Network Administration/Management

The ISO network management model partitions the functions of network management into five conceptual areas:

i. Configuration Management - exists to collect and monitor configuration information so that the effects of changes in hardware and software can be managed. From the collected information, a topographical view of the network may be constructed.
ii. Fault Management - detects abnormal network behavior (error detection, error diagnosis and error recovery).
iii. Performance Management – predicting trends in network performance by gathering statistical data about the behavior of managed objects and traffic flows between them. This facilitates the proactive upgrading and reconfiguration of the network to meet the changing needs of the users
iv. Accounting Management - determining the utilization of network services by individuals or groups of users and regulating such usage according to policy (e.g. apportioning network services amongst users to reduce network congestion; QoS).
v. Security Management – control access to network resources by policies to prevent (intentional or accidental) sabotage

Security management involves:

i. definition of user-sets (varying levels of authorization);
ii. identification of sensitive network resources;
iii. mapping sensitive network resources to user-sets;
iv. monitoring access points (firewalls are a security sub-system);
v. logging unauthorized access attempts and intrusion detection.

1. Managing network infrastructures

Architectural concepts

1. *The element level (*network components such as switches, routers, hubs, and interface equipment)
2. *The network level (*decisions about how to re-route traffic to alleviate network congestion or alert personnel of more serious problems)
3. *The service level (*cost reduction, customer service, and rapid creation of new services)
4. *The business level (*decisions about which services are successful, profit and cost centers, and overall business performance)
5. *The telecommunications management network (TMN)*

With the diverse requirements of each management level, how can one system provide the support mandated by an organization?

Layering allows the design of an architecture that mandates software operating at specific levels and communicating between adjacent levels via a well-defined interface. Such architecture is defined by the TMN. The TMN is a hierarchy that distributes functionality over five levels.

The lowest layer contains the network elements (such as routers or switches). Management information pertaining to network elements percolates up to the network management layer, which provides the five functions of management network wide.

Various networks, sub-networks and elements may be integrated at this level. The service management layer allows us to view a collection of network elements as a service (for example, Frame-Relay is a service level view of the ATM network). At the top of the framework is the business management layer, which provides a management view comprised of services.

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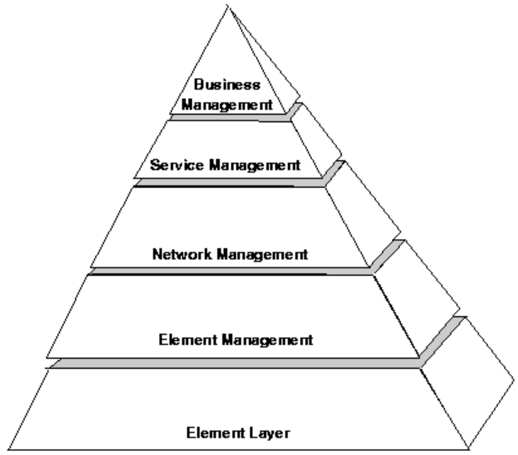

Fig 14: TMN Hierarchy

[LECTURE NOTE 'A Brief History of TMN']

TMN is based on the OSI management framework and uses an object-oriented approach, with managed information in network resources modeled as attributes in managed objects. Management functions are performed by operations comprised of common management information service (CMIS) primitives.
A network's managed information, as well as the rules by which that information is presented and managed, is referred to as the management information base (MIB). Processes that manage the information are called management entities. A management entity can take on one of two possible roles: manager or agent.
Manager and agent processes send and receive requests and notifications using the CMIP.

TMN architecture and interfaces, defined in the ITU M.3000 recommendation series, build on existing open systems interconnection (OSI) standards. These standards include, but are not limited to:

- **common management information protocol (CMIP)**—defines management services exchanged between peer entities
- **guideline for definition of managed objects (GDMO)**—provides templates for classifying and describing managed resources
- **abstract syntax notation one (ASN. 1)**—provides syntax rules for data types
- **open systems interconnect reference model**—defines the seven- layer OSI reference model

The benefits of TMN (multivendor, interoperable, extensible, scalable, and object-oriented) are important because they allow companies to manage complex and dynamic networks and services, and they allow those same companies to continue to expand services, maintain quality, and protect legacy investments. TMN describes telecom network management from several viewpoints: a logical or business model, a functional model, and a set of standard interfaces. Each of these is critically important and interdependent.

TMN Functional Model (details in lecNote)

TMN Functional Components

System Component	Description
WS	**The WS performs workstation functions. WSs translate information between TMN format and a displayable format for the user.**
data communication network (DCN)	**The DCN is the communication network within a TMN. The DCN represents OSI layers 1 to 3.**
OS	**performs operations system functions, including operations monitoring and controlling telecommunications- management functions; the OS can also provide some of the mediation, q- adaption, and WS functions.**

System Component	Description
MD	**performs mediation between local TMN interfaces and the OS information model; mediation function may be needed to ensure that the information, scope, and functionality are presented in the exact way that the OS expects. Mediation functions can be implemented across hierarchies of cascaded MDs.**
QA	**The QA enables the TMN to manage NEs that have non-TMN interfaces. The QA translates between TMN and non-TMN interfaces. A TL1 Q-adapter, for example, translates between a TL1 ASCII message- based protocol and the CMIP, the TMN interface protocol; likewise, simple network management protocol (SNMP) Q-adapter translates between SNMP and CMIP.**
NE	**In the scope of TMN, an NE contains manageable information that is monitored and controlled by an OS. In order to be managed within the scope of TMN, an NE must have a standard TMN interface. If an NE does not have a standard interface, the NE can still be managed via a Q-adapter. The NE provides the OS with a representation of its manageable information and functionality (i.e., the MIB). Note that the NE contains NE functionality—that is, the functions required in order to be managed by an OS. As a building block, the actual NE can also contain its own OS function, as well as QA function, MD function, etc.**

TMN Standard Interfaces

In the TMN model, specific interfaces between two TMN components communicate with one another. The TMN interfaces are as follows:

Table 2. TMN Interfaces

Interface	Description
Q	**The Q interface exists between two TMN-conformant functional blocks that are within the same TMN domain. The Qx carries information that is shared between the MD and the NEs that it supports.** **The Qx interface exists between the NE and MD; QA and MD; and MD and MD. The Q3 interface is the OS= interface. Any functional component that interfaces directly to the OS uses the Q3 interface. In other words, the Q3 interface is between the NE and OS; QA and OS; MD and OS; and OS and OS**
F	**The F interface exists between a WS and OS, and between a WS and MD**
X	**The X interface exists between two TMN-conformant OSs in two separate domains, or between a TMN-conformant OS and another OS in a non-TMN network.**