Sri Lanka Institute of Information Technology

B.Sc. Honours Degree
in
Information Technology

Final Examination
Year 3, Semester I (2019)

IT3010 – Network Design and Management

Duration: 2 Hours

May 2019

Instructions to candidates:

- This paper is preceded by a 10-minutes reading period. The supervisor will indicate when answering may commence.
- This paper has 4 questions with a total of 100 marks.
- Answer all the questions in the booklet given.
- This paper contains 11 pages including the cover page.

Question 1 (25 marks)

You are the newly appointed Network Engineer for ABC Company. The company is in the process of large scale network expansion.

a) Name four issues you may face, as the Network Engineer. Discuss how you are going to solve them. (4 marks)

b) Describe one practical example where you can apply the ISO Network Management principles for the issues mentioned in part a) above. (4 marks)

c) The goal of Configuration Management is to monitor network and system configuration information so that the effects on network operation of various versions of hardware and software elements can be tracked and managed. Construct how this can assist in managing a network. (8 Marks)

d) When deciding on the various aspects of Security Management, differentiate does the network manager need to balance between? (4 Marks)

e) Justify the benefits of implementing a Performance Management System on a network. (5 Marks)

Question 2 (25 marks)

a) Explain the benefits of using an encoding rule such as TLV approach in relation to Abstract Syntax Notation 1 (ASN.1)? (3 Marks)

b) One of the operations available in SNMP v1 is Get-Next-Request. Construct a full description of this operation. In your answer you should draw a diagram of the operation and explain what it is used for. (7 Marks)

c) Part of the P&D company network is given in the Figure 2.1, illustrating its SNMP architecture. Use the given diagram to answer the following questions.

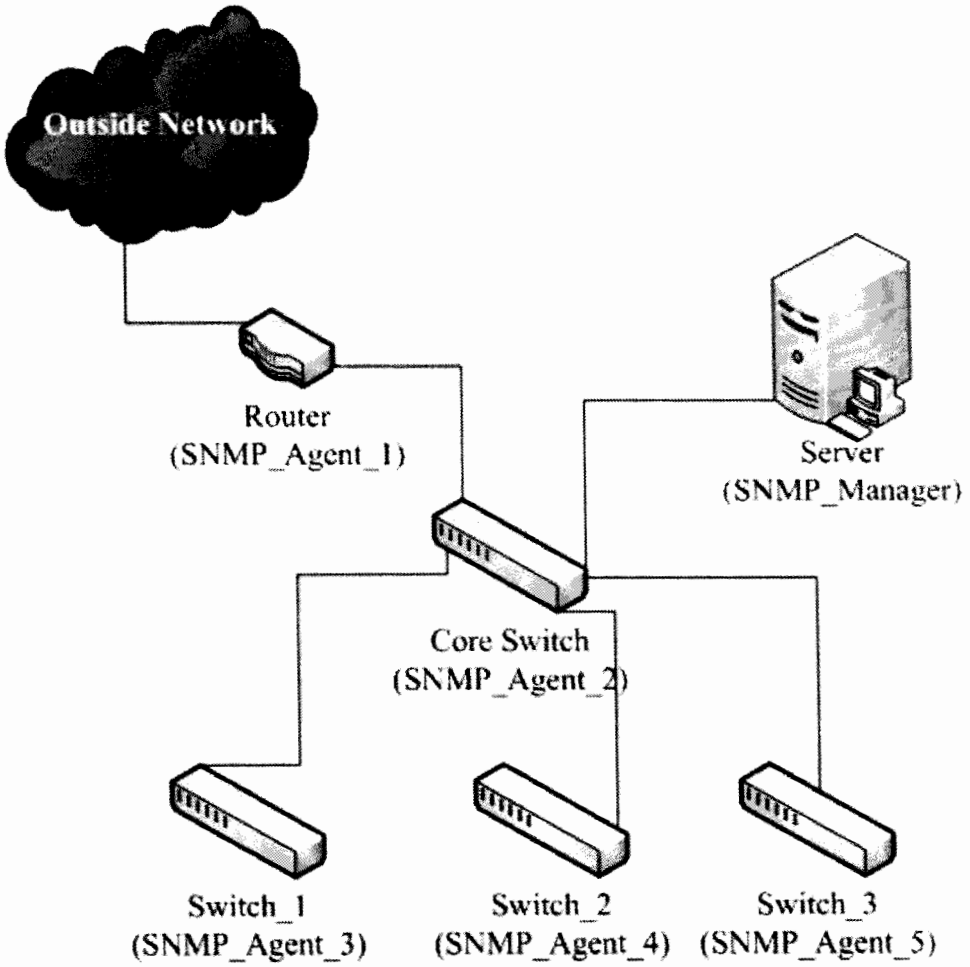

Figure 2.1

i. The SNMP message (in hexadecimal) given in Figure 2.2 is exchanged between the Server and Switch_2. Based on the message answer the following questions.

```
30 2B 02 01 02 04 08 49 6C 6F 76 65 4E 53 44 A1 1C 02 04

3B 0B 16 37 02 01 00 02 01 00 30 1C 30 0C 06 08 2B 06 01

02 01 01 01 00 05 00 30 0C 06 08 2B 06 01 02 01 01 03 00

05 00
```

Figure 2.2

a. Name the SNMP version used? (1 mark)

b. Outline the security/community string in (Symbolic)? (1 mark)

c. Identify the Request ID (decimal)? (1 mark)

d. Identify if there are any errors? (1 mark)

e. Are there any multiple number of Object identifiers defined? If so discover the Object ID (OID) number. (2 marks)

f. Is the message generated and sent by the SNMP_Manager or the SNMP_Agent ? Justify your answer in one sentence. (1 mark)

ii. A partial view of the MIB of a SNMP_Agent is given in Figure 2.3. Interpret the SNMP reply message to be sent for the SNMP request message mentioned in part i). Clearly mention the attributes and the values. (5 marks)

```
+-- -iso(1)
|
+-- -org(3)
      |
      +-- -dod(6)
             |
             +-- -Internet(1)
             |
             +-- -MGMT(2)
                 |
                  +-- -MIB-2(1)
                  |
                  +--system(1)
                        |
                        +-- -R-- String    sysDescr(1)
                        |        Textual Convention: DisplayString
                        |        Size: 0..255
                        |     value: SLIIT
                        +-- -R-- ObjID     sysObjectID(2)
```

```
|     value: NET-SNMP-MIB::netSnmpAgentOIDs.10
+-- -R-- TimeTicks sysUpTime(3)
|     value: 0:04:13.61
+-- -RW- String    sysContact(4)
|         Textual Convention: DisplayString
|         Size: 0..255
|         value: Root <root@localhost>
(configure /etc/snmp/snmp.local.conf)
+-- -RW- String    sysName(5)
|         Textual Convention: DisplayString
|         Size: 0..255
|     value: server
+-- -RW- String    sysLocation(6)
|         Textual Convention: DisplayString
|         Size: 0..255
|   value: Unknown (edit /etc/snmp/snmpd.conf)
```

Figure 2.3

iii. Distinguish objects that fall into the Fault Management category from the given in Figure 2.3 (3 marks)

Question 3 (25 marks)

a) A network map is a useful tool to a Network Manager, and each layer of the OSI reference model should be documented. Describe at least seven elements that should be documented at the network layer. (4 marks)

b) You are the newly appointed Network Engineer for ABC Company. The company is in the process of large scale network expansion. Construct why, when and how you would perform 'Baselining' in your network management process. (4 marks)

c) "Network baseline information is a key to detect anomalies."

   i. Do you agree to this statement or not? (2 marks)

   ii. Justify your answer. (3 marks)

d) Differentiate eight (8) pieces of non-network data that should be collected when mapping a network. (4 marks)

e) Interpret the use of at least five (5) Linux performance monitoring tools, including common command line arguments where required. (5 marks)

f) As a network engineer plan how long must you monitor to set a network performance baseline? (3 marks)

Question 4 (25 marks)

a) Explain the use of *SWAP* partition? (2 marks)

b) "A Network Engineer must monitor every aspect of a network using a Network Monitoring Tool".

i. Do you agree or disagree with the given statement? (1 mark)

ii. Give reasons for your answer in part i). (3 marks)

c) Operating system virtualization refers to the use of software to allow system hardware to run multiple instances of different operating systems concurrently, allowing you to run different applications requiring different operating systems on one computer system.

i. Name the main virtualization technique used in server virtualization. (2 marks)

ii. With the aid of a diagram describe the main virtualization technique mentioned in part i). (5 marks)

d) A partial network diagram of ABC Server Farm is given in Figure 4.1.

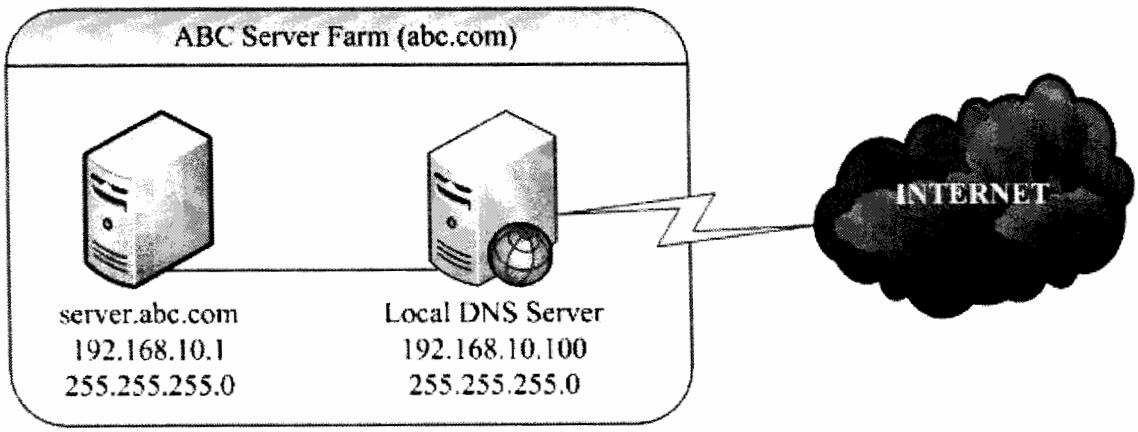

Figure 4.1

The network administrator of *ABC Server Farm* needs to configure the Local DNS Server with a forward lookup and a reverse lookup zone for *server.abc.com*. Copy the two partially created lookup zone files (Figure 4.2 and Figure 4.3) to your answer booklet and build the DNS entries as needed. (12 marks)

Forward.abc.sub

```
$TTL 86400
@  IN   SOA  dnsServer.abc.com.  root.abc.com.
(
2011071001   ;Serial
3600         ;Refresh
1800         ;Retry
604800       ;Expire
86400        ) ;Minimum TTL

//DNS connection mapping entry
//server IP address mapping entry
//server hostname mapping entry
```

Figure 4.2

reverse.abc.sub

```
$TTL 86400
@  IN   SOA  dnsServer.abc.com.  root.abc.com.
(
2011071001   ;Serial
3600         ;Refresh
1800         ;Retry
604800       ;Expire
86400        ) ;Minimum TTL

//DNS connection mapping entry
//domain pointer mapping entry
//server hostname mapping entry
//server IP address mapping entry
```

Figure 4.3

~ End of the Question Paper ~

Appendix

BER SNMP

Primitive ASN.1 Types	***Identifier in hex***
INTEGER	02
BIT STRING	03
OCTET STRING	04
NULL	05
OBJECT IDENTIFIER	06

Constructed ASN.1 type	***Identifier in hex***
SEQUENCE	30

Primitive SNMP application types	***Identifier in hex***
IpAddress	40
Counter (Counter32 in SNMPv2)	41
Gauge (Gauge32 in SNMPv 2)	42
TimeTicks	43
Opaque	44
NsapAddress	45
Counter64 (available only in SNMPv2)	46
Uinteger32 (available only in SNMPv2)	47

Context-specific types within an SNMP Message	***Identifier in hex***
GetRequest-PDU	A0
GetNextRequestPUD	A1
GetResponse-PDU (Response-PDU in SNMPv 2)	A2
SetRequest-PDU	A3
Trap-PDU (obsolete in SNMPv 2)	A4
GetBulkRequest-PDU (added in SNMPv 2)	A5
InformRequest-PDU (added in SNMPv 2)	A6
SNMPv2-Trap-PDU (added in SNMPv 2)	A7

ASCII Code Table

ASCII	Hex	Symbol	ASCII	Hex	Symbol	ASCII	Hex	Symbol	ASCII	Hex	Symbol
64	40	@	80	50	P	96	60	`	112	70	p
65	41	A	81	51	Q	97	61	a	113	71	q
66	42	B	82	52	R	98	62	b	114	72	r
67	43	C	83	53	S	99	63	c	115	73	s
68	44	D	84	54	T	100	64	d	116	74	t
69	45	E	85	55	U	101	65	e	117	75	u
70	46	F	86	56	V	102	66	f	118	76	v
71	47	G	87	57	W	103	67	g	119	77	w
72	48	H	88	58	X	104	68	h	120	78	x
73	49	I	89	59	Y	105	69	i	121	79	y
74	4A	J	90	5A	Z	106	6A	j	122	7A	z
75	4B	K	91	5B	[	107	6B	k	123	7B	{
76	4C	L	92	5C	\	108	6C	l	124	7C	|
77	4D	M	93	5D	]	109	6D	m	125	7D	}
78	4E	N	94	5E	^	110	6E	n	126	7E	~
79	4F	O	95	5F	_	111	6F	o	127	7F	

```
Message ::= SEQUENCE {
      version INTEGER {version-
1(0)},
      community OCTET STRING,
      data PDUs
}

PDUs::= CHOICE {
      get-request [0] IMPLICIT
PDU,
      get-next-request [1]
IMPLICIT PDU,
      get-response [2] IMPLICIT
PDU,
      set-request [3] IMPLICIT
PDU,
      trap [4] IMPLICIT Trap-PDU
}

PDU ::= SEQUENCE {
      request-id INTEGER,
      error-status INTEGER {
            noError (0),
            tooBig (1),
            noSuchName(2),
            badValue (3),
            readOnly (4),
            genErr (5)
            },
error-index INTEGER,
variable-bindings VarBindList
}

VarBindList ::= SEQUENCE OF
VarBind
VarBind ::= SEQUENCE {
      name ObjectName,
      value ObjectSyntax
}

ObjectName ::= OBJECT IDENTIFIER

ObjectSyntax ::= CHOICE {
      simple SimpleSyntax,
      application-wide
ApplicationSyntax
}
```

Zone File Resource Records

A

This refers to the Address record, which specifies an IP address to assign to a name, as in this example:

<host> IN A <IP-address>

If the <host> value is omitted, then an A record points to a default IP address for the top of the namespace. This system is the target for all non-FQDN requests.

NS

This refers to the NameServer record, which announces the authoritative nameservers for a particular zone.

The following illustrates the layout of an NS record:

IN NS <nameserver-name>

Here, <nameserver-name> should be an FQDN.

PTR

This refers to the PoinTeR record, which is designed to point to another part of the namespace.

PTR records are primarily used for reverse name resolution, as they point IP addresses back to a particular name.

A reverse name resolution zone file is used to translate an IP address in a particular namespace into an FQDN. It looks very similar to a standard zone file, except that PTR resource records are used to link the IP addresses to a fully qualified domain name.

The following illustrates the layout of a PTR record:

<last-IP-digit> IN PTR <FQDN-of-system>

The <last-IP-digit> is the last number in an IP address which points to a particular system's FQDN.