NETWORK CONFIGURATION

Cable Termination

Terminating unshielded twisted pair cables (UTP)

Ethernet cables are the most used UTP cables in Computer networking. These cables are categorized in various categories with each category having distinct features. The key distinguishing features for cable categories are; transmission speed and transmission distance.

The most used Ethernet cable categories are CAT 5e and CAT 6. CAT stands for Category

The table below shows Ethernet cable categories.

Ethernet Cable Performance Summary			
Category	Shielding	Max Transmission Speed (at 100 meters)	Max Bandwidth
Cat 3	Unshielded	10 Mbps	16 MHz
Cat 5	Unshielded	10/100 Mbps	100 MHz
Cat 5e	Unshielded	1000 Mbps / 1 Gbps	100 MHz
Cat 6	Shielded or Unshielded	1000 Mbps / 1 Gbps	>250 MHz
Cat 6a	Shielded	10000 Mbps / 10 Gbps	500 MHz

Cat 7	Shielded	10000 Mbps / 10 Gbps	600 MHz
Cat 8	Details to be released later		

Due to the higher usage of Ethernet cables, then Cable termination skills is a must have skill for every networking profession.

Ethernet Cables can be of two categories namely; Straight through and cross-over ethernet cables.

Straight Through Cable

Both ends have the same color coding. It is mainly used when two different devices are to be connected for communication purposes. If you try to use a straight through cable for two similar devices it will not work.

It can be used in either of the following connections

- PC to Switch
- PC to Hub
- Router to Switch
- Switch to Server
- Hub to Server

Color Coding for Straight Through cable:

There are two types of configurations namely T-568A and T-568B. The T-568B is the most commonly used standard. However, the T-568A will still work perfectly well. The key thing is to ensure that you use uniform standard in both sides of a straight through cable.

Straight-through cable

T-568A		T-568A
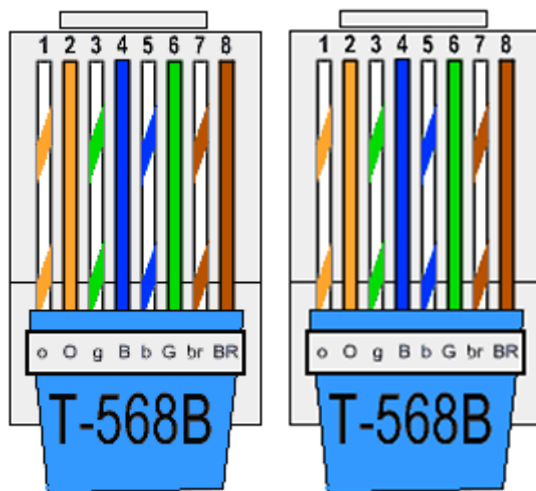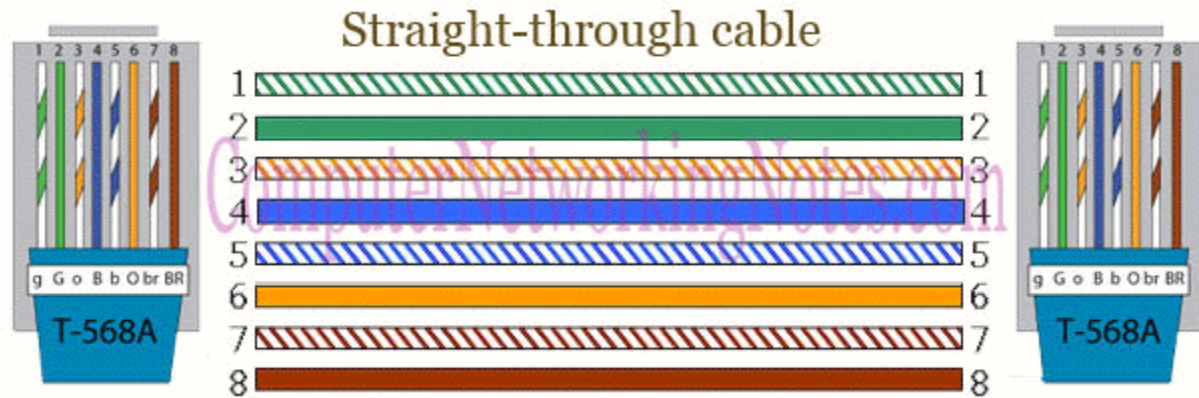
Cross-Over cables

It is used to connect similar devices. Cross over cables use different configuration standards in the two ends. i.e one end uses T-568 A while the other one uses T-568B

The cross-over cable is used to connect the following devices.

- Two computers

- Two hubs

- A hub to a switch

- A cable modem to a router

- Two router interfaces

Color Coding for Cross-over cable
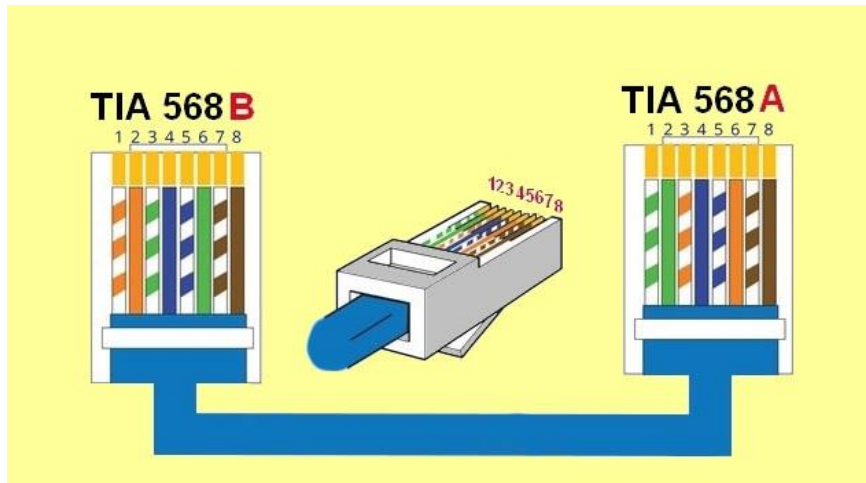
Steps Involved in Terminating Ethernet Cables

Step 1: Assemble Necessary Tools

Tools Needed to Perform Ethernet Cable Termination

- Wire Strippers – I recommend the IDEAL Telecomm/Datacom Wire Strippers
- Wire Cutters (Side Cutters will work)
- RJ45 Crimping Tool
- 2 - RJ45 Modular Data Plug (Ends)
- Bulk CAT6 Network Cable
- Ruler
- Testing tool

Step 2:

Using a <u>Crimping Tool</u>, trim the end of the cable you're terminating, to ensure that the ends of the conducting wires are even.

Step 3:

Using the coil of wire, pull the necessary amount of wire for the connection you need to make. Be sure to include an extra 2 inches on either end of the wire for the data plug.

NOTE: Network cables have a maximum length, depending on which type is being used. Although maximum length varies by manufacturer, a common rule of thumb is 650 feet for a CAT6 cable and 250 feet for a CAT5e cable. If the length of the wire between two powered network devices exceeds this length, signal degradation and data loss may occur.

TIP: Do your best to run the wire along the path it will follow between the two devices. Do not pull the cable tight between two points and be sure the cable is not kinked or tightly pulled around corners. The cable should have a little wiggle room.

TIP: If the location of the wire allows, consider including an extra length in the cable. This prevents having to make another cable if one device needs to move a short distance after the cable is made. One way of adding a short length to the cable is to wrap it around a closed fist 2 or 3 times.

Step 4:

Measure out 1.5 inches from one end of the wire and place the wire in the wire strippers at that location. The cable should be snug in the strippers, but not tight. For the recommended strippers, the second notch inward is appropriate.

Ensure the blade of the wire stripper is perpendicular to the wire and turn the wire stripper around the cable **once**, which will score the sheathing of the wire.

NOTE: Turn the wire stripper only once. Turning the stripper more than once increases the chance of cutting the sheathing of the inner wires. If the inner sheathing is cut, it can make the next steps more difficult or cause the wires to break.

Remove the wire stripper and gently bend the cable along the score line. This should break the sheathing which can be pulled off the wire and thrown away.

NOTE: As you become more experienced with making Ethernet cables, you may not

need to remove the full 1.5 inches of sheathing.

After the sheathing is removed, the bundle of 8 wires will be exposed as shown.

Step 5:

Separate the 4 twisted wire pairs from each other, and then unwind each pair, so that you end up with 8 individual wires. Flatten the wires out as much as possible, since they'll need to be very straight for proper insertion into the connector.

You can use a rod or even a pen to straighten the cables

Step 5:

Holding the cable with the wire ends facing away from you. Organize the wires from left-to-right using either T-568A or T-568B

Step 6:

Holding the RJ45 connector so that its pins are facing away from you and the plug-clip side is facing down, carefully insert the flattened, arranged wires into the connector, pushing through until the wire ends emerge from the pins. For strength of connection, also push as much of the cable jacket as possible into the connector.

Step 7:

Check to make sure that the wire ends coming out of the connector's pin side are in the correct order; if not, remove them from the connector, rearrange into proper formation, and re-insert. Remember, once the connector is crimped onto the cable, it's permanent. If you realize that a mistake has been made in wire order after termination, you'll have to cut the connector off and start all over again!

Step 8:

Insert the prepared connector/cable assembly into the RJ45 slot in your crimping tool. Firmly squeeze the crimper's handles together until you can't go any further. Release the handles and repeat this step to ensure a proper crimp.

If your crimper doesn't automatically trim the wire ends upon termination, carefully cut wire ends to make them as flush with the connector's surface as possible. The closer the wire ends are trimmed, the better your final plug-in connection will be.

Step 9:

Repeat the above steps on the other end of the cable. If you are making a straight through cable, ensure you use the same color-coding standard in both ends if you are making a cross-over cable use standard A on one side and Standard B on the other side.

Step 10: Testing the cable

Plug one end of the cable into the tester and the other end into the female jack that comes with the tester.
Every network cable tester has a display that tells you either "pass," "fail," or "open." If you get fail or open you know that the termination is not correct, or the terminal is not fully pressed into the tester.

A fail gives more precise information, in the tester I'm using it shows the order of the pins and whether or not your numbers match up with the tester's numbers.

If you get a "fail" and any of the pins (for example 1 and 4) are mixed up, the tester will show you which numbers are out of order. When you get a pass the tester also shows you the numbers on top match the numbers on bottom. This means you did everything correctly and you can move on.

Ethernet Cables DO's and Don'ts

Do: Cross Power the Cable at a 90-Degree Angle

If you do need to or happen to cross your data network cabling, they should be kept at a 90-degree angle in order to avoid interference.

Don't: Run Cable in Unsafe Locations

- At some point, you may need to run the cable in the ceiling or wall. Make sure the cable doesn't touch the ceiling tiles and do not run the cable over electrical conduit, water pipes, or any other pipes, as it is unsafe and may not pass inspection.

- Do not run any data cable beneath the floor.

Do: Use Different Color Schemes

- Separating cabling colors is convenient and keeps your data lines organized.

Don't: Bundle Cables Too Tightly

- Kinked cable can have a negative effect on the network and reduces the quality of the cable.

- Cables that are bound too tightly are difficult to troubleshoot, should there ever be an issue.

Do: Label the Cable

Ask yourself the following questions to help with the labeling process:

- Which location is the cable destined for?

- How was it terminated?

- Is the cable for Ethernet or a jack?

Don't: 'Over-Cable' Your Racks

Having too much cable in your data center will create excess heat, which isn't good as the racks need to stay cool.

Do: Use an Effective Wire Management System

- Use a safe and effective wire bundling device (**cable ties**) to organize patch cabling between racks.

- Space your wires out in a patch panel.

- Dress your cabling without diving or cable-crossing.

- Create a simple map layout of cable locations that will serve as a quick and easy reference for locating cable for repair or replacement.

Don't: Leave Wires Exposed by Terminations

Leaving the Ethernet cable wiring exposed by terminations runs the risk of damaging the wire inside the termination and can break inside the plug.