

Buffering Streams

- o Do you really want to read/write 1 character or line at a time?
- o Buffering means that you read/write in chunks and it's faster than trying to set up reads/writes one at a time
- o Graphics normally uses buffers for what's displayed on your screen
- o Buffers can usually be "wrapped" around other stream types to buffer that type
 - o Class to use: BufferedStream

Buffering

- o Buffer both of your FileStream objects using BufferedStream

Polymorphism?

- o What if you wanted to be able to switch between writing out to a file or writing to standard output based on whether or not the program is given two arguments (write to a file) or one?

Polymorphism (cont'd)

- o Both are of type TextWriter!

- o Use TextWriter to enable a user to write output to either a file or the console.

How else?

- o What ways can you imagine using polymorphism in games?

Networking?

- o Computer network
 - o A system of computers interconnected by telephone wires or other means in order to share information [dictionary.com]

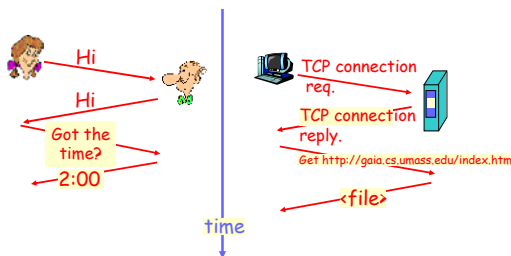
The Internet in the USA



Messages

- o Protocol
 - o A formal description of the message formats and rules that two or more entities follow to exchange messages.
- o What kind of protocols are used in games?

Protocols



Types of Transfer

- o Networks typically provide two types of transfer
 - o Connection-oriented
 - o often reliable
 - o stream based
 - o Connectionless
 - o often unreliable
 - o datagram based

Sockets

- o Berkeley sockets are one of the most widely used communication APIs
- o A socket is an object from which messages are sent and received
- o Class: Socket



Layers

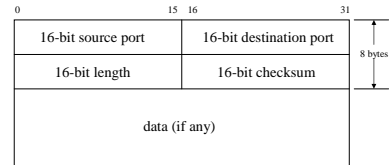
Application	Telnet, FTP, SMTP, HTTP, etc.
Transport	TCP, UDP
Network	IP
Link	device driver and interface card

The TCP/IP Protocol Suite

- o TCP/IP is a set of protocols that were created specifically to allow development of network and inter-network communications on a global scale
- o TCP/IP is the most commonly used protocol within the internet.
- o TCP/IP is normally considered to be a four-layer system.
- o It is a connection-oriented protocol

User Datagram Protocol

- o UDP is a simple, unreliable, datagram-oriented, transport layer protocol (RFC768).
- o It is often used for "chatty" applications



IP: Internet Protocol

- o IP is the workhorse protocol of the TCP/IP protocol suite
- o IP provides an unreliable, connectionless, datagram delivery service
- o RFC791 is the official specification of IP

Addressing

- o A distinction is made between names, addresses, and routes
 - o A name indicates what we seek
 - o An address indicates where it is
 - o A route indicates how to get there
- o IP deals primarily with addresses. It is the task of higher level protocols to make the mapping from names to addresses.

IP Addresses

- o Every host on the internet must have a unique *Internet Address* (an IP address)
- o IP addresses are 32-bit numbers and are divided into two components: the host address and the network address
 - o The number of bits assigned to the host and network varies depending on the class of the address

Dotted Decimal Notation

- o IP addresses are normally written as four numbers, one for each byte of the address.
 - o 129.21.38.169
- o The easiest way to differentiate between the classes is to look at the first number

Class	Range
A	0.0.0.0 to 127.255.255.255
B	128.0.0.0 to 191.255.255.255
C	192.0.0.0 to 223.255.255.255
D	224.0.0.0 to 239.255.255.255
E	240.0.0.0 to 247.255.255.255

Assigning IP Addresses

- o Since every interface must have a unique IP address, there must be a central authority for assigning numbers
- o That authority is the *Internet Network Information Center*, called the InterNIC.
- o The InterNIC assigns only network ids, the assignment of host ids is up to the system administrator

IP addresses

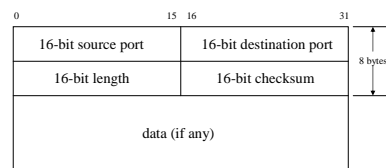
- o Dns class
- o IPAddress
- o IPHostEntry
- o [sample programs shown in class]
- o Loopback: 127.0.0.1

ICMP

- o Used to "ping" machines
- o It's a part of IP
- o [example shown in class]

User Datagram Protocol

- o UDP is a simple, unreliable, datagram-oriented, transport layer protocol (RFC768).



Datagrams

- o Datagram packets are used to implement a connectionless, packet based, delivery service.
- o Each message is routed from one machine to another based solely on information contained within that packet.
- o Multiple packets sent from one machine to another might be routed differently, and might arrive in any order.
- o Packets may be lost or duplicated during transit.
- o [see examples of UDP in class]