

Network Architecture

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Need for Protocol Architecture

- ▶ What issues do we have to deal with to download a file over a computer network if we are to build the network from scratch?
 - ▶ Signal generation, synchronization, exchange management, encoding, error detection and correction, flow control, recovery, message formatting, security, addressing, routing, switching, congestion control, efficiency, utilization, reliability, quality of service, security, ...
- ▶ Consider example scenarios,
 - ▶ Exchange messages between two “computers”?
 - ▶ Transfer files between two “computers”?



Figure: Downloading a file over a computer network

Protocols and Layered Protocol Architecture

- ▶ Network protocols. A protocol describes how two or more peers on a network communicate by obeying a set of rules or conventions.
 - ▶ Syntax defines the format of the data blocks that the peers exchange
 - ▶ Semantics includes control information for coordination and error handling
 - ▶ Timing includes speed matching and sequencing
- ▶ Example protocol, the Trivial File Transfer Protocol¹
- ▶ Layered architecture. Organizing the protocols in layers
 - ▶ Example. Organizing the protocols based on “natural division” of application, computers, and networks, we have application layer protocols, transport layer protocols, and network access layer protocols.
- ▶ How does the Internet divide the protocols into layers?

¹K. Sollins. *The TFTP Protocol (Revision 2)*. STD 33. RFC Editor, 1992.

TCP/IP Layers and Example Protocols

Application.	Providing user access
Transport.	Data transfer between end points; error control, flow control, congestion control, reliable delivery
Internet.	Routing, QoS, congestion control
Network Access/Data Link.	Framing, reliable delivery, logical interfacing
Physical.	Bit streams transmission, medium specification, signal encoding, data rate, bandwidth, and physical connector

SMTP,FTP,SSH,HTTP		
TCP, UDP		
IPv4,IPv6	ICMP,OSPF,RSVP	ARP
Ethernet,WLAN,ATM,frame relay		
Twisted pair,optical fiber, satellite		

Experiments and Demo

- ▶ Run a Web server and a Web client and examine network traffic
- ▶ Objectives
 - ▶ To gain an understand operations of protocols, HTTP, TCP, and IP
 - ▶ To gain hands-on experience with the experimental environment used in class