TTM4128 Exam 21/5 2013 Engelsk

Appendix 1. Simplified version of SMI for SNMP version 2

Appendix 2. ASN.1 Encoding

Task 1. SNMP (40%)

A simplified version of SMI for SNMP version 2 is found as Appendix 1.

1.1. Explain the general role of SMI in the SNMP Framework and explain short the principal role and usage of the definitions in the various parts denoted as Part A, C and D.

Solution:

SMI is an ASN.1 specification defining   types and macros as well as instances of object identifiers to be used for MIB definitions.

Part A: Instances of Object Identifiers of nodes in the MIB tree.

Part C: Define the types ObjectName and NotificationName to be used in Varbind-fields. Both are OBJECT IDENTIFIERS.

Part D: Define the SNMP specific ASN.1 types to be used in the definition of MIB types as well as SNMP protocol PDUs. The ASN.1 type SEQUENCE to be used in the definition of Tables as well as PDUs is not included.

1.2 Explain shortly the role and usage of the macros defined in Part B, E and F.

Solution:

Part B: Module Identity Macro is used to give administrative information to ASN.1 Modules. This includes a reference to MIB node. Module identity macro is used to define MIB nodes used for administrative purposes other than identifying a Module, Mib object or a Notification

Part E: OBJECT-TYPE MACRO used to define MIB types

Part F: NOTIFICATION-TYPE MACRO used to define Notifications.

The Varbind field in SNMPv2 protocol is defined as VarBind ::= SEQUENCE {name ObjectName, CHOICE {value ObjectSyntax, unSpecified   NULL, noSuchObject[0] IMPLICIT NULL, noSuchInstance[1] IMPLICIT NULL, endOfMibView[2] IMPLICIT NULL } }

1.3 Explain shortly the usage of the VarBind-field. What is the principal difference between the usage of the VarBind-field In SNMP version 2 protocol compared to SMP version 1 protocol with respect to notifications?

1.4 An instance of a managed object value is sent from an agent to manager. The Object Syntax is Counter32 with value 16. The object identifier of the managed object type is iso.org.dod.internet.mgmt.mib-2.ip.ipReasmReqds, where ip::= {mib-2 4} and ipReasmReqds::= {ip 14}.

What is the BER encoding of the Varbind field? Give the solution in hexadecimal representation.

1.5 SNMP is now going to be used in a home for management of electrical appliances. The equipment involved is a PC, a water heater and a temperature controlled oven. Concerning the water heater as well as the oven, the output temperature shall be manageable. In addition it shall be possible to turn the heater as well as the oven on and off.

Please propose two new MIB object types. Sketch proposed attribute instances defined in the macros in Appendix 1. The OBJECT IDENTIFIERS of MIB objects and notifications can freely be

chosen by using the MIB sub-tree of the MIB node temperaturecontrol ::= {enterprises ntnu telematics exam 1}, where

ntnu::= {enterprises 1234 }, telematics ::= {ntnu 1} and exam::= {telematics 1}

Task 2. WEB-based management (30%)

2.1. In the ISO and SNMP management frameworks various aspects of management functionality are described in different models such as Organisation Model, Information Model, Communication Model and Functional Model.

What are the elements of the information model of WBEM (WEB-Based Enterprise Management) and what are the languages used to represent these elements.

2.2 WS-Management (WEB-service based management) is based on the SOAP protocol. Explain shortly the structure of the SOAP protocol and sketch the principal structure and content of a SOAP message.

Solution:

2.3 In the SNMP protocol there is a set of defined SNMP messages. In WEB-services based management the management messages are defined using operations and methods. Give some examples of the operations/methods applied in WS-management.

Solution:

WS-Management

❏ Specification: core set of web services and operations central to system managment:

❖ DISCOVER the presence of management resources and navigate between them

❖ GET, PUT (update), CREATE, and DELETE individual resource instances, such as settings and dynamic values

❖ ENUMERATE the contents of containers and collections, such as large tables and logs

❖ SUBSCRIBE to events emitted by managed resources

❖ EXECUTE specific management methods with strongly typed input and output parameters

WEB-based   6

2.4   Figure 1 presents one operation between management entities. Explain the operation, the xml name spaces and the various elements of the header and body and used in this operation. Explain the web service addressing concepts as well as the resource model concepts applied.

Solution: The message is a Put operation. A response PutResponse is expected. The three xml name spaces references defined are xmlns:s, xmlns:wsa and xmlns:xxx . These are used to refer to general soap concepts, web services addressing concepts and specific resource model concepts.

The wsa (web services addressing) concepts used in this message are:

wsa: ReplyTo, is used for the address to reply to in a message where a response is expected.

wsa: To, is the address of the Put operation

wsa: Action, indicates the being invoked against the resource

wsa: MessageID, indicates a uniqued ID for the message

The xxx (resource) concepts used are Customer ID, Region, Customer with sub attributes first, last, address, city, state zip.

```
<s:Envelope
    xmlns:s="http://www.w3.org/2003/05/soap-envelope"
    xmlns:wsa="http://schemas.xmlsoap.org/ws/2004/08/addressing"
    xmlns:xxx="http://fabrikam123.example.com/resource-model" >
  <s:Header>
    <wsa:ReplyTo>
      <wsa:Address>
        soap://www.fabrikam123.example.org/sender
      </wsa:Address>
    </wsa:ReplyTo>
    <wsa:To>soap://www.example.org/pushport</wsa:To>
    <xxx:CustomerID>732199</xxx:CustomerID>
    <xxx:Region>EMEA</xxx:Region>
    <wsa:Action>
      http://schemas.xmlsoap.org/ws/2004/09/transfer/Put
    </wsa:Action>
    <wsa:MessageID>
      uuid:00000000-0000-0000-C000-000000000047
    </wsa:MessageID>
  </s:Header>
  <s:Body>
    <xxx:Customer>
      <xxx:first>Roy</xxx:first><xxx:last>Hill</xxx:last>
      <xxx:address>321 Main Street</xxx:address>
      <xxx:city>Manhattan Beach</xxx:city>
      <xxx:state>CA</xxx:state>
      <xxx:zip>90266</xxx:zip>
    </xxx:Customer>
  </s:Body>
</s:Envelope>
```

Figure 1.

Task 3. Network management of a mobile network (30%)

Assume a mobile telephone network operator. The physical units of the mobile network consists of mobile switching equipment with 2 Mobile Switching Centers (MSCs) and 10 Base Station Controllers (BSCs). A network management system (NMS) will be installed on 4 physical nodes to monitor the mobile network. These nodes are denoted as IT Node 1 – IT Node 4. One of the IT nodes has the role as the Network Operation Center (NOC). The system is illustrated in Figure 2.

NMS need to get information about the state of MSCs and BSCs. The MSCs and BSCs need to be able to inform the NMS about critical system states. In addition the 4 IT nodes collect data from the MSCs and BSCs and store them in log files. It is not important here which IT Node that are managing the various MSC and BSC, i.e. any arrangement could be applied here with respect to which of the IT nodes that is managing which of the MSCs and BSCs.

All of the IT nodes will have log file analyzers installed. Alarms and reports from the IT Nodes are sent to NOC. The log file analyzers will immediately generate an alarm in case of a critical system state discovered and will also periodically send reports in case of normal operations.
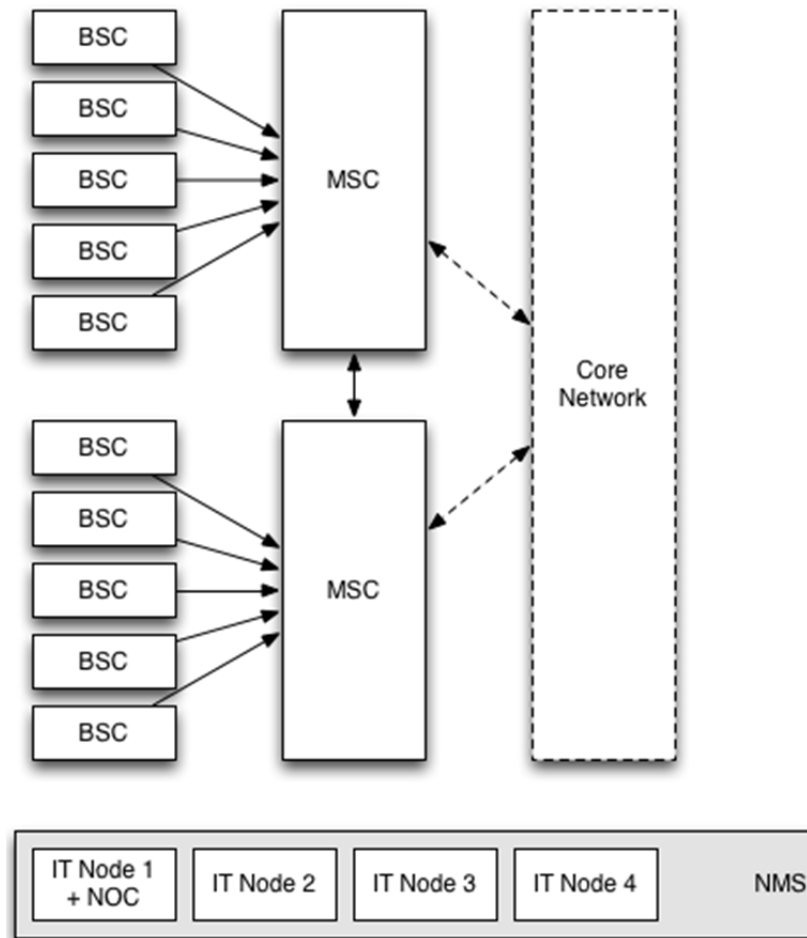
Figure 2.

3.1 The company wants to use SNMP for network management functions described.

Considering the components of the SNMP Organisation Model, which SNMP components are needed, and in which physical unit will they execute?

Answer:

SNMP Manager: IT nodes (are managing BSCs/MSCs) and NOC (is managing IT nodes)

SNMP Agent: BSCs, MSCs and IT Nodes

3.2. SNMP has the two basic types of PDUs, i.e. *request/response* and *trap*. Give a brief description of the application area of these PDUs. Explain where request/response and traps are used in the described network management scheme.

Answer:

Request/responses are used by the manager to poll values of managed variables and to set values to variables used for control actions. Traps are used by the agents to inform on own initiative about events or states in the managed system. This can be regular sent information or state changes of interest for the manager.

Application of Traps: BSCs/MSCs send traps to IT nodes and IT nodes send traps to NOC

Application of Request/Response: IT nodes sends Requests to BSC and MSC

3.3. The company will use the SNMP implementation of Net-snmp. Explain which elements of Net-snmp that will be installed on the various physical units.

Answer:

Snmpd on MSCs/BSCs and IT Node 2 – IT Node 4, snmpget commands on IT nodes

Snmptrapd on IT nodes, snmptrap on MSCs/BSCs and IT Node 2 – IT Node 4

3.4. NOC is now outsourced to a service provider, and communication to/from NOC is only possible using the http protocol. Explain how the communication between the NOC and IT Nodes can be realized with respect to protocol, service definition and addressing.

Answer:

Instead of sending SNMP traps, the log file analyzer will send SOAP messages to a web service. The web service is described in a WSDL file which will be the basis for the client.

Required: IP address, Port, WSDL