

Chapter 2

Protocols and Architecture

Need For Protocol Architecture

- A protocol is a set of standard rules used by computers communicate with each other across a network.
- In a protocol architecture, different communication problems are solved by different protocols.
- Programmers avoid solving the same problems in different applications.

Standardized Protocol Architectures

- Required for devices to communicate
- Vendors have more marketable products
- Interoperability
- Customers can insist on standards based equipment
- Two standards:
 - OSI Reference model
 - Never lived up to early promises
 - TCP/IP protocol suite
 - Most widely used

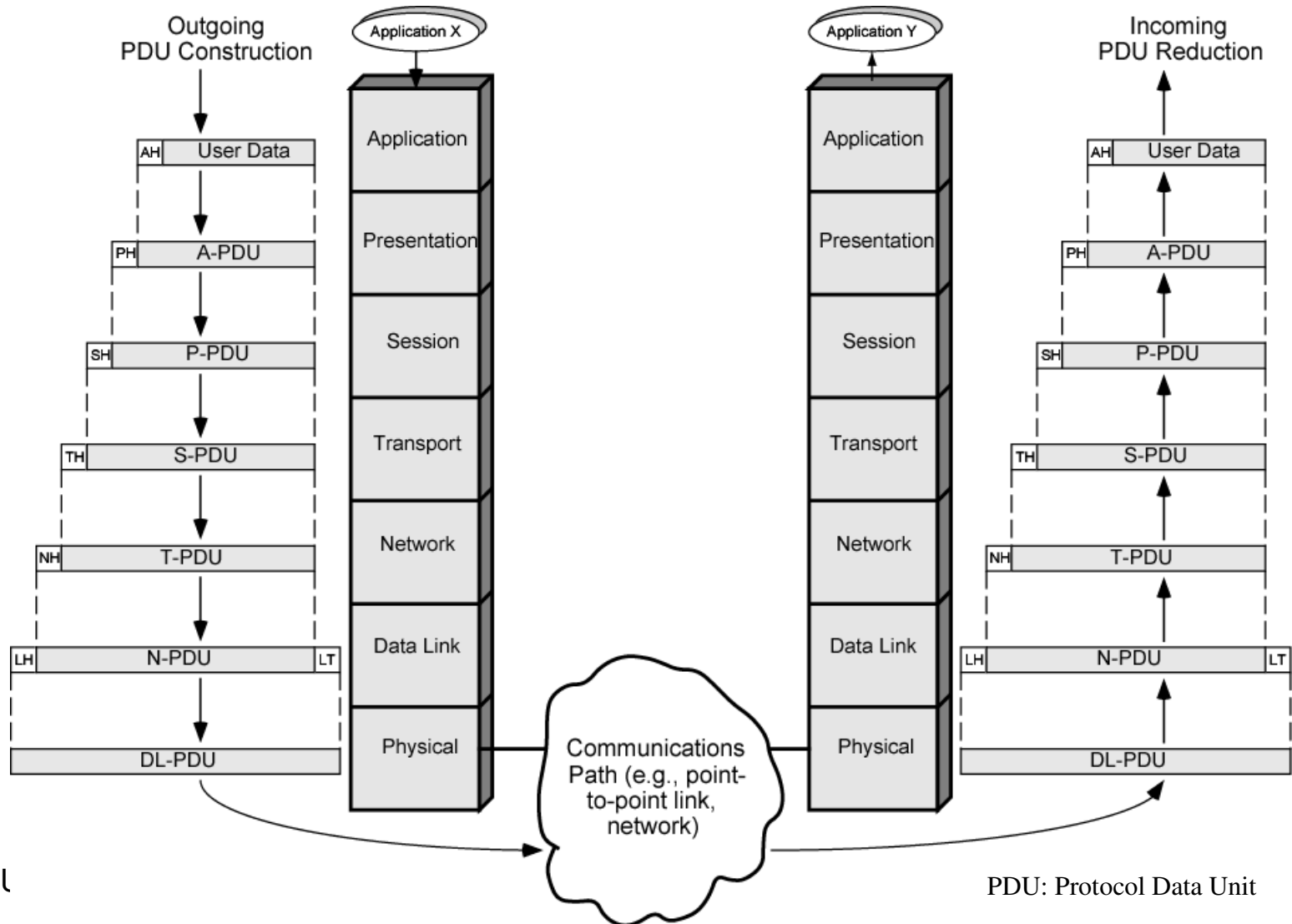
OSI

- Open Systems Interconnection
- Developed by the International Organization for Standardization (ISO)
- Seven layers
- A theoretical system delivered too late!
- TCP/IP is the de facto standard.

OSI - The Model

- A layer model
- Each layer performs a subset of the required communication functions
- Each layer relies on the next lower layer to perform more primitive functions
- Each layer provides services to the next higher layer
- Changes in one layer should not require changes in other layers

The OSI Environment



OSI Layers (1)

- Physical
 - Physical interface between device and network
 - Cables, connectors,
 - Modulation techniques
 - Bit rate,
 - Signal processing, etc.
- Data Link
 - Addressing (local)
 - Local communication protocols, topologies, e.g. star, bus, ring.
 - Error detection and control

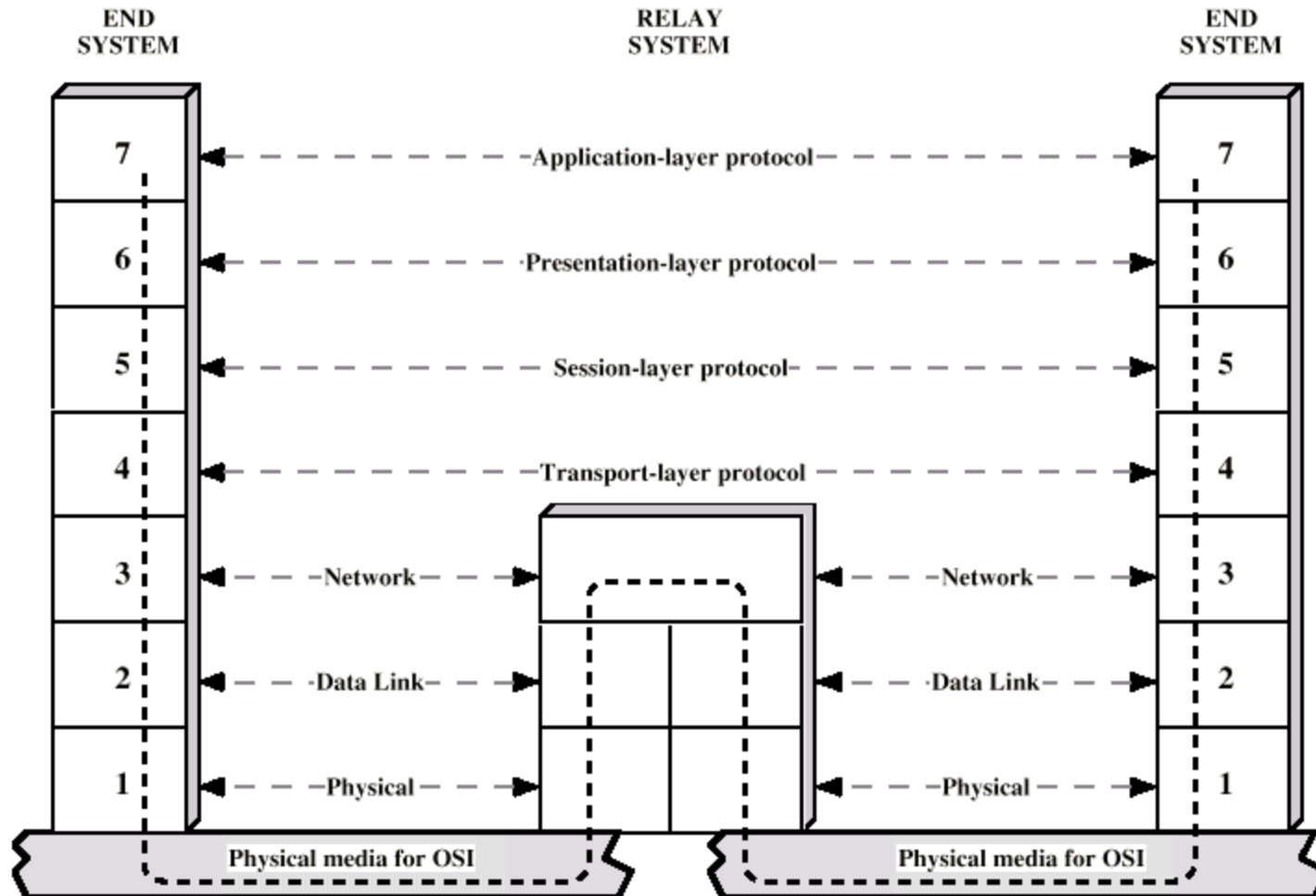
OSI Layers (2)

- Network
 - Global, device and network addressing
 - Interconnects different networks using forwarding nodes, or routers.
 - Unreliable transport of information between different networks.
 - Higher layers do not need to know about underlying technology
 - Not needed on direct links (not true in TCP/IP)
- Transport
 - Exchange of data between end systems
 - Error free
 - In sequence
 - No losses
 - No duplicates

OSI Layers (3)

- Session
 - Control of dialogues between applications
 - Dialogue discipline
 - Grouping
 - Recovery
- Presentation
 - Data formats and coding
 - Data compression
 - Encryption
- Application
 - Means for applications to access OSI environment

Use of a Relay



TCP/IP Protocol Architecture

- Developed by the US Defense Advanced Research Project Agency (DARPA) for its packet switched network (ARPANET)
- Used by the global Internet
- No official model but a working one.
 - Application layer
 - Transport layer
 - Internet layer
 - Link layer

Link Layer

- Physical and data link layers of OSI.

Internet Layer

- Internet Protocol (IP)
- Global host addressing: IP address
- Routing
- Best effort, unreliable delivery of data.
- Implemented in end systems and routers

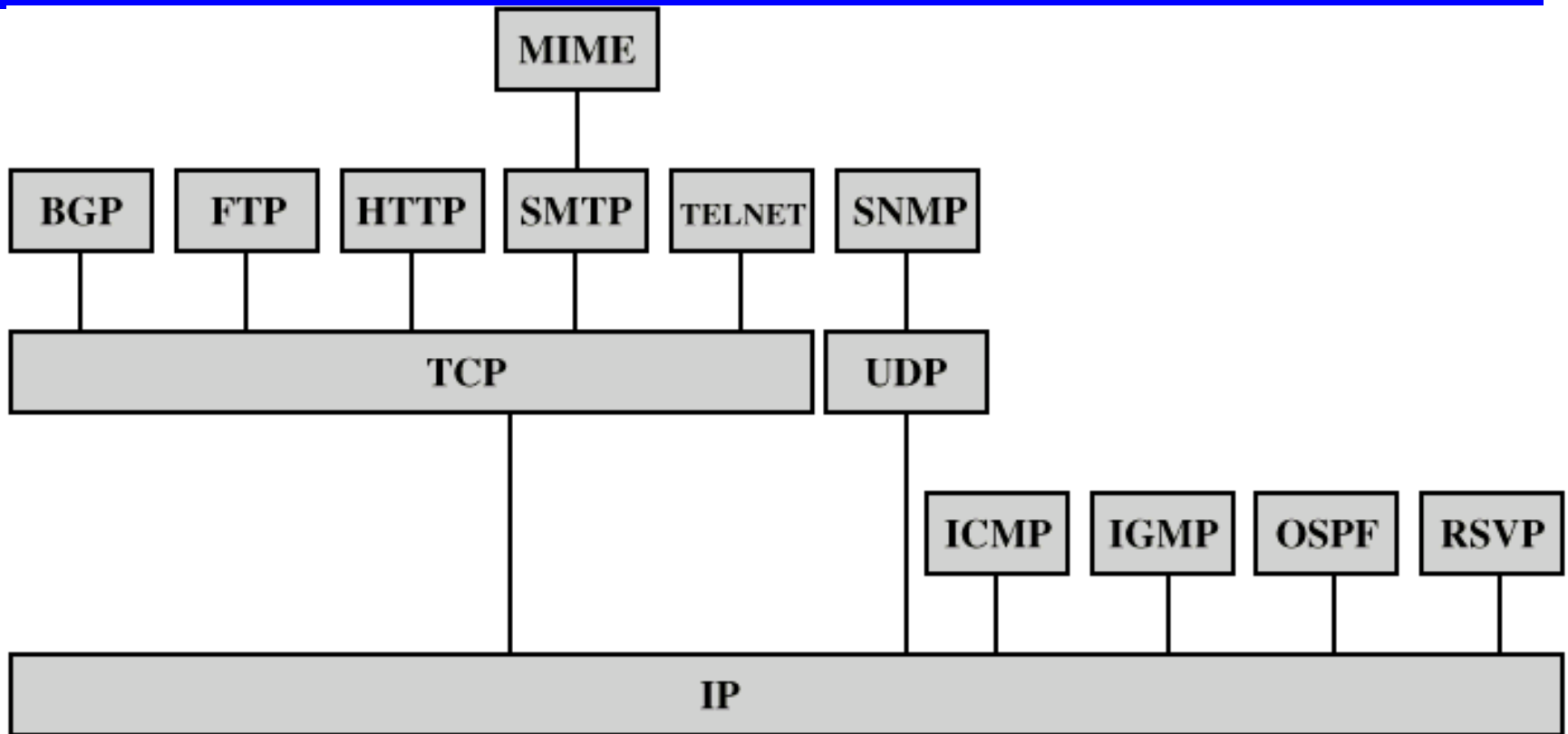
Transport Layer

- Port numbers
- Transmission Control Protocol (TCP)
 - Reliable delivery of data
 - Ordering of delivery
 - Congestion control
- User Datagram Protocol (UDP)
 - Unreliable delivery of data

Application Layer

- Support for user applications
- e.g. HTTP, SMTP, FTP

Some Protocols in TCP/IP Suite



BGP = Border Gateway Protocol

FTP = File Transfer Protocol

HTTP = Hypertext Transfer Protocol

ICMP = Internet Control Message Protocol

IGMP = Internet Group Management Protocol

IP = Internet Protocol

MIME = Multi-Purpose Internet Mail Extension

OSPF = Open Shortest Path First

RSVP = Resource ReSerVation Protocol

SMTP = Simple Mail Transfer Protocol

SNMP = Simple Network Management Protocol

TCP = Transmission Control Protocol

UDP = User Datagram Protocol

Required Reading

- Stallings chapter 2
- Comer, D. Internetworking with TCP/IP volume I
- Comer, D. and Stevens, D. Internetworking with TCP/IP volume II and volume III, Prentice Hall
- Halsall, F. Data Communications, Computer Networks and Open Systems, Addison Wesley
- RFCs