

Introduction to Fiber Optics



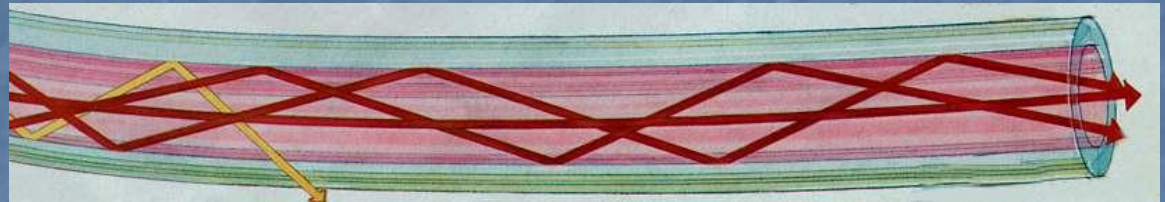
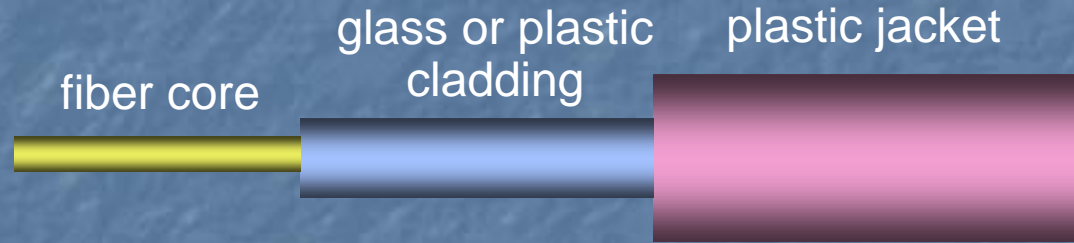
What are Fiber Optics?

- **Fiber optics** (optical fibers) are long, thin strands of very pure glass about the diameter of a human hair.
- They are arranged in bundles called **optical cables** and used to transmit light signals over long distances at very high speeds

What are Fiber Optics?

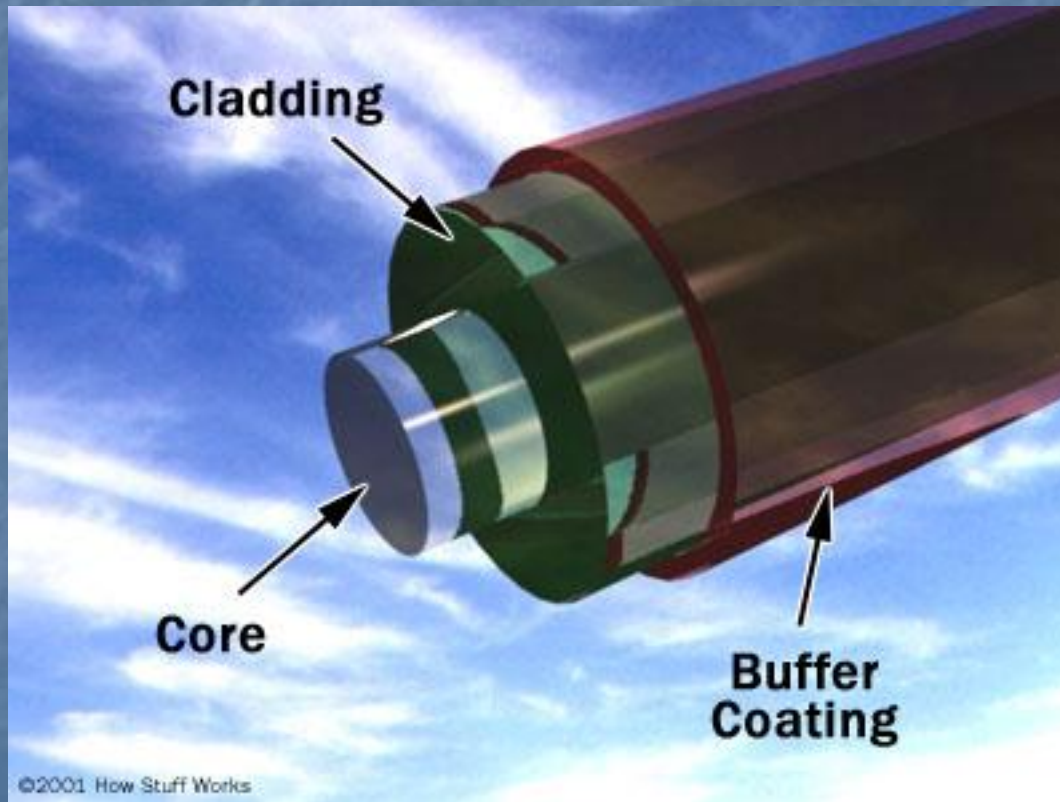
- If you look closely at a single optical fiber, you will see that it has the following parts:
 - **Core** - Thin glass center of the fiber where the light travels
 - **Cladding** - Outer optical material surrounding the core that reflects the light back into the core
 - **Buffer coating** - Plastic coating that protects the fiber from damage and moisture

Fiber Optics

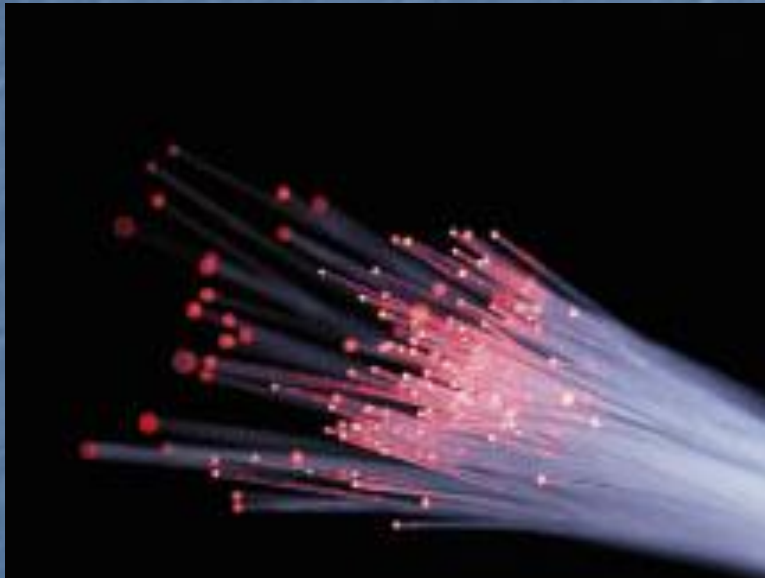
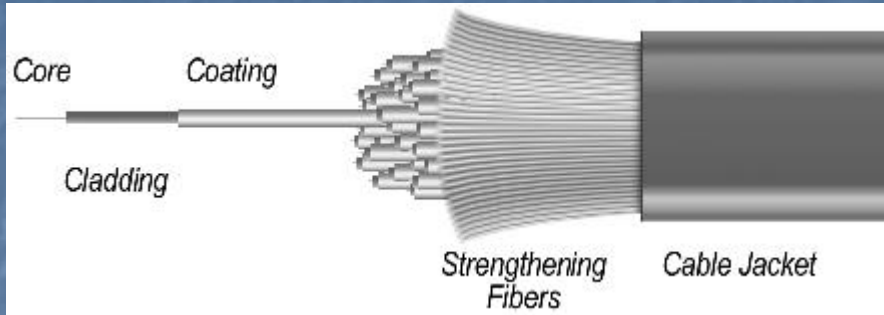


TOTAL INTERNAL REFLECTION

What are Fiber Optics?



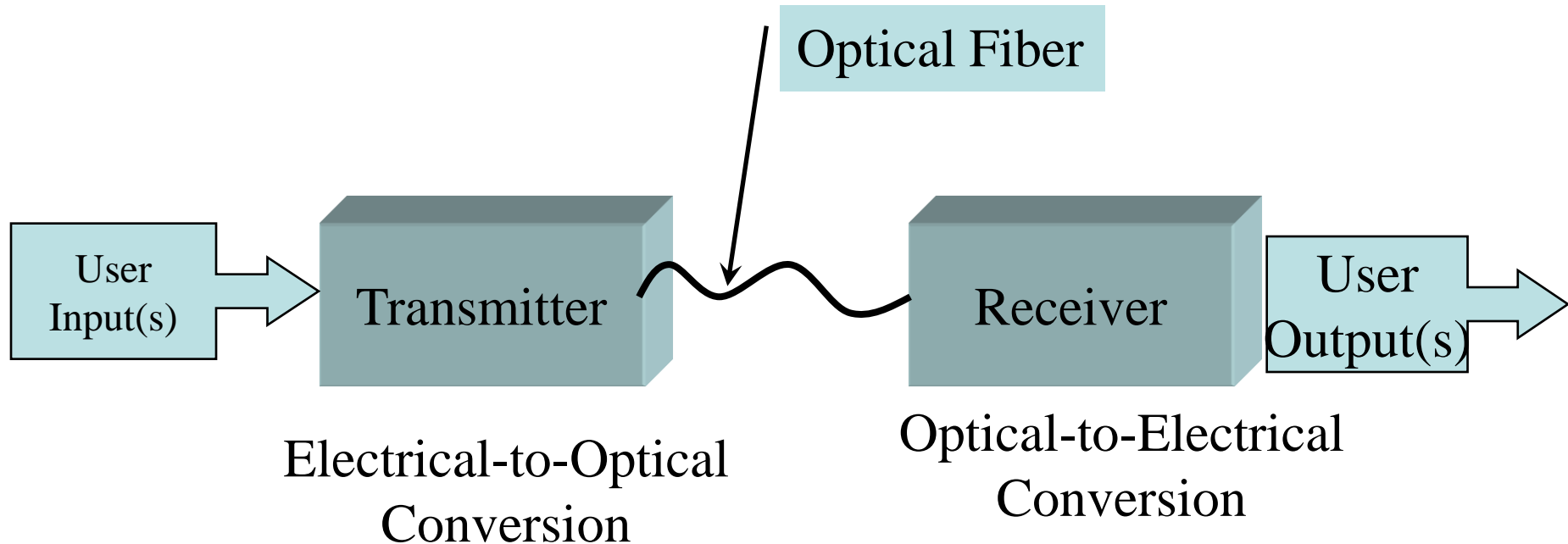
Fiber Optic Cables



SOURCE: SURFNET.NL

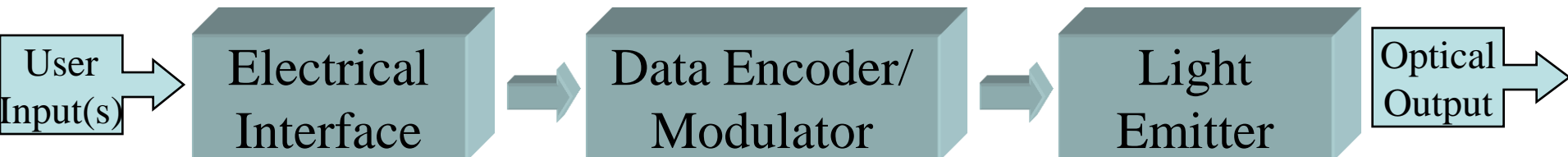
Elements of an Optical Fiber communication

- Fiber optic links contain three basic elements
 - transmitter
 - optical fiber
 - receiver



- **Transmitter (TX)**

- Electrical interface encodes user's information through AM, FM or Digital Modulation
- Encoded information transformed into light by means of a light-emitting diode (LED) or laser diode (LD)



- Receiver (RX)

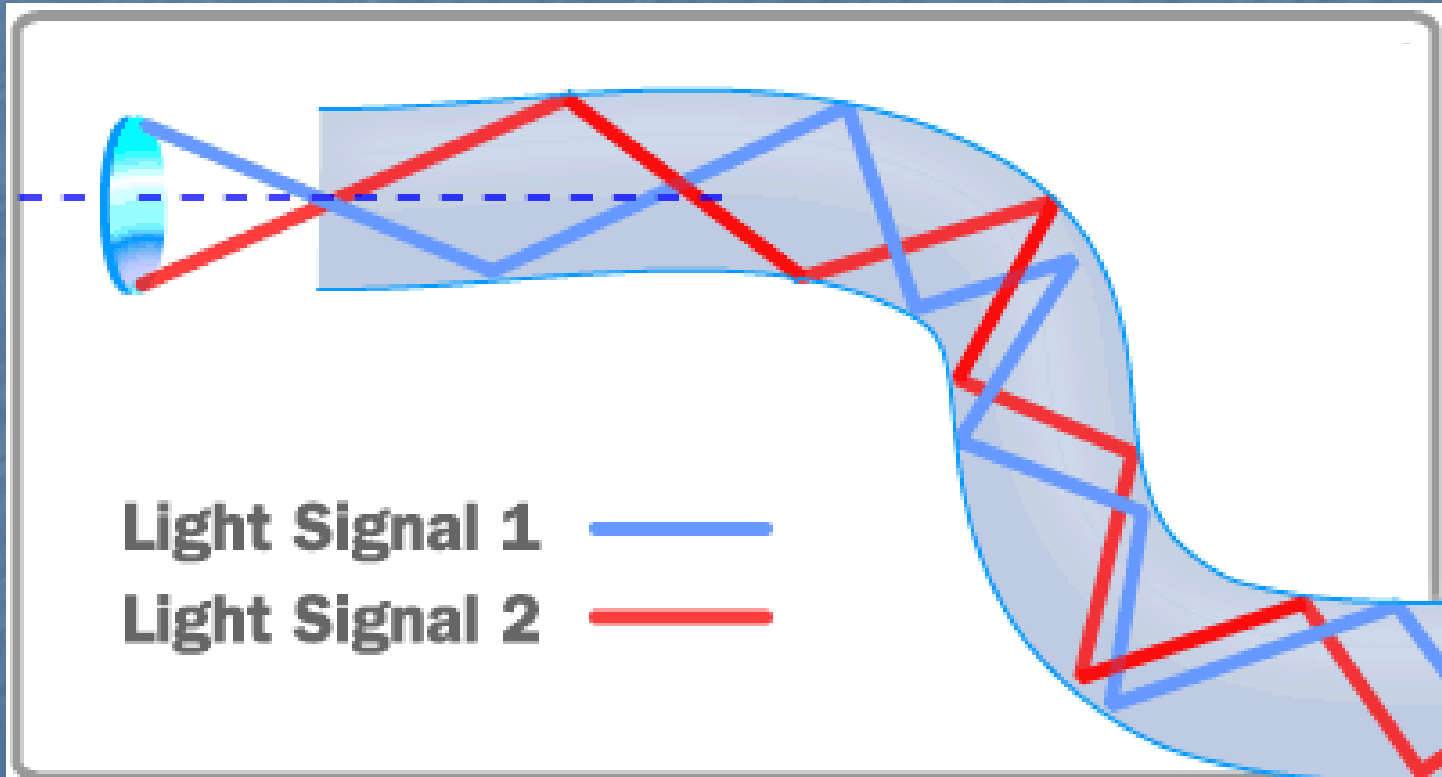
- decodes the light signal back into an electrical signal
- the data decoder/demodulator converts the signals into the correct format



How Does an Optical Fiber Transmit Light?

- Suppose you want to shine a flashlight beam down a long, straight hallway.
- Just point the beam straight down the hallway -- light travels in straight lines, so it is no problem. What if the hallway has a bend in it?
- You could place a mirror at the bend to reflect the light beam around the corner.
- What if the hallway is very winding with multiple bends?
- You might line the walls with mirrors and angle the beam so that it bounces from side-to-side all along the hallway. This is exactly what happens in an optical fiber.

How Does an Optical Fiber Transmit Light?



How Does an Optical Fiber Transmit Light?

- The light in a fiber-optic cable travels through the core (hallway) by constantly bouncing from the cladding (mirror-lined walls), a principle called **total internal reflection**.
- Because the cladding does not absorb any light from the core, the light wave can travel great distances.
- However, some of the light signal **degrades** within the fiber, mostly due to impurities in the glass. The extent that the signal degrades depends on the purity of the glass and the wavelength of the transmitted light

Types of optical fibers

- Single mode

- only one signal can be transmitted
- use of single frequency

- Multi mode

- Several signals can be transmitted
- Several frequencies used to modulate the signal

Advantages of optical fibers

- Can carry much more information
- **Less expensive** .
- Thinner
- Much higher data rates
- Much longer distances than co-axial cables
- Immune to electromagnetic noise
- Light in weight
- Unaffected by atmospheric agents