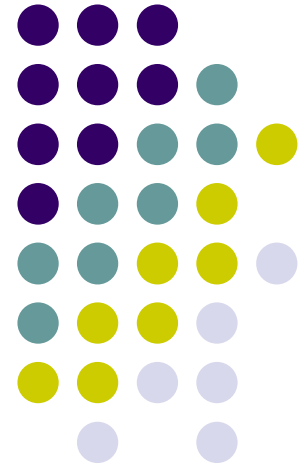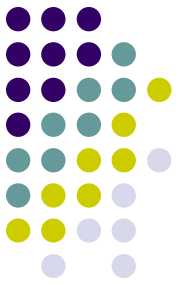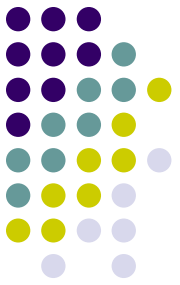# Network Cabling

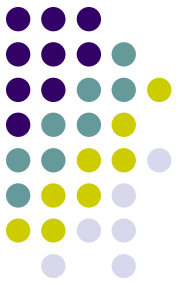## Making connections with Cat5/Cat5e

Overview

- What cable types are available?

- How do cables work?

- How are cables used in networking?

- How are connections made?

Learning Objectives

- List common cable types used in networking

- Describe how UTP cables are made

- Explain how UTP cables are used in Ethernet networks

- Demonstrate the ability to make a working patch cable

- Name the two wiring standards used for wired Ethernet networks and their uses
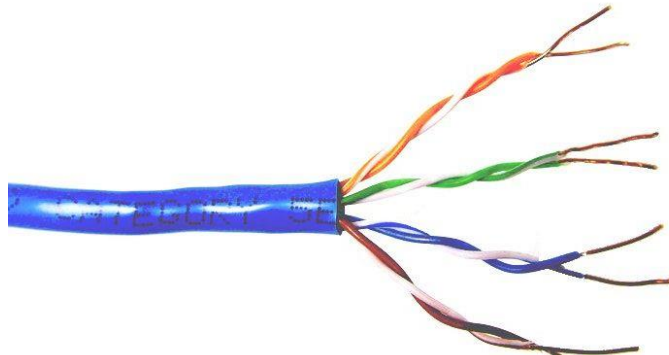
Common network cable types
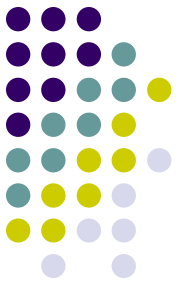
- Coaxial cable

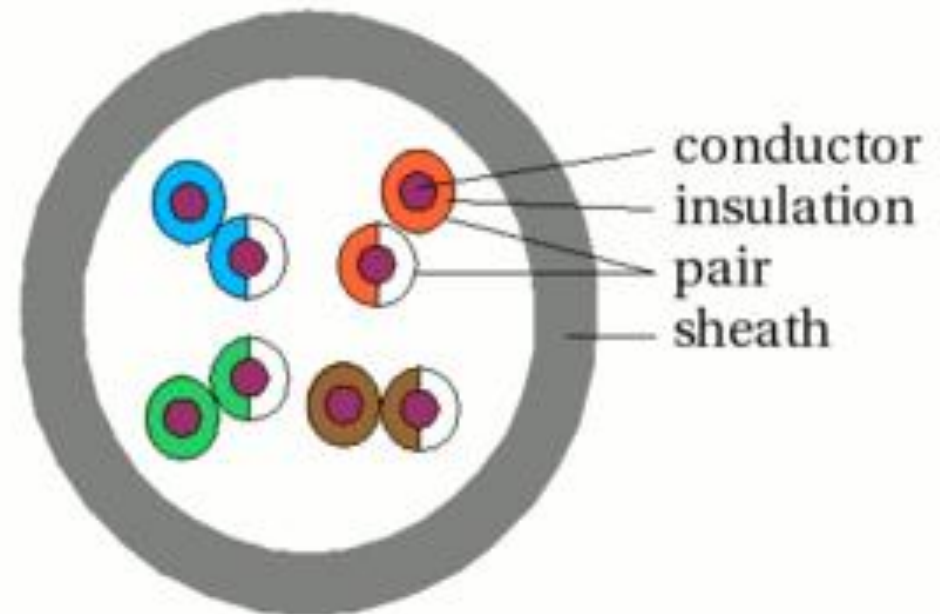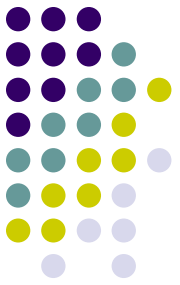- Unshielded twisted pair

- Fiber optic

UTP characteristics

- Unshielded
- Twisted (why?) pairs of insulated conductors
- Covered by insulating sheath

UTP
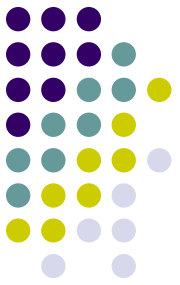
conductor
insulation
pair
sheath

# UTP categories

Category 1   Voice only (Telephone)

Category 2   Data to 4 Mbps (Localtalk)

Category 3   Data to 10Mbps (Ethernet)

Category 4   Data to 20Mbps (Token ring)

Category 5   Data to 100Mbps (Fast Ethernet)
Category 5e   Data to 1000Mbps (Gigabit Ethernet)

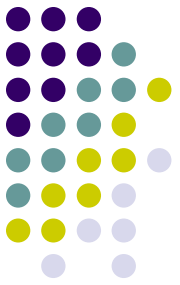Category 6   Data to 2500Mbps (Gigabit Ethernet)

Cat5/Cat5e cable

- 100/1000Mbps data capacity

- For runs of up to 90 meters

- Solid core cable ideal for structural installations (PVC or Plenum)

- Stranded cable ideal for patch cables

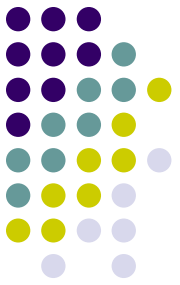- Terminated with RJ-45 connectors

RJ45 connector
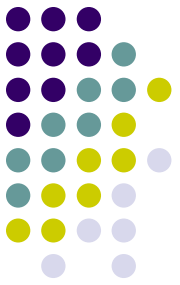
Making connections - Tools
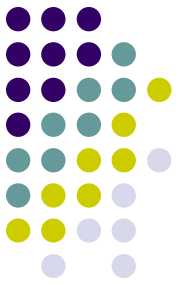
- Cat5e cable
- RJ45 connectors
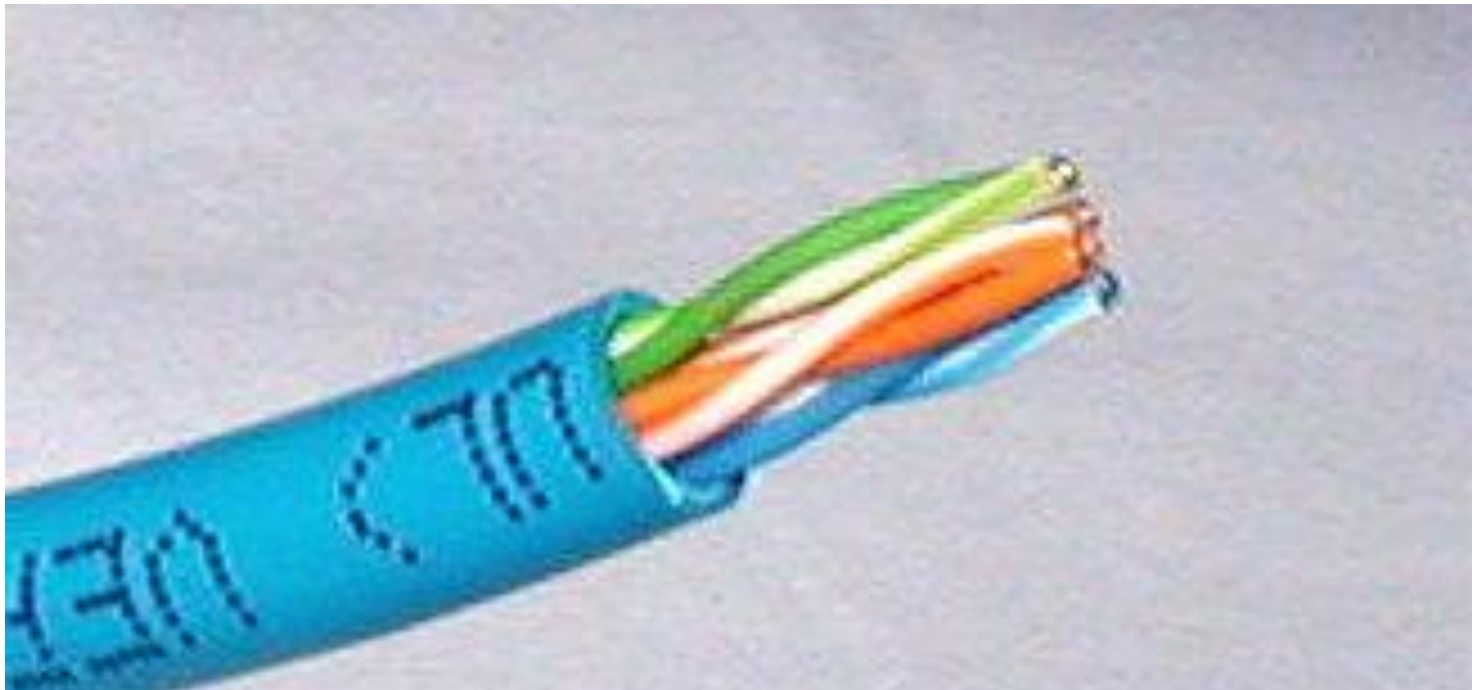- Cable stripper
- Scissors
- Crimping tool
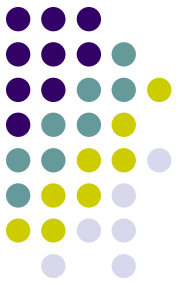
Making connections - Steps

1. Strip cable end
2. Untwist wire ends
3. Arrange wires
4. Trim wires to size
5. Attach connector
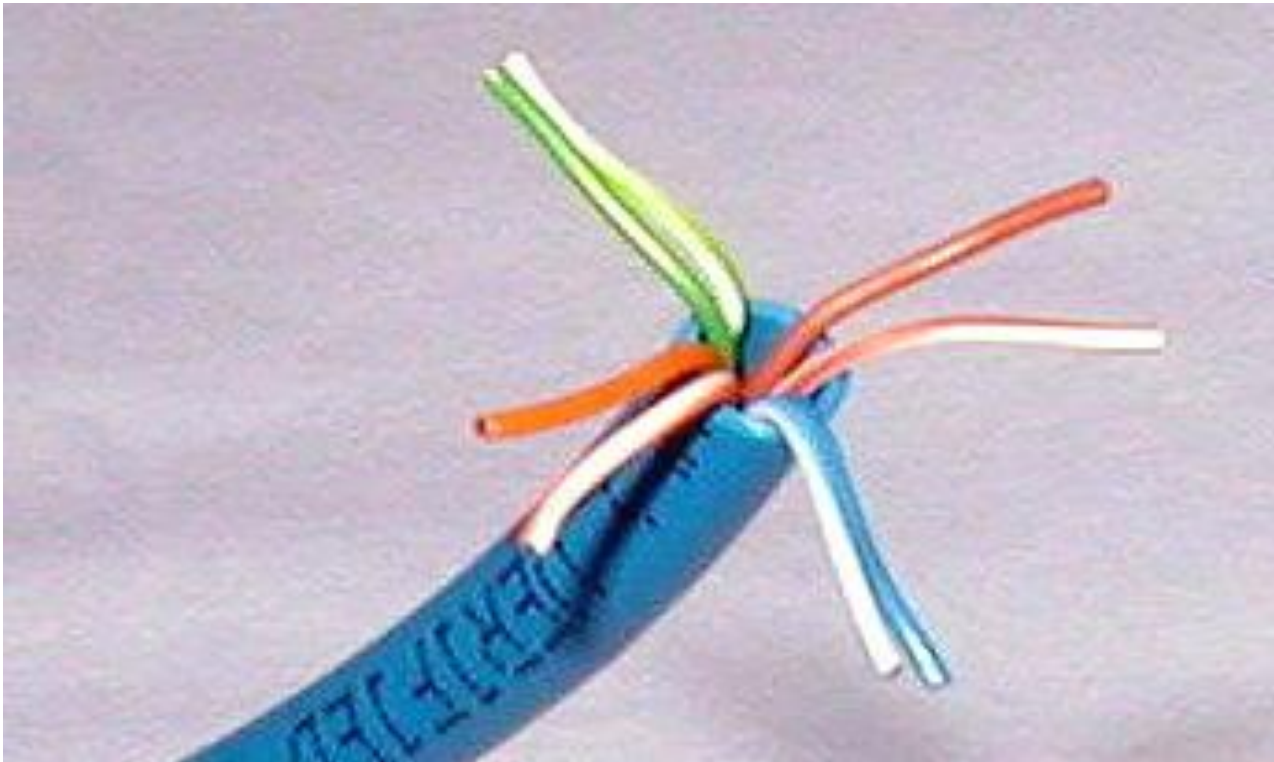6. Check
7. Crimp
8. Test

Step 1 – Strip cable end

- Strip 1 – 1½" of insulating sheath
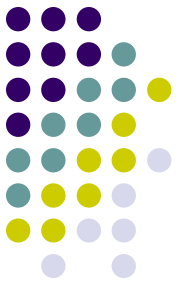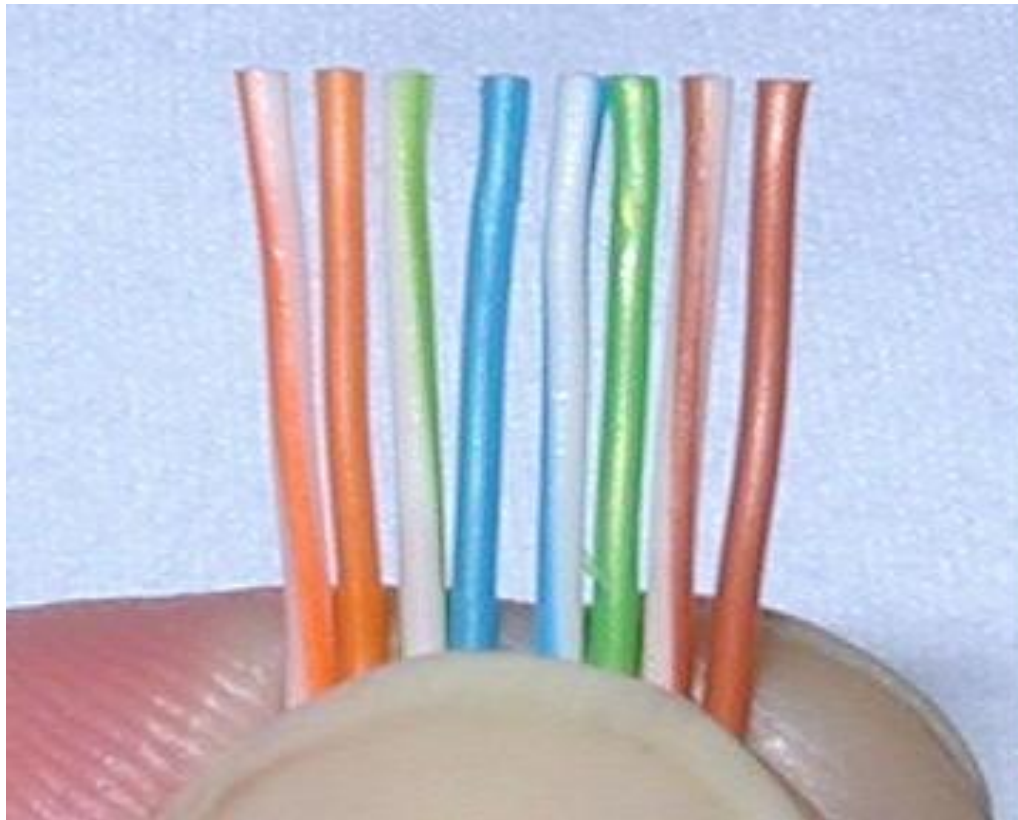- Avoid cutting into conductor insulation

Step 2 – Untwist wire ends

- Sort wires by insulation colors

Step 3 – Arrange wires

- TIA/EIA 568A: GW-G OW-Bl BlW-O BrW-Br
- TIA/EIA 568B: OW-O GW-Bl BlW-G BrW-Br
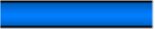
EIA/TIA 568A Ethernet UTP cable wiring diagram

Pin	Signal Name	Description	cable wire color	Name	Pin
1	TX+_D1	Transmit Data+	White with green strip	TX+_D1	1
2	TX-_D1	Transmit Data-	Green with white stripe or solid green	TX-_D1	2
3	RX+_D2	Receive Data+	White with orange stripe	RX+_D2	3
4	BI+_D3	Bi-directional+	Blue with white stripe or solid blue	BI+_D3	4
5	BI-_D3	Bi-directional-	White with blue stripe	BI-_D3	5
6	RX-_D2	Receive Data-	Orange with white stripe or solid orange	RX-_D2	6
7	BI+_D4	Bi-directional+	White with brown strip	BI+_D4	7
8	BI-_D4	Bi-directional-	Brown with white stripe or solid brown	BI-_D4	8
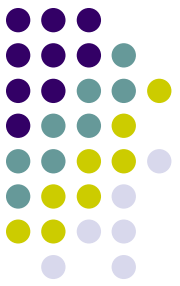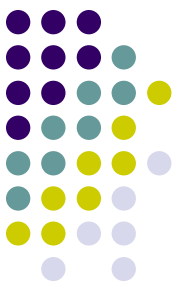
EIA/TIA 568B Ethernet UTP cable wiring diagram

Pin	Signal Name	Description	cable wire color	Name	Pin
1	TX+_D1	Transmit Data+	White with orange stripe	TX+_D1	1
2	TX-_D1	Transmit Data-	Orange with white stripe or solid orange	TX-_D1	2
3	RX+_D2	Receive Data+	White with green stripe	RX+_D2	3
4	BI+_D3	Bi-directional+	Blue with white stripe or solid blue	BI+_D3	4
5	BI-_D3	Bi-directional-	White with blue stripe	BI-_D3	5
6	RX-_D2	Receive Data-	Green with white stripe or solid	RX-_D2	6
7	BI+_D4	Bi-directional+	White with brown strip	BI+_D4	7
8	BI-_D4	Bi-directional-	Brown with white stripe or solid brown	BI-_D4	8

Step 4 – Trim wires to size

- Trim all wires evenly
- Leave about ½" of wires exposed
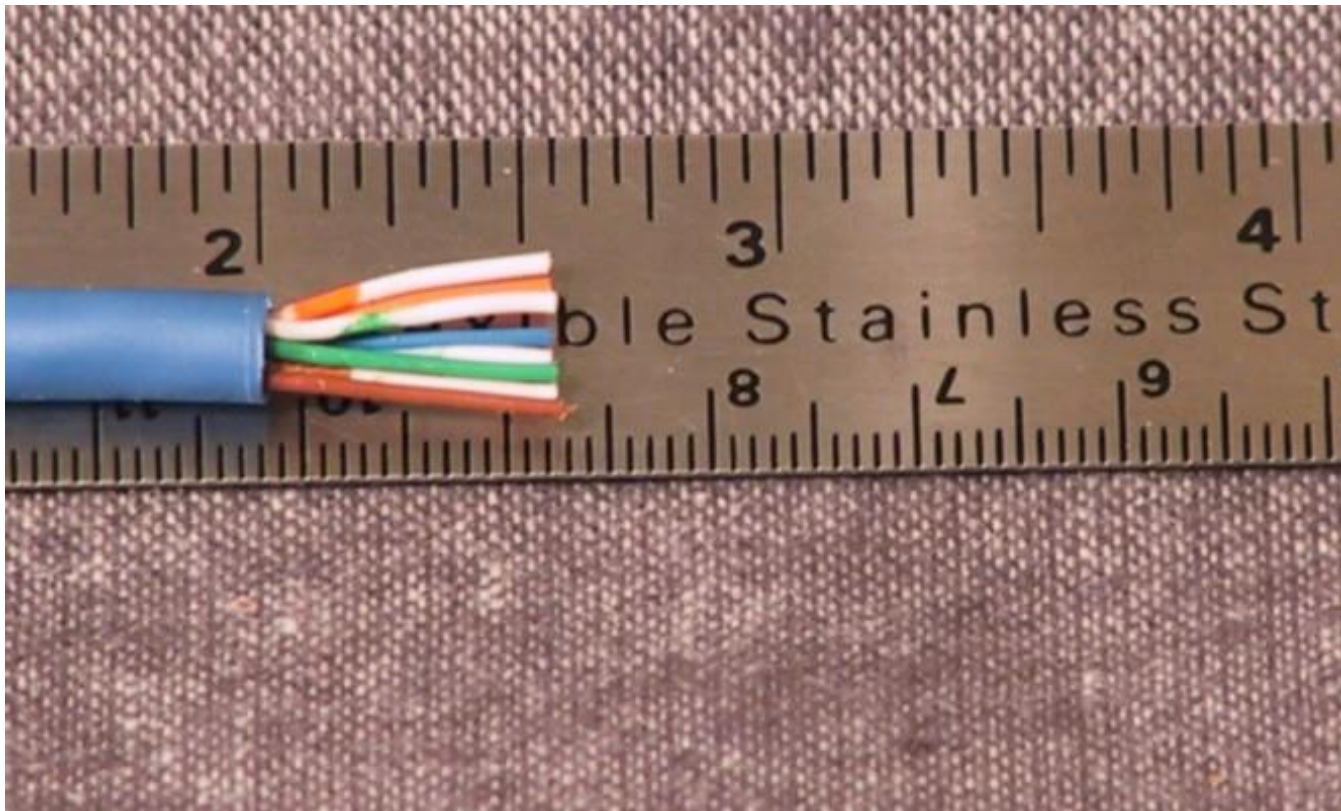
Step 5 – Attach connector

- Maintain wire order, left-to-right, with RJ45 tab facing downward
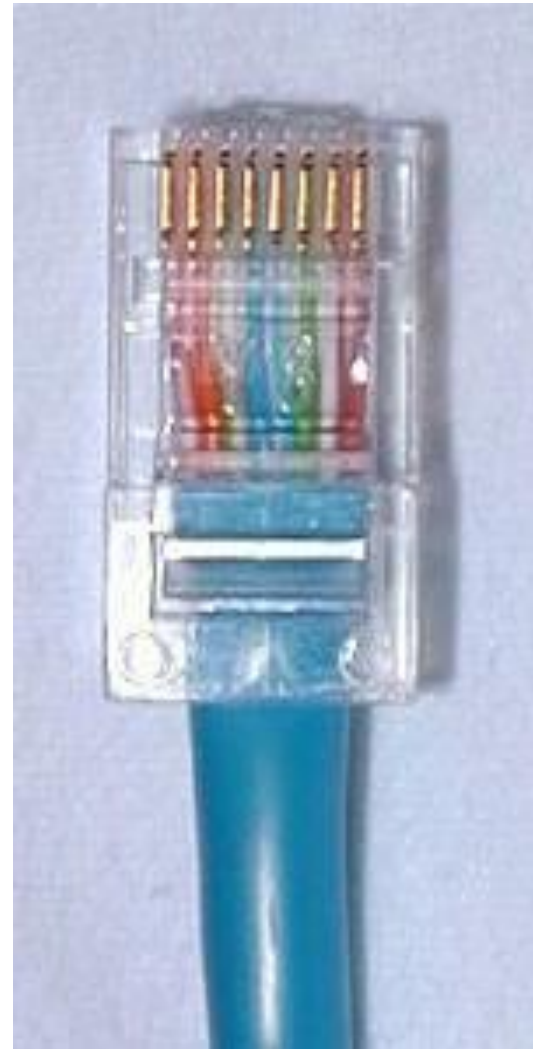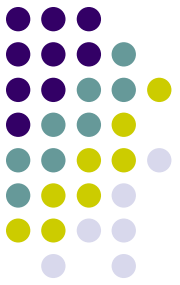
Step 6 - Check

- Do all wires extend to end?
- Is sheath well inside connector?

Step 7 - Crimp

- Squeeze firmly to crimp connecter onto cable end (8P)

Crimp Tool

After Crimping
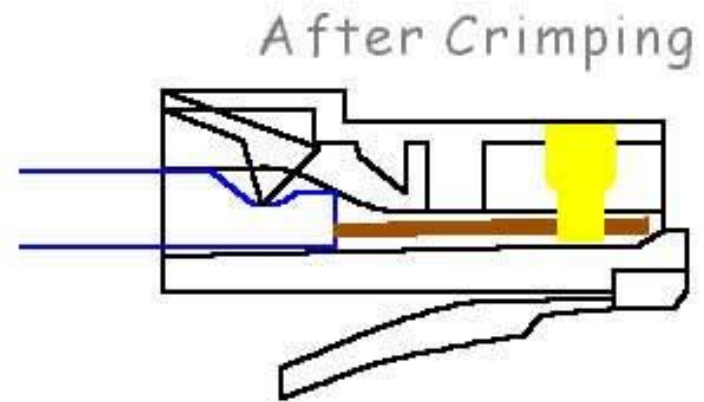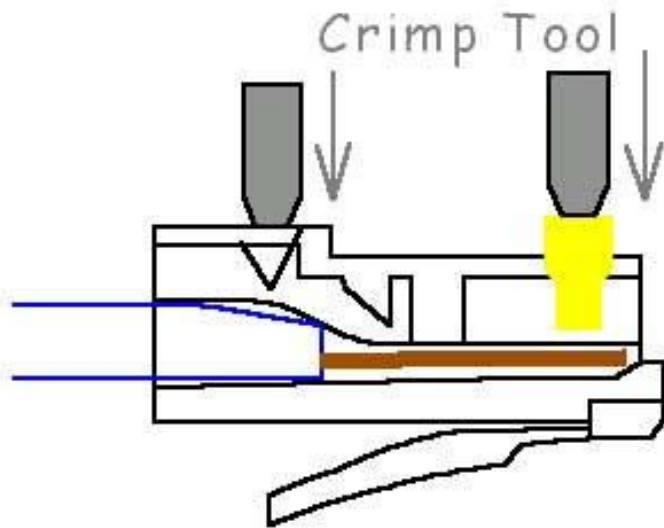
Step 8 – Test

- Does the cable work?
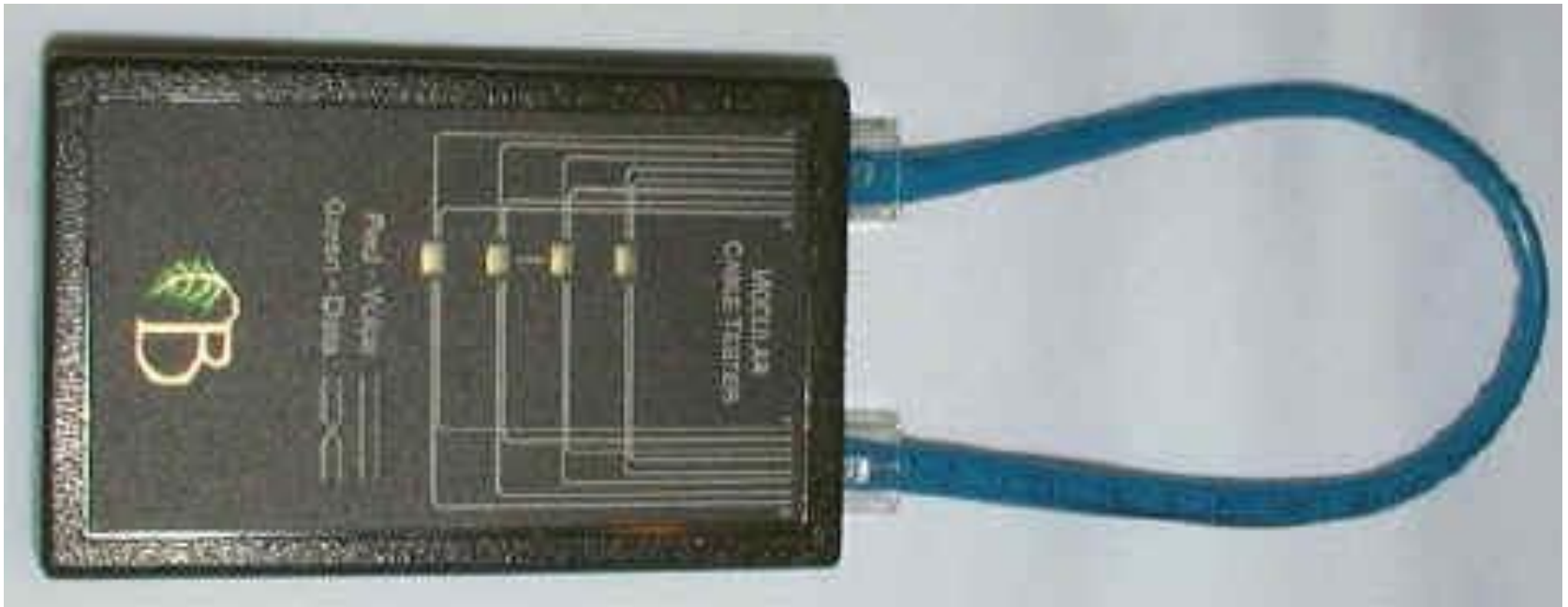
Straight-Through Wired Cables

Straight-Through refers to cables that have the pin assignments on each end of the cable. In other words Pin 1 connector A goes to Pin 1 on connector B, Pin 2 to Pin 2 ect. Straight-Through wired cables are most commonly used to connect a host to client. When we talk about cat5e patch cables, the Straight-Through wired cat5e patch cable is used to connect computers, printers and other network client devices to the router switch or hub (the host device in this instance).

Straight Through Wiring Guide
568-B

Connector A		Connector B
Pin 1	1 — 1	Pin 1
Pin 2	2 — 2	Pin 2
Pin 3	3 — 3	Pin 3
Pin 4	4 — 4	Pin 4
Pin 5	5 — 5	Pin 5
Pin 6	6 — 6	Pin 6
Pin 7	7 — 7	Pin 7
Pin 8	8 — 8	Pin 8
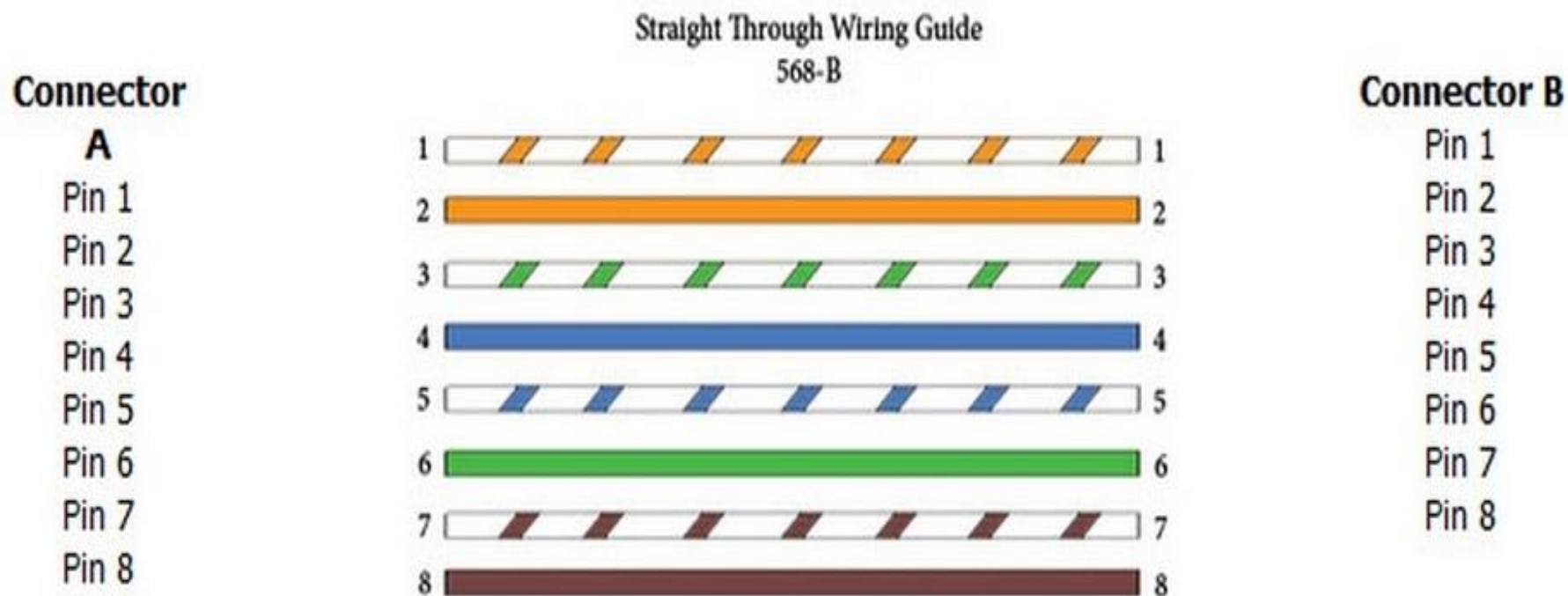
Crossover Wired Cables

Crossover wired cables (commonly called crossover cables) are very much like Straight-Through cables with the exception that TX and RX lines are crossed (they are at oposite positions on either end of the cable. Using the 568-B standard as an example below you will see that Pin 1 on connector A goes to Pin 3 on connector B. Pin 2 on connector A goes to Pin 6 on connector B ect. Crossover cables are most commonly used to connect two hosts directly. Examples would be connecting a computer directly to another computer, connecting a switch directly to another switch, or connecting a router to a router. *Note: While in the past when connecting two host devices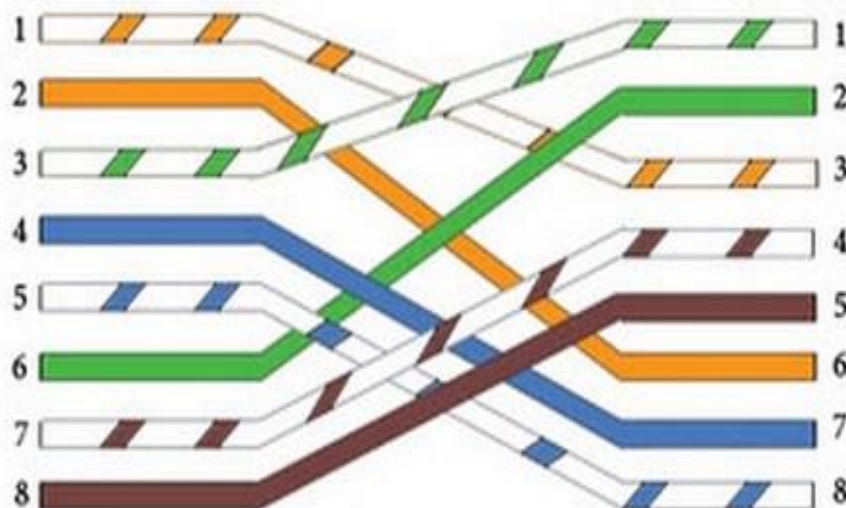 directly a crossover cable was required. Now days most devices have auto sensing technology that detects the cable and device and crosses pairs when needed.*

Crossover Wiring Guide
568-B

Connector A		Connector B
Pin 1	1 — 1	Pin 3
Pin 2	2 — 2	Pin 6
Pin 3	3 — 3	Pin 1
Pin 4	4 — 4	Pin 7
Pin 5	5 — 5	Pin 8
Pin 6	6 — 6	Pin 2
Pin 7	7 — 7	Pin 4
Pin 8	8 — 8	Pin 5

Rollover Wired Cables

Rollover wired cables most commonly called rollover cables, have opposite Pin assignments on each end of the cable or in other words it is "rolled over". Pin 1 of connector A would be connected to Pin 8 of connector B. Pin 2 of connector A would be connected to Pin 7 of connector B and so on. Rollover cables, sometimes referred to as Yost cables are most commonly used to connect to a devices console port to make programming changes to the device. Unlike crossover and straight-wired cables, rollover cables are not intended to carry data but instead create an interface with the device.

Rollover Wiring Guide
568-B

Connector A		Connector B
Pin 1		Pin 8
Pin 2		Pin 7
Pin 3		Pin 6
Pin 4		Pin 5
Pin 5		Pin 4
Pin 6		Pin 3
Pin 7		Pin 2
Pin 8		Pin 1

Let's go to work!