CCNA 1 v3.1 Module 3
Networking Media

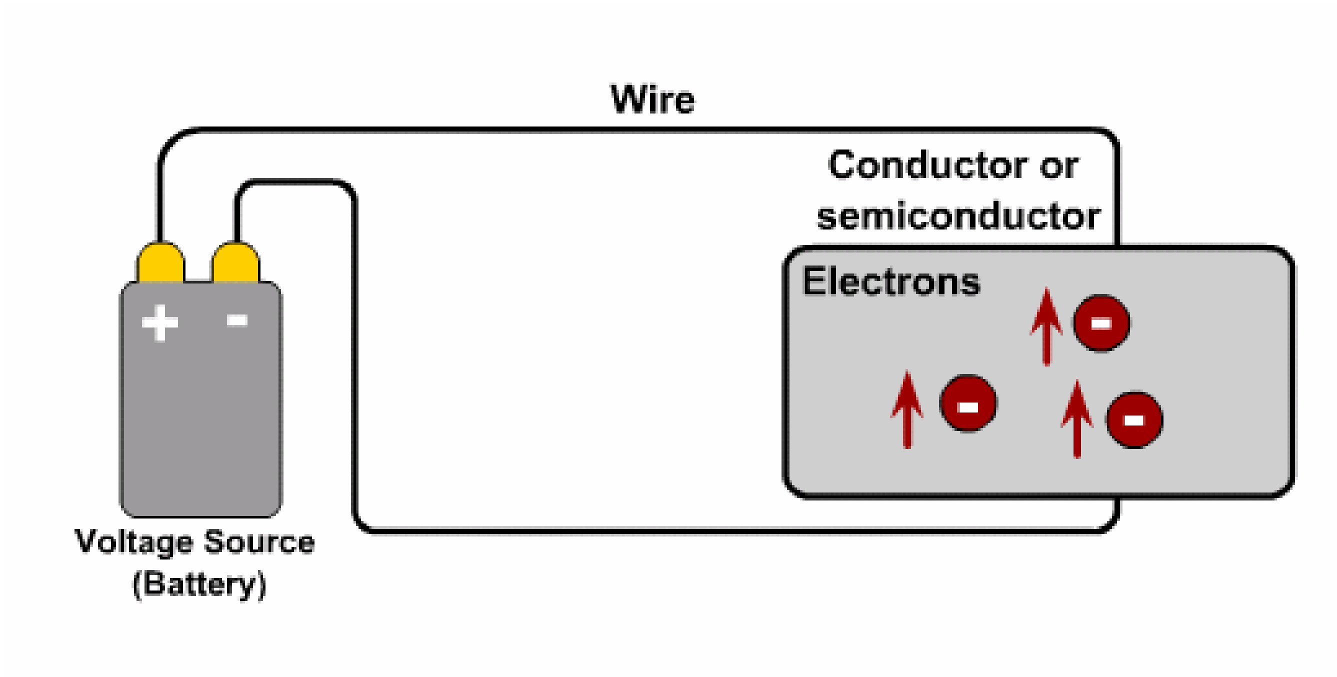
Objectives

Upon completion of this module, the student will be able to perform tasks related to the following:	
3.1	Copper Media
3.2	Optical Media
3.2	Wireless Media

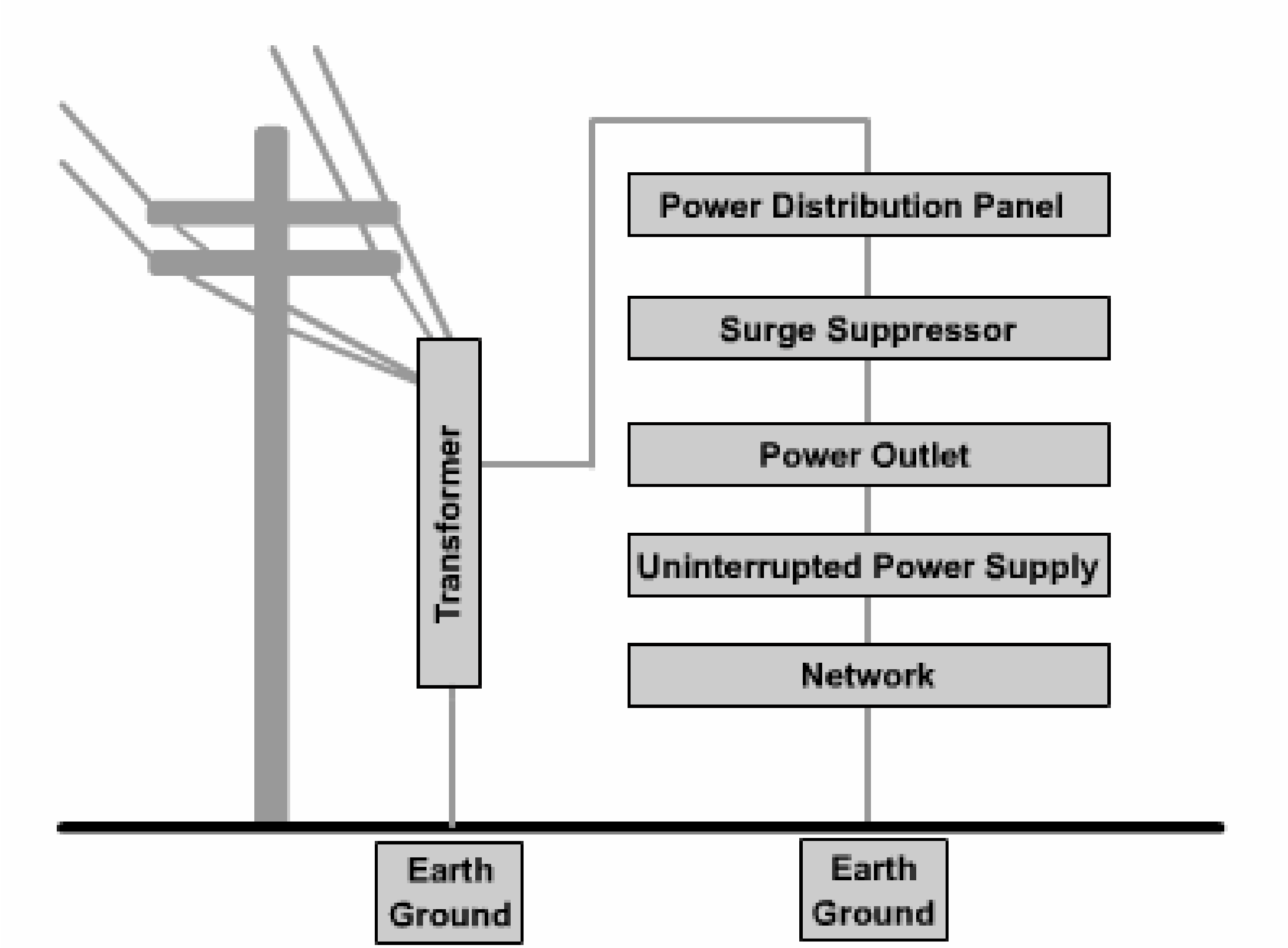
Resistance and Impedance

Insulators	Conductors	Semiconductors
Electrons flow poorly	Electrons flow well	Electron flow can be precisely controlled
Plastic Rubber Air Paper Dry Wood Glass	Copper (Cu) Silver (Ag) Gold (Au) Solder Water w/Ions Humans	Carbon (C) Germanium (Ge) Gallium Arsenide (GaAs) Silicon (Si)

Current Flow



Circuits


Power Distribution Panel
Surge Suppressor
Power Outlet
Uninterrupted Power Supply
Network
Transformer
Earth Ground
Earth Ground

Cable Specifications

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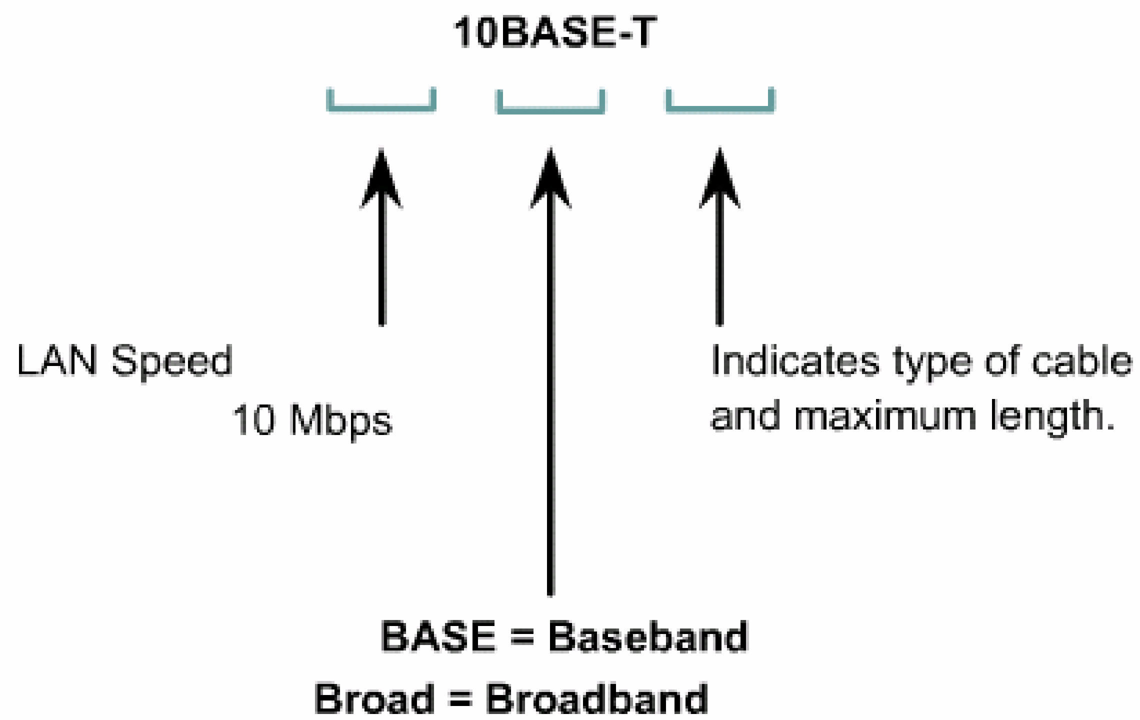
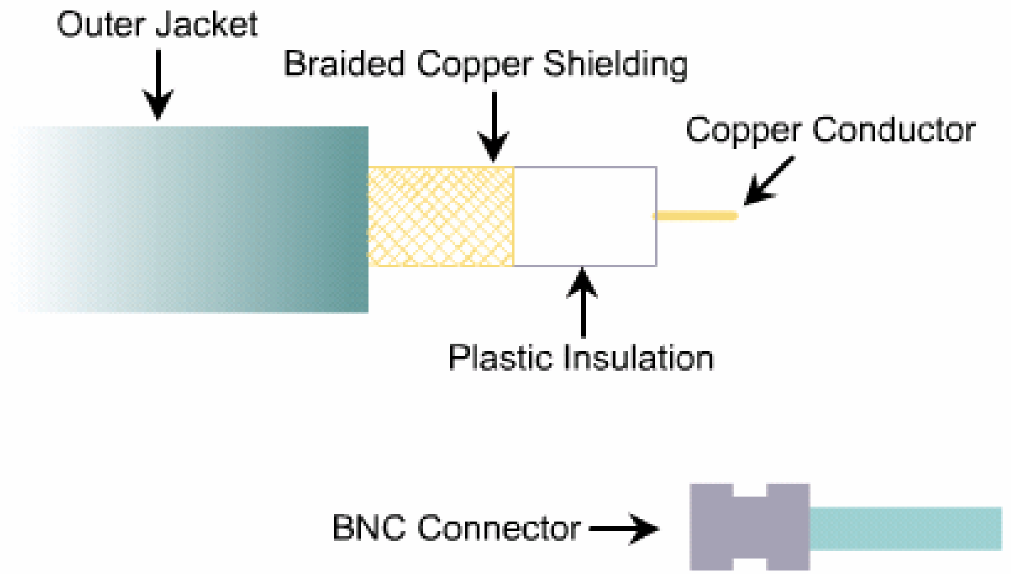
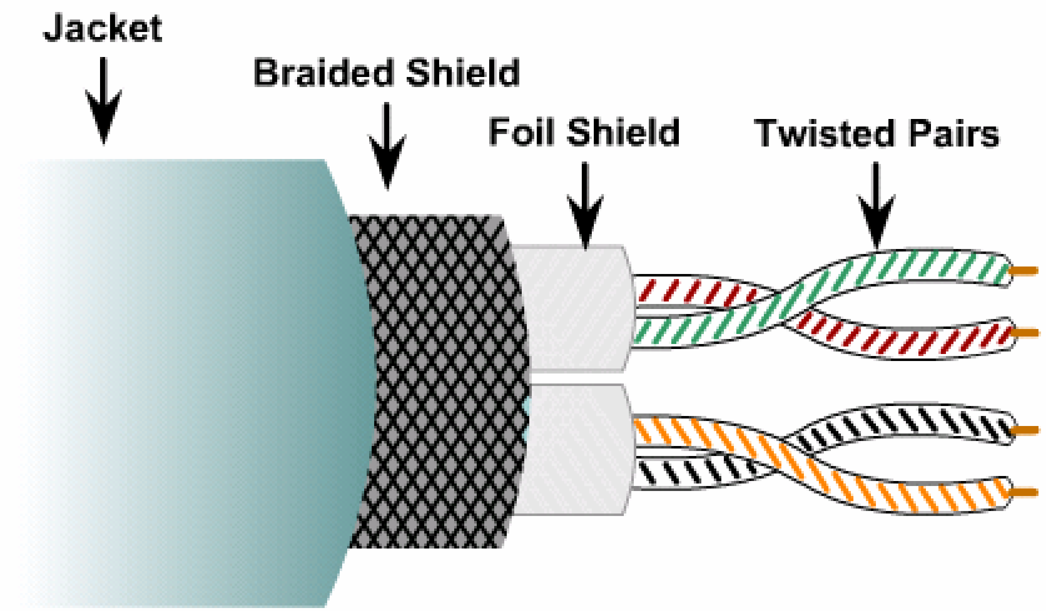


Coaxial Cable



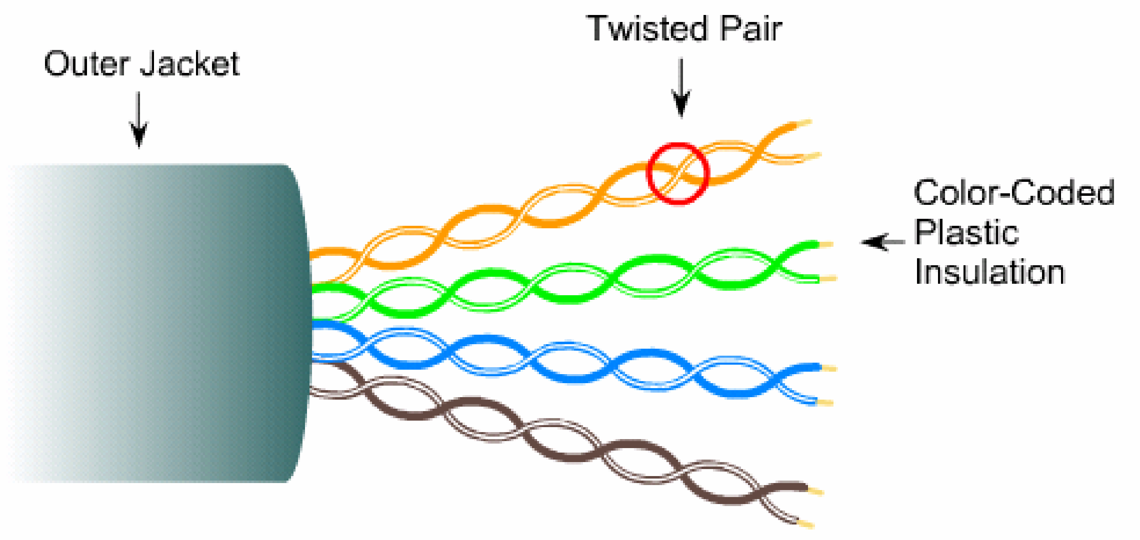
- Speed and throughput: 10 - 100 Mbps
- Cost: Inexpensive
- Media and connector size: Medium
- Maximum cable length: 500m

Shielded Twisted-Pair Cable



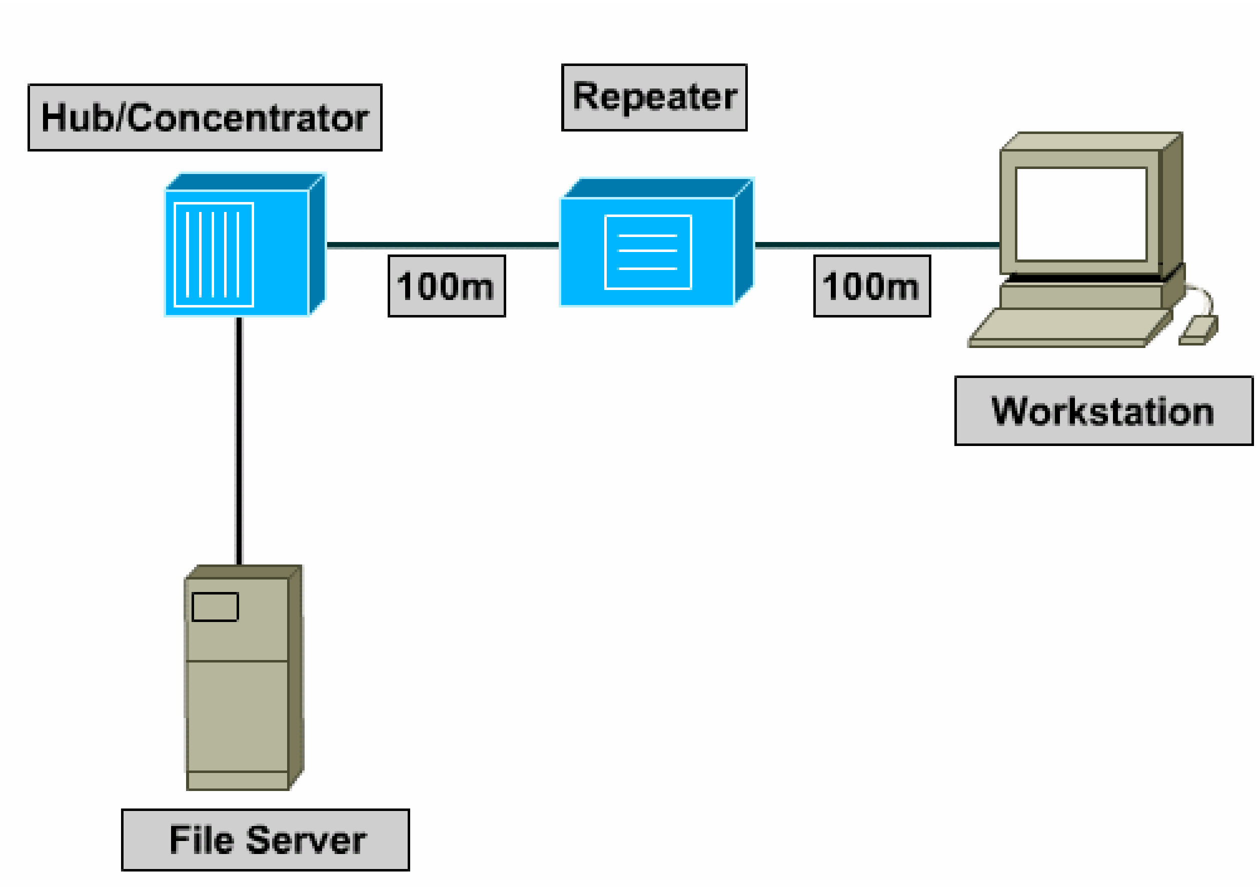
- Speed and throughput: 0 - 100 Mbps
- Cost: Moderate
- Media and connector size: Medium to Large
- Maximum cable length: 100m

Unshielded Twisted Pair (UTP)



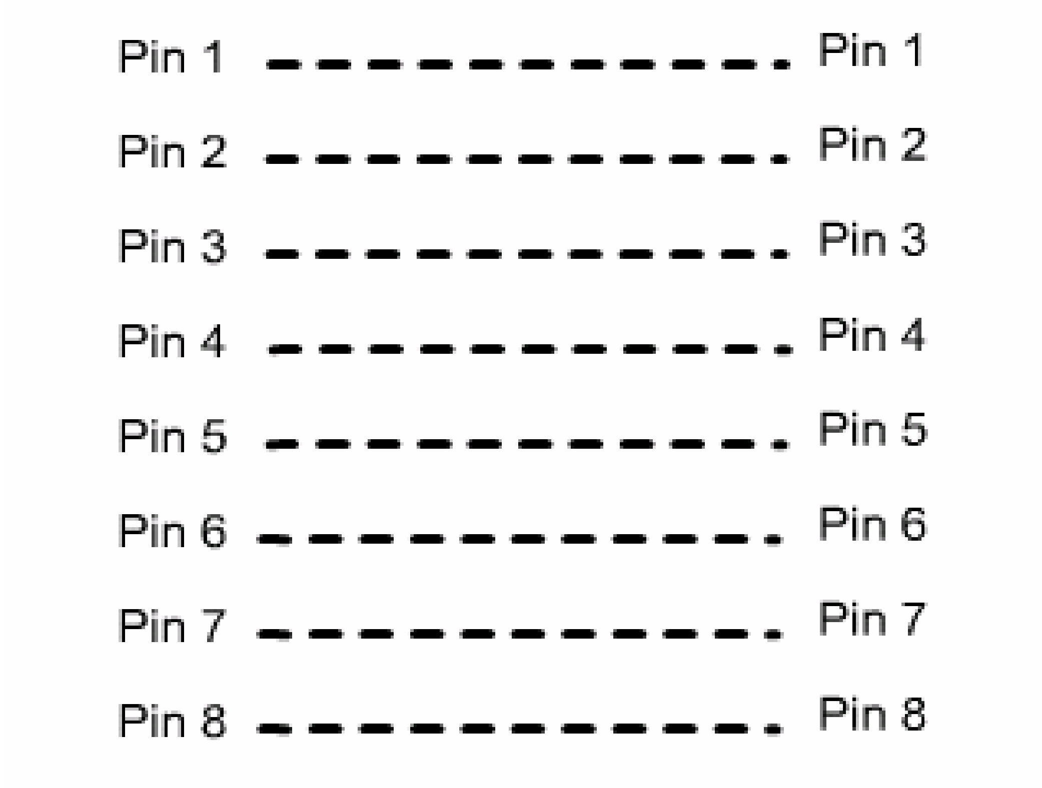
Speed and throughput: 10 - 100 - 1000 Mbps (depending on the quality/category of cable)
Cost: Least Expensive
Media and connector size: Small
Maximum cable length: 100m

Unshielded Twisted Pair (UTP)



Unshielded Twisted Pair (UTP)

Unshielded Twisted Pair (UTP)



Unshielded Twisted Pair (UTP)

Unshielded Twisted Pair (UTP)

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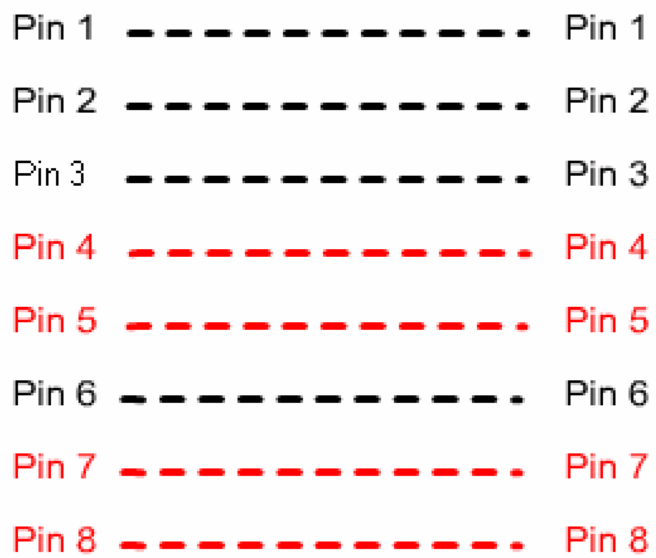
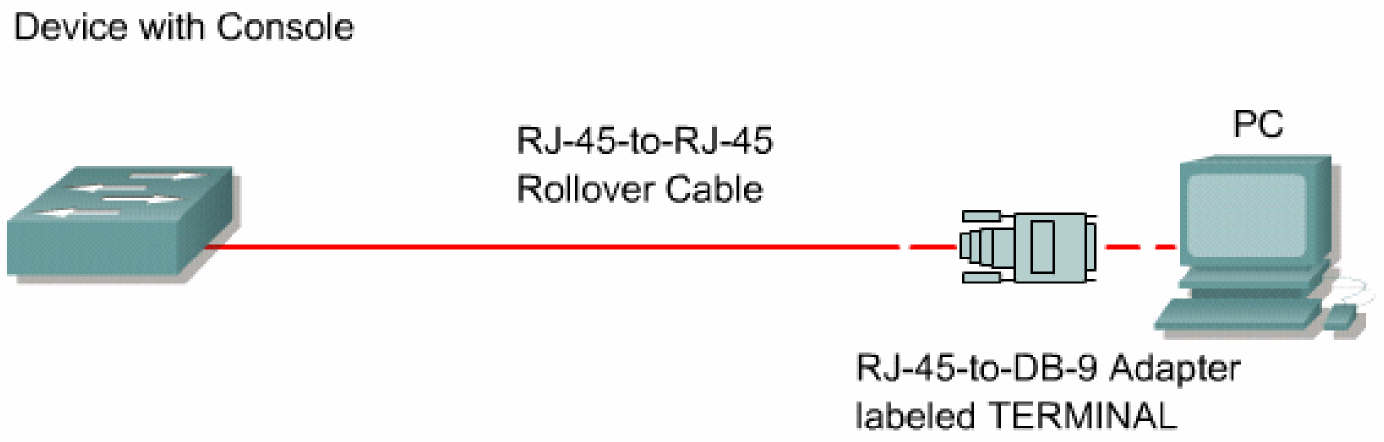


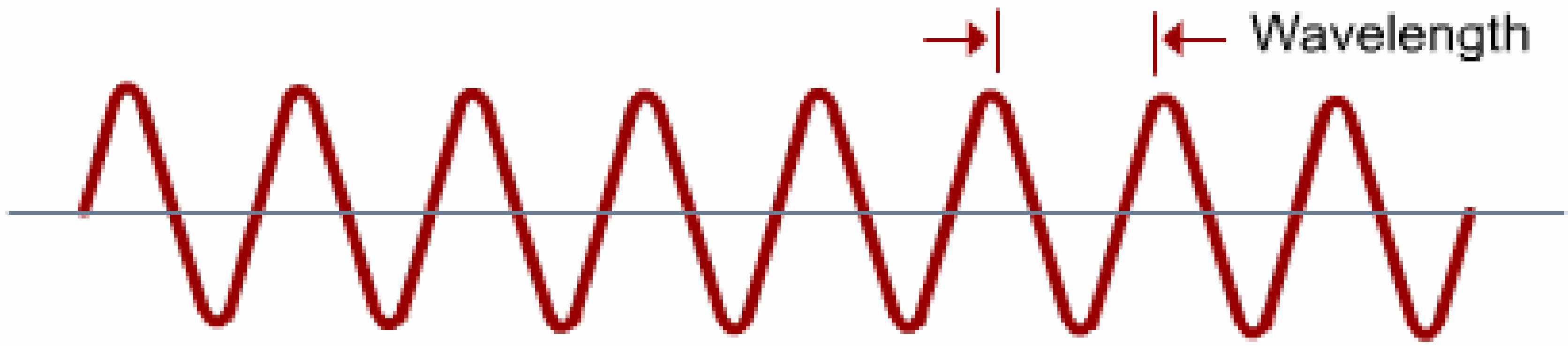
An Ethernet (10BASE-T and 100BASE-TX) cross-connect cable has only four active wires 1, 2, 3, and 6

Unshielded Twisted Pair (UTP)

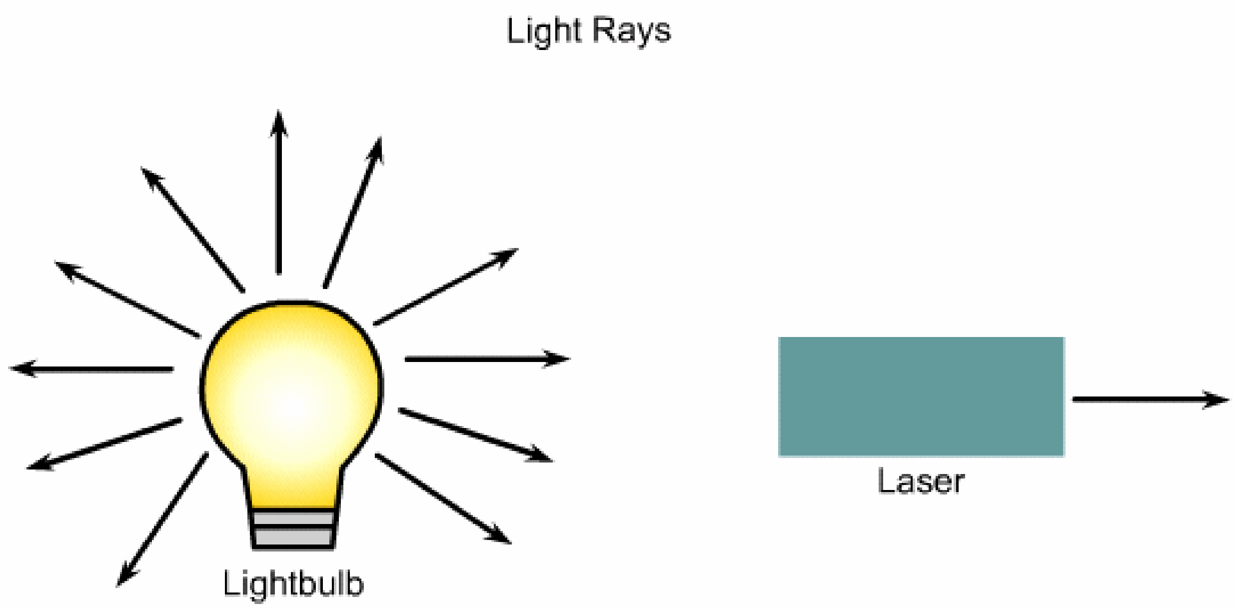


PCs require an RJ-45 to DB-9 or RJ-45 to DB-25 adapter.
COM port settings are 9600 bps, 8 data bits, no parity, 1 stop bit, no flow control.
This provides out-of-band console access.
AUX switch port may be used for a modem-connected console.

The Electromagnetic Spectrum

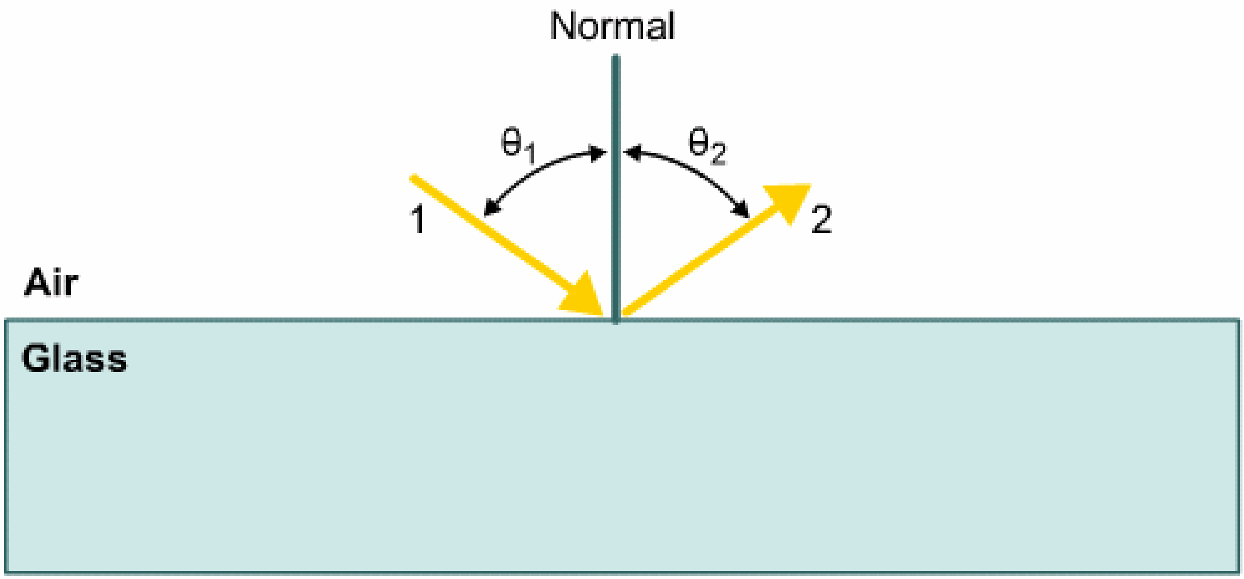


Ray Model of Light



Index of Refraction = n = $\frac{\text{Speed of light in vacuum}}{\text{Speed of light in material}}$

Reflection



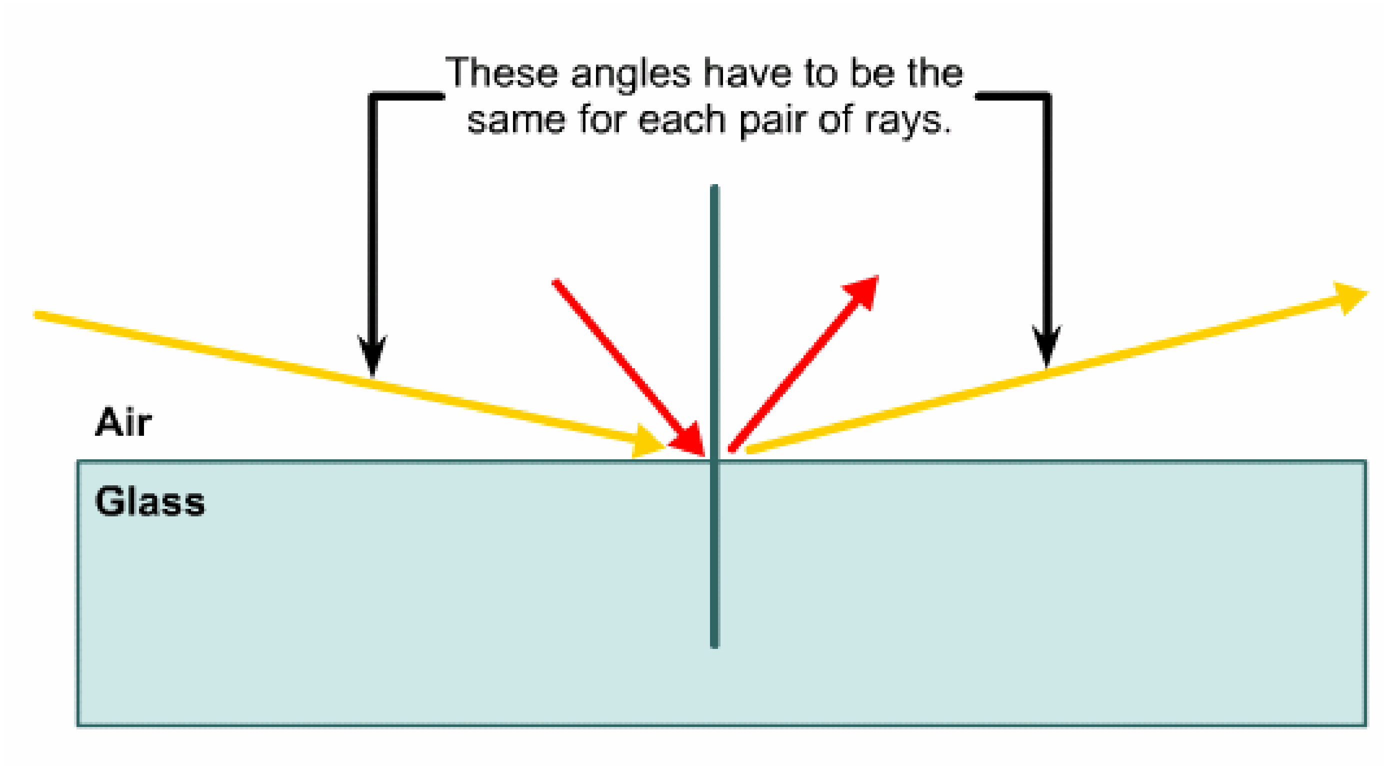
Ray 1: Incident ray, measured θ_1 degrees from the normal

Ray 2: Reflected ray, measured θ_2 degrees from the normal

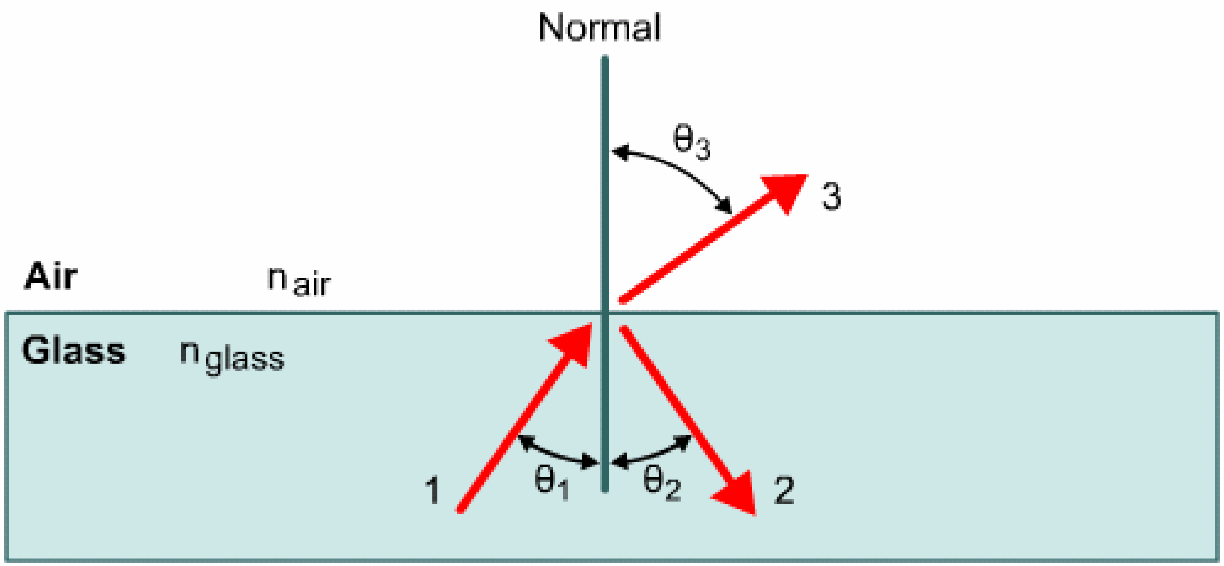
Law of Reflection: $\theta_1 = \theta_2$

Light traveling through the air is reflected off the surface of glass.

Reflection


These angles have to be the
same for each pair of rays.
Air
Glass

Refraction



Ray 1: Incident ray

Ray 2: Reflected ray

Ray 3: Refracted ray

Law of Reflection: $\theta_1 = \theta_2$

Law of Refraction: since $n_{air} > n_{glass}$, $\theta_3 > \theta_1$

Total Internal Reflection

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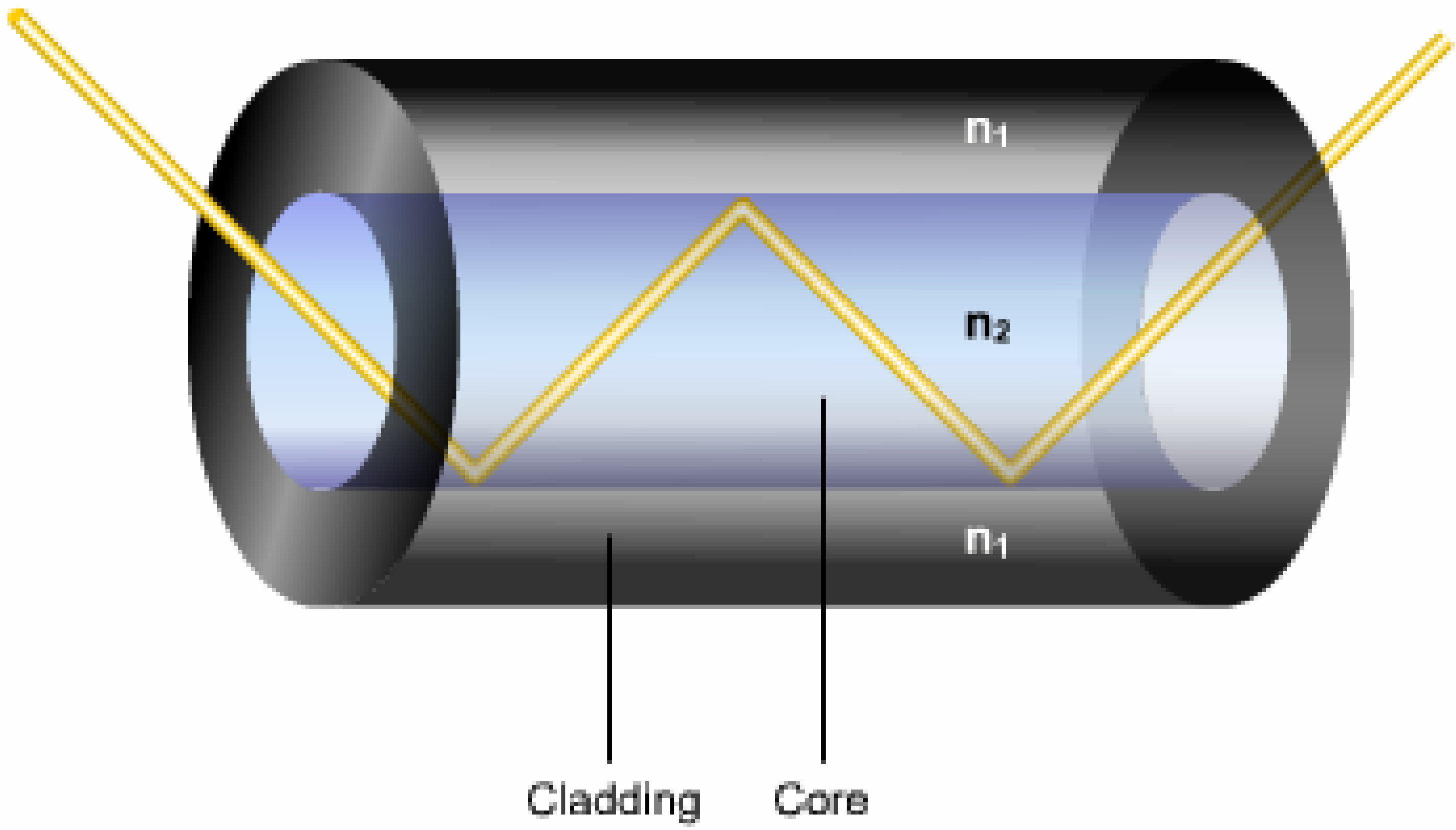
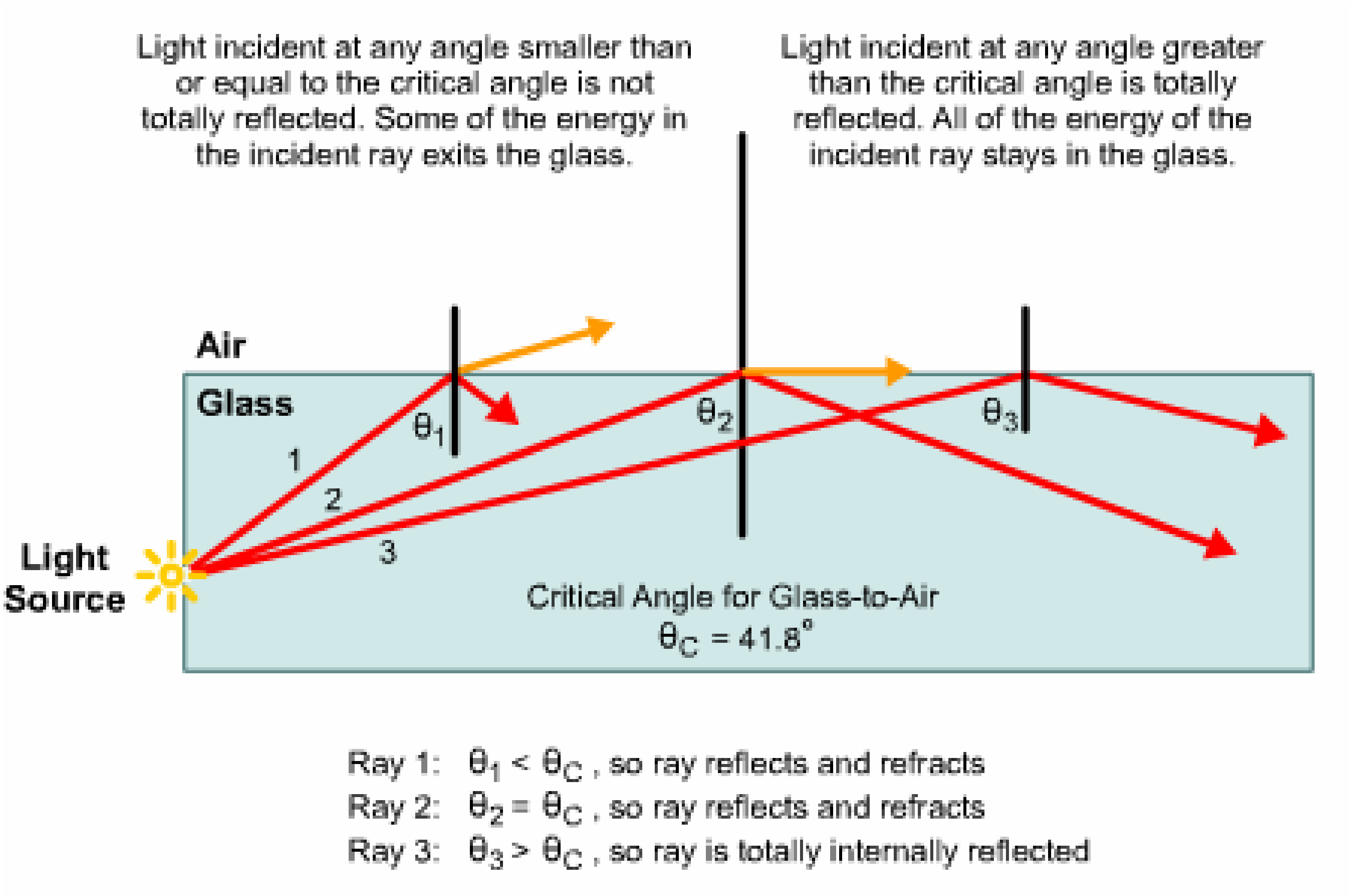
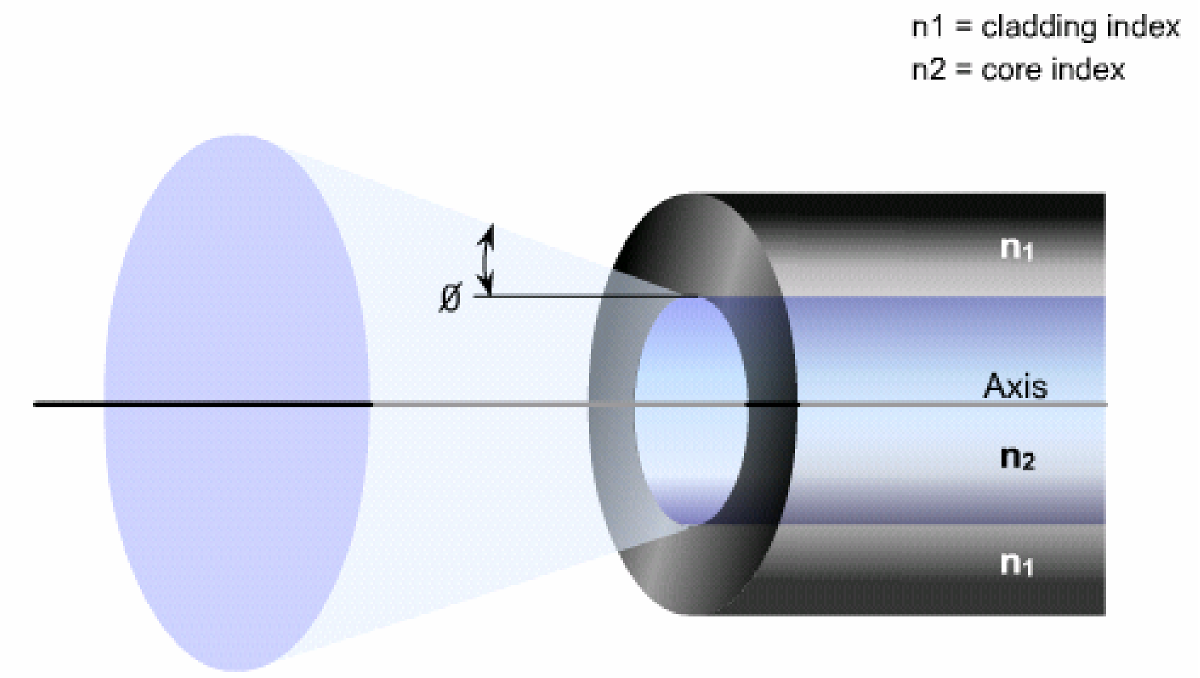


Total Internal Reflection



Total Internal Reflection



Numerical aperture (NA) measures the range of angles that will be totally internally reflected

Multimode Fiber

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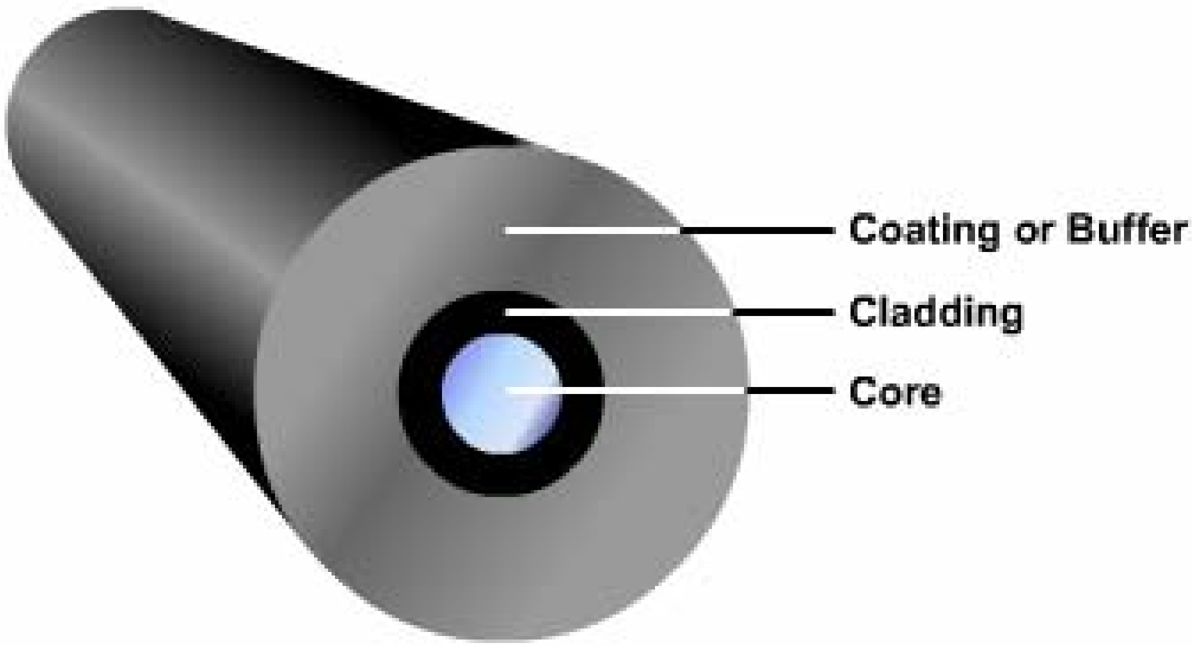

Multimode Fiber

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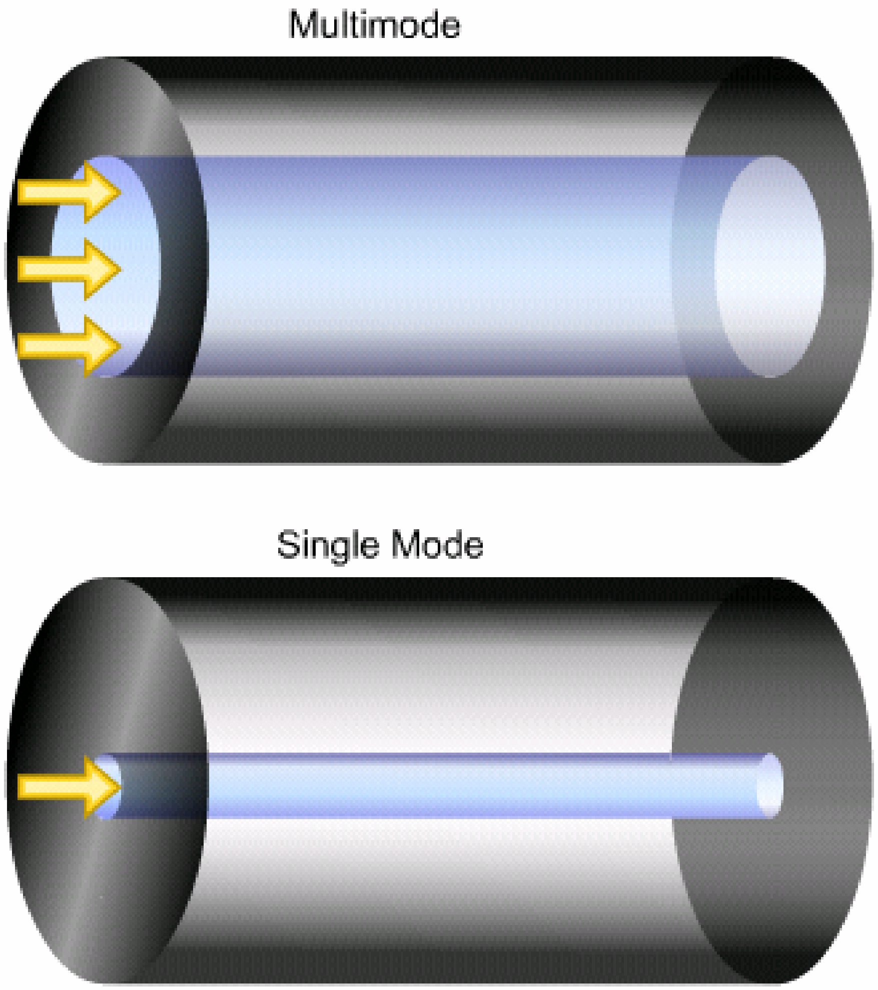

Multimode Fiber

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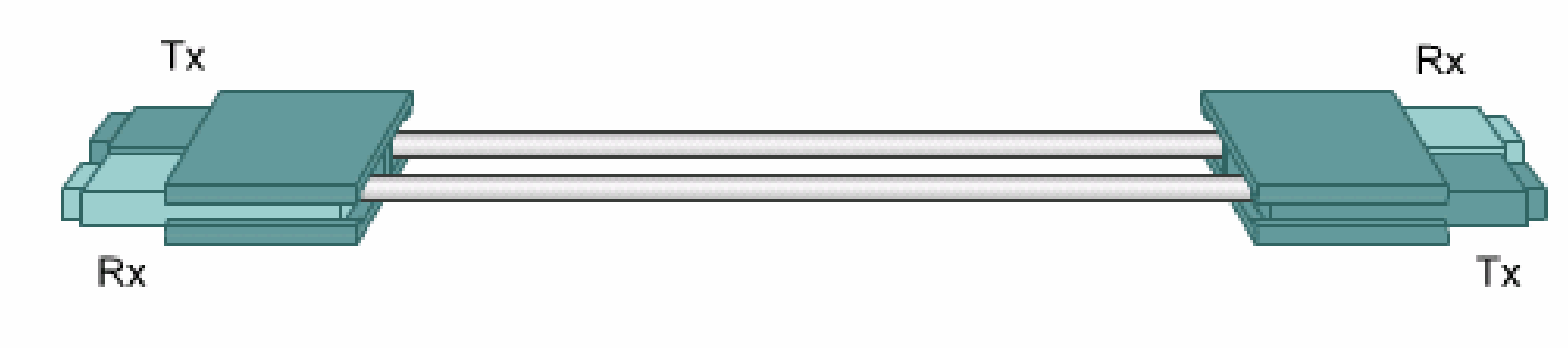
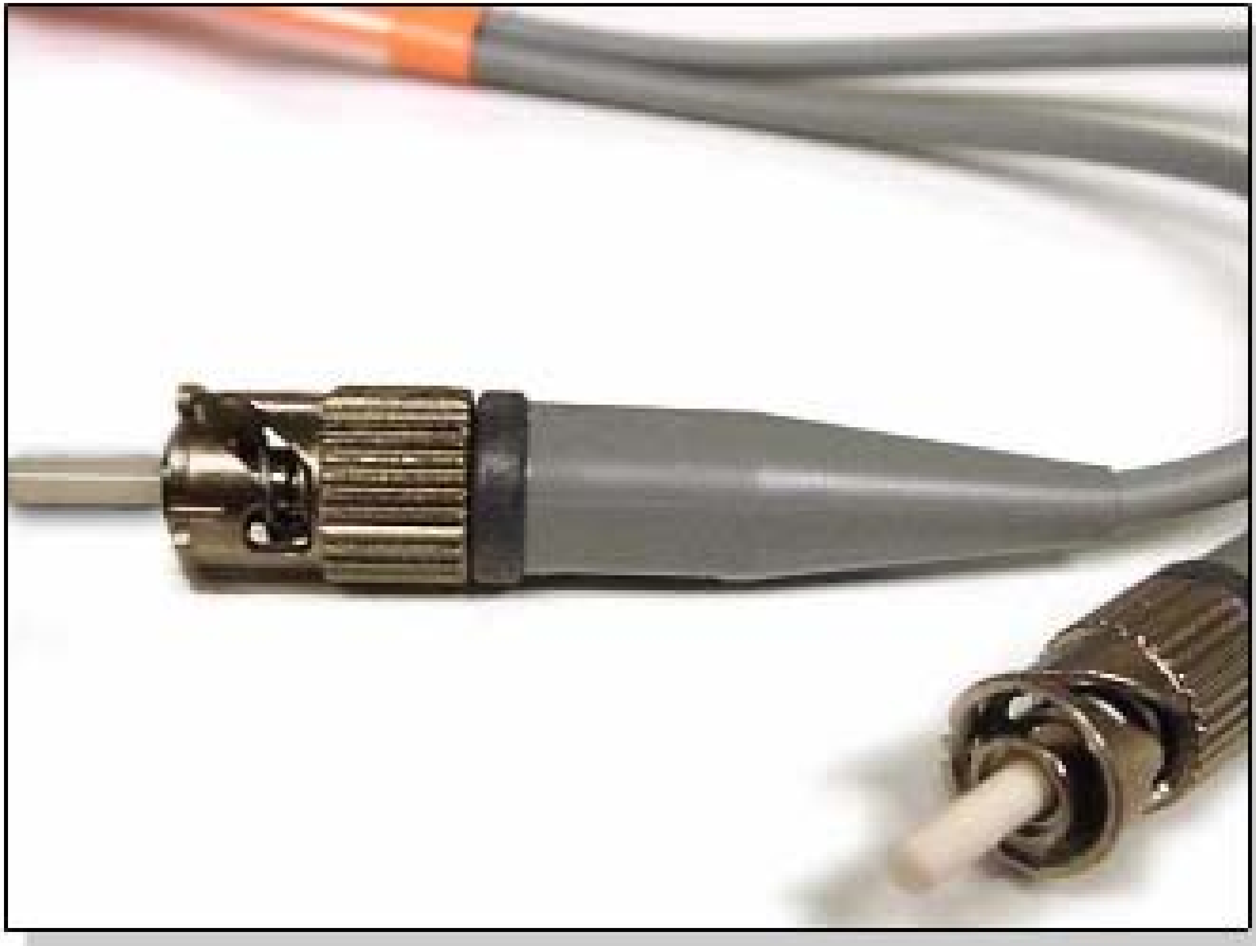
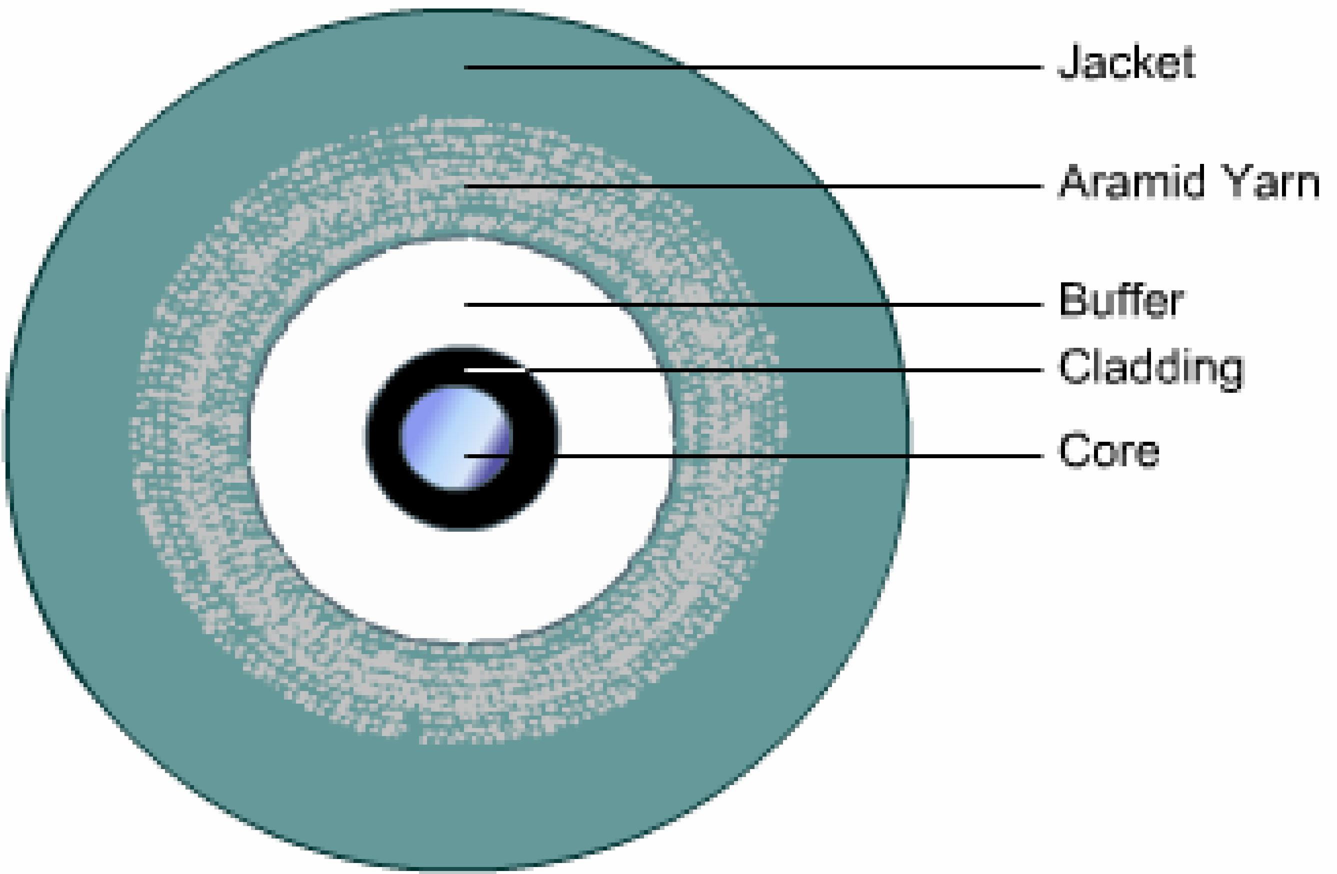


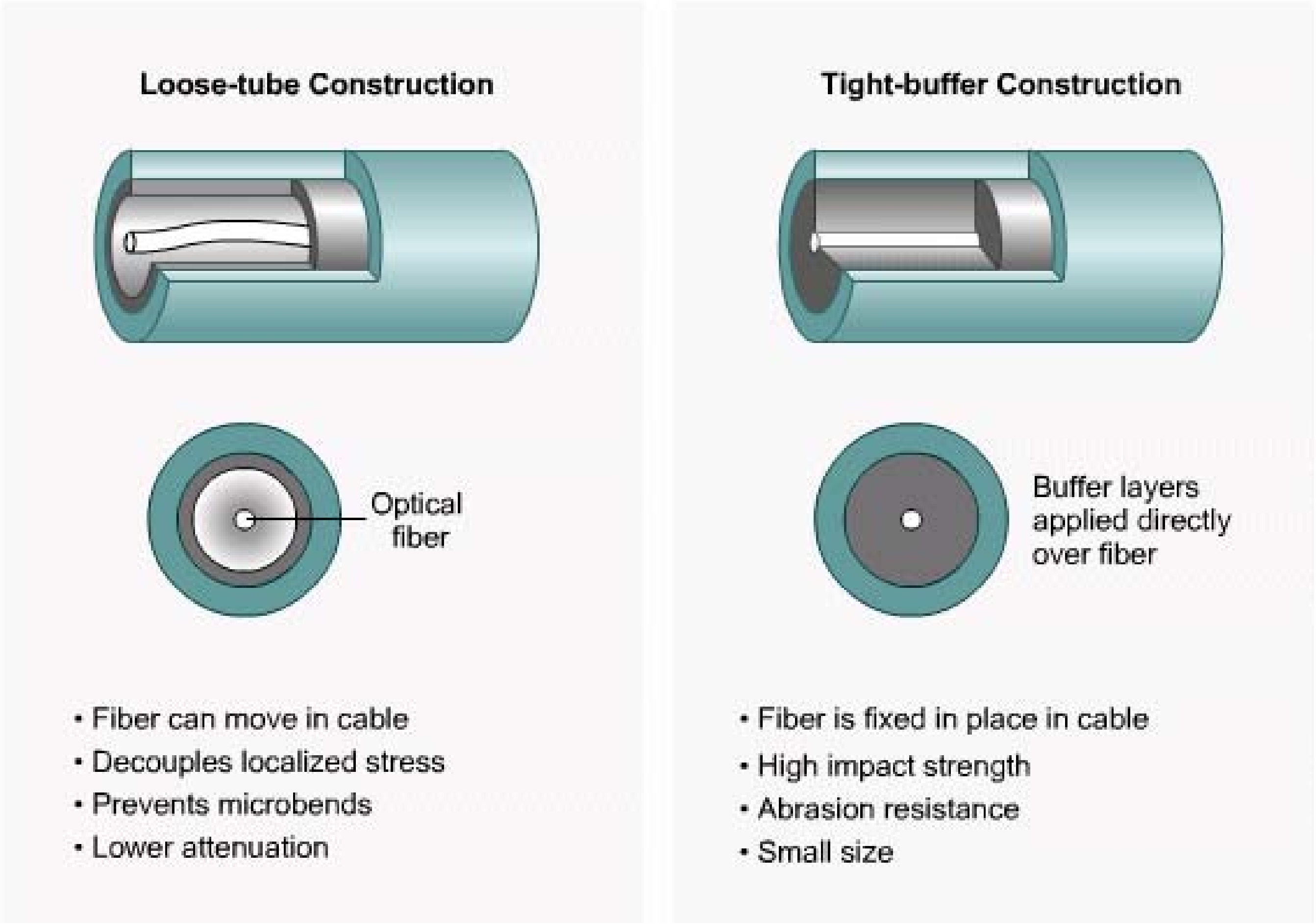
Multimode Fiber



Multimode Fiber



Multimode Fiber



Single-mode Fiber

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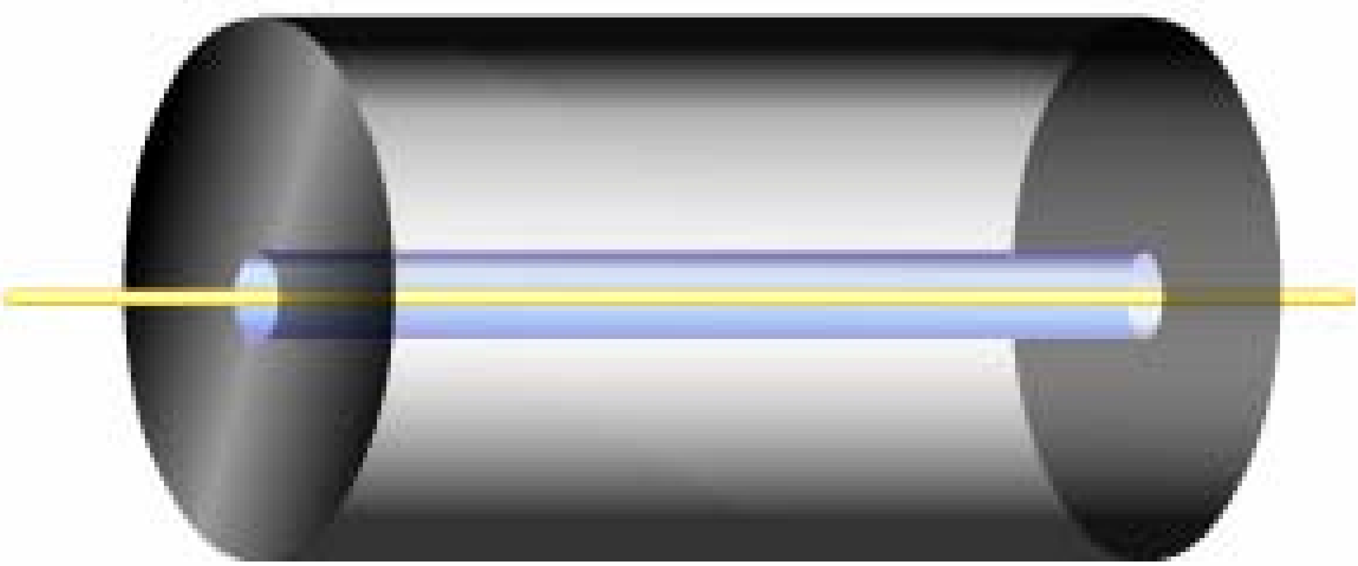
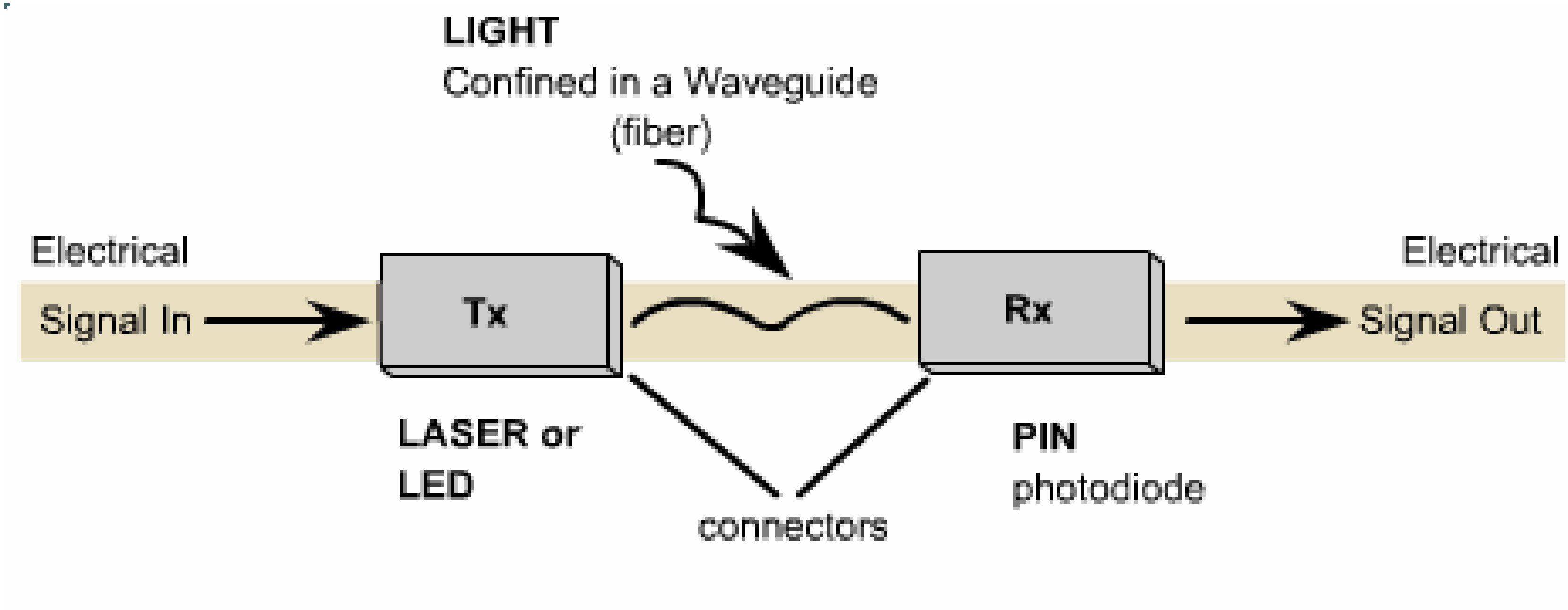
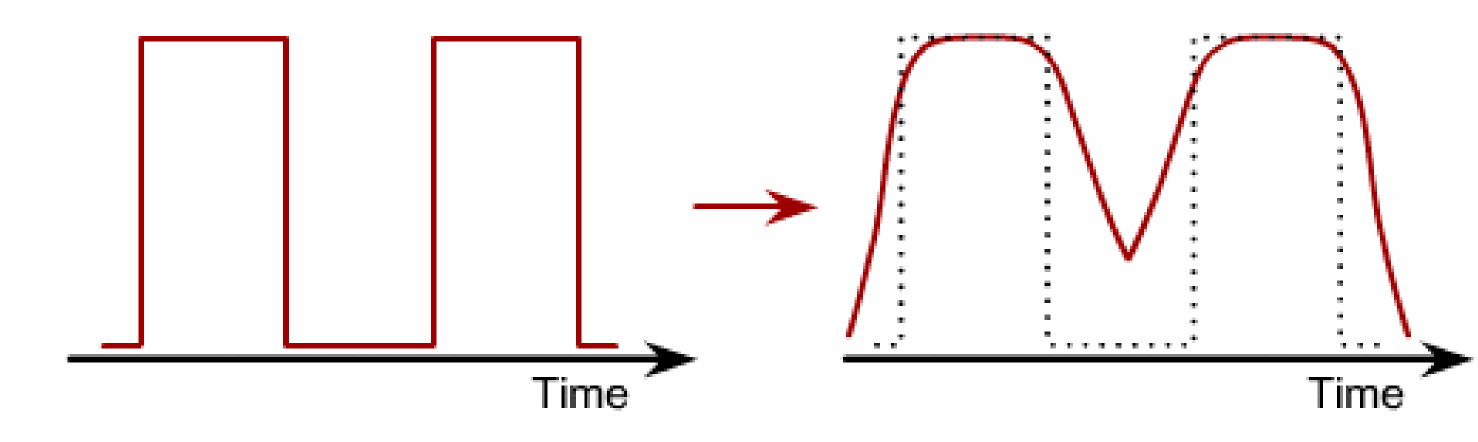


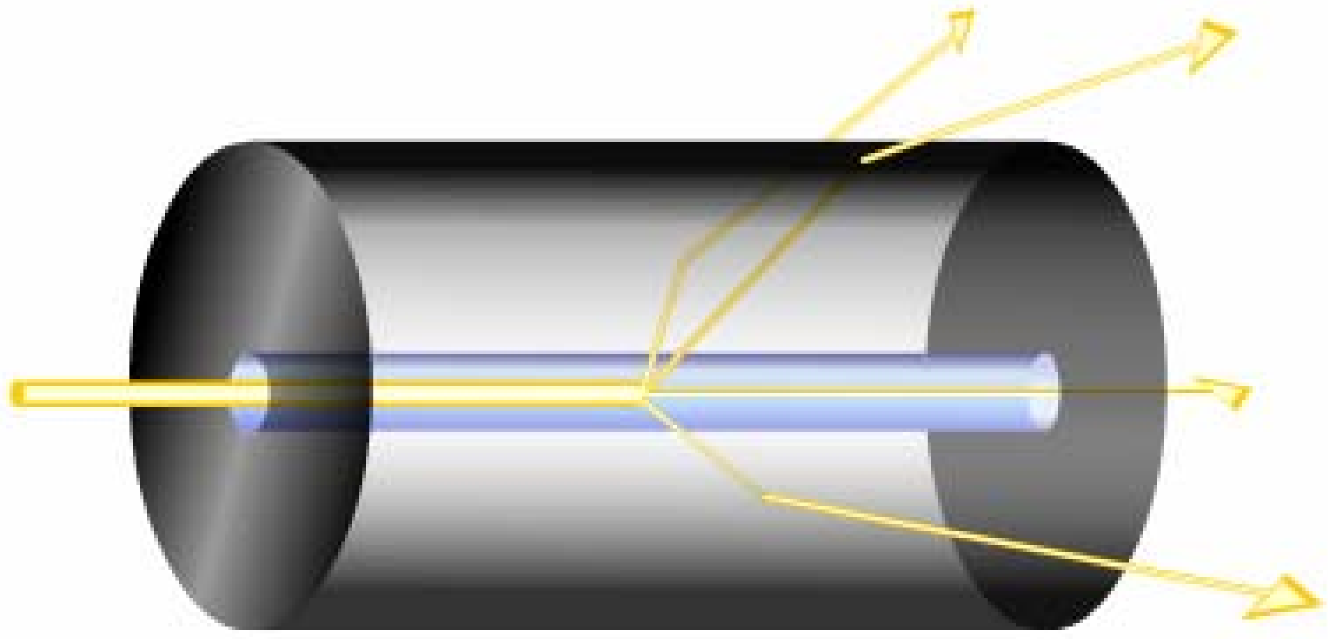
Optical Media



Signals and Noise in Optical Fibers



Scattering



Bending

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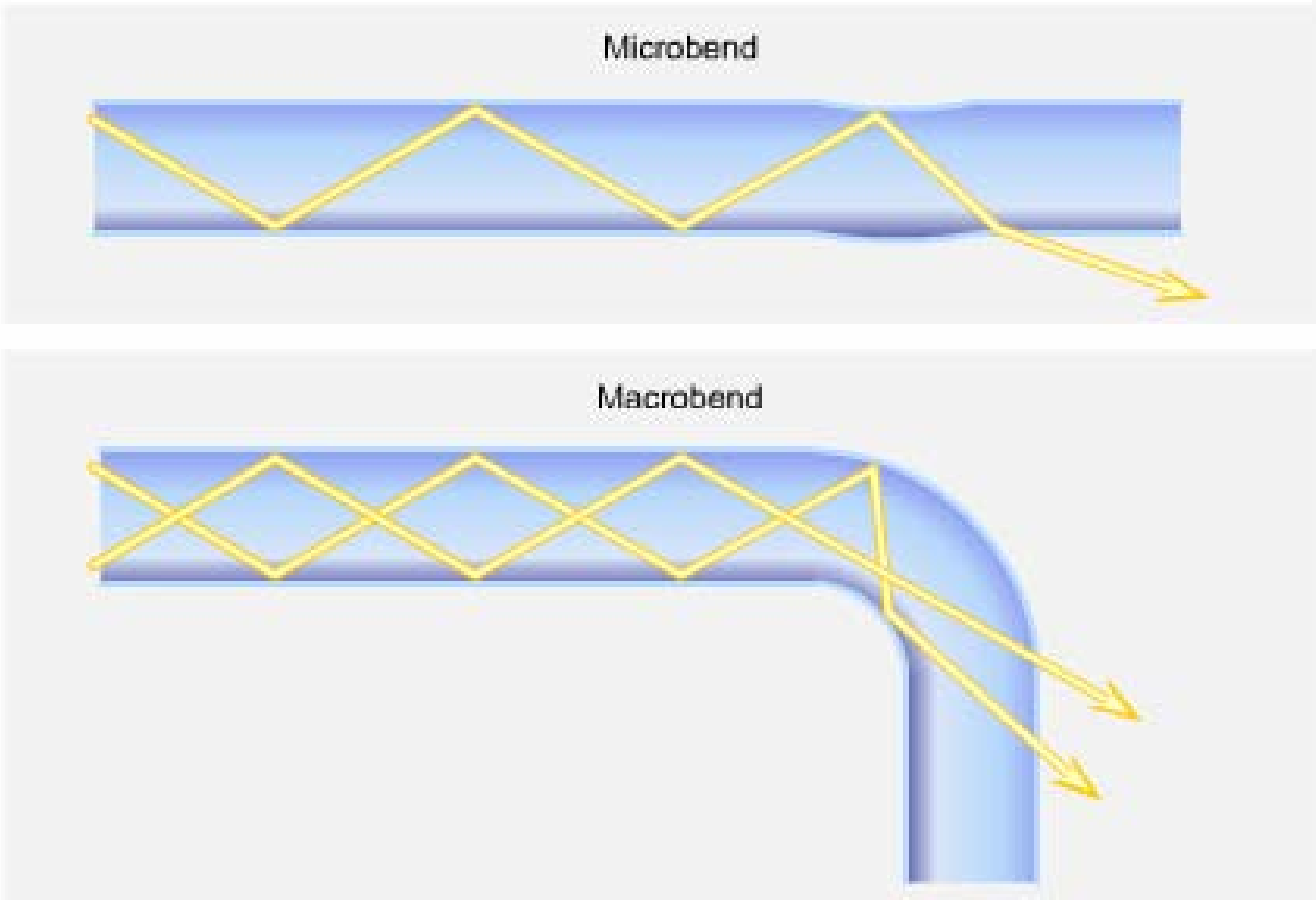
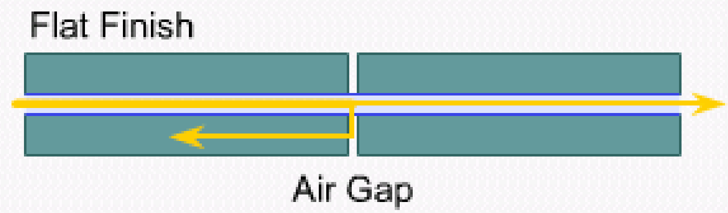
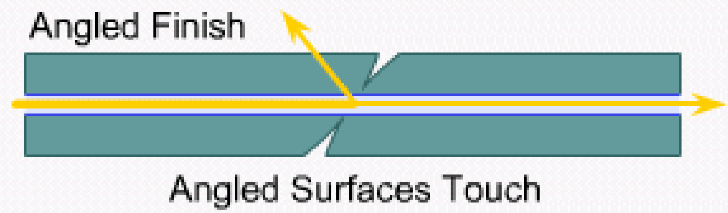


Fiber End Face Finishes

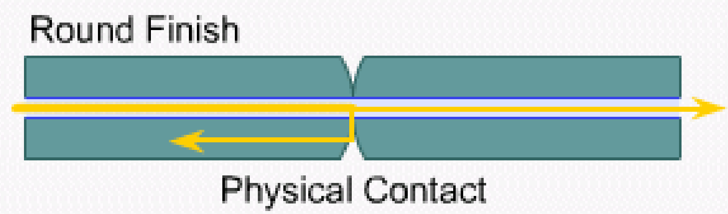
Flat: Finish causes light to be reflected back into the fiber due to a step in the refractive index caused by the glass-air-glass interface.



Angle: Polish connectors cause the reflection to exit the core and dissipate in the cladding.

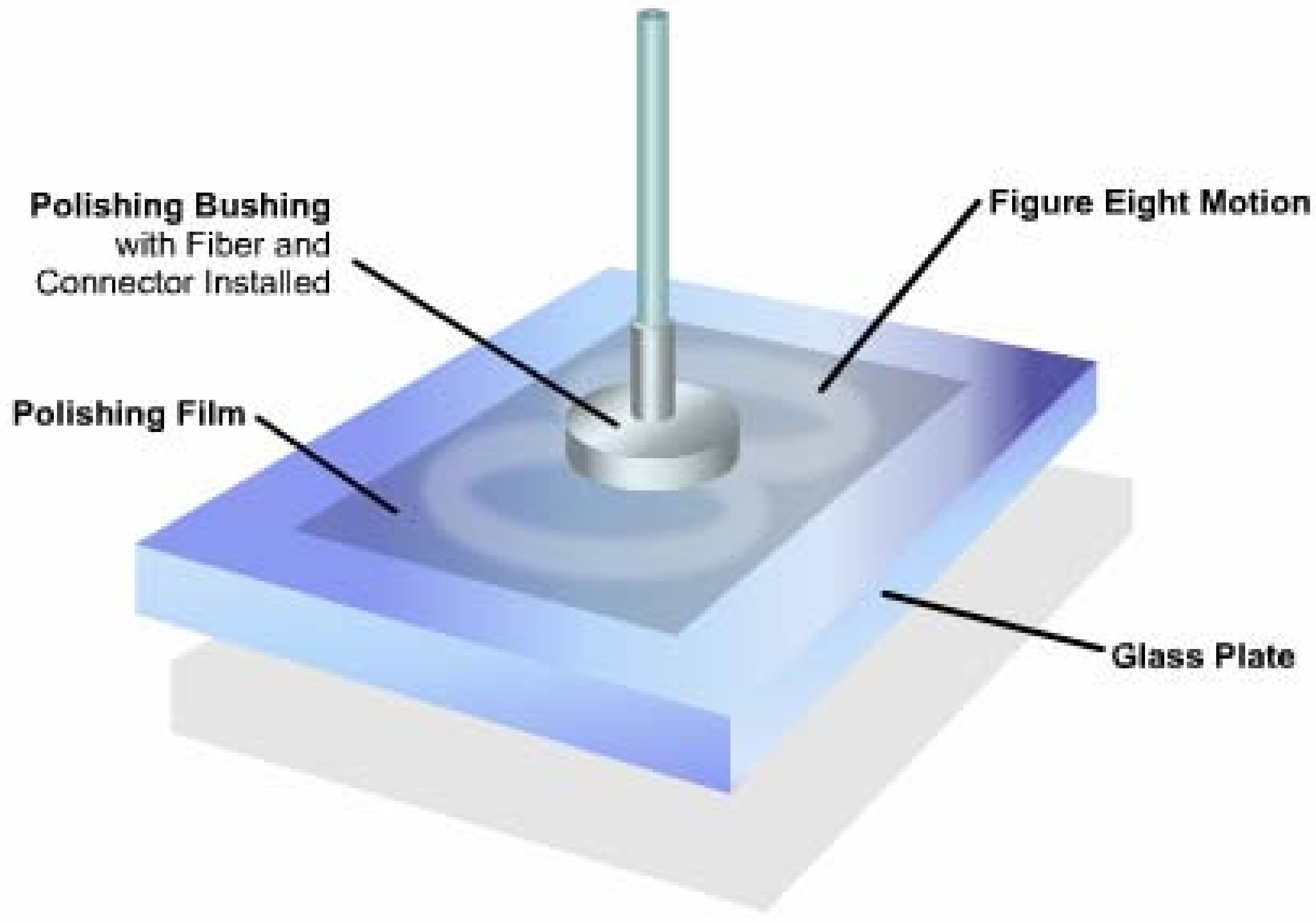


Physical Contact (PC): Finish minimizes backreflection due to the very small refractive index discontinuity.

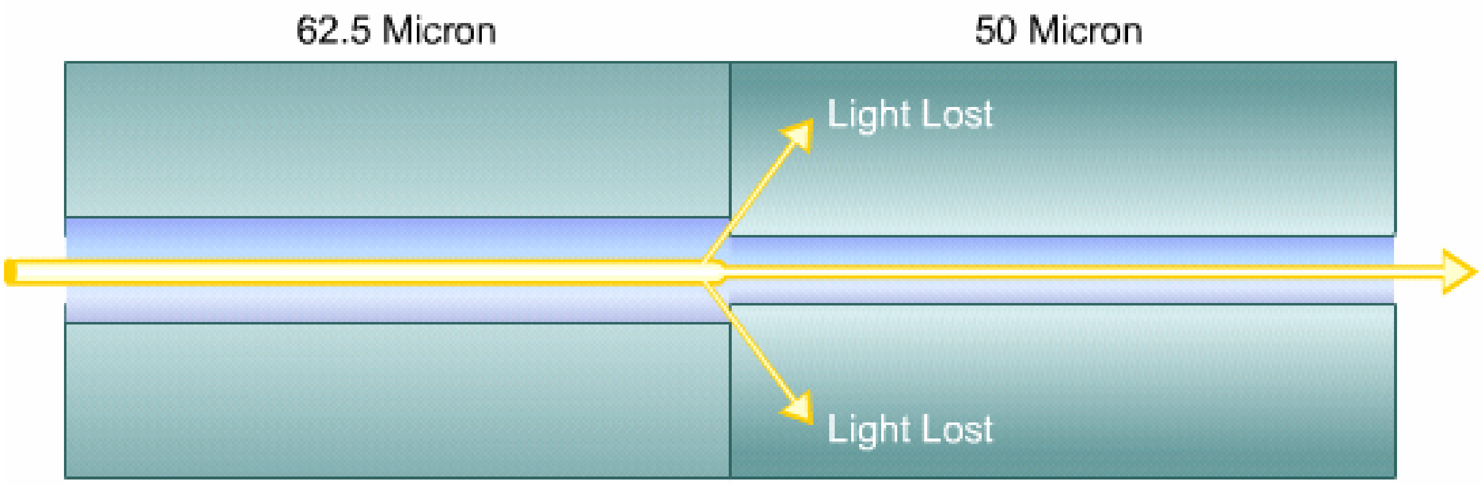


Ultra: Polish connector finish uses several grades of polishing film to achieve an untra-smooth surface.

Fiber End Face Polishing Techniques



Splicing



Calibrated Light Sources and Light Meter

Wireless LAN Standards

- 802.11
- 802.11b
- 802.11a
- 802.11g

Internal Wireless NIC for Desktop or Server

PCMCIA NIC for Laptop

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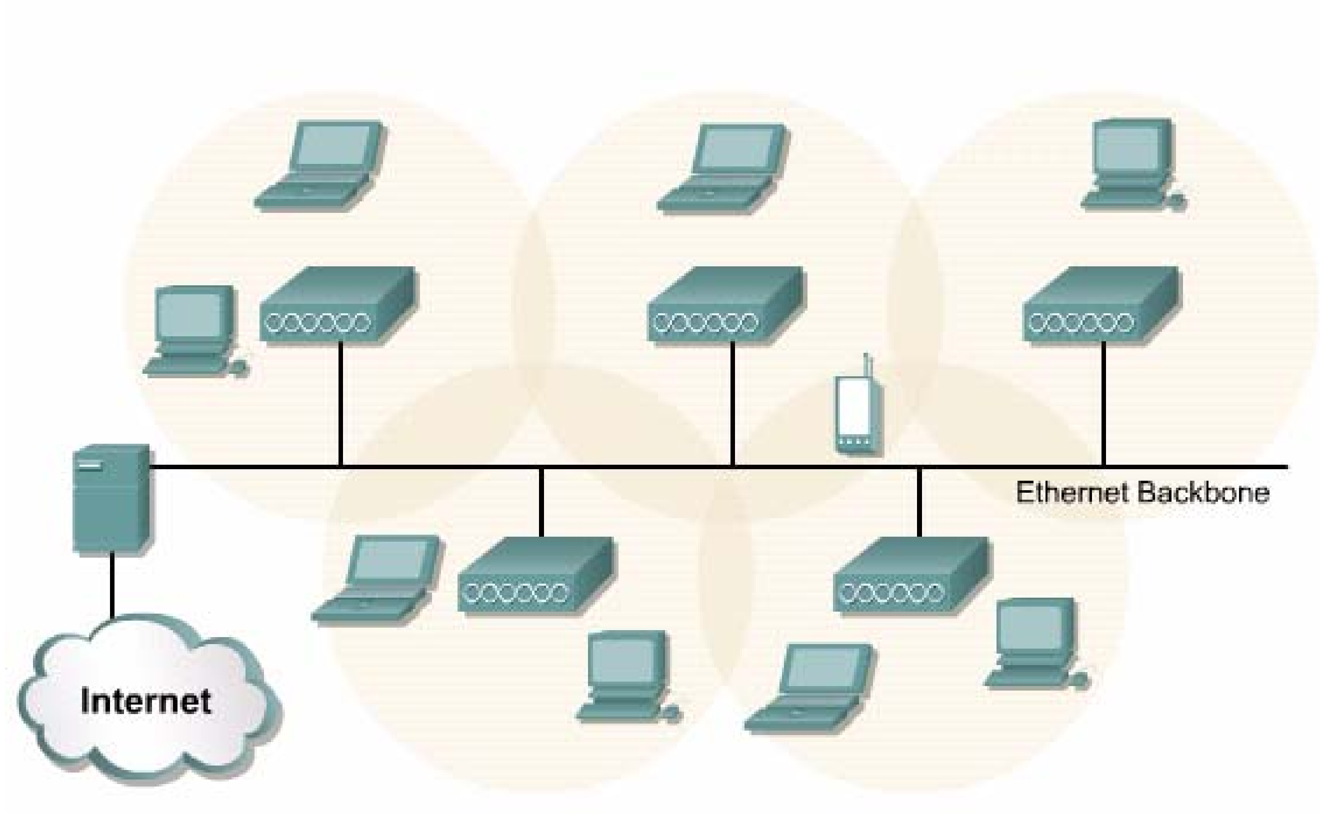
External USB Wireless NIC

Access Point

Wireless LAN



Roaming

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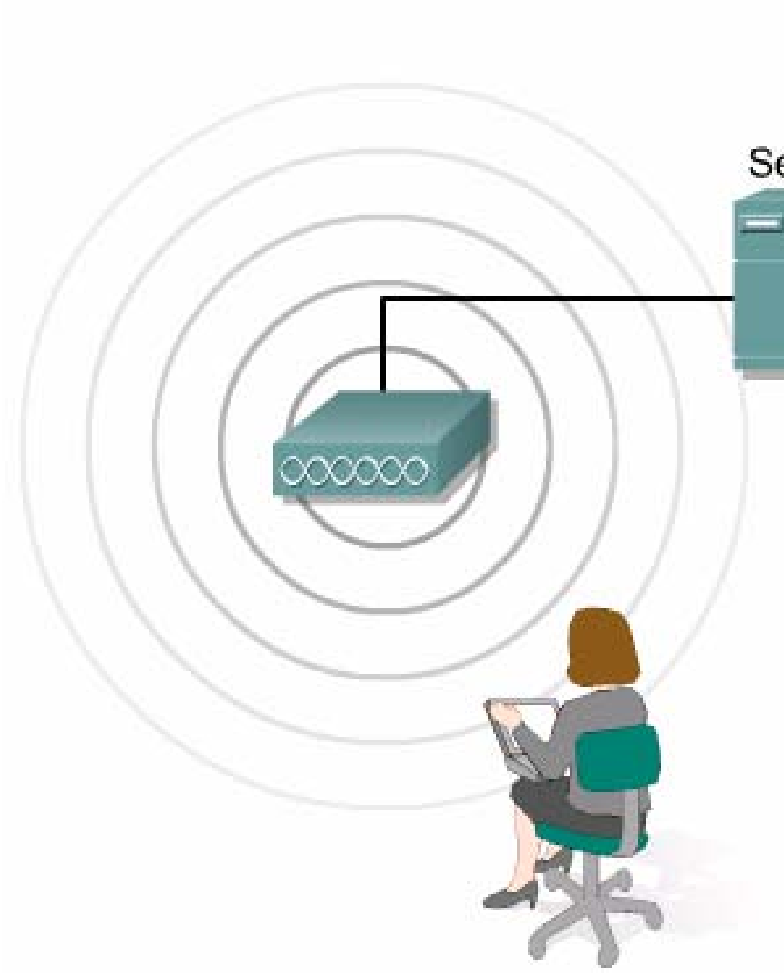

IEEE 802.3 Wireless Frame Types

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Management Frames

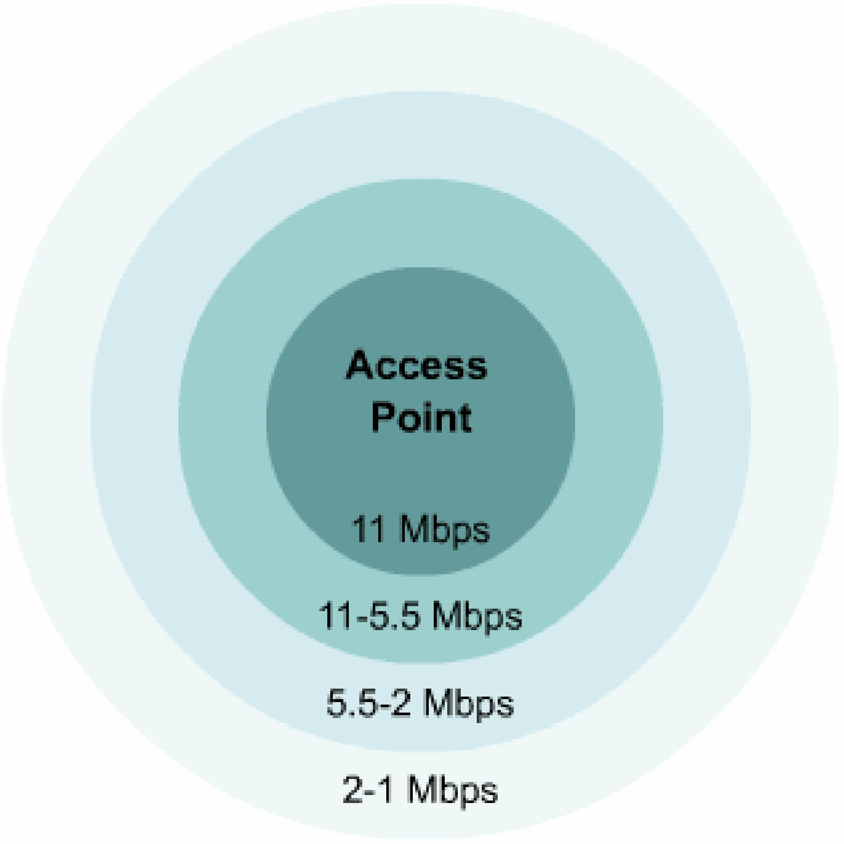
- Association request frame
- Association response frame
- Probe request frame
- Probe response frame
- Beacon frame
- Authentication frame

Control Frames

- Request to send (RTS)
- Clear to send (CTS)
- Acknowledgment

Data Frames

Adaptive Frame Types



Authentication and Association Types

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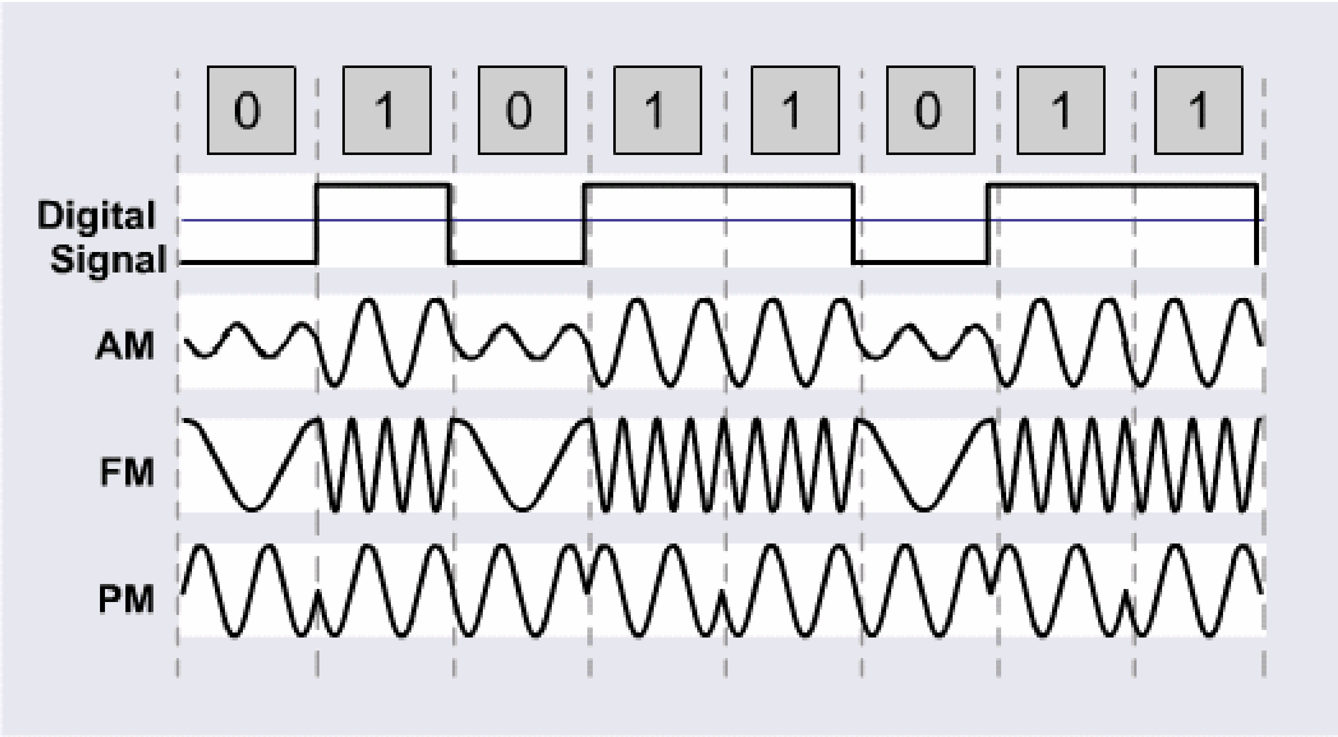
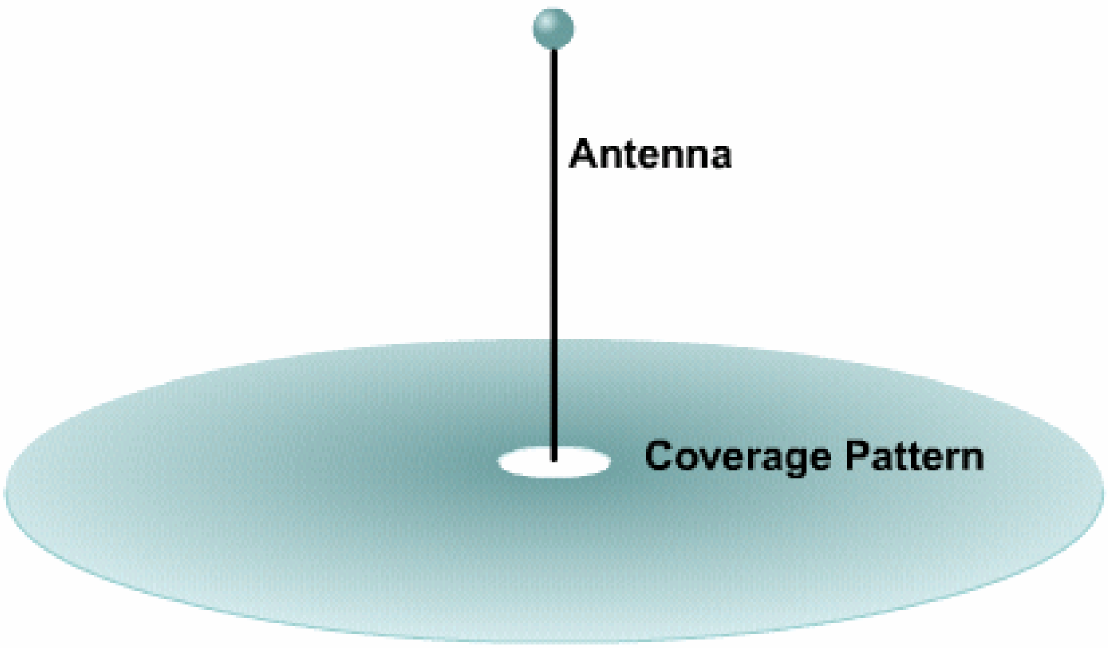
- Unauthenticated and unassociated
- Authenticated and unassociated
- Authenticated and associated

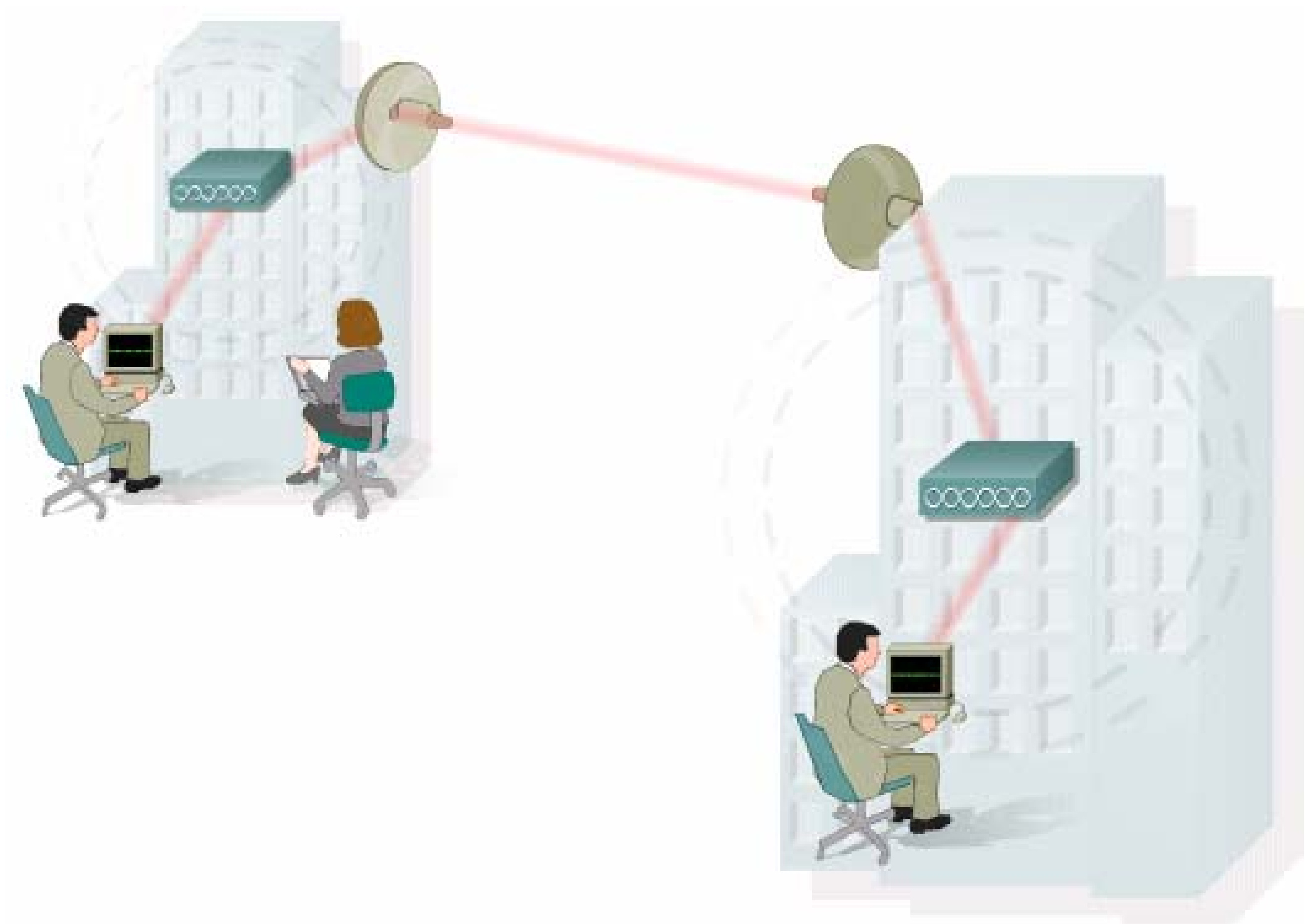
Modulation



Omni Directional Antenna



Radio Wave



Wireless Security

- EAP-MD5 Challenge
- LEAP
- User Authentication
- Encryption
- Data Authentication