Exhibit 7

customers (known as 'provisioning') and the management of the performance of the network – known as 'provide and maintain' functions. These two sets of functions, which are focused on the network, are normally considered to provide the so-called role of 'network management'.

For any national operator, network management is a vast undertaking. It involves the control of many thousands or millions of lines, multiplexors, subscriber concentrator switches, digital transmission line systems, local exchanges, junction tandems, trunk exchanges, etc. Each piece of equipment has to be configured, assigned to a customer or for common use in the network, its performance monitored, faults have to be repaired and the equipment brought back into service. Just keeping an up-to-date inventory of all the equipment identities, their location, their status, etc., is a huge task in itself. Although historically the records used were paper-based with manual tracking, increasingly now operators use computer-based network management systems. Thus, the network management function is delivered through a range of large computer systems running programs that enable technicians at several dispersed centres within the country to control remotely whole regions of the network. Such systems require large data bases to hold all the inventory and status information of the equipment in the catchment area. Real-time monitoring and remote control is provided by the extensive deployment of control links from the various network elements (i.e. equipment) to network-management centres. Typically, the latter are referred to as 'operations and maintenance centres' (OMCs). The control-links from the equipment and the OMCs are deemed to reside in the top layer (Administrative Layer) of the multi-layered model of Fig. 11.4, described earlier in this chapter.

OMCs provide a range of functions, typically including:

(i) Remote monitoring of alarms from exchanges and Core transmission systems.
(ii) Remote access to the exchange-control systems to:
- change the status or features of a subscriber's line;
- initiate a new subscriber's line;
- monitor a subscriber's line;
- change the telephone number of a subscriber's line;
- change the contents of the exchange routeing codes and tables;
- set software changes and upgrades;
- manage software restoration actions;
- install software builds.

(iii) Monitoring of unmanned exchange and Core-transmission buildings for intruder and fire alarms, etc.
(iv) Remote collection of traffic usage information (to be used for dimensioning and forecasting of growth in demand, traffic dispersion, etc.).
(v) Remote collection of call-record data from the exchanges for forwarding to separate billing centres.

In addition, there are separate network management centres which monitor the whole national network, the links to other operators and the international links to other countries. These national or regional control centres have the responsibility of overall control of the network performance. Importantly, it is the technicians at these centres

that have the ability to initiate remedial action across the range of transmission systems and exchanges to cope with major breakdowns or traffic overloads in the network. Where there is advanced warning of likely telephone traffic surges – e.g. as a result of televised telephone voting, where a massive number of calls can be expected to a single number during a short time of day – technicians at the network control centres can initiate re-routeing of calls and other measures, such as call gapping, to limit the extent of overload and ameliorate the effects on the QOS for the customers. In the case of call gapping, the control systems of the offending local exchanges are set to switch only a limited proportion of calls to the overloaded destination, e.g. one call every 5 seconds [13].

In practice, the management of the network is undertaken at two levels. The first level is that of the management of individual pieces of network equipment or 'elements', e.g. cables, multiplexors, line systems, cross-connects, exchanges, signalling systems and intelligent network data bases. So-called element managers are control systems, usually computer-based, that are specific to the particular elements' technology. For example, an SDH add-drop multiplexor (ADM) controller is used to configure the ports on all the ADMs supplied by a particular manufacturer. Normally, element controllers are able to extend remote control to all the many elements within an area – typically a region within a country, as set by practical constraints or organisational boundaries of the network operator. In addition to managing the configuration of the equipment, element managers usually also monitor one or more performance parameters (e.g. digital error rate) and any fault alarms or system error messages. Element managers are usually located in operational buildings, such as exchanges or Core Transmission Stations.

The second level of network management is at the overall network level, having end-to-end control for that particular network. Examples include: the full network view of private circuits (or leased lines), telephone calls and ATM cell routeing. Generally, network managers, which are also computer-based systems, coordinate the outputs from all the element mangers involved in the network so that a total overview is obtained. It is these network management systems that are located in the network management centres described above.

So far we have considered only the management of the network itself, but there is a further range of operations associated with managing the interactions with customers – usually referred to as 'customer service' or 'service management'. There are four main areas of service management, namely: order taking, fault management, provisioning and billing. The key aspect of service management is that it involves providing an interaction with customers. This is provided by service centres which are contacted by customers through telephone calls, e-mails, fax, web sites or even in person. The support systems for service management employ large-scale computing with massive data bases.

Fig. 11.11 presents a summary top-level view of the widely accepted logical architecture for operations management, which is structured as a five-layer hierarchy. At each layer a distinct set of operational activities are undertaken by groups of people, using dedicated computer support systems, associated with the relevant data bases, following prescribed processes and providing outputs for different recipients.

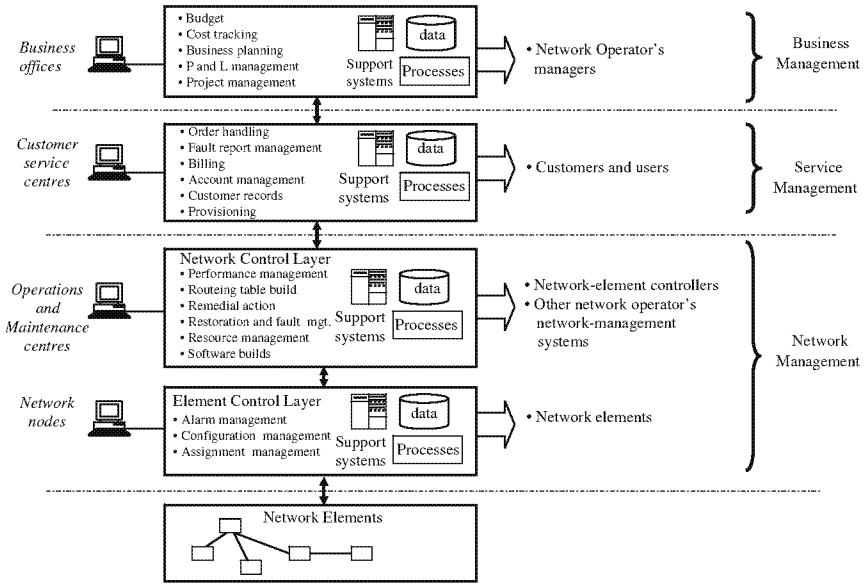

Figure 11.11 Operations Management Hierarchy

At the base of the hierarchy are all the network elements, i.e. the network itself. As described above, these are managed by technicians at network buildings using element controllers, shown as the second layer in the architecture. The element controllers are, in turn, managed on an end-to-end basis by the network management centres, which are deemed to sit in the third or network-control layer. Above this is the service-management layer providing the interface to the customers of the network service. Finally, there is a top layer which comprises all the activities associated with managing the operator's business. This includes functions such as budget build, financial tracking of expenditures within the organisation – particularly expenditure on network equipment! – human-resource management, payment of salaries, invoicing and treasury functions, etc. Generally, the element-control layer and the network-control layer are assumed to act as a combined network-management function.

Whilst the five-layer architectural view of Fig. 11.11 helps define the various categories of activities involved in managing a telecommunications-network-operator business, it does not provide a structure for the design of the vast range of support systems and their data bases and the process associated with execution. However, the Telecommunications Management Forum (TMF), which includes representation from network operators and equipment manufacturers worldwide, has addressed this problem. The TMF have developed the so-called FAB model to help the industry agree on how the set of activities or processes involved in providing network services should be structured. Fig. 11.12 presents the model, which identifies three sets of processes: those associated with customer care, service development and operations and network and systems management. Its name is derived from the three fundamental