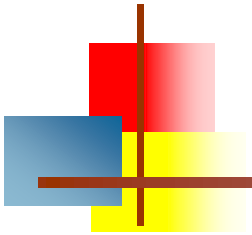
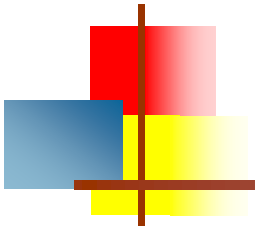


Introduction to Networks & Distributed Computing
CECS 327



Performance - Latency

Latency = Propagation Delay + Transmit Time + Queuing & Processing Delay

= Tp+ Tx+ Tq

Tp (Propagation Delay) = (***Distance across link***)/(***Speed-of-light delay***)

Tx (Transmit Time) = (***Size of date***)/(***Throughput***)

Tq (Queuing & Processing Delay) = *This is hard to measure so a statistically generated value or a constant is used*. (***depends on congestion***)

where

Distance = length of the wire over which the data will travel (usually meters/sec)

Speed-of-light = effective speed of light over the channel

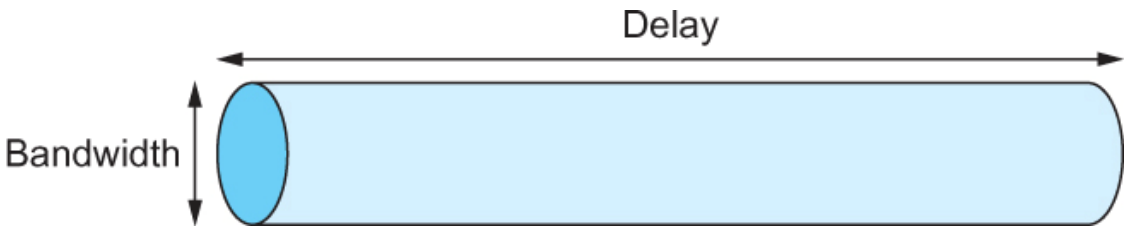
Size = size of the packet (usually bits)

Throughput = #bits/(unit time) at which the packet is transmitted (usually bits/sec)

Delay X Bandwidth

Delay-bandwidth product as a measure of ***network capacity***

Latency (**delay**) length of the pipe and bandwidth the width of the pipe

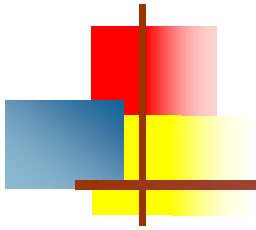


Network as a pipe MK

Delay of 50 ms and bandwidth of 45 Mbps

50 x 10^-3 seconds x 45 x 10^6 bits/second

2.25 x 10^6 bits = 280 KB data.



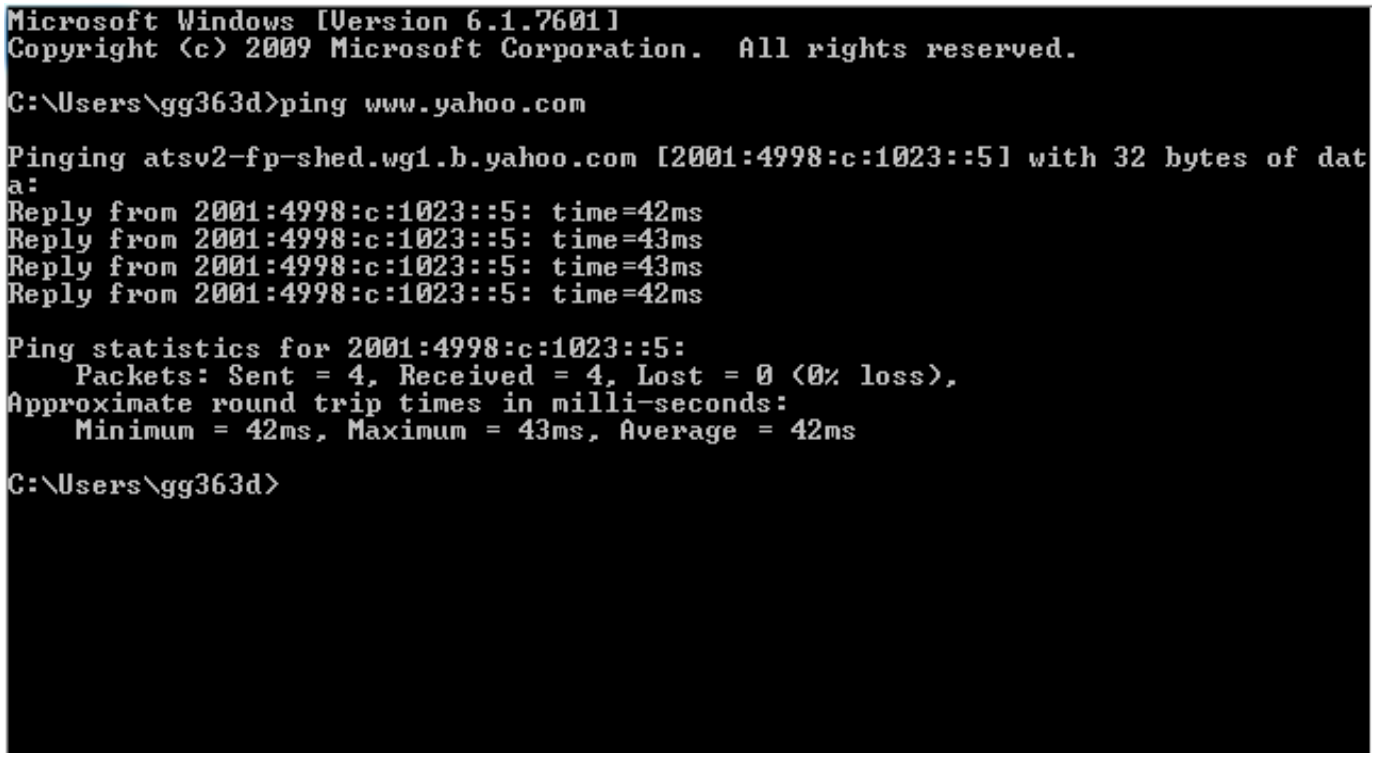
Performance

- Chapter 1: Prob. 4 (a) and (b)
  - Hint: Propagation=RTT/2
- Chapter 1: Prob. 6

Performance - Tools

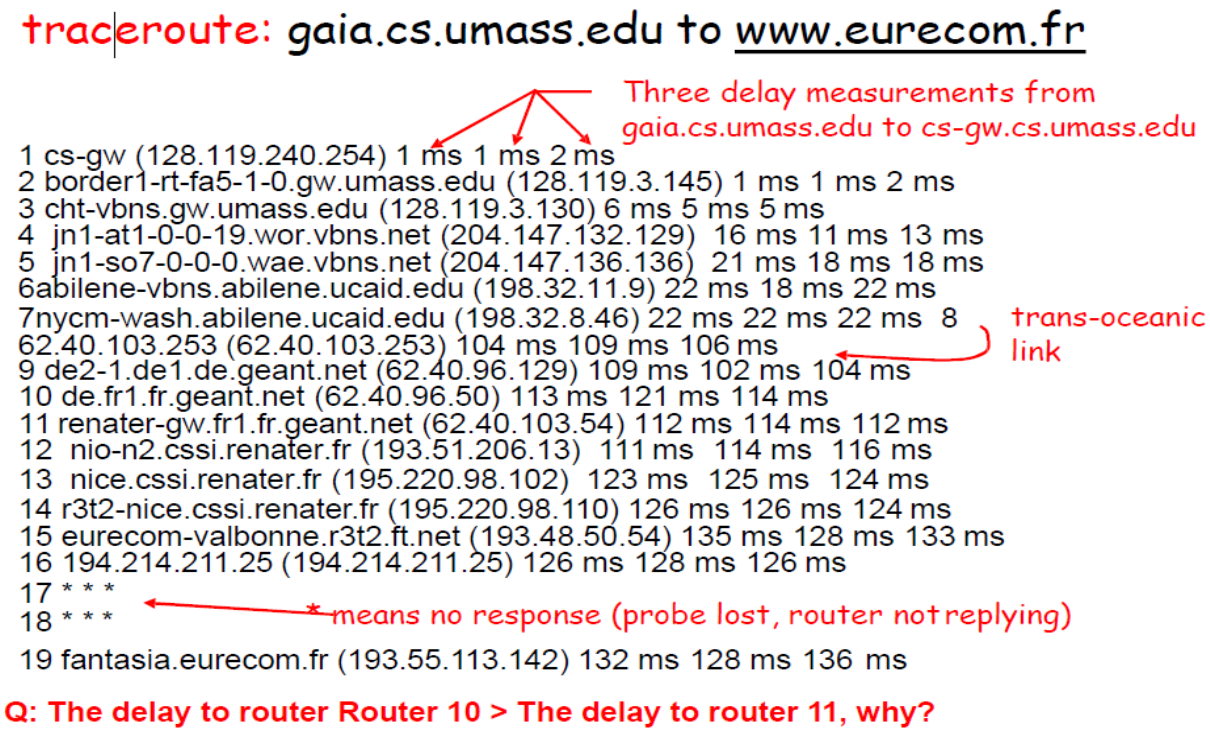
Two tools for probing the Internet are available on most computers:

ping -- sends a message to the specified computer and waits for a response. **ping** reports its findings**.**



Performance - Tools

Traceroute (tracert) -- sends a message to the specified computer reporting the intermediate computers along the path to the destination.



Performance - Tools

Netstat

NETSTAT [-a] [-e] [-n] [-s] [-p proto] [-r] [interval]

-a Displays all connections and listening ports.

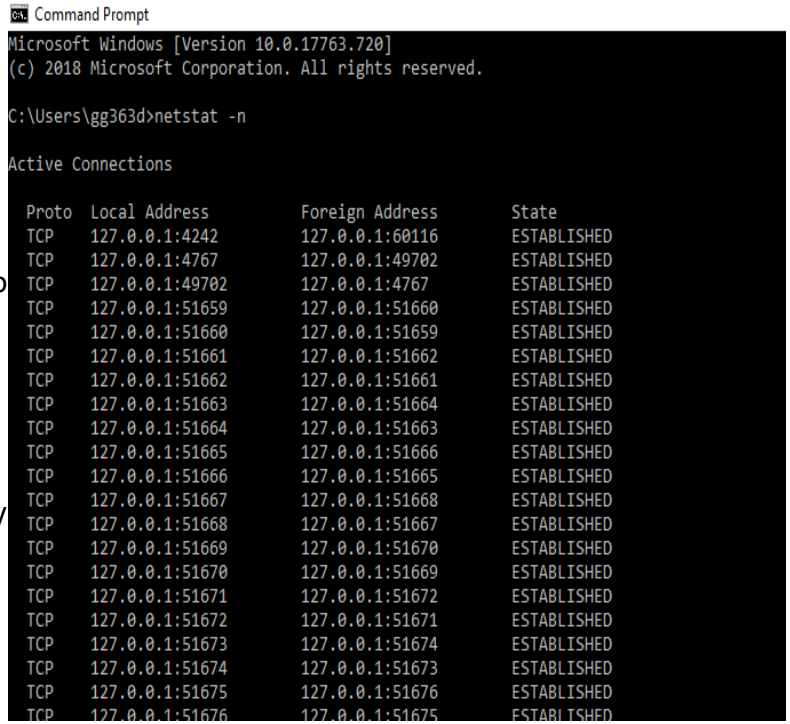
-e Displays Ethernet statistics. This may be combined with the -s option.

-n Displays addresses and port numbers in numerical form.

-p proto Shows connections for the protocol specified by proto; proto may be TCP or UDP. If used with the -s option to display per-protocol statistics, proto may be TCP, UDP, or IP.

-r Displays the routing table.

-s Displays per-protocol statistics. By default, statistics are shown for TCP, UDP and IP; the -p option may be used to specify a subset of the default.

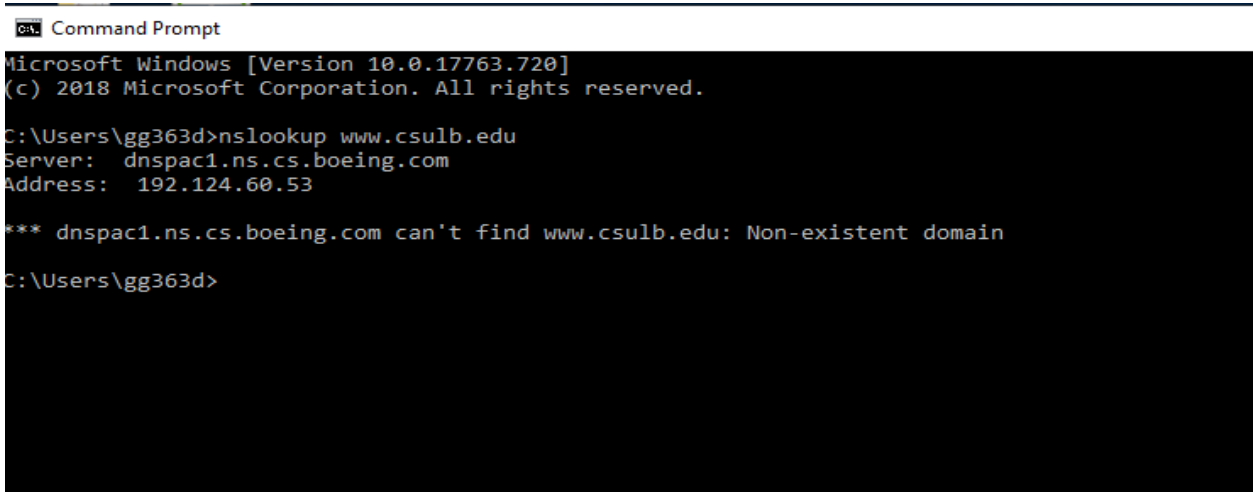


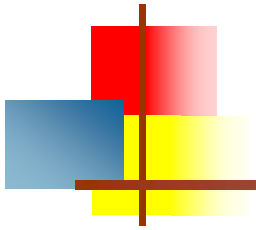
interval Redisplays selected statistics, pausing interval seconds between each display. Press CTRL+C to stop redisplaying statistics. If omitted, netstat will print the current configuration information once.

Performance - Tools

Nslookup

- An interactive program for querying Internet Domain Name System servers
- Converts a hostname into an IP address and vice versa querying DNS
- Useful to identify the subnet a host or node belongs to
- Lists contents of a domain, displaying DNS record





References

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- Computer Networks, Fifth Edition: A Systems Approach (The Morgan Kaufmann Series in Networking).
- Computer Networks and Internets (5th Edition)
- Some slides by Dr. Tracy Bradley Maples