



ECE686: Wireless Communication Networks

Lecture 1: Introduction



What is a Communication Network?

- Arrangements of hardware and software that allow users to exchange information. In other words, a connection of links and switches/routers, which permits the exchange of information.
 - Links: copper wire, fiber optics, radio, microwaves, etc.
 - Switches/routers: circuit switching, packet switching, etc.
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Circuit vs. Packet Switching

- Circuit switching: a circuit is set up between two terminals for the duration of the conversation. Resources (bandwidth, time slot, etc) are reserved among the circuit, which are used by the two terminals exclusively. The circuit is released when the call terminates. Example: telephone network.
- Packet switching: packets can follow different paths to the destination. The resources in the network can be shared by many connections. Example: Internet.



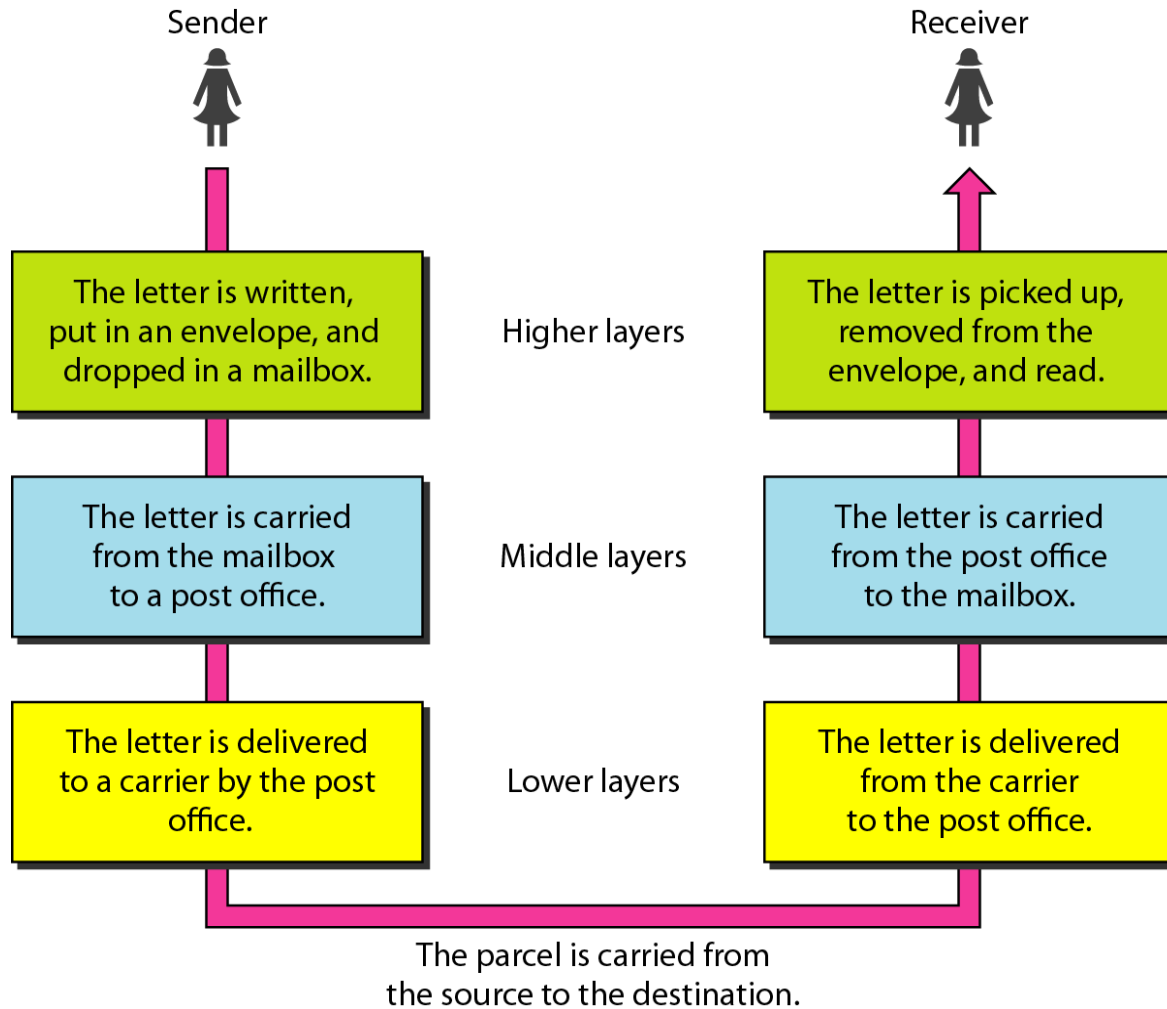
A Comparison

	Circuit switching	Packet switching
Dedicated path	Yes	No
Bandwidth available	Fixed	Dynamic
Potential waste	Yes	No
Store and forward	No	Yes
Call setup	Yes	No need
congestion	At setup time	On every packet
Charge	Per minute	Per packet
Same route/all packets	Yes	No



Telephone Network vs. Internet

- Telephone network: designed for voice conversation (very likely with constant rate). Less suited to data (e.g., email, ftp, web browsing, etc) and other nonconversational transmissions. Nonvoice transmissions tend to be bursty, i.e., data come in spurts with idle gaps between them.
- Internet: suited to data transmission. It provides best-effort services, with no guarantee on the delays or even the loss rate of the transmissions. The network is not reliable and offers no security.
 - Self-organizing: the packets find their way to their destination even a link or a router breaks down.



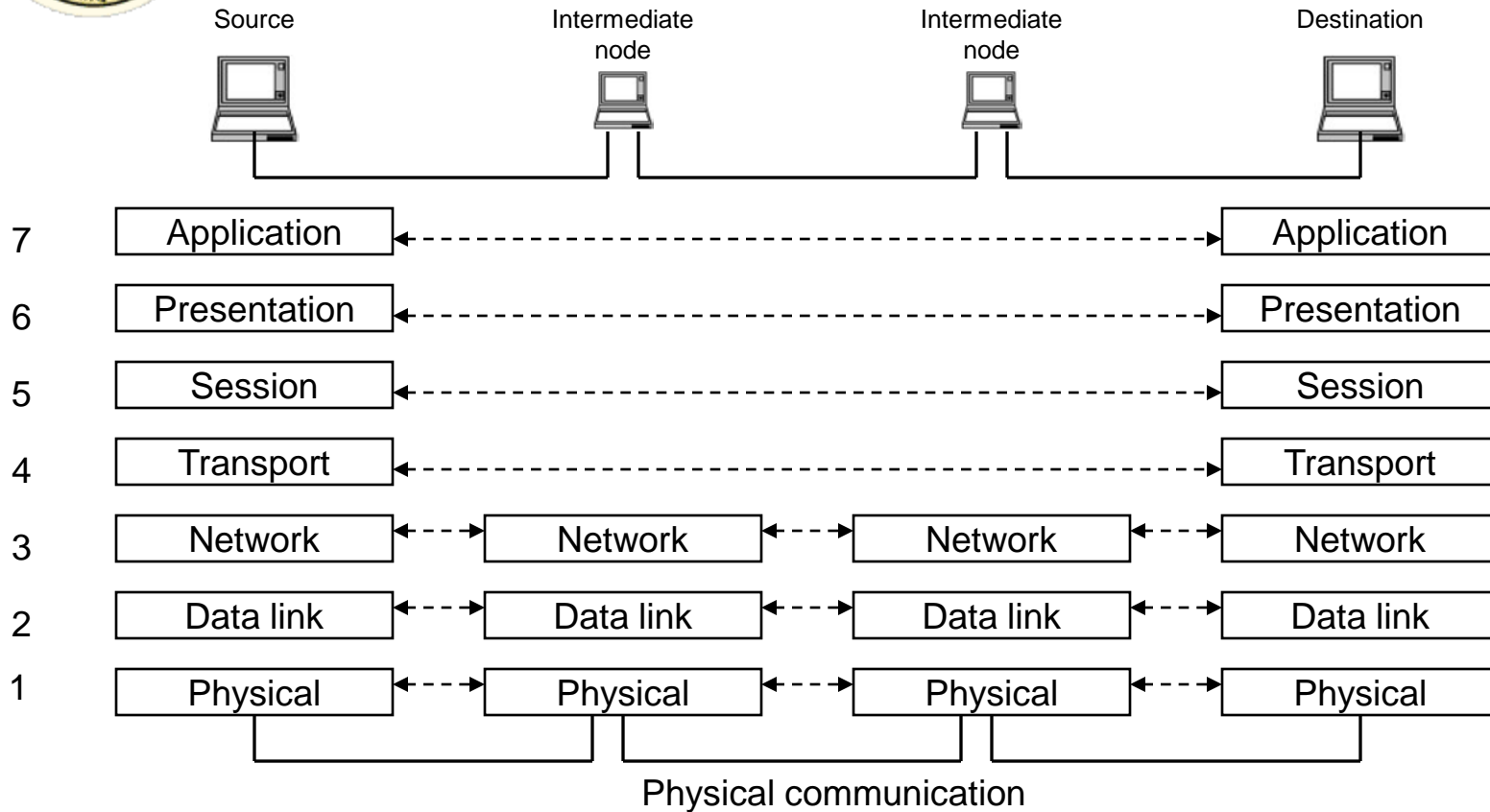


The Way Networks Work

- Layered architecture: Using the services provided by the lower layer, each protocol layer deals with a specific task and provides transparent service to the layer above it.
 - Different layers can be designed more or less independently
 - The flexibility to modify or change the techniques in a protocol layer without significant impact on overall system design.
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Open system Interconnection (OSI) model



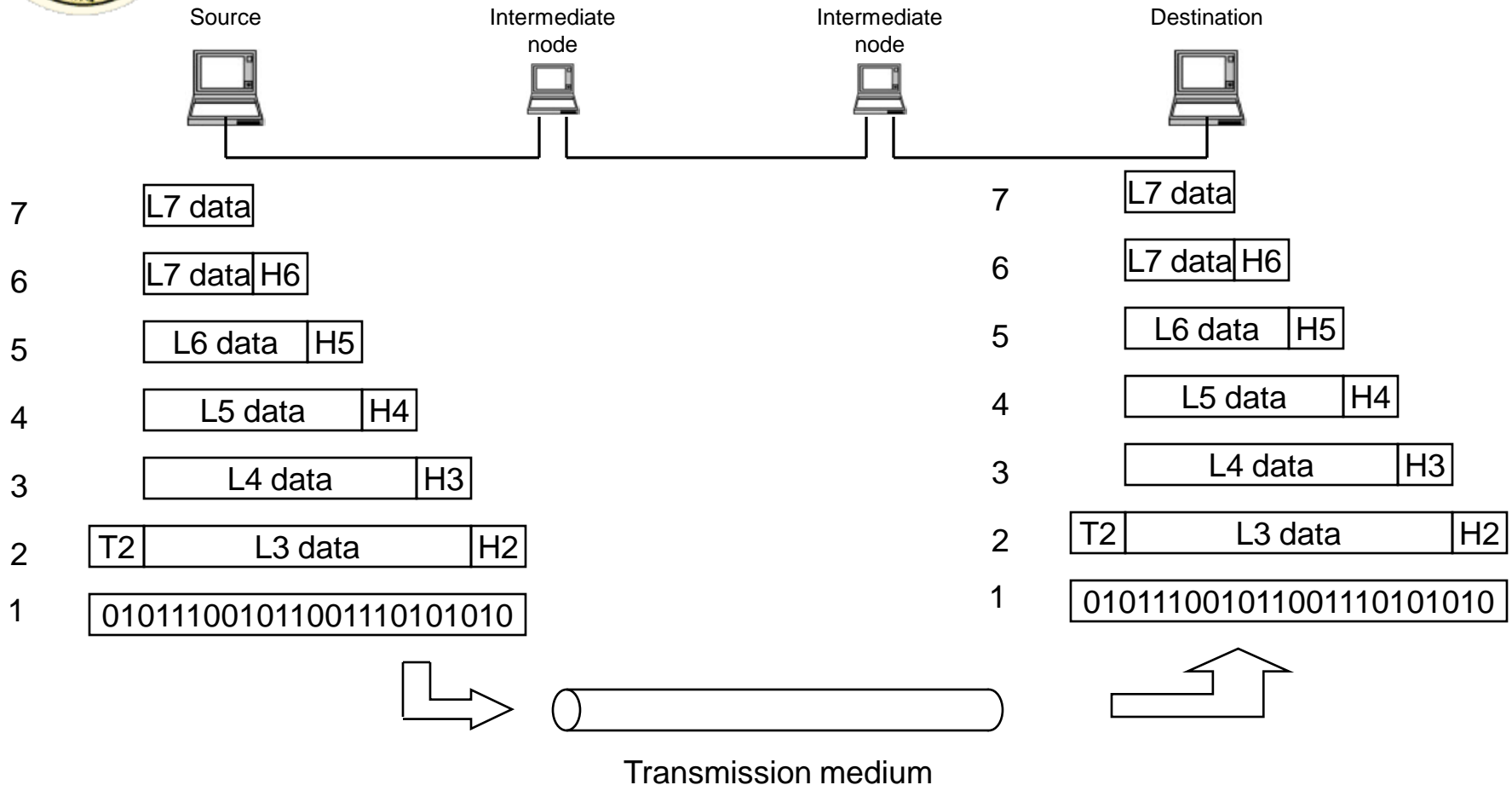


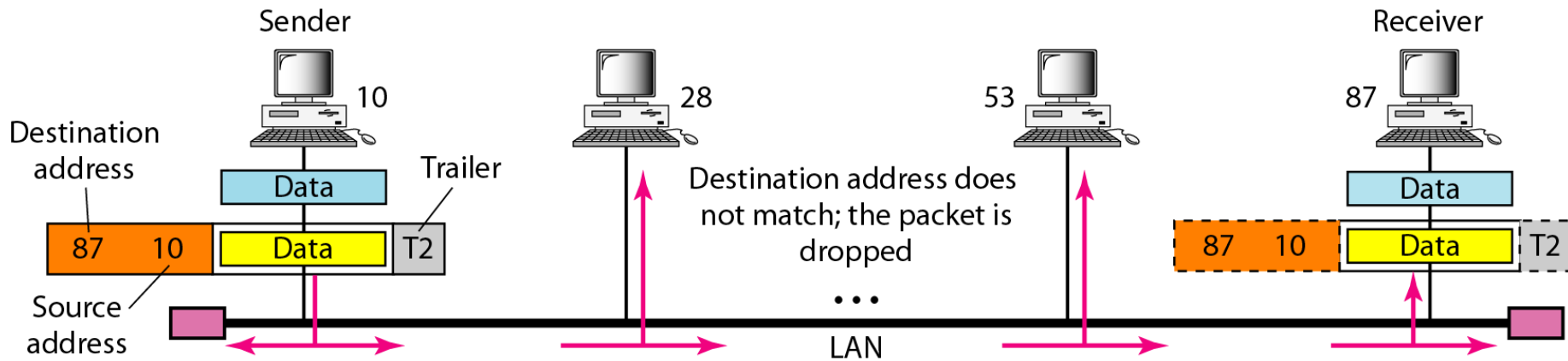
OSI Model (Cont'd)

- Physical layer: implement a digital communication link that delivers **bits**
- Data link layer: implement a **frame** delivery service between nodes that are attached to the same physical link. Physical/MAC address
- Network layer: guide the **packets** from their source to their destination, along a path that may comprise a number of links. Logic/IP address.
- Transport layer: process-to-process delivery of **segments**. For example, overseeing error control and flow control. Port address.
- Session layer: dialog control (e.g., allows two systems to enter a dialog) and synchronization (e.g., insert checkpoints for every 10 pages for a file of 100 pages).
- Presentation layer: take care of data compression, security, and format conversion so that nodes that use different representations of information can communicate efficiently and securely
- Application layer: implement commonly used communication services such as file transfer, telnet, etc.



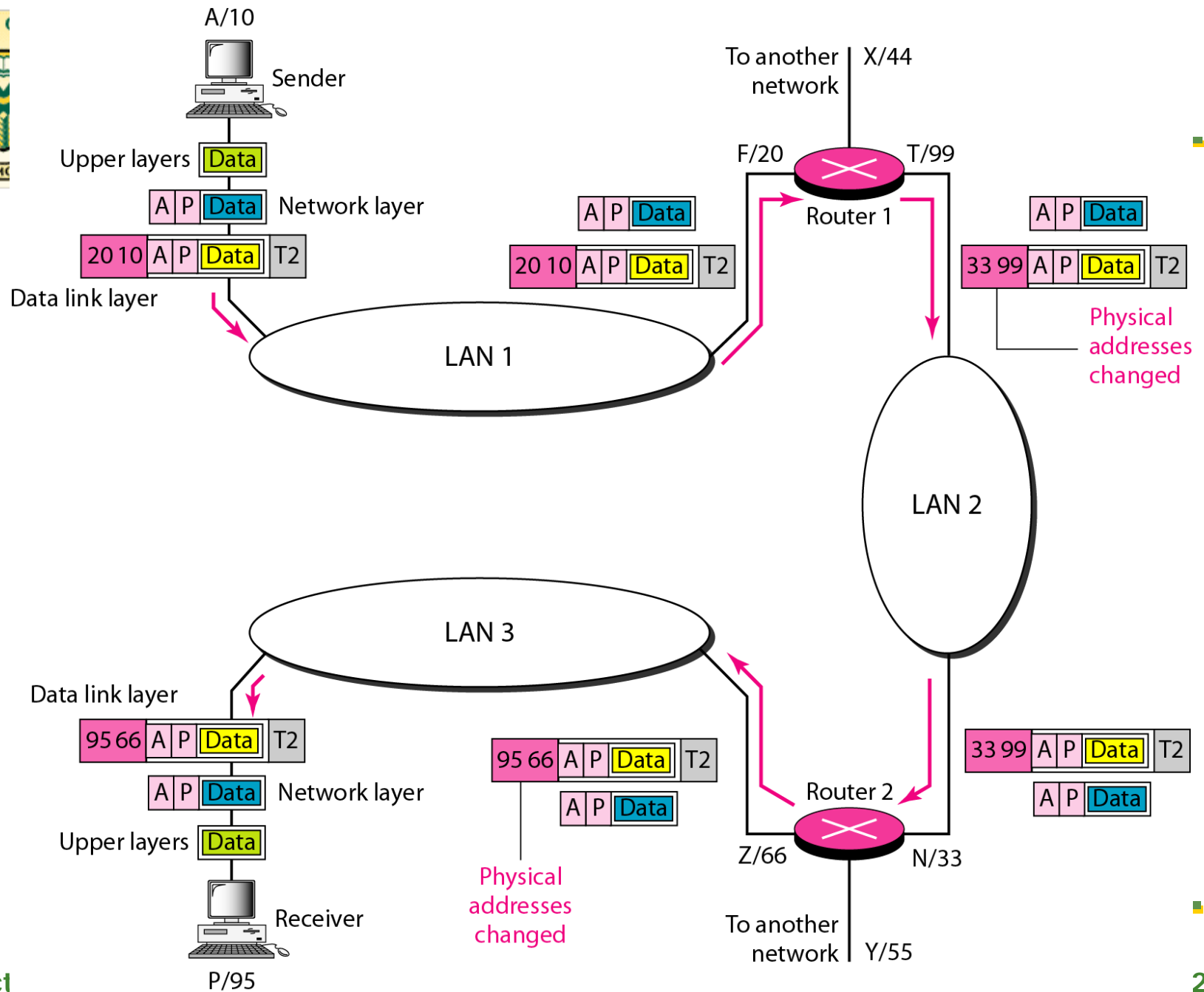
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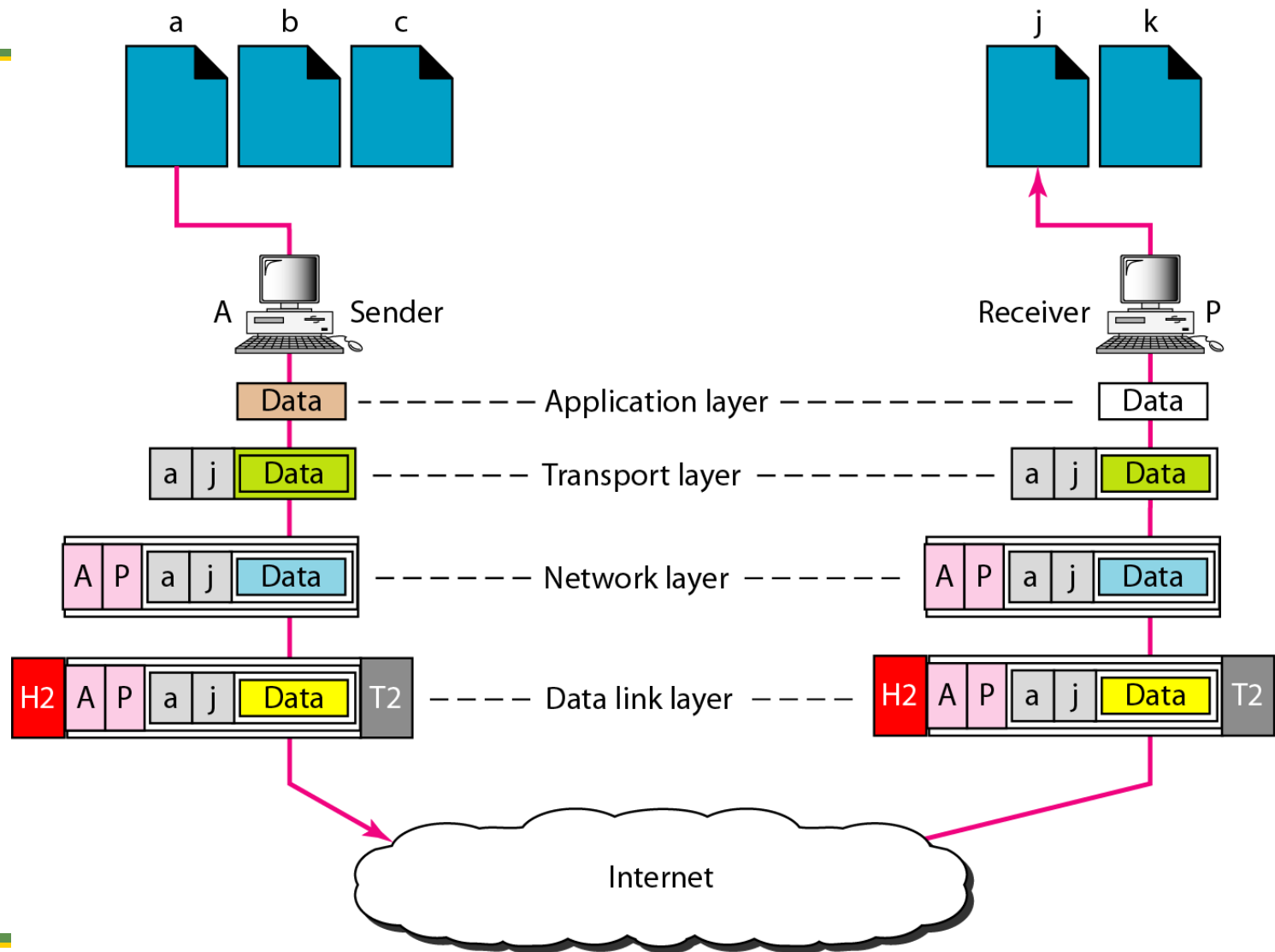




06 : 01 : 02 : 01 : 2C : 4B

6 bytes = 12 hex digits = 48 bits







Wireless Communication Networks

- Problems associated with multimedia services in a wireless environment
 - High bit error rate (BER)
 - Fading
 - Limited bandwidth
 - Interference
 - Handoff