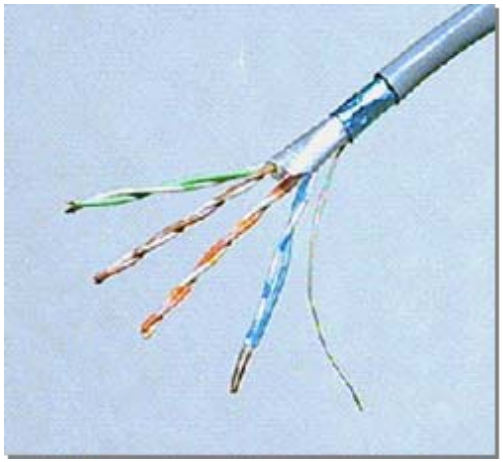
Cable Standard for Industrial Ethernet

Topics covered in this paper

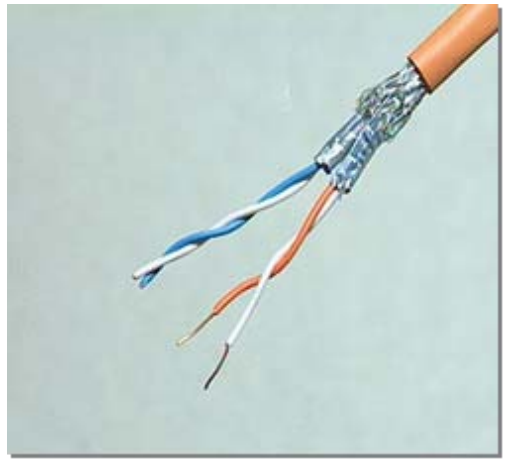
- **Twisted Pair Cables and Connectors**
- **Fiber Optic Cables and Connectors**
- **What Benefits does Fiber Optic Cable Provide?**

Twisted Pair Cables

- Cat3 for 10M, Cat5 or above for 100M, 1000M.

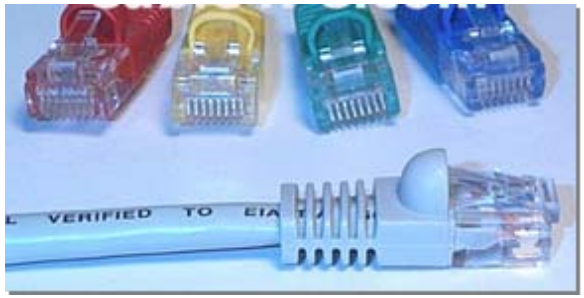


UTP:
Un-shielded Twisted Pair



STP:
Shielded Twisted Pair

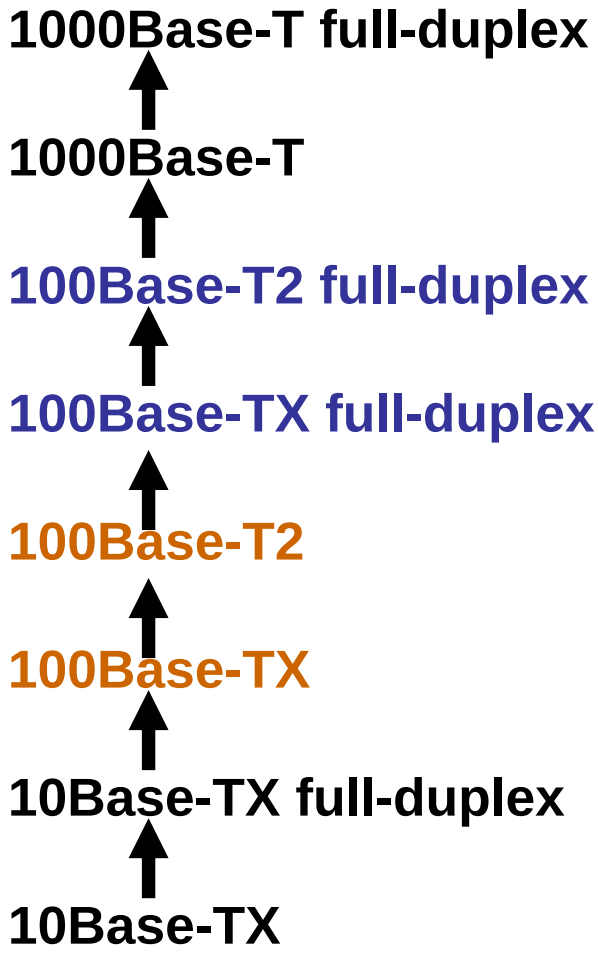
Twisted Pair Cable Connectors



- Standard RJ45: Popular, not robust
- Industrial RJ45: Not standard, water/vibration proof
- DB9: SIEMENS proprietary

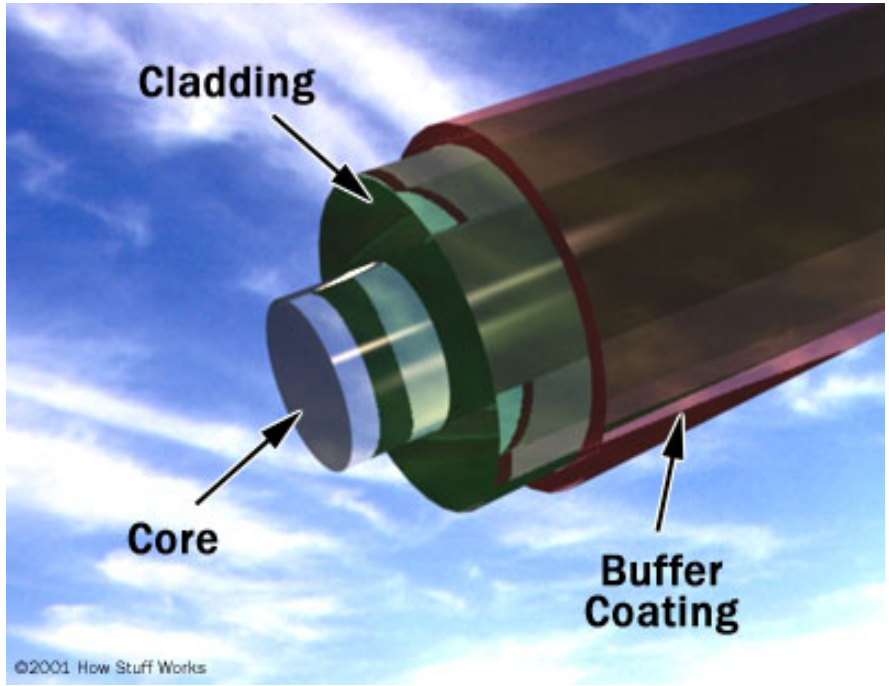
Twisted Pair Speed and Pin Assignments

- Backwards compatible
- Auto-negotiation – lowest speed will be chosen
- Half duplex works with shared Ethernet (HUB) only
- Full duplex works in switching environment. Doubles performance of Ethernet.



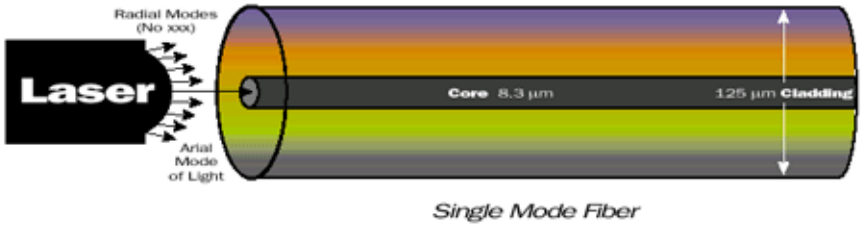
What is Fiber Optics?

- **Core** - Thin glass center of fiber to guide the light rays.
- **Cladding** - Outer optical material surrounds the core to reflect the light back into the core.
- **Buffer coating** - Plastic coating that protects the fiber from damage and moisture.
- 9/125/250, 62.5/125/250

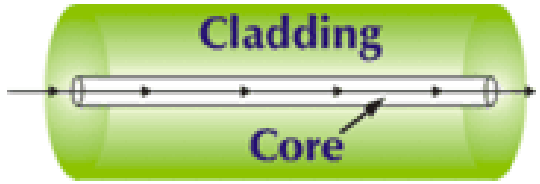


Single Mode vs. Multi Mode

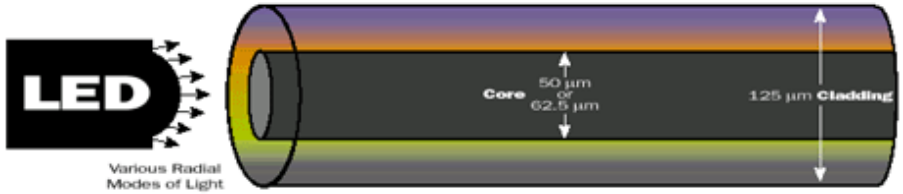
Single Mode



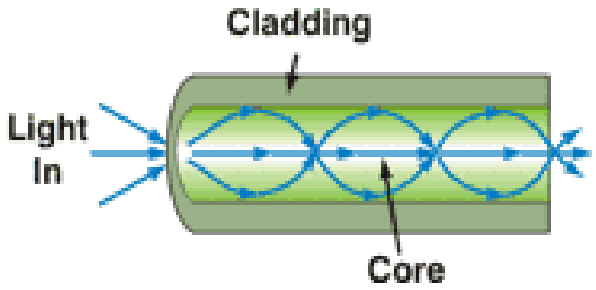
Single Mode Fiber

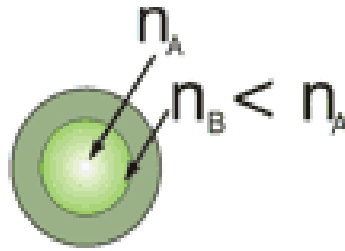


Multi Mode

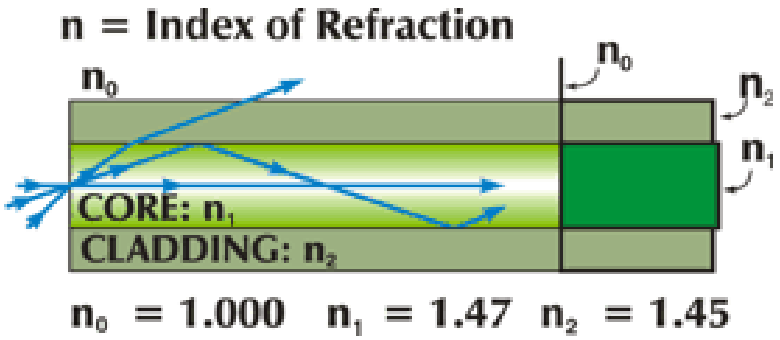


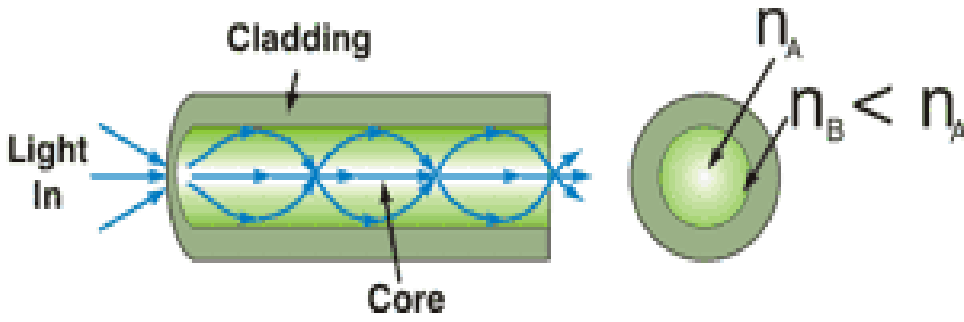
Multimode Fiber





Step Index Core vs. Graded Index Core for Multi Mode





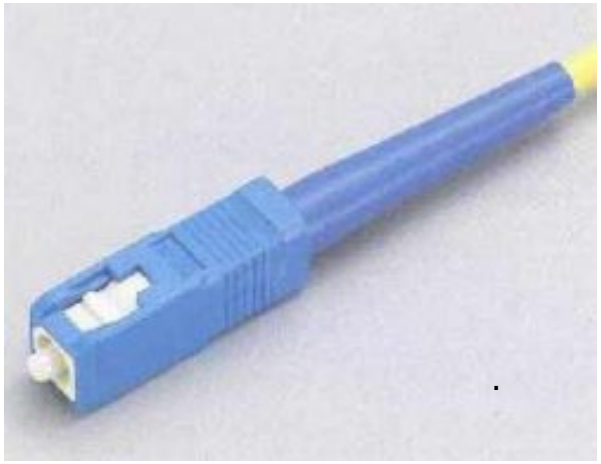
Step-index Fiber: Fiber that has a uniform index of refraction throughout the core that is a step below the index of refraction in the cladding.

Graded-index Fiber: Optical fiber in which the refractive index of the core is in the form of a parabolic curve, decreasing towards the cladding.

Classes of Fiber Optics

	Core diameter	Cladding diameter	Wavelength	Light source
Single-mode fibers	5 to 10 microns (Moxa, 9 microns)	125 microns	1,300 to 1,550 nm	Laser, VCSEL infrared
Multi-mode Step Index fibers	50, 62.5 or above microns (Moxa, 62.5 microns)	125 to 140 microns	850 to 1,300 nm	LED, VCSEL infrared
Multi-mode Step Index fibers	400 to 600 microns	230 to 630 microns	750 to 2000 microns	LED, VCSEL infrared
Multi-mode plastic fibers	750 to 2000 microns	750 to 2000 microns	650 nm	LED, visible red

Fiber Optic Connectors Used in Ethernet



SC, Subscriber Connector (NTT)

ST, Straight Tip (AT&T Trademark)

Small-Form-Factor, SFF connectors

LC (Lucent Technology, 1.25 mm ferrule)

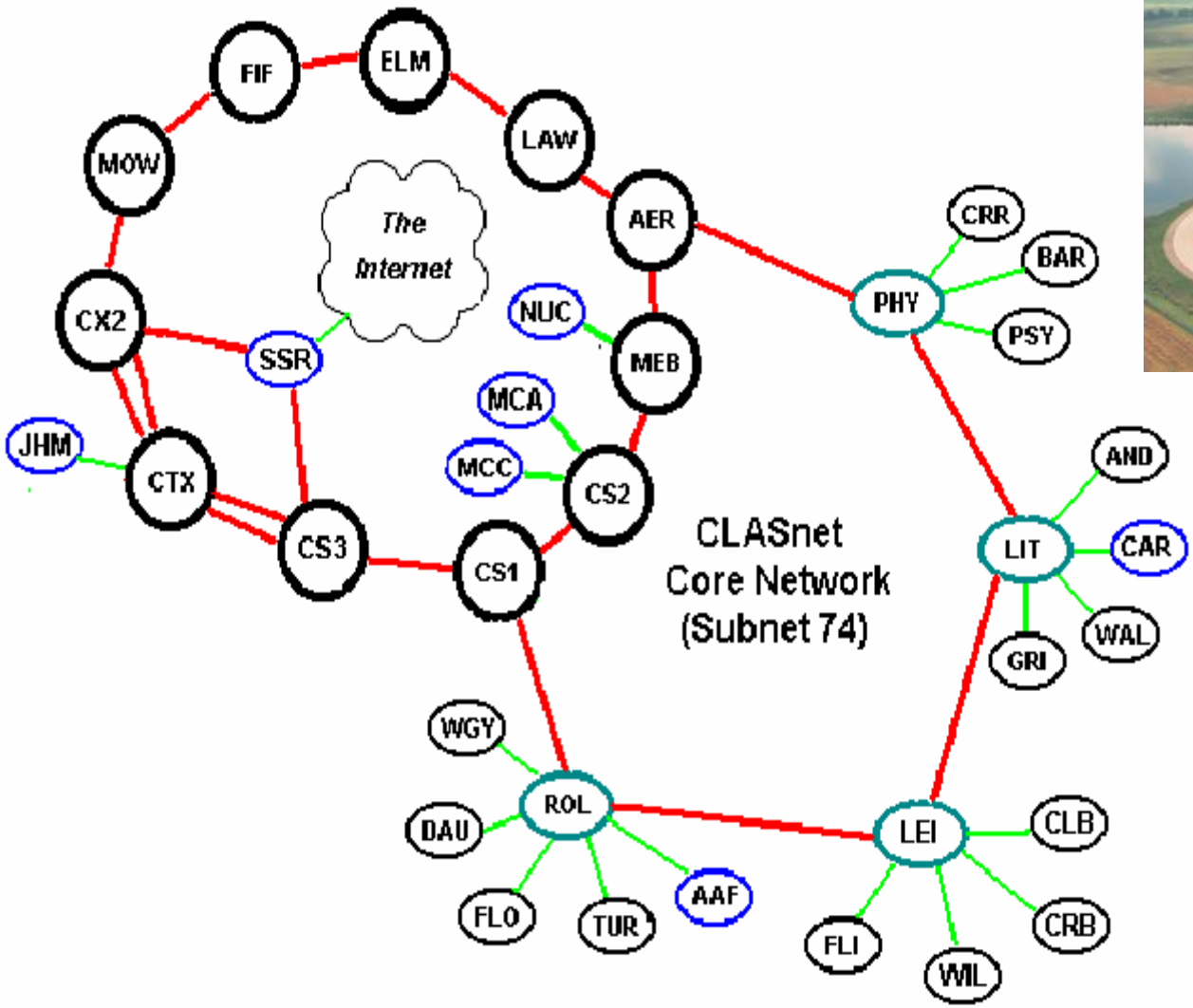
MT-RJ (AMP, Tyco Electronics)

Why We Need Fiber Communication

- ***Long distance networks for Industrial application***
- **Higher bandwidth for future use**
- **For Safe & Secure wiring systems**

= High Demand for Fiber Optics in Industrial Applications

Long Distance Network For Industrial Application



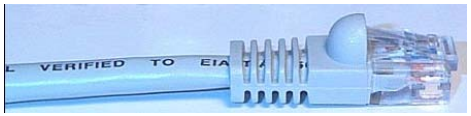
Fiber Optic

Copper

High Bandwidth

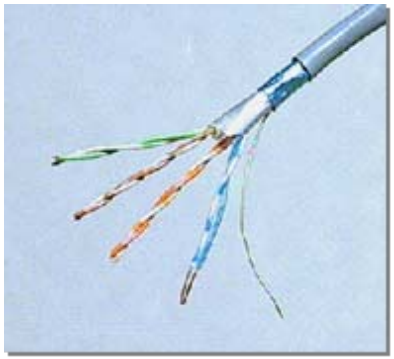
- **Higher bandwidth** for future use

The information-carrying capacity of fiber is greater than twisted-pair cable.



Max Bandwidth: 1G ⟷ **Max Bandwidth: 10G**

Bandwidth



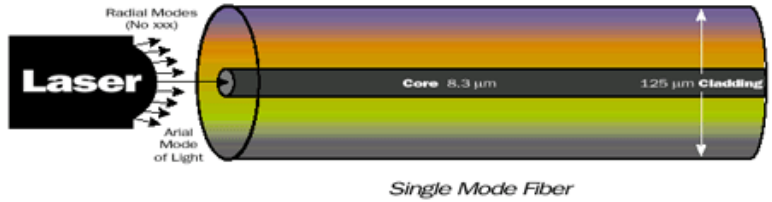
Safe & Secure Wiring System

Safe

No interference

Secure

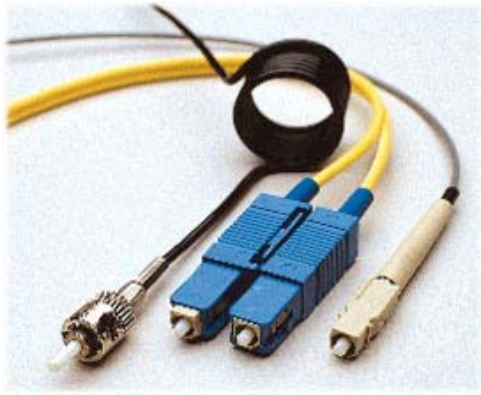
+



Single Mode Fiber

No Hacking

What Moxa Provides



- Complete product range for fiber optic Ethernet

Benefits of Using Fiber

- **Less signal degradation** - **Light signals** - No interference with signals from other fibers in the same cable.
- **Long distance Communication**
- **Higher bandwidth** for future use.
- **Non-flammable** - Since fiber is non-electrical, there is no fire hazard.