protected by patents as were those of its competitors. Peripherals were to be purchased from sources that could supply the equipment immediately in volumes needed for mass production. Software was to be developed separately from the central processing unit. As a result, IBM decided to buy the 16-bit Intel 8088 chip for its PC (which could support up to one full megabyte of memory) and license the operating system rather than developing one itself.. Initially, for its operating system the task force’s managers chose Gary Kildall, who had written what was by 1981 the dominant operating system for microcomputers – CP/M. When Kildall refused to sign a nondisclosure agreement, they turned to Bill Gates, whose Microsoft enterprise in Seattle was producing a version of the programming language BASIC for microcomputers but had not yet built an operating system. Since IBM wanted an operating system that was invisible to a computer user, that did not require the user to program the computer, and that upon which applications could be run, Microsoft purchased QDOS from Tim Paterson for \$100,000 since it had no rights to the CP/M system which it used for some Apple products and the XENIX system which it could license was not appropriate for the IBM PC. The QDOS system, tweaked by Bill Gates and renamed MS-DOS, became the operating system for the first IBM PC. Microsoft licensed MS-DOS non-exclusively to IBM for a low one-time fee that gave IBM the right to use MS-DOS on any computer it could sell. It also gave Microsoft the right to sell MS-DOS both to software developers and to all the manufacturers that wanted to make IBM PC clones that could run IBM PC software. The IBM PC made its debut in October 1981 and was an instant success, selling an estimated 250,000 in the first year of production -- each one using Microsoft’s recently-named MS-DOS operating system. Soon, most of the new and best software -- like Lotus 1-2-3 -- was being written for it. As more people bought PC computers and software developers created more applications to run on them, the IBM PC or its clone running on MS-DOS became the de facto standard since PC buyers “were looking for the hardware that ran the most software, and they wanted the same system the people they knew and worked with had.”

Mass market - Although the early models had very limited capabilities, some 200,000 were sold in 1977 to computer hobbyists, small businessmen, and academics by such firms as Apple Computer, Radio Shack, and Commodore. When IBM entered the PC market in 1981, sales which had been 150,000 in 1979, 325,000 in 1980, and 500,000 in 1981, jumped in 1982 to 2,000,000. In 1983, sales reached almost 5,000,000, and stayed at that level in 1984.

Apple – Unlike IBM, Apple kept its operating system proprietary and refused to license it to others. Thus, even though Apple’s GUI system was far superior to MS-DOS and even early versions of Windows, it lost out and was relegated to a niche of computer techies and handlers of computerized images and photographs – the latter because Apple’s 24-bit microprocessor had color rendition capabilities that were much better than the PC’s 8-bit and 16-bit systems.

A Note about the PC

- PCs went through multiple PC eras with each era reflecting a new microprocessor chip and often a new operating system
 - The Intel eras were based on the 8088, 80286, 386, 486, Pentium, and successive chips
 - The Microsoft operating systems were DOS, and the various versions of Windows, starting with 3.0 up to the present XP and Vista
 - In each era, the memory, speed, and capabilities of the computer increased and both the size and especially the cost of the computer decreased

A Note about the PC - 2

- IBM's commitment to the mainframe eventually caused it to lose control of the PC market
 - While IBM's XT (based on the 8088 chip) and AT (based on the 80286 chip and introduced in 1984) were great successes, IBM held back on a computer with a 386 chip in order to protect sales of its lower end mini-computers
 - Result: Compaq Computer came out with the first 386 chip-based PC in 1986 lost both its control of PC architecture and its ability to dominate the PC industry

IBM's XT (based on the 8088 chip and introduced in 1981) and AT (based on the 80286 chip and introduced in 1984) were great successes, but the IBM found the AT challenging sales of its lower end mainframes. And IBM saw itself as a mainframe hardware and software manufacturer. IBM manipulated the price and performance of a new line of hardware so that it would not steal business from more expensive products. IBM also encouraged adoption of new O.S. software by releasing hardware that required the software. But this orientation led IBM to hold back on PC development using a 386 chip to protect sales of its lower end mini-computers which were only a little more powerful than the 386. The result was that a competitor, Compaq Computer, came out with the first 386 chip-based PC in 1986. IBM tried to fight back with the PS/2 which used a new operating system -- OS/2 -- and a new "microchannel bus" that allowed accessory cards with special functions (like video, sound, or mainframe COM) to connect to this system, but which was incompatible with the AT bus. This led a coalition of manufacturers to produce a bus which had many (but not all) of the IBM microchannel capabilities, but which was both compatible with the AT bus and all of the already existing add-on cards. The Result: the PS/2 and the OS/2 were a bust and IBM lost both its control of PC architecture and its ability to move the industry single-handedly to a new design. Instead, IBM became just another PC maker, with worldwide market share today of scarcely 7%. Its design, however, did come to dominate the computer world: Apple Computer, which once shared a 39% market share with Tandy and developed its own proprietary computer architecture, now accounts for a mere 3% of the worldwide consumer market. Virtually all the other machines out there claim as their familial ancestor that very first IBM PC

A Note about the PC -3

- Other consequences of IBM's entry into the PC market
 3. It made Intel and Microsoft the dominant players in the PC industry
 4. It created a demand for new types of packaged software that could be used by non-techie users in offices and homes
 - Prior to packaged software, software applications were generally created for existing installation computers by in-house or contract software programmers who wrote custom-made code

Intel & Microsoft - From IBM's point of view, they were largely unintended and mostly unexpected consequences. Two companies whose fortunes were made by the success of the IBM PC and its clones were Intel and Microsoft who quickly became the PC industry's two major players. With the birth of the IBM PC and the "IBM PC clones," Microsoft enjoyed nearly two decades of spectacular prosperity. In 1979, Microsoft revenues were over \$1 million; by 1982, \$24 million; by 1990, \$1 billion -- largely as a result of the success of Windows (1985) and Microsoft Word. (1983)

Packaged Software – The first types of packaged PC software to take off were spreadsheets, starting with VisiCalc and Lotus 1-2-3, followed by database management programs like dBase and word processing programs like WordStar and Word Perfect. Eventually these lost out to Microsoft-originated programs like Excel, Access, and Word.

Code – The need to write custom-made software applications to run on an organization's Mainframe and Mini-computers created the occupations of computer programmer and systems analyst. The purpose of the systems analyst was to look at an organization's way of doing business, modify it in a way that its operations and procedures could efficiently be computerized, and then design the appropriate data inputs, outputs, and operations to be performed by the computer on the data. After this was done, the computer programmer proceeded to write and debug the necessary computer code. With the development of packaged software programs, the function of the computer programmer became that of tweaking the packaged code to fit the organization's computer system and writing such auxiliary code as was necessary to add such functions to the software package as the organization thought necessary.

A Note about the PC - 4

- Other consequences of IBM's entry into the PC market
 5. The appearance of PCs on a multitude of desks within corporate, government, and university offices led to the creation of internal enterprise networks or intranets to link these computers
 - By 1983, start-ups Novell and 3Com were providing software for Local Area Networks (LANs). Others soon followed

Fifth Computer Age

- 1991 – present: era of the Internet
 - Desktop and laptop PCs, home modems, and the World Wide Web
 - Graphical User Interfaces
 - Web browsing software
 - 1993 – Mosaic
 - 1994 – Netscape Navigator 1.0
 - 1996 – Internet Explorer 3.0
 - Beginnings of e-Commerce & e-Government
 - Internet both a broadcasting (websites & streaming video) and narrowcasting (e-mail) medium

Computers

- Each Computer Age has had a differential impact on society
 - The first two Computer Ages of computers had limited impact on society because of their limited capabilities, large size, high expense, and inability to communicate
 - Resided in large corporate and governmental entities where they handled tabulation and payroll functions

Computers

- The third Computer Age had a little more of an impact because it did have some limited communication with dumb terminals
 - This had impact on such areas as travel reservations, remote data input and output, and banking transactions
- The fourth Computer Age had an ever-increasing impact as micro processing capability increased, costs decreased, and increasing numbers of people acquired computers

Effects of the Personal Computer

- Altered the dynamics and structure of office work
 - Replaced typewriters and their clerk-typists
 - Supplemented centralized paper record files with online desktop files
 - Thanks to spell check, eliminated typing errors and misspellings in documents
 - Replaced card index files and standardized paper case files with local databases

Even before the Internet and Local Area Networks, the PC had a major impact on the office. At a time when typewriters were strictly secretaries' tools and copy machines were hulking contraptions that got their own rooms, this deceptively trivial change of putting the PC on office desks fundamentally altered the dynamics of office work.

The Internet & the PC

- While each Computer Age has had a differential impact on society, it is the Internet, however, that made the PC such a revolutionary technology
 - Made the PC part of worldwide network
 - Made possible the near-real-time dissemination of text, audio, still imagery, and video
 - Allowed any PC or computer to communicate with any other computer regardless of platform

Internet as the 5th Computer Age

– 5th Computer Age – 1991 – present: Internet

- Desktop and laptop PCs, home modems, and the World Wide Web
- Graphical User Interfaces
- Web browsing software
- Beginnings of e-Commerce & e-Government
- Internet both a broadcasting (websites & streaming video) and narrowcasting (e-mail) medium

The Internet

Origins of the Internet - 1

- 1958 – Creation of the Defense Advanced Research Projects Agency (DARPA)
 - Internet grew out of DARPA’s attempt to link DoD and contractor computers into a network so that information could be easily shared
- 1969 - Creation of the ARPANET
 - Based on packet switching & a network of nodes
 - Grew from 4 computers in 1969 to 15 in 1971 and nearly 2,000 by 1985

DARPA had a project to link the computers of its participating institutions. Linking each computer to the others by dedicated long-distance phone lines would produce astronomical phone bills. In addition, there was the incompatible software problem. The solution, developed by ARPANET designer Laurence G. Roberts, was two-fold:

• **Packet switching with each message broken up into small packets and sent along the best available route to be reassembled at its destination.** Instead of using a single, continuous line or a radio frequency between the sender and the recipient, in packet messaging one first chops the digital message into uniform data packets. Each packet is tagged with a header containing instructions that tells where it is supposed to go. A computer then ejects the packets into a network, and each piece is directed to its destination by any computer that it happens to pass through along the way. Once all the packets arrive at their destination, the recipient reassembles the message.⁸ This may seem like a way to communicate that is even more round-about than going digital, but it offers some advantages. A message can reach its recipient as long as there is *any* continuous chain from point A to point B. The message does not depend on any single, specific link. So, even if several lines or computers in a network were destroyed, the network can still function. This was the feature that had originally caught the interest of the Defense Department—the potential to build a communications system that could survive a nuclear war.

• **A network of nodes -- each with a minicomputer to receive and transmit packets and also to convert messages so the software on the receiving computer could read them.** It soon became clear that it was easy for additional computers to join the network. As long as you complied with the network's software standards—"protocols"—you were in business. You could dump a message into the network, and it would find its way to its intended recipient.

Origins of the Internet - 2

- 1985 – Funding of the network was assumed by the National Science Foundation and the name changed to the INTERNET
- 1989 – The NSF abandoned its support of the net and allowed commercial Internet service providers (ISPs) to offer Internet access to paying customers
 - By 1995, the Net encompassed 44,000 local networks, 160 countries, and an estimated 50 million users

In 1985, ARPANET changed its name to INTERNET after funding of the network was assumed by the National Science Foundation (NSF) from DARPA. By that time had become a common mode of communication among university researchers, government scientists, and a few outside computer engineers. As computer use exploded in the 1980s, people from outside the area of research wanted in, and because the Internet was so open and inclusive by design (being built on shared knowledge rather than on hoarded information), there was no effective way of stopping them. In 1989, the NSF abandoned its financial support of the net, and commercial Internet service providers (ISPs) were allowed to offer Internet access to paying customers. In 1990, the Net was officially opened to commerce. By 1995, the Net had grown to encompass 44,000 local networks, 160 countries, 26,000 registered commercial entities, and an estimated 40-50 million users.

Origins of the Internet - 3

- Origins of the Internet – 3
 - 1989 – Tim Berners-Lee of CERN developed three breakthrough techniques that made possible the World Wide Web
 - Hypertext Markup Language (HTML) – to format and layout pages of text on the Internet
 - Hypertext Transfer Protocol (HTTP) – a system to link documents
 - Uniform Resource Locators (URLs) – a scheme to address and thereby locate specific nodes of information

In 1989, Tim Berners-Lee, a British researcher at CERN [the European Lab for particle physics] developed three breakthrough techniques for digital communication:

- Hypertext Markup Language (HTML) -- to format and lay out pages of text on the Internet
- Hypertext Transfer Protocol (HTTP) -- a system to link documents
- Uniform Resource Locators (URLs) -- a scheme to address and thereby locate specific nodes of information.

Together, these three innovations transformed the landscape of digital communications, allowing information to flow much more easily across computer networks and raising the possibility that a new crop of users -- beyond the scientific and academic community - - would be tempted to go on-line.

Origins of the Internet - 4

- 1993 – Development of Mosaic – the first web browser by Marc Andreessen
- 1994 – Development of Netscape Navigator – an upgraded version of Mosaic
- 1996 – Development of Internet Explorer by Microsoft

Intrigued by the potential of Berners-Lee's innovations, Marc Andreessen and some friends began to think about that next stage -- how to hook graphics and multimedia into the network *{and also make them run seamlessly to the user across a much wider set of computers}*. The result was Mosaic -- the first Internet browser.

Mosaic & Navigator - The development of Mosaic led to the creation of Netscape in 1994 -- an event which took Microsoft by surprise. Founded by Marc Andreessen and Jim Clark, founder of Silicon Graphics, Netscape was a classic Hi-tech startup. It had no money, no reputation, and one truly ingenious product -- the web browser formerly known as Mosaic but modified and renamed as Netscape Navigator in December 1994. Within a year, Netscape was worth \$7 Billion. !! By April 1995, the company had distributed 6,000,000 copies of Netscape Navigator and had captured 75% of the exploding Internet market. The following year, its market share hit 90% with revenues of \$346,000,000.

Internet Explorer - By this time, Microsoft began to take notice. On December 7, 1995, Bill Gates convened an all-day meeting of analysts, journalists, and leading Microsoft customers and announced that the company would do whatever it took to dominate the Internet market. Gates announced that Microsoft would make web browsers and web servers an integral part of its business and would distribute all of its web browsers and Internet services for free. In February 1996, Microsoft created an Internet Platform and Tools Division -- a 2500 person group charged with developing net products. By 1996, they had developed Internet Explorer 3.0 -- a browser that had the look and feel of Netscape Navigator. Microsoft also began bundling Internet Explorer with all computers using a Windows operating system. The result was that Internet Explorer became the dominant web browser.

Intellectual Effects of the Internet - 1

- Made anyone with Internet access both a potential publisher and broadcaster
- Changed how people access and get information
 - Enabled people to obtain information not available in most news media outlets or libraries
 - Enabled people to seek out controversial issues and topics that are ignored by the mass media
 - Abolished information gatekeepers
- Fostered the rapid circulation of information, rumors, and misinformation

Publisher & broadcaster – In the words of Charles Jonscher in his *The Evolution of Wired Life*, “The Net has removed the asymmetry, the yawning divide, between producer and consumer, and this is indeed a completely unprecedented feature in any mass !! medium. On the World Wide Web each of us can be a publisher and a broadcaster as well as a reader and a viewer All Internet subscribers who take the trouble to put a page up on their website, whether a political manifesto or just a smiling passport photograph to let the world know what they look like, are publishers with a global reach of millions of readers.”

Information Gatekeepers - Up until a decade ago, news-magazine editors and nightly news producers were information gatekeepers whose decisions strongly influenced what viewers could see and hear. Viewers now can seek out controversial images on the Internet even if mainstream news outlets avoid them. Now, there is ‘a moral vacuum as the feeds go online,’ says Jonathan Zittrain, an assistant professor at Harvard Law School. ‘It has diluted somewhat the agenda setting power of the mainstream media.’

Rumors – As Thomas Friedman notes, “At its best, the Internet can educate more people faster than any media tool we've ever had. At its worst, it can make people dumber faster than any media tool we've ever had. The lie that 4,000 Jews were warned not to go into the World Trade Center on Sept. 11 was spread entirely over the Internet and is now thoroughly believed in the Muslim world. Because the Internet has an aura of "technology" surrounding it, the uneducated believe information from it even more. They don't realize that the Internet, at its ugliest, is just an open sewer: an electronic conduit for untreated, unfiltered information. “

Intellectual Effects of the Internet - 2

- Led to the migration of intellectual content from the printed page to the web
 - Many academic journals and other publications are now published only online
 - Many publications now have an online as well as a printed version
 - News magazines such as *Time* and *Newsweek*
 - Newspapers such as the *New York Times*, *Washington Post*, and *Los Angeles Times*

As on-line reference works proliferated, the Encyclopaedia Britannica reduced its famous door-to-door sales force from 2,300 to 0 in seven years. Since 1996, the electronic versions of the encyclopedia – CD-ROMs, DVD disks, and the Website – have been the company's main source of revenue. According to Tom Panelas of Britannica.com, in many cases the e-versions are preferable. You can search for a word or a phrase in the whole text, link some encyclopedia entries to others, and link entries to helpful websites. "Subtext: This hard-bound compilation of human wisdom, reknown since 1768, is dead and gone forever." The venerable Oxford English Dictionary moved online in the Spring of 2000.

Intellectual Effects of the Internet - 3

- Allowed the reader to intervene in the text of a book or article by:
 - Altering the visible format of the text
 - Linking to related information (such as a definition, a picture of an object, an extended discussion of a point, or a related subject) in other texts
 - Making annotations and comments on the text
- Brought the incipit back to life in the form of the URL
 - It thus returned printed text to the status of the Medieval manuscript

Economic Effects of the Internet - 1

- Enabled formerly local markets to become national and even international markets by
 - Diminishing the costs of acquiring needed market information
 - Allowing auction sites such as e-Bay to turn local flea markets into a worldwide community of potential buyers and sellers

Local to international markets - Information is essential for a market to expand in scope. Sellers must be able to identify potential customers and persuade them to try their products. Sellers must also be able to communicate with, and monitor the behavior of, their agents in remote parts of the distribution chain. Buyers, for their part, need some way to identify the product that best suits their needs. They must also feel confident that the local sales agent can speak and act on behalf of the manufacturer. Even if transport costs were zero, markets could remain highly localized unless buyers and sellers had some means of accomplishing the above tasks. The global communications revolution has given buyers and sellers the necessary means.

Economic Effects of the Internet - 2

- Ended the economics that result from poor matching of supply and demand
 - Poor matching of supply and demand reflected both the limited shelf space for storing physical media and the need for a local audience or market
 - The Internet allowed for virtual stores with infinite shelf space and real-time information about sales trends to emerge
 - Thus, virtual stores like Rhapsody and Amazon.com made it profitable to sell long-tail items

Before the Internet - Prior to the Internet, the selling of books, movie admissions, and CDs/DVDs, and similar entertainment items faced two limitations. The first is the need to find local audiences. An average movie theater will not show a film unless it can attract at least 1,500 people over a two-week run; that's essentially the rent for a screen. The second is limited shelf space. An average record store needs to sell at least two copies of a CD per year to make it worth carrying; that's the rent for a half inch of shelf space. And so on for DVD rental shops, videogame stores, booksellers, and newsstands. In each case, retailers will carry only content that can generate sufficient demand to earn its keep. But each can pull only from a limited local population - perhaps a 10-mile radius for a typical movie theater, less than that for music and bookstores, and even less (just a mile or two) for video rental shops. It's not enough for a great documentary to have a potential national audience of half a million; what matters is how many it has in the northern part of Rockville, Maryland. In the tyranny of physical space, an audience too thinly spread is the same as no audience at all

The Internet & product demand - To get a sense of product demand, unfiltered by the economics of scarcity, look at Rhapsody, a subscription-based streaming music service that currently offers more than 735,000 tracks. Once you go below the top 40,000 tracks, which is about the number carried by the average real-world record store, the number of Rhapsody tracks streamed at least once a month included the top 400,000. As fast as Rhapsody adds tracks to its library, those songs find an audience, even if it's just a few people a month, somewhere in the country. Take books: The average Barnes & Noble carries 130,000 titles. Yet more than half of Amazon's book sales come from **outside** its top 130,000 titles. Consider the implication: If the Amazon statistics are any guide, the market for books that are not even sold in the average bookstore is larger than the market for those that are. The average Blockbuster carries fewer than 3,000 DVDs. Yet a fifth of Netflix rentals are outside its top 3,000 titles. Rhapsody streams more songs each month **beyond** its top 10,000 than it does its top 10,000. In each case, the market that lies outside the reach of the physical retailer is big and getting bigger. Thus, **there is a large market for items not in the supply chain. With the Internet and virtual stores, it becomes possible to meet long-tail demand.**

Economic Effects of the Internet - 3

- Facilitated commerce by reducing transaction costs
 - Permitted disintermediation
 - Enabled airlines to dispense with travel agents
 - Gave rise to direct sell websites like Expedia, Priceline, & Travelocity
 - Reduced paperwork costs
 - Airlines reduced the costs of processing an airline ticket from \$8 to \$1 by substituting e-tickets for paper tickets

Economic Effects of the Internet - 4

- Facilitated the rise of offshore banking
 - Online banking permitted banks and financial institutions to establish themselves in countries with minimal or no regulations
- Facilitated the rise of global back offices
 - Enabled sites in Third World countries to perform such functions as transaction data entry, payroll and bill processing, insurance claims processing, etc

Economic Effects of the Internet - 5

- Allowed banks to replace tellers with online banking and automated teller machines
 - Allowed people to purchase airline tickets, books, and other online
 - Hurt brick-and-mortar bookstores
 - Drove travel agents out of business by allowing people to book their own trips
 - Replaced the newspaper ad with online ads at Craigslist, eBay, and other similar websites

Economic Effects of the Internet - 6

- Altered the economics of information production & dissemination
 - Eliminated such large fixed costs of information production as printing presses & TV studio equipment
 - Eliminated the marginal costs of paper & ink
 - Eliminated the costs of transmission & distribution
 - Eliminated or reduced many traditional sources of revenue for information content producers
 - This has greatly affected newspapers and magazines by eliminating subscription sales and diminishing advertising revenues

Social Effects of the Internet - 1

- Fostered Exhibitionism
 - Allowed people to turn their lives via camcorders and the Internet into web spectacles
- Allowed people to assume virtual identities
- Facilitated access to Pornography
 - Porn pioneered the use of streaming video, Java-based methods of video transmission, and encryption for secure credit card purchases
 - Accelerated the decline of sex magazines

Exhibitionism - If anything, the Internet was even more accommodating than the video camera to life movie performers. Exhibitionists converted their lives into entertainment and placed themselves on the other side of the glass by mounting camcorders on their PCs that recorded their every move. Anyone who logged onto the site could then view the on-going drama or lack thereof in the individual's daily existence. I.e. Life the TV show.

Virtual identities - Individuals could log onto chat rooms or interactive games and construct their identities and write their plots from whole cloth, creating virtual lives.

Pornographers – According to Eric Schlosser in his *Reefer Madness. Sex, drugs, and cheap labor in the American black market*, “The distribution of pornography through the Internet has indeed soared in recent years. Porn has once again been at the forefront of technological innovation, pioneering the use of streaming video, Java-based methods of transmitting footage, and encryption for secure credit card purchases via the Internet.!! Americans now spend about \$1 billion a year for online pornography. Surfing the Web to view explicit images or to chat about sex with strangers has become a daily routine for millions. In 1997 perhaps 22,000 Web sites offered sexually explicit images for free; today the number is closer to 300,000. In 2000 a survey found that 31.9 percent of the nation's men and 10.5 percent of its women had visited a sexually oriented

Social Effects of the Internet - 2

- Created bonds between ordinary citizens of different states
- Enabled individuals with specialized or ideosyncratic interests to find each other, communicate with each other, exchange information, and coordinate their activities

Citizens of different states - For the first time in history, it is easy for average residents of one state to develop strong interests and common bonds with those of other states.” Thus, a member of Greenpeace in the American northwest may have more in common with another Greenpeace member in Germany than with the logger who lives next door. Using email, web sites, and inexpensive long distance, they may actually communicate more often with each other than with their neighbors.

Specialized interests - If you want to become expert in Polynesian garment making of the 17th century, you can not only do so, but find many others interested in precisely the same thing. The Internet enables us to communicate with people who share our interests precisely -- not just other BMW owners but owners of BMW 2002s - - regardless of where they live and what other interests they and we have.

Social Effects of the Internet - 3

- Affected the nature and quality of human interaction
 - Transmits much less non-verbal information than face-to-face communication
 - Replaces high quality relationships in the real world with low quality virtual relationships
 - Permitted human relationships to transcend the limitations of geographic proximity
 - People who don't know their next door neighbors now have online chats with people on other continents

Computer-mediated communication transmits much less nonverbal information than face-to-face communication. Computer-mediated communication omits the messages conveyed by our facial expressions, vocal intonations, postures, body movements, and gestures -- information that conveys key messages about our emotions, degree of cooperation, and trustworthiness. Moreover, face-to-face encounters provide a depth and speed of feedback that is impossible in computer-mediated communication. !! The poverty of social cues in computer-mediated communication inhibits interpersonal communication and trust, especially when the interaction is anonymous and not nested in a wider social context. Computer-based communication is more egalitarian, frank, and task-oriented than face-to-face communication. Computer-based groups are quicker to reach an intellectual understanding of shared problems -- probably because they are less distracted by 'extraneous' social communication -- but they are much worse at reaching a consensus and generating the trust and reciprocity necessary to implement that understanding.!! Computer-mediated communication works best when it overlays a physical community of face-to-face relationships. I.e. social capital is a prerequisite for, rather than a consequence of,

Political Effects of the Internet - 1

- Facilitated political mobilization
 - Enabled narrow coalitions and interest groups to use the Internet to find and mobilize sympathizers via targeted websites and email responses
- Enhanced the power of small sub-groups (such as dissenters or terrorists) vis-à-vis the State
 - Such groups can use the Web to obtain critical information, mount propaganda campaigns, solicit funds, recruit new members, and plan and coordinate actions

Political mobilization - It was a purely volunteer effort by the International Committee to Ban Land Mines, organized primarily over the Internet, that drove the treaty to ban land mines. Another purely volunteer effort created Linux as an alternative operating system to Microsoft. A volunteer effort organized over the Internet built the coalition of anti-globalization activists that shut down the WTO meeting in Seattle in 2001. Real-world conflicts such as the [Danish] cartoons controversy almost instantly echo in cyberspace. ... E-mails, blogs, and text messages have been used to press a boycott of Danish goods in Arab countries and a 'Buy Danish' campaign in the United States.

Vis-à-vis the State - The *Liberation Tigers of Tamil Eelam (LTTE)* in Sri Lanka are a potentially dramatic example of how modern technologies can sharply boost the power of destructive sub-groups relative to the state. !! The LTTE uses the Internet to support a world-wide state-of-the-art propaganda campaign and to organize the extraction of tens of millions of dollars from the Tamil diaspora. The LTTE pioneered in the battlefield use of off-the-shelf civilian technologies -- use of night vision glasses (to facilitate night operations), GPS signals (to accurately target projectiles), and

Political Effects of the Internet - 2

- Enhanced the power of networked small groups and individuals vis-à-vis state and large corporate bureaucracies by
 - Greatly reducing the information-gathering costs that previously favored large organizations over small ones
 - Enabling the superior coordinating and quicker decision-making capabilities of small entities vis-à-vis larger ones to exert their effects

Empowerment - The economist Ronald Coase found that the cost of gathering information determines the size of organizations. Thus complex tasks on a vast scale required organizational behemoths. The Internet changed that by driving the cost of information down to virtually zero. Consequently, lower information-gathering costs mean smaller organizations. When it cost a great deal to learn and know things – i.e. when transaction costs were very high – large corporations helped solve the problem of gathering and coordinating information by creating massive bureaucratic pyramids. Their job was to gather, validate, and store the information needed to coordinate all of the organization's activities. Now with internal communications networks and the Internet, small organizations and networked entities can now handle the necessary information coordination and do so much more quickly and cheaply. This has given individuals and small groups the capabilities that formerly only large organizations had.

Military Effects of the Internet - 1

- Changed the role of the combat camera operator
 - Before: Shot film for historical record and stock imagery
 - After: Shot digital imagery for near-real time dissemination to combat commanders, intelligence personnel, and public affairs officers
- Turned wars and insurgencies into contests of competing imagery as well as of competing combatants and weaponry

Military Effects of the Internet - 2

- Permitted the remote training of personnel in-the-field by the use of digital imagery, audio-visual production, and multimedia
 - Before: Trainers found out about a desired film or video via a published catalog, got film or video from a base VI facility, and since they got it days or weeks after order, had to plan ahead for it to use it in their course
 - After: Trainers can resort to on-line catalogs, order it over the web, and receive either a digital VI product over the web or a physical VI product via mail

A Note on Search Engines

- The ever larger numbers of web pages placed on the Web created a need for search engines so that users could find desired items
- Thus, the emergence of several search engines
- Problem: a typical search brings too many hits

Too many hits -Thus, a search on the term “Ronald Reagan” yielded 8, 800,000 hits. Searches on the term “radio” yielded 720,000,000 hits, the term “cell phones” yielded 84,900,000 hits, the term “quantum mechanics” yielded 5,000,000 hits, “Brandy Station battlefield” yielded 25,100 hits, and term “Joseph Nicephore Niepce” yielded 30,800 hits.

Google

- Linked user search terms to relevant ads
- Created an algorithm for rank ordering search results so the most important results ranked at the top of the queue
- Pioneered in machine translation
- Popularized the idea of digitizing all of the world's books
- Was a major player in the development of the concept of "cloud computing"

User search terms & ads – Google came up with the idea of ads that display only when directly relevant to a search term. The effectiveness of the ad could be measured because success was defined by the user clicking on the ad. As a result, Google's ads provided advertisers with a one-to-one match between an advertiser and a receptive viewer because the very act of submitting a search term provided precise information about what a user is thinking about, permitting a highly educated guess about a user's likely interest in an advertiser's product and freeing the advertiser of the inefficiencies of broadcasting a message to large numbers of people who would have no interest in the product. Initially in 2000, 85% of all Google searches resulted in no advertisements at all because the search had no relation to any commercial product or service offered by Google's advertisers. This approach was so popular with advertisers that Google's revenues grew from \$400 million in 2002 to \$16.5 billion in 2007

Google's Rank-ordering algorithm - What Google's software algorithm does is order web pages with the greatest authority at the top of the queue. To calculate authority for any given page, Google looks at the links for the entire web and notes which Web sites link

A Note on Blogs

- A “Blog” is a contraction of the term “web log”
- It is a website maintained by an individual who posts regular entries
 - These are usually news on a particular subject, commentaries on current events, personal online diaries, or rants
 - They allow readers to post comments on what has been blogged

Blogs have fostered partisan debate, focused the attention of the mainstream media on particular events or topics, and also contributed paranoid concepts and conspiracy theories to the public debate. Bloggers also serve as fact checkers and provide feedback about products. An example of the power of blogging was the Kryptonite bicycle lock. A blogger posted a comment on a discussion blog for bicycle enthusiasts informing people that the U-shaped Kryptonite lock could easily be picked with a Bic ballpoint pen. Two days later a blogger posted a video demonstrating how this could be done. Kryptonite attempted to pacify the situation by stating that its locks remained a ‘deterrent to theft.’ This press release, however, satisfied no one, prompting angry blog comments that were read by thousands of people. Five days after the initial blog, the crescendo of complaint caught the attention of the *New York Times* and the Associated Press, which each ran stories about Kryptonite’s problems with its locks and the bloggers’ comments. Three days later, the company finally announced that they would exchange any affected lock for free. This meant 100,000 new locks, which along with the associated shipping and handling expenses, cost the company \$10 million or 40% of its revenues.

A Note on Wikis

- A “Wiki” is a website that allows the easy creation and editing of any number of interlinked web pages
 - It is in effect a collaborate website of collaborately composed pages
- The most famous wiki and one of the ten most accessed web items is “Wikipedia” – the online encyclopedia
 - It s website is <http://www.wikipedia.org>

A Note on Social Networking Sites

- Social networking sites
 - Focus on building online communities of people who share interests or something else in common
 - Provide means to connect with friends, former classmates, or old acquaintances (usually via self-descriptive pages about oneself)
 - Provide a recommendation system by which links to others can be established
 - Two noted social networking sites are Facebook, MySpace, and Twitter

The Cell Phone

The Cell Phone

- Was anticipated in science fiction before becoming a product
 - Dick Tracy's wrist watch radio
 - Captain Kirk's beeping communicator
- Catered to people's desire to have portable, wireless phone service
- As time has gone on, the cell phone has acquired web access, photographic, and video capabilities
 - The laptop computer is slowly migrating to the cell phone

A Note about Cell Phones

- Cellular Telephone systems consist of
 - A large number of both receiver cells and low-power transmitters that relay local calls from one cell to another
 - A signal strong enough for the local phone company to relay it anywhere
- In 1985, there were 91,600 mobile phone subscribers in the U.S.; in 2000, there were 85,000,000; in 2005, there were 207,900,000

Effects of the Cell Phone - 1

- Did away with the phone booth and the public pay phone
- Made place irrelevant in terms of being able to receive a phone call
- Permitted live continuous contact between news organizations and reporters in the field
- Made possible the creation of IEDs that could be exploded remotely by the bomber setting off the bomb by a phone call

Effects of the Cell Phone - 2

- Broke down the line separating personal private space from public social space
 - Created the phenomenon of “absent presence” – being in a social space while completely ignoring one’s surroundings
- Contributed to traffic accidents
- Affected public opinion polling accuracy and sampling techniques

Absent presence - As the sociologist Erving Goffman observed in another context, there is something deeply disturbing about people who are "out of contact" in social situations because they are blatantly refusing to adhere to the norms of their immediate environment. Placing a cellphone call in public instantly transforms the strangers around you into unwilling listeners who must cede to your use of the public space, a decidedly undemocratic effect for so democratic a technology. Listeners don't always passively accept this situation: in recent years, people have been pepper-sprayed in movie theaters, ejected from concert halls and deliberately rammed with cars as a result of rude behavior on their cellphones.

Traffic accidents – As Paul Levinson notes, “Radio flourishes in kitchens, bathrooms, and cars, where hearing something unrelated to your eating, bathing, or driving works well. Television and cellphones with images do not work in cars, since the driver cannot afford to be visually or otherwise distracted. This is why even the entirely acoustic, non-visual traditional cellphone, unlike one-way radio, which does not entail conversation, must be used carefully by drivers.”

Polling techniques - Since the 1970s, pollsters have relied on sampling techniques based upon land-line telephone interviewing. The pollsters sample the public by randomly dialing telephone numbers in every region from a list of the area codes in that region and exchanges known to be