NETWORK REFERENCE MODELS

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Network reference models

- Breaks down network functionality/architecture into layers
- Defines which functions should be performed at each layer
- Allows vendors and other organizations to develop products or standards for the different layers with no risk of lack of interoperability.
- There are two:
  - OSI MODEL – 7 layers
  - TCP/IP MODEL – 4 layers

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The OSI Model

- OSI - " Open Systems Interconnection".
- Contain in 7 different layers that interact with each other.

7	Application
6	Presentation
5	Session
4	Transport
3	Network
2	Data Link
1	Physical

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Application Layer

- User interacts with the OSI model at this layer through applications
- Application layer provides network services to applications through different protocols
- The application layer contains a variety of protocols that are commonly needed by users.
- Examples: HTTP, FTP, Telnet, SMTP, POP3
- These protocols give end-user applications access to network resources

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Presentation Layer

- This layer provides independence from differences in data representation/syntax/format (e.g., encryption)
- Examples:
  - conversion from ASCII to EBCDIC
  - Encryption and decryption of data
  - Compression and decompression of data

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Session Layer

- Allows applications/processes to establish maintain an ongoing session.
- Communication sessions consist of requests and responses that occur between applications - >Dialogue.

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Transport Layer

- The *transport layer* defines how a given packet gets delivered to the appropriate process.
- Transport layer therefore provides end to end connection between processes – process to process communication
- The addressing system used to distinguish different processes on the same device and/or attached to the same network interface is the *port number.*
- There are two protocols
  - Transmission Control Protocol(TCP)
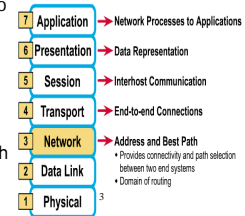 - User Datagram Protocol(UDP)

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Network Layer

- Provides network-wide addressing and a mechanism to move packets between networks (routing)
- Responsibilities:
  - Network addressing – IP addressing
  - Routing-deciding which path a packet will take from source to destination.
- Example protocol:
  - IP from TCP/IP

The 7 Layers of the OSI Model

7	Application	→ Network Processes to Applications
6	Presentation	→ Data Representation
5	Session	→ Interhost Communication
4	Transport	→ End-to-end Connections
3	Network	→ Address and Best Path • Provides connectivity and path selection between two end systems • Domain of routing
2	Data Link	
1	Physical	

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Data Link Layer

- Media access control (decides which host will send data via a shared medium)
- Places data and retrieves it from the physical layer
- Provides error detection and correction capabilities.

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Physical Layer

- Determines the specification for all physical components
  - Transmission medium e.g wireless, fiber, coaxial, twisted pair
  - Cable specifications, cable connectors, connectors pin layout
  - Data encoding (bits to waves) - modulation or demodulation
  - Electrical properties
- Example protocols (layer 1 and 2):
  - Ethernet (IEEE 802.3)
  - Token Ring (IEEE 802.5)
  - Wireless (IEEE 802.11a/b/g/n)

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How Does It All Work Together
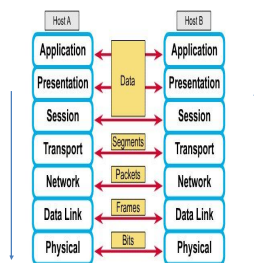
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TCP/IP Model

- Developed in the the late-60s
- The Defense Advance Research Projects Agency (DARPA) originally developed Transmission Control Protocol/Internet Protocol (TCP/IP) to interconnect various defense department computer networks.
- DARPA an agency of the U.S. Department of Defense
- Has four layers.
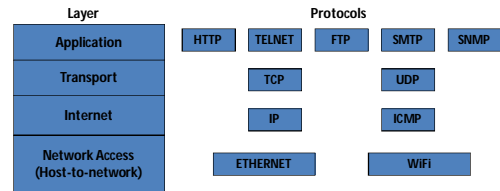
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4 layers of the TCP/IP model

- Layer 4: Application
- Layer 3: Transport
- Layer 2: Internet
- Layer 1: Network access

| Application |
| Transport |
| Internet |
| Network Access |
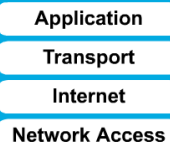
It is important to note that some of the layers in the TCP/IP model have the same name as layers in the OSI model.
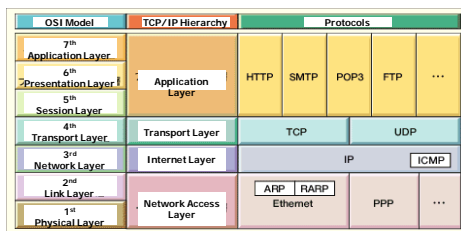*Do not confuse the layers of the two models.*

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TCP/IP Reference Model

Layer	Protocols
Application	HTTP TELNET FTP SMTP SNMP
Transport	TCP UDP
Internet	IP ICMP
Network Access (Host-to-network)	ETHERNET WiFi

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Comparing TCP/IP with OSI

OSI Model	TCP/IP Hierarchy	Protocols			
7th Application Layer	Application Layer	HTTP	SMTP	POP3	FTP	…
6th Presentation Layer					
5th Session Layer					
4th Transport Layer	Transport Layer	TCP		UDP	
3rd Network Layer	Internet Layer	IP			ICMP
2nd Link Layer	Network Access Layer	ARP RARP Ethernet		PPP	…
1st Physical Layer					

Network Access : includes device driver and network interface card
Internet: : handles the movement of packets, i.e. Routing
Transport : provides a reliable flow of data between two hosts
Application : handles the details of the particular application

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