

Transmission Media

Transmission Media

- A **transmission media** is defined as anything that can carry information from a source to a destination.
- For example, the transmission medium for two people having a dinner conversation is the air.
- For a written message, the transmission medium might be a mail carrier, a truck, or an airplane.

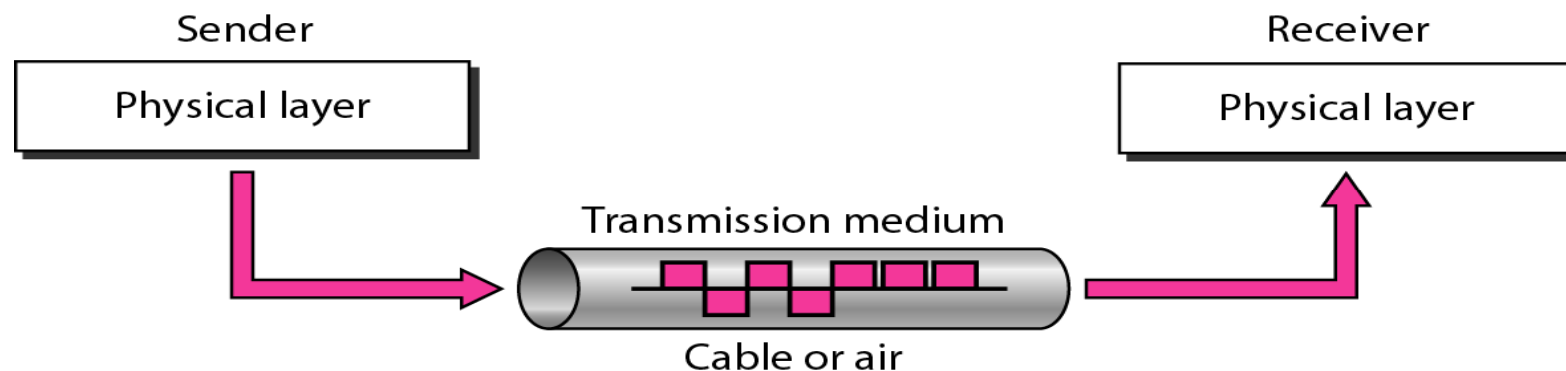


Figure 7.1 *Transmission medium and physical layer*

Transmission Media



- In data communications the definition of the information and the transmission medium is more specific.
- The transmission medium is usually free space, metallic cable, or fibre-optic cable.
- The information is usually a signal that is the result of a conversion of data from another form.

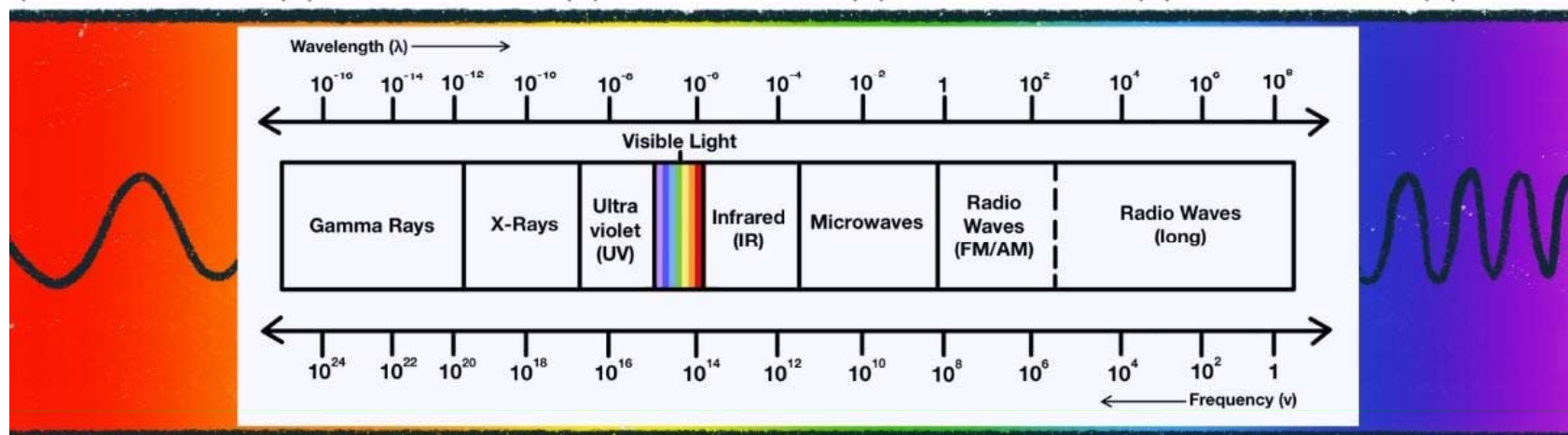
Transmission Media

- Electromagnetic energy, a combination of electric and magnetic fields vibrating in relation to each other, includes power, radio waves, infrared light, visible light, ultraviolet light, and X, gamma, and cosmic rays.
- Each of these constitutes a portion of the electromagnetic spectrum.
- Not all portions of the spectrum are currently usable for telecommunications.
- The media to harness those that are usable are also limited to a few types.

Transmission Media

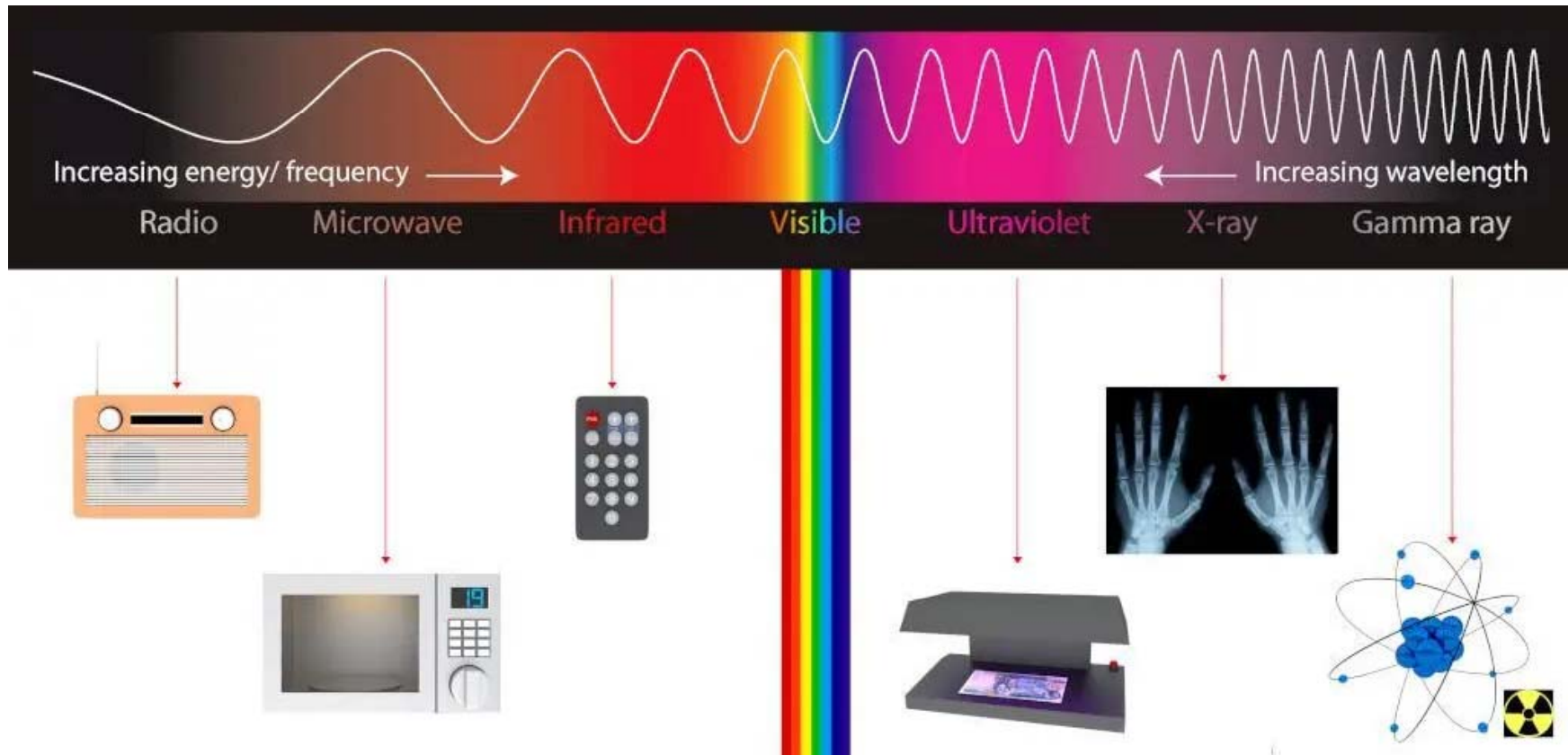
Electromagnetic Spectrum

The  Chemistry
Notes 



The electromagnetic spectrum is the orderly dispersion of electromagnetic waves according to their wavelength and frequency.

Transmission Media



Transmission Media

- In telecommunications, transmission media can be divided into two broad categories: guided and unguided. Guided media include twisted-pair cable, coaxial cable, and fiber-optic cable.
- Unguided medium is free space.

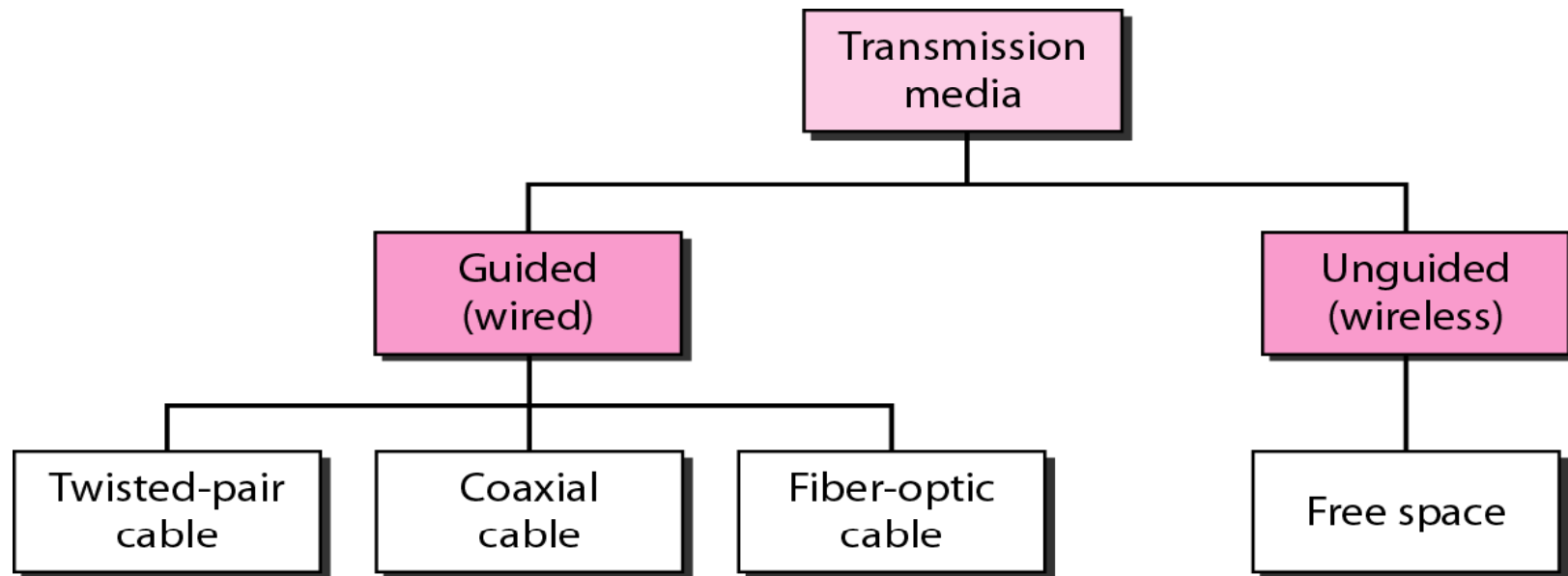


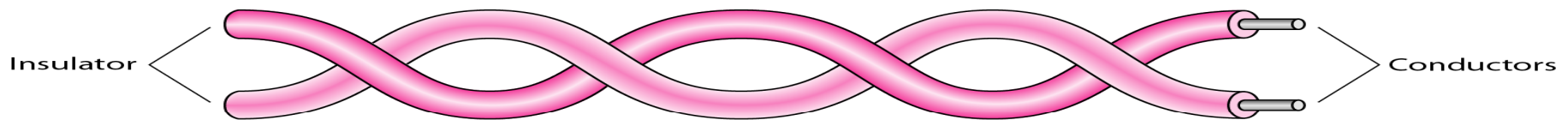
Figure 7.2 *Classes of transmission media*

7-1 GUIDED MEDIA

- Guided media, which are those that provide a conduct from one device to another, include twisted-pair cable, coaxial cable, and fibre-optic cable.
- A signal travelling along any of these media is directed and contained by the physical limits of the medium.
- Twisted-pair and coaxial cable use metallic (copper) conductors that accept and transport signals in the form of electric current.
- Optical fibre is a cable that accepts and transports signals in the form of light.

1. Twisted-Pair Cable

- A twisted pair consists of two conductors (normally copper), each with its own plastic insulation, twisted together, as shown in Figure 7.3.



7-1 GUIDED MEDIA

- One of the wires is used to carry signals to the receiver, and the other is used only as a ground reference. The receiver uses the difference between the two.
- In addition to the signal sent by the sender on one of the wires, interference (noise) and crosstalk may affect both wires and create unwanted signals.
- If the two wires are parallel, the effect of these unwanted signals is not the same in both wires because they are at different locations relative to the noise or crosstalk sources .
- This results in a difference at the receiver. By twisting the pairs, a balance is maintained.
- For example, suppose in one twist, one wire is closer to the noise source and the other is farther; in the next twist, the reverse is true.

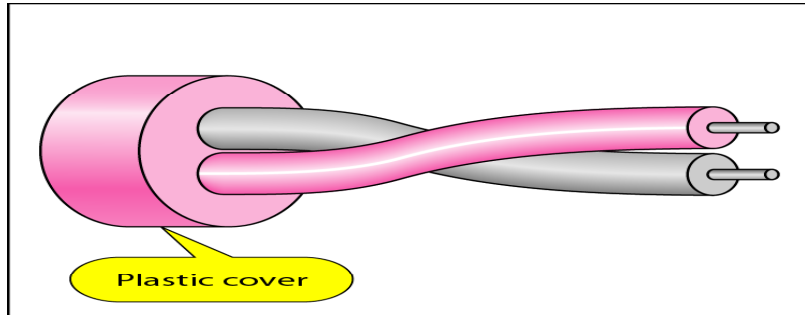
7-1 GUIDED MEDIA

- The most common twisted-pair cable used in communications is referred to as **unshielded twisted-pair (UTP)**. IBM has also produced a version of twisted-pair cable for its use called **shielded twisted-pair (STP)**.
- STP cable has a metal foil or braided- mesh covering that encases each pair of insulated conductors.
- Although metal casing improves the quality of cable by preventing the penetration of noise or crosstalk, it is bulkier and more expensive.

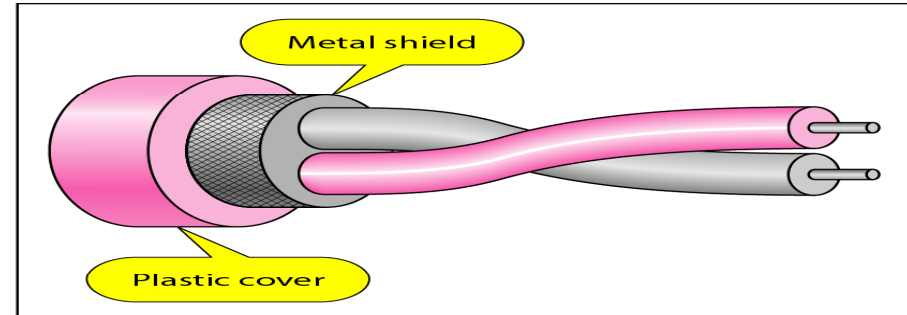
7-1 GUIDED MEDIA

- *Unshielded Versus Shielded Twisted-Pair Cable*
- The most common twisted-pair cable used in communications is referred to as unshielded twisted-pair (UTP).
- IBM has also produced a version of twisted-pair cable for its use called shielded twisted-pair (STP).
- STP cable has a metal foil or braided mesh covering that encases each pair of insulated conductors.
- Although metal casing improves the quality of cable by preventing the penetration of noise or crosstalk, it is bulkier and more expensive.
- Figure 7.4 shows the difference between UTP and STP.
- Our discussion focuses primarily on UTP because STP is seldom used outside of IBM.
- Connectors: The most common UTP connector is RJ45 (RJ stands for registered jack). The RJ45 is a keyed connector, meaning the connector can be inserted in only one way.

7-1 GUIDED MEDIA



a. UTP

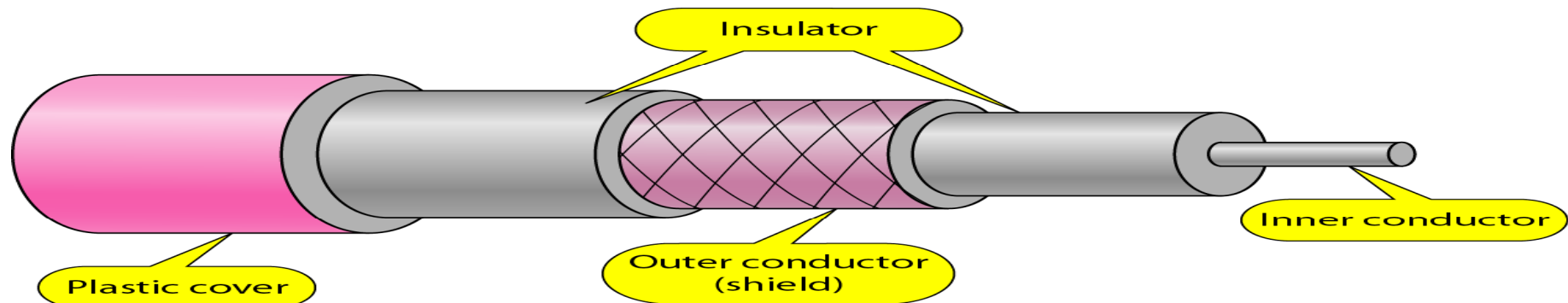


b. STP

- *Applications*
- Twisted-pair cables are used in telephone lines to provide voice and data channels. The local loop--the line that connects subscribers to the central telephone office---commonly consists of unshielded twisted-pair cables.
- The DSL lines that are used by the telephone companies to provide high-data-rate connections also use the high-bandwidth capability of unshielded twisted-pair cables.

7-1 GUIDED MEDIA

- *Coaxial Cable*
- Coaxial cable (or coax) carries signals of higher frequency ranges than those in twisted-pair cable, in part because the two media are constructed quite differently.
- Instead of having two wires, coax has a central core conductor of solid or stranded wire (usually copper) enclosed in an insulating sheath, which is, in turn, encased in an outer conductor of metal foil, braid, or a combination of the two.



7-1 GUIDED MEDIA

- *Coaxial Cable*
- The outer metallic wrapping serves both as a shield against noise and as the second conductor, which completes the circuit.
- This outer conductor is also enclosed in an insulating sheath, and the whole cable is protected by a plastic cover
- *Coaxial Cable Standards*
- Coaxial cables are categorized by their radio government (RG) ratings.
- Each RG number denotes a unique set of physical specifications, - wire gauge of the inner conductor, the thickness and type of the inner insulator, the construction of the shield, and the size and type of the outer casing.

Table 7.2 *Categories of coaxial cables*

<i>Category</i>	<i>Impedance</i>	<i>Use</i>
RG-59	75 Ω	Cable TV
RG-58	50 Ω	Thin Ethernet
RG-11	50 Ω	Thick Ethernet

7-1 GUIDED MEDIA

- *Applications*

- Coaxial cable was widely used in analog telephone networks where a single coaxial network could carry 10,000 voice signals and later in digital telephone networks too where a single coaxial cable could carry digital data up to 600 Mbps.
- However, it has largely been replaced today with fibre-optic cable.
- Cable TV networks also use coaxial cables, however, cable TV providers replaced it with fibre-optic cable. Cable TV uses RG-59 coaxial cable.
- It is also used in Ethernet LANS because of its high bandwidth, and consequently high data rate.
- The 10Base-2, or Thin Ethernet, uses RG-58 coaxial cable with BNC connectors to transmit data at 10 Mbps with a range of 185 m.
- The 10Base5, or Thick Ethernet, uses RG-11 (thick coaxial cable) to transmit 10 Mbps with a range of 5000 m.
- Thick Ethernet has specialized connectors.