**Q.2 a. With the help of suitable diagram explain the architecture of the telephone network model.**

**Answer:**

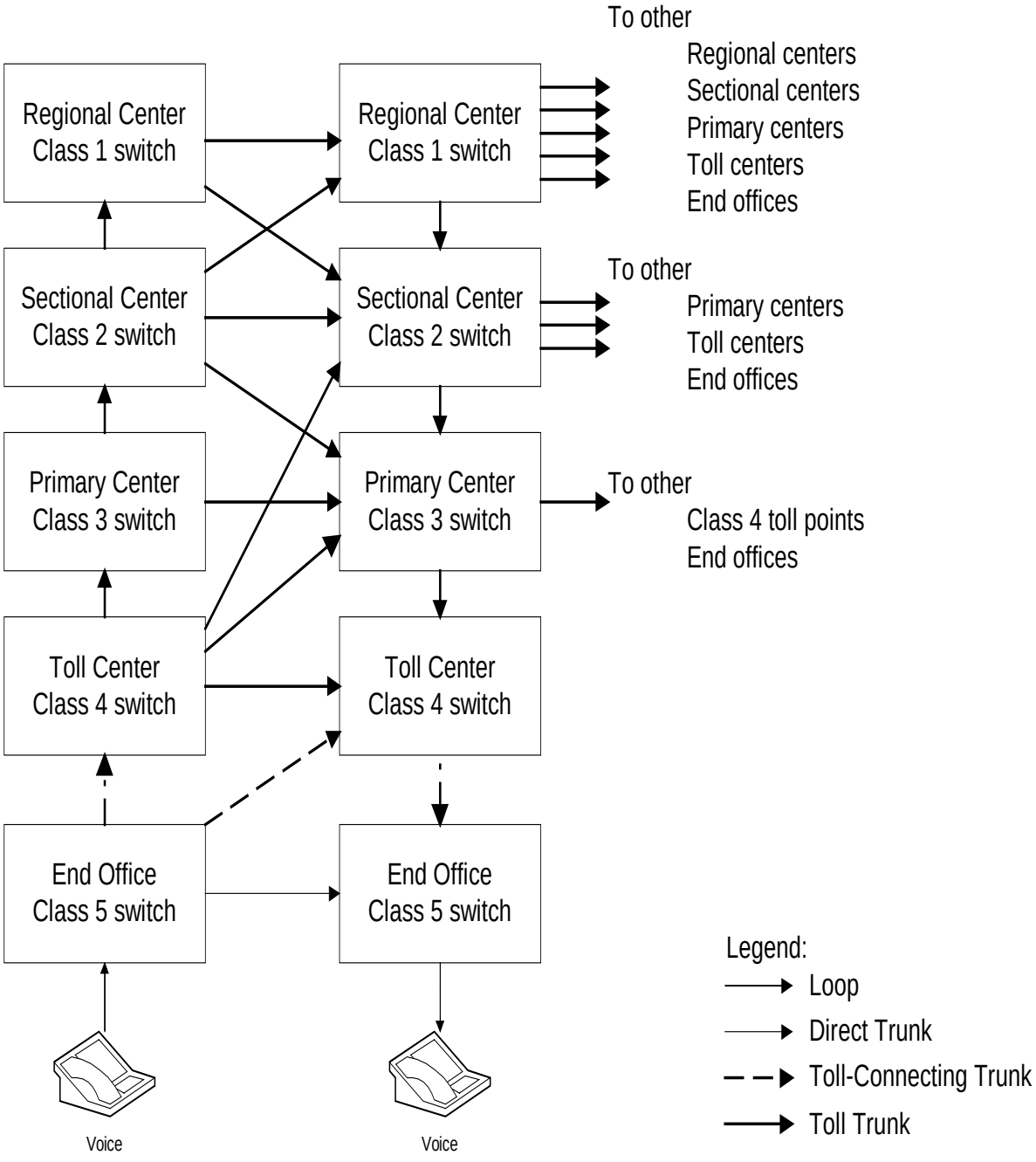



**Figure 1.1 Telephone Network Model**

**b. Explain different OSI network management applications defined by ISO.**

**Answer:** Page 68, 69 & 70

**Q.3a. List the five Network Management Standards with their salient points.**

**Answer:**

**Table 3.1 Network Management Standards**

| Standard | Salient Points |
|---|---|
| OSI / CMIP (Common Management Information Protocol) | ■ International standard (ISO / OSI)<br>■ Management of data communications network - LAN and WAN<br>■ Deals with all 7 OSI layers<br>■ Most complete<br>■ Object oriented – classes, inheritance<br>■ Well structured and layered<br>■ Consumes large resource in implementation – complex |
| SNMP / Internet (Simple Network Management Protocol) | ■ Industry standard (IETF)<br>■ Originally intended for management of Internet components, currently adopted for WAN and telecommunication systems<br>■ Easy to implement – uses scalar objects<br>■ Most widely implemented |
| TMN (Telecom Management Network) | ■ International standard (ITU-T)<br>■ Management of telecommunications network – service providers<br>■ Based on OSI network management framework<br>■ Addresses both network and administrative aspects of management – Service and Business Management |
| IEEE | ■ IEEE standards adopted internationally<br>■ Addresses LAN and MAN management<br>■ Adopts OSI standards significantly<br>■ Deals with first two layers of OSI RM – Physical and Data Link |
| Web-based Management | ■ Web-Based Enterprise Management (WBEM) – spec by DMTF<br>■ Java Management Extensions (JMX) – called earlier JMAPI |

**b. Describe the two-tier Network Management organizational model with diagram.**

**Answer:**

The organization model describes the components of network management and their relationships. Figure 3.2 shows a representation of a two-tier model. Network objects consist of network elements such as hosts, hubs, bridges, routers, etc. They can be classified into managed and unmanaged objects or elements. The managed elements have a management process running in them called an agent. The unmanaged elements do not have a management process running in them. For example, one can buy a managed or unmanaged hub. Obviously the managed hub has management capability built into it and hence is more expensive than the unmanaged hub, which does not have an agent running in it. The manager communicates with the agent in the managed element.

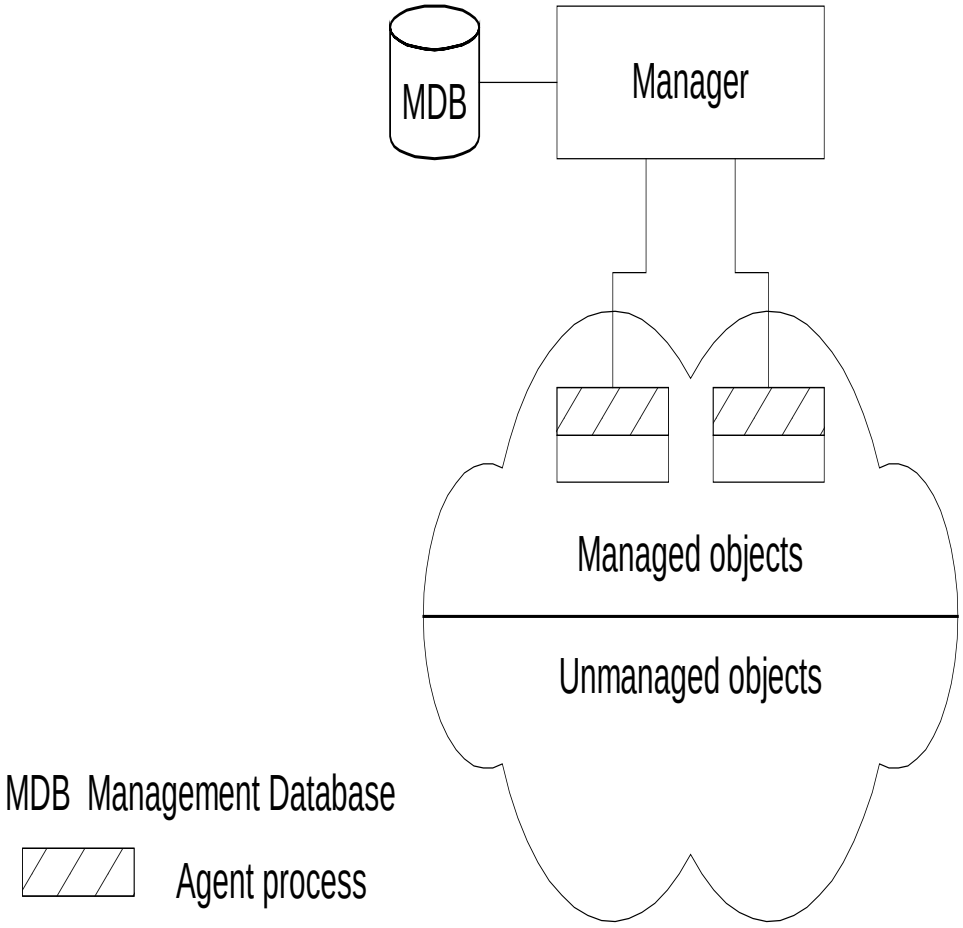



**Figure 3.2 Two-Tier Network Mangement Organization Model**

**Q.4 a. List SNMP based ASN.1 data type structures with supported data types and appropriate comments.**

**Answer:**

| Structure | Data Type | Comments |
|---|---|---|
| Primitive types | INTEGER | Subtype INTEGER (n1..nN)<br>Special case: Enumerated INTEGER type |
| | OCTET STRING | 8-bit bytes binary and textual data<br>Subtypes can be specified by either range or fixed |
| | OBJECT IDENTIFIER | Object position in MIB |
| | NULL | Placeholder |

| | | |
|---|---|---|
| Defined types | NetworkAddress | Not used |
| | IpAddress | Dotted decimal IP address |
| | Counter | Wrap-around, non-negative integer, monotonically increasing, max 2^32 -1 |
| | Gauge | Capped, non-negative integer, increase or decrease |
| | TimeTicks | Non-negative integer in hundredths of second units |
| | Opaque | Application-wide arbitrary ASN.1 syntax, double wrapped OCTET STRING |

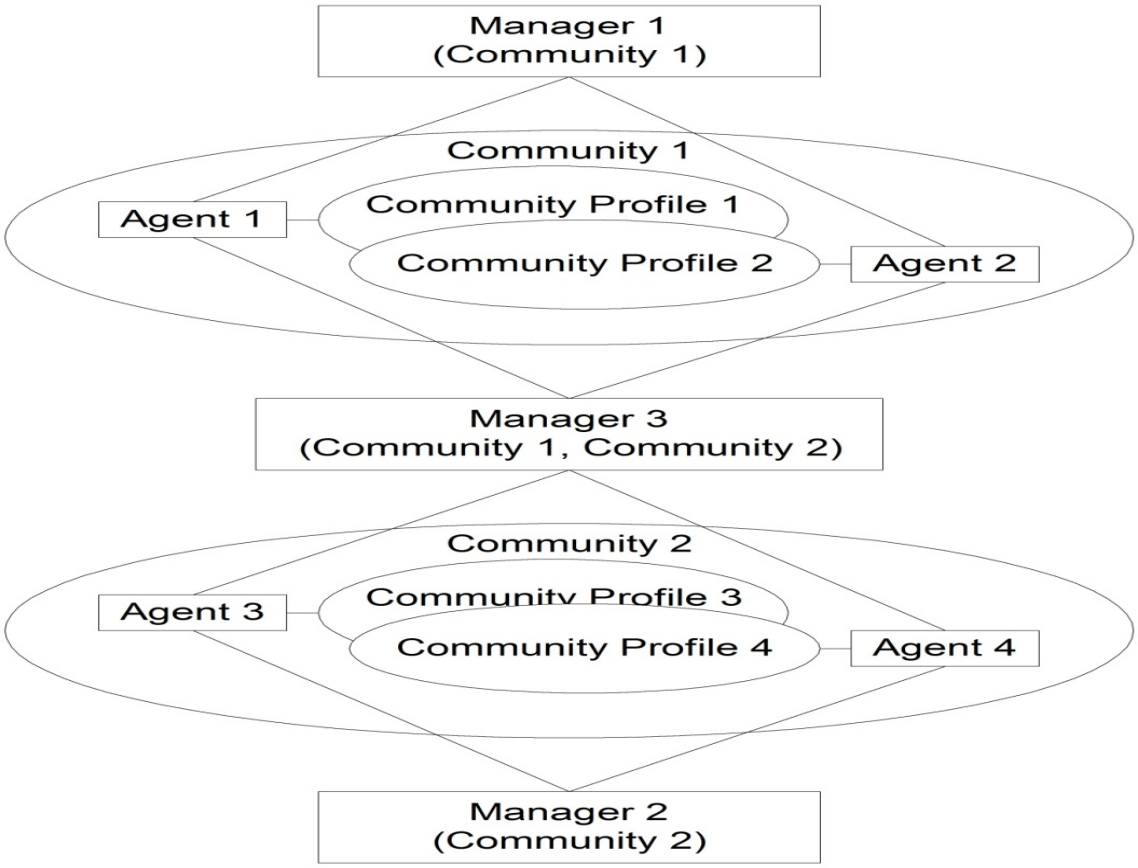
| | | |
|---|---|---|
| Constructor Types | SEQUENCE | List Maker |
| | SEQUENCE OF | Table Maker |

**b. Draw a diagram for SNMP Network Management Architecture and explain the data path between the manager application process and the agent application process via the four transport function protocols.**

**Answer:** Page 181 to 182

**Q.5 a. Define an SNMP access policy in SNMP management. Elaborate using a diagram.**

**Answer:**
A pairing of an SNMP community with an SNMP community profile is defined as an **SNMP access policy**. This defines the administrative model of SNMP management. Figure below shows an example of three network management systems in three network operation centers (NOC) having different access to different community domains.




Agents 1 and 2 belong to Community 1. However, they do have two different community profiles, community profiles 1 and 2. Manager 1, which is part of Community 1, can communicate with both Agents 1 and 2. However, it cannot communicate with Agents 3 and 4 belonging to Community 2. Manager 2 has access to them as it also belongs to Community 2. Agent 3 has community profile 3 and Agent 4 has community profile 4. Manager 3 has access to both Community 1 and 2 and hence can communicate with all the agents. We can picture an enterprise network management fitting this scenario. If a corporation has two operations in two cities, Manager 1 in NOC 1 and Manager 2 in NOC 2 are responsible for managing their respective domains. A top view of the overall operations can be viewed and managed by NOC 3 in the headquarters operation.

**b. What is Remote Monitoring?**

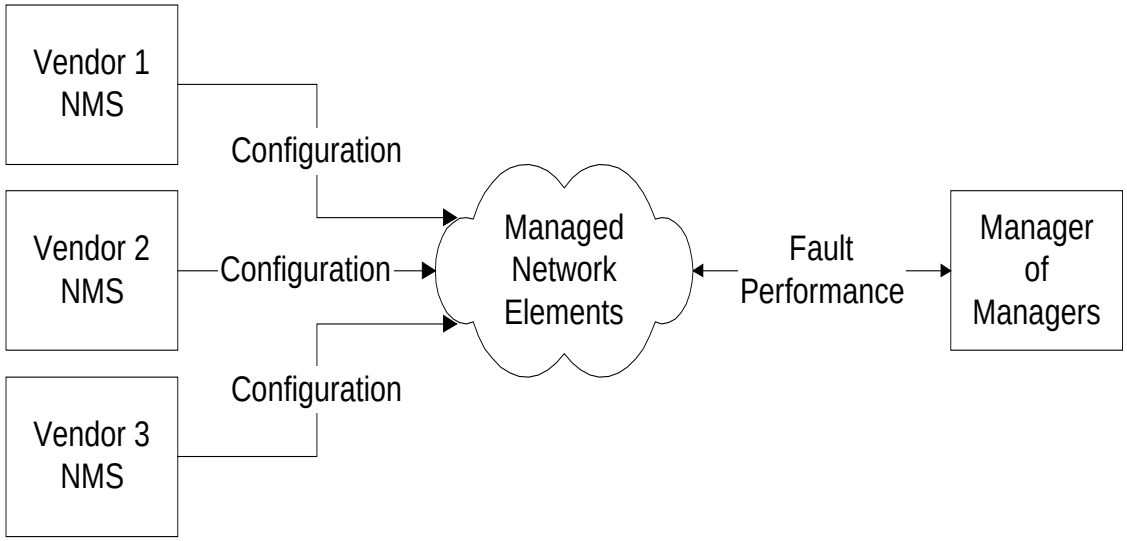
**Answer:**
SNMP messages go across the network between a manager and an agent using a tool that "sniffs" every packet that is going across a local area network (LAN), opens it, and analyzes it. It is a passive operation and does nothing to the packets, which continue to proceed to their destinations. This is called monitoring or probing the network and the device that does the function is called the network monitor or the probe. Let us distinguish between the two components of a probe: (1) physical object that is connected to the transmission medium and (2) processor, which analyzes the data. If both are at the same place geographically, it is a local probe, which is how sniffers used to function. The monitored information gathered and analyzed locally can be transmitted to a remote network management station. In such a case, remotely monitoring the network using a probe is referred to as **remote network monitoring** or **RMON.**

**Q.6 a. Write the syntax and one example for the following SNMP command-line tools**

**(i) SNMP Get Command (ii) SNMP Get-Next Command**
**(iii) SNMP Walk Command**

**Answer:** Page 497 to 498

**b. With the help of suitable diagram, describe a functional NMS Configuration?**
**Answer:**




**Q7 a. What is meant by network provisioning? How is it implemented in the ATM technology?**

**Answer:**

**Network provisioning,** also called circuit provisioning in the telephone industry, is an automated process. The design of a trunk (circuit from the originating switching center to the destination switching center) and a special service circuit (customized for customer specifications) is done by application programs written in operation systems. Planning systems and inventory systems are integrated with design systems to build a system of systems.

Thus, a circuit designed for the future automatically derives its turn-up date from the planning system and ensures that the components are available in the inventory system. Likewise, when a circuit is to be disconnected, it is coordinated with the planning system and the freed-up components are added to the inventory system. Thus, the design system is made aware of the availability of components for future designs.

Network provisioning in broadband wireless area network (WAN) communication using ATM technology is complex. The virtual-circuit concept is always used and has to be taken into account in the provisioning process. The switches are cell-based, in contrast to frame-based packet switching. Each ATM switch has knowledge of the virtual path–virtual circuit (VP–VC) of each session connection only to the neighboring nodes and not end-to-end. Each ATM switch vendor has built their proprietary assignment of VP–VC for end-to-end design into the ATM switch. The architecture of end-to-end proisioning of ATM circuits could be either centralized or distributed, and is based on whether the circuit is a permanent virtual circuit (PVC) or a switched virtual circuit (SVC). Commercial products, which provision PVCs across multiple vendor products, have recently been introduced in the market.

**b. Describe the basic five points guide to setting up policies and procedures**

**Answer:**

The basic five points guide to setting up policies and procedures is:

1. Identify what you are trying to protect
2. Determine what you are trying to protect it from
3. Determine how likely the threats are
4. Implement measures, which will protect your assets in a cost-effective manner
5. Review the process continuously and make improvements to each item if a weakness is found

**Q8. a. How we classify reports under report management? List the different category for each report.**

**Answer:** Page 575 to 576

**b. Define the term Service level management. What is the objective of service level management?**

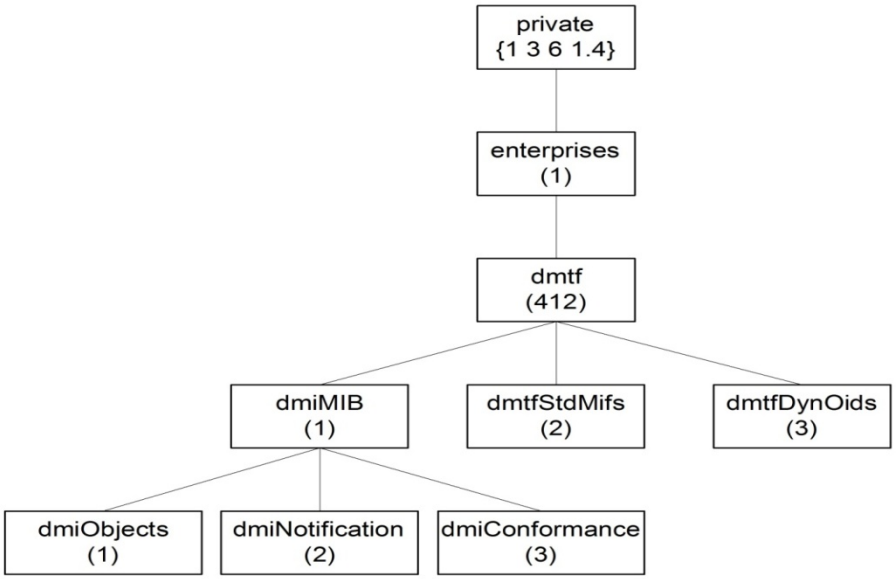
**Answer:**
Service level management is defined as the process of:
(1) Identifying services and characteristics associated with them,
(2) Negotiating an SLA,
(3) Deploying agents to monitor and control the performance of network, systems, and application components, and
(4) Producing service level reports. The definition of service level management is compared with the quality of service (QoS) management defined by the Object Modeling Group (OMG). The characteristics associated with services are service parameters, service levels, component parameters, and component-to-service mappings. A service parameter is an index into the performance of a service—for example, the availability of a business application for a customer. The business application depends upon various underlying components—for example, network devices, systems, and applications on the systems. Thus, there is a one-to-many mapping between the service parameter and the underlying component parameters.

The availability of the business application in the SLA can be defined in terms of the availability of these underlying components. In this case, the availability service parameter is a function of the availability component parameter. An SLA is a contract between the service provider and the customer, specifying the services to be provided and the quality of those services that the service provider promises to meet. The pricing for the service depends on the QoS commitment.

The **objective of service level management is** to ensure customer satisfaction by meeting or exceeding the commitments made in the SLA and to guide policy management. In addition, it provides input to the business management system.

**Q9 a. Explain Desktop Management Interface with a diagram.**

**Answer:**
The Desktop Management Interface (DMI) is an industry standard generated by the Desktop Management Task Force (DMTF). The task force was formed in 1992 to develop, support, and maintain management standards for PC systems and products. In DMI, Managed Objects with attributes are defined by ASN.1 syntax. Objects are grouped, and multiple instantiations are defined from tables, as in SNMP management. However, the tables do not have all the capabilities of SNMPv2. DMI Managed Objects may be managed by an SNMP manager, using the DMI MIB shown in Figure below.



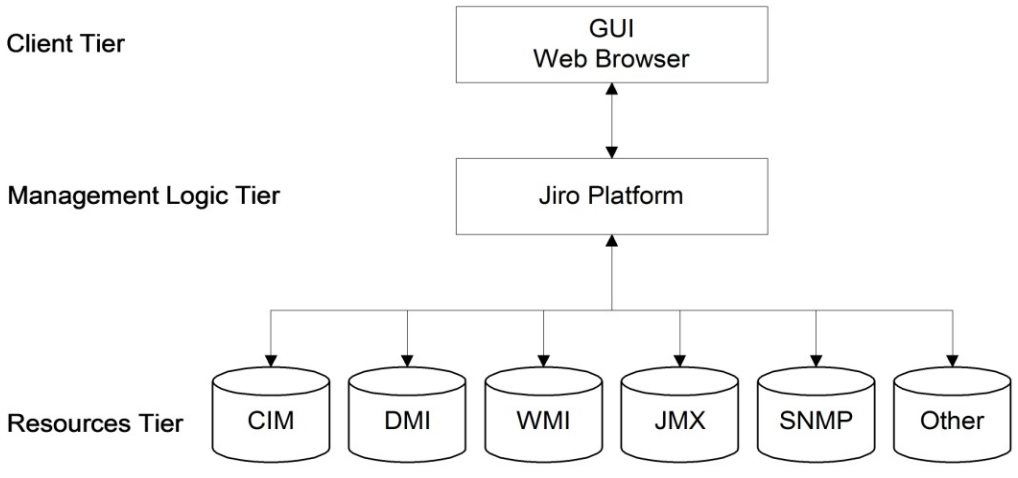

**DMI MIB**

It is a subnode under dmtf, which is in the enterprises branch of the Internet MIB. The two MIBs, dmtfStdMifs and dmtfDynOids, are reserved for future use by new standard MIBs and remote SNMP/DMI support. The DMI MIB defines MOs, notification, and conformance groups.

**b. What is Jiro? Draw a diagram to explain.**

**Answer:**

Jiro (pronounced gyro) is a platform for managing storage area network (SAN). It has three-tier architecture as illustrated in the diagram below:




**Jiro Architecture**

Jiro Implements an infrastructure for creating integrated and automated management software in a distributed, cross-platform environment. Jiro introduces a middle tier of management between the client/GUI and other Java-based agent technologies such as JMX and JDMK. This middle tier is where the automation of management take place.

Jiro divides a management environment into domains. Each domain only a shared management server (a Java Virtual Machine running Jiro services) that represents the domain as a whole. Other private management server can host management services that are specific to their host. Object model supports distributed objects based on Java object model. Component model is a set of core components used to build portable applications.

The need for the Jiro technology because of a storage sector dominated by point products that are not compatible with each other of information that are difficult to integrate, complex to manage, or that actually prohibit cross-platform information management are the problems of the present storage landscape. Its history began when it was decided to develop a Java language extension designed to make it easier for the developer to create new storage management applications, enable faster design cycles, lower development costs, and offer a wider market potential.

## Text Book

**Network Management Principles & Practice, Mani Subramanian, Pearson Education, 2000**