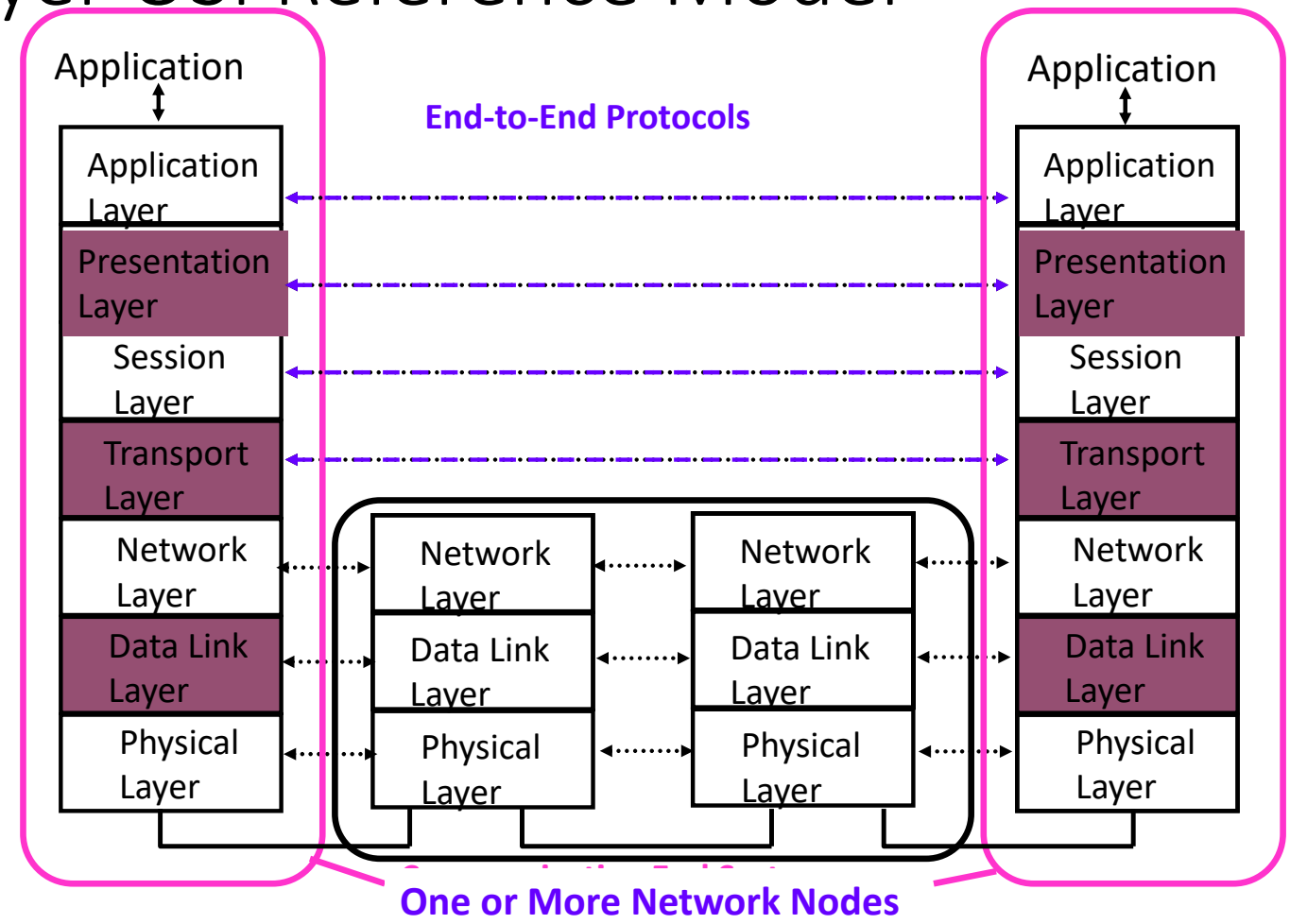
7-Layer OSI Reference Model



Physical Layer

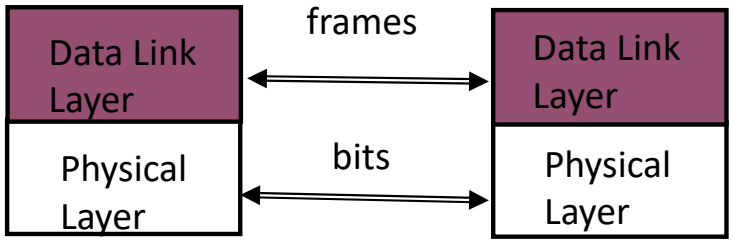
- Transfers bits across link (units are bits)
- Deals with the transmission system and transmission media
  - DSL, cable modem, telephone modems…
  - Twisted-pair cable, coaxial cable optical fiber, radio, infrared, …

Physical Layer (2)

- Definition & specification of the physical aspects of a communications link
  - Mechanical: cable, plugs, pins...
  - Electrical/optical: modulation, signal strength, voltage levels, bit times, signal duration…
  - functional/procedural: how to activate, maintain, and deactivate physical links… (like a phone call)

Data Link Layer

- Transfers *frames* (blocks of info) across *direct* connections
- Groups bits into frames; adds check bits
- Detection of bit errors; Retransmission of frames
- Activation, maintenance, & deactivation of data link connections



Data Link Layer

- Link includes case where multiple users need to be connected to the medium (example?)
- Medium access control for local area networks
- Flow control (so as not to overwhelm buffer on other end)

Network Layer

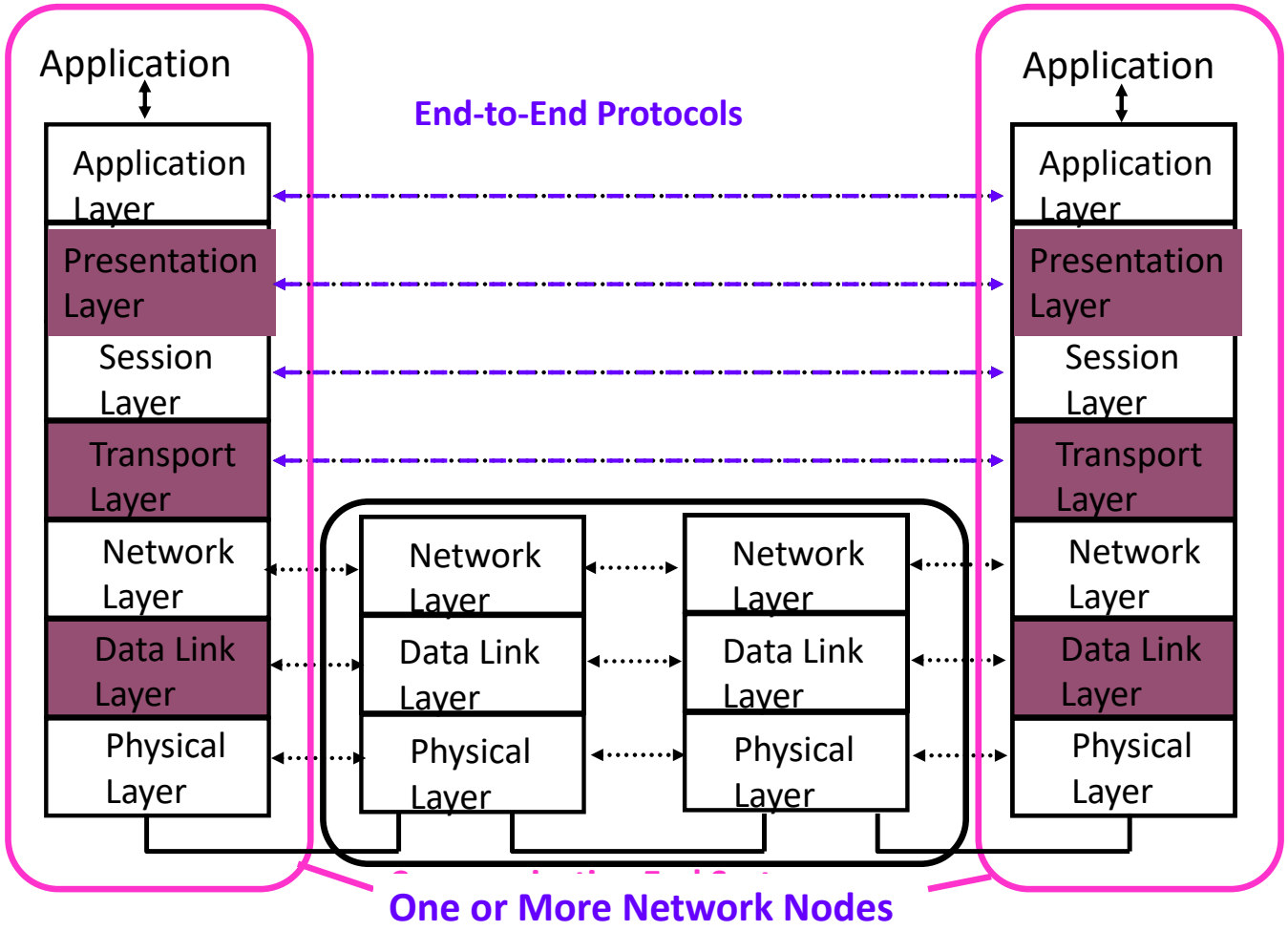
- Transfers *packets* across multiple links and/or multiple networks
  (no pt-2-pt any more)
- Addressing must scale to large networks
- Nodes *jointly* execute routing algorithm to determine paths across the network (makes net. layer most complex)

Network Layer (2)

- Routing: procedure to select path across net
- When two machines are connected through
  - Same PS net: single address sp and routing procedure
  - Different nets:
    - nets differ in internal routing/addressing/packet size
    - Need an internetwork protocol

Network Layer (3)

- Forwarding transfers packet across a node
- Congestion control to deal with traffic surges
- Connection setup, maintenance, and teardown when connection-based


Application
Application
End-to-End Protocols
Application Layer
Presentation Layer
Session Layer
Transport Layer
Network Layer
Data Link Layer
Physical Layer
Application Layer
Presentation Layer
Session Layer
Transport Layer
Network Layer
Data Link Layer
Physical Layer
Network Layer
Data Link Layer
Physical Layer
Network Layer
Data Link Layer
Physical Layer
One or More Network Nodes

- Each node must implement lower 3 layers
- Lower 2 layers involve interaction of peer-2-peer processes across a single link
- Net. Layer in source and destination are not peers (don’t talk directly)
- Nodes in Net. Layer jointly execute routing
- Top 4 layers involve interaction of peer processes across net.

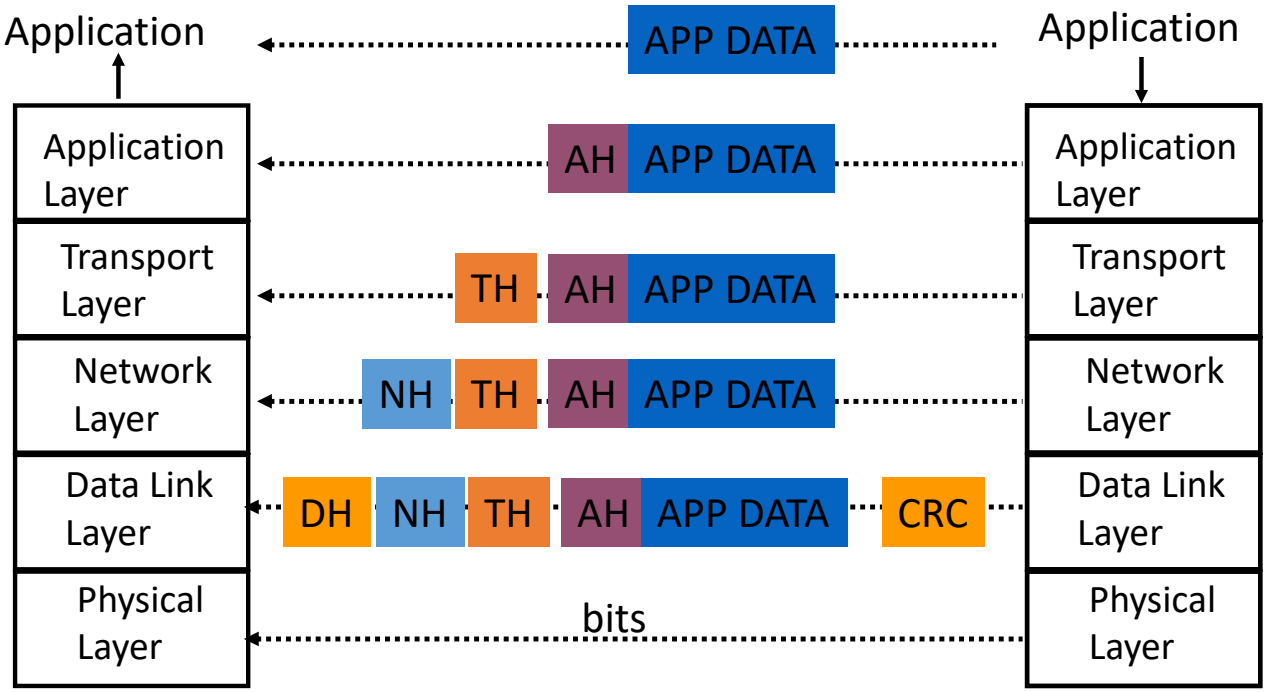
- OSI wanted to develop
- A layering model
- Standards for computer nets (protocols use)
- By time protocols were developed, TCP/IP emerged as an alternative (time to market)

- مدل TCP/IP
  - 1- لایه Application (پروتکلهای HTTP، SMTP، RTP، DNS، ...)
  - 2- لایه Transport (پروتکل های TCP، UDP)
  - 3- لایه Internet (پروتکلهای IP، ICMP، ...)
  - 4- لایه Network Interface

- بیان استفاده شده در کتابهای آموزشی شبکه های کامپیوتری
  - 1- لایه Application
  - 2- لایه Transport
  - 3- لایه Network
  - 4- لایه Data Link
  - 5- لایه Physical

Headers & Trailers

- Each protocol uses a header carrying control information: address, sequence number, flags, size indicators, etc…
- Check bits may be appended (trailer) for error detection



- در درس شبکه های کامپیوتری 3 لایه بالا ، با رویکرد Top-Down توضیح داده میشود.
- در درس انتقال داده ها 2 لایه پایین ، با رویکرد Bottom-Up مطرح میشود.