Lesson 1 Cabling

At a Glance

The physical pathway used to connect two or more computers together as a network includes the transmission media. The quality of the network system is dependent on its transmission media. The most common forms of electrical and electronic transmission are solid and composite wire cables. There are several types of cable, including **coaxial, Unshielded Twisted-Pair "UTP" and fiber optic**. Each type adheres to standards set by the **Institute of Electrical and Electronics Engineers (IEEE).** **The Telecommunications Industry Association (TIA) and the Electronic Industries Association (EIA)** standards govern all aspects of cable distances and connector configurations.

In choosing cabling for a network, there are several factors to consider: **cost, expansion capabilities, bandwidth, signal attenuation, and EMI (Electro-Magnetic Interference).** Each type of cable has different specifications that affect these factors, and each organization has different needs. Considering cable system factors is very important for building a network system that meets an organization's needs.

- **Bandwidth:** Bandwidth represents how much information can be sent at one time over a specific cable type, or the measure of information capacity of transmission over a cable. Bandwidth is the difference between the highest and lowest frequencies of the transmission, measured in hertz. Bandwidth is a factor used to evaluate cable.

- **BNC:** The "British Naval Connector" is the connector used with coaxial cables.
- **Expansion:** is the ability to increase the size of a network after the initial installation. It is a factor used to evaluate cable.
- **Fiber optic cable:** uses light to transmit information across a network. The core of the cable is made of glass, which is protected by a layer of gel or plastic. A plastic cover surrounds the entire cable.
- **Hertz** is the unit of frequency measurement, which is equal to one cycle per second (for example, one waveform per second). Computers and related devices are often measured in kilohertz (kHz=1,000 Hz), megahertz (MHz=1,000 kHz), gigahertz (GHz= 1,000 MHz).
- **EMI (Electro-Magnetic Interference):** the interference of electrical signals across a cable by outside electrical or magnetic devices. It is a factor that is used to evaluate cable.
- **RJ-11:** A registered jack 11 is a telephone connector used on modern telephone lines.
- **RJ-45**: A registered jack 45 is an eight-wire connector used to connect computers to category 5 unshielded twisted pair cables in a network.
- **Signal attenuation**: is a factor used to evaluate cable that relates to how long a signal can travel across a cable before the signal becomes too weak to be recognized in a network.
- **Transmission Media:** Transmission media is the physical pathway used to connect two or more computers together as a network and includes air and space in addition to cable.
- **Unshielded Twisted-Pair Cable (UTP)**: UTP is network cable that consists of up to 4 pairs of wires. Each pair is twisted around each other at a different rate and the entire cable is encased in a protective plastic covering.
- **ETHERNET Cable:** Ethernet pronounced "E-thernet" (with a long "e") is the standard way to connect computers to a network over a wired connection. It provides a simple interface and for connecting multiple devices, such computers,

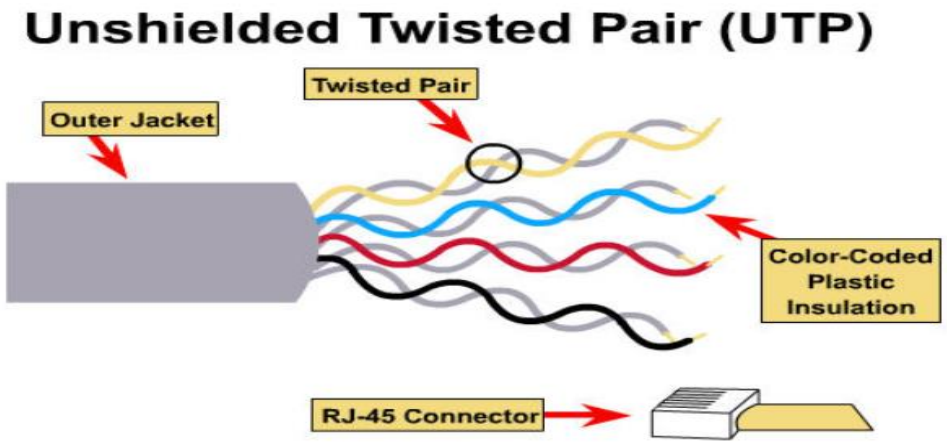
routers, and switches. Ethernet provides the connections that make up the worldwide Internet and that connect the Internet to our workplaces and our homes.

- **IEEE (Institute of Electrical and Electronics Engineers):** IEEE, an association dedicated to advancing innovation and technological excellence for the benefit of humanity, is the world's largest technical professional society. It is designed to serve professionals involved in all aspects of the electrical, electronic, and computing fields and related areas of science and technology that underlie modern civilization. IEEE's roots go back to 1884 when electricity began to become a major influence in society.

The Four Basic Elements of Ethernet:

The Ethernet system includes four building blocks that, when combined will build a working Ethernet:

1. **The frame**, a standardized set of bits used to carry data over the system.
2. **The Media Access Control protocol**, consisting of a set of rules embedded in each Ethernet interface that allow Ethernet stations to access the Ethernet channel, in either half- or full-duplex mode.
3. **The signaling components** standardized electronic devices that send and receive signals over an Ethernet channel.
4. **The physical medium**, the cables and other hardware used to carry the digital Ethernet signals between computers attached to the network.

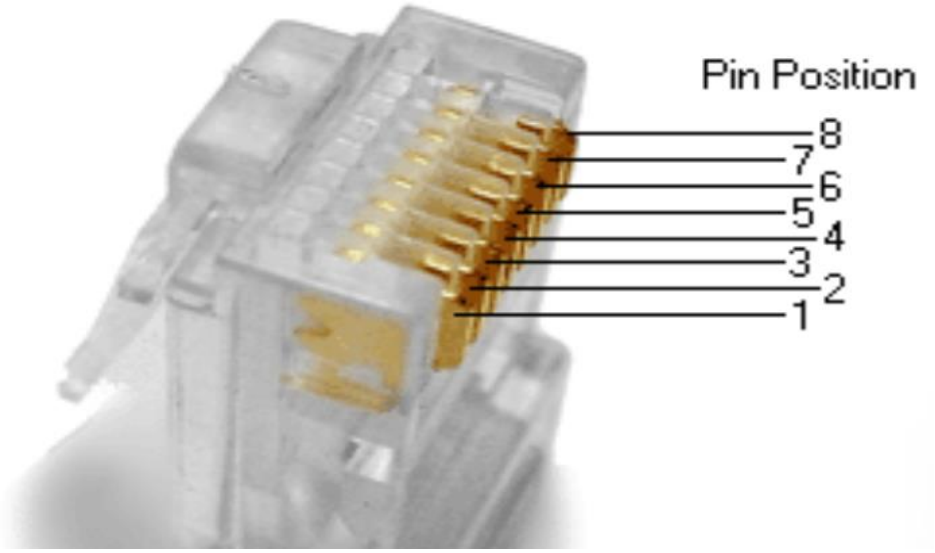


There are two standard types of network cable wiring:

1. EIA/TIA 568A Ethernet UTP cable wiring.
2. EIA/TIA 568B Ethernet UTP cable wiring.

RJ-45

A registered jack (RJ) is a standardized physical network interface for connecting telecommunications or data equipment. There are four pairs of wires in an Ethernet cable, and an Ethernet connector (8P8C) has eight pin slots. Each pin is identified by a number, starting from left to right, with the clip facing **away** from you.



EIA/TIA 568B is the most common and is what we'll be using for our straight Ethernet cable. The tables below show the proper orientation of the colored wires to the pins.

T568A Standard	
Pin 1	White/Green
Pin 2	Green
Pin 3	White/Orange
Pin 4	Blue
Pin 5	White/Blue
Pin 6	Orange
Pin 7	White/Brown
Pin 8	Brown

T568B Standard	
Pin 1	White/Orange
Pin 2	Orange
Pin 3	White/Green
Pin 4	Blue
Pin 5	White/Blue
Pin 6	Green
Pin 7	White/Brown
Pin 8	Brown

Crimping tool

A **crimping tool** is a device used to conjoin two pieces of metal by deforming one or both of them in a way that causes them to hold each other. The result of the tool's work is called a **crimp**.

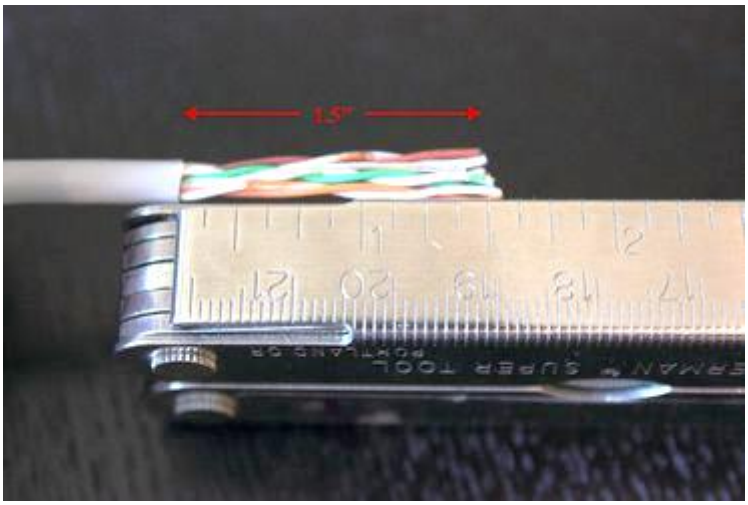
Straight and Crossover cable

Common Ethernet network cable are straight and crossover cable. This Ethernet network cable is made of 4 pair high performance cable that consists twisted pair conductors that used for data transmission. Both end of cable is called RJ45 connector.
The cable can be categorized as **Cat 5, Cat 5e, Cat 6 UTP cable**. Cat 5 UTP cable can support 10/100 Mbps Ethernet network, whereas Cat 5e and Cat 6 UTP cable can support

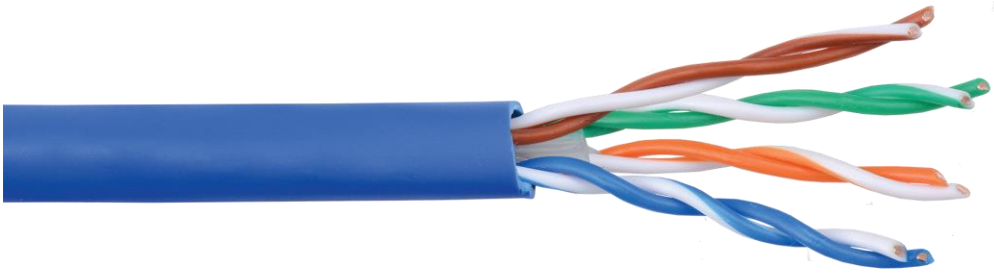
Ethernet network running at 10/100/1000 Mbps. You might heard about Cat 3 UTP cable, it's not popular anymore since it can only support 10 Mbps Ethernet network.

Steps for UTP Installation:

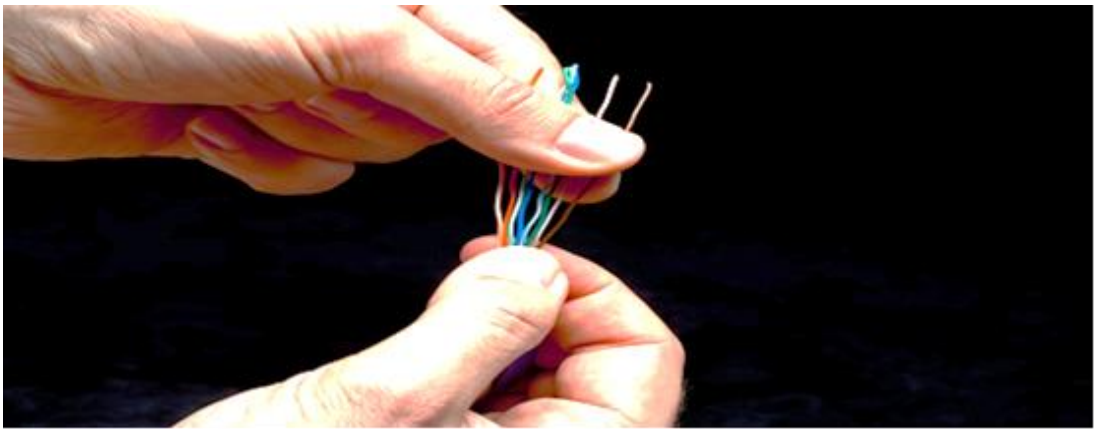
Step 1: Strip the cable jacket about 1.5 inch down from the end.

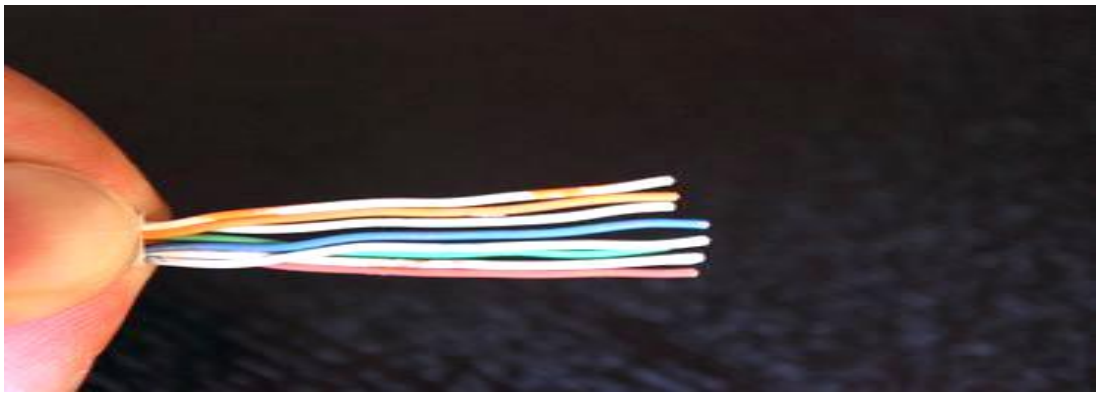


Step 2: Spread the four pairs of twisted wire apart.

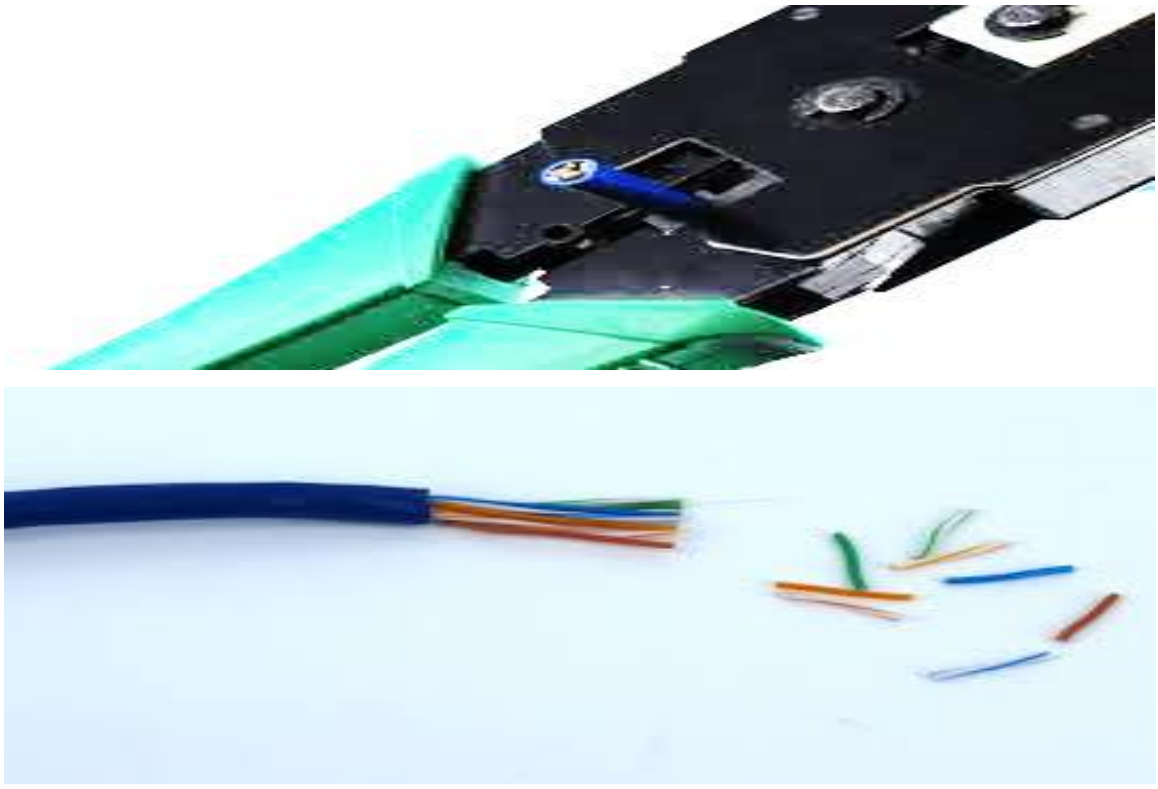


Step 3: Untwist the wire pairs and neatly align them in the T568B orientation.

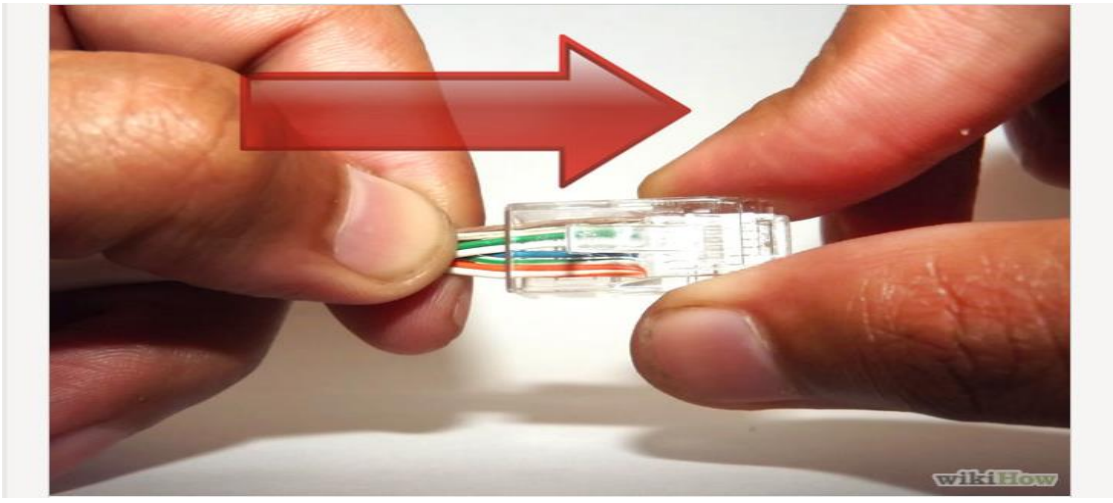




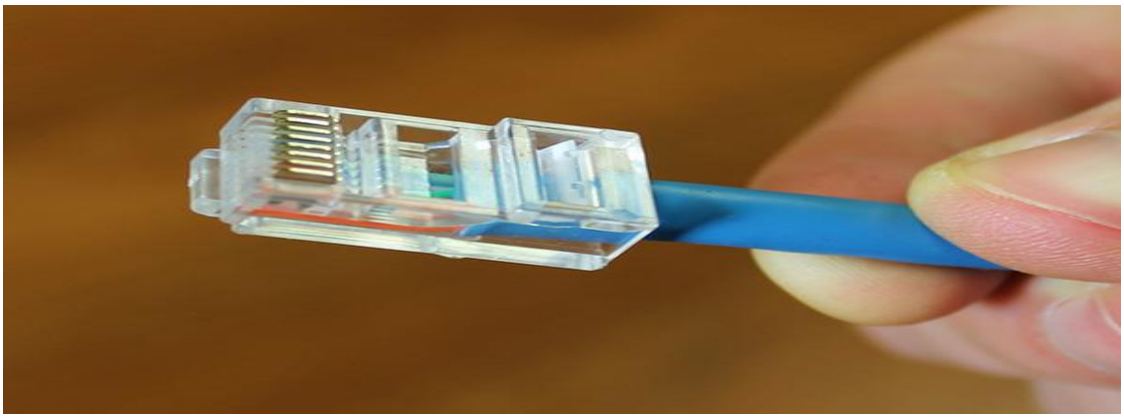
Step 4: Cut the wires as straight as possible, about 0.5 inch above the end of the jacket.



Step 5: Carefully insert the wires all the way into the modular connector, making sure that each wire passes through the appropriate guides inside the connector.



Step 6: Push the connector inside the crimping tool and squeeze the crimper all the way down.



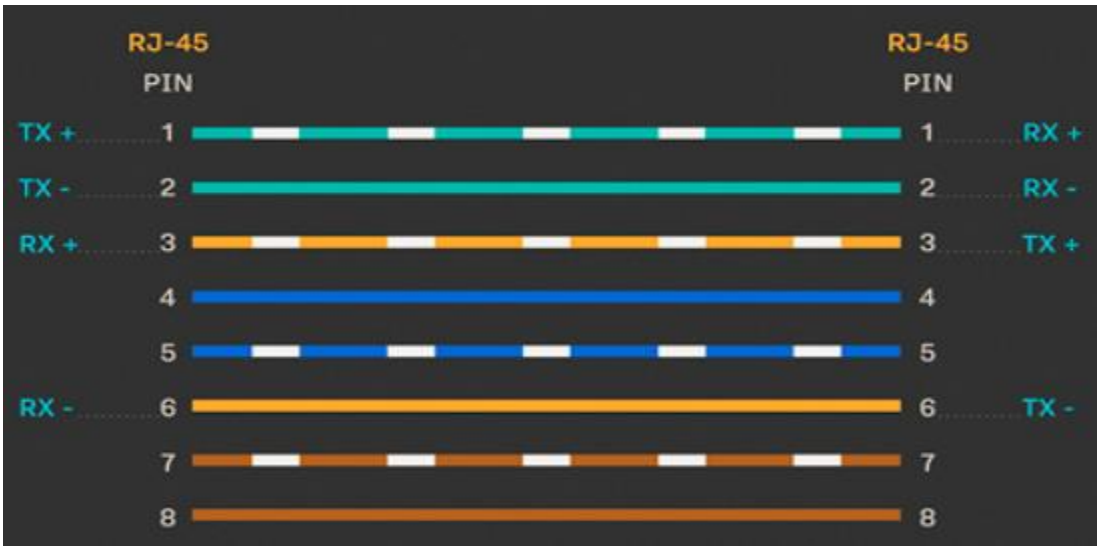
Step 7: Repeat steps 1-6 for the other end of the cable according to your requirement (crossover or straight through).

Step 8: To make sure you've successfully terminated each end of the cable, use a cable tester to test each pin.

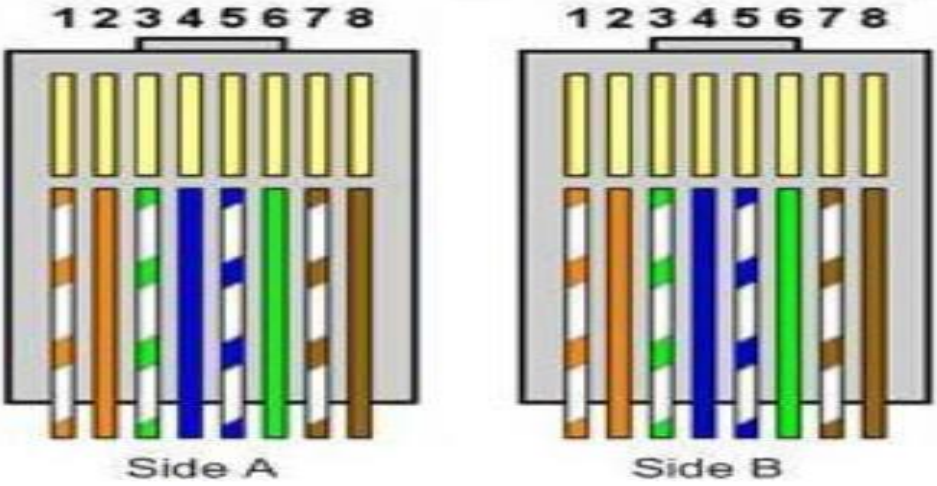
That's it. For crossover cables, simply make one end of the cable a T568**A** and the other end a T568**B**.

Straight Through cable

Is used to connect different type of devices. If you need to check how straight cable looks like, it's easy. **Both sides (side A and side B) of cable have wire arrangement with same color**.



Pin ID	Side A	Side B
1	Orange-white	Orange-white
2	Orange	Orange
3	Green-white	Green-white
4	Blue	Blue
5	Blue-white	Blue-white
6	Green	Green
7	Brown-white	Brown-white
8	Brown	Brown



Crossover Cable

It's usually used to connect same type of devices. A crossover cable can be used to:

Both sides (side A and side B) of cable have wire arrangement with following different color.

Pin ID	side A	side B
1	Orange-white	green-white
2	Orange	green
3	green-white	orange-white
4	blue	brown-white
5	blue-white	Brown
6	green	orange
7	brown-white	Blue
8	brown	blue-white