

Assignment 1



NET 3006 – Enterprise Network Management

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Due date: February 4th, 2016 (at 11:55 pm)

Question 1 – Review questions (20 marks)

- a) Describe the differences between connectionless service and connection-oriented service. (4)
- | Connectionless | Connection-Oriented |
|-----------------------------------|----------------------------|
| Does not require connection setup | Require connection setup |
| Unreliable transmission | Reliable transmission |
| Less overhead | More Overhead |
| Ex: UDP | Ex: TCP |
- b) Describe the differences between circuit-switching and packet-switching networks. (4)
- | Circuit-switching | Packet-switching |
|--|--|
| Dedicated path resources assigned for transmission | No dedicated path |
| Inefficient use of resources | Efficient use of resources |
| Fast transmission | Adds delay to the transmission (queue delay) |
- c) Describe the differences between TCP and UDP transport protocols and states which one SNMP uses and explain why? (3)
- | TCP | UDP |
|-----------------------------|-----------------------------------|
| Connection-Oriented | Connectionless |
| Flow and congestion control | No flow or congestions control |
| Require connection setup | Does not require connection setup |
| Reliable transmission | Unreliable transmission |
| More Overhead | Less overhead |

SNMP use UDP because of its simple, fast transmission, and less amount of overhead added to the traffic.

- d) Describe why an application developer might choose to run an application over UDP rather than TCP. (3)
- If the application does not require reliable transmission but delay sensitive and can afford packet losses but then UDP is suitable for it.
- e) Find the RFC number for the following protocols: IPv4, Mobile IP for IPv4 (MIPv4), SNMP, TCP (3)
- IPv4: RFC791
MIPv4: RFC3344
SNMP: RFC1157
TCP: RFC793

- f) Look in the SNMP RFC and find what language is used to communicate management information by operation of the SNMP. (3)
ASN.1 language

Question 2 – Ping & Traceroute (10 marks)

- a) Use PING and Traceroute tools for probing two local hosts and 2 remote hosts (international). Explain your findings and list all the limitations of both tools. (5)
- b) Traceroute www.csit.carleton.ca (or any other host) and compute the average time a packet takes to travel from your host to the remote host. Repeat the experiment using the same remote host and compare the new average travel time with the old one. Explain your results. (5)

Question 3 – Network management (20 marks)

- a) Consider the two ways in which communication occurs between a managing entity and a managed device: request-response mode and trapping mode. What are the advantages and disadvantages of these two approaches, in terms of (i) overhead, (ii) notification time when exceptional events occur, and (iii) robustness with respect to lost messages between the managing entity and the device? (5)

Request-response

(i) Two way communication require more overhead

(ii) Need to be periodic polling in order for the manager to be updated with recent events.

(iii) The manager poll the information and expect event report, if the request or the reply is lost, the manager with notice and act based on that.

Trapping

Less overhead since the agent is initiating the alarm message, no response needed from the manager

The agent report the event as soon as it sense it to the manager.

If the trap report message is lost, the manager will not notice except from the sequence number in the next trap message.

- b) Define the following terms: managing system, managed device, management agent, MIB, network management protocol. (5)

Managing system: Management systems provide network providers with the tools to manage the network.

Managed device: The network element being managed, consists of managed objects.

Management agent: A management interface through which a managing system can communicate with the network element for management purposes.

MIB: Conceptual representation of the managed device, i.e. a model of the device

Network management protocol: The language used between management entities for communication and exchanging information.

- c) Describe and define the 5 areas of network management (5)

Configuration management: Set and change network configuration and component parameters

Fault management: Detection and isolation of failures in network

Performance management: Monitor performance of network

Security management: Responsible for authentication, authorization, and encryption

Accounting management: Responsible for accounting of network usage

- d) Name and describe each of the 5 network management standards (5)

OSINM: Adopted by the ISO, Its management protocol is the CMIP

SNMP: Industry standard (IETF), most widely implemented NM.

TMN: Based on OSI Network Management, ITU standard

IEEE: Adopted internationally, addresses LAN/MAN management, Based on OSI Network Mgmt.
 Web-based Management: Based on Web technology, still an evolving technology.

Question 4 – Problem: Circuit and packet switching (20 marks)

Compute the required time to send a file from source to destination if

a) Circuit switching is used (10)

No need for dividing the file into packets, no need for store/forward in the intermediate routers.

There will be propagation delay for the entire distance = $(5\text{Km}) * (6 \text{ segments}) / (10^6 \text{ m/s})$

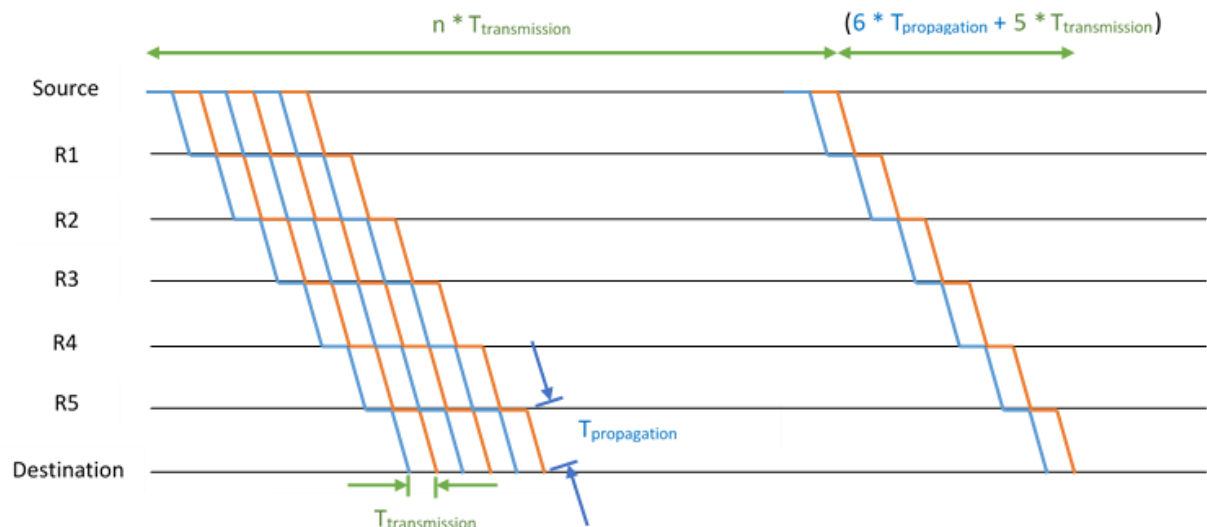
$$5000 * 6 / 1000,000 = 0.03 \text{ s}$$

The transmission time delay will be calculated once at the source = $(400\text{Mb}) / (100\text{Mb/s}) = 4 \text{ s}$

Circuit establishment = 0.01 s

Total delay = $0.03 + 4 + 0.01 = 4.04 \text{ s}$

b) Packet switching is used (assume a store and forward mechanism is used) (10)



The file will be divided into packets of maximum size $\rightarrow n = 50,000,000 / 100,000 = 500$ packet

Transmission time for one packet $T_{\text{transmission}} = 100,000 * 8 / 100,000,000 = 0.008 \text{ s}$

Propagation delay for one segment = $5000 / 1000,000 = 0.005 \text{ s}$

Total delay = $6 * T_{\text{propagation}} + (n+5) * T_{\text{transmission}} = 4.038 \text{ s}$

Assume the following about the network:

- The source and destination are separated by 5 intermediate routers
- The distance between each node is 5km
- The signal propagation is 10^6 m/s .
- The file size is 50,000,000 bytes.
- The maximum size of each packet is 100,000 bytes (please ignore the header size).
- The transmission speed of each link is 100 Mbps.
- The time required to establish the circuit is 10^{-2} seconds
- You can neglect the processing time used for routing.

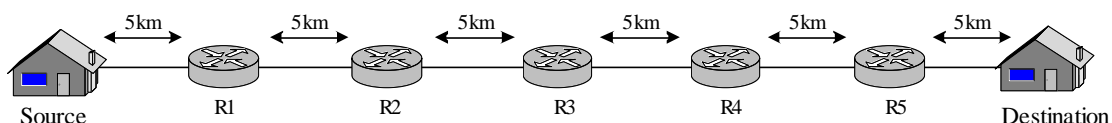


Figure 1 : Question 4

Question 5 – ASN.1 (15 marks)

The following is the informal record structure of John P. Smith's address

Name	John P. Smith
Address	1125 Colonel By Dr.
City	Ottawa
Province	Ontario
Zip Code	K1S 5B6

Write for your record the following:

- a) The informal record structure (5)

Name	First Last
Address	1125 Colonel By Dr.
City	Ottawa
Province	Ontario
Zip Code	K1S 5B6

- b) An ASN.1 description of the record structure (6)

```
PersonnelRecord ::= SEQUENCE {  
  name      VisibleString,  
  address   VisibleString,  
  city      VisibleString,  
  province  VisibleString,  
  zipCode   VisibleString  
}
```

- c) The record value for your home address (4)

address "1125 Colonel By Dr."

Question 6 – Encoding (10 marks)

An object identifier consists of a sequence of integers. The BER encoding packs the first two integers into a single sub-identifier. Thus, an identifier consisting of N integers has $N-1$ sub-identifiers. The first two integers can be combined because the first integer always takes on the value 0, 1, or 2, and the second integer must be less than 40 if the first integer is 0 or 1. The packing formula is:

$$Z = (X*40) + Y$$

where X is the first integer, Y is the second integer, and Z is the resulting sub-identifier value.

Use this definition to encode the object identifier internet {1 3 6 1} using the TLV method (give your result in binary format).

NOTE: OBJECT IDENTIFIER is UNIVERSAL class and its tag number is 6.

$$Z = (1*40) + 3 = 43 \rightarrow 0010\ 1011$$

$$\text{Type:} \quad 6 \rightarrow 0000\ 0110$$

$$\text{Length:} \quad 3 \rightarrow 0000\ 0011$$

$$\text{Value:} \quad \{43\ 6\ 1\} \rightarrow \{0010\ 1011, 0000\ 0110, 0000\ 0001\}$$

$$0000\ 0110\ 0000\ 0011\ 0010\ 1011\ 0000\ 0110\ 0000\ 0001$$

Question 7 – Encoding (5 marks)

Encode the IP address 10.20.30.40 in TLV format

Type: OCTATE STRING : 6 → 0000 0110

Length: 4 → 0000 0100

Value: {10 20 30 40} → {0000 1010, 0001 0100, 0001 1110, 0010 1000}

0000 0110 0000 0100 0000 1010 0001 0100 0001 1110 0010 1000

Type could be also Application-specific (Ex. [Application 0] = 0100 0000)