OSI
OPEN SYSTEMS INTERCONNECTION

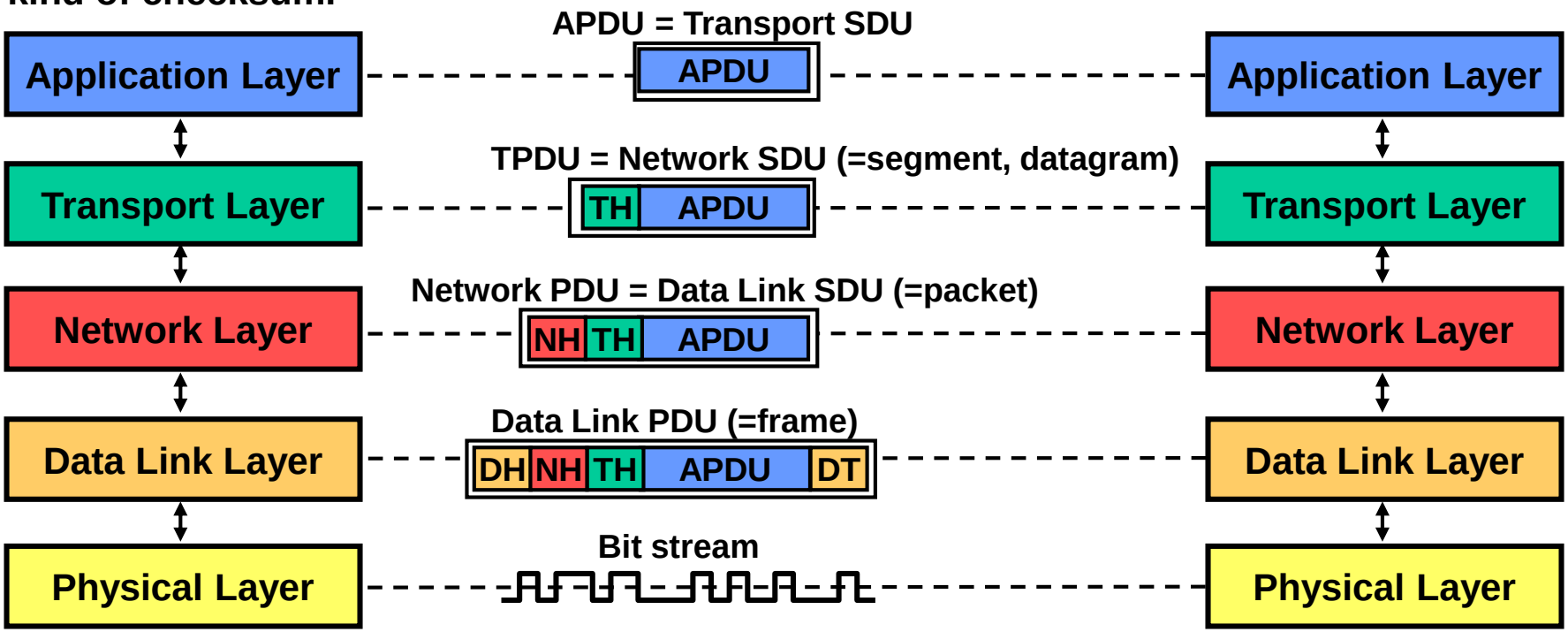
OVERVIEW OF PROTOCOL LAYERING AND OSI MODEL OF NETWORK STACKS

Peter R. Egli
peteregli.net

Contents

1. Layering model (1/2)

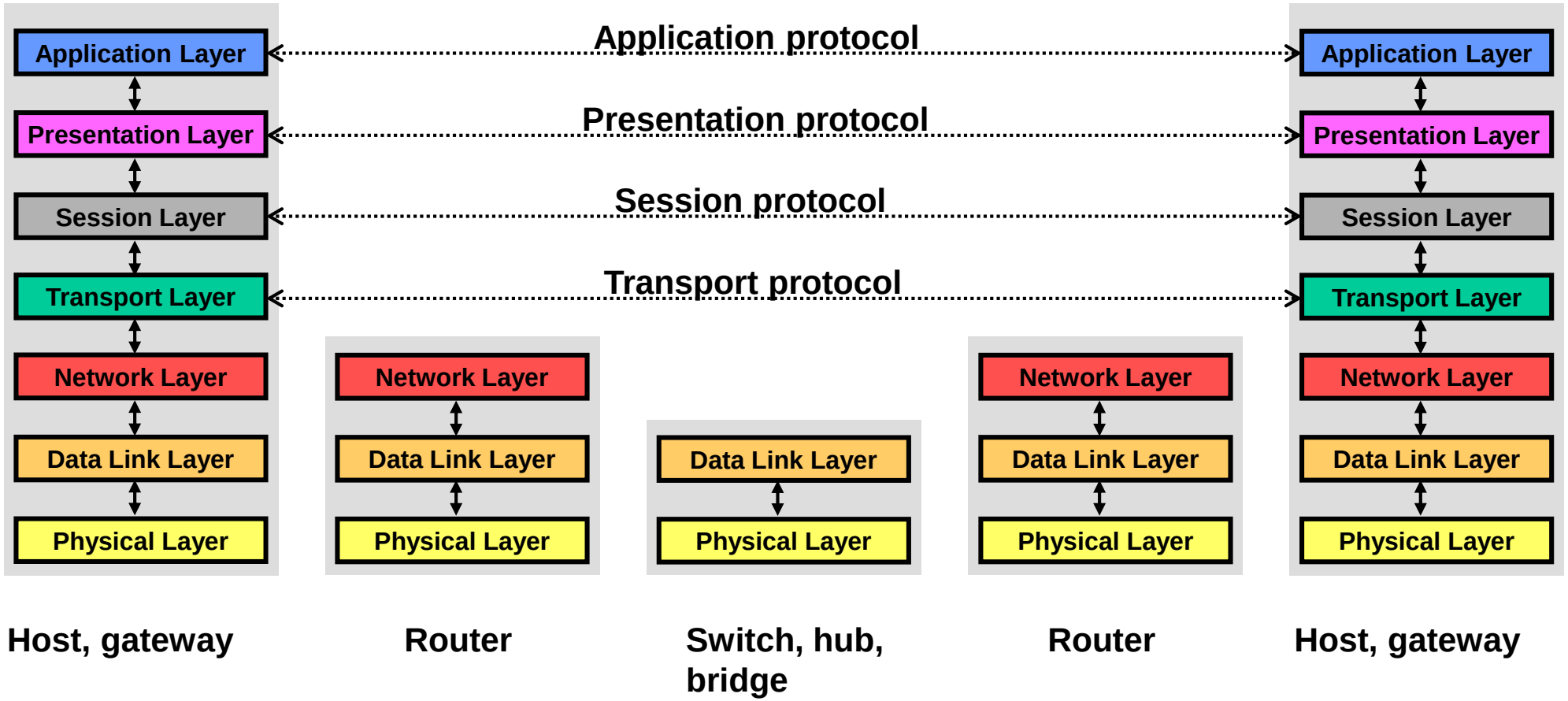
Protocol layers logically communicate with their peers (horizontal communication).
Physically data units are passed between protocol layers (vertical communication).
Each protocol layer encapsulates an outbound data unit into a protocol specific packet, i.e. adds a protocol specific header. Some protocols also add a trailer that usually contains some kind of checksum.



SDU	Service Data Unit (data unit that a specific protocol layer provides as transport service)
PDU	Protocol Data Unit (protocol header + payload = upper layer's PDU)
APDU	Application Protocol Data Unit
TPDU	Transport Protocol Data Unit

1. Layering model (2/2)

Depending on the type of a host either the full stack or only the lower layers are used:



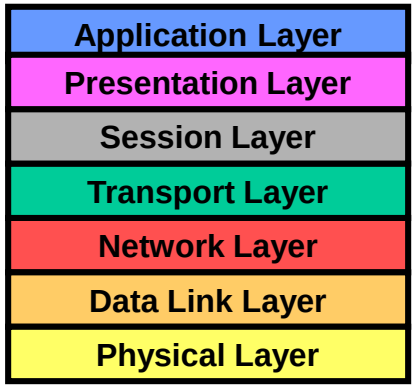
2. The 7 layers of OSI (1/2)

OSI (ISO/IEC 7498) was an attempt to combat the diversity of concepts and protocols. The choice for 7 layers has many reasons, among others the fact that IBM‘s SNA also had 7 layers and that there were already 7 working groups at OSI so each group was assigned a layer for definition.

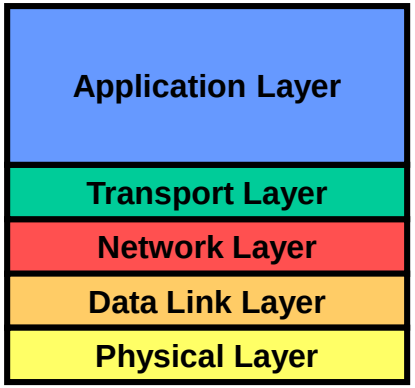
OSI did not really catch on, but its basic concept of layering is useful for the taxonomy of protocols (at which layer is a protocol and thus what is its function).

The session and presentation layers are almost always tightly coupled with the application protocol and thus may simply be omitted (collapsed with the application layer).

OSI stack:



Simplified OSI stack:



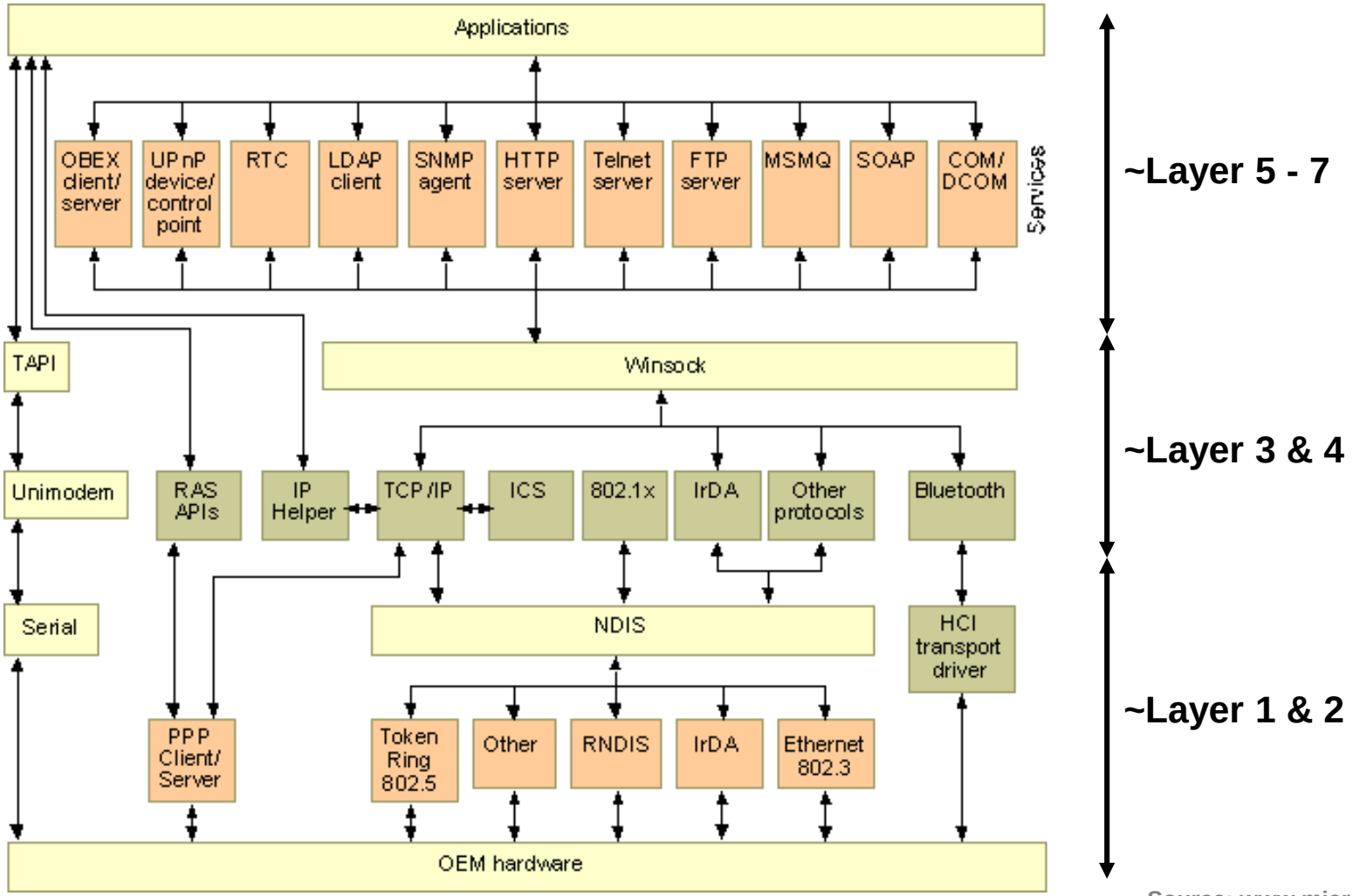
2. The 7 layers of OSI (2/2)

Each of the OSI layers performs a specific set of functions.

Application Layer	Performs application-specific functions like the exchange and execution of application-commands. Examples: HTTP, FTP, SMTP.
Presentation Layer	Performs conversion from application-specific data formats into a format that can be understood by the remote application. Examples: ASN.1, XML, EBCDIC, ASCII.
Session Layer	Controls (establish, manage, terminate) the dialogues (connections) between the peers. Examples: RPC.
Transport Layer	Provides transparent transfer of data units, possibly with some kind of quality of service. Examples: TCP, UDP, SCTP.
Network Layer	Forwards a packet towards its destination based on a network address. Examples: IP, IPX, AppleTalk DDP, X.25 packet layer.
Data Link Layer	Defines procedures for media access and framing of bits (start and end marking of bit stream). Examples: Ethernet, WLAN, ATM, Frame Relay.
Physical Layer	Defines the characteristics of the bit stream on the physical medium (voltages, frequencies, connector pinouts etc.). Examples: RS-232, Ethernet, Bluetooth, SCSI.

3. Where the OSI stack resides in a real system (1/2)

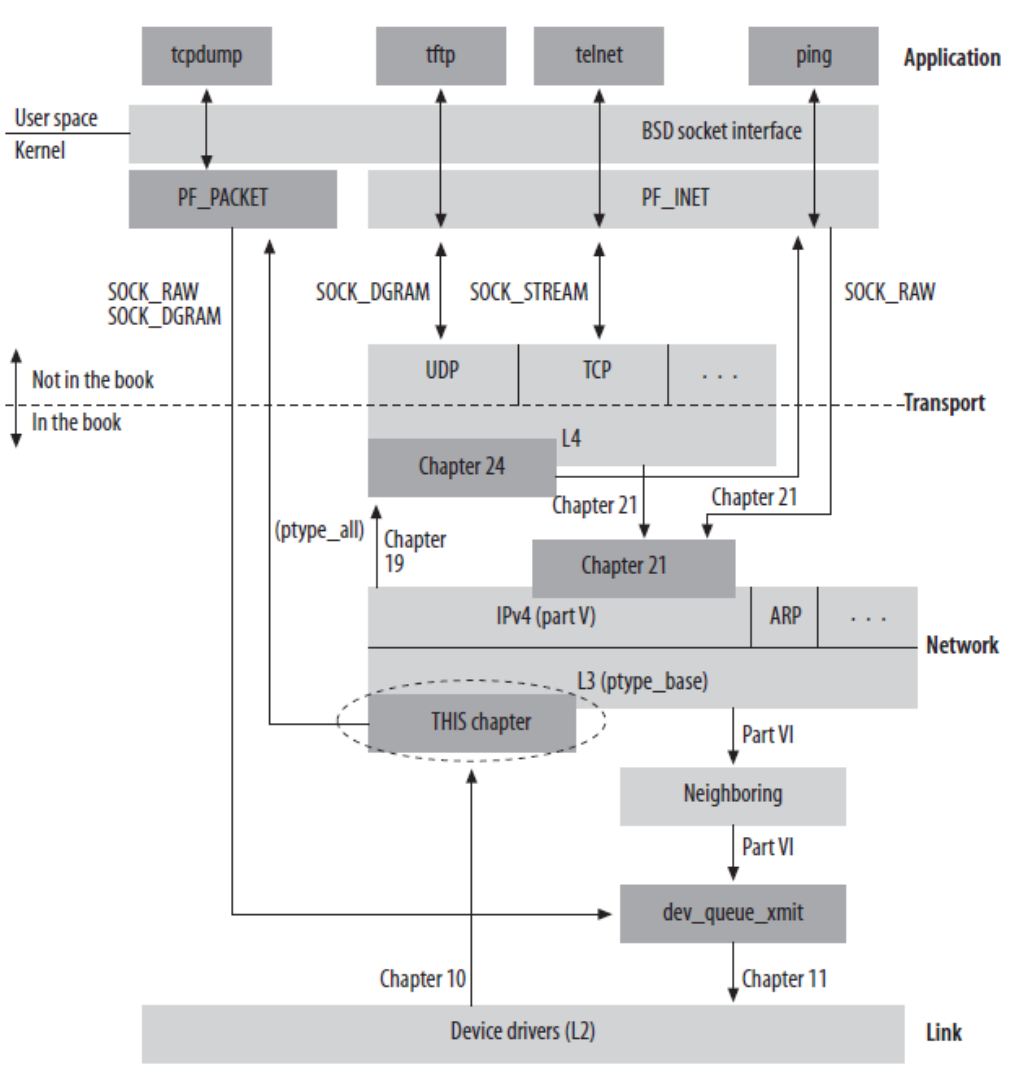
No system really implements protocols according to OSI. In reality the protocols (software modules processing a protocol) are integrated into the operating system (e.g. Windows).



Source: www.microsoft.com

3. Where the OSI stack resides in a real system (2/2)

Linux Network Stack



Layer 5 - 7

Layer 4

Layer 3

Layer 1 & 2

Source: Understanding Linux Network Internals, Christian Benvenuti, 2006, O'Reilly