CSE3151

COMPUTER NETWORKS

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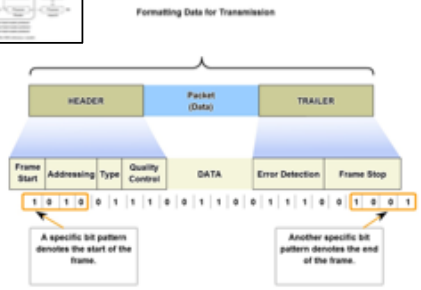
OSI Reference Model

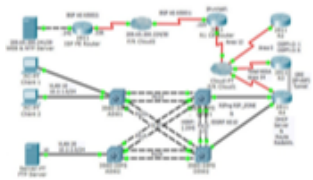
ALL PEOPLE SEEM TO NEED DATA PROCESSING

THE DATA LINK LAYER



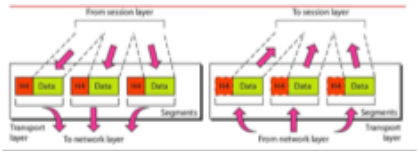
THE NETWORK LAYER

- A key design issue is determining how packets are routed from source to destination.
- More generally, the quality of service provided (delay, transit time, jitter, etc.) is also a network layer issue



THE TRANSPORT LAYER

- The basic function of the transport layer is to:
  - accept data from above it,
  - split it up into smaller units if need be,
  - pass these to the network layer, and
  - ensure that the pieces all arrive correctly at the other end.



THE SESSION LAYER

- The session layer allows users on different machines to establish sessions between them.
- Sessions offer various services:
  - including dialog control (keeping track of whose turn it is to transmit),
  - token management (preventing two parties from attempting the same critical operation simultaneously), and
  - synchronization

THE PRESENTATION LAYER

- Unlike the lower layers, which are mostly concerned with moving bits around, the presentation layer is concerned with the **syntax and semantics of the information transmitted.**
- In order to make it possible for computers with different internal data representations to communicate, the data structures to be exchanged can be defined in an abstract way, along with a standard encoding to be used ''on the wire.''
- The presentation layer manages these abstract data structures and allows higher-level data structures (e.g., banking records) to be defined and exchanged

THE APPLICATION LAYER

- The application layer contains a variety of protocols that are commonly needed by users.
- One widely used application protocol is HTTP (HyperText Transfer Protocol), which is the basis for the World Wide Web.
- When a browser wants a Web page, it sends the name of the page it wants to the server hosting the page using HTTP.
- The server then sends the page back. Other application protocols are used for file transfer, electronic mail, and network new

OSI Reference Model

Layer 7	**Application**	**Semantics** Initiates a request or accepts a request
Layer 6	**Presentation**	**Data Representations** Adds formatting, display, and encryption information to the packet
Layer 5	**Session**	**Dialog Coordination** Adds traffic flow information to determine when the packet is sent
Layer 4	**Transport**	**Reliable Transfer of Data** Adds error-handling information
Layer 3	**Network**	**Routing and Relaying** Sequencing and address information is added to the packet
Layer 2	**Data Link**	**Node-to-Node Data Transfer** Adds error-checking information and prepares data for going on to the physical connection
Layer 1	**Physical**	**Electrical and Optical Connection** Packet sent as a bit stream

OSI Model

Three concepts are central to the OSI model:

1. Services.
2. Interfaces.
3. Protocols.

- The **service definition** tells what the layer does, not how entities above it access it or how the layer works.
- Layer's **interface** tells the processes above it **how to access** it. It specifies what the parameters are and what results to expect.
- Finally, the **peer protocols** used in a layer are the **layer's own business.** It can use any protocols it wants to, as long as it gets the job done (i.e., provides the offered services). It can also change them at will without affecting software in higher layers.

A Critique of the OSI Model

1. Bad timing.
2. Bad technology.
3. Bad implementations.
4. Bad politics.

- David Clark of M.I.T. has a theory of standards that he calls the **apocalypse of the two elephants**

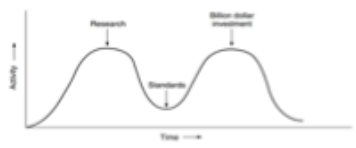


Figure 1-34. The apocalypse of the two elephants.

A Critique of the OSI Model

- **Bad Technology**
  - The choice of seven layers was more political than technical, and two of the layers (session and presentation) are nearly empty,
  - Whereas two other ones (data link and network) are overfull
- **Bad Implementations**
  - Given the enormous complexity of the model and the protocols, it will come as no surprise that the initial implementations were huge, unwieldy, and slow.
- **Bad Politics**
  - o be the creature European telecommunication ministries, the European Community, and later the U.S. Government

TCP/IP Reference Model

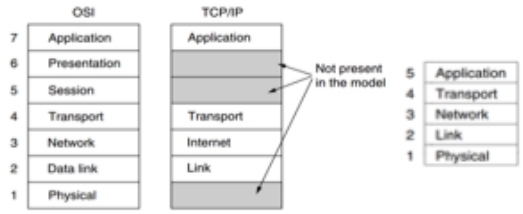


Figure 1-21. The TCP/IP reference model.

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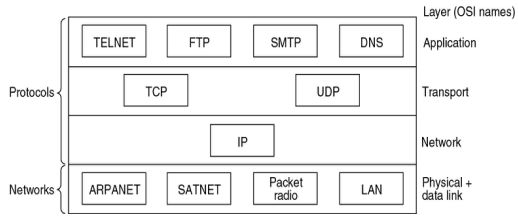

Protocols and networks in the TCP/IP model initially.

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- DSL- Digital Subscriber Line
- DSLAM - Digital Subscriber Line Access Multiplexer
- Module- modulator demodulator

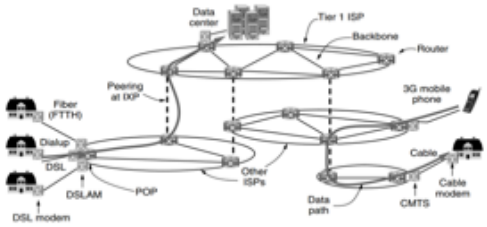


Figure 1-29. Overview of the Internet architecture.

- CMTS - Cable Modem Termination System
- FTTH - Fiber to the Home
- POP -Point of Presence

- ISP networks may be regional, national, or international in scope
- ISPs connect their networks to exchange traffic at IXPs (Internet eXchange Points)
- Basically, an IXP is a room full of routers, at least one per ISP.

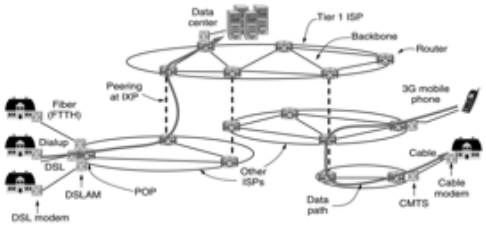
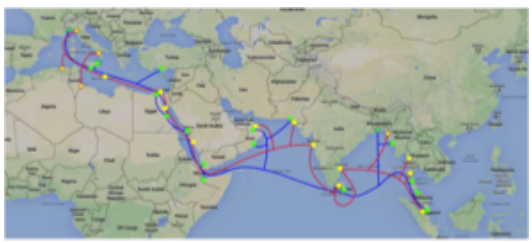


Figure 1-29. Overview of the Internet architecture.

- A LAN in the room connects all the routers, so packets can be forwarded from any ISP backbone to any other ISP backbone

Basic Internet Structure



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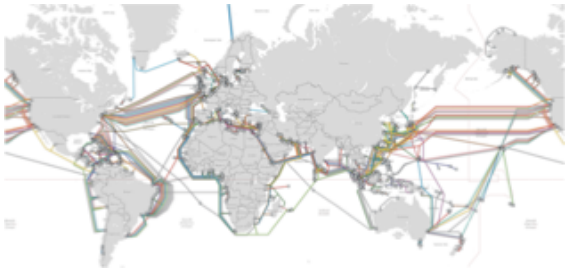
Basic Internet Structure



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