Chapter 10

Telecommunications Management Network

Objectives

- Telecommunications Management Network, TMN
- Concept of Operations Support System, OSS
- TMN conceptual model includes:
  - Customers
  - Service providers
  - Network
  - Operations support systems, OSSs
  - System operators
- TMN standards and documentation
- TMN architecture
  - Functional
  - Physical
  - Informational
- TMN service management architecture
  - Network element
  - Element management
  - Network management
  - Service management
  - Business management
- TMN service management
  - Operations, Administration, Maintenance, Provisioning; OAMP
- TMN implementation methodologies
  - OMNIPoint
  - eTOM

Why TMN

- Necessity for **interoperability basis**
- Need for management of more than just the network components
- Services - internal and external need management
- Business management needs to be addressed
- Networks / subnetworks need to be managed
- TMN joint effort by ITU-T and ISO

Notes

OS: Trunk Testing System

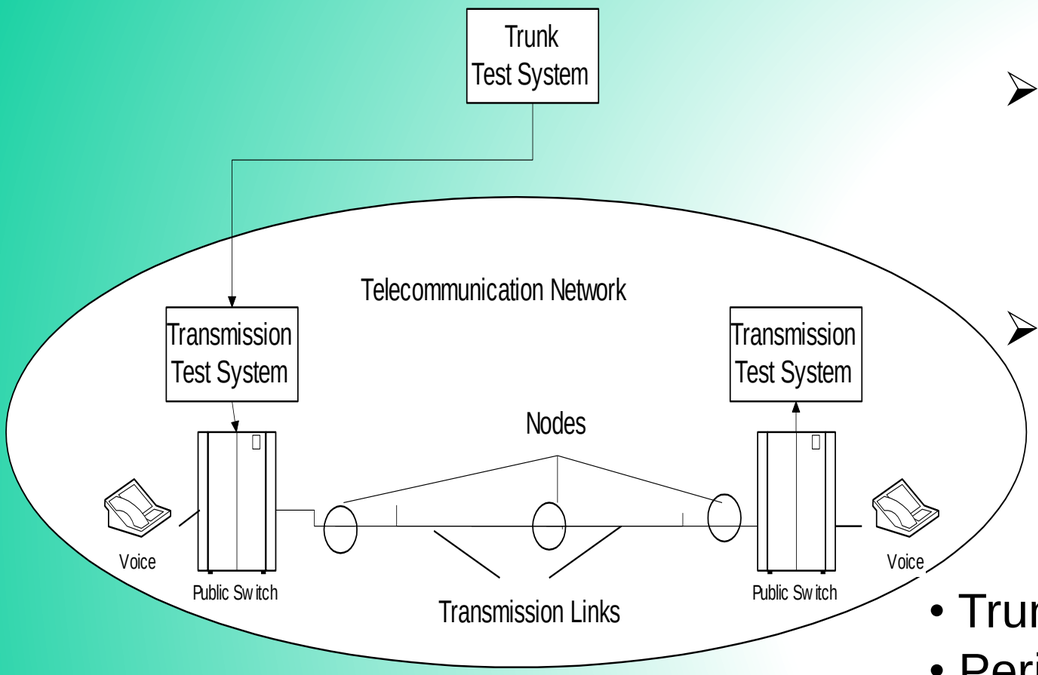


Figure 10.1 Operations Support System for Network Transmission

- TMN is built using the building blocks of the operations support system (OS or OSS).
- The operations system does not directly play a role in the information transfer, but helps in the OAMP (operation, administration, maintenance, and provisioning) of network and information systems.
- Figure 10.1 and Figure 10.2 present two **examples of OS** that are used in the operation of telephone network and services: **trunk test system and traffic measurement system**

Notes

- Trunk is a logical connection between two **switching nodes**
- Periodic measurement of loss and signal-to-noise (S/N) ratio of all trunks
- Failing threshold set for QoS; failing trunks are removed out of service before the customer complains

The above two examples of OS illustrate the necessity of their role in the OAMP of telecommunication network. They are part of the telecommunications network management activities, and fall under the performance management function of the network management that we have defined under the OSI model in Chapter 4.

OS: Telephone Switch Traffic

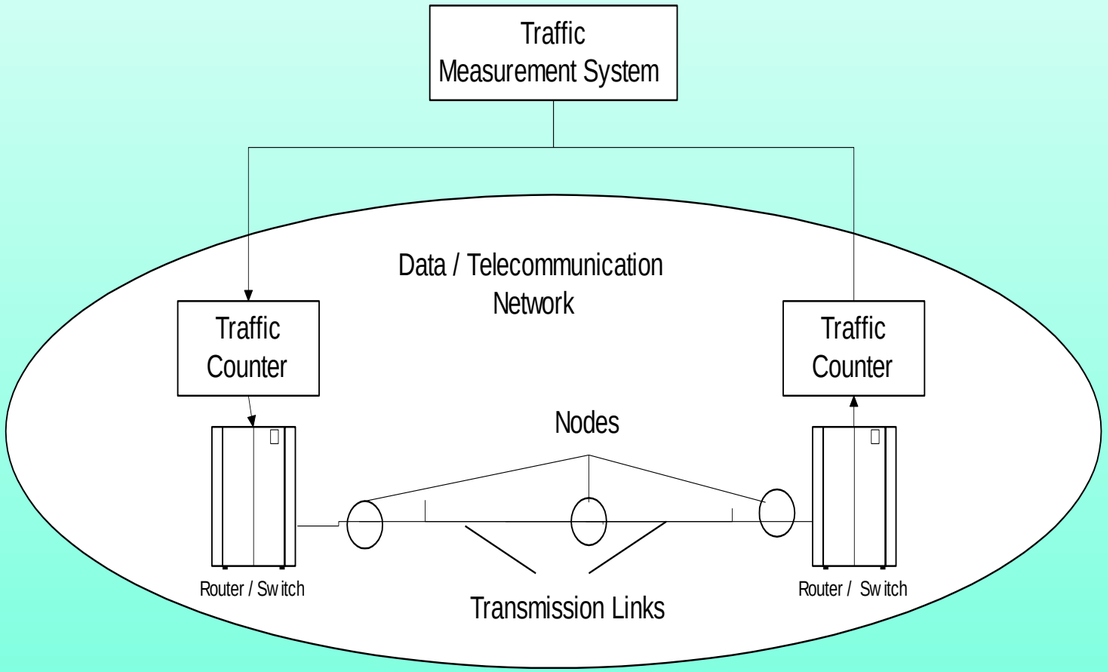


Figure 10.2 Operations Support System for Traffic Measurement

Notes

- Traffic monitored at *switch appearance*
- Call-blocking statistics obtained
- Traffic and call-blocking statistics provide data for planning
- Importance of Operations, Administration, Maintenance, and Provisioning

The trunk test system shown in Figure 10.1 is used to monitor the loss and signal-to-noise ratio in the trunk transmission system in Bell System. A trunk is a logical entity linking two switching offices. It can seize any available cable facility between the switches while carrying traffic. In order to ensure quality of service, loss and signal-to-noise on the trunks are measured at regular intervals by accessing every trunk at each switching office. This is done from a centralized test center. Any trunk that fails to meet the minimum criteria set for quality control is removed from service. Thus, by removing a trunk out of service as it is failing (but before it actually fails), the customer does not see any degradation of service. The same test system is also used for an on-demand test to track troubles.

Except during popular holidays such as Mother's Day, telephone service is almost always available for communication at any time of the day. This is due to careful planning and implementation of adequate facilities for traffic to be handled without being blocked for lack of facilities. Figure 10.2 shows a traffic measurement operations system, which measures the busy status of switch appearance (access point) on each switch. As the statistics on the number of paths being busy increases, either due to the lack of access points or the lack of adequate trunk facilities, additional equipment is added to reduce blocking.

TMN Conceptual Model

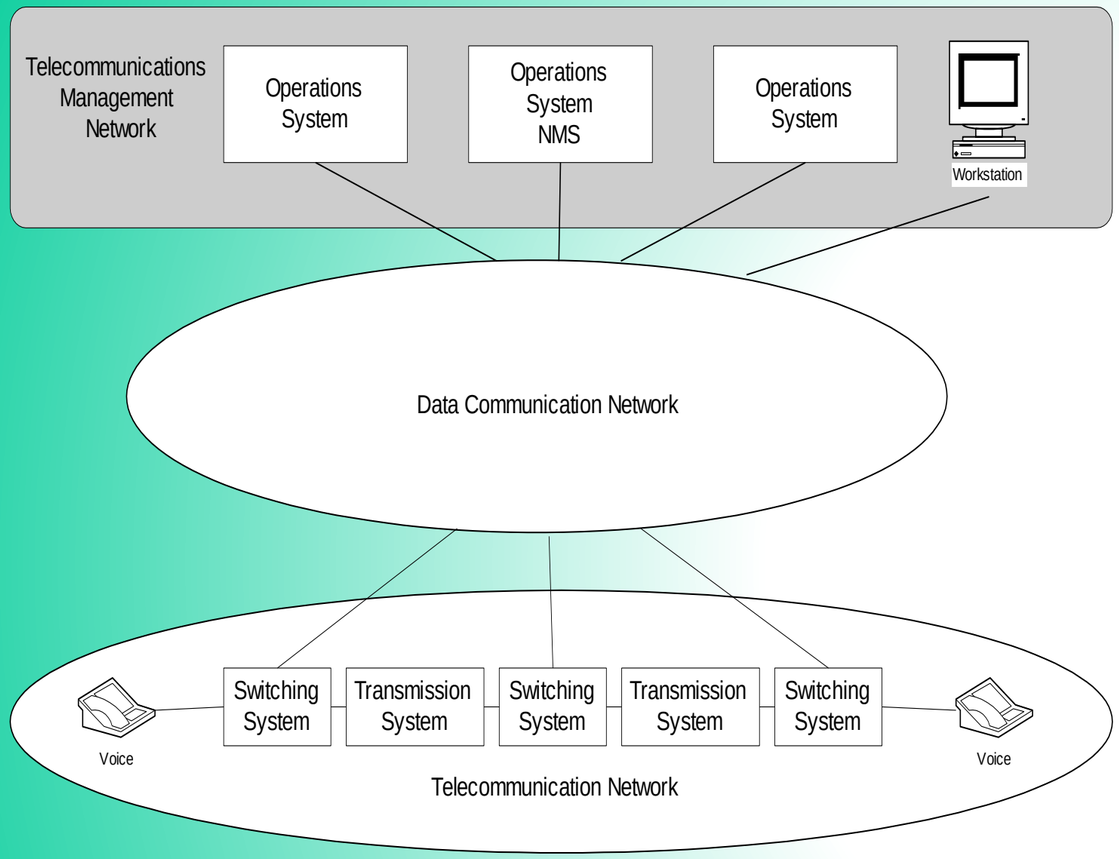


Figure 10.3 TMN Relationship to Data and Telecommunication Networks

Notes

- From a TMN point of view, the network management system is treated as an *operations support system*, as shown in Figure 10.3. It manages the **data communication and telecommunication network**.
- OSS, including the NMS, form a support network. It is logically a separate network, but may or may not be physically separate based on implementation.
- The telecommunication network in Figure 10.3 consists of network elements of switching exchanges and transmission systems. It is primarily the wide area network of communications. Switching systems include both analog and digital switches. And so are the transmission systems of both analog and digital types and include all means of transport facilities including twisted pair, coaxial, fiber optics, and wireless. Data communication network components consist of LANs, bridges, routers, gateways, and hosts.
- ITU-T Recommendation M.3010 defines TMN as a conceptually separate network that interfaces to one or more individual telecommunication networks at several points in order to send or receive information to or from them and control their operation

TMN Conceptual Model (cont.)

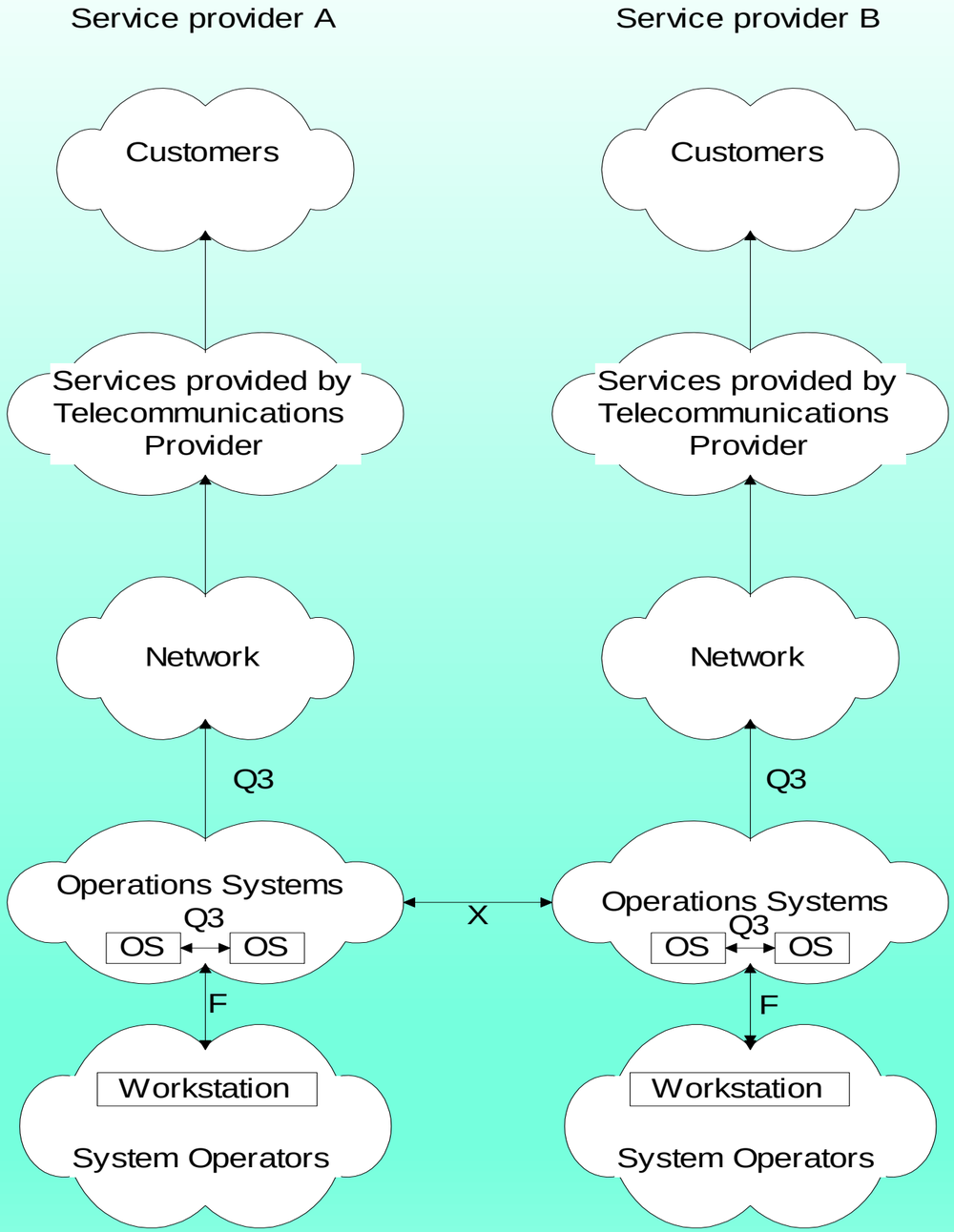


Figure 10.4 TMN Conceptual Model

Notes

- Components
- Interfaces

- **TMN Conceptual Model:** We have customers interfacing services provided…, networks underlie these services which are managed by operations systems; operations systems are carried out by workstations called system operators.

- **TMN Conceptual Model=** Components + Interfaces
- Interfaces:
  - Q3
  - F

TMN Architecture

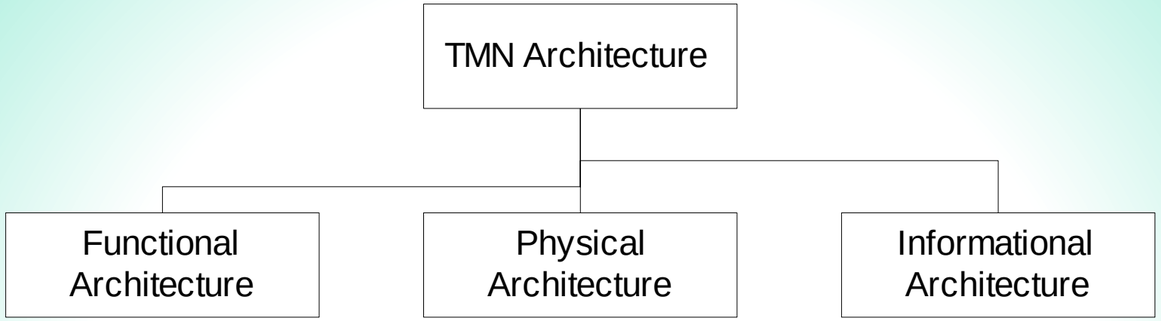


Figure 10.6 TMN Architecture

Notes

- Functional architecture:
  - Functional modules or blocks
  - Reference points between modules
- Physical architecture:
  - Physical blocks
  - Physical interfaces between the blocks
- Informational architecture:
  - Information exchange between entities
  - Object oriented

Functional Architecture

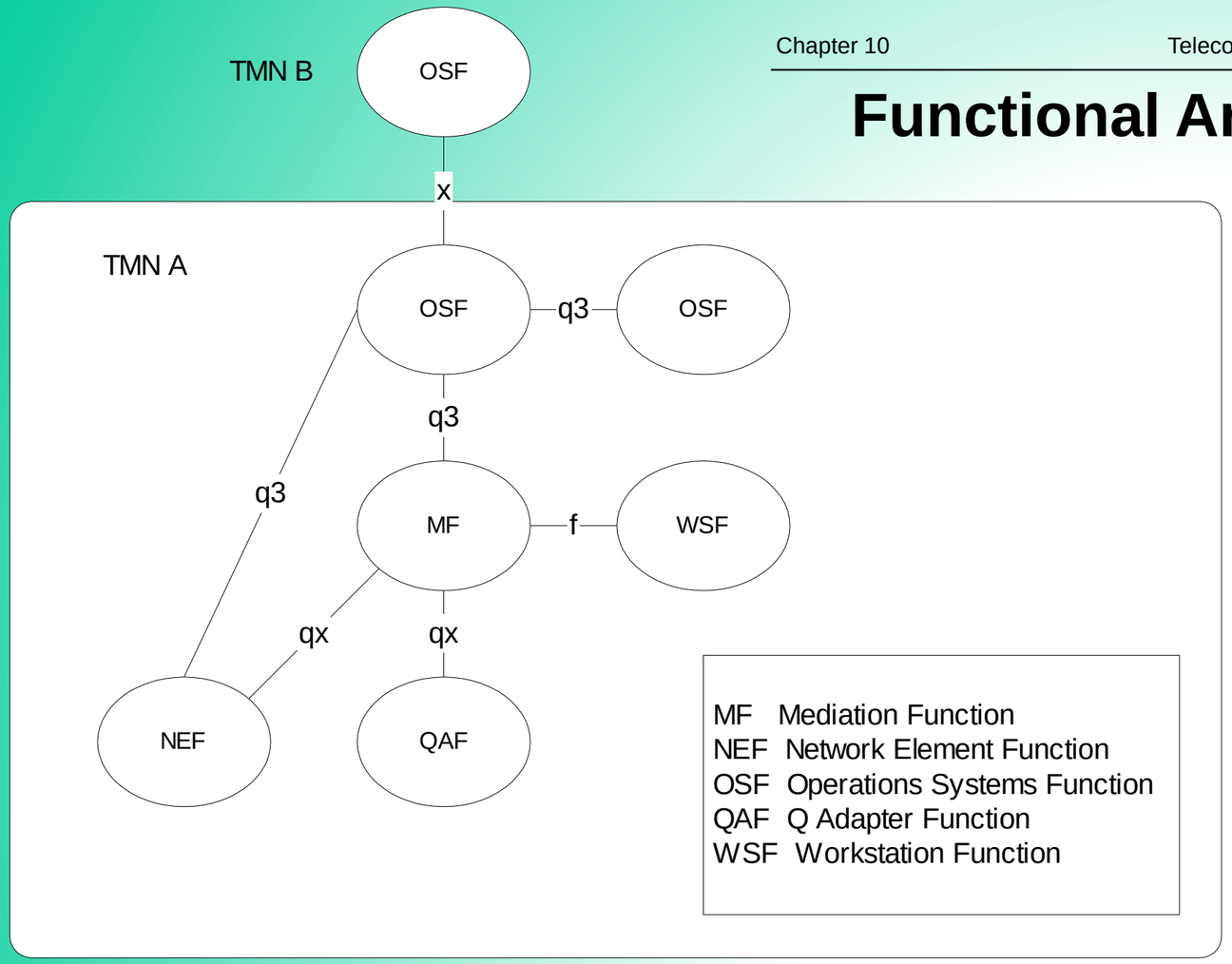


Figure 10.7 TMN Functional Architecture

Notes

- OSF: Functions performed by Operations systems: e.g., testing, accounting, trouble tracking

- NEF: Functions needed to support network elements;
- network elements themselves are not part of TMN (hubs, routers, switches, etc.).

- However, NM agent, MIB, and information for management (collision rate, packets dropped, etc.) are part of TMN

TMN Reference Point

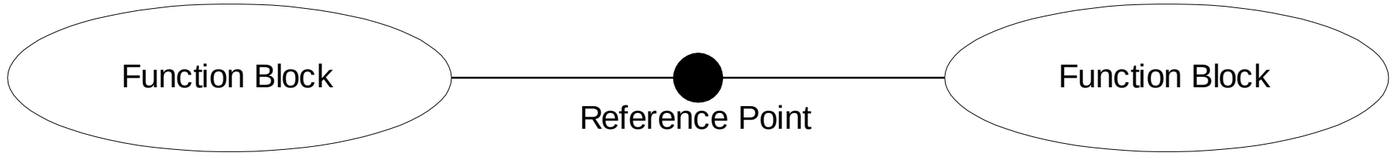


Figure 10.8 TMN Reference Point

Notes

- **Function blocks connected by conceptual interfaces, called *reference point***
- Designated by lower case letters (upper case letter for physical interfaces)
- x: Interface between operations systems that belong to different domains; e.g., interface between two NMSs belonging to two different domains
- q3: Interface between two OSFs (Functions performed by Operations Systems) in the same domain
- qx: Interface between mediation function such as RMON and agent in the network element
- f: Interface to the workstation

Physical Architecture

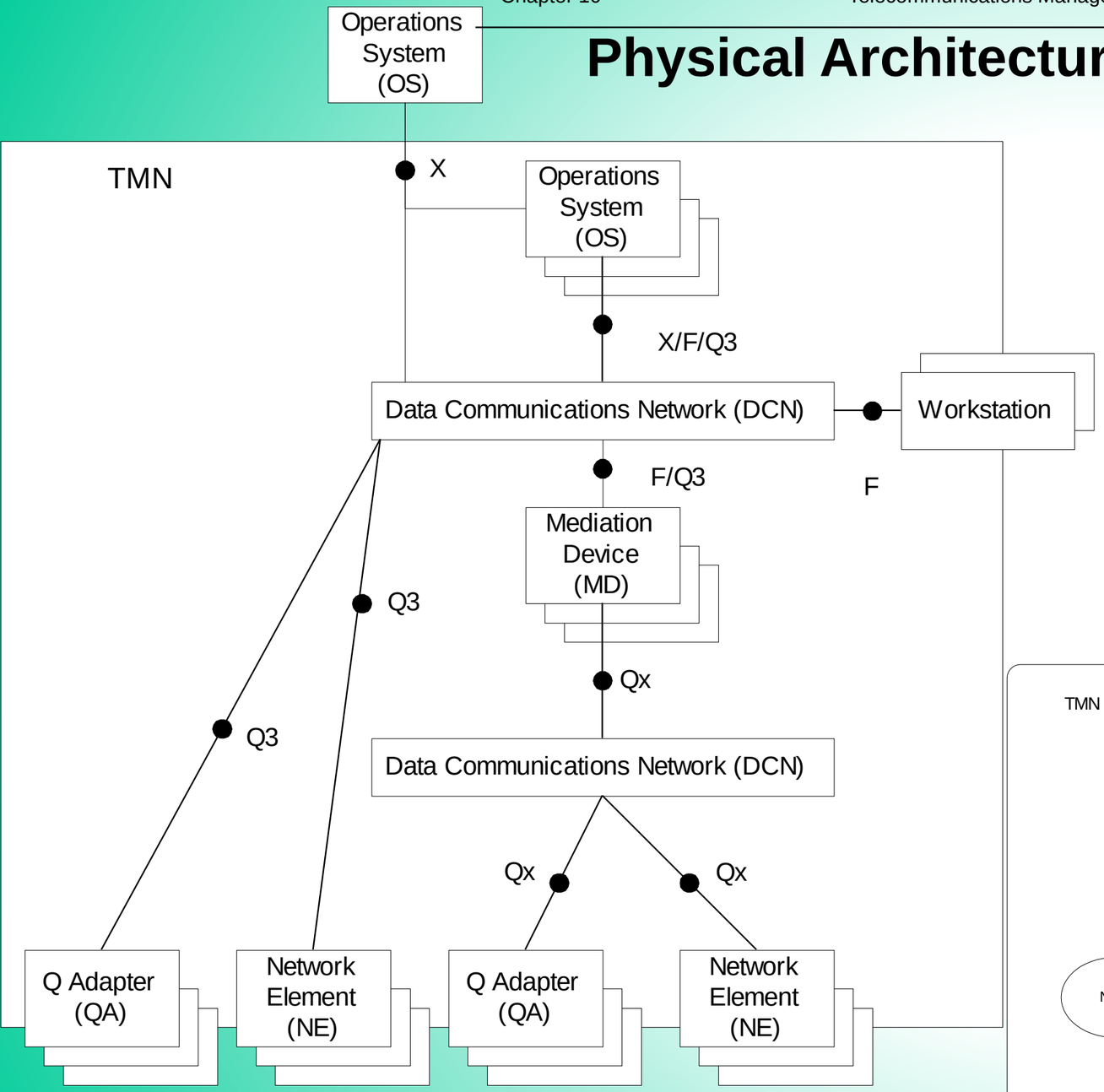


Figure 10.9 TMN Physical Architecture

- x: Interface between operations systems that belong to different domains; e.g., interface between two NMSs belonging to two different domains
- q3: Interface between two OSFs (Functions performed by Operations Systems) in the same domain
- qx: Interface between mediation function such as RMON and agent in the network element
- f: Interface to the workstation

Notice the correspondance between the functional blocks and physical blocks

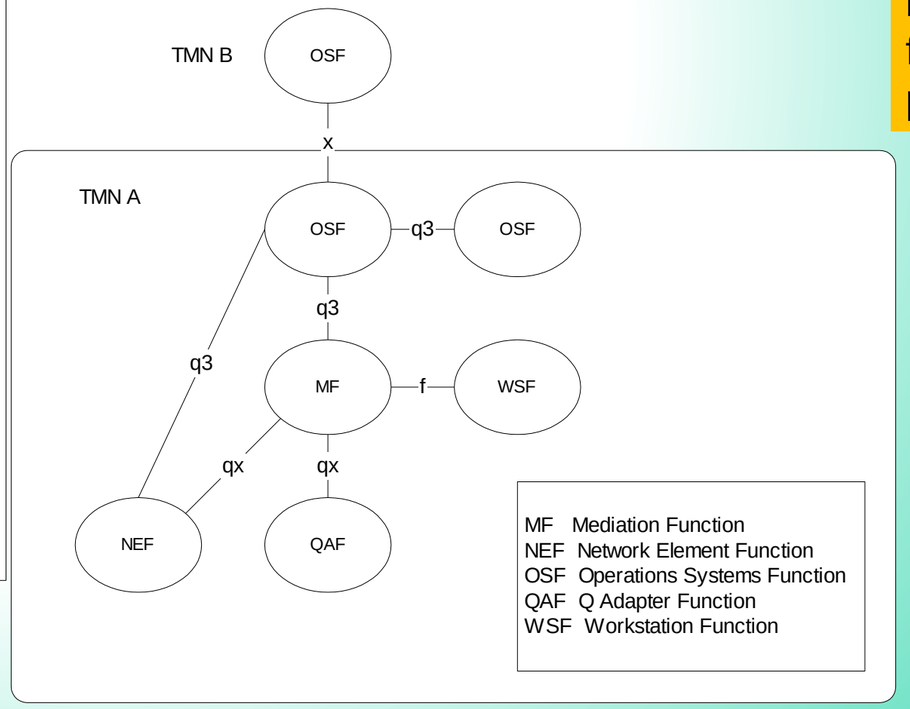


Figure 10.7 TMN Functional Architecture

Information Architecture

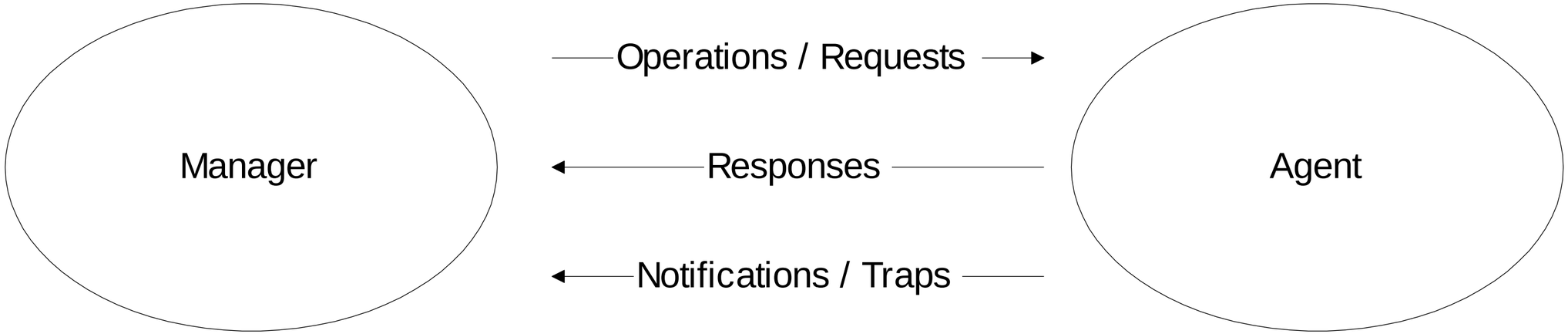
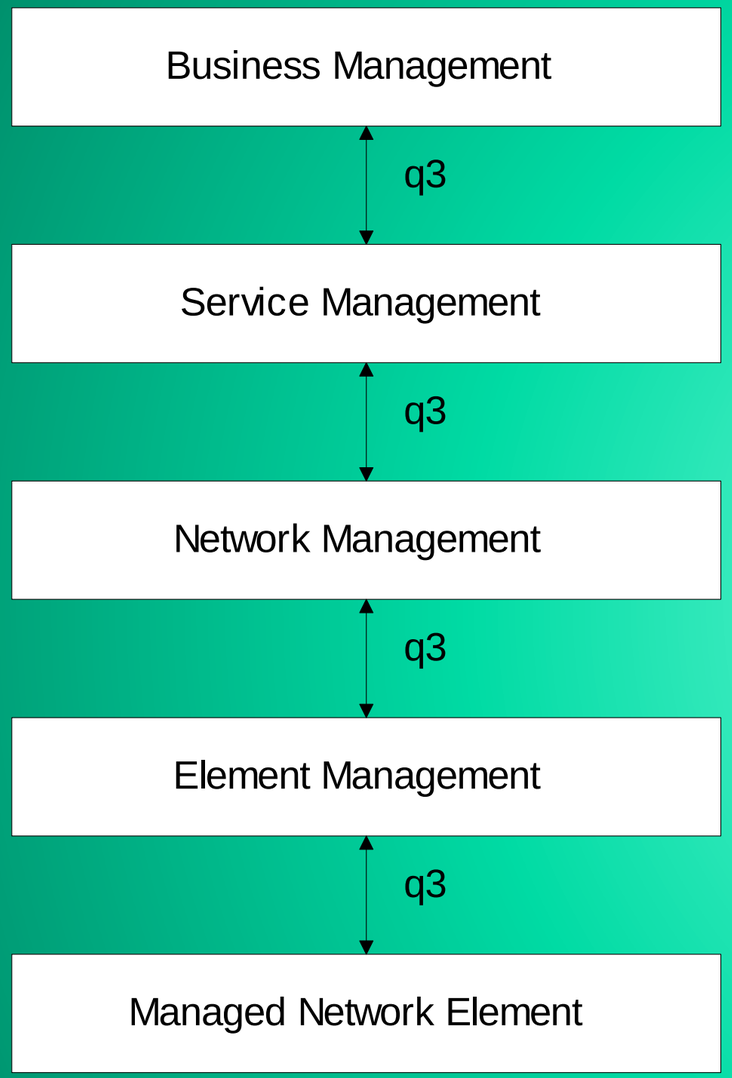


Figure 10.10 TMN Information Architecture

IT corresponds to an exchange of several types of messages between managers and agents

Notes

Service Architecture



The lowest layer is the network element layer comprising network elements such as switches, routers, bridges, transmission facilities, etc. The next layer, the network element management layer, manages the network elements. The third layer is the network management layer, which manages the network. The network management functions in this layer would include bandwidth, performance, quality of service, end-to-end flow control, network congestion control, etc. The network element layer and the network element management layer are vendor dependent, whereas the network management layer is not.

The service management layer is concerned with managing the services provided by a network service provider to the customer or to another network service provider. This will include services such as billing, order processing, complaints, trouble ticket handling, etc. The top layer in Figure 10.11 is the business management layer. This is concerned with managing a communications business, such as fiscal considerations, personnel needs, project management, and customer needs and satisfaction.

We notice that the TMN reference point between the various service layers is q3, which is the standard interface between operations system, network element, and MFs shown in Figure 10.7.

The TMN management services are classified into OSI system management functional areas, which are the five OSI application functions described in Section 3.9. They are configuration management, fault management, performance management, security management, and accounting management. This is presented in Figure 10.12.

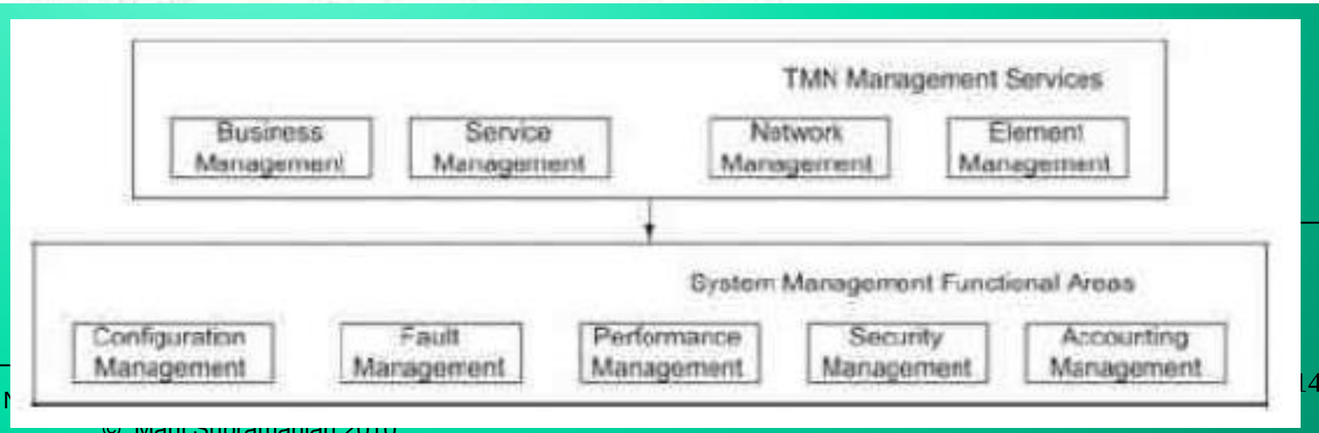
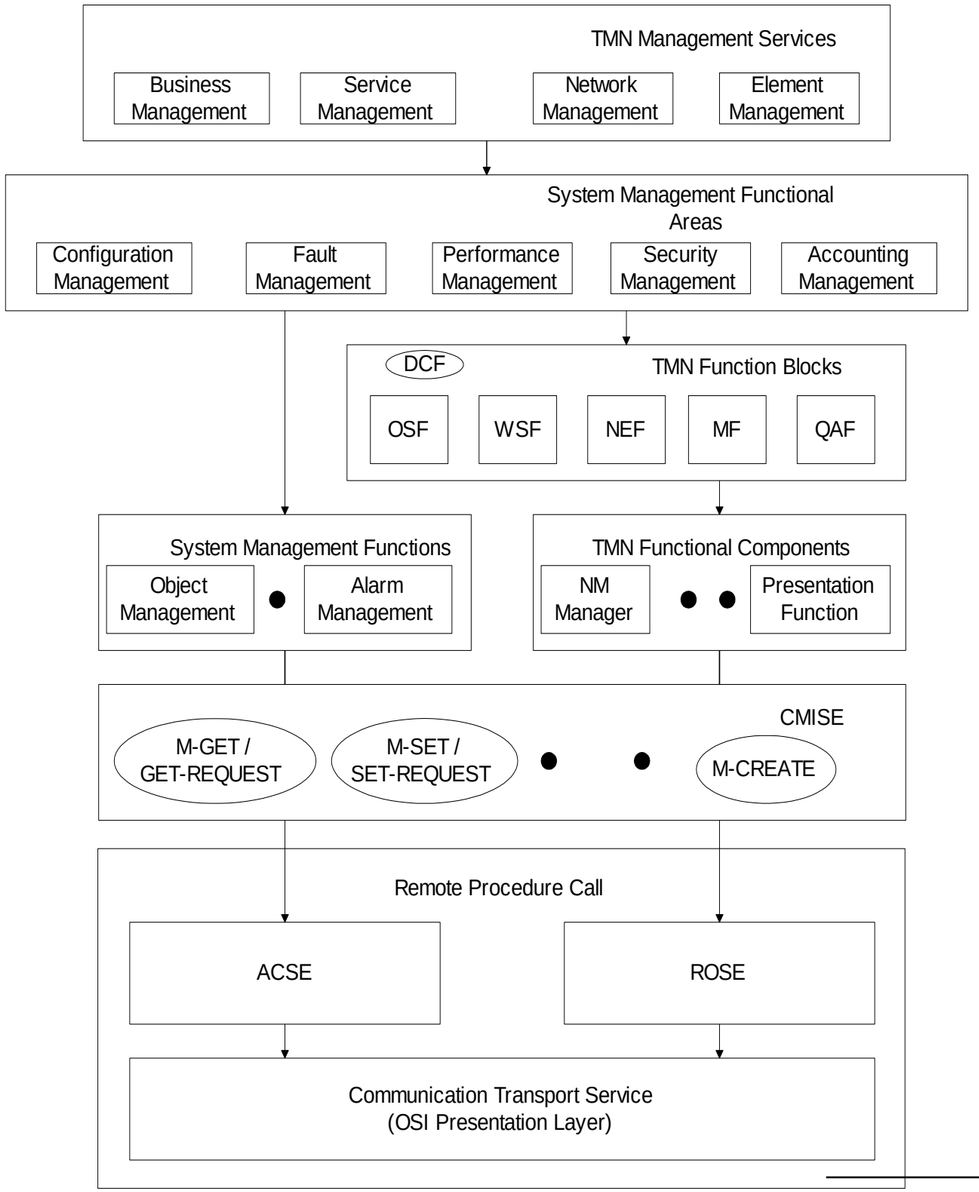


Figure 10.11 TMN Service Architecture

TMN Services & Functions



TMN Integrated View

Figure 10.13 TMN Services and Functions

Example (NMF)

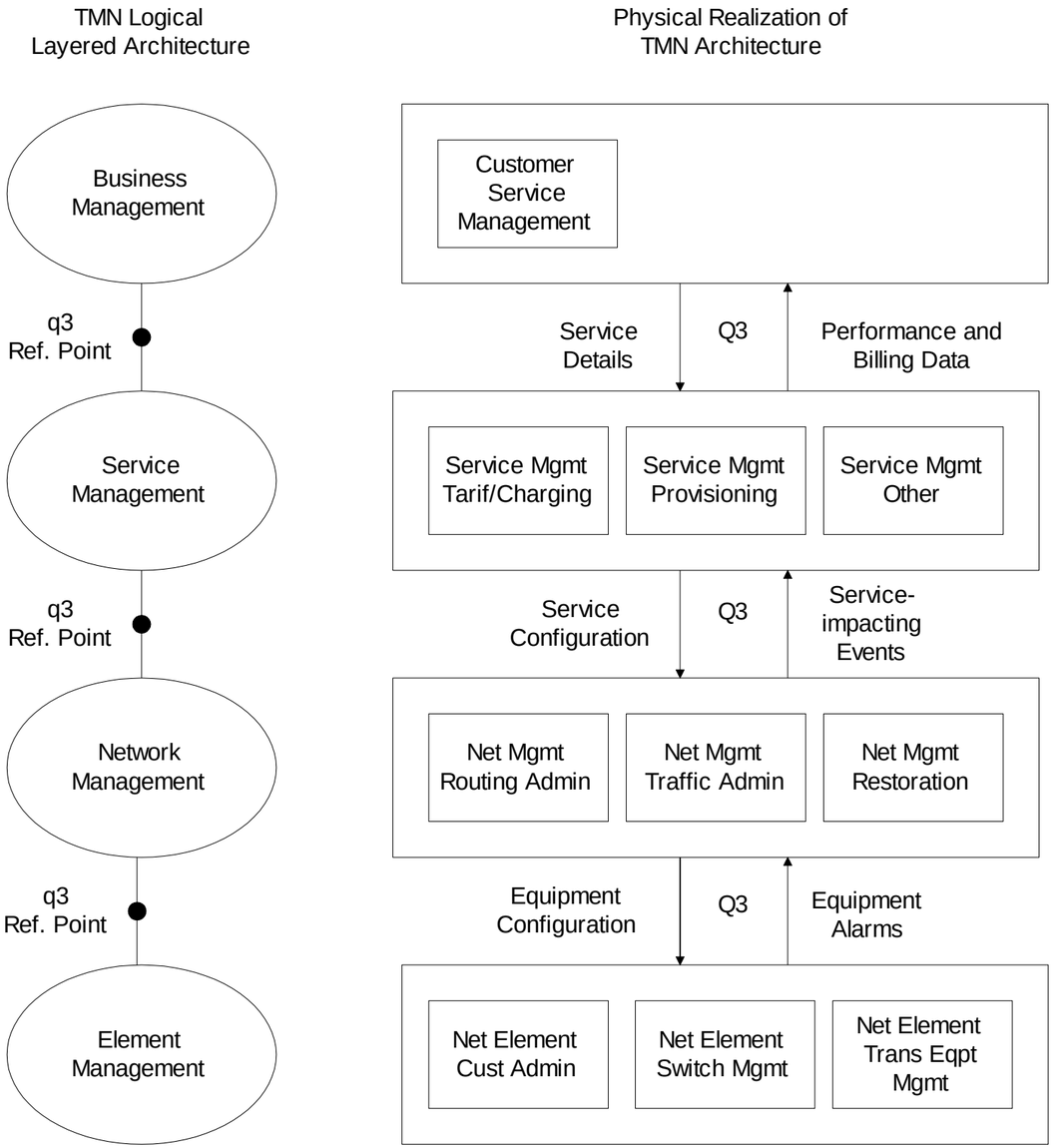


Figure 10.14 TMN Realization Example (NMF)

TMN IMPLEMENTATION

eTOM

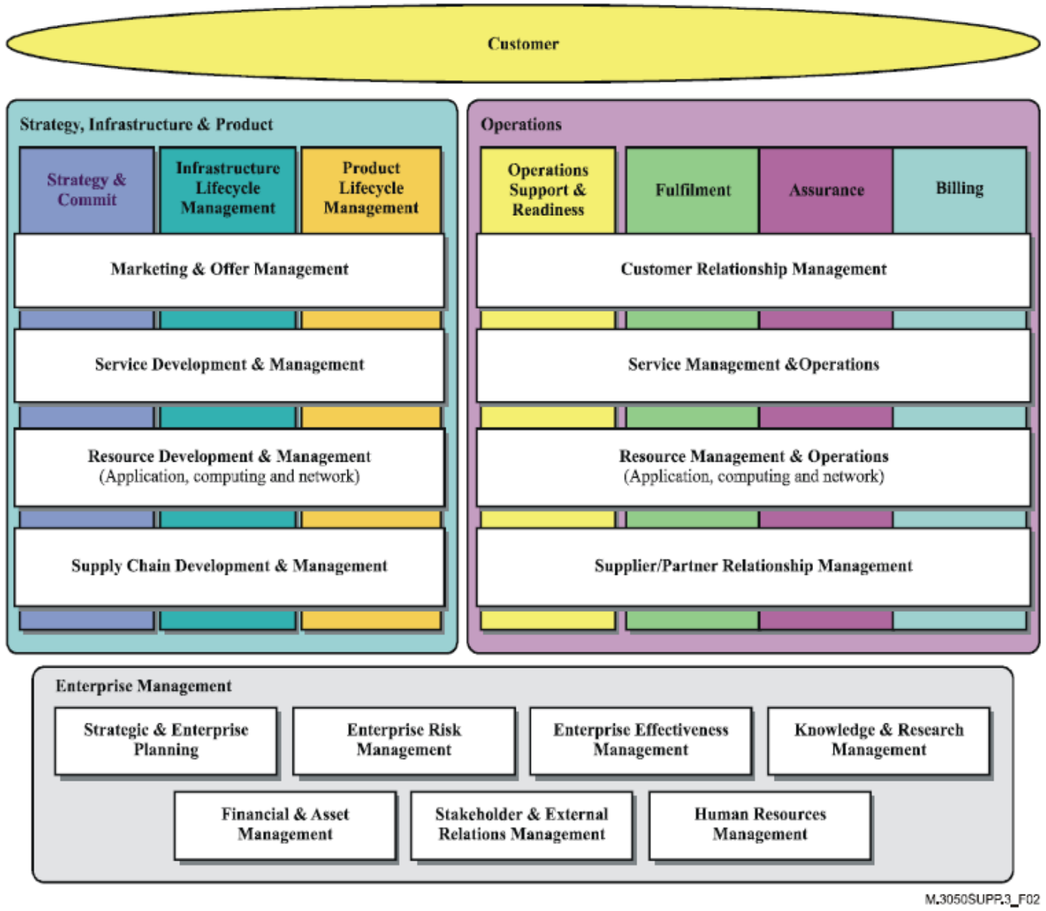


Figure 10.15 eTOM Business Process Framework – Level 0 processes

Notes

- TM Forum top-down implementation approach of TMN (ITU-T)

- **eTOM (enhanced Telecom Operations)**
  - Framework to automate delivery of “information, communication, and entertainment services”
  - Addresses business processes end-to-end
  - Multiple levels (0, 1, 2,and 3) based on details

TMN & eTOM

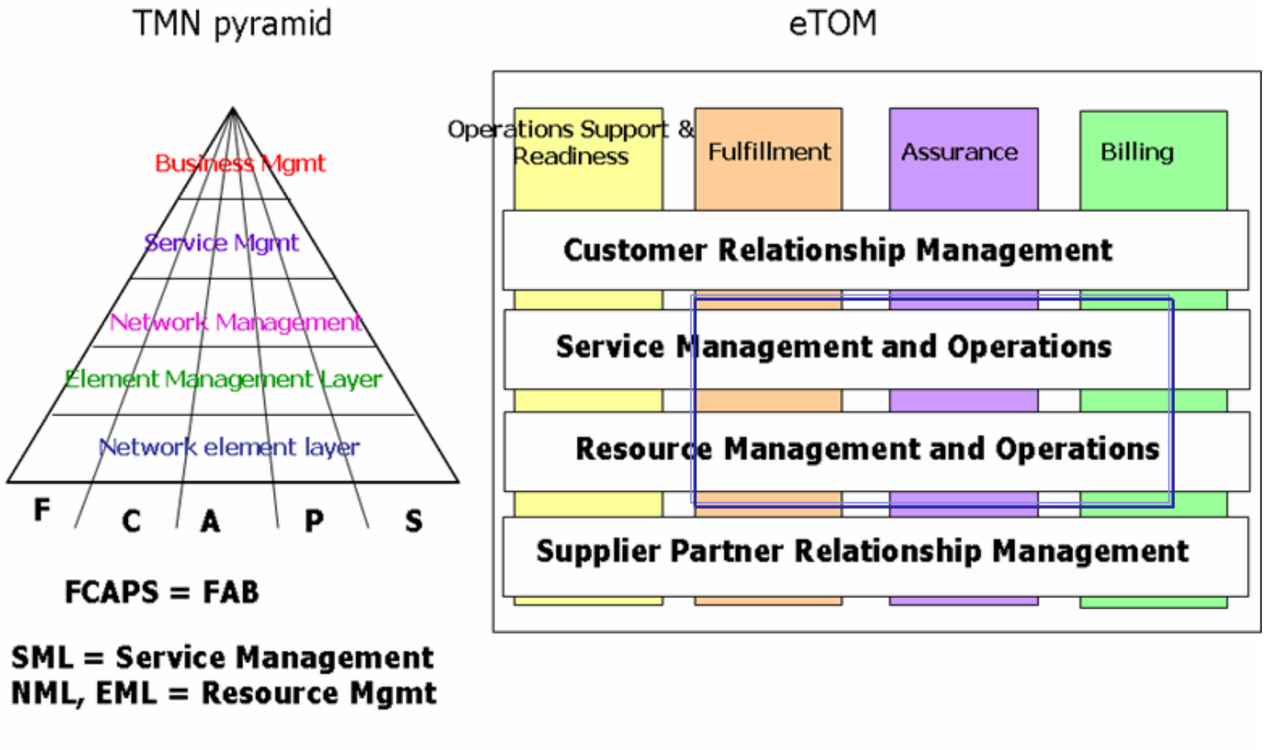


Figure 10.16 eTOM-to-TMN Model

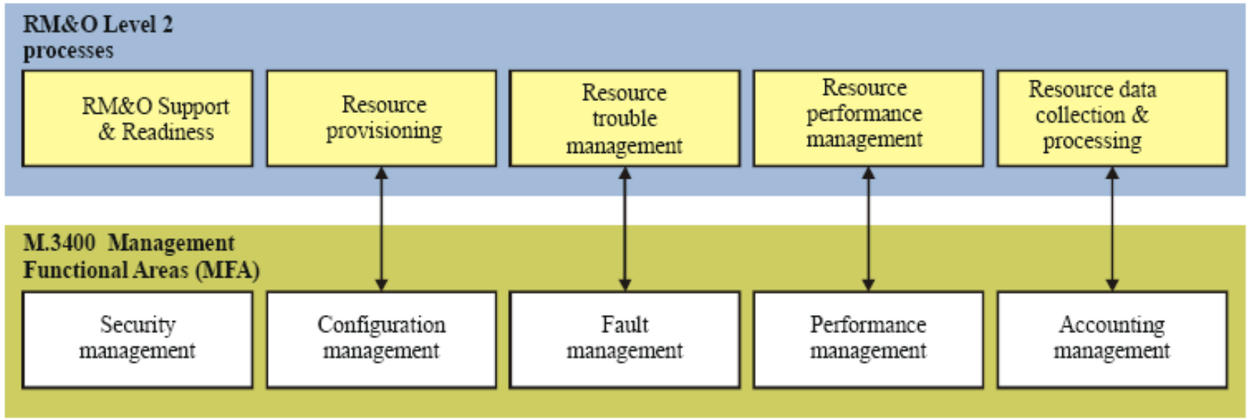
Notes

- eTOM-to-TMN mapping of functions
  - Fulfillment Configuration
  - Assurance Fault
    Performance
  - Billing Accounting
- Eqivalent NMS application functions in both TMN and eTOM

TMN Services & Functions

FCAPS (fault-management, configuration, accounting, performance, and security)

eTOM-to-TMN : M.3400 (Level 2) Processes



Notes

Figure 10.17 eTOM Level 2 processes-to-M.3400 function set groups

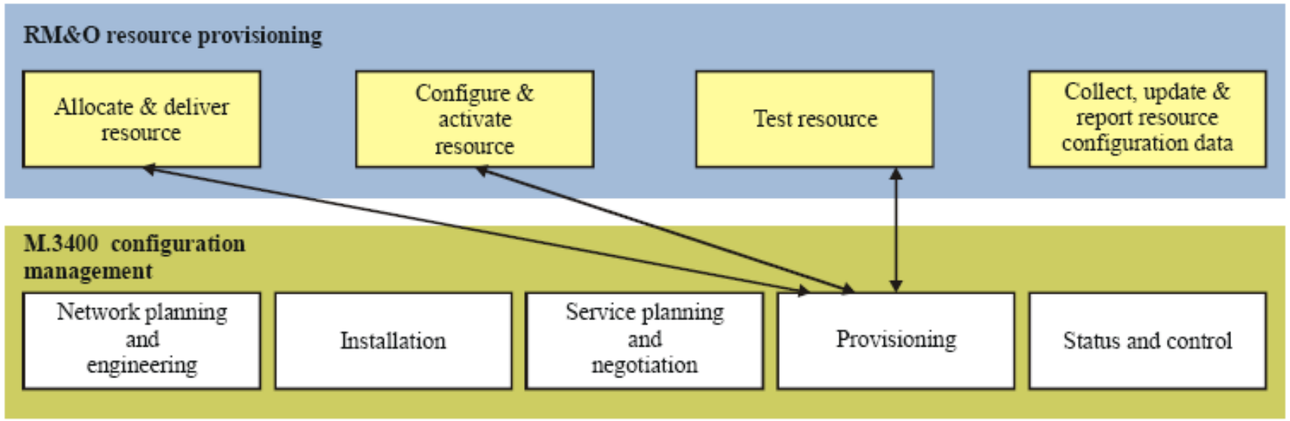


Figure 10.18 eTOM Level 2 processes-to-M.3400 Configurqation function