what is a networking cable.

*this is a study guide that was created from lecture videos and is used to help you gain an understanding of what is a networking cable.

Cabling

Coaxial cabling- Has small conductor in center, with insulator around it and then another conductor on outside. Keep in mind the name of the cable ex. RGB and the measurement, which is measured in Ohms'. Runs at 50 ohms

Type of Coaxial cables

RG58- also runs at 50 ohms, connector is BNC connector, T connector used to plug into NIC

Although coaxial isn't used much, cable modems still use coaxial cables.

RG6- 75 ohms, distinct with an F type connector which is screw in.

UTP and STP cabling-

Unshielded twisted pair has string made of kevlar and is used so you can pull it through pipe. The work is done through 4 pairs of wires inside of the cable. Networks are getting faster with the first running at 10mbps, and multiplying through powers of 10. Today networks work at 10 gbps. CAT is category rating and specifies the bandwidth the network cable can handle. The way to tell a CAT level is to read the cable itself. The number of twists per inch is how the CAT rating is measured.

CAT 3 designed to run at 16mhz, which is cycles per second. Megabits per second is the cables bandwidth. Used on 10mbps networks.
CAT 5 designed to run at 100mbps although had problems.

CAT 5E fixed cat5 problems and still runs at 100mbps
CAT 6 is a heavier cable and more twisted, also has a piece of tape to separate the different pairs
CAT 6A fixed cat6 problems and they both can handle 10gbps networks

RJ11 connector is used on telephone systems, it is a modular plug.
RJ45 connector has 8 connectors to handle 4 pairs of cabling

Shielded twisted pair has foil which acts a shield and goes onto an RJ45 connector itself, they are used when there is a lot of nice that can cause problems for UTP cables.

Fire ratings- There are 3 fire ratings with twisted pairs: PVC which is cheap plastic, riser which is designed to run between floors of buildings, and plenum is what we use the most and is fire retardant

Fiber optic cabling- has a fiber core, surrounded by cladding and has a cable jacket to protect the whole setup. There are two types: multimode and single mode. Multimode is designed to propagate light, orange color. Multimode carries LED light inside. Single mode is used to carry laser signals and designed to go long distances, yellow color.

Fiber optic runs off duplex.

ST connector are the earliest connectors, they are round, twist in and looks like a BNC connector.
SC connector are square and you punch them in. An FC connector screws in and looks like an ST connector.

LC connector are used a lot when you have a bunch of fiber optic cables.
MT-RJ connectors have two connectors and are popular high density connectors.

Polishing- PC connector is classic polich, UPC is more rounded and allows to propagate light better, the best connection is APC, which is an angled polished connector. You see APC when you want a good connection.

Ethernet

IEEE 802.3 is ethernet and is a standard on how to make an ethernet network. Developed in February 1980.

The ethernet frame has stayed the same since the beginning. Ethernet lives on MAC address. And the CRC is known as an FCS on ethernet. A frame will normally not be over 1500 bytes.

10Base5 is a version of 802.3, 10 is the speed, base (entire bandwidth has 1 channel) or broad (ethernet that runs like cable television), 5 is the length of the cable in meters. It is usually T, such as 10BaseT.

Early ethernet- most wired networks are ethernet, they have a switch with cables running to the hosts for ethernet nowadays. 10Base5 don’t exist anymore. Segmented ethernet has no switch and there is just one big cable. CSMA/CD stands for carrier sense multiple access/collision detection. A reflection occurs at the end of cables. Terminating resistors eat the signals at the end of the cables. 10Base2 has 200, well technically 185, meter segments. It has a BNC connector. At the end you would put a terminating resistor. Remove the resistor and place a T connector with cable into a NIC to make an extended 10base2 connection. It can handle 30 devices per segment.

10BaseT- Early ethernet ran the risk if the segment broke the entire network would drop, IBM made token ring to fix this issue and compete with ethernet, which used a box called MSAU instead of a bus like normal ethernet. Token ring was proprietary and it was expensive. Using cheap UTP inside a box created 10BaseT, which was an alternative to the expensive token ring. 10BaseT led the start of the topology that led to switch. 10BaseT runs at 10 mbps and 100 meters between switch and node and a maximum of 1024 nodes to one switch. It was designed to run on CAT 3 cable or better.

Modern Ethernet

Next generation of ethernet is 100Base; you can't tell if a fiber optic card or RJ45 connection is 10 base or 100base or something else. 100BaseTX is the same as 100BaseT. It runs at 100 mbps and has 1024 nodes per hub and is 100 meters from node to hub, and is meant to run on CAT5 or CAT5E.

There is also 100BaseFX or 100BaseF, and it has 1024 nodes per hub and runs on a multimode cable and runs up to two kilometers between the hib and any individual device.

What a switch does that a hub will not do is monitor the traffic going in and out of the connections, to determine the mac address of the device that is plugged into the end of each ports. When that happens, you can inspect the frame and can send to only the specific port. A hib will send it to every port. A switch can improve bandwidth on a network. A switch makes a point to point connection between to devices.

Half Duplex is when you can send or receive, but not at the same time. Being able to talk and listen or send and receive at the same time, is full duplex. Ethernet used to run only on half duplex. Full Duplex started with 100BaseT and on. It is now the standard.

Connecting Switches

If you have a 24 port switch that you are using and you need to expand your broadcast domain by bringing in another switch. Use patch cables: regular cable/straight through which is wired the same on each end, and a crossover cable, which is wired differently on opposite ends. When using a crossover cable, you can plug it in anywhere on the switch. An uplink port is pre crossover port and you can use a straight through cable to be in the crossover port.

Gigabit ethernet and 10 gigabit ethernet
Gigabit ethernet took us from 100mbps to 1000mbps,
Gigabit ethernet standards- 1000BaseCX- copper standard that uses twinax and 25 meters between switch and the node.
1000BaseSX uses multimode fiber optic and 500 meters
1000BaseLX is single mode fiber optic and 5 kilometers
1000BaseT- uses unshielded twisted pairs, runs with CAT 6 and 100 meters.

10GbE 10GBaseT- designed to work on CAT6 runs on 55 meters or CAT6A at 100 meter.
10GBaseSR- multimode cable, variable length based off cable 26 – 400 meters
10GBaseLR- long range on single mode, 1310 nano meter and 10 kilometers.
10GBaseER- single mode 1550 nano meter and 40 kilometers.
Both ER and LR are Single mode and difference is light wavelength

There is also a W version for all of these, such as 10GBaseEW but they are designed to work on a SONET networks.

Switch backbones- when interconnecting switches, you have to have a central switch that feeds outlying switches. Backbone- one high speed switch that only connects to other switches, switches on the outlying can run at different speeds.

GBIC are interchangeable devices that are designed to be moved in and out of switches, when you buy the right GBIC for your network then the switch can talk to anybody. Bridge loop can cause a network to come down, but spanning tree protocol (STP) doesn't allow it to. STP is within all switches. A port will shut off to get rid of any bridge loop. Improper cabling creates bridge loops.

Switches free us from the concept of daisy chaining.

Introduction to Structured Cabling

Troubleshooting-Structured-Cabling
An ethernet network is a switch connecting to a device with a cable. The cabling organization is called structured cabling. Structured cabling has 3 big components to it. There is a telecommunications closet or equipment room. Which has horizontal runs to your work area.

A patch panel is one end of the horizontal run. This is where you terminate. A patch cable is CAT6 or 6A and uses stranded core. You plug in the cable to the patch panel and then to the switch. Then another cable connects from a wall outlet and to each individual computer. TIA standards define the standard for structured cabling.

Crimping cables
Can be T568A or T568B,

How to make your own cable- strip off an inch of insulation to expose the wires
(Wire Color Order- *If color starts with B it never moves, green on bottom is 56A and if 568B then orange is on the bottom. 458B is more predominant.) -> untwist cables -> cut wires and leave half an inch -> put wires into crimp (once you crimp it, there is no way to un-crimp it!)

If you want to make a crossover cable, then all you have to do is make one side of the cable a 568B and once side a 568A!

It is easier and more convenient to buy the cables.

Punchdown blocks
100 punchdowns can be used instead of crimps, for each port there is a 110 punchdown. There is a CAT rating on every patch panel. You use a punchdown tool to punch down properly. There are 568A and 568B guidelines for punchdown blocks. Place the individual wire in the proper punchdown area -> punch into using punchdown tool

Equipment Room- 19 inch rack is standard for equipment racks which includes Main distribution frame (MDF), Intermediate Distribution frames, patch panel, primary switch, router, servers. A 'U' is a standard height for components in a rack.
Demarc- separates telephone and cable equipment from yours, you need to create demarc extension from the demarc into your offices cable modem.

Testing cable
Test cables for wiremaps, continuity, and distance.
Wiremap- checks to ensure all wires are punched into right place on the cable. It compares the pins on both ends.
Continuity- shows if wires are connected at all or if there any breaks.
Distance- use a Time Domain Reflectometer, which shows the lengths the cable and pinpoints breaks to ensure a cable is within a 90 meter TDR limit.

Troubleshooting Structured Cabling

Check connections through control panel and see network and sharing center to verify if you

can’t find connections. Go into device manager and check if is is enabled; check other network settings. Loopback is a plug that can test the network connection but are outdated. Patch cables are notorious for breaking, so check those! Also, replace the plug connecting the device and the patch panel.

Advanced troubleshooting structured cabling

If the switch goes down, then everybody in the network will go down. Check the electricity if everything is out in the equipment room. Use a voltage monitor to check and diagnose power, get a UPS to take care of those issues. You can use environmental and temperature monitors.

Try not to mess with the horizontal run after setup, use your TDR to find if there is a break or an issue.

UTP is susceptible to interference issues, verify it by paying someone to look for an interference issue in your cabling.

Modal distortion is when you have light down a fiber optic cable, Over time it will break down in multi mode cables. 9/10 most of the problems are not in the equipment centers itself.

Using a toner and probe

Which connection corresponds to an outlet; use a fox and hound or tone generator and tone probe. It generates a tone for you, so you can find specific cables and where they are connected. Tone generators create signal for the probe, an the probe translates the signal into an audible tone.