MODULE 10: Networking

Lecture 10.3
The Internet Protocol Architecture

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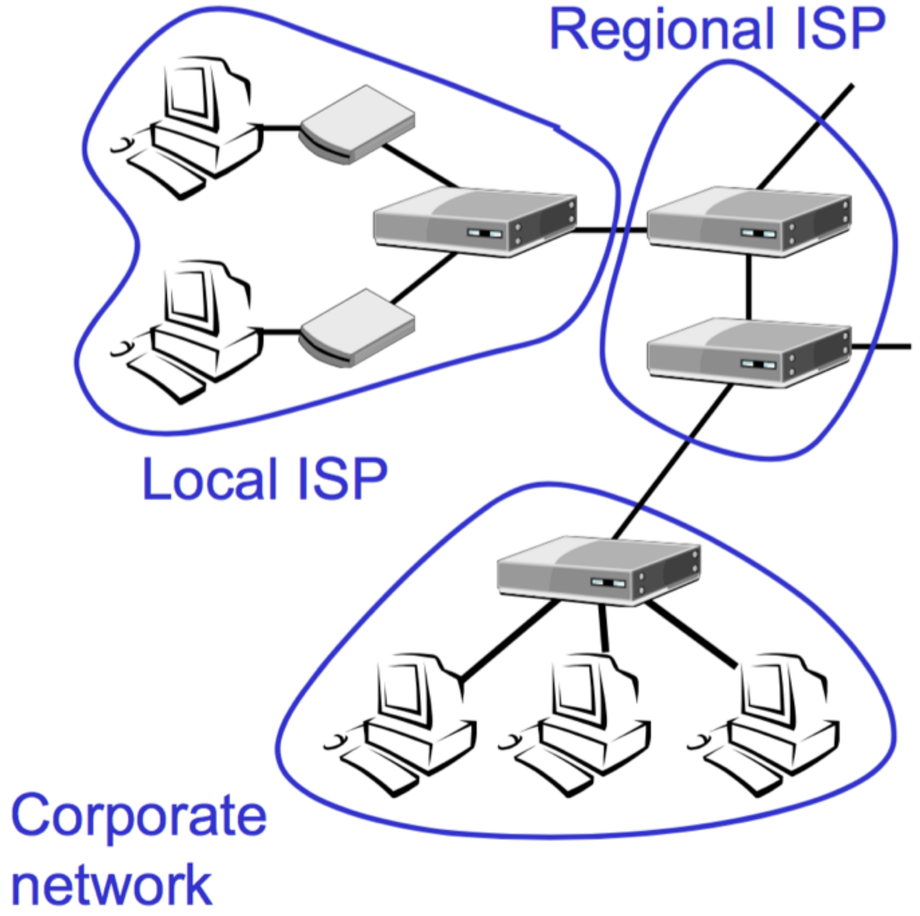
Lecture 10.3 Objectives

- Describe the basic architecture of the Internet
- Describe the basic functions of the TCP/IP protocol suite to support this architecture
- List the major protocols in theTCP/IP suite and briefly describe their functionality
- Comment on why TCP/IP has been so successful

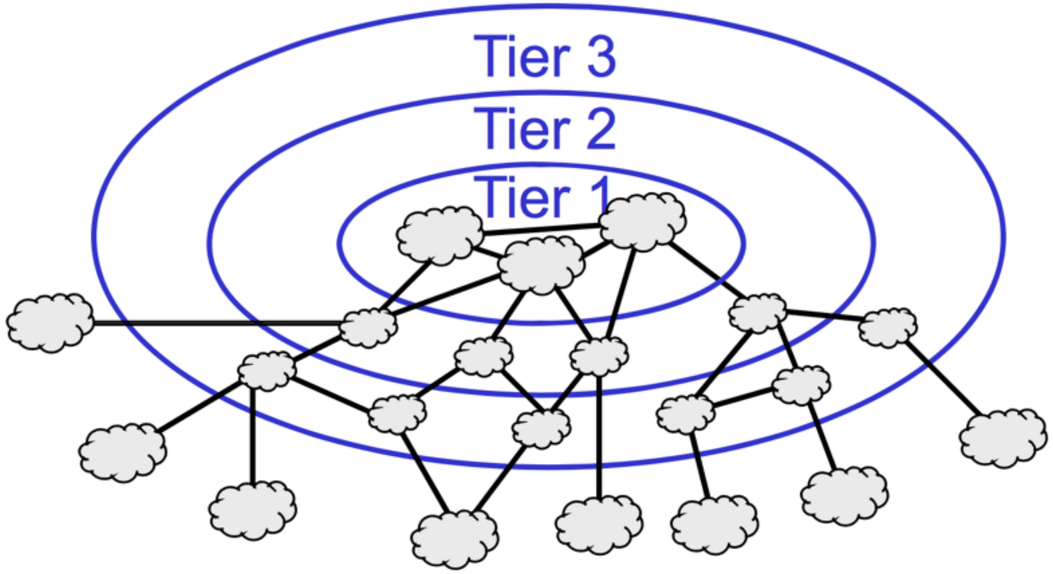
The Internet: A Collection of Nodes

- End hosts
- Clients and servers
- Communication links
  - Local and wide area
  - Wires, optical fiber, wireless
  - Varying bandwidth
- Switches and routers
  - Edge and core devices
  - Varying capacity



Today's Internet is Built by ISPs

- The Internet consists of:
  - Home, campus, and corporate hosts and networks, and
  - Three tiers of Internet Service Providers (ISPs)

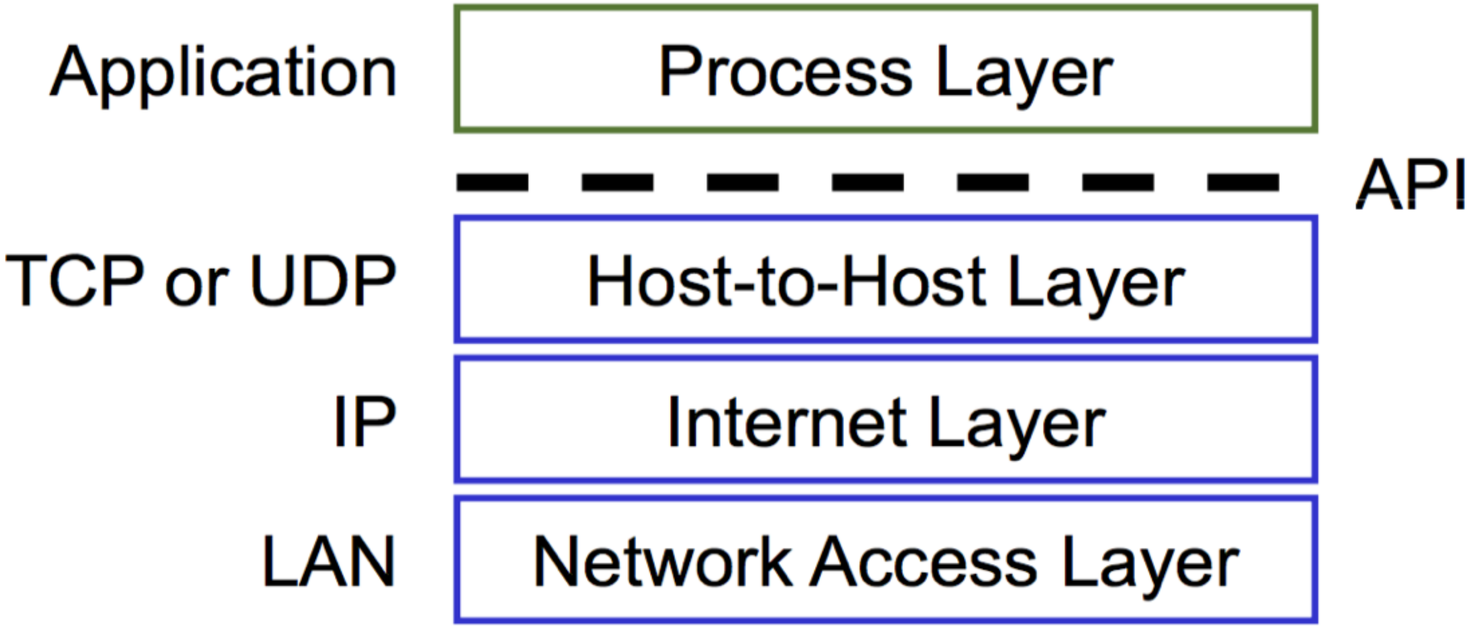


The TCP/IP Protocol Suite

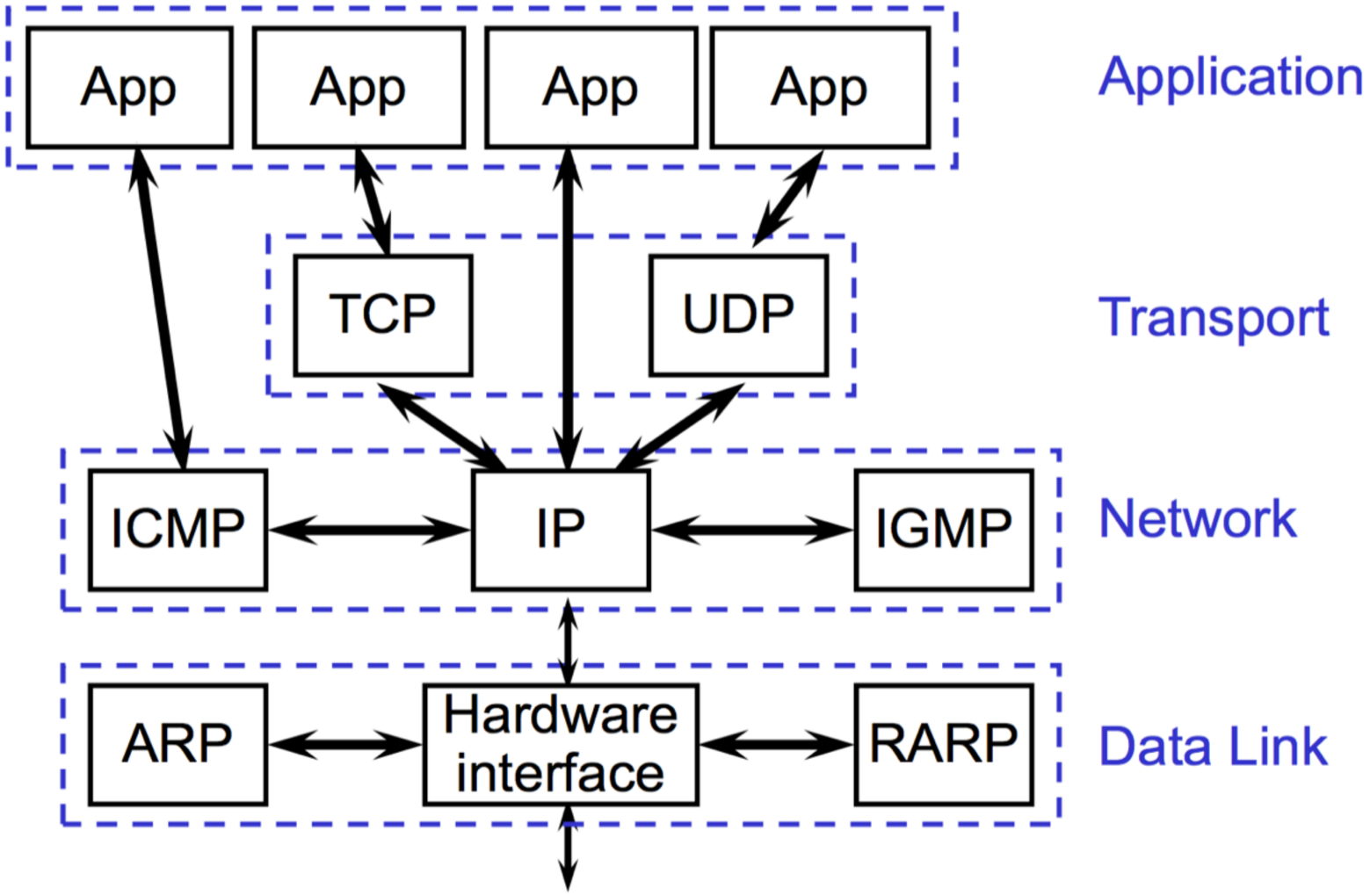
- The TCP/IP protocol suite provides the functions that allow data to move from end to end through different networks
  - End hosts communicate
  - Intermediate nodes coordinate to route packets through network
  - Addressing and other basic functions to allow both of these functions
- TCP/IP works in conjunction with Data Link and Physical layer protocols which move frames between directly connected devices

DoD Model: The Basis for TCP/IP

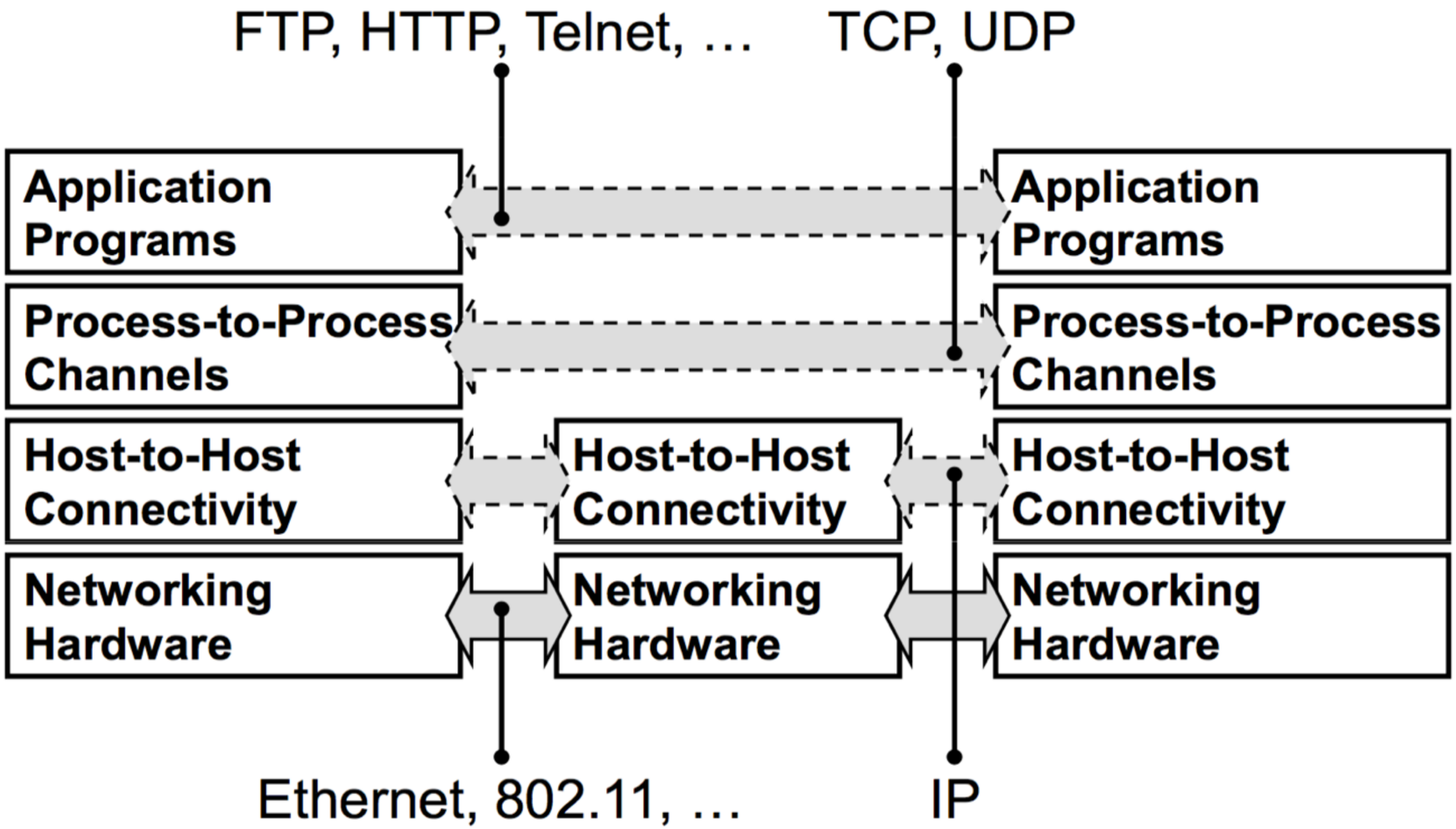
- Model developed for the US Department of Defense in the ARPANET days
- A simpler model than the OSI model
  - Predates OSI model
  - Widely realized



TCP/IP Suite: Simplified View



TCP/IP Suite: Functional View



CHECK POINT

As a checkpoint of your understanding, please pause the video and make sure you can do the following:

- Describe the basic architecture of the Internet
- Describe the basic functions of the TCP/IP protocol suite to support this architecture

If you have any difficulties, please review the lecture video before continuing.

Internet Protocol Suite: Transport

- TCP: Transmission Control Protocol
  - Byte stream transfer
  - Reliable, connection-oriented service
  - Point-to-point (one-to-one) service only
- UDP: User Datagram Protocol
  - Unreliable (“best effort”) datagram service
  - Point-to-point, multicast (one-to-many), and broadcast (one-to-all)

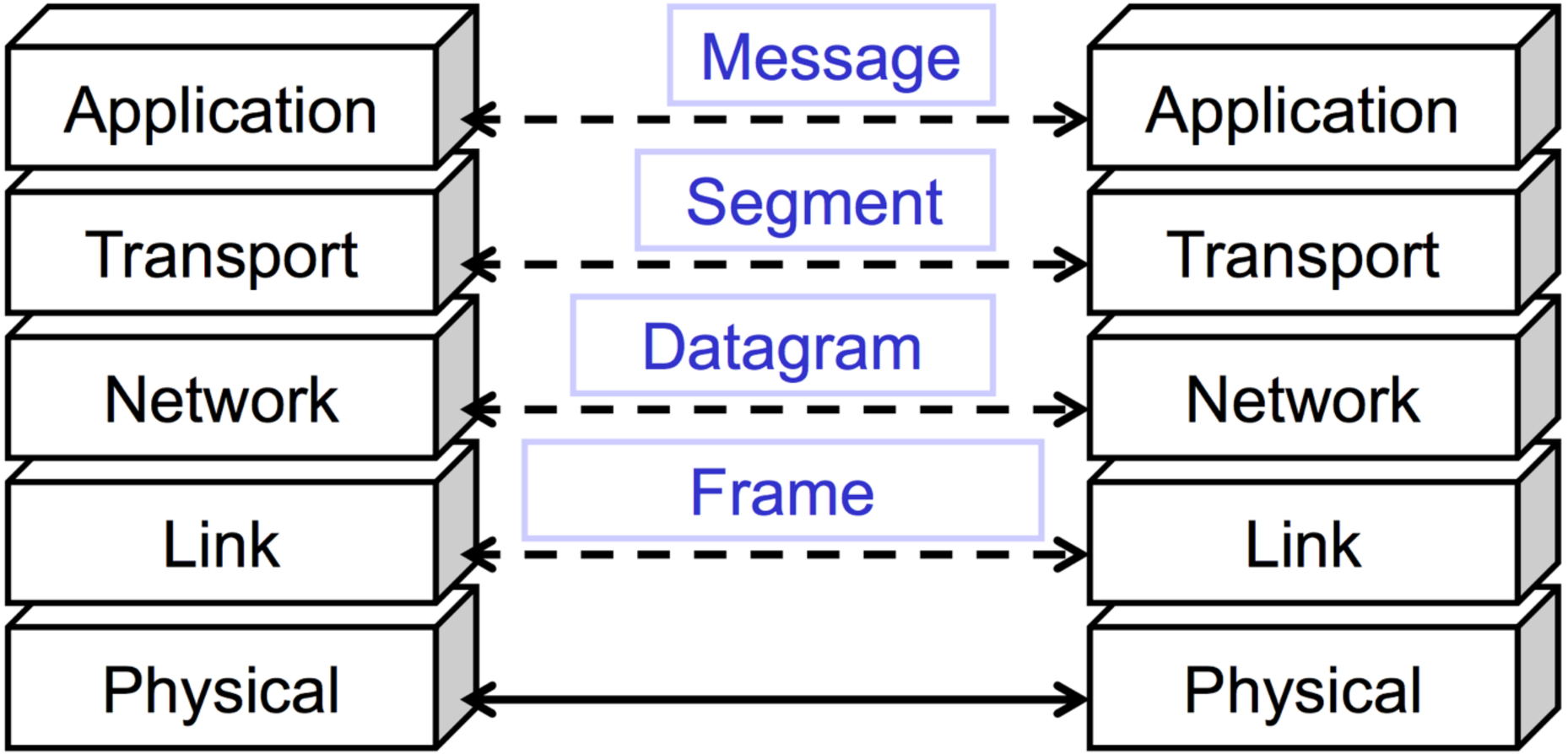
Internet Protocol Suite: Network

- IP: Internet Protocol
- Unreliable service
- Performs routing
- Supported by routing protocols, e.g. RIP, IS-IS, OSPF, IGP, and BGP
- ICMP: Internet Control Message Protocol
  - Used by IP (primarily) to exchange error and control messages with other nodes
- IGMP: Internet Group Management Protocol
  - Used for controlling multicast (one-to-many transmission) for UDP datagrams

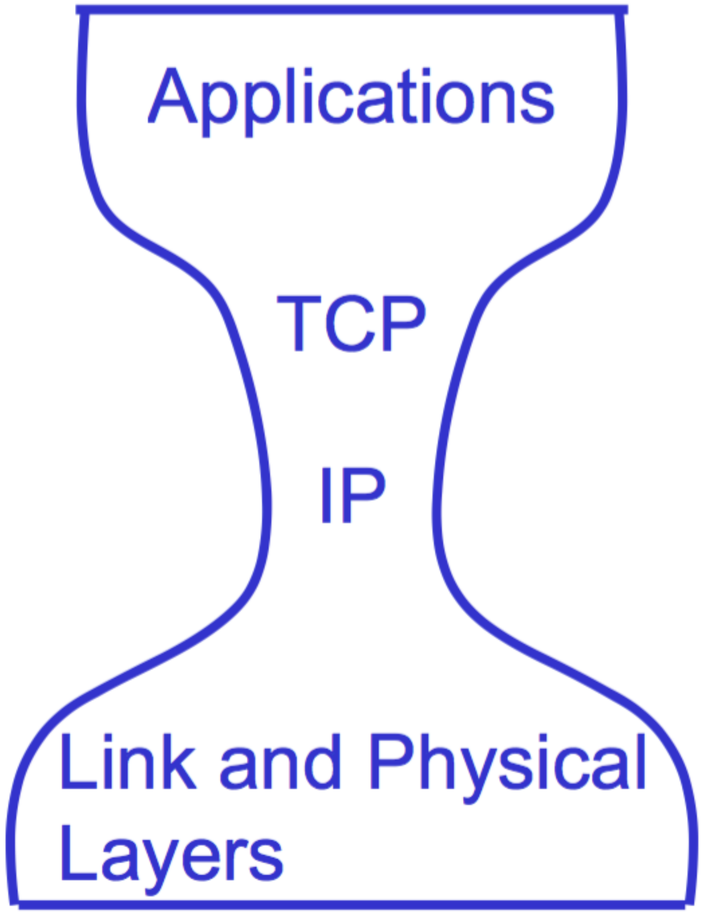
Internet Protocol Suite: Data Link

- ARP: Address Resolution Protocol
  - Translates from an IP (network) address to a network interface (hardware) address, e.g. IP address-to-Ethernet address or IP address-to-FDDI address
- RARP: Reverse Address Resolution Protocol
  - Translates from a network interface (hardware) address to an IP (network) address

Packet Terminology



Why is TCP/IP so Successful?



- Defines basic functions that can be used by many applications
- Requires little of the lower-level link and physical layers
- “Hourglass” concept
  - TCP/IP is the common unit in many networks
  - Lots of variation in applications
  - Lots of variations in link layers

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Summary

- TCP/IP provides protocols to support routing and end-to- end functions in the Internet
- Can rely on different Data Link and Physical layer protocols
- TCP and UDP provide transport layer functions
- IP is the network layer protocol, supported by different routing and control protocols

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