

Computer Network(CSC 503)

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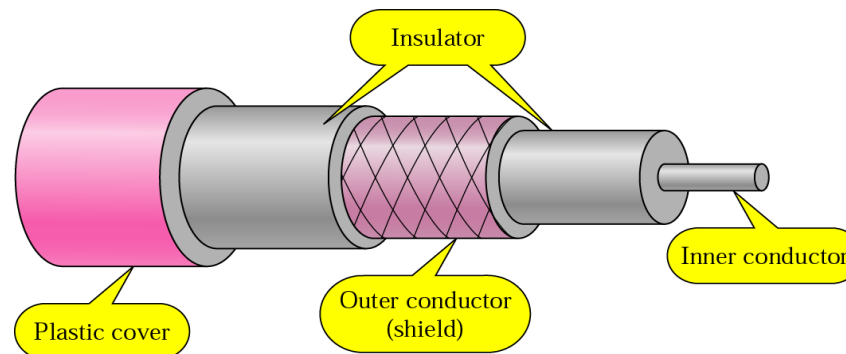
Lecture 11

2. Physical Layer

- 2.1 Introduction to Communication Electromagnetic Spectrum
- 2.2 Guided Transmission Media: Twisted pair, Coaxial, Fiber optics.

Coaxial cable

- ❏ Coaxial cable is a copper-cored cable surrounded by a heavy shielding and is used to connect computers in a network.
- ❏ Outer conductor shields the inner conductor from picking up stray signal from the air.
- ❏ High bandwidth but lossy channel.
- ❏ Repeater is used to regenerate the weakened signals.



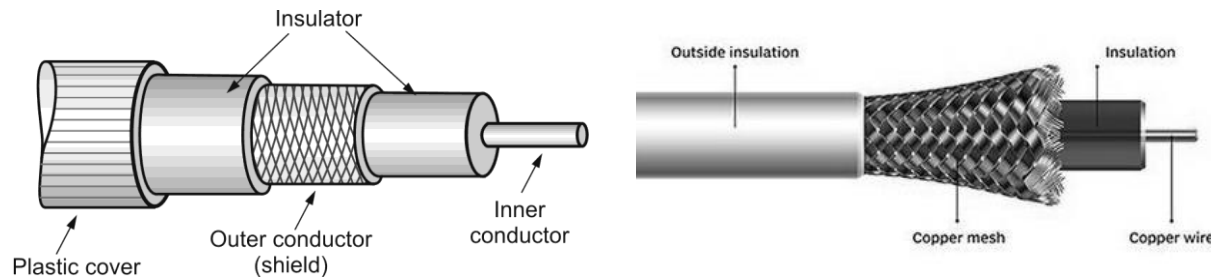
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Here the most **common coaxial standards** are as follows :

- 50-Ohm RG-8 or RG-11 : used with thick Ethernet
- 50-Ohm RG-58 : used with thin Ethernet
- 75-Ohm RG-59 : used with cable television
- 93-Ohm RG-62 : used with ARCNET.

Thicknet : 10base5

Thinnet : 10base2



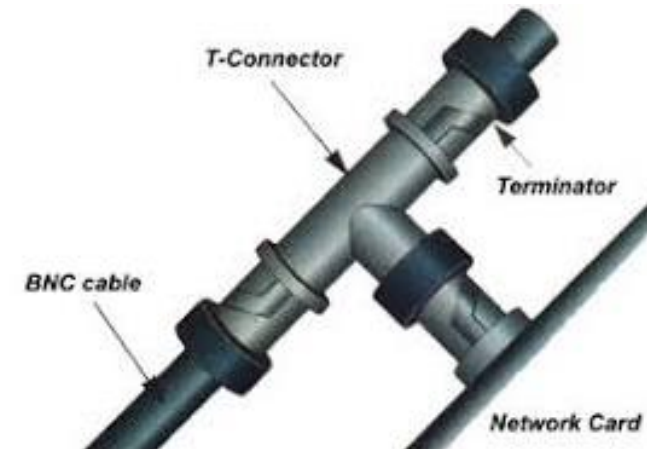
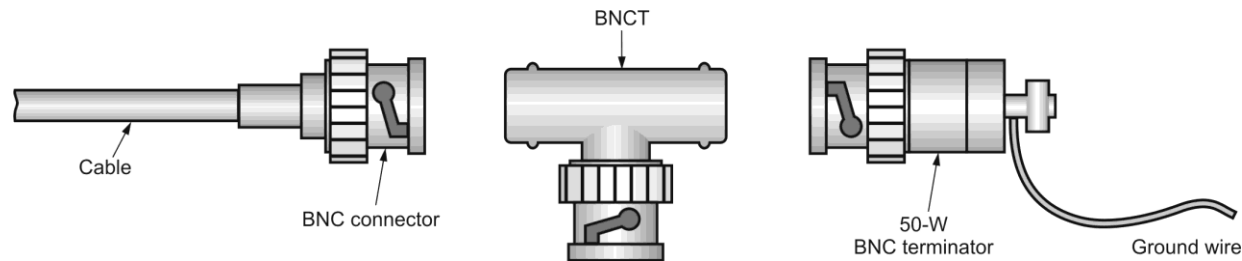
Application of Coax

- Television distribution
- Long Distance telephone transmission
- Short-run computer system
- Local Area Network

Three popular types of connectors for Coax :

- (i) The BNC connector
- (ii) The BNC T connector
- (iii) The BNC terminator.

- To connect coaxial cable to devices, it is necessary to use coaxial connectors.
- The most common type of connector is the **B**ayone-**N**eill-**C**oncelman, or BNC connectors.



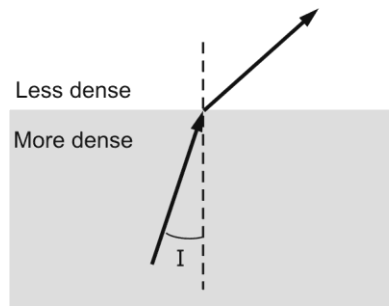
Fiber Optics



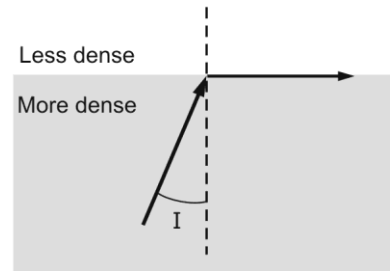
- Made of glass, transmits signals in the form of light
- Light pulse can be used to signal a 1-bit and the absence of a pulse a 0 bit.
- Optical transmission has 3 components:
 1. Transmission media(ultra thin glass fiber)
 2. Light source(LED/laser diode) both emit light pulses when an electric current is applied.
 3. Detector(Photodiode) : Generates an electric pulse when light falls on it.
- By attaching an LED/laser to one end of the optical fiber and a photodiode to the other, we can create a unidirectional data transmission system that →
 1. Accepts an electrical signal, converts it to light pulses and transmits these light pulses.
 2. Reconverts the output to an electrical signal at the receiving end.

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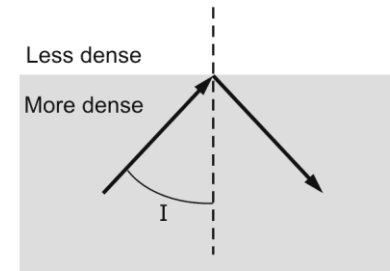
- A ray of light changes direction when going from a more dense to a less dense substance.



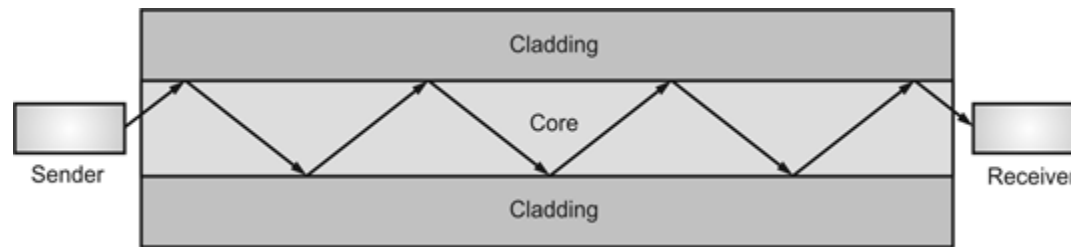
$I < \text{Critical angle,}$
refraction



$I = \text{Critical angle,}$
refraction

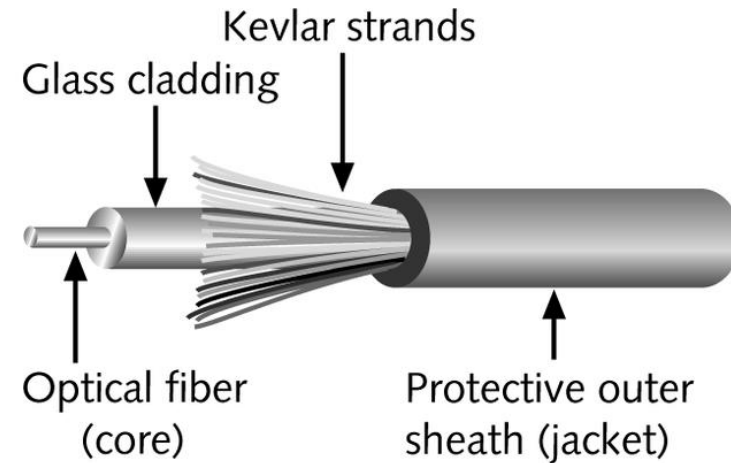


$I > \text{Critical angle,}$
reflection



Fiber Optics Structure

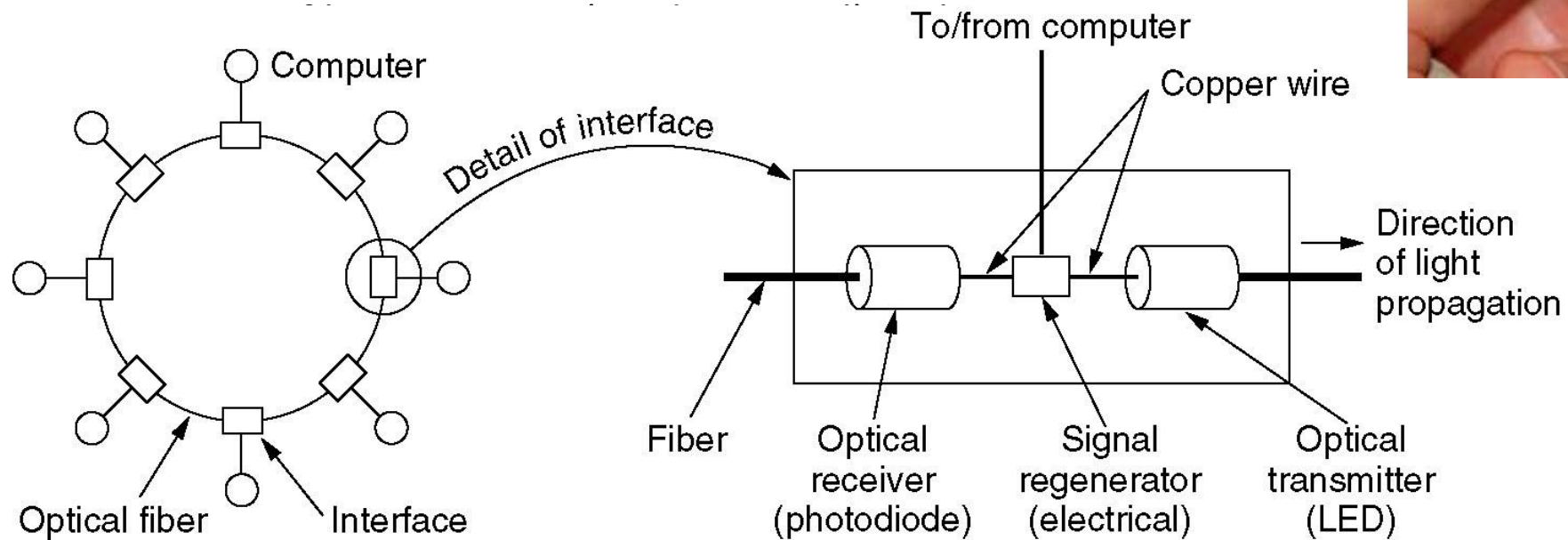
- Contains one or several glass fibers at its core
- Surrounding the fibers is a layer called cladding



Loosely coupled Vs Tightly coupled

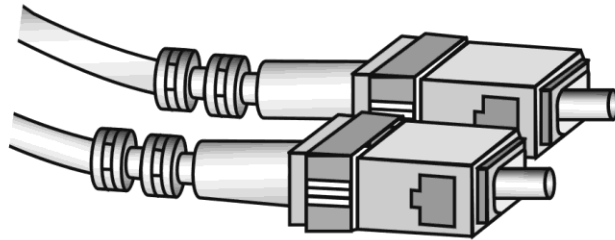


Fiber Optic Networks

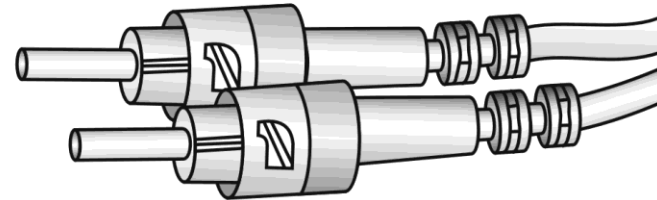


Fiber Optic Cable Connectors

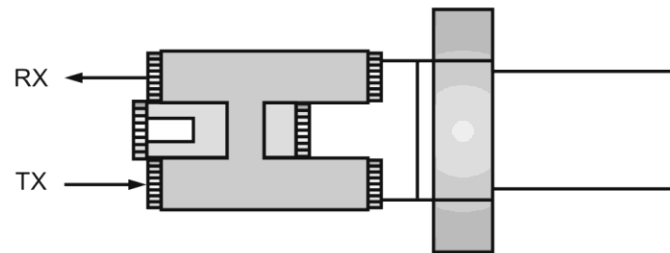
- Subscriber Channel (SC) Connector
- Straight-Tip (ST) Connector
- MT-RJ Connector → (Same size as RJ45)



SC connector

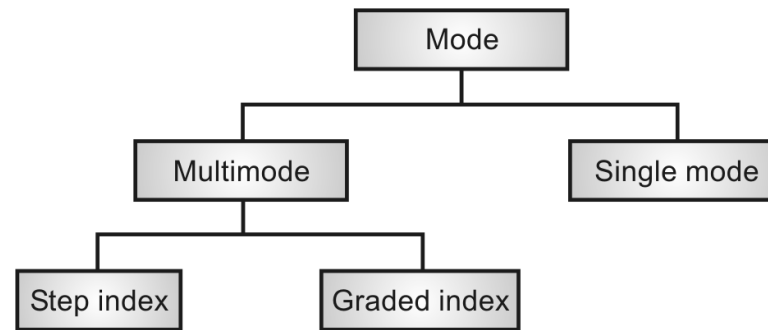


ST connector



MT-RJ connector

Transmission Mode of fiber Optics

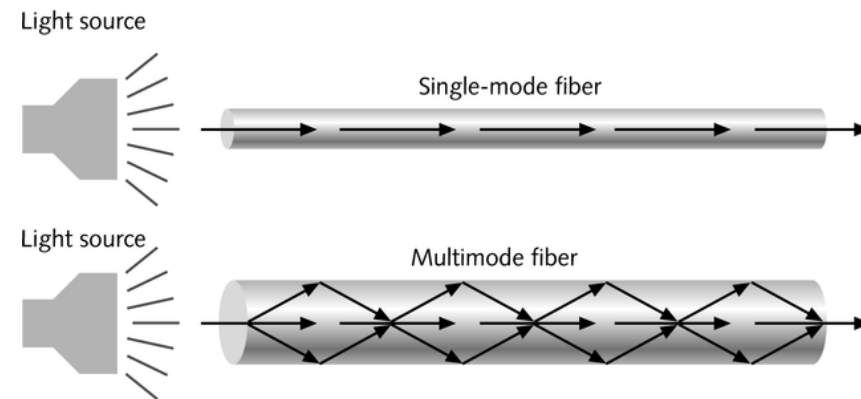


■ Single-mode fiber

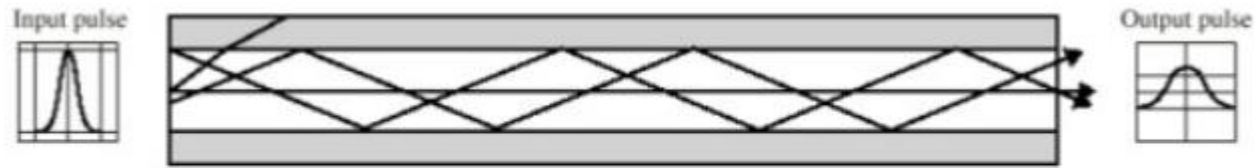
- Carries light pulses along single path
- Uses Laser Light Source

■ Multimode fiber

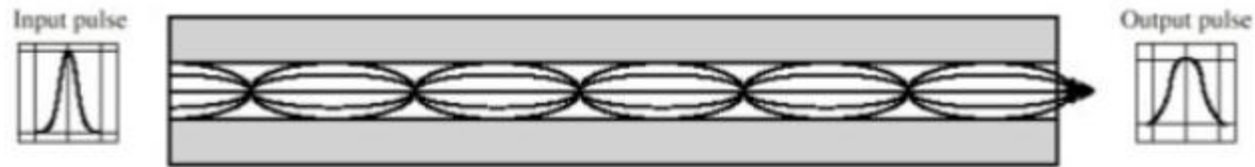
- Many pulses of light generated by LED travel at different angles



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(a) Step-index multimode



(b) Graded-index multimode



(c) Single mode

Fiber Sizes for Fiber Optic Cable

Type	Core (μm)	Cladding (μm)	Mode
50/125	50.0	125	Multimode, graded index
62.3/125	62.5	125	Multimode, graded index
100/140	100.0	140	Multimode, graded index
8.3/125	8.3	125	Single mode

Advantages and Disadvantages of Fiber Optic Cable

Advantages:

- Higher bandwidth, Greater capacity
- Less signal attenuation
- Immunity to electromagnetic interference
- Resistance to corrosive materials
- Light weight
- Greater immunity to tapping –Secure communication
- No Sparks in cut
- No Shock hazard
- Long life expectancy than coax and TP

Disadvantages:

- Installation and maintenance
- Unidirectional light propagation
- High Cost
- Special Skills required

Applications of Fiber Optic Cable

- (1) Use as **backbone networks(Internet)** because its wide bandwidth is cost-effective.
- (2) Some **cable TV companies** use a combination of optical fibre and coaxial cable to create a **hybrid network**.
- (3) **Local-Area Networks** such as **100Base-FX network** and **1000Base-X** also use fibre-optic cable.