Assignment #1:

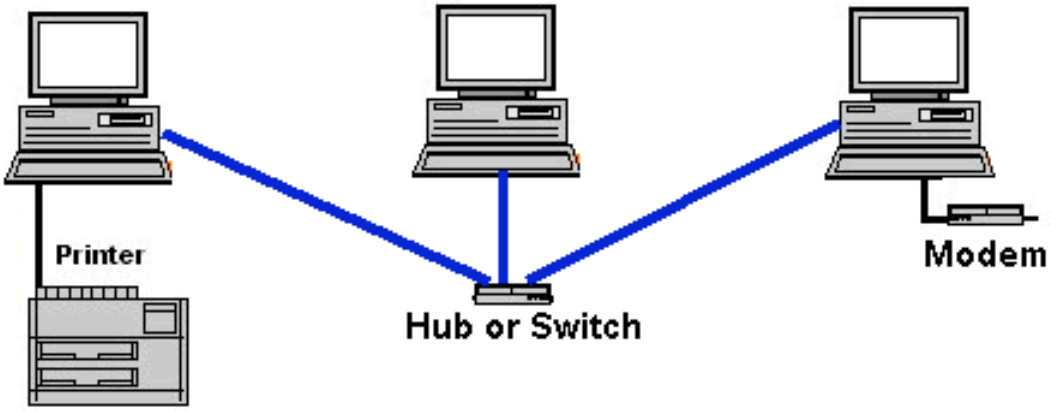
Explain in detail the differences between Client - Server, Peer to Peer, and Server - Terminal Networks and provide examples of the uses for each.

1. **Server-terminal network**. In this scenario, the user workstation a terminal is an input and viewing station, it is not handling the processing, the computing is being performed, or the application is running, on a server.
    a. Typically, a large number of terminals are connected over a Local Area Network LAN to a mainframe or mini computer or server. A dumb terminal needs to be connected to a terminal server which then connects to the Ethernet or token ring network.(Sheldon, 2001).
    b. The cost of a terminal workstation is low, but without a connection to the server, it cannot run software or store more that a modicum of data.
    c. The first library catalog systems in UH libraries depended on this type of network and as a result it was completely dependent on the server and the network connections for the terminal to be able to work.
    d. Computers can emulate terminals(Clayton, 2001) or behave like terminals and connect to servers like the Unix OS machines running the Blackboard software or a email program like PINE.
2. **Peer to peer network** is also referred to as p2p. In this situation, typically all the computer nodes are seen as equals and can behave as both client and server.
    a. This is usually a local area network. Napster is an example of how this network became more than local. ("How The Internet Works, Part II Power To The People's PCs," 2001)
    b. A peer-to-peer network may be used in an environment with few workstations or where there is no money to support central server. In this environment, each user can access information and or applications from other workstations in the network.
    c. My home has a peer-to-peer network through which we share printing, cd-rom burning and Internet access. The security on files on the individual machines done via sharing parameters and password.

d. This network set up, is simple, cheap, and very effective for small groups who are willing to share peripherals and when security allows share directly from and to their personal workstation.

e. The article that these pictures come from said peer to peer networks need special software to share a modem. The Airport must be providing that in the home network serving as a router/switch I believe this is still a p2p network since it has no server.

Peer-to-Peer Network



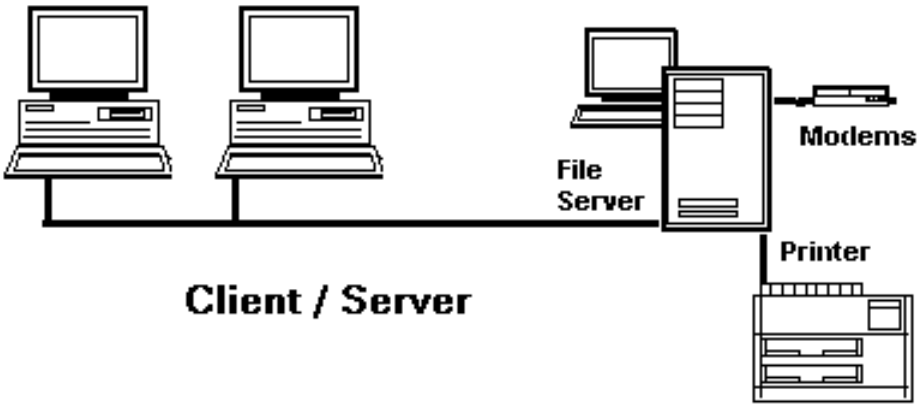
Sources: http://freepctech.com/pc/002/networks007.shtml (The NOSPIN Group, 2002)

3. **Client-server network.** The UH library system of today uses this type of network. In this situation, the client at the desktop is running software rather than having to access it off the server or another peer computer. The server, what was the large computer of the past, does some of the processing, but much of the procession power is distributed across the multiple workstations in the network.

a. The server may control access to a large shared database, printing and external connections.(Mastin, 2001) After years of the terminal server environment with dumb terminals this transition has made it possible to put a lot more power on the desktop.

b. One outstanding advantage is that now if the server or network connections go down, the workstations can work and just update the server when the connection returns. The advantage over not having to manually

input transactions once the network or server is back up, not having access to the main database is a disadvantage but much work can still go on.



(The NOSPIN Group, 2002)

Clayton, J. (2001). *McGraw-Hill illustrated telecom dictionary* (3rd ed.). New York: McGraw-Hill.

How The Internet Works, Part II Power To The People's PCs. (2001). *Smart computing Sandhills Publishing Company, 5*(2), 136-139.

Mastin, R. (2001). *Telecom & networking glossary: understanding communications technology* (2nd ed.). Newport, R.I.: Aegis Publishing Group.

Sheldon, T. (2001). *McGraw-Hill encyclopedia of networking & telecommunications.* Berkeley, Calif.: Osborne.

The NOSPIN Group, I. (2002, 2002). *Peer to peer vs. client server networks.* Retrieved June 5, 2003, from http://freepctech.com/pc/002/networks007.shtml

Well done and obviously well researched. The slight deduction is due to your lack of consideration of cost in any of this. We have talked about cost a number of times in the discussions and I would like to have seen you consider it here. Unfortunately, cost is the determining factor in most networking decisions and deciding on what type of network p2p, client/server etc. is often made not on what is the best match for the location but rather on what can be afforded.

Assignment #2

Discuss methods for designing a digital network that will require minimal changes when the need to increase the bandwidth of the network occurs. Provide specific examples and cost considerations.

When designing a network it is important to remember that you want to provide bandwidth and to do that you need a clean undistorted signal.

Even though the current situation may only need simple data transfer, like email and internet access, currently people are already using the network for chat rooms, audio (music) downloading, video and the future will only bring bigger bandwidth users such as virtual reality which needs, video and audio in an interactive environment.

The backbone of the network should be duplex multimode fiber optic cable since this will provide the best signal with little degradation even over long distances. A router will be needed to communicate with the ISP. At this time, the use is at a T-1 level. So that is the router you need, in the future this router can be upgrade to support the increased need but the fiber cable will still support the needs of the institution. At the University of Hawaii, we installed the first fiber optic cables about 17 years ago, and most of that original cable is still in use. Appropriate cable can be purchased from http://www.pcconnection.com 500 feet run about $349

The switches for the various network segments should support the current and growing needs. Switches can be purchased that support 10mbs and 100mbs. They can be set, to auto detect so that the maximum speed possible is delivered. If at this point all the wiring and computers are only supporting 10mbs it can be set to that, and later be reprogrammed to auto detect, or set to the higher speed.

Cabling to the workstations from the switches should be CAT5, so that it can support that 100mbs when the time comes. From http://www.pcconnection.com 500 ft of Cat 5 cable will cost under $100. 5 foot patch cables run about $3.

The switches and cabling to individual segments of the network can be upgraded independently to increase bandwidth as needed. The stable fiber backbone will provide the infrastructure that will hold up over time. (Riled, 97)

When the complete network needs to be upgraded, the ISP can be contracted for a T-3 or other appropriate expanded capacity and the router would need to be upgraded at that time.

It makes sense to buy good cheap equipment that meets the current needs and then upgrade this as necessary. The installation of the fiber optic backbone and design of the network so that the switches and routers connect directly to the backbone will keep bandwidth bottlenecks to a minimum and although the expense may seem high for fiber, it is well worth it. (Hrybyk, 2001). The local high school where my son attended, used coaxial cable at the backbone for the campus TV network, although this save money then, now we are having to replace it in it's entirety because it is not high enough quality to support the current bandwidth needs. One of the biggest 'expenses' of this is the extended down time of the complete network while it happens. Also all the node connections must also be changed.

For switches, examples from www.mwave.com: ALLIED TELESYN, INC. 8PORT 10/100BTX AUTO NEGOTIATING W/100BFX FIBER UPLINK should do the job just fine, these are under $200 for 8 ports with a fiber uplink
Alternatively, for lager segments: NET 10BT/100BTX 24-PORT CNSH2401 RACK MOUNT N-WAY SWITCH W/1-1000BFX (SC) FIBER PORT for $142, there are several sizes of these that would work. This supports, both older Cat,3,4 and 5 TP for the existing connections. For areas that have the Cat 5, when 200/100mbs is needed it will be ready to handle the load.

Hrybyk, M. (2001). *Re-Designing Networks, the Internet from a blank slate*. Retrieved June 15, 2003, from http://hp.bccna.bc.ca/Community/Conf2001/bcnetwebpowerpoint_files/frame.htm#slide0001.htm

Riedl, r. C., Shannon. (97). Impact North Caroline: 21st century education, update on progress and activity. *T H E Journal, 25*(5), 47.

Score 100

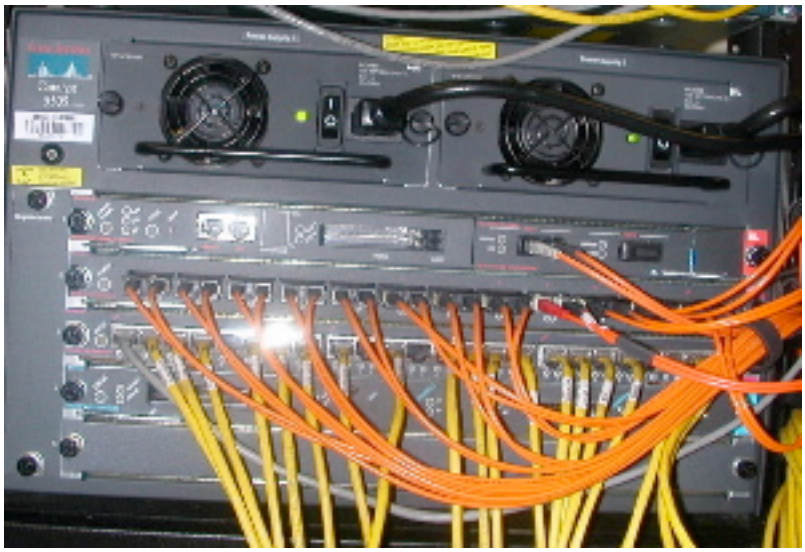
Well done RuthMarie. You seem to have a good grasp of what we are talking about. The reasoning is sound and the proposal would actually work. I like the fact that you seem to understand where to spend a little extra money and where to keep your costs to a minimum.

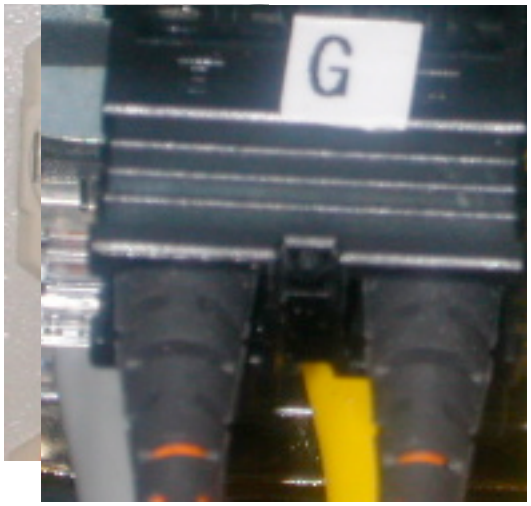
Assignment #3

Discuss establishing a network that connects several sites and the bandwidth requirements that exist based on the need to transmit both data and video from site to site.

The network that is connecting several sites on the UH Manoa Campus uses multimode fiber optic cable from each one of the sites. This is dedicated network. (Marconi, 2003)The multimode fiber is being used because the distances are long but less than 2 km, the need for bandwidth is high and because it is being used in public areas. Since it does not emanate a signal and it is not prone to interference, this seems the best media for the job.

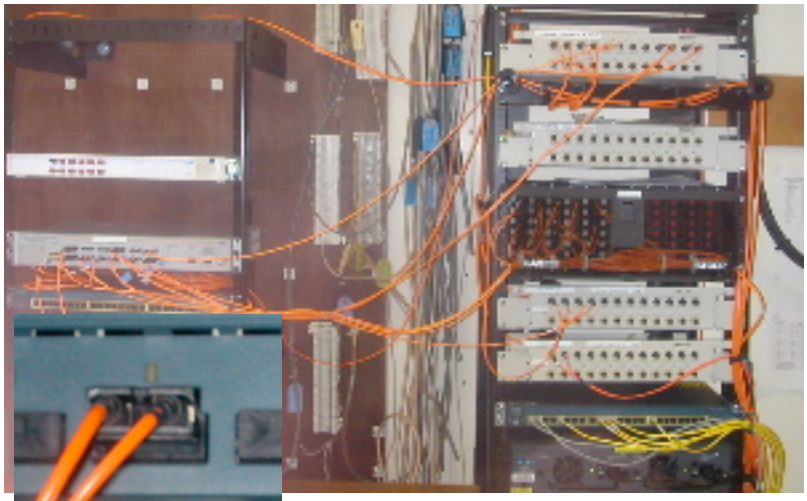
The multimode fiber connects into a modular unit that has a fiber 100base-FX switch and a fiber 100base router ($5800) and a copper cat-5 switch. All the servers go into the copper switch, which connect to the fiber switch that connects to the router.
In this picture of the modular unit. From the top down the 2 cables are the router connections out to the router in Webster hall, then a fiber switch for all the floors in this section of the building, then a copper switch to the servers in that room, then router it self and a open slot.





The fiber connectors are SC connector into the fiber switch, with ST connectors into the router. These 2 connectors are basically the same.(Stepanek, 2003)

These fiber switches (32 port) ($5000) and hybrid fiber switch and routers are expensive but since all the networks are fiber based the use of direct fiber connections without the media converter has been selected because the top consideration is maximum speed, bandwidth. (Thomas Sheldon, 2001).
One of the switches connects out to the campus wireless router, which can only support the slower video connections.



MT-RJ which has 2 fibers in one connector, http://www.cxtec.com/cables/guides/fiber.php#6 is used on the fiber that connects between the 100base-T routers (Tom Sheldon,

2002) this is done to allow for full duplex transmission and to minimize loss and latency.

One of the sites connects into the network with copper gigabyte link and goes to a media converter ($35) (**http://www.puredata.com/products/460164041.htm**) so that it can connect in the fiber router. In this area, this is the most cost effective way to handle this.

Thanks to Tom Ishimura from the UHM Libraries DNS division for the tour of the library data closets.

Marconi. (2003). *Web-based Wan Theory*, from http://www.marconi.com/html/education/webbasedwantheory.htm#l1

Sheldon, T. (2001). *McGraw-Hill encyclopedia of networking & telecommunications*. Berkeley, Calif.: Osborne.

Sheldon, T. (2002, 2002). *Linktionary networking defined and hyperlinked*. Retrieved June 2003, from http://www.linktionary.com/

Stepanek, L. (2003). '*Stab-and-Twist' or 'Stick-and-Click*' *Kinks and Hints*. Retrieved June, 2003, from http://www.sdmmag.com/content/kinksnhints/2002/1202/

Assignment #4

Discuss the need for network security in a school environment and provide examples of establishing groups and a directory structure that will provide a simple method of establishing this security.

Network security is critical in a school environment. Several groups need connections. The students save files, use applications for student work like email and print. These students should not be able to connect to the file servers or computers where the teachers store grades, tests and similar items. The teachers group needs to be able to store grades and update centralized records, and monitor students activities which includes being able to access their save files.

Another group is academic, and psychological councilors, teachers, administrators and students should not be able to access the records and communications of this group. The group may need to able to access the grade and attendance records stored by teachers so they can monitor the student's work. They may also need to monitor what the students themselves are writing and storing to make sure they are safe and doing well.

Administrators need to be able to monitor all activity, although some records and files held by the counseling staff may be kept confidential.

Setting up all these separate security groups is done by setting up Organizational Units and groups. I think of it as nested folders. The biggest folder holds all the others and if you have access to it, you can access everything inside it, and then it goes down, if you are in the innermost folder, you only have access to your own items (student files).

Every user can print to a specified printer and has access to send jobs to the printer, but they cannot view or control jobs unless they are their own (student). The system admin can see all print jobs and control them if necessary.

Applications are also available based on the necessary security; for example, students can get to email or MS office applications as can everyone else. Only the counselors can get to the IEP creation programs. Teachers and admin can get to the grades and test creation programs. This is done by setting the security for each one that is user specific.

I am looking at using Windows 2003 as the server software. To set up the security, set up 4 areas in your root, the Users data, the shared applications, the print spooler and the administrative programs. These could be 4 separate servers, which will increase the access speed.

Everyone gets a personal folder in the users data where they can store their documents. Set the permissions so that the user can only store documents in the users data, to keep them from leaving them on various computers. For the students we give them their passwords, for everyone else we set it so they set their password the first time they use it.

Some folders will be set up in the users data that will allow several people with common work projects to save their work in that shared place. This might include teachers of a particular class like all English teachers.

In the applications folder will be folder for each application and the users will be assigned access only if they need to use that application.

The print spoolers will also be organizational unit specific, so that the IEP are not printing where others can get them.

The administrative program section is controlled by the administrator. In the case of my library, this is where we would put the client software for all the desktop computers and software that we have multiple licenses or that are too big to use from the server. In this case we track were the copies are installed, and de-install and reinstall as needed, but make use that we stay within our license agreements.

I really understand this set up so much better after our discussions. I cannot wait to get the server software, so I can set it up correctly. Currently we have no real structure on my server. However, I know now how to take it apart and put it back together properly!