Introdu	ction to Notworking	
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COMP 321		
Dave Johnson	n	









Evolution of the Internet

The ARPANET (Advanced Research Projects Agency Network) starting in 1966

- Initiated by U.S. Government research agency to enable "resource sharing"
- Connected some universities and other government contractors

The original protocols were not "TCP/IP"

- Conceptually similar to today's IP (network layer) and TCP (transport layer) together in one protocol
- Called NCP (Network Control Program) (before the word "protocol" was used)
- Designed originally only for communicating directly over the ARPANET, running on the ARPANET physical layer and data link layer
- Beginning in 1973, IP designed as a replacement to connect other networks together (originally called "concatenating" networks, thus the "Catenet")

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TCP vs. UDP

The Internet uses two common transport layer protocols

Transmission Control Protocol (TCP)

- Used for "most" communication
- Provides a bi-directional reliable stream of bytes (carried by IP packets)
- Guarantees no loss, duplication, errors, etc.
- Addresses individual sender and receiver processes

User Datagram Protocol (UDP)

- Provides roughly the same service as IP packets, no guarantees of reliability
- A bi-directional "best effort" datagram service
- Addresses individual sender and receiver processes

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Byte Ordering: Big-Endian vs. Little-Endian

Naming comes from "Gulliver's Travels", Jonathan Swift (Lemuel Gulliver), 1726

"It is allowed on all hands, that the primitive way of **breaking eggs** before we eat them, was **upon the larger end**: but his present Majesty's grandfather, while he was a boy, going to eat an egg, and breaking it according to the ancient practice, happened to cut one of his fingers. Whereupon the Emperor his father

published an edict, commanding all his subjects, upon great penalties, to break **the smaller end** of their eggs. The people so highly resented this law, that our histories tell us there have been six rebellions raised on that account; wherein one Emperor lost his life, and another his crown...."



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Byte Ordering: Big-Endian vs. Little-Endian

"On Holy Wars and a Plea for Peace," Danny Cohen, IEN 137, April 1, 1980

"It may be interesting to notice that the point which Jonathan Swift tried to convey in Gulliver's Travels in exactly the opposite of the point of this note.

"Swift's point is that the difference between breaking the egg at the little-end and breaking it at the big-end is trivial. Therefore, he suggests, that everyone does it in his own preferred way.

"We agree that the difference between sending eggs with the little- or the bigend first is trivial, but we insist that everyone must do it in the same way, to avoid anarchy. Since the difference is trivial we may choose either way, but a decision must be made."

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Listening vs. Connected Socket Descriptors

The return from listen() gives you a "listening" socket file descriptor

- Represents the server process waiting for incoming connection requests

 Listening at the address and port number from the bind() call
- Remembers up to limited number of new requests until the server gets to them
- Normally, created once by the server and reused as each new connection request comes in (as long as this server is willing to accept new connections)

The return from accept() gives you a <u>new</u> "connected" socket file descriptor

- Each return from accept() on listening socket represents a <u>new</u> connection, giving a <u>new</u> connected socket file descriptor for talking with that new client
- Separate listening socket remains, listening for new connections from clients
- Server closes each new connected socket when done with that particular client

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