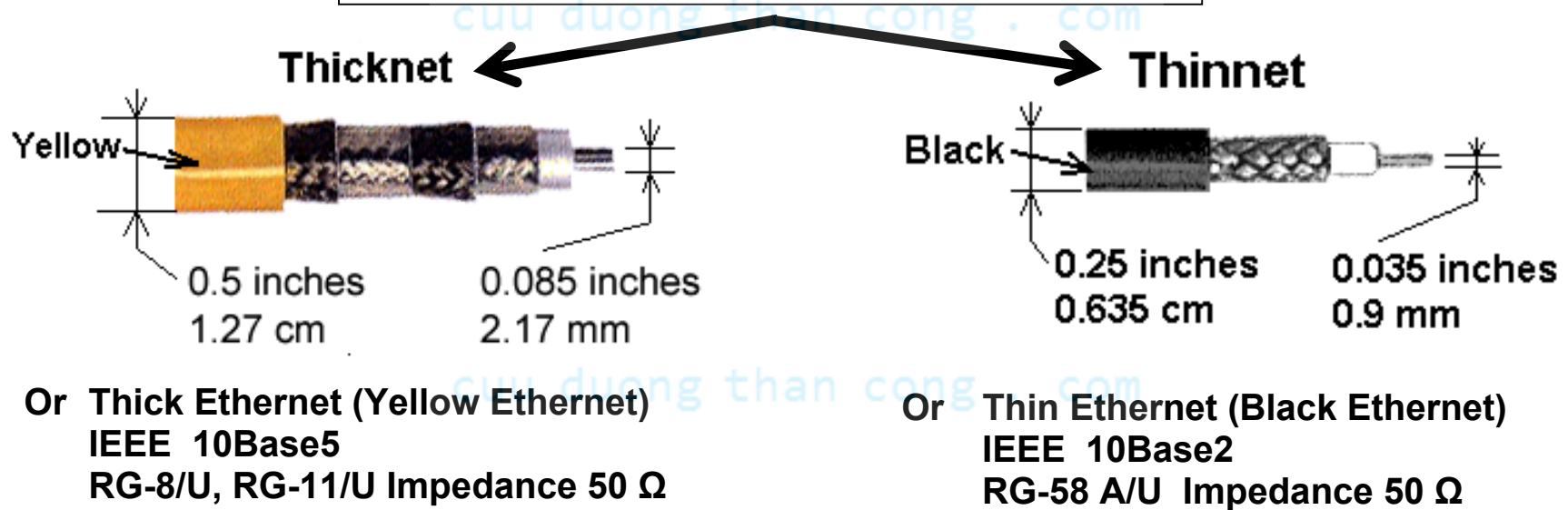
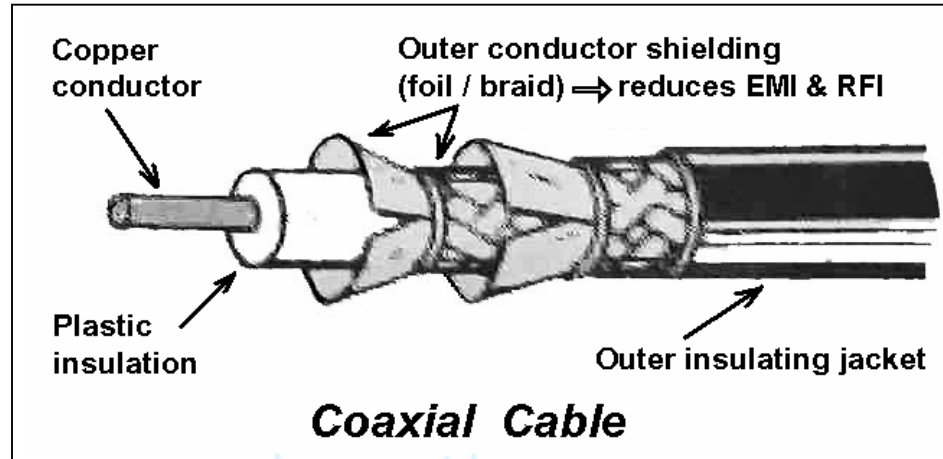
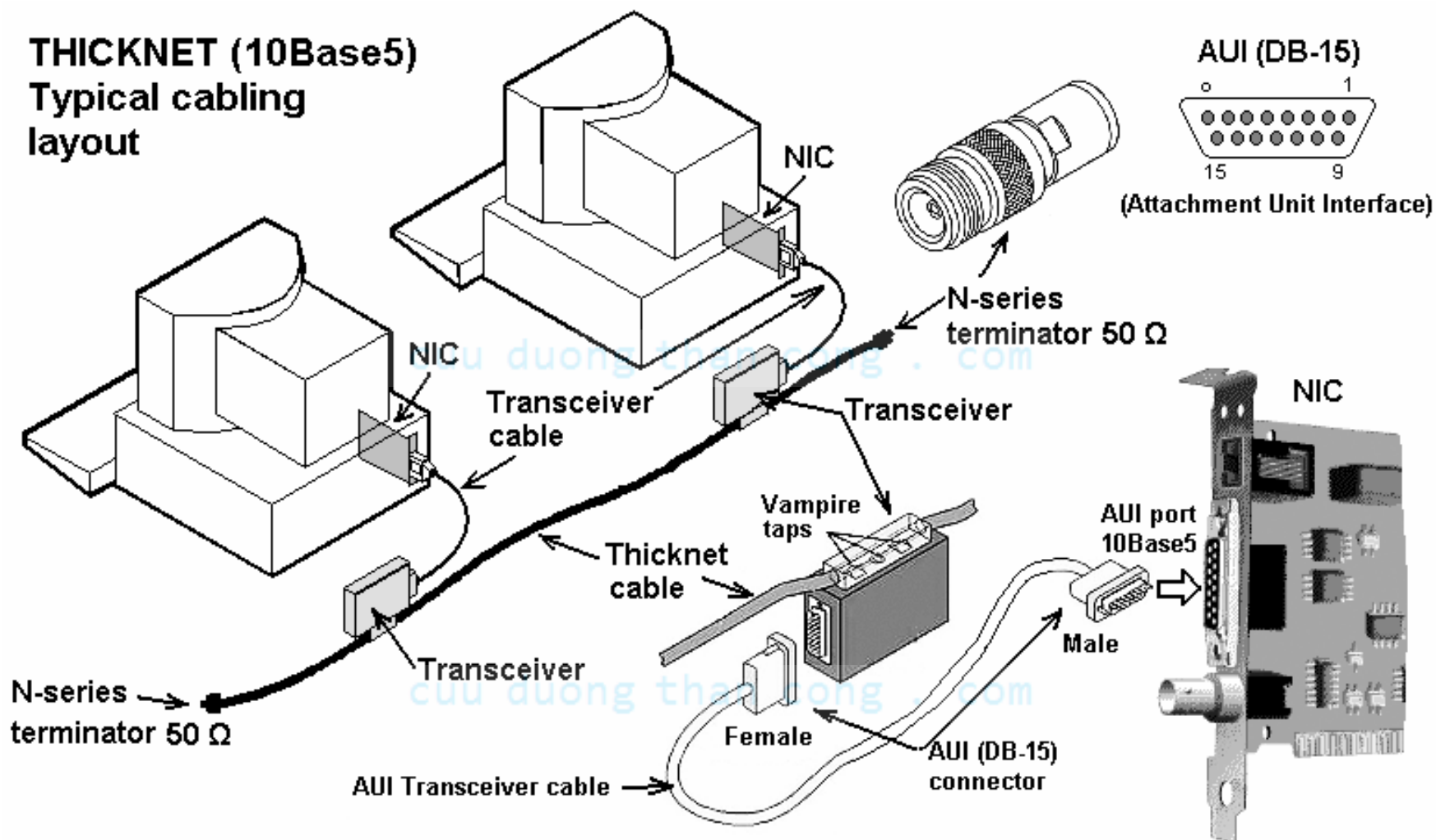


CẤU TẠO VÀ PHÂN LOẠI CÁP ĐỒNG TRỤC (COAXIAL CABLE)



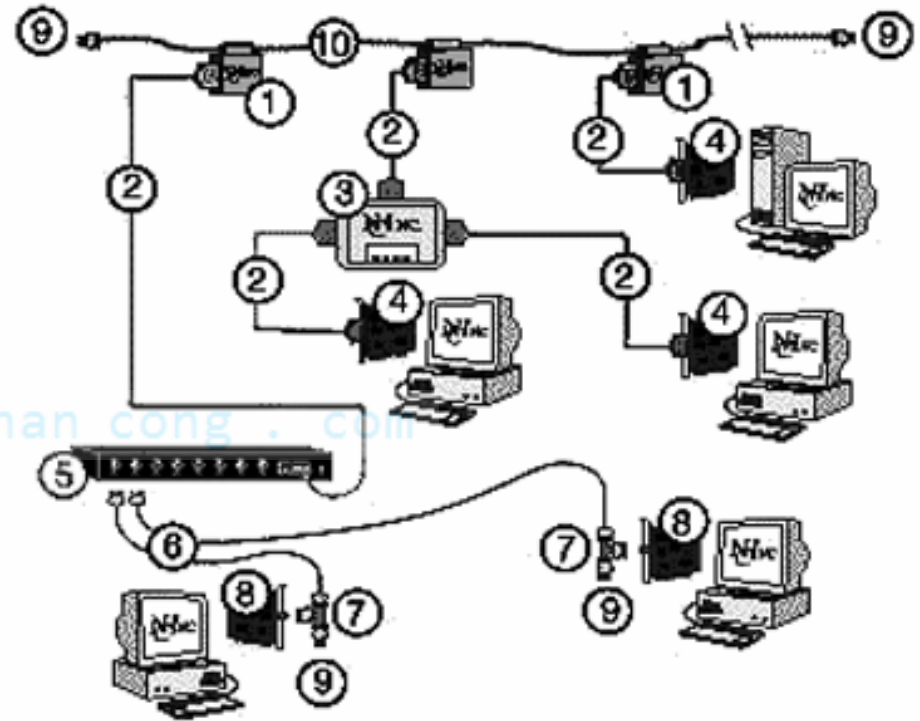
CÁP ĐỒNG TRỤC DÀY (THICKNET) KẾT NỐI THEO TOPO DẠNG BUS DÙNG BỘ THU/PHÁT NGOÀI (EXTERNAL TRANSCEIVER)



CHUẨN IEEE CHO THICK ETHERNET (10BASE5)

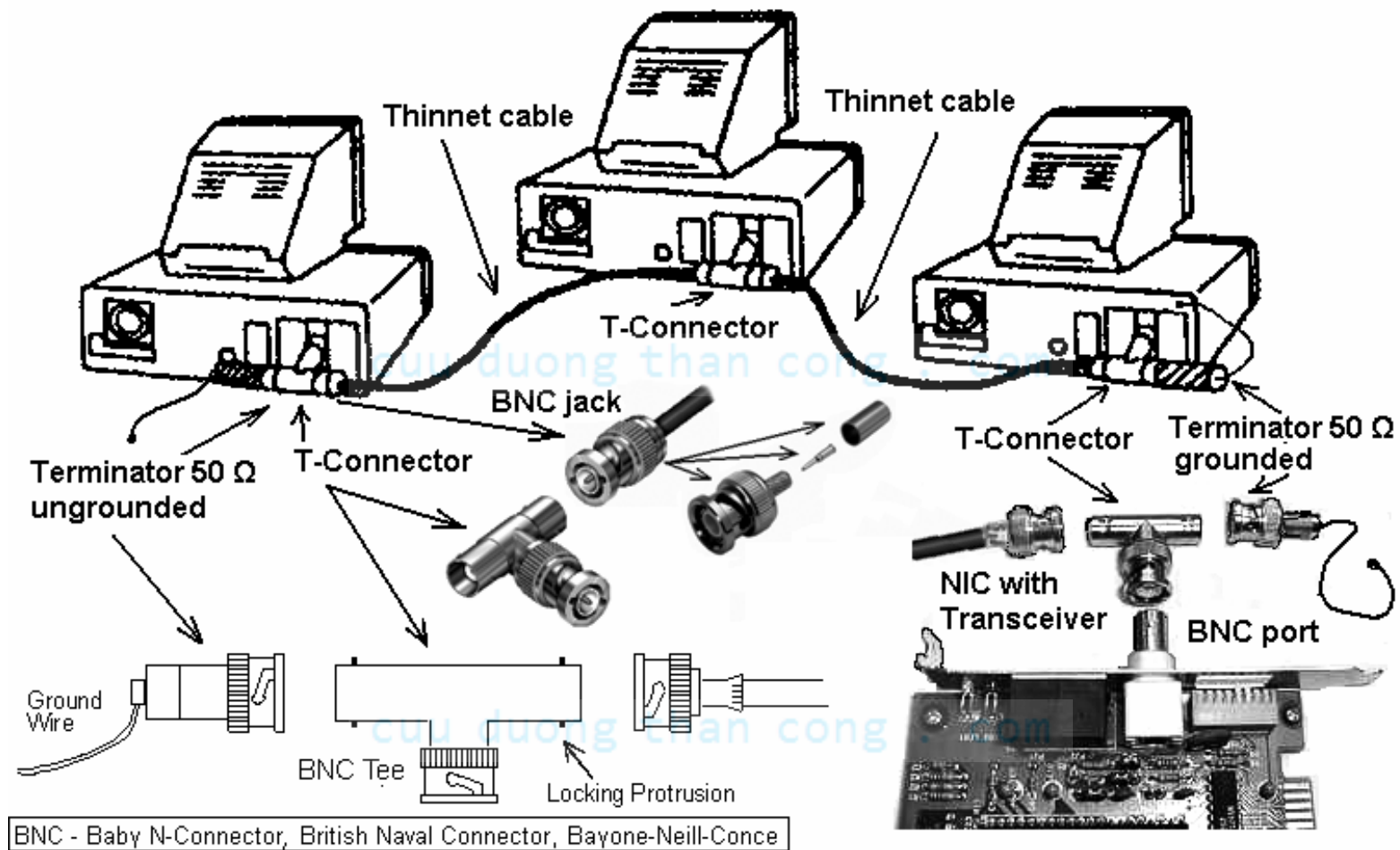
10BASE5 PARAMETERS AND WIRING RULES

- Bus topology. 10 Mbps Baseband (full-duplex not supported). Using Manchester encoding.
- Maximum length per segment is 500 meters.
- Maximum of 101 segments in a standard Ethernet (one backbone and 100 branch segments).
- Maximum of 1024 stations may be attached to a 10Base5 network..
- Up to 100 transceivers can be attached to a single 500 meter segment.
- Minimum distance between transceivers is 2.5 meters.
- Maximum length of standard AUI transceiver drop cable is 50 meters.
- Maximum length of office transceiver cable is 12.5 meters.
- Both ends of the cable segment must be terminated with a 50 ohm terminator.
- Repeaters may be used to extend the signal thereby increasing overall cable segment length.
- Maximum of 2 repeaters may be used between devices. In fact, we can use 4 repeaters by "the 5-4-3 rule". So that maximum length of cable is 2.5 km.



- | | |
|------------------------------|--------------------------------|
| 1. Transceiver | 6. PVC Thinnet Cable |
| 2. Transceiver Cables | 7. BNC T-Connector |
| 3. 2 Port AUI Fanout | 8. Thinnet BNC Network Card |
| 4. Thicknet AUI Network Card | 9. 50 Ohm Terminator |
| 5. Thinnet Repeater | 10. Thick Ethernet Trunk Cable |

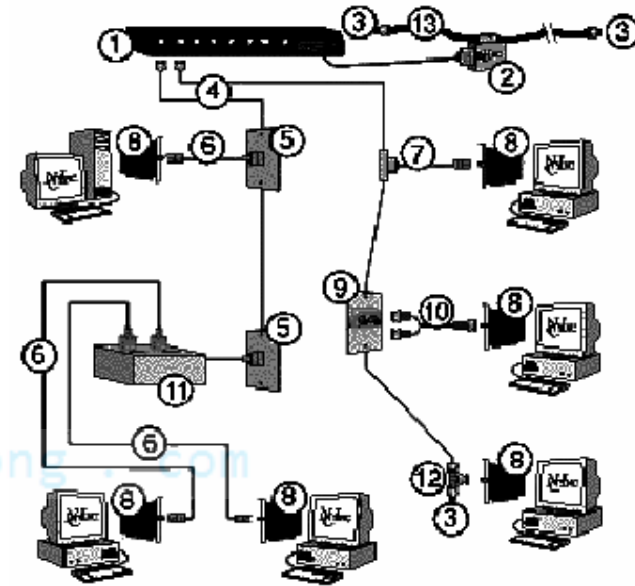
CÁP ĐỒNG TRỤC MỎNG (THINNET) KẾT NỐI THEO TOPO DẠNG BUS DÙNG T-CONNECTOR VÀ NIC CÓ SẴN BỘ THU PHÁT (BUILT-IN TRANSCEIVER)



CHUẨN IEEE CHO THINNET ETHERNET (10BASE2)

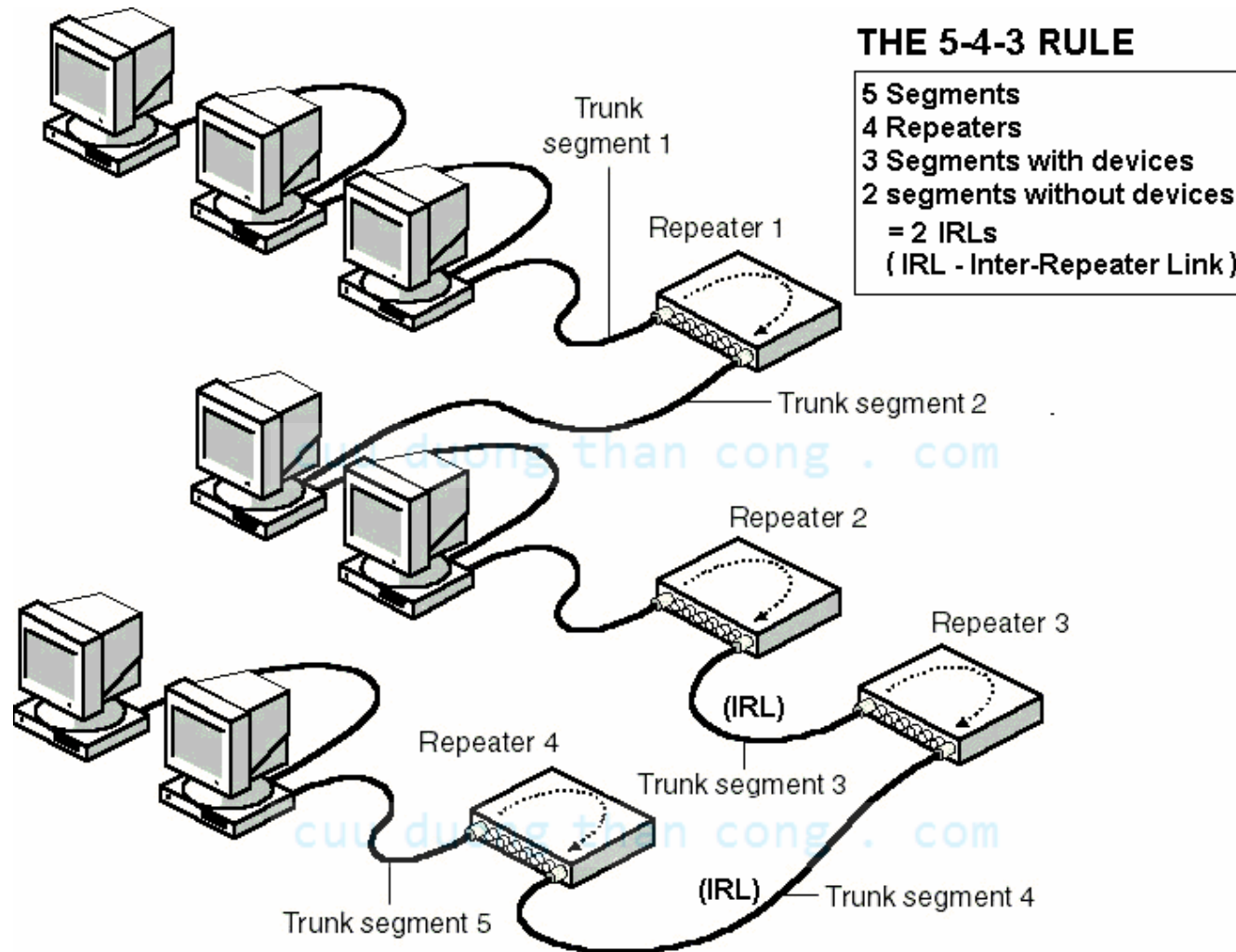
10 BASE 2 PARAMETERS AND WIRING RULES

- Bus topology. 10 Mbps Baseband (full-duplex not supported). Using Manchester encoding.
- Maximum length per segment is 185 meters.
- Maximum of 30 stations per segment are allowed.
- Maximum of 1024 stations may be attached to a 10Base2 network.
- NIC's come with built-in transceivers so connections are made directly to NIC via T-connector.
- T-connectors must be plugged directly into NIC. There can not be any cable between T-connector and NIC.
- Minimum of 0.5 meter is allowed between T-connectors.
- Both ends of the cable segment must be terminated with a 50 ohm terminator. One end of the cable must be grounded, the other end must remain ungrounded.
- Terminator must be attached to open jack of T-connector at both ends of the segment. Do not attach terminator directly to cable without T-connector.
- Repeaters may be used to extend the signal.
- Maximum of 2 repeaters may be used between devices. In fact, we can use 4 repeaters by "the 5-4-3 rule".
- So that maximum length of cable is 925 meters.



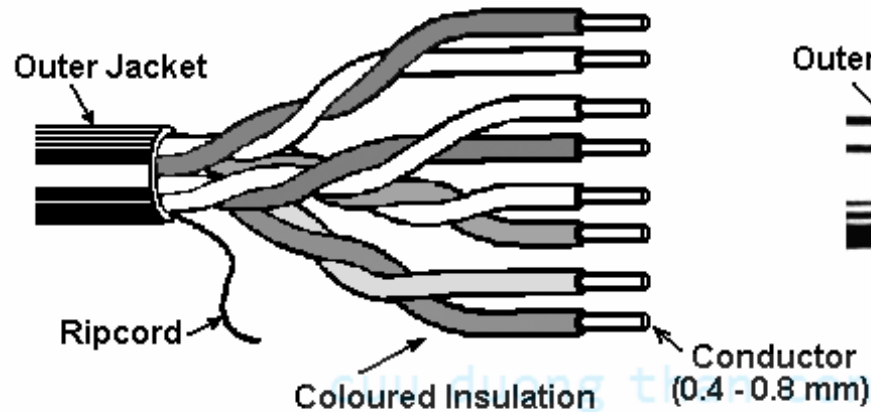
- | | |
|--------------------------------------|-----------------------|
| 1. 8 Port Repeater | 2. Transceiver |
| 3. 50 Ohm Terminator | 4. PVC Thinnet Cable |
| 5. Thinnet Tap Wallplate | 6. Thinnet Drop Cable |
| 7. Self-terminating Drop Cable | 8. Network Card |
| 9. No Drop Wallplate | 10. No Drop Cable |
| 11. Thinnet Tap 4 Port Expansion Box | |
| 12. BNC T-Connector | |
| 13. Thick Ethernet Trunk Coax Cable | |

SƠ ĐỒ ĐI DÂY LUẬT 5-4-3 DÙNG 4 REPEATER



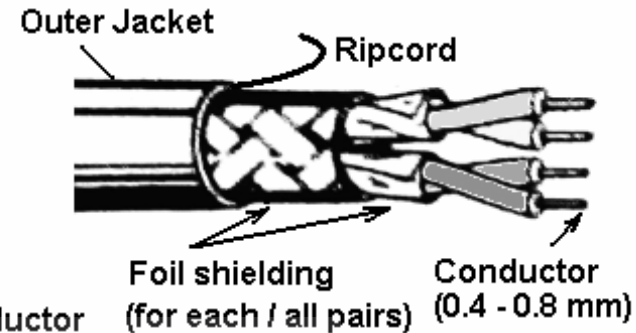
CẤU TẠO VÀ PHÂN LOẠI CÁP XOẮN KÉP (TWISTED-PAIR CABLE)

UTP cable (4-pairs)
(Unshielded Twisted-Pair)



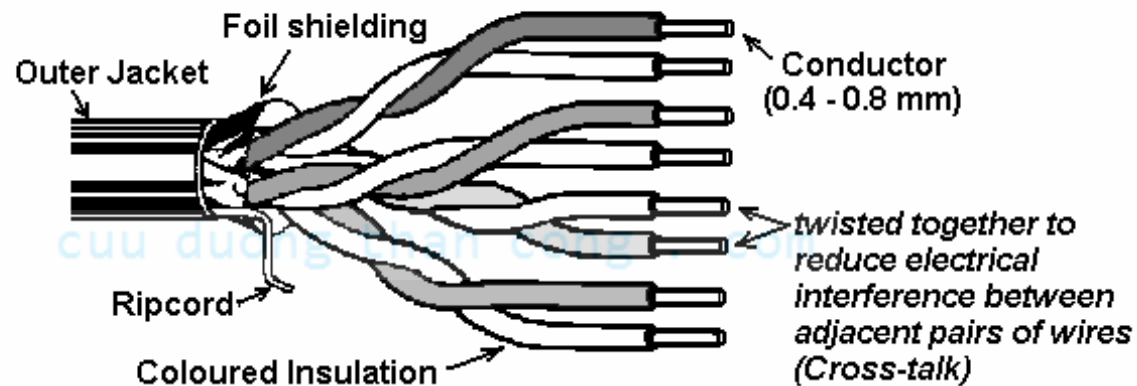
Impedance :
 $100 \Omega - 150 \Omega$

STP cable (2-pairs)
(Shielded Twisted-Pair)



ScTP cable (4-pairs)

(Screened UTP or FTP - Foil Twisted Pair)



PHÂN HẠNG CẤP UTP (ScTP) THEO CHUẨN EIA/TIA 568A (EIA/TIA Electronic Industry Association/Telecommunication Industry Association)

CATEGORY	MAX DATA RATE	APPLICATION
1	1 Mbps	one twisted-pairs for traditional telephone voice communication (but not data).
2	4 Mbps	4 twisted-pairs for voice & data transmission (ISDN), 4 Mbps Token Ring, ARCNET.
3	10 Mbps	4 twisted-pairs (3 twists per foot) for voice & data transmission, Ethernet 10Base-T. (can use for Ethernet 100Base-T4 & 100Base-T2)
4	20 Mbps	for 20 Mbps data transmission , Ethernet 10Base-T, 16 Mbps Token Ring.
5	155 Mbps	4 twisted pairs (a higher number of twists per foot than previous categories and a teflon based outer coating). Higher transmission rate (100Mhz) and better noise immunity. Used for Ethernet 10Base -T, Fast Ethernet 100Base-TX, -T4 or -T2, Fast ARCNET 100Mbps, 16Mbps Token Ring, and ATM 155Mbps on UTP.
5e	1000 Mbps	enhanced category 5 - more comprehensive testing is carried out on all four pairs to measure the effect of transmitting data, particularly with regard to crosstalk. This category is primarily intended for use in Gigabit Ethernet networks.
6	1000 Mbps	a proposed standard for cable having a transmission frequency of 200 MHz.
7	1000 Mbps	a proposed standard for cable having a transmission frequency of 600 MHz using fully shielded cables (individual foil pairs and overall braid shield - ISTP).

CHUẨN IEEE 802.3 CHO CÁP XOẮN KÉP KẾT NỐI ETHERNET TOPO DẠNG STAR

Standard	IEEE Released	Symbol rate	Encoding	Medium	Full-duplex
10Base-T	802.3i -1990	10Mbd	Manchester	Two pairs of 100 Ω UTP CAT3 or better	Supported
100Base-TX	802.3u - 1995	125Mbd	4B/5B	Two pairs of 100 Ω UTP CAT5 or 150 Ω STP	Supported
100Base-T4	802.3u -1995	33Mbd	8B/6T	Four pairs of 100 Ω UTP CAT3 or better	Not
100Base-T2	802.3y - 1997	25Mbd	PAM5x5	Two pairs of 100 Ω UTP CAT3 or better	Supported
1000Base-T	802.3ab -1999	125Mbd	PAM5x5	Four pairs of 100 Ω UTP CAT5 or better	Supported
1000Base-X	802.3z -1999	1250Mbd	8B/10B	Two pairs of 150 Ω STP	Supported

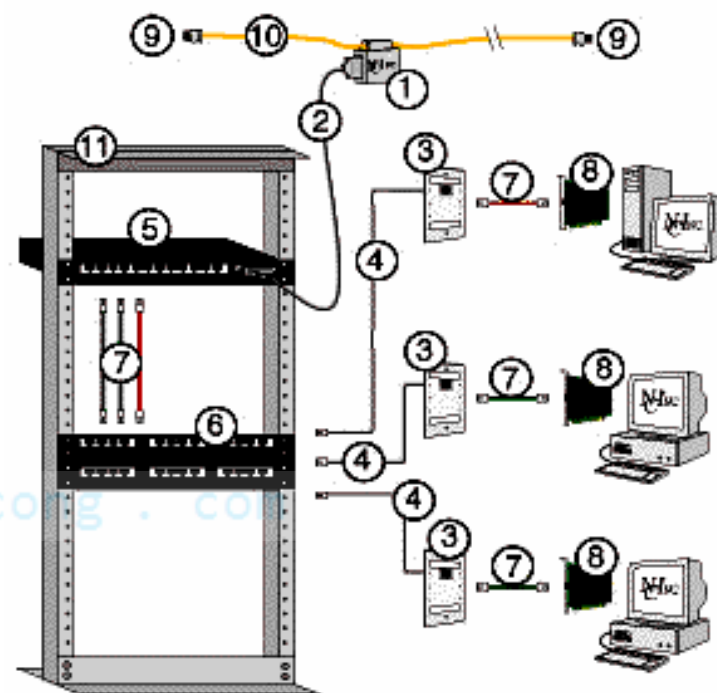
RJ-45 CONNECTOR PIN ASSIGNMENTS FOR EACH OF THE ETHERNET TWISTED PAIRS.

Pin	10Base-T Signal	100Base-TX Signal	100Base-T4 Signal	100Base-T2 Signal	1000Base-T Signal
1	TD+ (Transmit Data)	TD+ (Transmit Data)	TX_D1+ (Transmit Data)	BI_DA+ (Bidi Data)	BI_DA+ (Bidi Data)
2	TD- (Transmit Data)	TD- (Transmit Data)	TX_D1- (Transmit Data)	BI_DA- (Bidi Data)	BI_DA- (Bidi Data)
3	RD+ (Receive Data)	RD+ (Receive Data)	RX_D2+ (Receive Data)	BI_DB+ (Bidi Data)	BI_DB+ (Bidi Data)
4	Not used	Not used	BI_D3+ (Bidi Data)	Not used	BI_DC+ (Bidi Data)
5	Not used	Not used	BI_D3- (Bidi Data)	Not used	BI_DC- (Bidi Data)
6	RD- (Receive Data)	RD- (Receive Data)	RX_D2- (Receive Data)	BI_DB- (Bidi Data)	BI_DB- (Bidi Data)
7	Not Used	Not Used	BI_D4+ (Bidi Data)	Not used	BI_DD+ (Bidi Data)
8	Not Used	Not Used	BI_D4- (Bidi Data)	Not used	BI_DD- (Bidi Data)

CHUẨN IEEE ETHERNET 10BASE-T

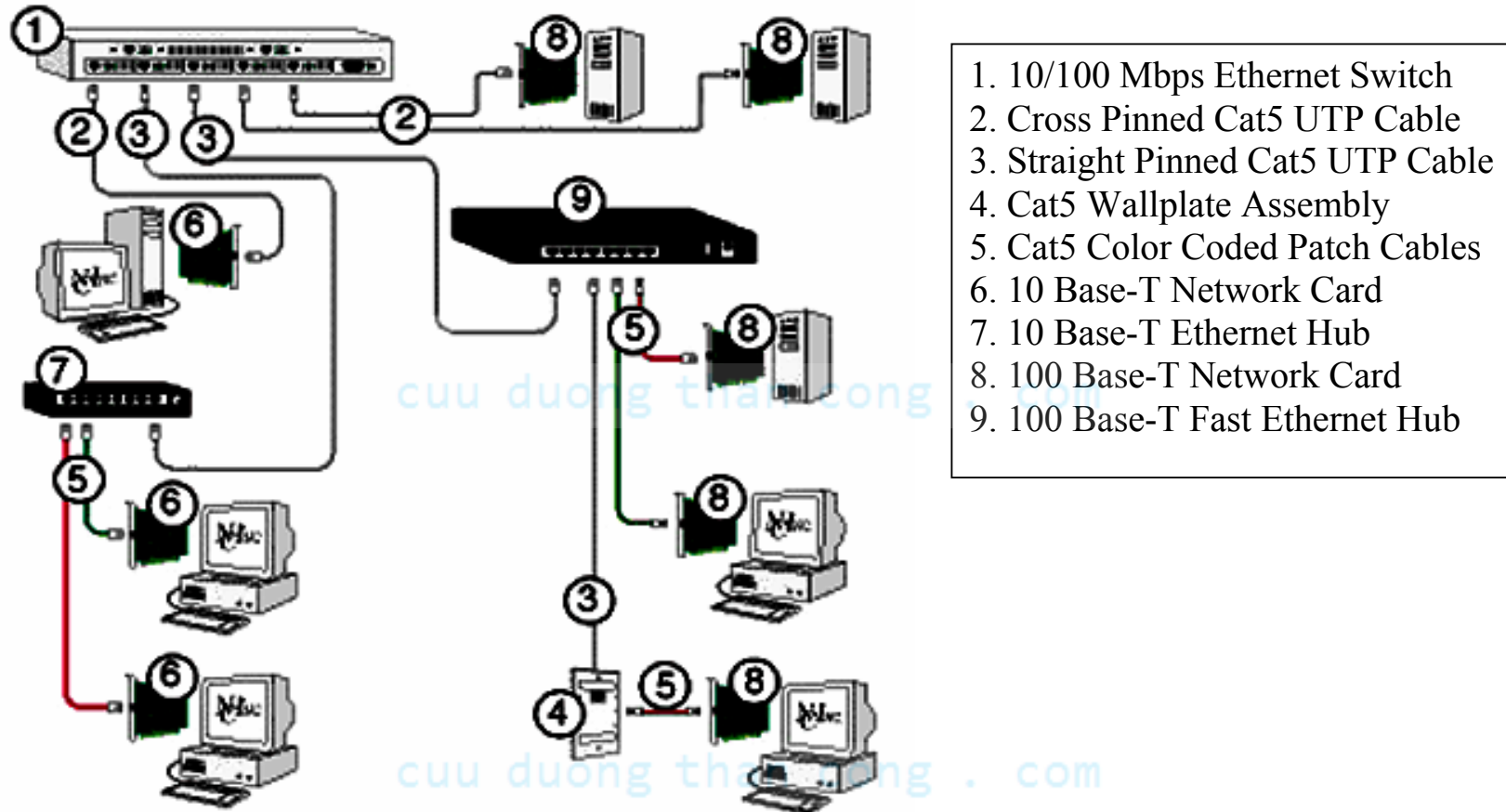
10 BASE-T PARAMETERS AND WIRING RULES

- Star topology using HUB. 10Mbps Baseband. Using Manchester encoding.
- Maximum length per segment is 100 meters. (10 meters Patch cord + 90 meters horizontal cable)
- Maximum of 2 devices per segment; one is the station and the other is the hub.
- Maximum of 2 Inter-Repeater Links between devices without using bridge or switch (A hub is a repeater).
- Certain hubs come with a standard BNC and/or AUI connection.
- Hubs can connect to fiber optic or coax networks.
- Unshielded twisted pair no less than Category 2 is required for 10BaseT operation, however, Category 3 or higher is preferred.
- UTP cabling is not recommended for areas with electromagnetic or radio frequency interference (EMI/RFI).
- NIC's come with built-in transceivers so connections are made directly to the NIC.
- NIC's with standard AUI ports must use a 10Base-T twisted pair transceiver.

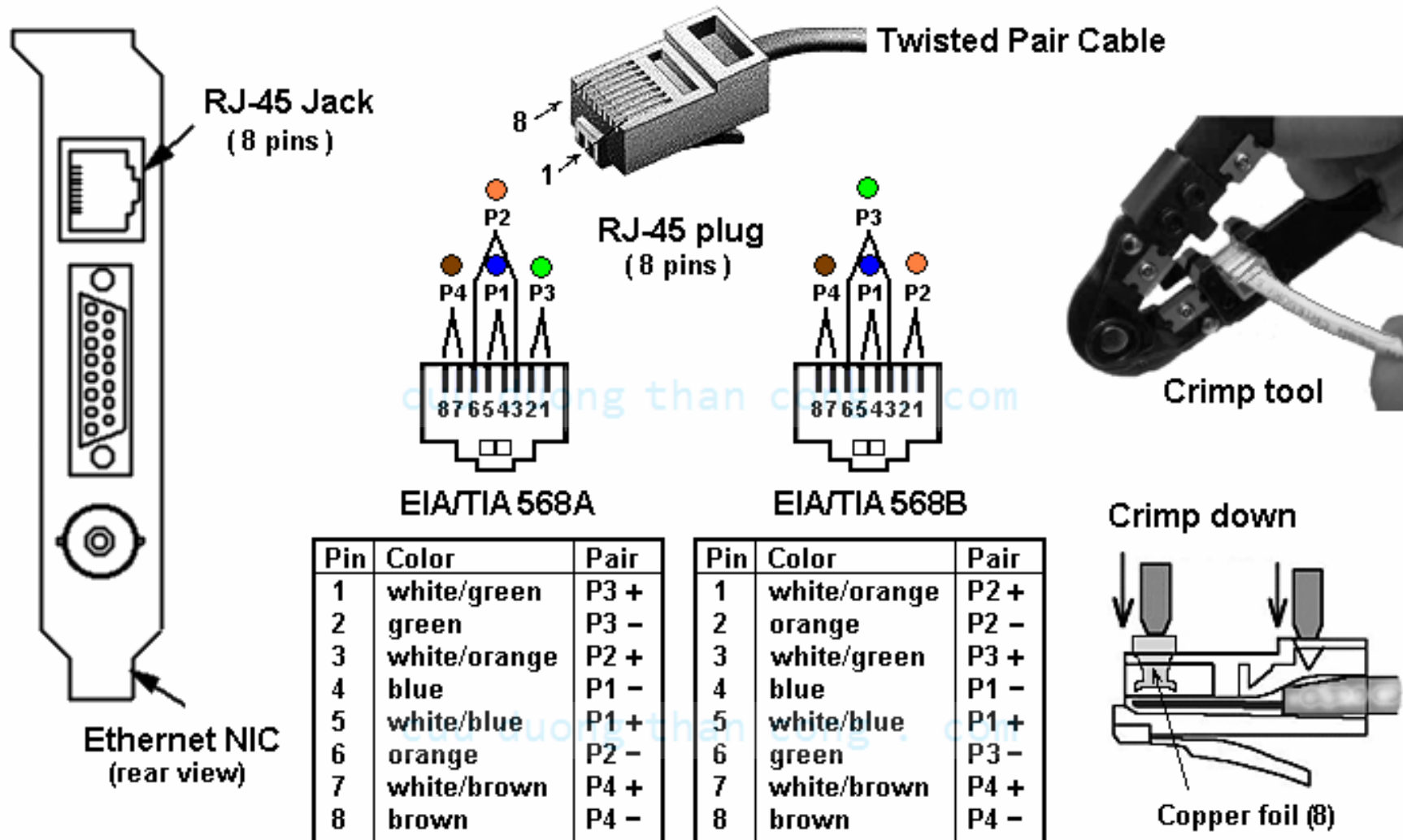


- | | |
|-----------------------------------|----------------------|
| 1. Transceiver | 2. Transceiver Cable |
| 3. Cat 5 Wallplate (Outlet) | 4. Cat 5 UTP Cable |
| 5. 10 Base-T Hub | 6. Cat 5 Patch Panel |
| 7. Cat 5 Color Coded Patch Cables | |
| 8. 10 Base-T RJ45 Network Card | |
| 9. 50 Ohm Terminator | |
| 10. Thick Ethernet Trunk Cable | |
| 11. Equipment Rack | |

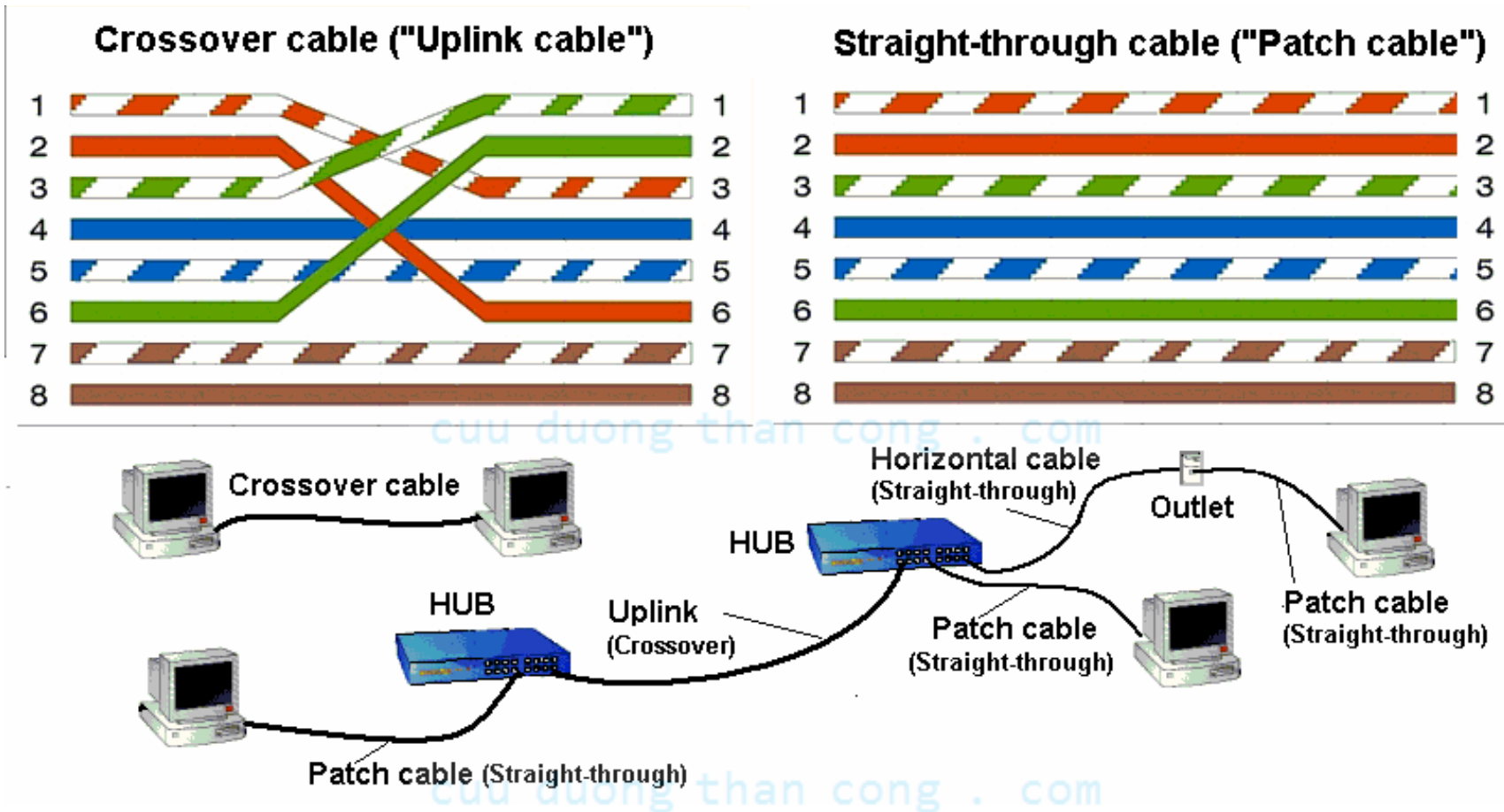
ETHERNET 100BASE-T



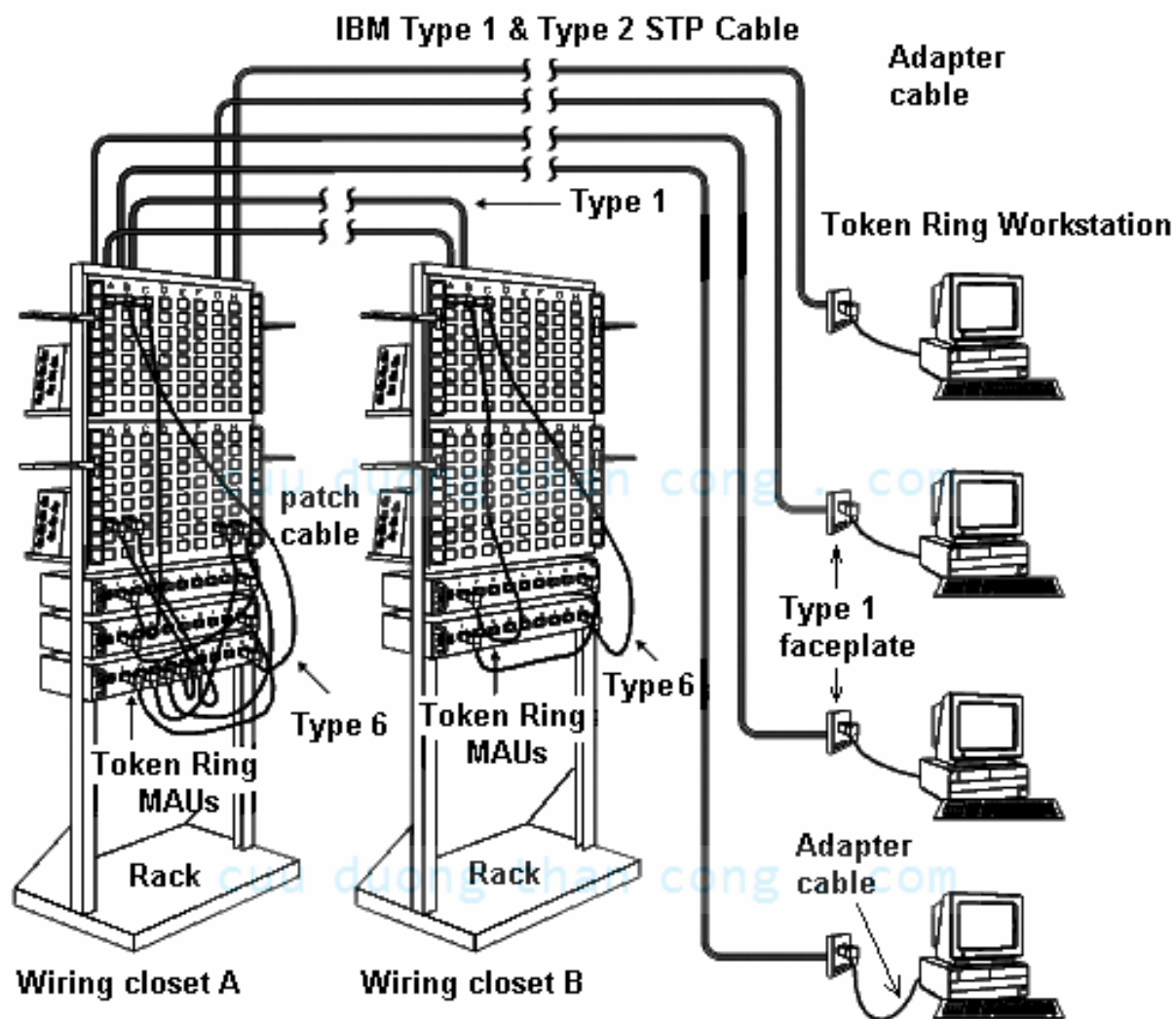
CHUẨN MẪU DÂY CÁP UTP VÀ JACK ĐẦU NỐI RJ-45



ĐẤU NỐI CÁP THẲNG VÀ CÁP CHÉO

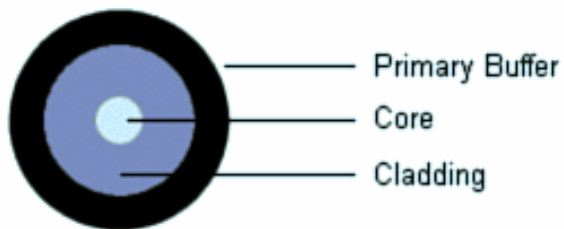


CẤP STP THƯỜNG DÙNG CHO MANG TOKEN RING

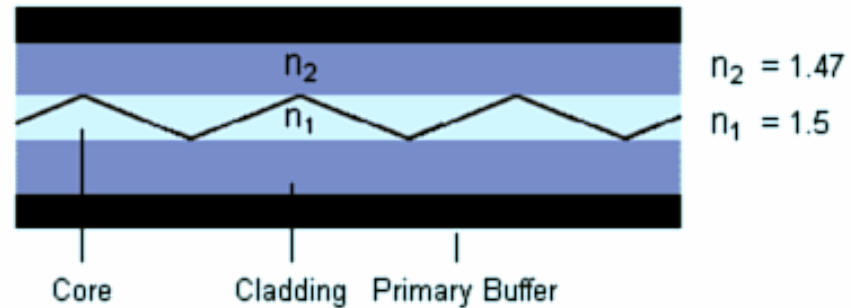


CẤU TẠO VÀ PHÂN LOẠI CÁP QUANG (OPTICAL FIBER)

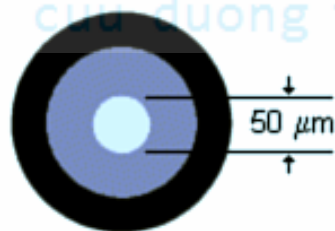
Basic Construction of an Optical Fiber



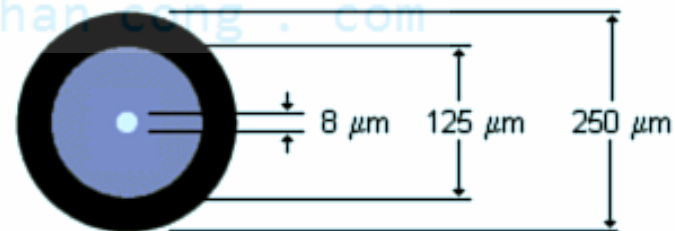
Light Transmission in an Optical Fiber



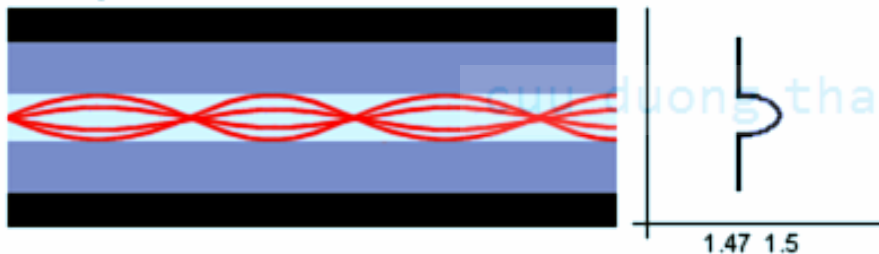
Multi-Mode Fiber



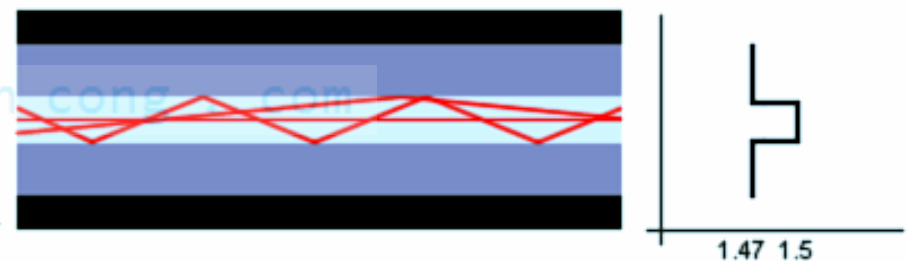
Single-Mode Fiber



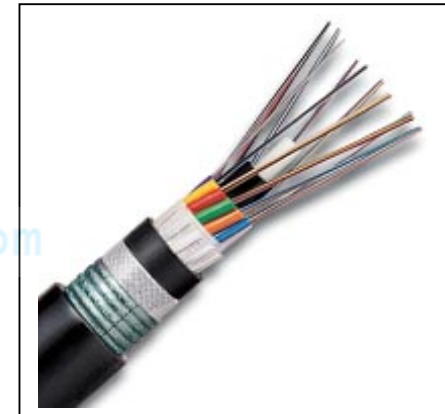
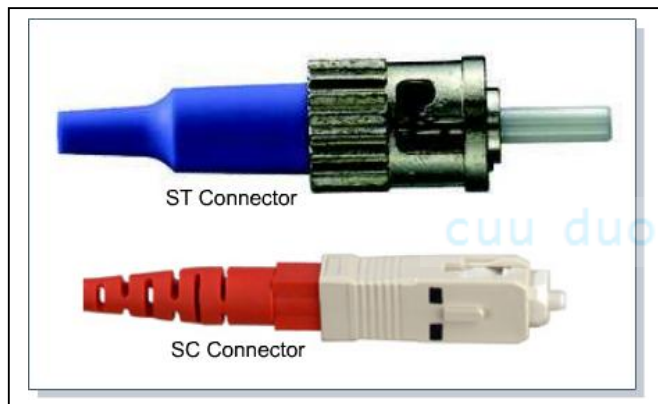
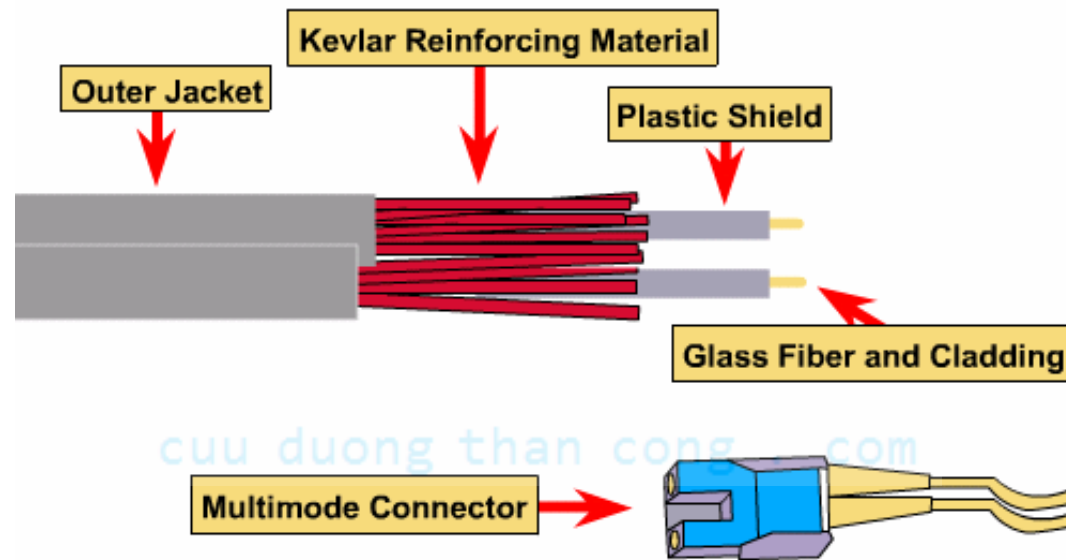
Light Paths in a Graded Index Fiber



Light Paths in a Stepped-Index Fiber



Fiber Optic Cable



MULTI-MODE FIBER (MMF)

- Multi-mode fiber typically has a core diameter of 50 or 62.5 micron.
- Allows good coupling from inexpensive LEDs light sources, and the use of inexpensive couplers and connectors.
- Support segment lengths 2000 meters for 10 and 100 Mbps Ethernet, and 550 meters for 1 Gbps Ethernet.
- Two types of multi-mode fiber :
 1. Graded Index Fiber -----> reducing modal dispersion of the signal.
 2. Stepped Index Fiber -----> lower bandwidths than graded index fibers.

SINGLE-MODE FIBER (SMF)

- Core diameter that is so small (8 or 10 microns) that eliminates modal dispersion.
- More difficult to make coupling light into the fiber.
- Lasers must be used as light sources to attain high bandwidth.
- Supporting much longer segment lengths than multi-mode fiber. (5000 meters supported at all Ethernet).
- More expensive to deploy than multi-mode fiber.

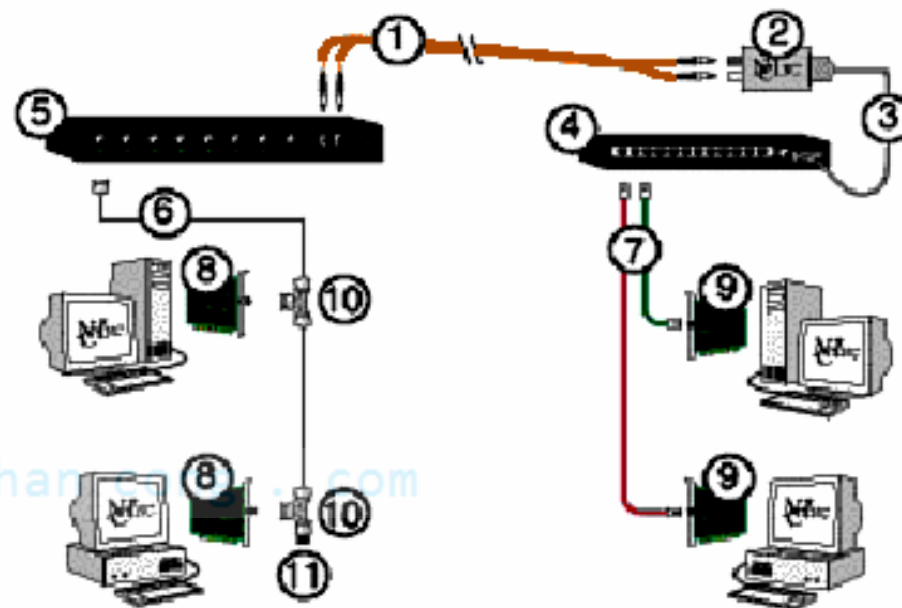
CHUẨN IEEE CHO CÁP QUANG KẾT NỐI ETHERNET

Standard	Medium and wavelength connector and encoding	Maximum segment length	Application
10Base-FL (Fiber Link)	MMF 62.5/125 , 850 nm wavelength ST connector, Manchester	2000 m	Fiber Optic Inter-Repeater Link ideal for connecting between buildings.
10Base-FB (Fiber Backbone)	MMF 62.5/125 , 850 nm wavelength ST connector, Manchester	2000 m	increases the number of repeaters by reducing the amount of interframe gap shrinkage.
10Base-FP (Fiber Passive)	MMF 62.5/125 , 850 nm ST connector, Manchester	500 m	using for "fiber optic passive star" system
100Base-FL (Fiber Link)	MMF 62.5/125 , 850 nm wavelength ST connector, Manchester	2000 m	for connecting between buildings.
100Base-FX	MMF 62.5/125 , 1300 nm wavelength EC connector, 4B/5B.	Half 420m Full 2000 m	essentially a "fiber" version of the 100Base-TX standard
1000Base-LX (Long wavelength)	MMF 62.5/125 or 50/125 or SMF 10/125. 1300 nm wavelength. duplex SC connector, 8B/10B.	Half 316 m Full MMF: 550 Full SMF: 5000	able to drive longer distances.
1000Base-SX (Short wavelength)	MMF 62.5/125 or 50/125 850 nm wavelength. duplex SC connector, 8B/10B.	MMF 62.5/125 Half 275 m Full 275 m MMF 50/125 Half 316 m Full 550 m	Short wavelength lasers have the advantage of being less expensive than long wavelength lasers.

CHUẨN IEEE ETHERNET 10BASE-FL

10 BASE-FL PARAMETERS AND WIRING RULES

- Maximum length per segment is 2 km.
- Maximum of 2 devices per segment; one is the station and the other is the hub.
- Star topology.
- 62.5-micron duplex multimode fiber cable is recommended. 50 and 100 micron is also available.
- Maximum of 2 repeaters may be used between devices.
- Repeater come in pairs. A pair counts as 1 repeater.
- NIC's with standard AUI ports must use a fiber optic transceiver.
- EMI/RFI is nonexistent.
- Best security.



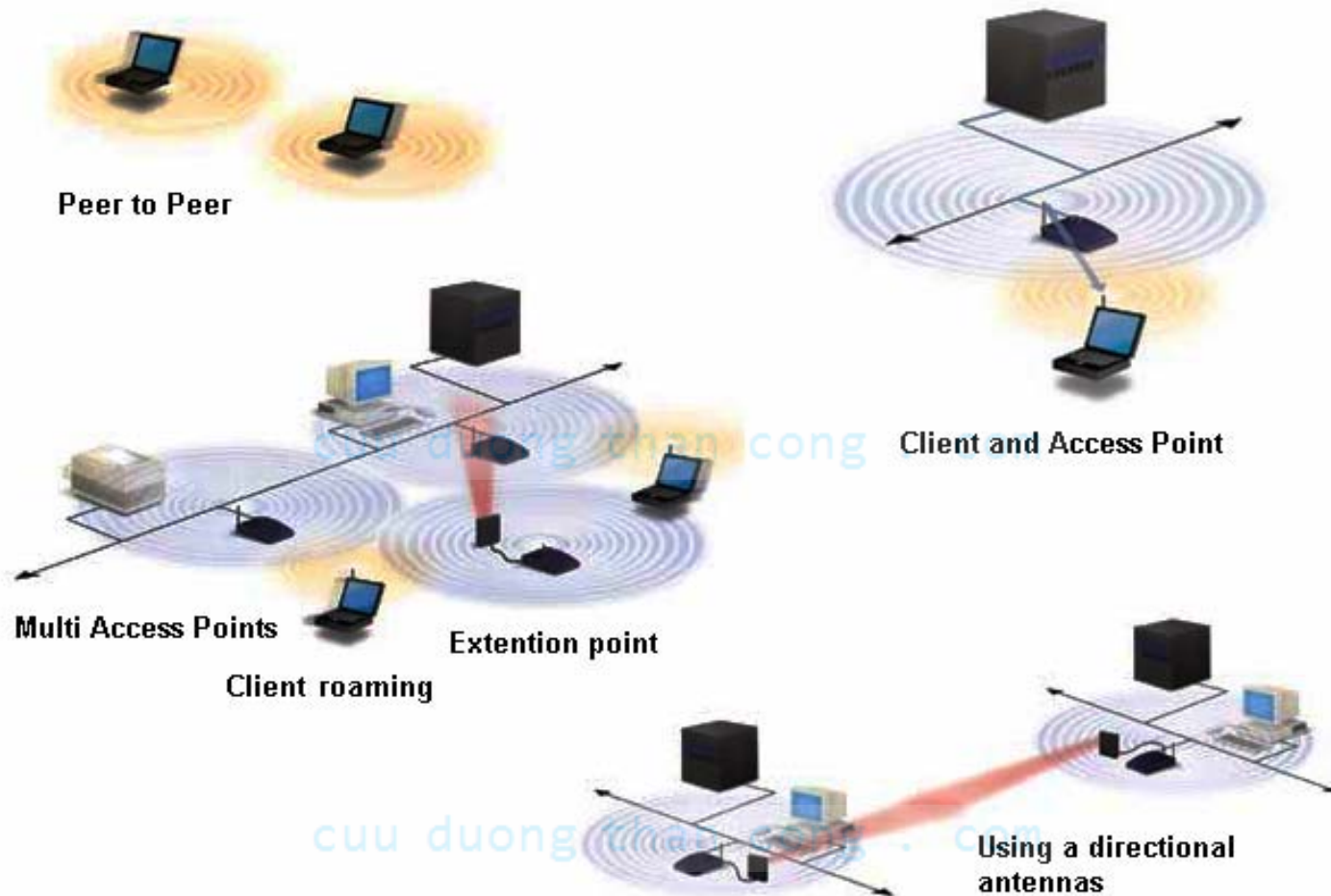
- | | |
|-----------------------------------|----------------------|
| 1. Fiber Optic Cable | 2. Transceiver |
| 3. Transceiver Cable | 4. 10 Base T Hub |
| 5. Thinnet Repeater | 6. PVC Thinnet Cable |
| 7. Cat 5 Color Coded Patch Cables | |
| 8. Thin Ethernet BNC Network Card | |
| 9. 10 Base-T RJ45 Network Card | |
| 10. BNC T-Connector | |
| 11. 50 Ohm Terminator | |

PHƯƠNG TIỆN TRUYỀN DẪN VÔ TUYẾN

TYPE	CHARACTERISTIC	FCC LICENSE ?	APPLICATION
Terrestrial microwave	Point to Point GHz link, High bandwidth. Disturbed by bad weather	Yes	Private remote links LAN repeater connections
Satellite microwave	Point to Multipoint expensive, covers large area GHz link, 250 ms delay.	Yes	One to many transmission CATV
Radio	Multipoint or Point to Point VHF & UHF radio channel Mobile units are available	Yes	for Private WANs for Wireless LANs Long-distance data communication
Infrared	Point to Point short-range link High bandwidth possible	No	Wireless LANs PC to PC connection
Laser	Point to Point Disturbed by bad weather	No	Short-links (Private link between buildings)

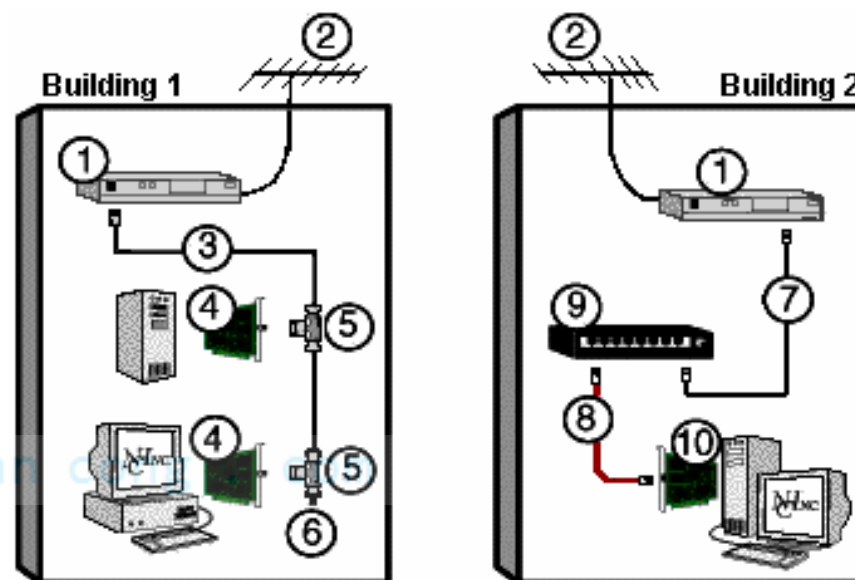
FCC - Federal Communications Commission

CÁC MÔ HÌNH TRIỂN KHAI MẠNG WLAN



WIRELESS ETHERNET (IEEE 802.11)

- IEEE 802.11 was the first of the wireless LAN technologies and provided a data throughput of 1 - 2 Mbps and used a frequency range of about 900 Mhz.
- 802.11 WLAN standard allows for transmission over infrared light and two types of radio transmission within the unlicensed frequency band: frequency hopping spread spectrum (FHSS) and direct sequence spread spectrum (DSSS). FHSS is limited to a 2-Mbps data transfer For all other WLAN applications, DSSS is the better choice.
- IEEE 802.11b (referred to as *802.11 High Rate* or *Wi-Fi*), provides for a data rate of 11 Mbps over DSSS with a frequency range of 2.4 Ghtz.
- IEEE 802.11a, which provides throughput of 54 Mbps and also uses DSSS on a frequency of 5 Ghtz. the frequency will reach 5.7 Ghtz and allow WLAN's to break the 100 Mbps threshold.
- IEEE 802.11g transmission over relatively short distances Operates at up to 54 megabits per second (Mbps)
- Basic Access Methode is CSMA/CA.
- Using the Wired Equivalent Privacy 64/128 bits (WEP) or the Wi-Fi Protected Access (WPA) to secure.



1. Wireless Ethernet Bridge
3. PVC Thinnet Cable
5. BNC T Connector
7. Cat5 UTP Cable
9. 10 Base-T Ethernet Hub

2. Outdoor Antenna
4. Thin Ethernet Network Card
6. 50 Ohm Terminator
8. Cat5 Patch Cables
10. 10 Base-T Network Card