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Applied Computing

Wales Institute of Science and Art (WISA)

Networks and Cybersecurity Essentials (ACCA4024)

Home Work 3: **Straight Through and Crossover Cables**

Submission Deadline: **On or before 06/11/2020 23.59 Hrs.**

Submission Via Moodle Link.

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Objectives

- Understand cabling standards for use in LAN cabling environments.

Background/ Scenario

The TIA/EIA has specified unshielded twisted pair (UTP) cabling standards for use in LAN cabling environments. TIA/EIA 568-A and 568-B stipulates the commercial cabling standards for LAN installations; these are the standards most commonly used in LAN cabling for organizations and they determine which color wire is used on each pin.

With a crossover cable, the second and third pairs on the RJ-45 connector at one end of the cable are reversed at the other end, which reverses the send and receive pairs. The cable pinouts are the 568-A standard on one end and the 568-B standard on the other end. Crossover cables are normally used to connect hubs to hubs or switches to switches, but they can also be used to directly connect two hosts to create a simple network.

Note: With modern networking devices, a straight-through cable can often be used even when connecting like devices because of their autosensing feature. With autosensing, the interfaces detect whether the send and receive circuit pairs are correctly connected. If they are not, the interfaces reverse one end of the connection. Autosensing also alters the speed of the interfaces to match the slowest one. For example, if connecting a Gigabit Ethernet (1000 Mb/s) router interface to a Fast Ethernet (100 Mb/s) switch interface, the connection uses Fast Ethernet.

The Cisco 2960 switch has autosensing turned on, by default; therefore, connecting two 2960 switches together works with either a crossover or a straight-through cable. With some older switches, this is not the case and a crossover cable must be used.

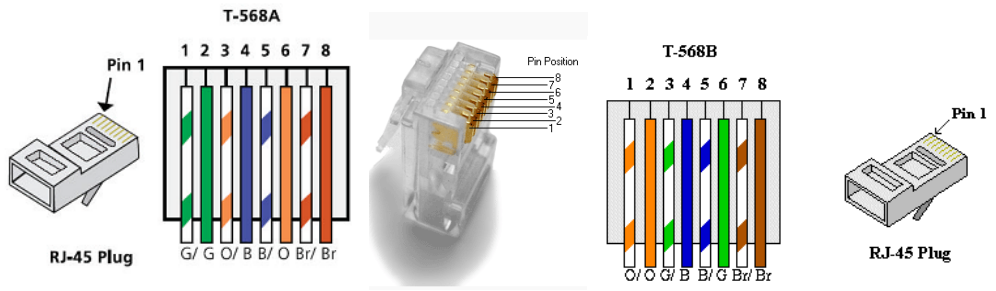
In addition, the Cisco 1941 router Gigabit Ethernet interfaces are autosensing and a straight-through cable may be used to connect a PC directly to the router interface (bypassing the switch). With some older routers, this is not the case and a crossover cable must be used.

When directly connecting two hosts, it is generally advisable to use a crossover cable.

Task 1: Analyze diagrams and tables for the TIA/EIA 568-A and TIA/EIA 568-B standard Ethernet cable.

The following table and diagrams display the color scheme and pinouts, as well as the function of the four pairs of wires used for the 568-A standard.

Note: In LAN installations using 100Base-T (100 Mb/s), only two pairs out of the four are used.



Record your reflection

1. What are these TIA/EIA Standards? How do 568 A differs from 568 B? Are there any other standards? (100 – 300 Words)

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_____
_____

2. What is a Straight through Cable and Cross over Cable? Which cable should be selected during a simple network installation (Topology includes Routers, Switches and End Devices)? (100 – 300 Words). You shall use Tables, Diagrams to clarify.

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What are these TIA/EIA Standards? How do 568 A differ from 568 B? Are there any other standards? (100 – 300 Words)

The Telecommunications Industry Association (TIA) and Electronic Industries Association (EIA) are standards organisations who have set the standards for cabling in a variety of settings. The organisations began working together in the 1980s to come up with a cabling system that was standardised to allow it to be supported by differing technology manufacturers to ensure that different products would be able to form a part of the communication using the same cabling system.

It wasn't until 1991 that they released the Commercial Building and Telecommunication Cabling standard TIA/EIA 568. This standard set out how to "design, build and manage a cabling system which is structured" [1]

TIA EIA 568 was the first release of this standard and was followed by the release of:

- TIA/EIA-568-A-1995 (Commercial Building Telecommunications Wiring Standards)
- TIA/EIA-568-A updates (1998-1999)
- TIA 568-B.1-2000 (Commercial Building Telecommunications Wiring Standard)

These standards updated different parameters and requirements as well as minimum performance levels which would need to be followed by anyone setting up a network in a commercial setting or manufacturing the cabling products to be used as part of any network. These standards are now outdated as the latest release of was ANSI/TIA-568-D which was released in 2017.

As well as the EIA/TIA standards there are also:

- International Standards Organisation/International Electrotechnical Commission (ISO/IEC)
    - Stricter than TIA
- European Committee for Electrotechnical Standardisation (CENELEC)
    - Essentially the same as ISO/IEC
- British Standards Institute (BSI)
    - The same as CELNELEC standards whilst also producing their own national standards, testing and certification

What is a Straight through Cable and Cross over Cable? Which cable should be selected during a simple network installation (Topology includes Routers, Switches and End Devices)? (100 – 300 Words). You shall use Tables, Diagrams to clarify.

A Straight Through cable also known as an Ethernet Patch Cable is typically used to connect a host to a router, switch to router. The wired pins at either end of the cable are matching. These pins may follow either the TIA/EIA 568-A OR 568-B but this must be the same on both ends. Autosensing on interface devices is able to detect the circuit and reverse the connection on one end of the cable to suit.

A Crossover Cable is typically used to connect two of the same devices, usually host to host but can include switch to switch, router to router, hub to hub or switch to hub. The pins at either end of the cable are not matching. This is because the wires cross over each other which results in there being a TIA/EIA 568-A connection on one end and 568-B on the other.

The image below illustrates the differences between the two cables.

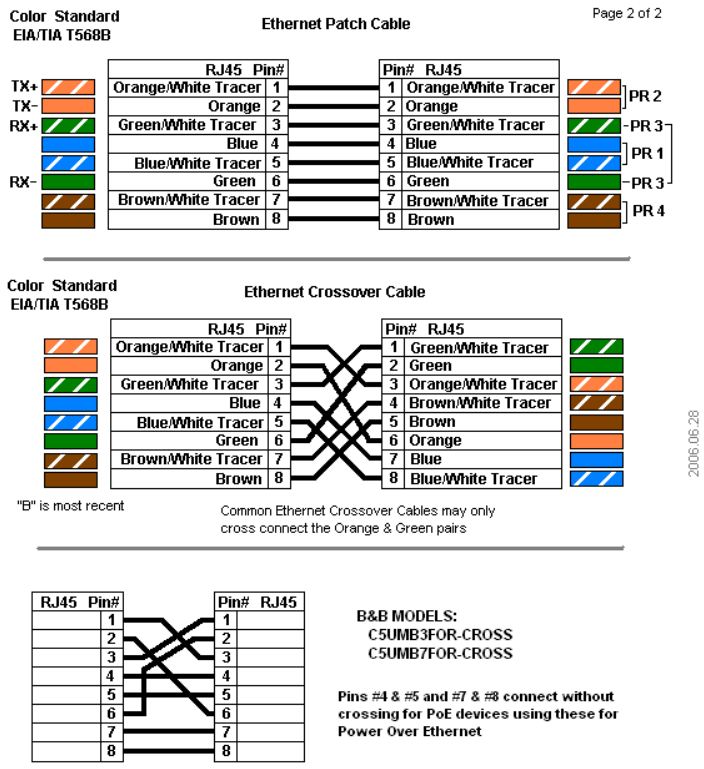

Figure 1 Straight through cable vs crossover cable

The figure below illustrates how both Straight Through Cable (solid black line) and Cross Over Cable (dashed black line) may be used in a simple network.

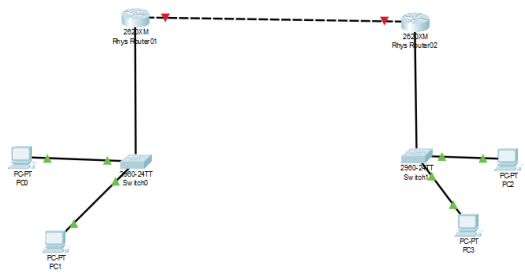

Figure 2 Simple Local Area Network

Bibliography

[1] Linktionary, “TIA/EIA Structured Cabling Standards,” 2001. [Online]. Available: https://www.linktionary.com/t/tia_cabling.html. [Accessed 24 October 2020].

[2] Netshop, “Cabling Standards - What you Need to Know,” [Online]. Available: https://www.netshop.co.uk/about/news/cabling-standards--what-you-need-to-know. [Accessed 24 October 2020].

[3] Router-Switch.com, 26 Dec 2017. [Online]. Available: https://www.router-switch.com/faq/difference-between-straight-through-and-crossover-cable.html. [Accessed 24 Oct 2020].

[4] berbagisolusi, “Simple Local Area Network (LAN),” 1 December 2011. [Online]. Available: https://berbagisolusi.wordpress.com/2011/12/01/simple-local-area-network-lan/. [Accessed 24 Oct 2020].