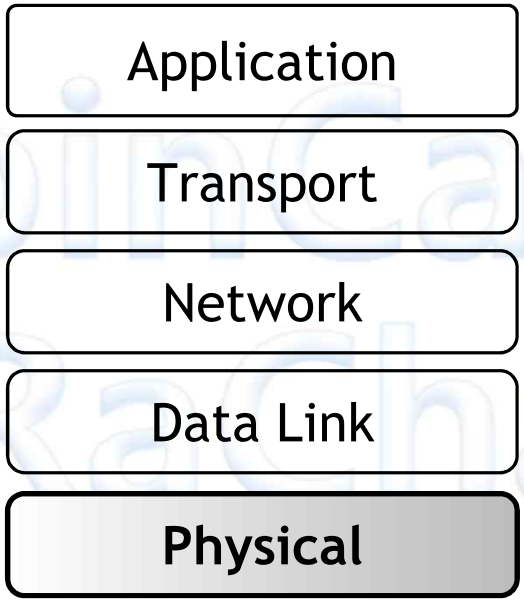
TCP/IP Network

Physical Layer



- 컴퓨터 데이터를 물리 신호로 변환하여 전송 매체에 신호를 전달
  - 부호화
  - 신호변환
- 물리 부품으로 구성

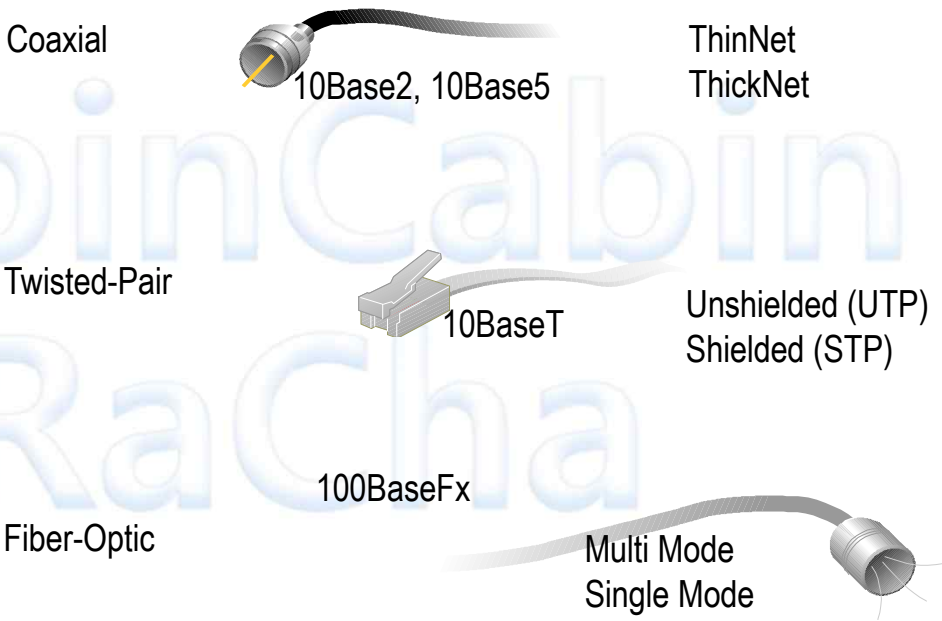
TCP/IP Network

Physical Layer

Cable & Connector

- UTP/STP
  - RJ-45 Connector

- Fiber-Optical Cable
  - ST, SC, LC Connector



TCP/IP Network

Physical Layer

Type of Ethernet

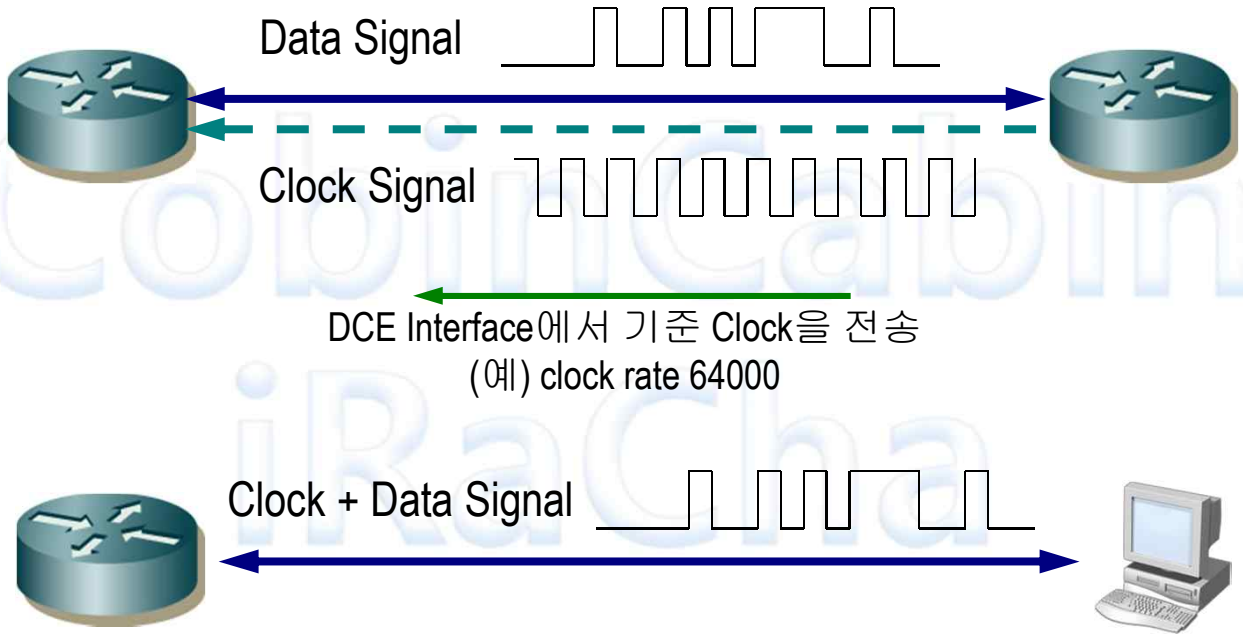
- 앞 숫자
  - 속도
- Base
  - Baseband Signal
- 뒤 숫자
  - 전송거리
- T
  - Twisted Pair Cable
- F
  - Fiber Cable
- S
  - Short Length
- L
  - Long Length

Ethernet Type	Bandwidth	Cable Type	Duplex	Maximum Distance
10Base-5	10 Mbps	Thicknet Coaxial	Half	500 m
10Base-2	10 Mbps	Thinnet Coaxial	Half	185 m
10Base-T	10 Mbps	Cat3/Cat5 UTP	Half	100 m
100Base-TX	100 Mbps	Cat5 UTP	Half	100 m
100Base-TX	200 Mbps	Cat5 UTP	Full	100 m
100Base-FX	100 Mbps	Multimode Fiber	Half	400 m
100Base-FX	200 Mbps	Multimode Fiber	Full	2 km
1000Base-T	1 Gbps	Cat5e UTP	Full	100 m
1000Base-TX	1 Gbps	Cat6 UTP	Full	100 m
1000Base-SX	1 Gbps	Multimode Fiber	Full	550 m
1000Base-LX	1 Gbps	Single-Mode Fiber	Full	2 km
10GBase-CX4	10 Gbps	Twin-axial	Full	100 m
10GBase-T	10 Gbps	Cat6a/Cat7 UTP	Full	100 m
10GBase-LX4	10 Gbps	Multimode Fiber	Full	300 m
10GBase-LX4	10 Gbps	Single-Mode Fiber	Full	10 km

TCP/IP Network

Physical Layer

Clock 신호 동기화 방법

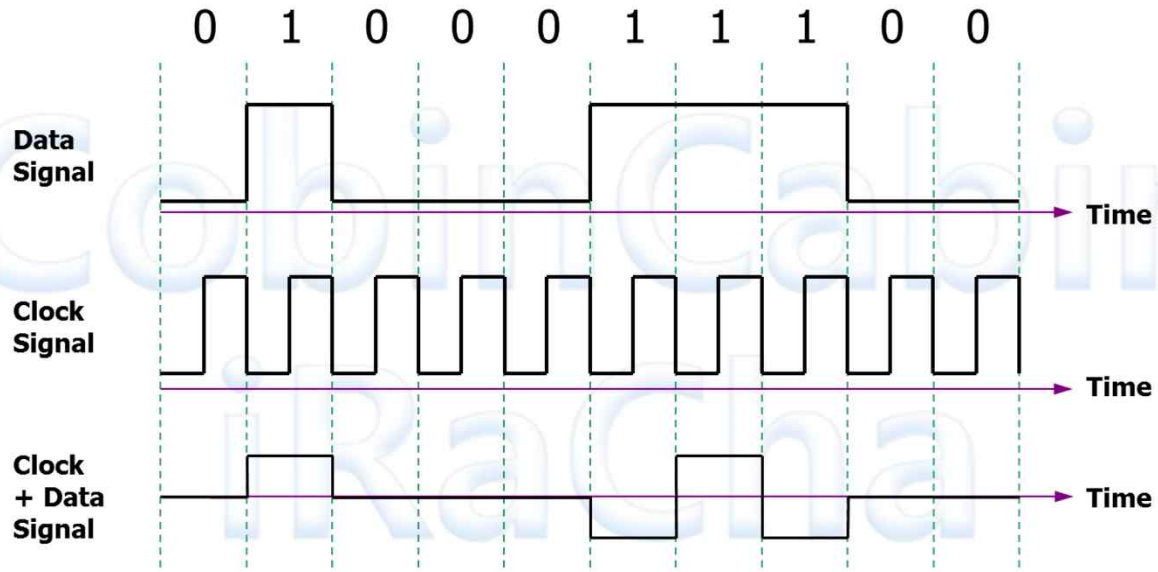


- 동기화
  - 신호의 타이밍을 동일하게 설정
- DCE
  - WAN으로 신호를 전달하는 장치

TCP/IP Network

Physical Layer

전용 회선상의 Clock신호와 Data신호 파형

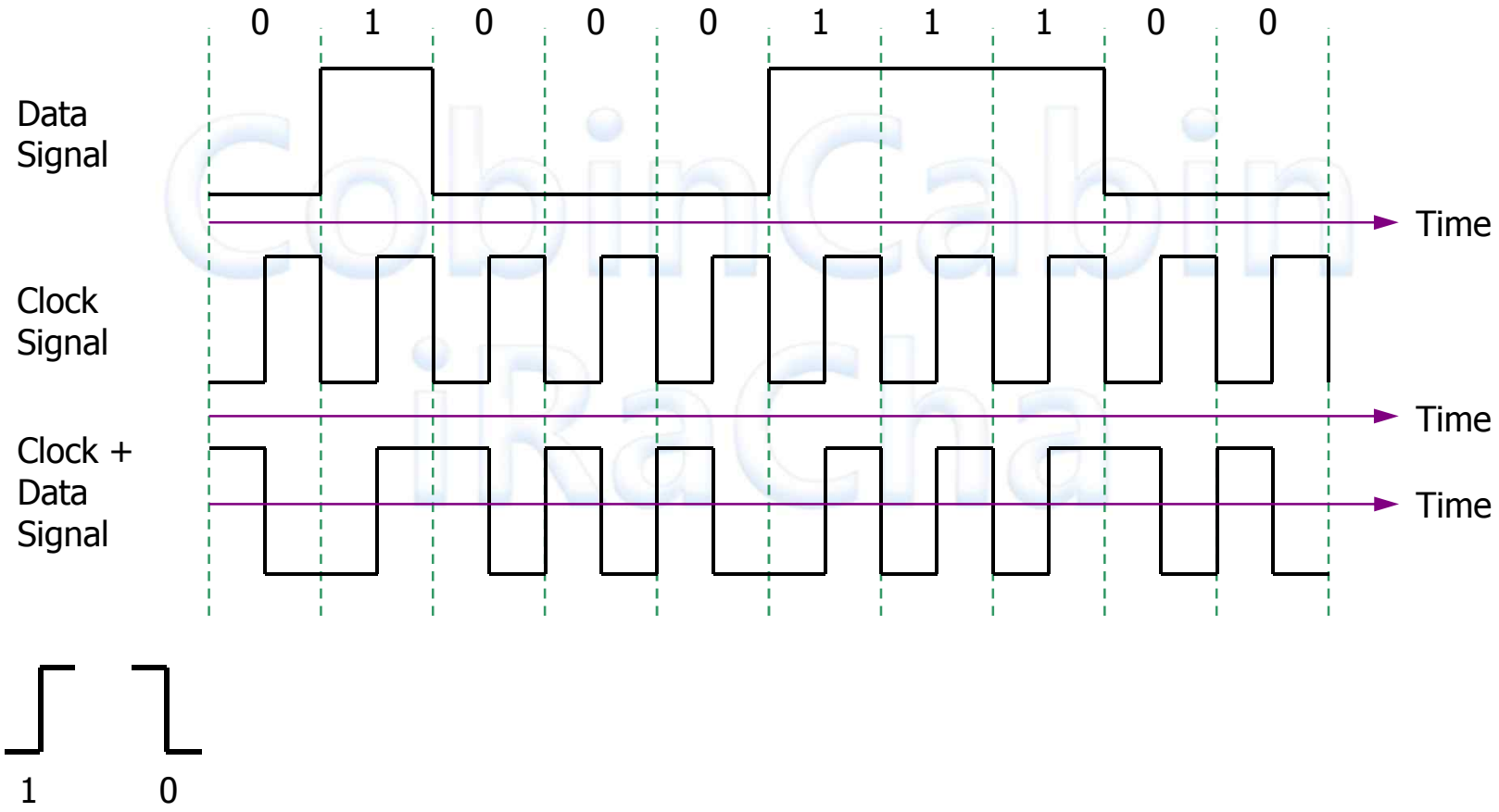


- 1은 한 번은 High(+), 한번은 Low(-) 형태를 번갈아 가면서 신호를 전달
- T1/E1
- Bipolar
- B8ZS(Bipolar 8-zero Substitution)

TCP/IP Network

Physical Layer

Ethernet(10Mbps)상의 Clock신호와 Data파형



TCP/IP Network

Physical Layer

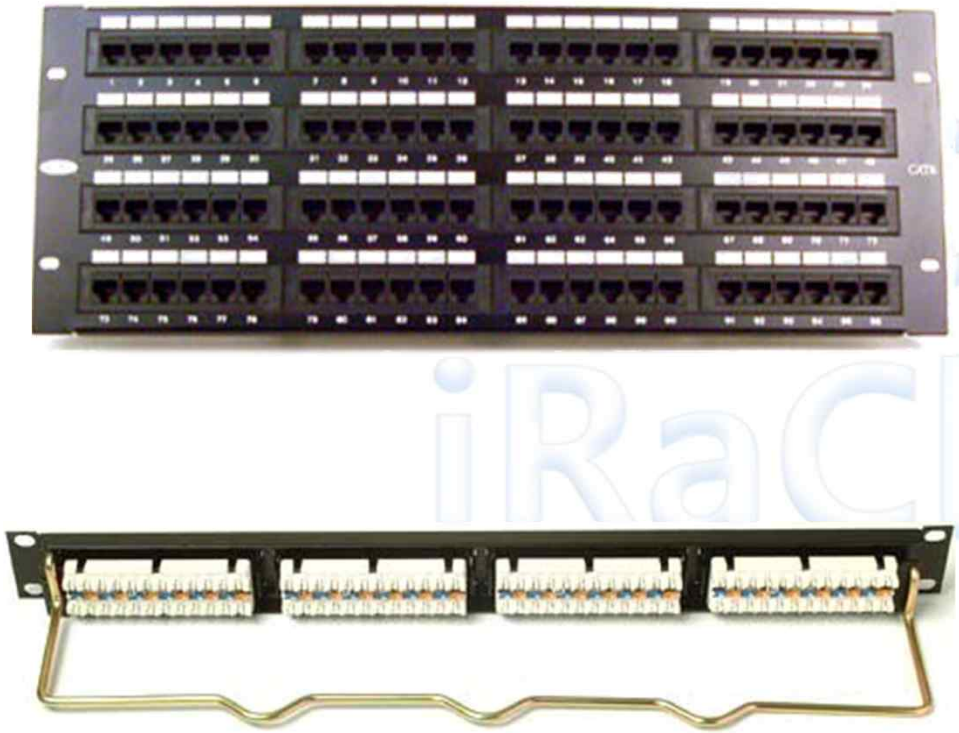
Ethernet상의 Clock신호와 Data파형

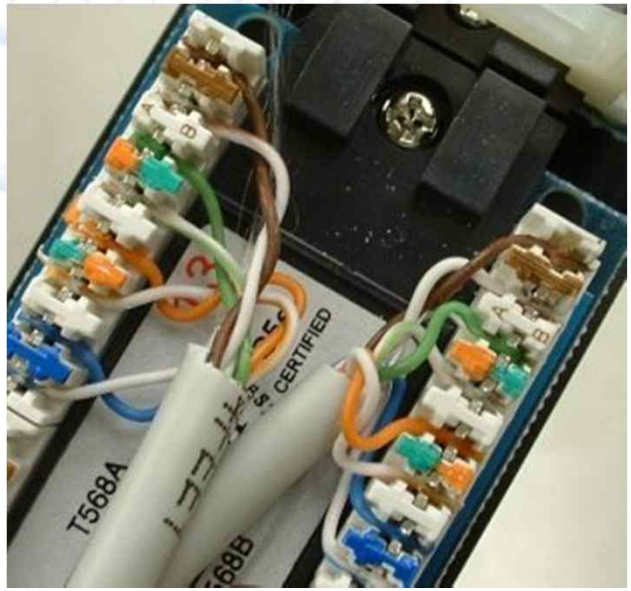
- Manchester : 10Mbps
  - Ethernet(10Mbps)는 맨체스터(Manchester) 인코딩(encoding) 방식을 사용한다.
  - 일정 시점에서 Low에서 High로 변하면 1, High에서 Low로 변하면 0으로 판단하는 신호
  - 항상 주기적으로 변하기 때문에 클럭 신호가 필요 없다. (데이터 신호에 클럭(Clock) 신호가 포함되어 있음.)
- MLT3 : 100Mbps
- NRZ : Standard Signaling
- NRZI : Fiber Optical Cable

TCP/IP Network

Physical Layer

UnSheiled Patch Panel

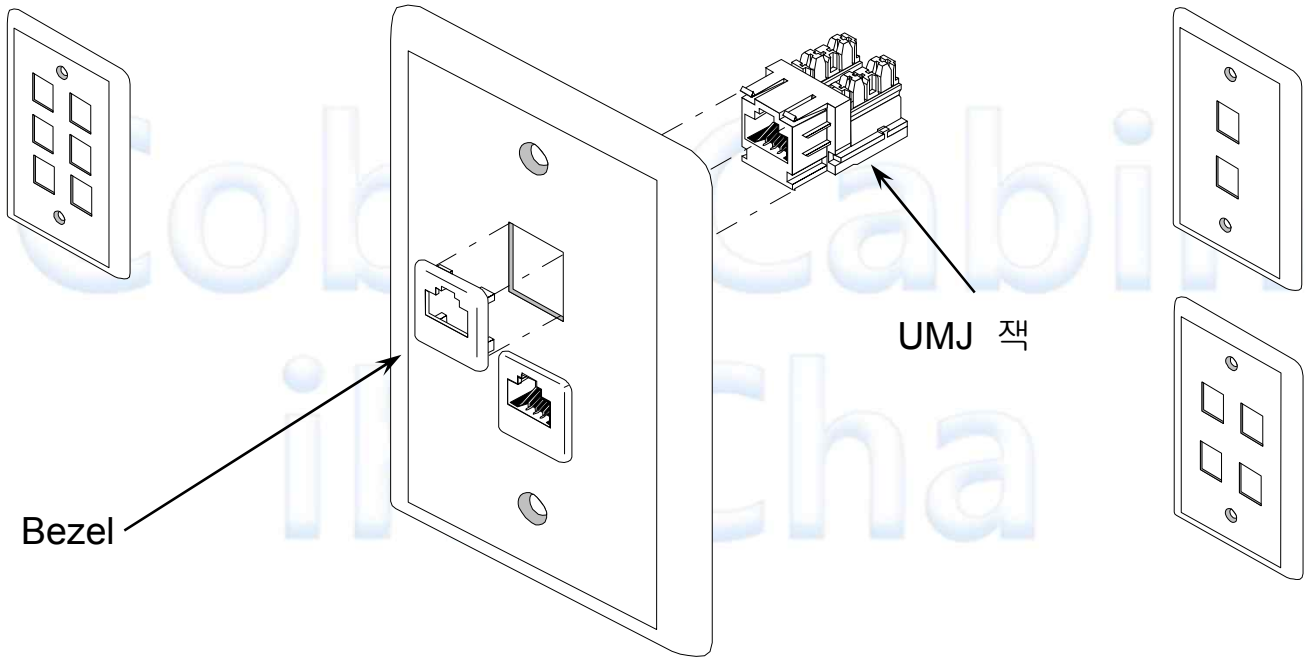




TCP/IP Network

Physical Layer

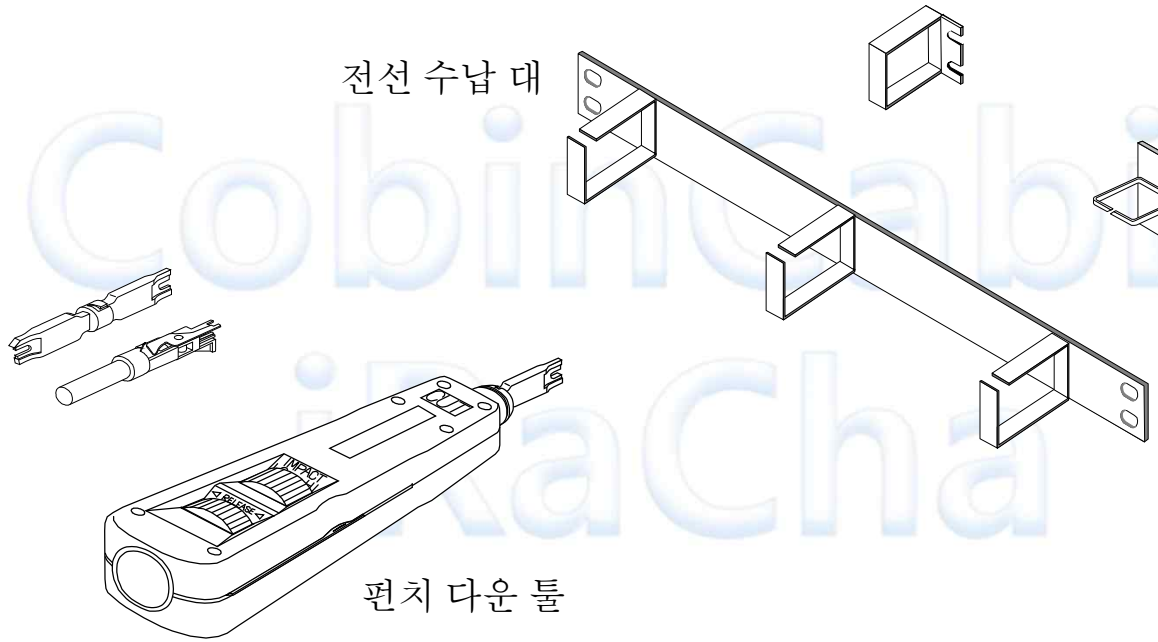
미국형 Face Plate



TCP/IP Network

Physical Layer

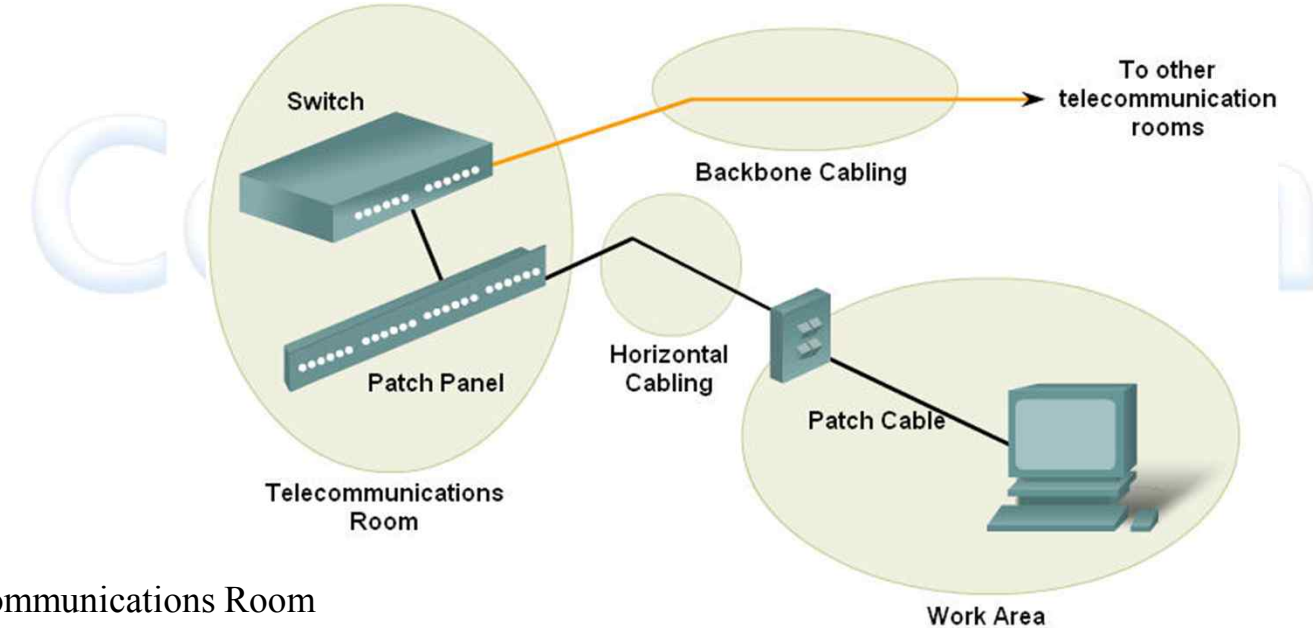
Cable Guide & Punch Down Tool



TCP/IP Network

Physical Layer

LAN Cabling Areas



- Telecommunications Room
- Work Area
- Patch Panel
- Patch Cable
- Backbone Cabling
- Horizontal Cabling

TCP/IP Network

Physical Layer

UTP Cable Category

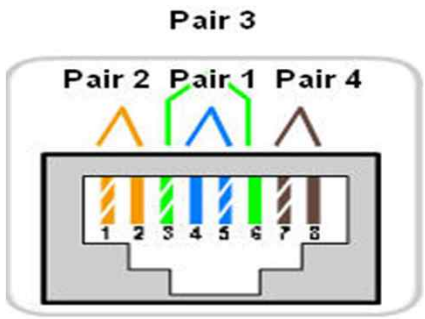
- EIA(Electronic Industries Alliance)
- EIA/TIA-586 표준 규격 (CAT1/2/3/4 표준 삭제)

• CAT 1	1Mbps 미만	아날로그 음성 (전화) ISDN BRI 연결용
• CAT 2	4Mbps	주로 IBM의 토큰링에 사용
• CAT 3	16Mbps	10BaseT Ethernet 데이터 및 음성 전송
• CAT 4	20Mbps	16Mbps 토큰링에서 사용. 많이 사용하지 않음
• CAT 5	100Mbps	100Mbps FastEthernet Network. 가장 보편적
• CAT 5e	100MHz	1Gbps 지원
• CAT 6	200MHz~250MHz	1000Mbps를 구성하기 위해 만들어졌다
• CAT 7	600MHz	10Gbps

TCP/IP Network

Physical Layer

Ethernet Connectors RJ45 Pinouts



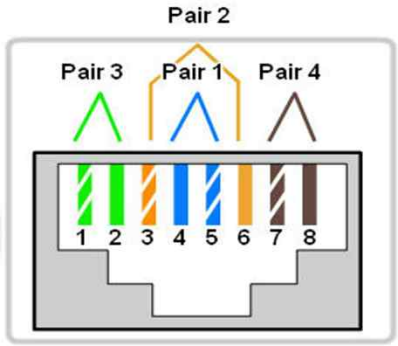
Pin Number	Signal
1	TD+ (Transmit Data, positive-going differential signal)
2	TD- (Transmit Data, negative-going differential signal)
3	RD+ (Receive Data, positive-going differential signal)
4	Unused
5	Unused
6	RD- (Receive Data, negative-going differential signal)
7	Unused
8	Unused

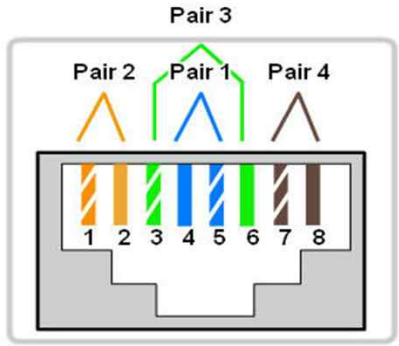
TCP/IP Network

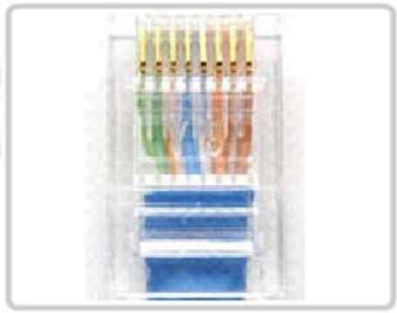
Physical Layer

RJ45 T568B Termination

- Pin out
  - Pin 배열
- T568A
  - G, O, BL, BR
- T568B
  - O, G, BL, BR
- Straight-Through Cable
- Crossover Cable
- Rollover Cable
  - Console Port와 컴퓨터를 연결



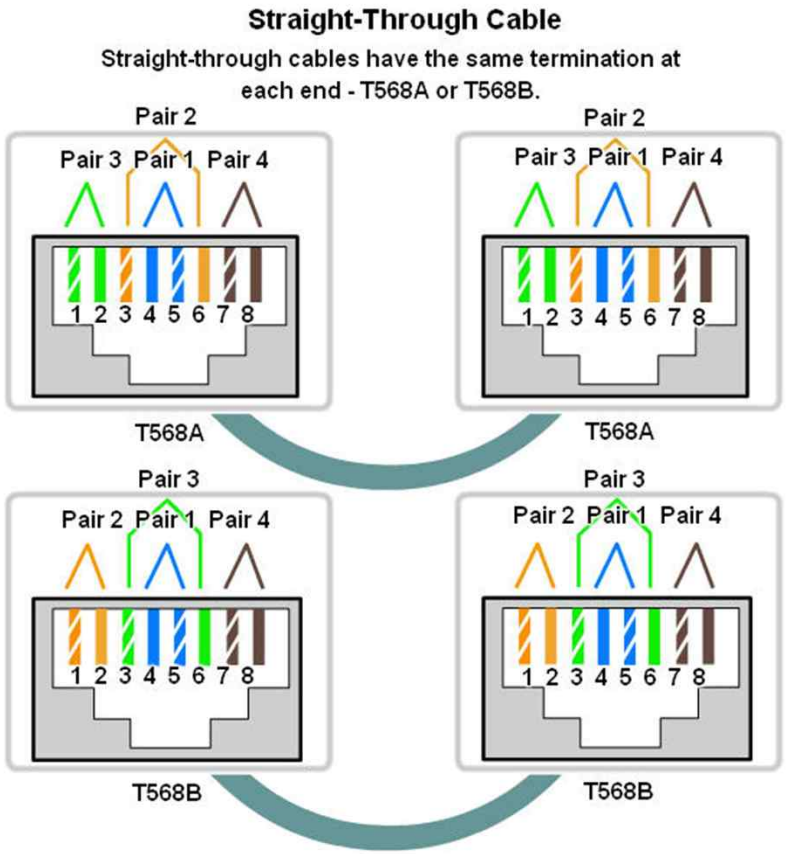


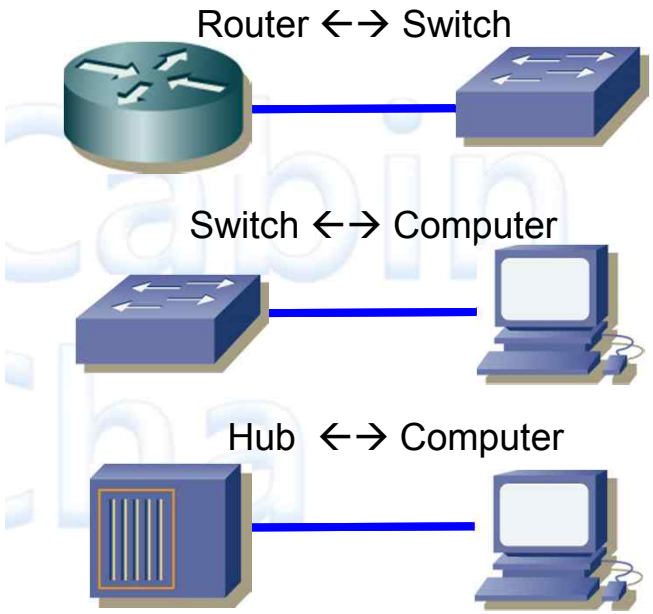


TCP/IP Network

Physical Layer

UTP Straight-Through Cable

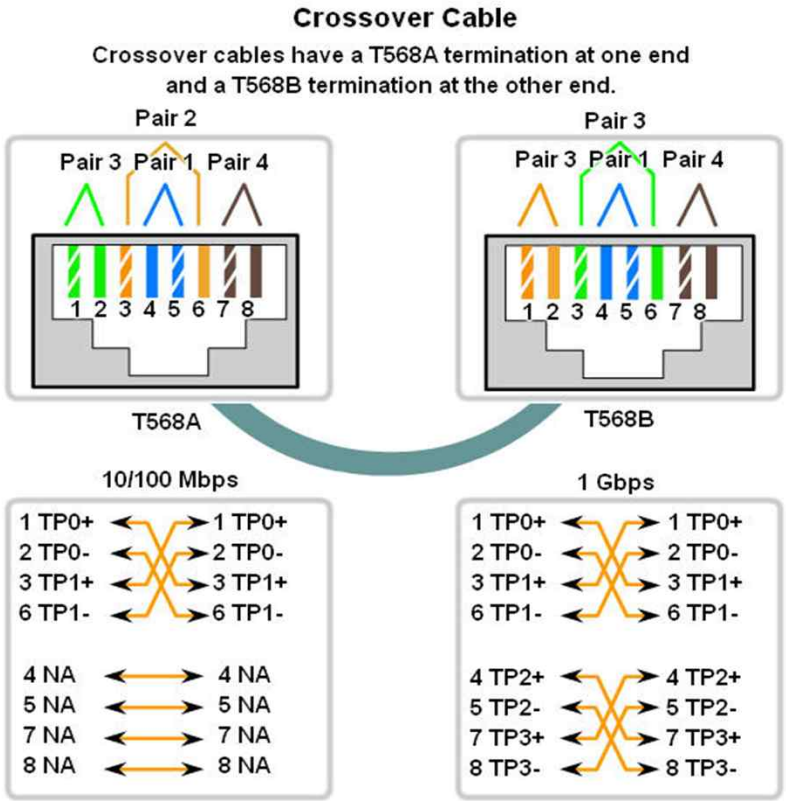


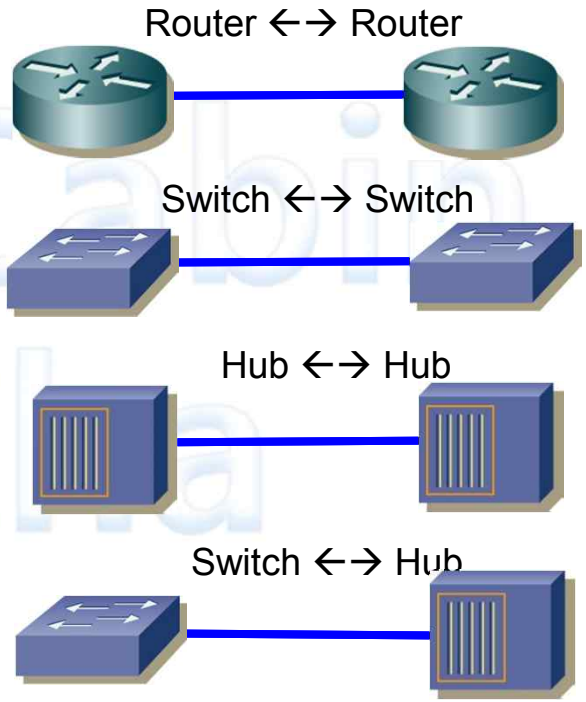


TCP/IP Network

Physical Layer

UTP Crossover Cable



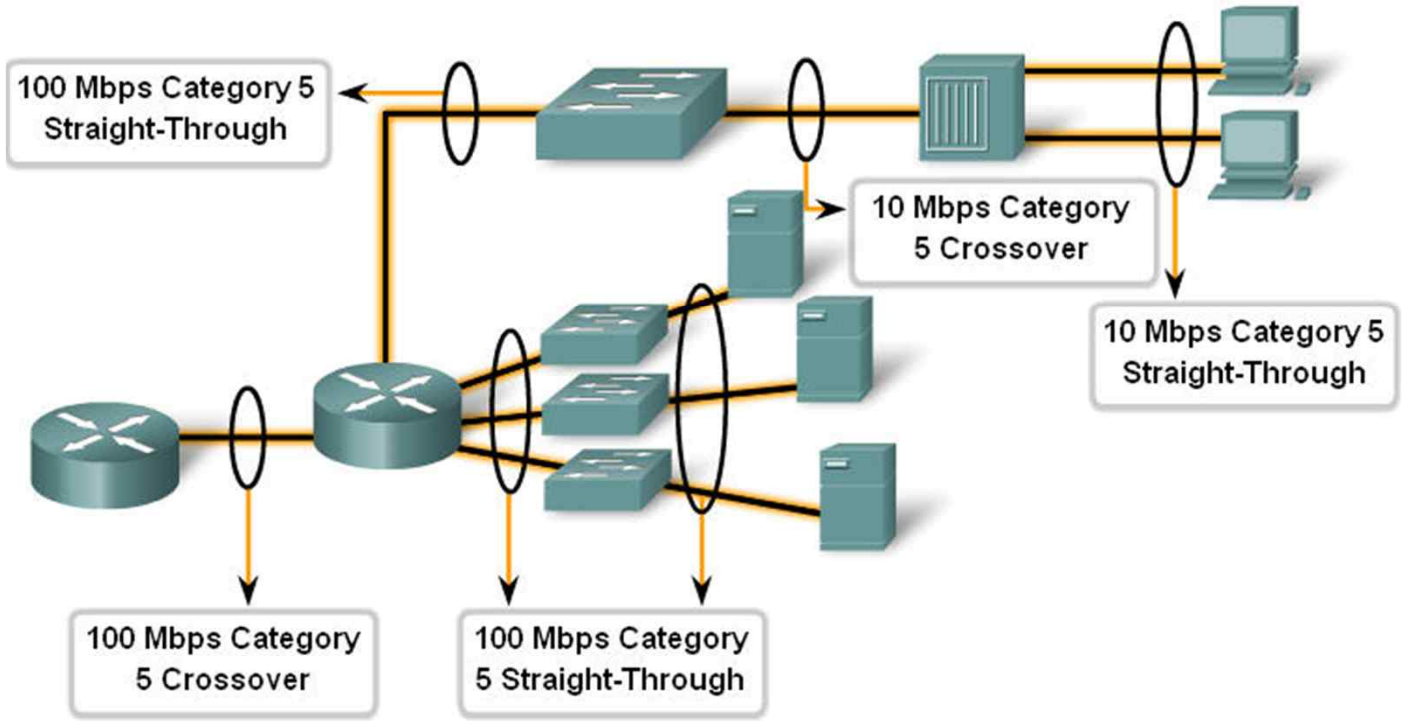


TCP/IP Network

Physical Layer

Cabling the Campus

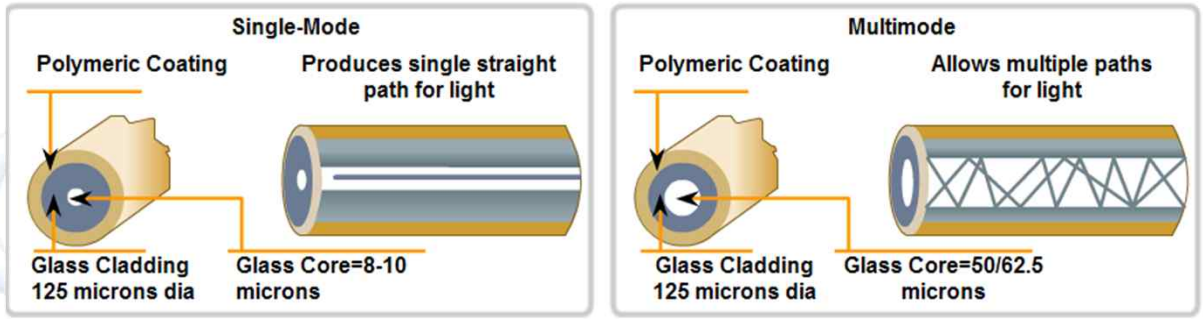
Identify the correct UTP cable type and likely category to connect different intermediate and end devices in a LAN.



TCP/IP Network

Physical Layer

Fiber Media Modes



- Single-Mode
  - 단일 경로
  - 큰 정밀도
  - 가격이 비싸다
  - 50Gbps
  - 작은 유리 코어 : 8 ~ 10 micron
  - Laser를 광원으로 사용
  - 장거리 통신에 적합 : 100Km까지

- Multimode
  - 다중 경로
  - 가격이 싸다
  - 큰 코어 : 50 ~ 62.5 micron 이상
  - LED를 광원으로 사용
  - 단거리 통신에 적합 : 2Km까지

TCP/IP Network

Physical Layer

Fiber Optical Connector

데이터 통신에서 가장 일반적인
Connector는 ST Connector이다

ISO 11801에서는
SC Connector가 규정되어 있다