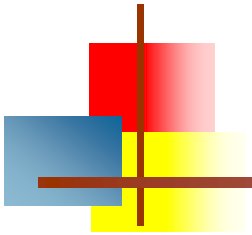
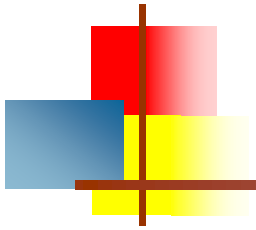


Introduction to Networks & Distributed Computing
CECS 327



Protocol Suites and Layering Models

Defn: Protocols are Standardized method for transmitting data and/or establishing communications between different devices.

- **They specify:**
  - Format of messages
  - Meaning of messages
  - Rules for exchanging messages
  - Procedures for handling problems
- **Network hardware** functions at a very low level.
- Hardware related problems can occur that need to be addressed by protocols:
  - Bits can be corrupted or destroyed
  - Entire packets can be lost
  - Packets can be duplicated
  - Packets can be delivered out of order

Protocol Suites and Layering Models

- **Protocols** can also be used to distinguish among:
  - Multiple computers on a network
  - Multiple applications on a computer
  - Multiple copies of a single application on a computer

Networks are very heterogeneous

Hardware/link → Ethernet: 3com, Dlink
Network → Routers: cisco, juniper etc.
Application → App: Email, IM, IE etc.

- The hardware/software of communicating parties are often not built by the same vendor, yet they can communicate because they use the same protocol

Protocol Suites and Layering Models

- **Sets of Protocols**
  - Sets of protocols are designed to work together.
  - Each protocol solves a small part of the communications problem
  - Sets of protocols are known as:
    - Protocol Suites
    - Protocol families
  - Ex: HTTP is using IP to send/receive data.
  - They are designed in layers.

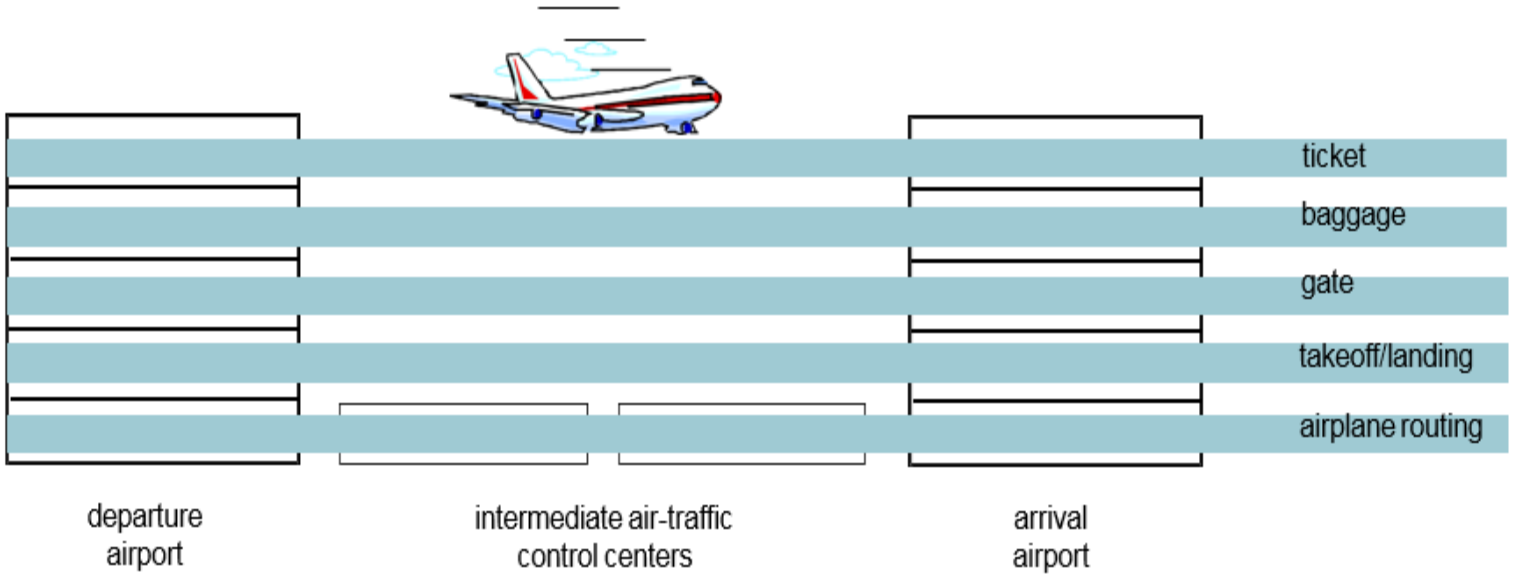
- **What is Layering in networking?**
  - A way to deal with complexity
  - Add multiple levels of abstraction
  - Each level encapsulates some key functionality
  - And exports an interface to other components
  - Example?

Protocol Suites and Layering Models

- **Organization of Air Travel Example**

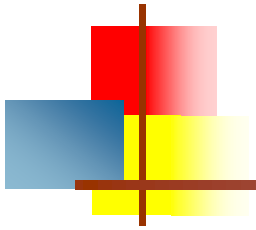
Protocol Suites and Layering Models

- **Organization of Air Travel Example**



Layers: each layer implements a service

- Via its own internal-layer actions
- Relying on services provided by layer below



Protocol Suites and Layering Models

Features of Layering:

- Sub-divide the problem
  - Each layer relies on services from layer below
  - Each layer exports services to layer above

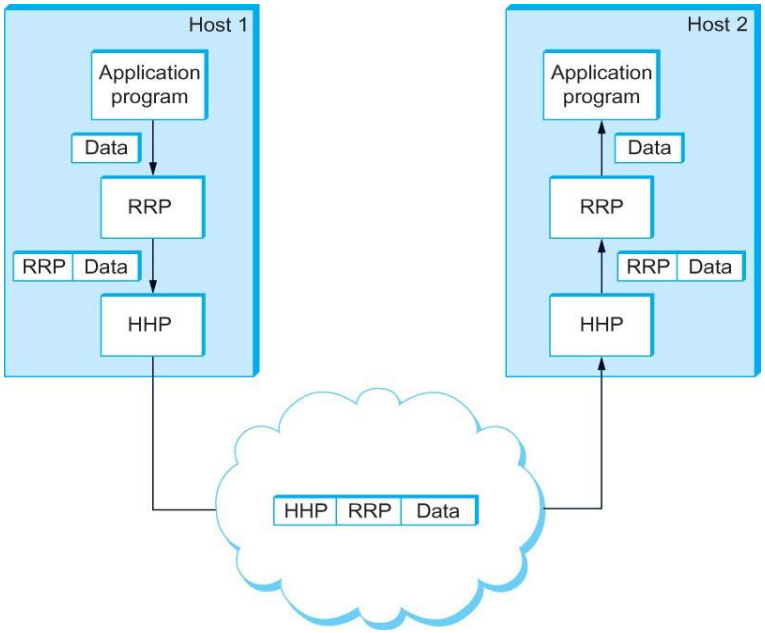
- Advantages of Layering?
  - Simplifies design and implementation
  - Easy to modify/evolve

Protocol Suites and Layering Models

Protocol Design

- Protocols are divided into layers
- Each layer is devoted to one sub-problem
- Protocols exist at many levels.
  - Application level protocols
  - Protocols at the hardware level
- Each protocol provides different service

to higher layers and relied on services from lower layers.

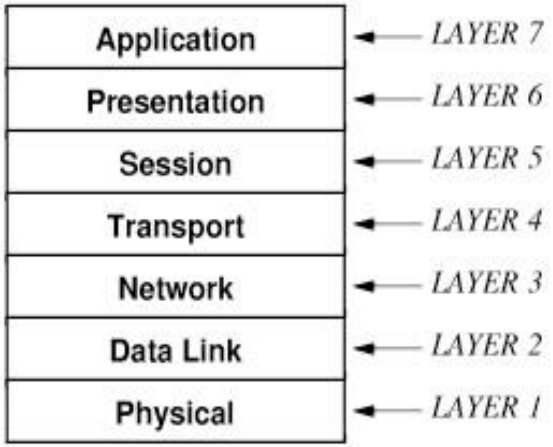


Protocol Suites and Layering Models

The OSI 7-Layer Model

The 7-Layer Model:

- Was defined fairly early in the development of
- Is now somewhat dated
- Does not include the internet layer

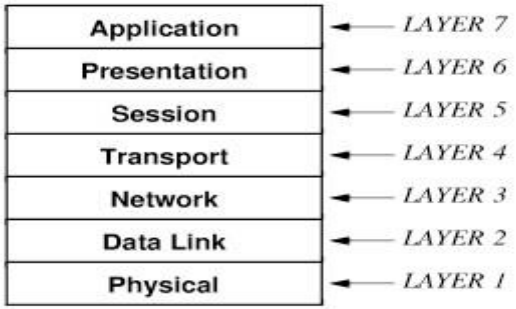


Example: The ISO (International Standards Organization) OSI (Open System Interconnection) 7-layer Reference Model

Protocol Suites and Layering Models

The OSI 7-Layer Model

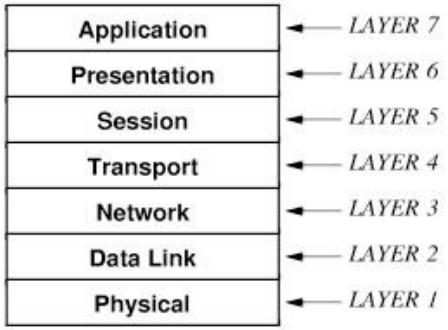
- **Layer 1: Physical**
  - Handles the transmission of raw bits over a communication link.
- **Layer 2: Data Link (media access)**
  - Collects a stream of bits into a larger aggregate called a *frame*
  - Network adaptor along with device driver in OS implement the protocol in this layer
  - Frames are actually delivered to hosts based on MAC address.

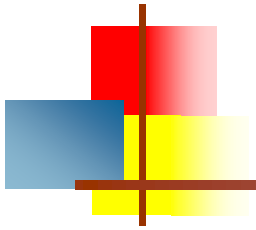


- **Layer 3: Network**
  - Handles routing among nodes within a packet-switched network
  - Unit of data exchanged between nodes in this layer is called a *packet*
  - Packets are actually delivered to hosts based on IP address.

Protocol Suites and Layering Models

- **Transport Layer**
  - Implements a process-to-process channel
  - Unit of data exchanges in this layer is called a *message*
- **Session Layer**
  - Provides the mechanism for opening, closing and managing a communication session between end-user appli
- **Presentation Layer**
  - Concerned about the format of data exchanged between peers
- **Application Layer**
  - Ensures application programs communication with other application programs over a network.





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