

CSE 3213: Computer Networks
Assignment # 1 - Solutions
Winter 2008

Q.1 Solution:

(a) Telephone Network – infrastructure and services:

The telephone network has a strongly controlled structure - it must keep track and have control over all existing connections (subnetworks), and their underlying technologies, to be able to provide a high QoS connection-oriented service. Scaling this structure is costly and difficult

The range of services provided by a telephone network is limited. New services cannot be easily introduced as it will involve changing the hardware at the local and trunk telephone centers.

(a) Internet – infrastructure and services:

In the case of the Internet, new networks (regardless of their underlying physical- and data-link- layer technology) can be connected to the global inter-network through routers. New services can be easily introduced in the Internet as long as these services are built on the existing TCP/UDP and IP protocols.

Q.2 Solution:

Layered protocols / architecture allow:

- 1) modularity, i.e. the breaking up of the design problem into smaller and more manageable peaces
- 2) simplicity / ease in designing new applications, independent from the underlying technology
- 3) efficient upgrade / replacement of components as new technology emerges

Q.3 Solution:

- | | |
|--|---------------------------------|
| a) Route determination | - Network Layer |
| b) Flow control | - Transport and Data-Link Layer |
| c) Mechanical and electrical interface | - Physical Layer |
| d) Reliable process-to-process data transportation | - Transport Layer |
| e) Reassembly of data packets | - Transport Layer |
| f) Error correction and retransmission | - Data-Link and Transport Layer |

Q.4 Solution:

$$\text{Result} = 2 * (2 * \dots (2 * (2 * \text{initial value}))) = 2^{\# \text{ of 18-month intervals}} * \text{initial value}$$

Internet is doubling every 18 months.

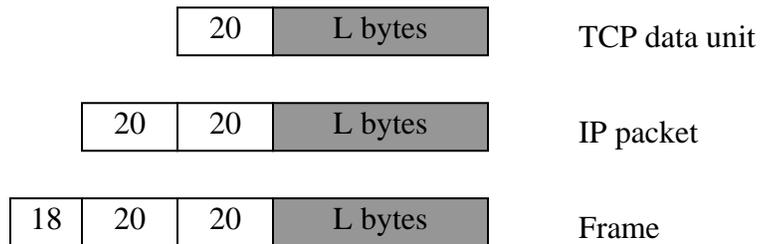
of months between Jan 1996 and Jan 2008 = 12*12 = 144 months

of 18-month periods in 144 months = 144/18 = 8

Gain in 144 months = $2^8 = 256$

Number of Internet users in Jan 2008 = 7 million * 256 = 1,792 billion

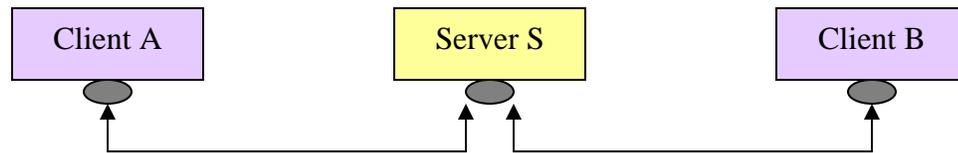
Q.5 Solution:



$$\text{percentage of message} = \frac{L}{L + 58} * 100[\%]$$

L	% of message information
100 bytes	$\frac{100}{158} * 100 = 63\%$ - 37% overhead !!!
500 bytes	$\frac{500}{558} * 100 = 90\%$
1000 bytes	$\frac{1000}{1058} * 100 = 95\%$

Q.6 Solution:



- (a) segment sent from A to S:
 - Source port number = 1024
 - Destination port number = 23
- (b) segment sent from B to S:
 - Source port number = 1025
 - Destination port number = 23
- (c) segment sent from S to A:
 - Source port number = 23 (or some number above 1024 in case of ‘forking’)
 - Destination port number = 1024
- (d) segment sent from S to B:
 - Source port number = 23 (or some number above 1024 in case of ‘forking’)
 - Destination port number = 1025
- (e) Source port number from (A to S) and from (B to S) can be the same. The destination (server) will use a combination of source port number and source IP address to determine the actual source.
- (f) If A and B are client programs on the same machine, they must have different source port numbers.

Q.7 Solution:

- (a) Internet radio is live, so we would like to prevent delays as much as possible. Also, we do not have time for error-detection. Hence Internet radio is **unreliable and connectionless**.
- (b) File transfer has to **reliable and connection-oriented**, to ensure that data is received correctly and in-order.
- (c) Ping is **unreliable and connectionless**. Unreliable since we are only interested in knowing if the destination host is active. Connectionless since 1 packet needs to be transmitted during each attempt – sequencing is not required.
- (d) Telnet is **reliable and connection-oriented**.
- (e) Email is **reliable and connection-oriented**.