THE UNIVERSITY OF NEW SOUTH WALES

Session 2, 2008

TELE 9752

Network Operations and Control – Examination 1

Materials: You may bring writing and drawing instruments to the exam. You may not bring any other materials.

Print your name and student number, and sign, on the top right hand corner of this page.

You have 10 minutes reading time plus 60 minutes writing time for this exam.

This exam consists of 16 questions.
You should attempt all questions
The maximum number of marks for each question is shown in brackets before the question, e.g. [2].
The sum of all marks for all questions is 50
Questions generally appear in the order in which topics were covered in the course.
Sections group together questions that relate to a single topic, and section headings indicate the total marks available for questions in that section.
You must return this exam paper with your answer booklet.
You are allowed to smile.

You might need to consult the following reference material:

Numeric codes for common ASN.1 types:
  02 INTEGER
  04 OCTET STRING
  06 OBJECT IDENTIFIER
  05 NULL
  16 SEQUENCE / SEQUENCE OF
Section 1: Network Management Systems
1. [5] What are the 5 functional areas for managing OSI networked systems?

2. [6] What is the difference between an element, an object and an agent, in the context of network management?

Section 2: Revisiting protocol stacks in context of management
3. [2] What feature is introduced to many protocol reference models to enable a network management system to have direct access to each layer?

4. [2] Give two examples of protocols that implement loopback functions in order to facilitate network testing.


7. [2] When a switch has been configured so that each of its ports belongs to a different VLAN, then will frames that are broadcast from one port be directly received (through the switch) on any other port?

8. [2] Why might a network operator block or limit the flow of ICMP traffic?

Section 3: Structuring and presenting management information
9. [2] The TCP MIB [RFC 4022] includes the following:

   tcpCurrEstab OBJECT-TYPE
   SYNTAX     Gauge32
   DESCRIPTION
   "The number of TCP connections for which the current state is either ESTABLISHED or CLOSE-WAIT."
   ::= { tcp 9 }

   Why is this object defined as a Gauge rather than a Counter?
10. [6] The TCP MIB [RFC 4022] defines a table of sockets that are being used for listening:

```
tcpListenerTable OBJECT-TYPE
   SYNTAX     SEQUENCE OF TcpListenerEntry
   MAX-ACCESS not-accessible
   STATUS     current
   ::= { tcp 20 }
```

```
tcpListenerEntry OBJECT-TYPE
   SYNTAX     TcpListenerEntry
   MAX-ACCESS not-accessible
   STATUS     current
   INDEX   { tcpListenerLocalAddressType,
              tcpListenerLocalAddress,
              tcpListenerLocalPort }
   ::= { tcpListenerTable 1 }
```

```
TcpListenerEntry ::= SEQUENCE {
   tcpListenerLocalAddressType       InetAddressType,
   tcpListenerLocalAddress           InetAddress,
   tcpListenerLocalPort              InetPortNumber,
   tcpListenerProcess                Unsigned32
}
```

a. [2] Why is the table object `tcpListenerTable` defined as being “not-accessible”?

b. [2] What is the purpose of the `STATUS` clause?

c. [2] Write an OID that potentially identifies the port number of a particular listener entry. The OID will start with “tcpListenerTable.” followed by a dot-separated string of integers or values of the form `<character><digit>` where:

- `InetAddressType` can have values T1, T2, T3...
- `InetAddress` can have values A1, A2, A3, ...
- `InetPortNumber` can have values P1, P2, P3, ... and
- `Unsigned32` can have values U1, U2, U3...

11. [3] What are the three pieces of information that determine the types of access (e.g. read, write or create) that a particular manager is permitted to make to a managed object through SNMPv1?
12. [2] Write the sequence of bytes that would be used to transmit the decimal integer 9752 using Basic Encoding Rules. You can show the value of each byte in hexadecimal; 9752 = 0x2618 in hexadecimal.


14. [2] What functions does SNMPv2 add that go beyond the functionality of SNMPv1?

15. [2] What advantage do SNMP Traps provide over a manager polling the agent to determine whether the value of an object has changed?
16. [7] RFC 2011 defines an ipAddrTable as:

```
ipAddrTable OBJECT-TYPE
  SYNTAX       SEQUENCE OF IpAddrEntry
  ::= { ip 20 }
ipAddrEntry OBJECT-TYPE
  SYNTAX       IpAddrEntry
  INDEX       { ipAdEntAddr }
  ::= { ipAddrTable 1 }
IpAddrEntry ::= SEQUENCE {
  ipAdEntAddr          IpAddress,
  ipAdEntIfIndex       INTEGER,
  ipAdEntNetMask       IpAddress,
  ipAdEntBcastAddr     INTEGER,
  ipAdEntReasmMaxSize  INTEGER
}
ipAdEntAddr OBJECT-TYPE
  SYNTAX       IpAddress
  ::= { ipAddrEntry 1 }
ipAdEntIfIndex OBJECT-TYPE
  SYNTAX       INTEGER (1..2147483647)
  ::= { ipAddrEntry 2 }
ipAdEntNetMask OBJECT-TYPE
  SYNTAX       IpAddress
  ::= { ipAddrEntry 3 }
ipAdEntBcastAddr OBJECT-TYPE
  SYNTAX       INTEGER (0..1)
  ::= { ipAddrEntry 4 }
ipAdEntReasmMaxSize OBJECT-TYPE
  SYNTAX       INTEGER (0..65535)
  ::= { ipAddrEntry 5 }
```

where the OID of ipAddrEntry is 1.3.6.1.2.1.4.20.1. An instance of an ipAddrTable has values shown in the table below (from Subramanian):

<table>
<thead>
<tr>
<th>Row</th>
<th>ipAdEntAddr</th>
<th>ipAdEntIfIndex</th>
<th>ipAdEntNetMask</th>
<th>ipAdEntBcastAddr</th>
<th>ipAdEntReasmMaxSize</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>123.45.2.1</td>
<td>1</td>
<td>255.255.255.0</td>
<td>0</td>
<td>12000</td>
</tr>
<tr>
<td>2</td>
<td>123.45.3.4</td>
<td>3</td>
<td>255.255.0.0</td>
<td>1</td>
<td>12000</td>
</tr>
<tr>
<td>3</td>
<td>165.8.9.25</td>
<td>2</td>
<td>255.255.255.0</td>
<td>0</td>
<td>10000</td>
</tr>
<tr>
<td>4</td>
<td>9.96.8.138</td>
<td>4</td>
<td>255.255.255.0</td>
<td>0</td>
<td>15000</td>
</tr>
</tbody>
</table>

a. [2] What is the OID of the IpAdEntNetMask object that has the value 255.255.0.0? You can start your OID with “ipAddrEntry.” to avoid writing out the prefix “1.3.6.1.2.1.4.20.1”

b. [5] If GetNext was repeatedly applied to this table, starting with the OID of ipAddrEntry., then what would be the first 5 values returned in get responses?