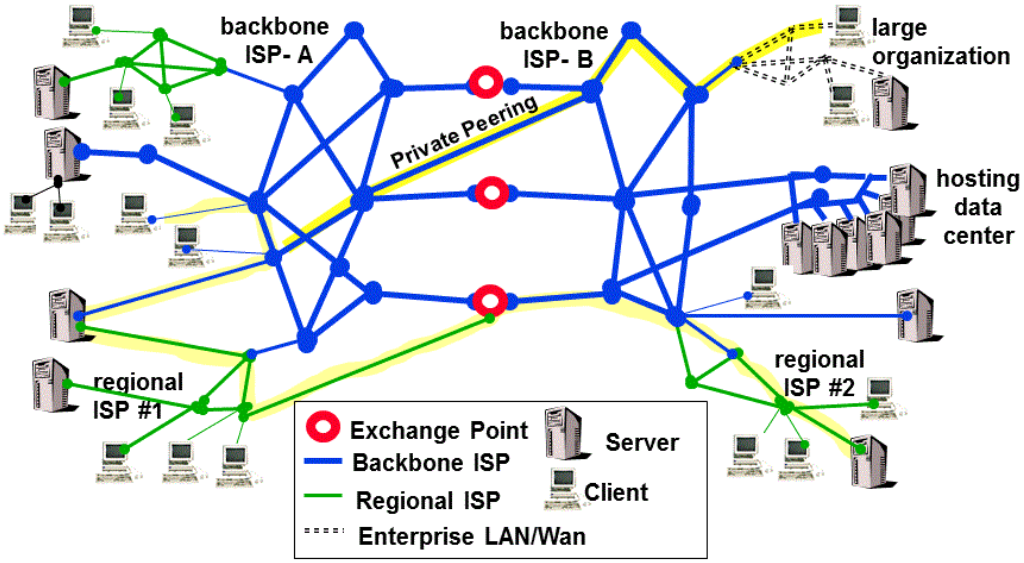
Birth of the Net

Worksheet 1 Reading Material

Before you start, read the following directions.

1. Read the questions in "Birth of the Net" section of the other handout so you know what to look for.
2. YOU MUST read ALL the information and then answer the questions. If you just "skim" to find the answers, I will NOT accept your assignment and you will get a 0%.
3. Repeat these steps for each section of questions.
4. This worksheet should take 45 to 60 minutes to complete.



Adapted from an old website called Learn the Net

Birth of the Net

The Internet has had a relatively brief, but explosive history. It grew out of an experiment begun in 1969 by the U.S. Department of Defense. The DoD wanted to create a computer network that would continue to function in the event of a disaster, such as a nuclear war. If part of the network was damaged or destroyed, the rest of the system still had to function. That network was called ARPANET (Advanced Research Projects Agency Network), which linked U.S. scientific and academic researchers, the forerunner of today's Internet.

NSFNET

In 1985, the National Science Foundation (NSF), an American research organization, developed NSFNET, a series of communication networks. Based on ARPANET protocols, NSFNET created a national backbone service, provided free to any American research and educational institution. At the same time, regional networks were created to link individual institutions with the national backbone service.

NSFNET grew rapidly as people discovered its potential and as new software applications made access easier. Corporations such as Sprint and AT&T; began to build their own networks that were then linked to NSFNET. NSF withdrew from the backbone business when commercial firms and other regional network providers took over the operation of the major Internet arteries.

NSF also coordinated a service called InterNIC that registered all addresses on the Internet so that data could be routed to the right system. This service is now administered by Network Solutions, Inc. and other Internet registration services in cooperation with NSF.

For a look at the Internet's major milestones, see The Roads and Crossroads of Internet History. Visit the the Computer History Museum's online exhibit of Internet history from 1962 - 1992.

Net Anatomy

Even though the Internet is a global network, in many ways it resembles a small town, with similar services.

Let's say you want to send or receive mail. The Internet has an electronic post office that allows you to communicate instantly--no stamps required. There are online libraries with free access to millions of books, magazines and newspapers that you can read any time of the day or night. Chat rooms are the Internet equivalent of 24-hour coffee shops, with people eager to gab around the clock. Instant Messaging or IM lets you communicate with friends and family whenever you want.

Social networking sites connect you electronically with folks across town or around the globe. The World Wide Web resembles a gigantic mall, where you can shop for almost anything. You can order a pizza, watch a movie, download music and meet and greet your neighbors. There are also online banks, where you can easily check your account and pay your bills. These are just a few of the services available on the Internet.

Getting Around Town

In the real world we use different types of vehicles for different purposes when traveling over the same roadways. For instance, you might use a car to commute to work and a truck to move furniture. The Internet works much the same way: different software applications accomplish different tasks: for example, a web browser to access news sites, an instant messaging program to communicate quickly with friends.

Some software, such as Google Chrome, Microsoft Internet Explorer and Mozilla Firefox, actually contain more than one kind of program. Although Internet Explorer is primarily a web browser, it also has a newsreader and a media viewer. (In later articles, we will explain what each of these programs do.) You can also use more specialized software, such as iTunes or Windows Media Player--stand-alone media players--and combine different programs together into a system that works best for you.

A Wired World

Now that you have an idea of some of the resources available on the Internet, explore how the Internet impacts modern life. The Pew Internet & American Life Project offers fascinating research.

Making Connections

If you are reading this online, undoubtedly you're already connected to the Internet. And if you're lucky, you have a high-speed DSL, cable or wireless connection. For those still tangling with older technology, we offer this admittedly dated information first written in 1996!

Modems

To go online your computer must be equipped with a modem, a device that translates the digital signals from your computer into analog signals that travel over a standard phone line. Those are the scratchy sounds you hear from a modem's speaker. Believe it or not, there is actually meaning in all that noise. A modem on the other end of the line understands it and converts the sounds back into digital information.

Modems come in different speeds and are measured in bps or bits per second. A 28.8 Kbps modem transmits data at speeds up to 28,800 bits per second. A 56 Kbps modem is twice as fast, sending and receiving data at a rate of up to 56,000 bits per second. Almost all modems today are at least 56 Kbps.

Faster is Better

Why does speed matter? On the Internet, you are constantly exchanging data with other computers. Some of these digital files can be quite large, especially for audio and video clips. As you will soon discover, you want this exchange to happen as quickly as possible.

Modems come in different speeds and can be installed inside your computer (internal), or connected to your computer's serial port (external). These days all new computers come equipped with an internal modem. But if you need to buy a modem for an older computer, consider purchasing an external one for two reasons. First, they are much easier to install. Second, occasionally your modem will freeze and needs to be reset. If your modem is external you can simply turn it off and on again. If it's internal, the only way to reset it is to turn off your computer and reboot, which can take several minutes.

Getting Wired

To connect an external modem to your computer, you'll need a serial modem cable. Most likely, your computer will have a connector on the back labeled serial, or with the IOIOIO icon. This connector comes in two varieties: 9-pin (male) or 25-

pin (female). If you only have one of these ports, it will probably be COM1. If you have two, one will be COM1, and the other will be COM2. After you plug in your modem, you can sign up for Internet service.

Usually your setup program will try and find your modem and its COM port. If it can't, it will ask you which COM port your modem is attached to. If you don't know, the easiest thing to do is try them all. Even if you only have two serial ports, you may be able to select one of four COM ports. Also, there are some other devices that use the COM ports. In some computers,the mouse is plugged into a serial port. This is known as a serial mouse. If you've got a serial mouse plugged into COM1, then just plug the modem into COM2. If you don't have a second COM port, you can purchase a card that goes inside your computer that will give you a second COM port. If this is necessary, you should check with the manufacturer of your computer.

Your modem will likely have a connector on the back with space for 25 pins. You need to make sure that the serial modem cable you purchase has the right number of pins on either side and is the correct "gender." The best thing to do is to look at the back of your computer and list the various connectors, the number of pins, and the gender. When you go to purchase your modem, find the cable that matches the connector.

Lastly, you'll need a standard phone cable to connect the modem to your phone line. The standard connector on a telephone cable is called an RJ-11. On the back of your modem, you'll probably have two RJ-11 jacks. One is for connecting the modem to a wall jack, and the other is for connecting the modem to a telephone.

Modems

Telephone lines were designed to transmit the human voice, not electronic data from computers. Modems were invented to convert digital computer signals into a form that allows them to travel over phone lines. Those are the scratchy sounds you hear from a modem's speaker. A modem on the other end of the line understands it and converts the sounds back to digital information that the computer understands.

It's True - Modem stands for MOdulator DEModulator.

Buying and using a modem used to be relatively easy. Not too long ago, almost all modems transferred data at a rate of 2400 Bps (bits per second). Today, modems not only run faster, they are also loaded with features like error control and data compression. In addition, modems also act like traffic cops, monitoring and regulating the flow of information. That way one computer doesn't send information until the receiving computer is ready for it. Each of these features--modulation, error control, and data compression--requires a separate kind of protocol. That's what some of the terms you see like V.32, V.32bis, V.42bis and MNP5 refer to.

If you need to replace a modem for an older computer, consider buying an external one, because it is much easier to install and operate. For example, when your modem freezes (not an unusual occurrence), you have to turn it off and on again to get it working properly. With an internal modem, that means restarting your computer--a waste of time. With an external modem it's as easy as flipping a switch.

Comparison of download timesBuilt for Speed

A modem's speed is measured in bits per second (bps). A 28.8 Kbps modem sends data at 28,800 bits per second. A 56 Kbps modem is twice as fast, sending and receiving data at a rate of up to 56,000 bits per second.

Many things can interfere with the speed of data transfer. These range from excessive noise on the telephone line, the speed of the web server from which you are downloading files, the number of other people trying to access the same file and the overall traffic on the Internet. Until the end of 1995, the conventional wisdom was that 28.8 Kbps was about the fastest speed you could squeeze out of a regular copper telephone line. Today, data transmission for a dial-up connection is typically 56 Kbps.

DSL

DSL (Digital Subscriber Line), a high-speed or broadband technology, has become increasingly popular. A DSL line remains connected to the Internet, so you don't need to dial up when you want to go online. Typically with DSL, data is downloaded to your computer at rates from to 1.544 Mbps to 512 Kbps; you can send data at 128 Kbps. Since a DSL line carries both voice and data, you don't have to install another phone line. You can use your existing line to establish DSL service, provided service is available in your area and you are within the specified distance from the telephone company's central switching office.

DSL service requires a digital modem and a network card in your computer. Prices for equipment, DSL installation and monthly service vary considerably, so check with your local phone company and Internet service provider. The good news is that prices continue to fall. In the U.S., expect to pay under $25 a month. Some companies now provide free installation and equipment when you commit to a year of service. For a detailed description of how DSL works and all the variations of the service, visit The Fast Guide to DSL.

Cable Modems

Another option is high-speed Internet access via cable TV. With speeds of up to 36 Mbps, cable modems download data in seconds that might take fifty times longer with a dial-up connection. Because it works over TV cable, it doesn't tie up a telephone line. Best of all, it's always on, so there is no need to connect and no more busy signals! This service is available throughout the United States, Europe and Asia. For an in-depth tutorial, visit How Cable Modems Work.

ISDN

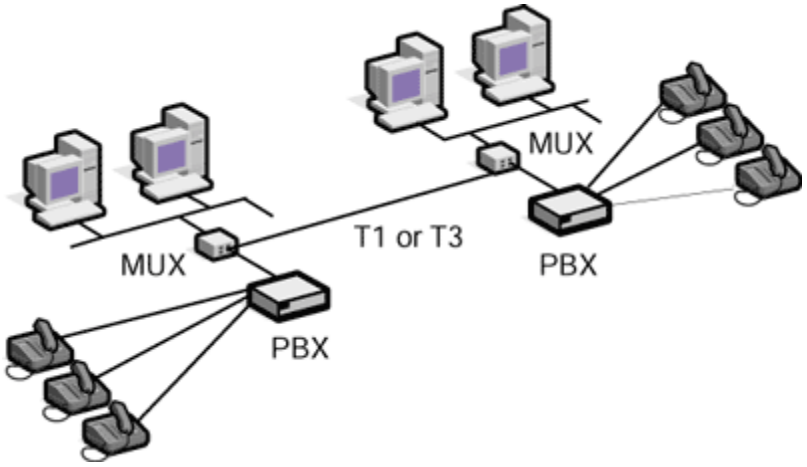
ISDN service is an older, but still viable technology offered by phone companies in some parts of the U.S. ISDN requires a so-called ISDN adapter instead of a modem, and a phone line with a special connection that allows it to send and receive digital signals. An ISDN line has a data transfer rate of between 57 Kbps and 128 Kbps. You have to arrange with your phone company to have this equipment installed. For more information, take the ISDN tutorial.

Making Business Connections

Leased lines come in two configurations: T1 and T3. A T1 line offers a data transfer rate of 1.54 million bits per second. A T1 line is a dedicated connection, meaning that it is permanently connected to the Internet. This is useful for web servers or other computers than need to be connected to the Internet all the time. It is possible to lease only a portion of a T1 line using one of two systems: fractional T1 or Frame Relay. You can lease them in blocks ranging from 128 Kbps to 1.5 Mbps. The differences are not worth going into in detail, but fractional T1 will be more expensive at the slower available speeds and Frame Relay will be slightly more expensive as you approach the full T1 speed of 1.5 Mbps. A T3 line is significantly faster, at 45 million bits per second.

Leased lines are expensive and are generally used only by companies whose business is built around the Internet or need to transfer massive amounts of data.

A very long time ago we used to have a T1 line at our school. We have since replaced it with a much faster connection that we will learn more about in the next section.



All About Broadband

The distinctive chatter of a dial-up modem is rapidly becoming a sound of the past as broadband sweeps the global. It's no mystery why when you consider the enormous benefits:

Save Time

Broadband operates from 10 to 20 times faster than a dial-up connection, enabling the speedy transfer of large amounts of data. Downloading a typical song takes a few seconds versus perhaps ten minutes with dial-up; e-mailing digital photos is almost instantaneous.

Save Money

There are lots of money saving broadband deals to be found. For example, If you now dedicate a second phone line for Internet access, you can cancel it. Broadband subscribers usually pay a flat monthly fee, avoiding hourly usage charges. In the long run, it may cost you less for broadband than for a dial-up account.

Convenience

With broadband you have instant Internet access, 24/7, so you don't have to connect each time you want to go online--you're always connected. This makes it easy to access information when you need it, check your e-mail, and even make phone calls over the Internet. Multiple computers can share a broadband connection, a great feature if family members want to be online at the same time.

New Services

Once you have high-speed Internet access, a new world of possibilities opens to you, such as telecommuting, videoconferencing, and Internet telephony. You can also listen to online radio and watch video-on-demand.

While all broadband services make dial-up seem glacial by comparison, not all deliver the same speed. Most broadband services are asymmetric, a fancy term that means that the download speed is faster than the upload speed. But since you will be downloading much more data, such as web pages, music and video, than you will be sending, your download speed is most critical. Depending on the type of service--cable, DSL, satellite or wireless--and other variables, broadband data speed range from 128 Kbps to a screaming 30 Mbps. (Since a three-minute song is

about 3 Mb, at the highest speed, you can download it in a fraction of a second--how cool is that?)

Broadband Choices

Now that you see all the benefits of a high-speed connection, here are four ways to go, depending on where you live and service availability.

Cable

If you have cable TV, your provider may also offer Internet access for an additional fee, typically $20 to $50 USD a month, depending on the plan. To access the service you need a cable modem, which is usually provided as part of the package. Cable can be speedy, ranging from 512 Kbps to 20 Mbps, but depending on how the cable system is configured, speed may decrease if many subscribers are online at the same time.

DSL

DSL, short for Digital Subscriber Line, employs an unused portion of your telephone line, so there's no need to install another one in your home or office. The service, which is typically provided by your local phone company, costs from $15 to $50 USD monthly for residential customers. To connect, you need a digital modem, usually provided by the phone company.

Since DSL service is delivered over a dedicated line, bandwidth is not shared with other subscribers as with cable. But connection speeds, ranging from 128 Kbps to 8 Mbps, depend on your distance from the local exchange. The maximum distance is about three miles (5 kilometers). If you live further than that, you can't hook up to DSL. Those living closest to the local exchange enjoy the fastest speeds.

Satellite

With satellite Internet access, you connect via the same satellite dish you use to receive TV programs. These systems can be one-way or two-way; with a one-way system, you download data via satellite, but you must upload via a dial-up phone line; with a two-way system, high-speed data is both sent and received via satellite. Satellite service requires substantial set-up fees and equipment and can cost up to $100 USD a month; speeds top 6 Mbps. For people in rural areas, where no other broadband service is available, satellite is an option, although an expensive one.

Just as bad weather may effect satellite TV reception, the same is true for Internet service. Also, because it takes time for the signal to travel to and from a satellite, you may experience a lag in data transmission, known as latency. In most cases, this is not a problem, except for aficionados of online gaming.

Wireless

This relatively new service delivers speedy Internet access via radio waves. WiFi is typically used in private wireless networks in homes and offices or in public places like airports or cafes. Speeds can reach 30 Mbps or more. To access the network your laptop must have a wireless PC card installed. The good news is that the number of WiFi hotspots is growing and many are free.

With a wireless router, you can set up a local wireless network in your home, so that you can use your laptop anywhere you wish. But you will still need Internet access with one of the above options.

Another recent development is Wide Area Wireless, which is similar to cell phone technology, except that it delivers Internet access. WAW can cover large areas, even an entire city. But unless you are lucky enough to live or work in an area where these wireless networks are deployed, you will have to settle for another option, at least for now.

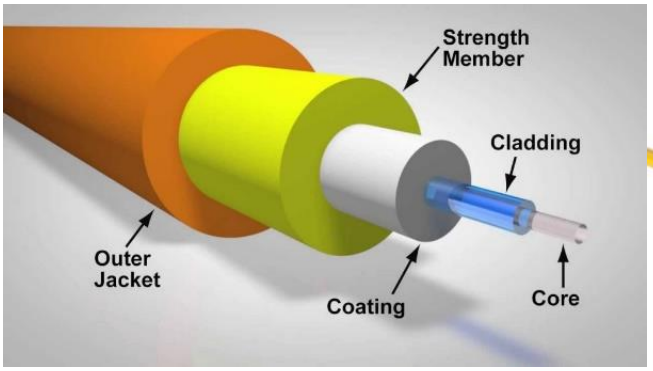
Fiber Optic Cables

Fiber optic cables are another way business have access to the internet. Instead of the copper wires that leased lines use, fiber optic cables use thin slivers of glass fiber that are protected by layers of thick plastic. You have probably seen them installing this in our community. The tubing that they run the fibers through comes on large spools and has large orange plastic tubing on it. Once the tubing is placed in the ground, they can then run the fiber optic cables through them.

Fiber optic cables allow the internet to travel at amazing speeds. We use fiber optic cables to get the internet to our school Our gigabit internet here at school will transfer 1 million bits in one second! In case you are curious, our school distict spends $100,000 a year for the internet for the entire school district!

As a comparison, here is how long it takes to download 1 gigabyte of data using the various internet connections:

- 56.6 Kbps modem – 41 hours!
- 1.5 Mbps DSL – 1 hour 31 minutes
- 20 Mbps Cable Modem – 8 minutes
- T3 leased line – 41 minutes
- 1 Gigabit (here at school) – 9 seconds!



Future Developments

Broadband and mobile broadband technology is constantly evolving. With people using smartphones, iPads and other tablet-based devices to go online, the future of "broadband" as we know it may become all but extinct.

This map shows us where a company called Level 3, a large company that is one of the key parts of the Internet's backbone, has their fiber optic cables buried.

The Future

When the World Wide Web began in 1990, few suspected how successful it would become. One estimate is that as of 2018, there were over 900 million websites and up to 60 trillion web pages. But as some people are well aware, the Web can be painfully slow for those who connect to the Internet using 56 Kbps modems over telephone lines. Because the data-carrying capacity of telephone lines, known as bandwidth, can be low, receiving large data files like video clips takes a long time. Fortunately new technology has addressed this problem.

Connecting to the Internet via DSL lines, cable, satellite and wireless networks increases bandwidth dramatically, making the Web much more useful. Increased speed has ignited an explosion of electronic commerce, video on demand, telecommuting, collaborative scientific projects, videoconferencing and virtual environments.

Internet2 World

The incubator for many of the emerging technologies shaping the future is known as Internet2. Formed in 1996 and administered by the University Corporation for Advanced Internet Development (UCAID), Internet2 is a partnership between universities, corporations and government agencies. It's a Petrie dish for networking experiments. The project's goals are to create new applications that can't run over the existing Internet and to develop the infrastructure that supports those applications.

Internet2 is a not a single network, but a consortium of hundreds of high-speed networks linked by fiber optic backbones that span the United States and links to other countries. The network transmits data at speeds up to 2.4 gigabits per second--45,000 times faster than a 56 Kbps modem-- allowing scientists to test their laboratory discoveries in the real world.

The next-generation network went online in February, 1999, linking a number of universities around the world. It should be available for commercial use soon. Then get ready for 21st century services like interactive television, virtual 3-D videoconferencing, and much more.

High-speed networks will make it possible for professionals to work in ways never before possible. For instance, scientists around the world can share specialized equipment like electron microscopes.

NASA has developed a Virtual Collaborative Clinic that connects medical facilities around the U.S., allowing doctors to manipulate high-resolution, 3-D images of MRI scans and other medical imaging. Not only can doctors consult and

diagnose, but they can simulate surgery by using a "CyberScalpel." Virtual surgery gives surgeons an opportunity to practice before ever entering the operating room, reducing the time required for the actual procedure. Using this kind of virtual technology, local hospitals can access resources and skills only available at larger institutions. NASA plans to use the technology to provide remote health care to astronauts on extended space journeys.

A Webbed World

While PCs were once the primary means of accessing the Internet, we're now seeing Internet-enabled devices such as netbooks, tablets and smartphones that send and receive e-mail and access the Web. Soon, everything from your car to your refrigerator will be connected to the global network, communicating with each other wirelessly. Electrolux, best known for its vacuum cleaners, has developed the ScreenFridge, an Internet refrigerator that manages your pantry, among other things. It e-mails a shopping list to your local supermarket and coordinates a convenient delivery time with your schedule. Say hello to a brave, new world.