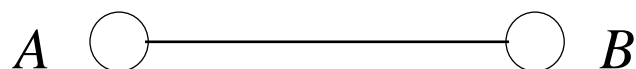


FUNDAMENTALS OF INFORMATION TRANSMISSION

- applies to both wired and wireless networks
- additional features unique to wireless discussed later

Bits, information, and signals

Motivation: hosts A and B are connected by point-to-point link

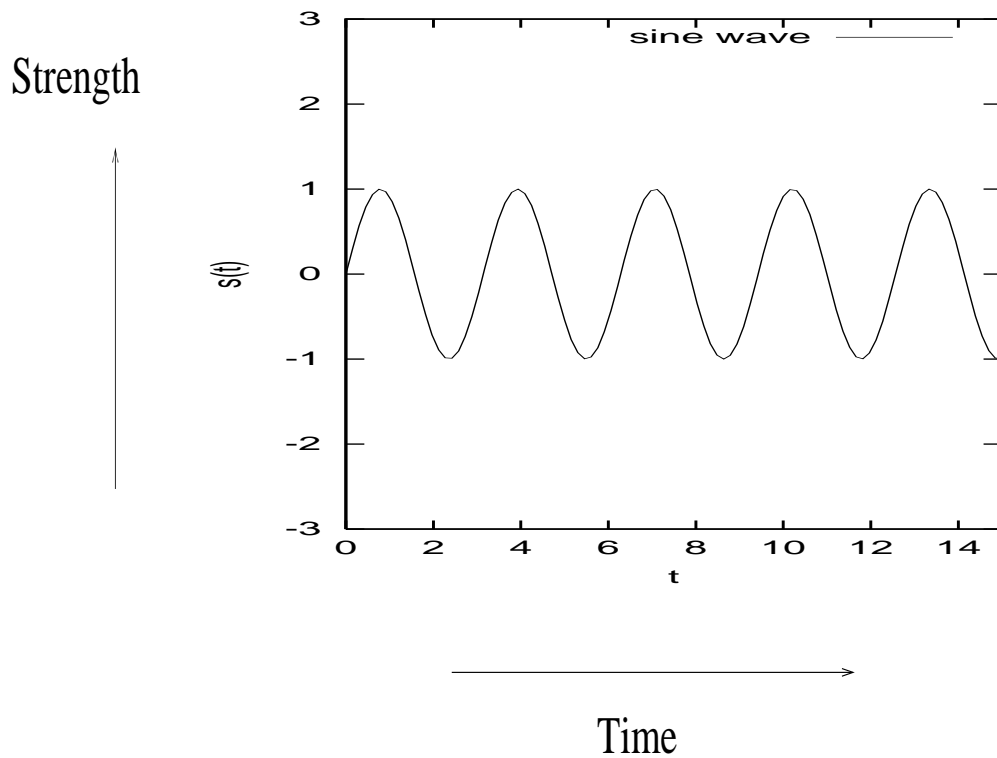


A wants to send bits 011001 to B

Physical medium: wired (fiber/copper) or wireless (space)

- signals: electromagnetic waves

Electromagnetic wave: oscillating sine curve

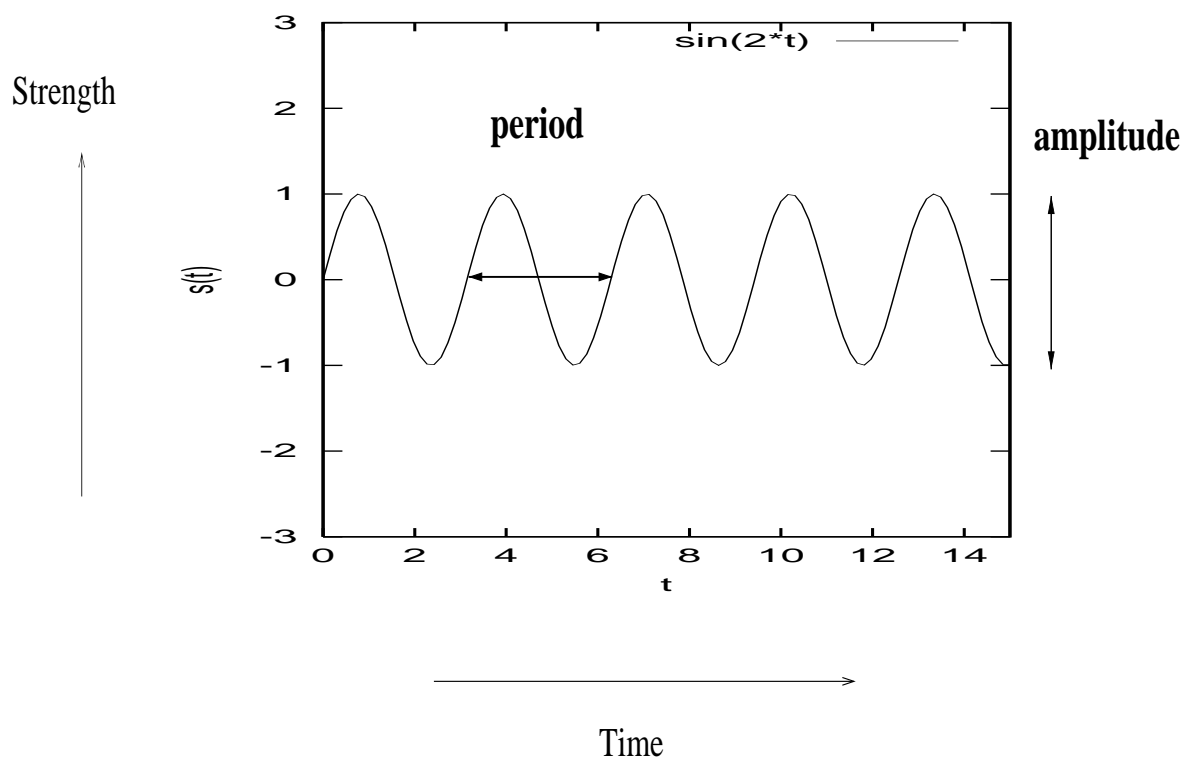


Direction of vibration: perpendicular to direction of travel

→ called transverse wave

→ sound wave: longitudinal — vibration in same direction as travel

Electromagnetic wave: two key features



→ period: T

→ amplitude (or magnitude)

→ third key feature?

Frequency f : how much vibration—i.e., how many periods—occur within a 1-second time window

→ f : $1/T$

→ unit: Hz

Ex.: 1 GHz sine wave has period 1 nanosecond

Travel speed of EM waves

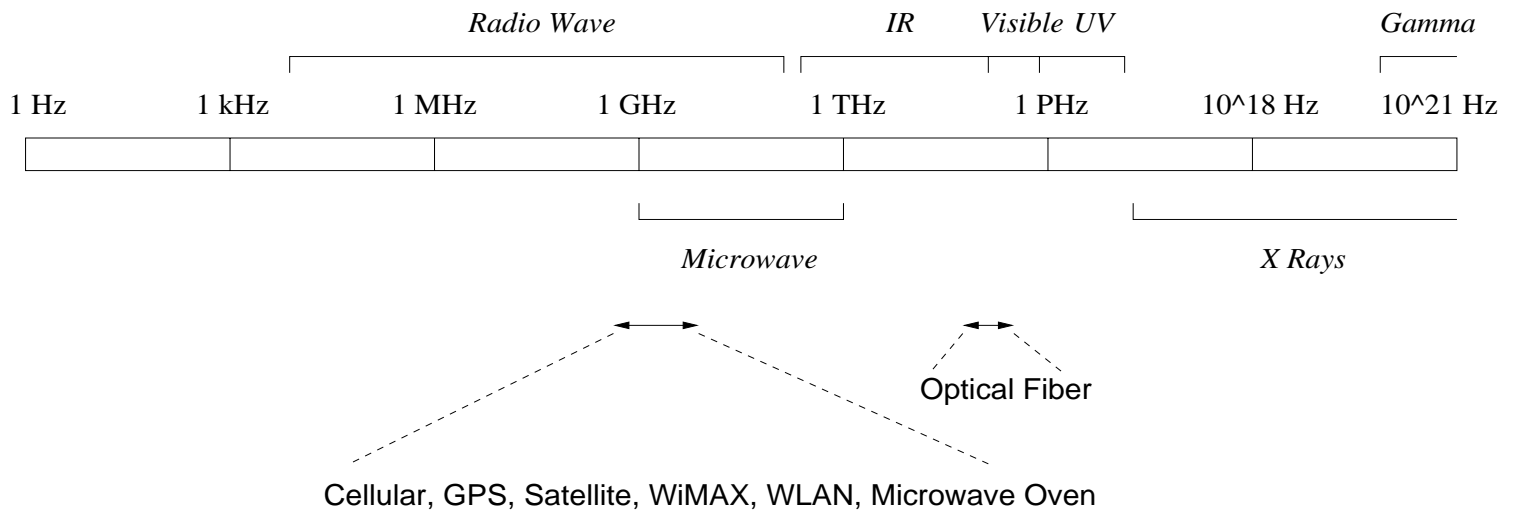
→ speed of light (in vacuum)

→ slower in copper, optical fiber, atmosphere

Electromagnetic spectrum:

→ some of its use today

→ logarithmic scale

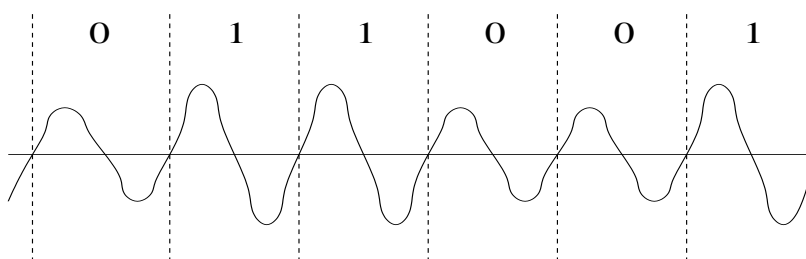


→ crowded near the 1 GHz neighborhood

Back to original problem: A wants to send B six bits
011001

→ how do sine waves help?

Utilize amplitude (signal strength) to encode 1's and 0's



→ large amplitude: 1

→ small amplitude: 0

Called amplitude modulation (AM)

→ same concept as AM radio

Throughput (bps):

→ if frequency is 1 Hz then 1 bps

→ if frequency is 1 MHz then 1 Mbps

→ if frequency is 1 GHz then 1 Gbps

→ if frequency is 1 THz then 1 Tbps

Networking problem solved!

(or not ...)