15-441 Computer Networking

Lecture 2 - Protocol Stacks

Last Lecture: What is the Objective of Networking?

- Enable communication between applications on different computers
  - Web (Lecture 22)
  - Peer to Peer (Lecture 23)
  - Audio/Video (Lecture 20)
  - Funky research stuff (Lecture 27)
- Must understand application needs/demands (Lecture 3)
  - Traffic data rate
  - Traffic pattern (bursty or constant bit rate)
  - Traffic target (multipoint or single destination, mobile or fixed)
  - Delay sensitivity
  - Loss sensitivity

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Last Lecture: Lots of Functions Needed

- Link
- Multiplexing
- Routing
- Addressing/naming (locating peers)
- Reliability
- Flow control
- Fragmentation
- Etc....

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Today's Lecture

- Layers and protocols
- Design principles in internetworks

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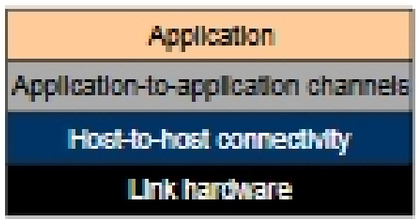
What is Layering?

- Modular approach to network functionality
- Example:



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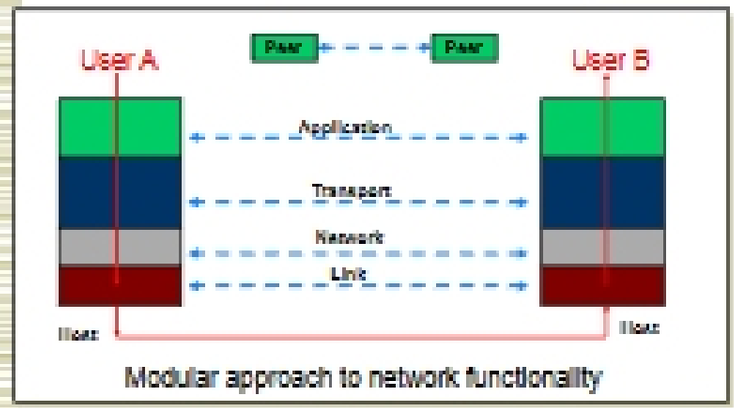
What is Layering?



Modular approach to network functionality

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Layering Characteristics

- Each layer relies on services from layer below and exports services to layer above
- Interface defines interaction
- Hides implementation - layers can change without disturbing other layers (black box)

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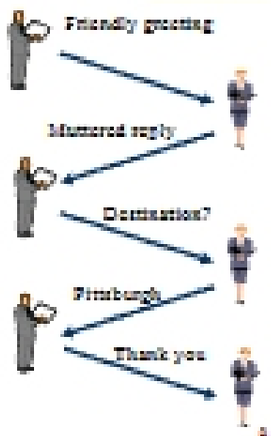
What are Protocols?

- An agreement between parties on how communication should take place
- Module in layered structure
- Protocols define:
  - Interface to higher layers (API)
  - Interface to peer (syntax & semantics)
    - Actions taken on receipt of a message
    - Format and order of messages
    - Error handling, termination, ordering of requests, etc.
- Example: Buying airline ticket



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The Internet Engineering Task Force

- Standardization is key to network interoperability
  - The hardware/software of communicating parties are often not built by the same vendor → yet they can communicate because they use the same protocol
- Internet Engineering Task Force
  - Based on working groups that focus on specific issues
- Request for Comments
  - Document that provides information or defines standard
  - Requests feedback from the community
  - Can be "promoted" to standard under certain conditions
    - consensus in the committee
    - interoperating implementations
  - Project 1 will look at the Internet Relay Chat (IRC) RFC

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Other Relevant Standardization Bodies

- ITU-TS - Telecommunications Sector of the International Telecommunications Union.
  - government representatives (PTTs/State Department)
  - responsible for international "recommendations"
- T1 - telecom committee reporting to American National Standards Institute.
  - T1/ANSI formulate US positions
  - interpret/adapt ITU standards for US use, represents US in ISO
- IEEE - Institute of Electrical and Electronics Engineers.
  - responsible for many physical layer and datalink layer standards
- ISO - International Standards Organization.
  - covers a broad area

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E.g.: OSI Model: 7 Protocol Layers

- Physical: how to transmit bits
- Data link: how to transmit frames
- Network: how to route packets
- Transport: how to send packets end2end
- Session: how to tie flows together
- Presentation: byte ordering, security
- Application: everything else

- TCP/IP has been amazingly successful, and it's not based on a rigid OSI model. The OSI model has been very successful at shaping thought

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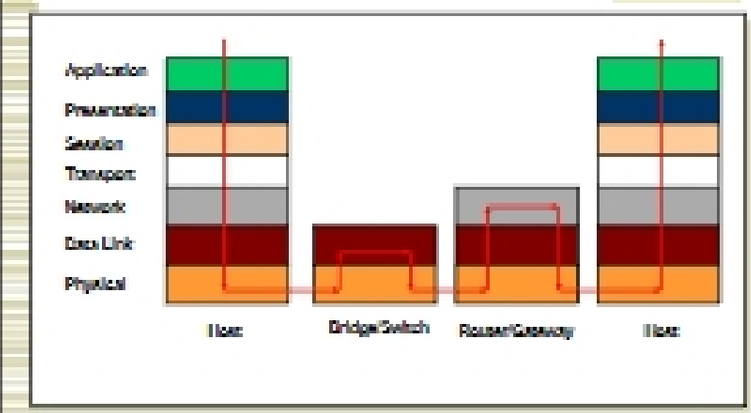
OSI Layers and Locations



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