

# Telecom Operations Map



**GB910**

*Approved Version 2.1*

*March 2000*

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# Acknowledgements

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- Mobile Management TMF Project Team, particularly:
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Their expertise and involvement in providing contributions and participating in discussions are greatly appreciated. A special thanks to Don Batorsky, Telcordia, who gave a lot of his personal time. His commitment, thoughtful input and ideas were and are invaluable. We appreciate that Bob Lewis, Telcordia, has made Don available to lead the Telecom Operations Map team. We also appreciate the Corporate Renaissance Consulting contribution of Business Process Mapping Methodology, with thanks to John Feather and Gene Jachera.



## Document Life Cycle

The Telecom Operations Map is being issued as Approved Version 2.1. The TeleManagement Forum ("TM Forum") expects to update it to reflect:

- Comments from implementation experience
- Additional member comment and public comment
- Enhancements or companion documents based on work currently in progress in the TM Forum

The Telecom Operations Map Version 2.1 supersedes the NMF Service Management Business Process Model and the TM Forum Telecom Operations Map Evaluation Version 1.0 and 1.1 in their entirety.

All documents approved by the TM Forum (as well as those previously approved by NMF) undergo a formal review and approval process. This document was approved by vote of TM Forum members.

This document will continue under change control. Supporting work will be issued as companions or appendices to this document. A document of this type is a "living document," capturing and communicating current knowledge, views and practices. Further updates will be made because of detailed work ongoing in the TM Forum and the industry.

Individuals or companies who are not members of the TM Forum are encouraged to provide comments on this document. However, in order for their comments to be considered, a signed waiver must be on file with TM Forum pertaining to intellectual property rights. To obtain this form, please contact the TM Forum.

### **Time Stamp**

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This version of the Telecom Operations Map can be considered valid until June 30, 2001.

### **How to obtain a copy**

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An electronic copy of the Telecom Operations Map can be downloaded at the TM Forum Web Site ([www.tmforum.org](http://www.tmforum.org)) at Publications or through a link to Publications from the specific team's public project area.

If you would like a paper version of this document, please order via the TM Forum Web Site or contact the TM Forum office. If you are not a member, please contact the TM Forum office on +1 973-425-1900.

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## Document History

Version	Date	Purpose
Evaluation Version 1.0	10/98	Evaluation Version released to public for comment Supercedes Service Management Business Process Model
Evaluation Version 1.1	4/99	Update to Public Evaluation Version for member comments and work validation of all input/output diagrams.
Evaluation Version 2.0	11/99	TOM 1.1 Member and Public Comment Updates Updates to input/output diagrams Language update to be inclusive of IP, Mobile, Wireless Introduction of e-business direction Indication of 3 TOM Application Note Addenda: -GIA -Mobile/Wireless Performance Mgt., Fraud and Roaming Agreement Mgt. -Process Re-engineering and Development Simple Methodology Steps Supercedes TOM 1.1
Approved Version 2.1	3/00	Approved by Members Some editing updates Some updates and corrections on spiders Change from Evaluation Version to Approved Supercedes Evaluation Version 2.0

## **Summary of changes in this version**

### **Changes from Telecom Operations Map Evaluation Version 2.0**

The TOM spiders (input/output diagrams) were reformatted for consistency and a few corrections or additions. The document was also updated to reflect its change in status from evaluation to approved version.

It supercedes Evaluation Version 2.0 of the Telecom Operations Map in its entirety.

### **Changes from the Telecom Operations Map Evaluation Version 1.1 to Version 2.x**

Significant changes were made in the Telecom Operations Map between Version 1.1 and Version 2.x, as follows:

- Introduction of Telecom Operations Map Addenda for Application Notes. These analyses will cover a variety of purposes, e.g., how to apply the map for various services, for service specific considerations, for actual end-to-end process flows, to provide more detail or understanding of a critical area, etc.
- For Telecom Operations Map 2.x, we introduce the following Application Notes as Addenda to the TOM:
  - IP Services: Global Intranet Access Service
  - Mobile Services—Performance Management, Fraud and Roaming Agreement Management
  - Process Re-engineering, Development and Management Simple Methodology Steps
- Initial introduction of e-business direction
- Additions and corrections to input/output diagrams
- Updates for the multiple comments from members and public

This list of changes does not include format or edit changes made to improve clarity. For detailed changes, please refer to the Telecom Operations Map working team disposition summaries (available only to members of TM Forum at the TelOps Map Team area on the TMF Collaboration Center).

## **Expectations for Future Additions**

The Telecom Operations Map (TOM) is a living document and member expectations for continued development of the map are high. Future releases may reflect some or all of the following:

- Assessment and update for e-Business considerations, possibly:
  - Defining need for one virtual or physical data source for all customer information, interactions, analysis, etc.
  - Integration of Customer Care Processes to create a Customer Relationship Management Process
  - Assessment of and additions for empowering and enabling the customer through the Customer Interface Management Process
  - Development of Selling Chain Management process or considerations due to the requirement to integrate and automate with other processes
  - Development of Supply Chain Management process or considerations due to the requirement to increase speed of service
  - Preliminary Draft Available to members
- Process and interaction additions for the Business Management layer of the TMN Model due to the requirement to understand and closely integrate with core enterprise, business processes—included in preliminary draft that reflects e-business changes.
- Providing and supporting connection or synergy of the TOM with the New Generation OSS systems work. Underway within TM Forum
- Consider updating the simple Business reference Model in the TOM with a more complex value chain model.
- Further definition of specific considerations for varying services, e.g., Broadband Services, IP Services, Mobile/Wireless Services

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# Preface

## TeleManagement Forum

The TeleManagement Forum is an international non-profit organization serving the information services and communications industry. Its mission is to help service providers and network operators automate their business processes in a cost- and time-effective way. Specifically, the work of the TM Forum includes:

- Establishing operational guidance on the shape of business processes
- Agreeing on information that needs to flow from one process activity to another
- Identifying a realistic systems environment to support the interconnection of operational support systems
- Enabling the development of a market and real products for integrating and automating telecom operations processes

The members of TM Forum include service providers, network operators and suppliers of equipment and software to the information services and communications industry. With that combination of buyers and suppliers of operational support systems, TM Forum is able to achieve results in a pragmatic way that leads to product offerings (from member companies) as well as paper specifications.

## The TM Forum Approach

TM Forum uses a business and customer services driven approach to achieving end-to-end automation using integrated Commercial Off-the-shelf (COTS) software. It enables product availability, along with development specifications needed to produce management systems that can work together to produce the operational results needed by service providers and network operators. TM Forum makes use of international and regional standards when available, and provides input to standards bodies whenever new technical work is done.

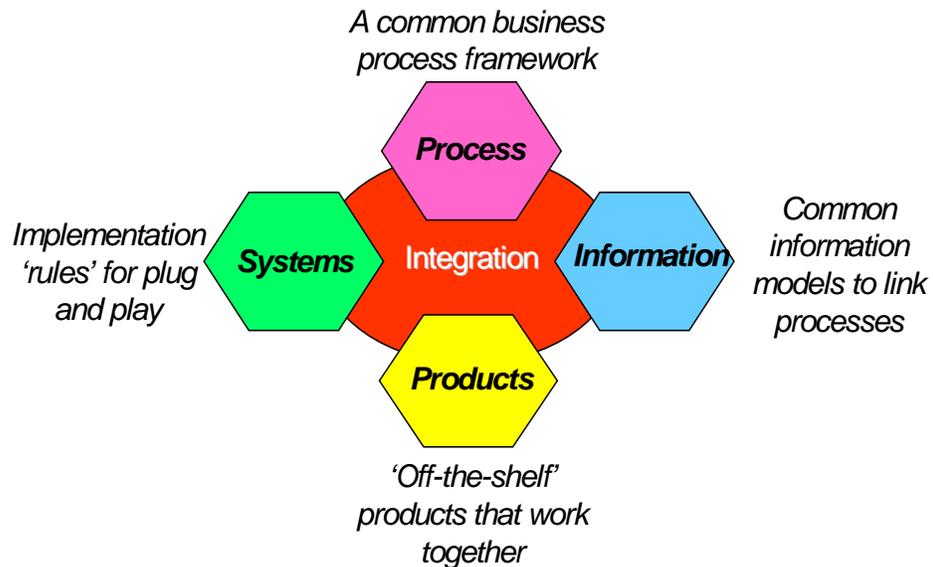
The TM Forum focus is on providing pragmatic solutions to business problems and is based on the business layering principles articulated in the ITU-T layered TMN model (See Chapter 2 for brief discussion of TMN model).

The TM Forum approaches automation from both a business context and a systems context. Through the work in business context areas, members define the business

process, requirement models and both technology-neutral information models, as well as technology-specific information models. This work is directly related to key market segment issues. The projects that develop the business context work can be both Process Automation (requirement and information modeling focused) projects and catalyst (implementation focused) projects.

The systems context work is done under the umbrella of TM Forum's drive to create a New Generation of Operations Systems and Software (NGOSS™) that more truly delivers Plug and Play environments. NGOSS™ is driven by the business context work and requirements for systems infrastructure. It includes business case development for NGOSS™, the development of detailed requirements for NGOSS™, the development of the application component design and the infrastructure into which applications can plug and unplug. The NGOSS™ infrastructure is being developed as a technology-neutral architecture with associated technology-specific architectures and technology selections.

NGOSS™ work and frameworks also drive TM Forum projects, e.g., projects that develop contract specifications and catalyst (implementation focused) projects. The most valuable TM Forum projects are those projects that combine solid modeling work or use of common objects and both a business and systems context in a catalyst implementation.



**Figure P.1: TeleManagement Forum Approach Components**

## Telecom Operations Map

The Telecom Operations Map serves as the blueprint for process direction and the starting point for development and integration of Business and Operations Support Systems (OSS). Now, it also helps to drive TM Forum members work to develop NGOSS™. For service providers, it provides a neutral reference point as they consider internal process reengineering needs, partnerships, alliances, and general working agreements with other providers. For suppliers, the Telecom Operations Map outlines potential boundaries of software components, and the required functions, inputs, and outputs that must be supported by products. It consists of:

- A description of the role of the Telecom Operations Map
- A high-level view of Communications Operations processes, sub-processes and activities that is top down, customer-centric, and end-to-end focused
- A high-level identification of the primary end-to-end processes of fulfillment, assurance, and billing, and sub-processes within each
- Illustrative examples of process flows that show end-to-end process
- A more detailed view of the functions of each sub-process, including activities of each sub-process box, as well as its inputs and outputs to other sub-process boxes
- Uses of the map

The basic model continues to be stable even as the Telecommunications industry continues to change, largely because the Telecom Operations Map:

- Uses a high level and generic approach
- Reflects a broad range of operations views
- Reflects the way service providers run and are architecting their businesses
- Is widely used

It is the 'de facto' standard for operations management processes for the industry.



## Chapter 1- TOM Objectives

Whether incumbent providers or new entrants, service providers continue to urgently require well-automated operations processes, since they are faced with ever-increasing competition and a market experiencing dramatic change at an unprecedented rate. Many are struggling to move from a manual-intensive, inconsistent, inflexible environment to one that provides significant improvement in customer focus, service quality, costs, and time to market. They have to pervasively do business electronically with trading partners, suppliers and wholesale and retail customers. For the growing Mobile, Wireless and IP Services markets, these SPs are focused on quickly provisioning new customers and supporting service quality issues. For all service providers, the drive to introduce both new value added services and dramatic improvements in customer care is intense.

For the full range of service providers and network operators, the leading focus of the TM Forum's mission is to enable end-to-end process automation of telecommunications and data services operations processes. The Telecom Operations Map is the framework for accomplishing this mission.

The purpose of the TOM is to continue to set a vision for the industry for competing successfully through the implementation of process driven approaches to operations management. This includes ensuring integration among all vital operations support systems concerned with service delivery and support. The focus of the Telecom Operations Map document is on the business processes used by service providers, the linkages between these processes, the identification of interfaces, and the use of Customer, Service, Network, and other information by multiple processes. Exploitation of information from every corner of the business will be essential to success in the future. The objectives of the Telecom Operations Map are to continue the progress made in establishing:

- An "industry owned" common business process model.
- Common definitions to describe processes of a service provider.
- Agreement on the basic information required to perform each process, sub-process and process activity, i.e., sufficient high level information to serve as the starting point for business requirements and information model development, and the satisfaction of those requirements through industry agreement and products.
- A process framework for identifying which processes and interfaces are in most need of integration and automation, and most dependent on industry agreement.

This document describes the processes and their points of interconnection that make up the end-to-end process flows for Fulfillment, Assurance and Billing across the process layers of the Telecom Operations Map. It identifies the major processes and

interfaces that make up an end-to-end process. Service providers need this common map of processes to enable doing business efficiently and effectively with other entities and to enable the development and use of third-party software without the need for major customization.

## Define Common Terminology

The TOM document also provides the definition of common terms concerning operations processes, sub-processes and the activities performed within each. Common terminology makes it easier for service providers to negotiate with customers, third party suppliers, and other service providers.

## Consensus Tool

The TM Forum produced the TOM initially as a consensus tool for discussion and agreement among service providers and network operators. Its broad consensus of support continues to grow. The map enables:

- Focused work to be carried out in TM Forum teams to define detailed business requirements and information agreements (exchanges between applications or systems) and to review those outputs for consistency
- Relating business needs to available or required standards
- A common process view for equipment suppliers, applications builders and integrators to build management systems by combining 3<sup>rd</sup> party and in-house developments

The anticipated result is that the products purchased by service providers and network operators for operational management of their networks and services will integrate better into their environment, enabling the cost benefits of end-to-end automation. Furthermore, a common industry view on processes and information will facilitate operator-to-operator and operator-to-supplier process interconnection, which is essential for rapid service provisioning and problem handling in a competitive global environment.

## Using This Document

A service provider's specific process architecture and organization structure is highly proprietary, since both are critical aspects of a provider's competitiveness. However, the Telecom Operations Map is a common view of operations processes that can easily translate to an individual provider's internal approaches. The document is *not* intended to be prescriptive about how the tasks are carried out, how a provider or operator is organized, or how the tasks are identified in any one organization.

The TOM is expected to be the starting point of detailed work that leads to an integrated set of specifications that will provide real benefit to both suppliers and procurers in enhancing industry operational management capability. This document is not a specification. It is a snapshot of industry views expected to continue to evolve based on changes in the industry. It is not intended to be too detailed, more a directional statement for the industry.

## **Intended Audience**

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The Telecom Operations Map aims at a wide audience of professionals in the Telecommunications and IT Industry. For experienced Telecommunications professionals, the Telecom Operations Map proves to be intuitive; a strong, common model of operations processes. Through TM Forum Catalyst projects and other work, it has been initially verified that the model has strong application for IP Services and Mobile/Wireless Services.

The TOM is aimed at service provider and network operator decision makers who need to know and input to the common business process model used to enable operations automation in a cost efficient way. It is also an important framework for specialists across the industry working on operations automation. The document or model supports, and is consistent with, many efforts under way in the industry supporting the dire need to accelerate business and operations automation in the communications and data services market.

It continues to give providers and suppliers a common model for discussing complex business needs in a complex industry with complex technologies. For both service providers and network operators additional complexities arise from:

- Moving away from developing their own operations systems software, to a more procurement and systems integration approach.
- New business relationships between service providers and network operators

The creation of new business relationships and the move away from developing internally are a reaction to market forces. These market forces require service providers and network operators to reduce time to market for new services, increase speed of service, as well as to drive down systems and operational costs.

The TOM is also aimed at service provider and network operator business process re-engineering, operations, procurement and other staffs for:

- Understanding the common business process model being used to drive integration and automation
- Getting involved in providing inputs, priorities and requirements

The Telecom Operations Map is also aimed at designers and integrators of operational management systems software and equipment suppliers. They can benefit from understanding how management processes and applications need to work together to deliver business benefit to service providers and network operators.

An equally important and related audience is suppliers of management applications, management systems, and networking equipment, who need to understand the deployment environment for their products and solutions.

## **Relationship to Standardization Activities**

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Much of the management infrastructure upon which systems will be built is expected to be based on standard interfaces. Relating business needs to available, or necessary standards is a primary goal of the TM Forum in promoting a standards-based approach to communications services management. Where applicable, the TM Forum uses industry standards in its work to promote the acceptance of standards and to minimize redundant work. People active in management standardization (in the broadest sense) will find the TOM useful in setting a top down, customer-centric context of how management specifications need to work together.

TM Forum uses existing standards as much as possible. As a result of implementation experience through Catalyst projects, TM Forum provides feedback to appropriate standards bodies.

## **Terms and Definitions**

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### **End User**

An end user is in the domain of the customer. An end user is interested in using communications and data services, e.g., Telecom, Internet/Intranet, Mobile/Wireless, etc.

### **Customer**

The customer purchases communications and or data services from a service provider and/or network operator.

### **Service Provider**

In the TOM, the term service provider refers to companies who provide communications and/or data services as a business. Service providers may operate networks, or they may integrate the services of other providers to deliver a total service to their customers.

Providing communications services to any customer may involve multiple service providers and/or network operators, where one provider may "sub-contract" with other providers to fulfill the customer's needs. When necessary to account for this relationship, the term service provider is used in this document to describe the company responsible to provide service to a customer. The term other provider is used to denote companies which have a sub-contractual responsibility.

## Network Operator

An organization that operates a communications network, network or data services capability, acting basically as a wholesaler. A network operator is a service provider. A service provider may provide the network operator role or may subcontract this role.

## Other Provider

Other providers include service providers and network operators who are subcontracted by the customer's service provider to deliver the original customer request fully or as a component of the request.

## End-to-End Process Flow

TM Forum uses the term 'end-to-end process flow' to include all sub-processes and activities, and the sequence required to accomplish the goals of the process. An end-to-end process has a beginning and an end with specific result expectations. TM Forum uses the term flow-through to mean automation across an interface or set of interfaces within an end-to-end process flow. TM Forum's focus is on top down, meaning customer point of view, end-to-end processes that deliver the required result to the customer with flow-through between the customer and the network elements.

Other definitions in this document that may be useful in relation to processes are:

### *Process*

A systematic, sequenced set of functional activities that deliver a specified result. In the TOM, process is used to refer to the overarching processes of Fulfillment, Assurance and Billing, as well as the process 'boxes' on the TOM Framework.

### *Sub-Process and Activity*

Each process in the TOM framework consists of a set of activities and/or sub-processes that must be executed for the overall process to deliver the desired result. An activity is used to refer to the action required by the specific process and is usually fairly focused. A sub-process is a collection of activities or an interface for a specific set of work activities that are required to accomplish the desired results from the process. A process in the TOM Framework can be a process in one case and a sub-process in another. There are overlay sub-processes that must be accomplished to support the customer. These overlay sub-processes are a set of activities that may need to be supported in multiple processes within the TOM framework, e.g., SLA Management, Fraud Prevention and Management. All of the processes in the TOM framework are made up of a set of sub-processes. The following examples should help to clarify.

- The Service Planning and Development Process has several sub-processes, e.g., Capacity Planning and Service Development are sub-processes.
- The Network Inventory Management process has several sub-processes, e.g., Installation in the Physical Network and Managing Spare Parts are sub-processes.
- Process: Sales
  - Activity: Review prices with customer
  - Activity: Issue Service Request to Order Handling
  - Sub-process: Initiate and gain commitment to provide new service feature through Service Development. Service Development acts as a sub-process in this case.
- Process: Order Handling
  - Activity: Issue Order
  - Sub-process: Reserve Number through Service Configuration. Service Configuration acts as a sub-process in this case
- Process: Service Problem Management
  - Activity: Provide Performance Data
  - Sub-process: Request reconfiguration through Service Configuration. Service Configuration acts as a sub-process in this case.

## Quality of Service (QoS)

Quality of Service is the measure of service quality defined for a service and provided to a customer. Quality of Service is the definition of the performance parameters used to assess service quality. The parameters are usually associated with a specific service or service type. Traditionally, the term QoS is used to refer to performance related parameters. Some use QoS to mean the quality of service for all aspects of the service, e.g., network performance measures and Completion On Time, Call Pick-up Time, etc. QoS can be subjective, e.g., is a call easy to hear? for voice, or objective, e.g., Cell Error Ratio for ATM. Defining QoS is easiest with digital circuits. QoS for IP Services is getting a lot of attention, since it is a connectionless service that is hard to measure and since QoS for IP Services came from the IT arena, i.e., the “best effort” delivery model. In the TOM, QoS is used to mean all the measures of service quality.

## Service Level Agreements (SLAs)

A Service Level Agreement can be considered part of contract with the customer. In many cases, it is part of or an addendum to the contract with the customer. The SLA is a negotiated agreement between a customer and a service provider, defining the service provided and the set of metrics to be used to measure the level of service committed against the level of service provided. Such service levels might include network performance metrics, installation completion on time metrics and intervals for new orders, availability, call pick up times at a work center, maximum periods of outage, average and minimum throughput, etc. The SLA also frequently defines

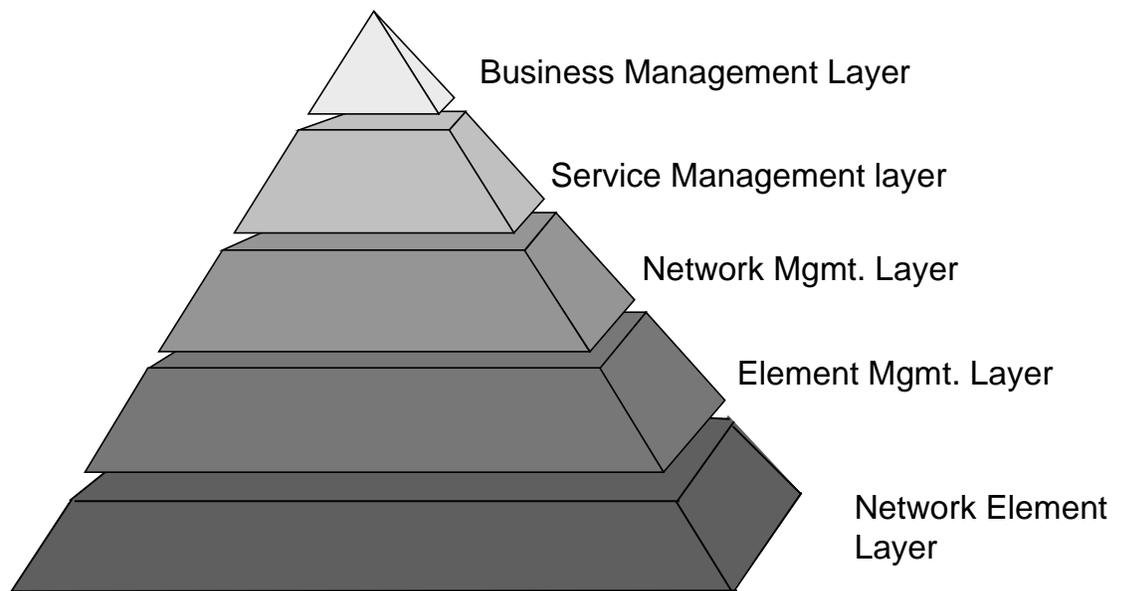
trouble reporting and escalation procedures, reporting requirements and the general responsibilities of both parties.

For term and acronym definitions not explained within this document, please refer to the TeleManagement Forum Glossary. The TeleManagement Forum Glossary can be found through the TM Forum web site, [www.tmforum.org](http://www.tmforum.org).



## Chapter 2 – The TMN Model

The communications industry has embraced the Telecommunications Management Network (TMN) model as a way to think logically about how the business of a service provider is managed. The TMN model consists of five layers, usually arranged in a triangle or pyramid. Business Management is at the apex, Service Management is the second layer, Network Management is the third layer, and Element Management the fourth layer with the physical network elements is represented in the bottom layer. The concept is that management decisions at each layer are different but interrelated. For example, detailed information is needed to keep a switch operating (at the element management layer), but only a subset of that information is needed to keep the network operating (e.g. is the switch operating at full capacity). Working from the top down, each layer imposes requirements on the layer below. Working from the bottom up, each layer provides capabilities to the layer above.



**Figure 2.1: Basic TMN Model**

The TMN model is simple, although its implementation is complex. The sheer number of standards now available that address the various interfaces between management systems sometimes makes it difficult to see and appreciate the big picture. *ITU-T Recommendation M.3400, TMN Management Functions*, provides a structure and decomposition of functions for all of the layers. However, those ITU-T

standards that specify information models and interfaces have been mainly concentrated on the management and connection of resources to the Network Element Layer. Until recently, little attention has been given to interface specifications and information models within the TMN. Consequently, it is difficult to apply the standards to a complete business case, such as for the procurement of a specific Operations Support System. It is also difficult to apply a customer centric focus on the processes that respond to the satisfaction of customer needs.

The Telecom Operations Map, using the TMN model as a foundation, addresses operations support and management for any communications service from a top down, end-to-end process and customer oriented standpoint.

## Chapter 3 – Business Drivers

### The Business Challenge

The communications industry is rapidly changing with new rules, new competitors, new customers, unprecedented demands and the emergence of requirements for e-business. Service providers worldwide all face similar challenges, risks, and struggles to remain profitable in the face of more competition, higher customer expectations, falling market share, and price pressures. As the providers face these challenges, their suppliers must find innovative ways to deliver value or they may also risk going out of business.

Service providers face very different regulatory environments and their business strategies and approaches to competition are quite distinct. In general however, service providers share several common characteristics:

- Heavily dependent upon effective management of information and communications networks to stay competitive
- Adopting a service management approach to the way they run their business and their networks
- Moving to more of an end-to-end Process Management approach developed from the customer's point of view
- Automating their Customer Care, Service and Network Management Processes
- Need to integrate new OSSs with legacy systems
- Focusing on data services offerings and
- Focusing on total service performance, including customer satisfaction
- Integrating with current technology (e.g. SDH/SONET and ATM) and new technologies (e.g., IP, DWDM)
- Emphasizing more of a “buy” rather than “build” approach that integrates systems from multiple suppliers

### **The importance of service**

The core of a service provider's success is rapid response to the service needs of the customer. As the market develops the key objectives are 'more for less' -- faster service introduction, improved quality of service at a lower cost. Achieving these objectives requires automation of Customer Care and the supporting Operations

Management Processes, a strong automated linkage between the management of customer service offerings and the underlying networking assets, as well as automated linkage with Enterprise applications. The level of automation and integration in the current environment of almost all service providers, existing and new entrants, is lower than what providers need to remain competitive. Many existing service providers that are facing new competitive pressures or facing restructuring are now actively engaged in re-engineering their business processes to integrate and automate, thereby decreasing costs and improving customer perceived value and performance. New entrants are developing operational processes based on automation of critical processes while planning to increase automation and integration as the business grows.

Some service providers choose to operate their own network infrastructure, while others choose to outsource this segment of their business. The effective exploitation of this network infrastructure, whether directly operated or outsourced, is an integral part of the service delivery chain and directly influences the service quality and cost perceived by the end customer. Service providers will need to become skilled at assessing outsourcing opportunities whether in network infrastructure areas or other areas and then, be skilled at integrating and managing any outsourcing arrangements.

With the growth of data services, it is becoming evident that the end customer perception of quality requires service providers to expand traditional measures of quality and to move more to proactive Service Management and interactive Customer Care. Customer applications now inherently provide sophisticated measures of quality. Service providers have to go beyond network-centric views of Quality of Service and support to meet customers expectations. It means pushing the limits of service and Customer Care processes performance.

Keeping up with quickly escalating customer service expectations, requires integrated and flexible process and system architectures that allow more off the shelf solutions and reduced dependence on customized solutions.

## Linking objectives and requirements

Making a link between communications business objectives and the requirements typically stated for operations management systems is a challenge. Systematic process models are an essential source of solutions to this challenge. They can be used to positively influence a service provider's organization in many ways such as:

- Simplifying internal communications and communications with suppliers or other outside parties
- Revealing the way the organization performs, particularly from a customer point of view
- Identifying process, sub-process and process activity interfaces, particularly at or supporting all points of contact between the service provider and its customers
- Identifying control points and critical performance metrics
- Targeting productivity and quality improvements

- Providing a framework to assess automation opportunities
- Allowing less experienced staff to be quickly effective
- Maintaining gains and enabling continuous improvement

Operations management systems and third party applications, becoming available in the market place today, are maturing in terms of their ability to support these business process models and needs.

### **Business process models**

The use of systematic business process models, like the TOM, also makes it easier to evaluate and improve the processes themselves. Employing business process modeling techniques contributes to the goals and profitability of service providers. Using consistent modeling techniques for business development and information system development brings noticeable efficiency improvements and removes barriers within those organizations and across cooperative, inter-corporation projects.

Service providers that use systematic business process modeling to manage and improve their businesses have a much greater chance of success in today's and tomorrow's marketplace.



## Chapter 4 - The Business Relationship Reference Model

The global nature of today's emerging telecommunication services is not only multi-national, but is also becoming multi-corporation as companies extend their reach to serve larger geographical areas or to increase the range of services they can offer to their customers. Although one route to accomplish this extended reach is through direct expansion of networks and development of new service capabilities, another route is via formal or informal relationships with other providers.

### Management value chain

With emerging e-business requirements and the structural transformation it requires, the demands on the service provider enterprise for automation and integration in processes and applications will be an ongoing concern. The relevant business relationships of a simplified Business Relationship Reference Model are between:

- Customers and Service Providers
- Service Providers and Service Providers
- Service Providers and their Suppliers

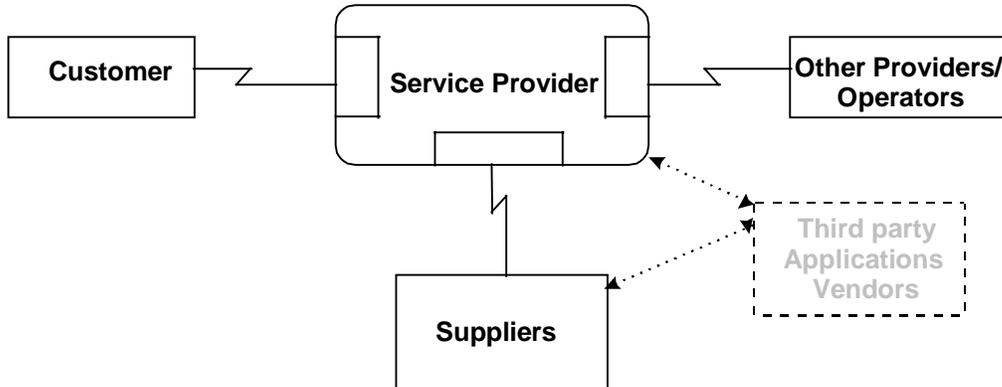
The process interfaces inherent in these relationships are part of the 'management value chain' from supplier to network operator and service provider through to customers. These automation and integration requirements involve the total depth and breadth of the service providers' business, including:

- Enterprise Management
- Customer Relationship Management
- Selling Chain Management
- Service Management
- Supply Chain Management
- Procurement Management.
- Network and Element Management

### A Business Reference Model

The Business Reference Model shown in Figure 4.1 is the foundation for the management value chain and illustrates the principal points of contact between a service provider, its customers, its suppliers and other service providers. A wide range of automation and integration opportunities exists among the business roles and relationships shown. Each has a specific business objective dictating the level

and type of management information exchanged, the robustness required of the management interface, and the priority with which industry agreements are pursued in the area concerned.



**Figure 4.1: The Business Reference Model**

There are many implications of this business model. In the past, there was a singular relationship: between the service provider and the customer. With this current view, there are more relationships and there is more complexity:

- The interfaces to suppliers, third party applications vendors and other providers/operators are external. These are initially 'procurement' interfaces, but after deployment, become an integrated part of a service provider's service delivery and support.
- To effectively manage the value chain, standardized internal interfaces and functions to support common or widely implemented management capabilities will be required.
- From the perspective of system software life cycle costs, it is not enough just to outsource custom development. Applications such as trouble ticketing provide opportunities to share a common system model for use within the enterprise versus developing a custom trouble ticketing system for use within the enterprise. It has the added benefit of simplifying the management of trouble ticketing across interfaces to external entities of the management value chain.

The business model interfaces are the points at which different applications vendors' software need to be able to exchange information. This may involve agreeing to a common applications component infrastructure, within which the applications will reside, as well as agreeing on the information to be exchanged. There are potential benefits to all by agreeing upon an open set of processes and information flows. For the service provider, it reduces development cost, enlarges the source of potential suppliers and the product functionality available. For the supplier, it creates a larger potential customer base for their products.

## **Establishing common specifications**

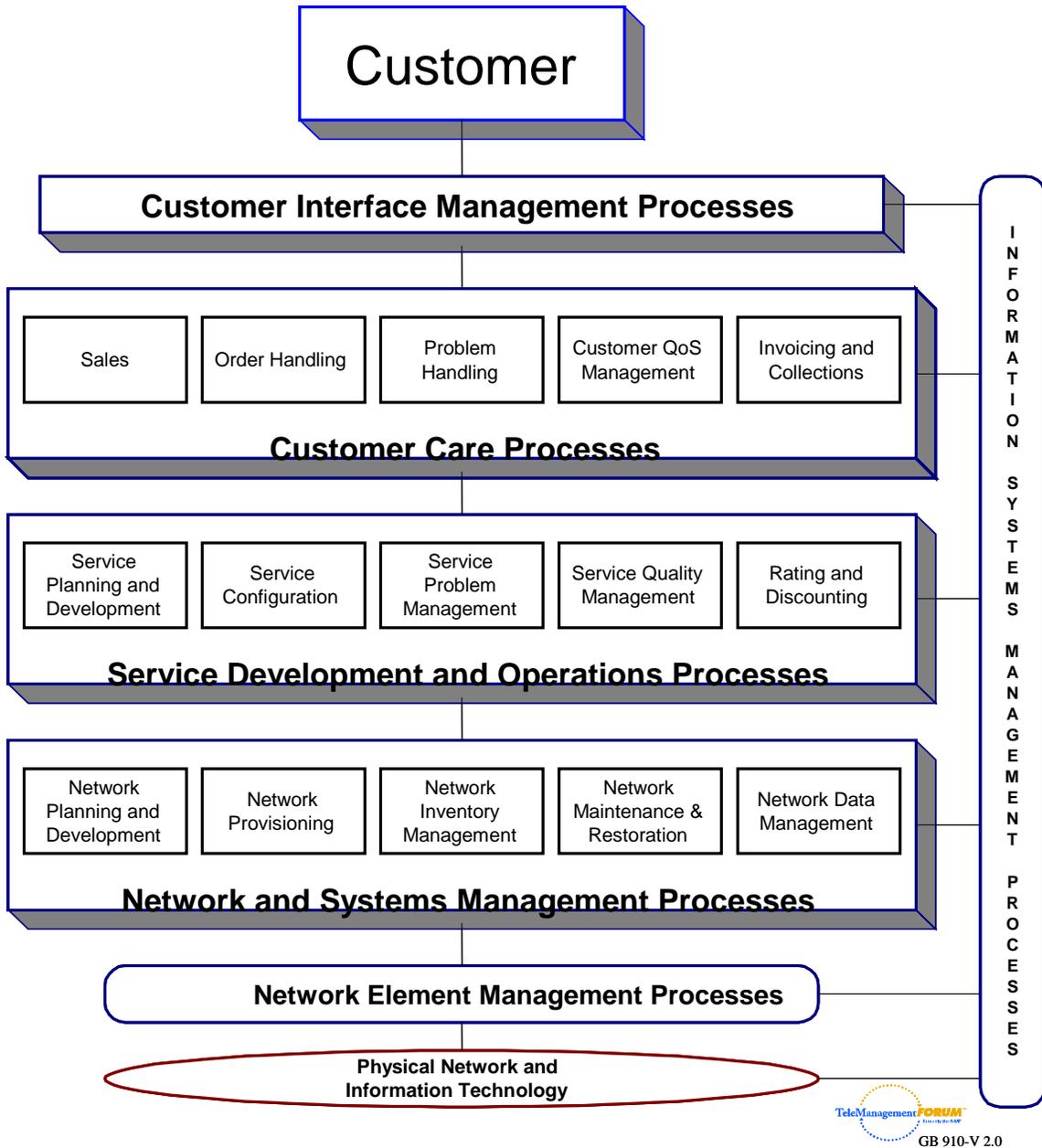
Today, the exchange of management information still has significant manual elements or involves proprietary, low-level interactions. There is a continuing need to establish common specifications and agreements to allow providers, their customers, and their suppliers to work together more effectively than is currently possible. Achieving this goal depends first on identifying the business objectives and the business process framework related to the value chain.

Today, the processes of most service providers remain very manual. No one has fully automated end-to-end processes across the majority of the functions depicted on the Telecom Operations Map, or has fully automated for all the services a service provider offers. Some processes may never be candidates for extensive automation. For example, the Service Development Process, except for Project Management aspects, will likely have a minimum of automation and is based on highly proprietary processes.



## Chapter 5 – Telecom Operations Process Model

Service providers must apply a customer-oriented and service management approach, using business process management methodologies, to cost effectively manage their businesses and deliver the service and quality customers require. To manage within a service provider's value chain, a common process framework is required. Figure 5.1 shows the Telecom Operations Map, the communications industry's common process framework for understanding the relationships among individual process flows.



**Figure 5.1: Telecom Operations Map, Business Process Framework**

The Telecom Operations Map uses the layers of the ITU-T TMN model to organize core business processes, but divides the Service Management layer into 2 parts: Customer Care and Service Development and Operations Processes. In the simplest sense, the division reflects differences between processes triggered by individual customer needs from those applied to a group of customers subscribed to a single service or service family. It also reflects the accountability for direct customer contact handling in Customer Care Processes and the critical need to focus on integration and automation of and in support of Customer Care Processes.

Depending on the provider, Customer Interface Management may be managed from within the individual Customer Care processes or, in combination across one or more of the Customer Care processes. As Web-based interfaces continue to emerge and e-business concepts are implemented, the integrated Customer Care interface is an essential service differentiator. For this reason, Customer Interface Management is also separately delineated and represents the customer interfacing functions (e.g., integrated customer contact management, Voice Response Units, ACDs, Web interface support) that are supported by Customer Care Processes.

The Telecom Operations Map can be used to describe both current processes and *future* processes. The TOM process framework is organization, technology and service independent.

## Telecom Operations Map Dimensions

Operations Management is complex with many dimensions that must be managed. The beauty of the Telecom Operations Map is in its simplicity to represent the multiple dimensions of Operations Management:

- Business Process Framework (Figure 5.1).
- Business Management
  - End-to-End Process Flows
  - Service or Technology, e.g., Broadband, IP, Mobile/Wireless
  - Business Management sub-process or use case
  - Sub-processes or function
- Information Exchange
- Business Relationships with suppliers and/or other providers
- Systems/Application and Data Architecture that supports the Business Processes

This document is *not* intended to capture every possible view involved with operations processes. Its intent is to provide a common process framework that can be aligned with how an individual service provider develops and performs their processes. Each service provider develops and updates their processes according to their business mission and strategies, including the business rules and policies that apply.

The Business Process Architecture Framework was highlighted in Figure 5.1 earlier in this chapter. The input and output diagrams in Chapter 7 provide more detail on the Business Process Framework and provide an initial view of sub-processes, process activities and information exchange. In the remainder of this Chapter and Chapter 6, selected Business Management Dimension Aspects are highlighted.

## Business Management Views

Business Process Management is the systematic design and definition of a company's processes and information, including the supporting data and systems structure, to meet its mission, goals and customer requirements. Business Process

Management starts with a Business Process Architecture designed to accomplish a specific company's objectives. A company will then define the detail of its end-to-end processes to deliver to customers and to meet its business requirements. The aspects of Business Management highlighted here provide direction on applying the Telecom Operations Map to support process management.

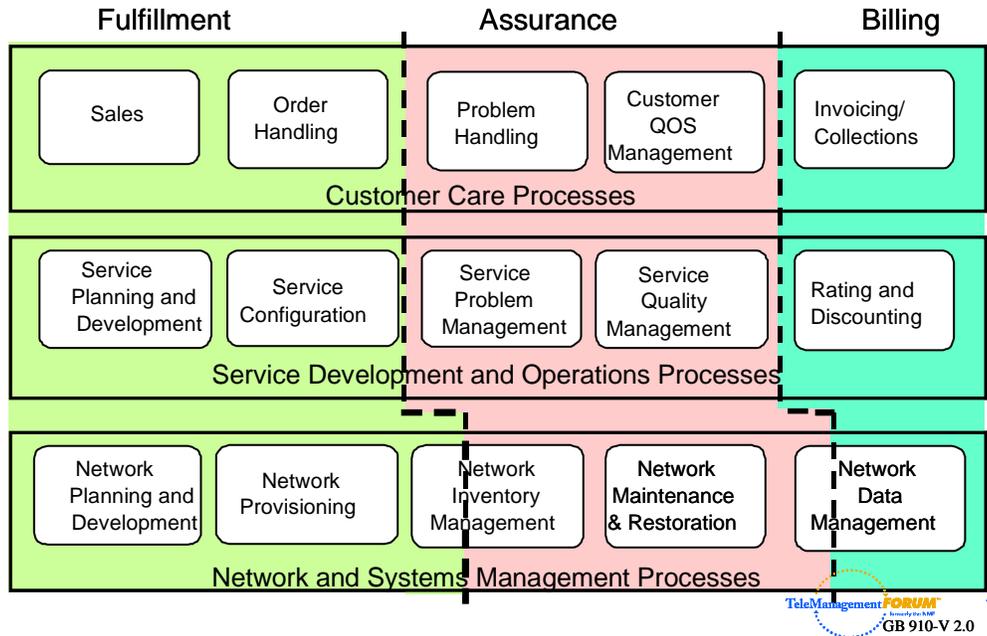
## End-to-End Process Flow

The objective of service providers is to automate their processes to deliver value to their customers. Therefore, the most critical process work is the design and definition of the end-to-end process flows for providing services to customers. The Telecom Operations Map approaches this as three basic end-to-end processes common to any service oriented business:

- Service Fulfillment (timely and correct provisioning of what the customer ordered)
- Service Assurance (maintaining the service--timely response and resolution of customer or network triggered problems, tracking, reporting, managing and taking action to improve performance for all aspects of a service)
- Service Billing (timely and accurate bills, knowledgeable and responsive Billing Inquiry support, including timely adjustment handling and payment collections)

Figure 5.2 shows a broad breakdown of the TOM framework into the three customer focused activities identified. The purpose is to show in more detail the predominant processes that need to be involved—integrated and automated to support the end-to-end, customer support processes.

The Network Inventory Management and Network Data Management boxes are split to display their significant role, more than an information input or output function, in both end-to-end processes depicted. For example, Network Inventory Management, which includes physical implementation activities in the network, is important to both the Fulfillment and Assurance processes for final installation of the service and restoration and repair of a service.



**Figure 5.2: 'FAB' End-To-End Process Breakdown**

(Fulfillment, Assurance, Billing)

Note: The interface to element management systems and the physical network are removed from this diagram for simplicity. Interaction to element management and the physical network support all three overarching processes.

### 'FAB' End-to-End Process Flows

The 'FAB' end-to-end process breakdown in Figure 5.2 does not get across the dynamic, *end-to-end process flow* required to support Service Fulfillment, Assurance and Billing. Figure 5.3 shows the three essential flow elements:

- Between the customer interface and support in a network element
- From sale through billing
- Between other providers and network operators

The vertical arrows represent the process interactions between the customer interface and the network elements, i.e., *process flow through*. The overlapping balloons are meant to show that Fulfillment, Assurance, and Billing predominantly include specific processes from the framework. However, all three end-to-end processes have interfaces among many processes across the map. The directionality of these three vertical arrows all shows end-to-end flow. As shown, the customer predominantly initiates the Fulfillment process. However, the Assurance process can be triggered by the customer or network elements and Billing is predominantly from data collection in the network to bills presented to the customer. The horizontal arrow shows the process flow interfaces required with other providers

and network operators. All three aspects of process flow are required for integration and automation.

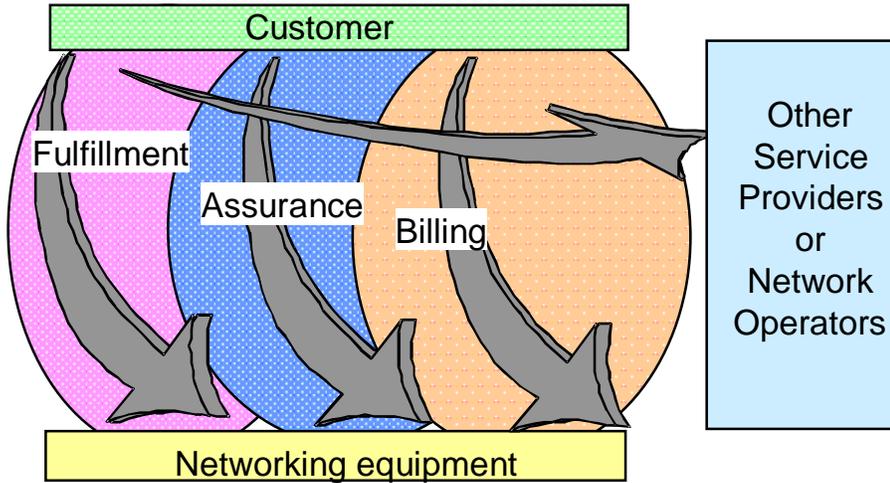


Figure 5.3: 'FAB' End-To-End and Flow-through Process Flows

### 3-D Telecom Operations Map

Certain activities and sub-processes are required for business management processes or are functional sub-processes that must support or be supported by the Fulfillment, Assurance and Billing Processes. The business management sub-processes and the functional sub-processes or set of process activities can be represented in a '3-D' overlay diagram. Overlay diagrams show that these sub-processes are supported or support the framework processes. One diagram example is shown Figure 5.4 for Service Level Agreement Management.

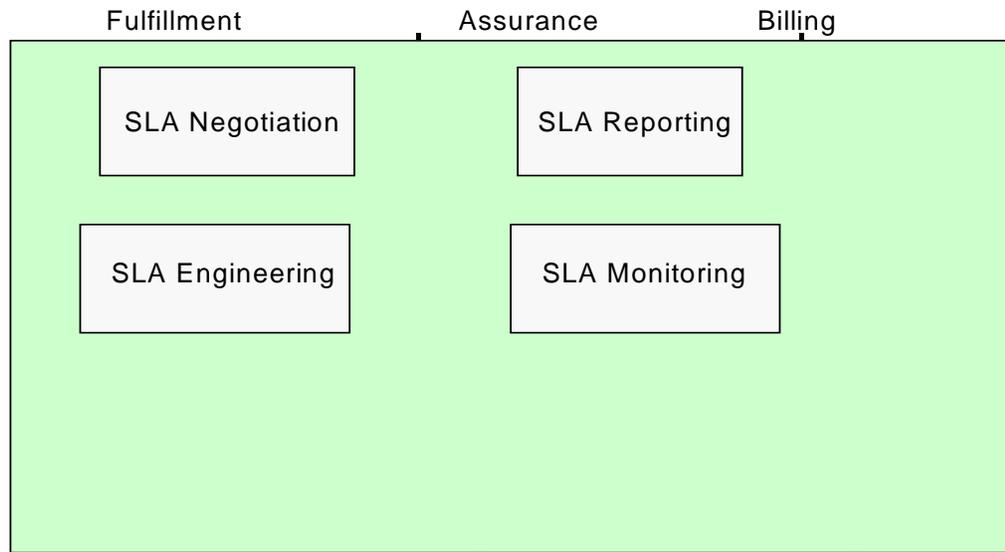


Figure 5.4. "3-D" Approach to Mapping--Service Level Agreements

The service provider needs to meet market demand for service quality and procedures for assuring contracted service quality. The Service Level Agreement (SLA) is a statement of the contracted quality of service levels between the service provider and the customer. The Management of the SLAs must consider all the business activities from identifying and defining SLA parameters, release management, configuring of the operational processes and systems to support and report life-cycle management of the agreements.

The SLA is part of the service offering and, therefore, is developed in the Service Development Process, as shown by the SLA Engineering overlay box. In some cases, a customer sale negotiation may result in a new SLA requirement. In that case, the Service Development Process is employed to establish the new requirement, if appropriate for the business.

To support existing SLA offers, the SLA Engineering box also indicates that the Service Configuration Process may need to be involved. Once the specific SLA offer is available, the Fulfillment Process triggers the Assurance process to manage SLA performance through monitoring and reporting. An SLA may include measures for performance, pricing, installation intervals, billing timeliness, time to repair, call handling and other metrics or requirements.

This overlay approach can also be used to look at functional sub-processes or capabilities required across the map. Test Management is an example of a functional sub-process that must support several framework processes, e.g., Service Configuration during Fulfillment, Problem Handling in Assurance, Rating and Discounting as part of Billing, Network Maintenance and Restoration as part of Assurance or Billing. Test Management capability support is managed either within the specific process or as a competency/capability function available to any process.

## Service and Technology Specific Dimensions

Common processes across services and technologies are essential to:

- Deliver to process cost targets and process performance improvement
- Provide a consistent customer service experience
- Enable cost effective and fulfilling people management
- Enable cost effective process automation

Services are differentiated in the common processes by differences in process activities and information required to support the specific service. Although the TOM at the framework level is technology and service independent, it is meant to be applied to real life services and technologies. The processes, flows and basic information will be consistent across two different technologies or services, but the detailed information will have differences. Certain activities or sub-processes may be required for one service or technology and not another. A Service Provider's business rules may dictate a different sequence of activities due to the nature of specific service or customer requirements.

There is a constant influx of new services and technologies in the telecommunications and data services industry that bring new process requirements or bring a new perspective to existing process requirements. Mobile/Wireless Services provide examples for both of these cases:

- Roaming Management--new process requirements
- Fraud Management extended to address new requirements in support of roaming capabilities--a new perspective on existing sub-process requirements

Roaming Agreement Management is an important aspect of Mobile Services. Roaming is a service provided by mobile service providers, where customers of a home service provider may use the infrastructure of another. To make this happen, the home service provider and the serving service provider negotiate and enter into a contractual relationship, called a roaming agreement, either directly or through a clearinghouse. The development and implementation of this contractual arrangement is managed as part of the Service Planning and Development Processes. The management of roaming agreements and the associated operational processes is complex, consisting of interfaces across all layers of the map.

Fraud and all activities to detect and prevent fraud are common to most networks. Mobility and roaming add to the complexity and difficulty of detecting and preventing fraud and are crucial considerations for managing Mobile Services.

For those interested in application of the Telecom Operations Map to specific services, with this release of the Telecom Operations Map, two service-related documents have been issued:

- "TOM Addendum IP Services: Global Intranet Access Service," which provides a view of TOM application by process for this IP Service
- "TOM Application Addendum: Mobile Services: Performance Management, Fraud and Roaming Agreement Management Special Considerations," which provides a review of these special considerations for Mobile Services and SLA Agreement.

## **Business Relationships with Suppliers and/or Other Providers Views**

Joint service arrangements are increasingly becoming the norm to support interconnection due to the huge growth in partnerships, alliances, mergers/acquisitions, new entrants--competitive access providers, and regulatory requirements. To provide service, one service provider will need to interface with one or more service providers and/or network operators. Service providers may interface with different functions at multiple layers of the Telecom Operations Map, when providing a joint service or subcontracting services. For example, the interface points vary depending on:

- The degree of process automation of the service providers involved
- The service or technology being supported
- Whether an SP is acting in a wholesale or retail role

- Whether an SP is acting on behalf of their network infrastructure or in support of a specific customer service instance

Increasingly a service provider's processes have to be viewed as part of an overall value chain and, therefore, it is critical to understand the interfaces required with suppliers, other providers and network operators. Since many processes that have been internal may now have external aspects, it is critical now to also understand the relationships of a service provider's internal processes. The onset of e-business demands it.

## Service Provider TOM Application

The service and network management structure and the process design of a service provider depends on their corporate mission, target markets and strategies. The basic operational functions identified within the Telecom Operations Map are process blocks that can be applied to various service providers' infrastructures and organizations. It is important to recognize that the specific process boundaries shown in the model do *not* correspond to organizational boundaries. In one service provider, a single work group may have responsibility for order taking and receipt of problem notification from a customer. Another work group might be responsible for tracking the progress of an order/trouble and reporting its completion. Another company might conduct all customer contact through one group, with all other processes providing input and taking instruction from that group. In each case, the basic function being executed is similar. To succeed a service provider must incorporate critical aspects from the views highlighted above, and effectively translate business mission, goals and strategies into a Business Process Management architecture along with an organizational structure. The Process Architecture must be supported by an integrated and automated Systems/Application and Data architecture, as well as an operational environment that executes these processes with high quality.

As we have discussed in this chapter, the TOM has put in place the Business Process Framework and identified aspects that support Business Process Management. Each service provider needs to evaluate the Telecom Operations Map Framework processes and identify how they perform each process internally, including the business rules and policies that they apply. In Chapter 6 examples of a Service Fulfillment, Assurance and Billing end-to-end process are depicted. Chapter 7 provides input and output detail for each the processes in the Framework.



## Chapter 6 – Examples of FAB Process Flows

### Process Interactions

Figures 6.1 through 6.3 (the FAB process diagrams) provide rough illustrations of the principles of process flow by depicting segments of a process or one instance of the application of the process flow. Developing process flow diagrams is one of the first steps in Business Process Mapping showing the relationships of service provider business needs to the identification of information, requirements, and sequencing required to drive automation.

For those interested in understanding Business Process Management somewhat more, the “TOM Application Notes: Process Re-engineering, Development and Management—Simple Methodology Steps” document, issued with this release of the Telecom Operations Map, provides a high level view of process redesign and development steps. It also shows a brief view of the Business Process Mapping technique, which is a process flow technique that makes it easier to see the customer’s point of view.

The figures in this chapter identify the interactions and types of information flows that take place within and between a service provider’s operations processes to support service to a customer. They are the representation of the dynamic process with emphasis on the process flow-through requirement, i. e., the flow between the customer and network and/or information technologies. In particular, they outline some of the typical activities for each high-level process providing further examples of the breakdown of those activities into discrete sub-processes and/or activities that cooperate to fulfil the need.

The process flows identified are consistent with those identified in Chapter 5 of this document, but do not capture all interactions. This is because they show a service instance or process application segment for example purposes. Chapter 7 captures lifecycle inputs and outputs for each process, whereas Figures 6.1-6.3 only capture a specific identified case. These diagrams also make use of more detailed process flows identified in the Network Management Detailed Operations Map (Reference 2) that support the Network Management Layer processes.

The TeleManagement Forum expects to develop robust process flows both at a generic level and in some more specific areas to provide more examples of process flow configurations. Based on member needs, process flows that adapt the generic flows to a specific technology or service will be developed. As mentioned earlier, these process flows must be representative, since every service provider architects

their specific processes based on both the needs of their target customers and the strategic needs of their business.

The TeleManagement Forum is using a banded flow approach as the standardized approach to process diagramming. It allows identification of essential and non-essential activities. Most importantly, it enables a concise view of the entire service process from a customer's perspective within the TelOps Map Framework. As more TOM Application Notes are developed, these example process flows will be replaced with more robust and clearer end-to-end process flows using the banded flow methodology.

### **A Service Fulfillment Process Flow Instance**

The Service Fulfillment process starts with pre-sale activity and ends with:

- On-time and correct installation of a customer's requested service--as well as a satisfied customer.
- The output of information required to manage the SLA, to provide problem/trouble management and to provide a correct bill.

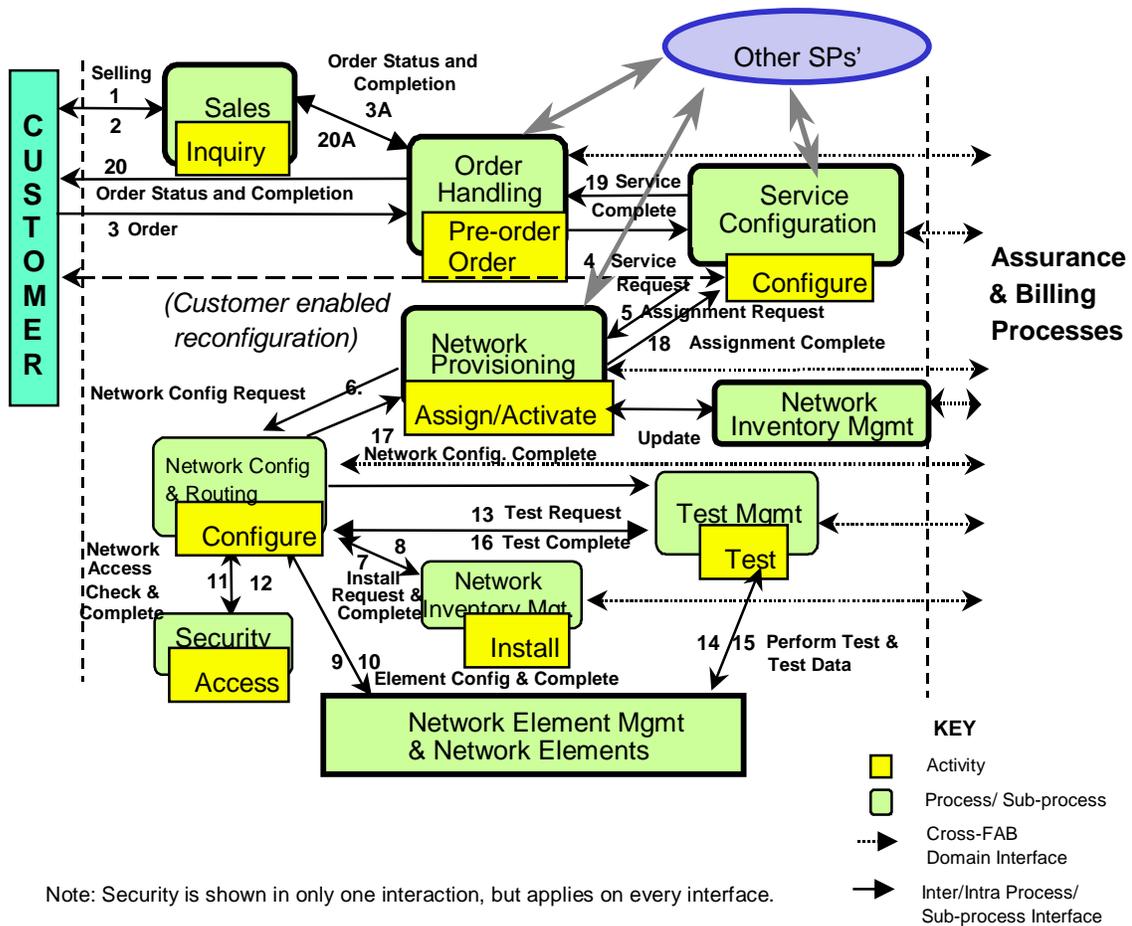


Figure 6.1: Rough Example of Fulfillment Process Flow Instance

### Order Request and Installation Example

This example of a fulfillment process shows a possible sequence of activities to support a customer inquiry, subsequent order for service, the configuration of the service, and the installation and completion of the request. Depending on the service provider process, orders can be placed through the sales process and/or directly through the order management process. For a specific service provider, some customers may be supported by a specific sales team that places some or all orders for the customer and tracks them to completion. These dual trigger process interfaces and follow-ups are shown as 3/3A and 20/20A.

For this representation, the Network Provisioning process has one of its sub-processes explicitly displayed: Network Configuration and Routing (Reference 2).

The complete fulfillment flow-through may not actually be required every time for some simple services, which have pre-assigned service capacity. For example, the flow for an instance of a service set-up could be bypassed at Network Provisioning, when configured and tested facilities have been pre-provisioned. This depends upon a particular provider's operational process and policy. It will also impact the timing of interactions with Network Inventory Management; hence, the interface sequence number has been omitted.

In other cases, more process activities may be required for a variety of reasons, e.g., due to the complexity of the service being offered, due to a new SLA requirement, etc.

Interfaces to the customer are shown, as well as the output interfaces required to support Service Assurance and Billing processes, i.e., trouble/problem management, SLA management and billing. Interfaces are required with other service providers or network operators when the service offered to a customer involves joint service arrangements.

As mentioned in the diagram note, security is critical and applied at every interface. Security, like test management, may be a functional sub-process applied across the map or be managed as part of the specific process and handled as requirements for the process and system involved.

## **A Service Assurance Process Flow Segment**

The Service Assurance process starts with registering SLA terms by specific customer and updating trouble/problem management systems for specific service and customer instance. It ends with:

- Identification of an SLA or QoS violation, reporting, managing improvement and providing information to Billing, if there is a bill impact.
- Identification of a trouble from the customer or identification of a trouble triggered by network or information technologies through fast isolation, restoration, repair and providing information to Billing for credits, if there is a bill impact—and a satisfied customer.

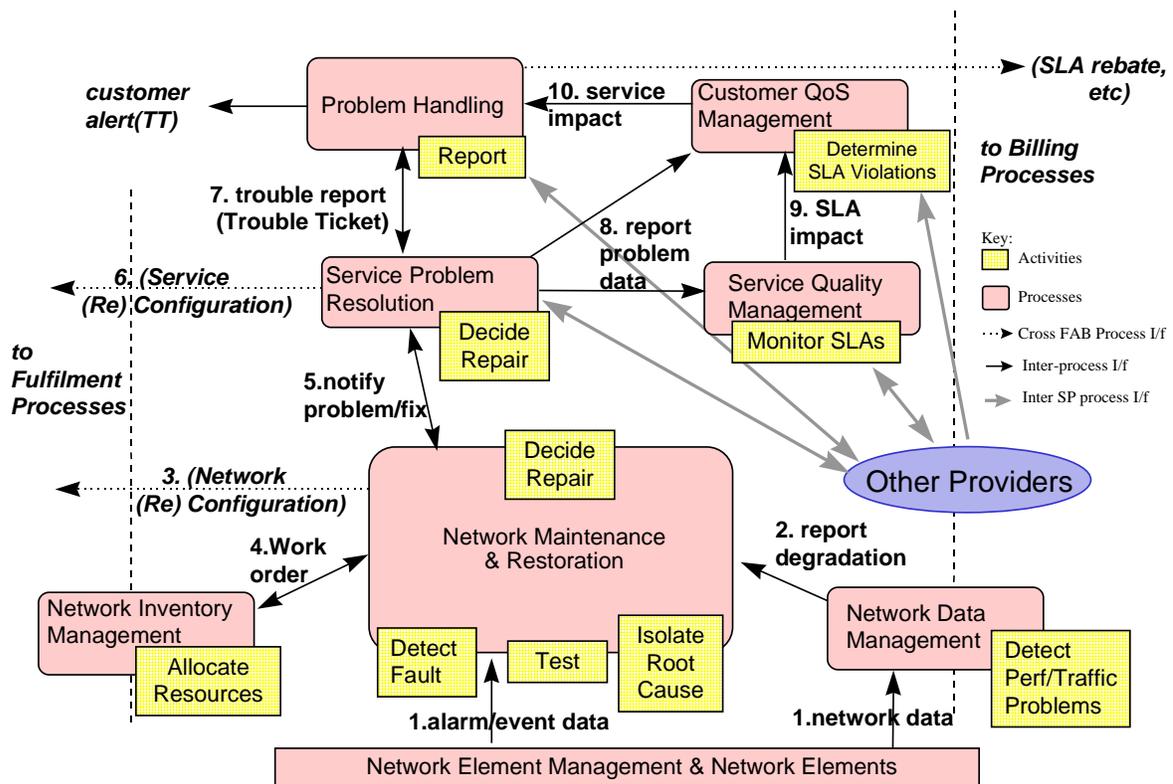


Figure 6.2: Rough Example of Assurance Process Flow Segment

### Network-Detected Fault / Quality of Service Problem Example

Figure 6.2 shows a possible sequence of activities in response to a *network-detected* problem. The problem could be non-service-affecting because of inherent ‘self healing’ capabilities in the underlying network and information technology infrastructure (for example, SONET/SDH networks have some instant redirection capabilities). The service provider’s policy could be to decide on how to repair the problem at the network layer and, subject to ‘no-break in service’, may not even inform the service layer of the event.

The figure shows two ways a potential service-affecting problem could be identified, i.e., by either an ‘alarm event’ or by synthesis of network data, through Network Data Management. Neither is exclusive. Network Data Management collects and processes both performance and traffic data, as well as usage data. The usage data is used in the Billing Process.

Most service providers are driving their Service Assurance processes to become primarily proactive, meaning triggered by automation rather than triggered by the

customer. This is important for improving service quality, customer perception of service and for lowering costs.

Customer Care Processes have been reactive until recently. The extreme pressure to reduce cost, customer demand for more control and customer demand for more proactive, customer-enabled service support are driving a major shift to interactive support through automation. With the advent of Internet access, interactive customer-enabled service includes giving the customer the ability to see and act on service performance or the performance of 'his/her network.' Superior companies are also recognizing the value of customer provided information at each customer interface point. They are capturing that information for use in other ways across the enterprise, e.g., to customize offers to customer needs, to relate to the customer in future interactions, etc.

If the service provided is a joint service type arrangement, the main service provider must interface with other service providers or network operators to monitor and support the service provided.

### **A Service Billing Process Flow Instance**

The Service Billing process starts with creating and updating customer accounts, as well as registering SLA terms by specific customer. It ends with a satisfied customer and:

- Correct and on-time issuance of bills, including application of outage credits and SLA violation credits.
- Customer Account or Billing Inquiry support.
- Timely and accurate bill adjustment.
- Management of accounts receivable, including payment collections from customers.

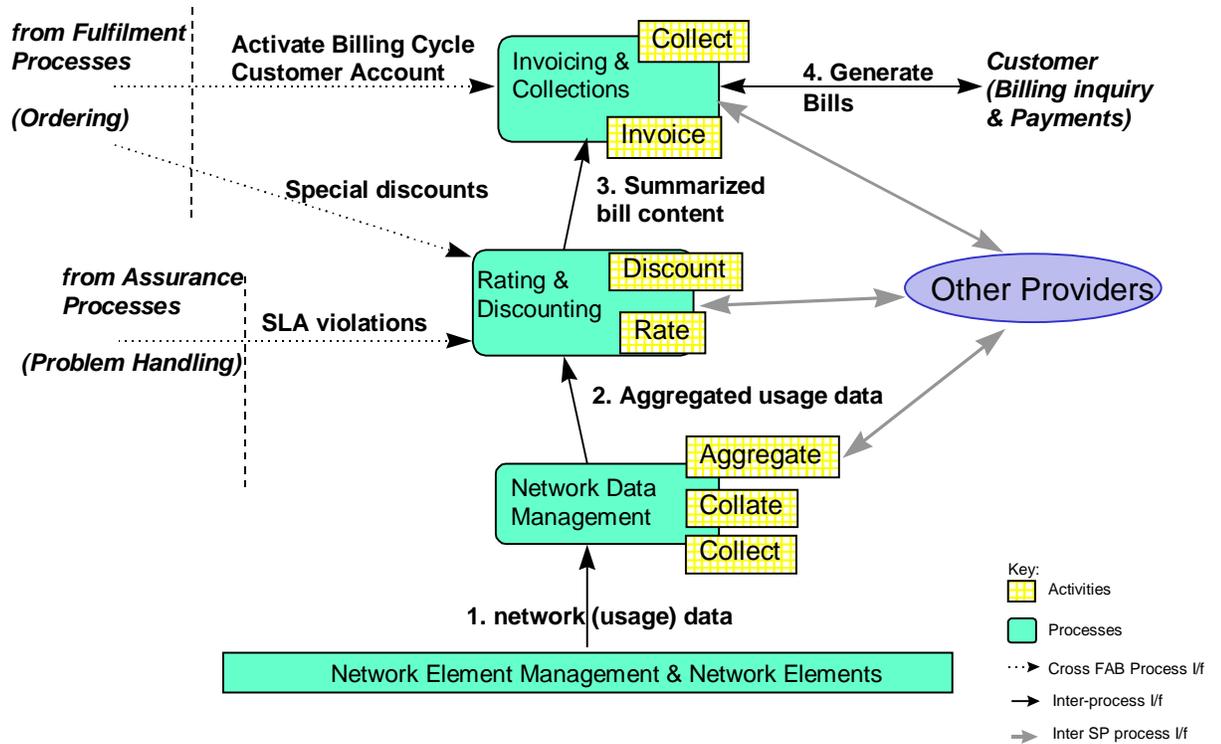


Figure 6.3: Rough Example of Billing Process Flow Instance

### Flat Rate, Usage and SLA Element Bill Generation Example

Figure 6.3 shows a typical sequence of activities to generate a bill that has flat rate elements (e.g., one-time installation, monthly recurring charges), usage charges and possible SLA adjustments. Service providers may also choose to apply discounts or rebates (for outages and/or Service Level Agreement breaches) to a specific customer’s bill, according to service type, by promotion, by customer relationship, according to its policy or customer contract.

When a service is provided by a combination of different service providers, usage and/or other billing data may be aggregated by the ‘main’ service provider from input by other ‘secondary’ service providers’ and one bill presented to the customer. This is a trend, but depends on the service provider billing strategy, customer wishes, the actual service arrangement provided, and/or service provider process capability and policy.



## Chapter 7 - The Operational Processes

In this chapter the sub-processes, process activities and interfaces of each process block within the Telecom Operations Map Framework are described, including the most common inputs and outputs. All of these processes involve *significant* work (e.g., volume plans, project management of large sets of orders) and work force planning (e.g., scheduling of people per shift) and management activities at the global, sub-process and functional level.

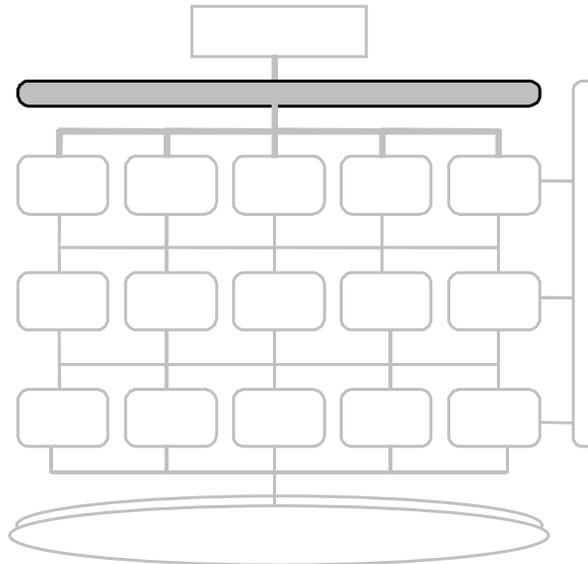
The format and content of these Input-Output Diagrams will evolve based on:

- Experience and implementations
- Assessment for new directions, e.g., e-business
- Development of sequenced and more detailed process flows
- Inputs and comments

### Customer Care Processes

These processes involve direct interaction with a customer to provide, maintain, report on service, and bill for services. The customer is the ultimate buyer of a communications service with many end users in their organization that utilize the Service Provider's services. The Service Provider must interact at many interfaces to support its customer and end users.

## Customer Interface Management Processes

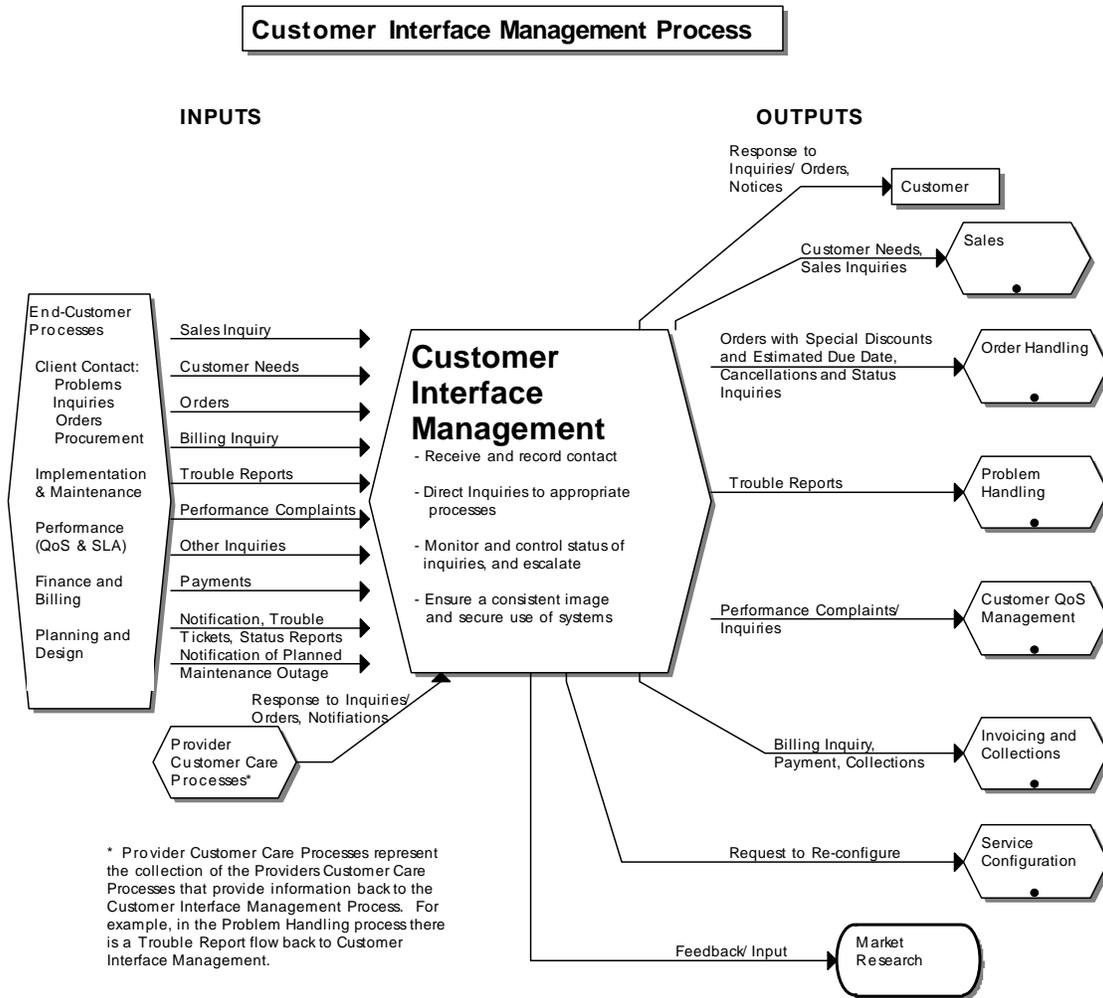


The Customer Interface Management Process may be a distinct process, or may be performed as part of the individual Customer Care Processes on an individual service or cross-service basis. These are the processes of directly interacting with customers and translating customer requests and inquiries into appropriate "events" such as, the creation of an order or trouble ticket or the adjustment of a bill. This process:

- Logs customer contacts
- Directs inquiries to the appropriate party
- Tracks the status to completion
- Provides regular follow-up to the customer

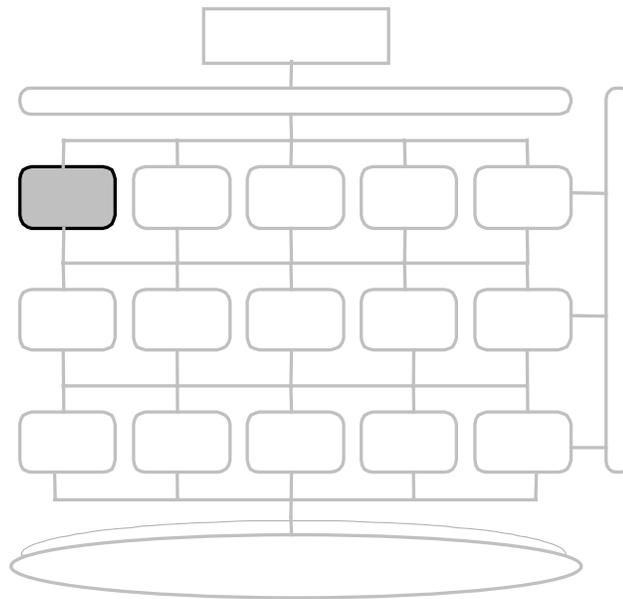
In those cases where customers are given direct access to service management systems, this process assures consistency of image across systems, and assures security to prevent a customer from harming their network or those of other customers.

The aim is to provide meaningful and timely customer contact experiences as frequently as the customer requires. This process begins with customer contact and ends with customer contact and a delighted customer. A specific start and end of the process depends on the underlying process being executed.



**Figure 7.1 Customer Interface Management Processes**

## Sales Process



The Sales Process encompasses learning about the needs of each customer, and educating the customer about the communications services that are available to meet those needs. It includes the activities of selling and field support activities. It includes working to create a match between the customer's expectations and the service provider's ability to deliver.

Depending on the service provider process, it can be purely selling or can include various levels of technical sales or 'back-office' support. With customer demand for sharply decreased intervals, customized solutions and the need to reduce cost of costly order errors, more and more technical sales support is being provided as early in the process as possible. The Sales process may include pre-order work and interfaces. More and more routine selling activities are moving to an Internet, customer-enabled interface and to other less costly Customer Care contact points. SLA negotiation, RFP (Request for Proposal) management and negotiation are led from this process. Sales functions, supporting the process, can be organizationally aligned geographically, by industry or by account size when functions provided for large accounts are different than for small accounts, for example.

The aim is to respond quickly, sell the correct service to suit the customer's need and set appropriate expectations with the customer. The process starts with identifying a potential customer or customer need and basically ends with closure of a Sale (and support activities as determined by the specific service provider's process). This includes customer need assessment, customer decision to buy, including customer and service requirement information required to correctly order, provide, support and bill for the service the customer requested.

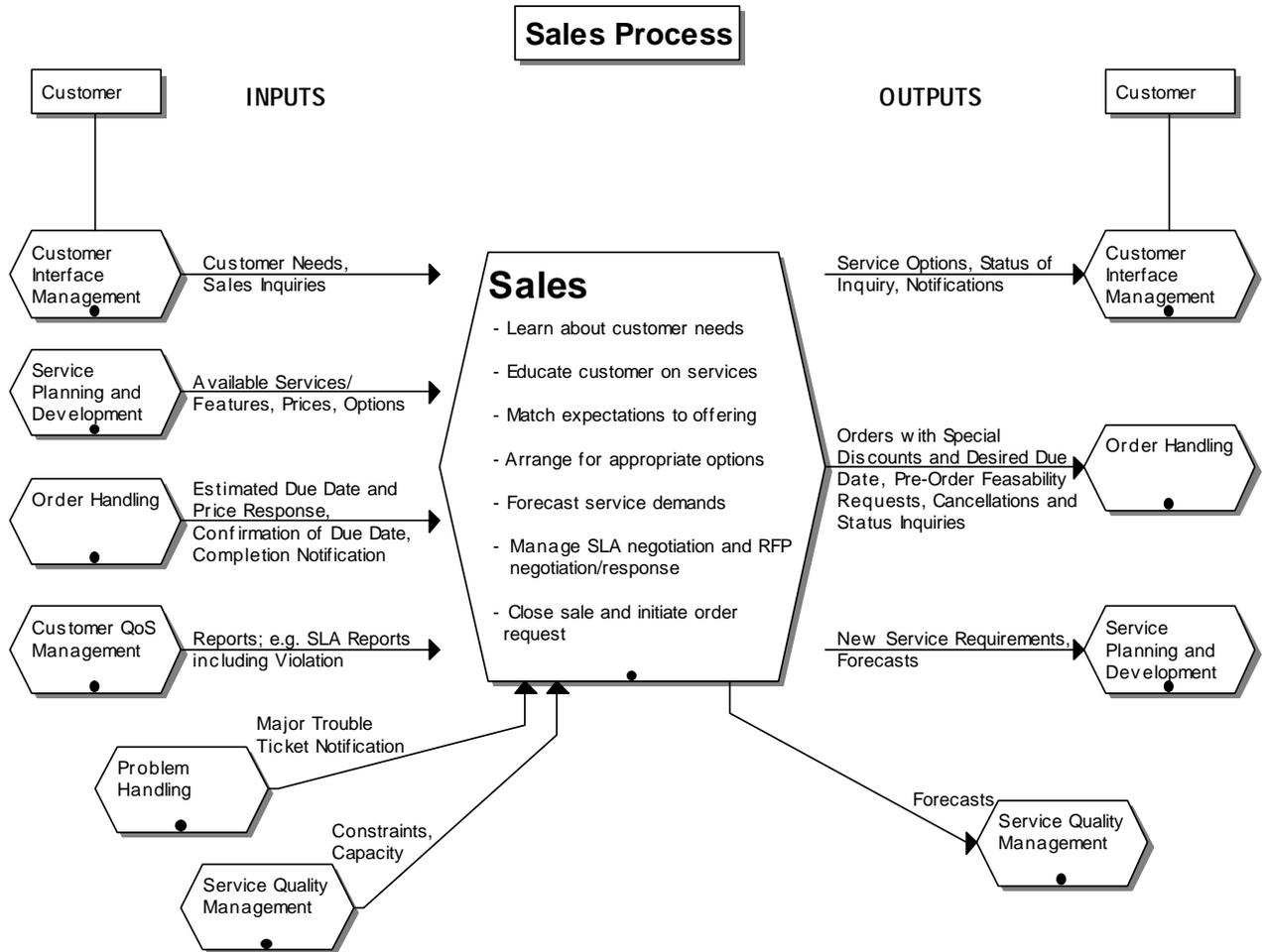
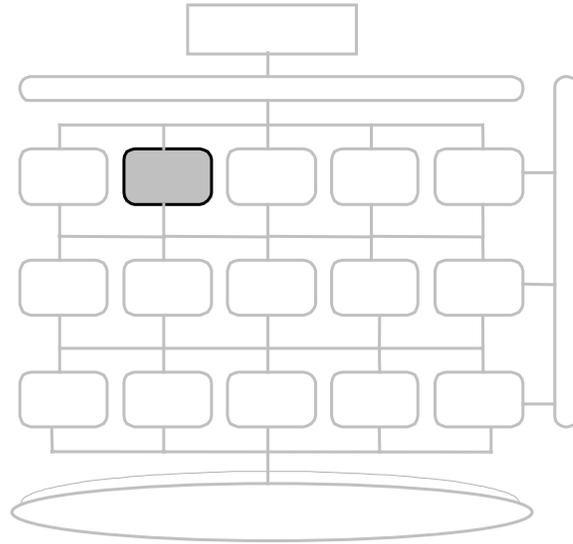


Figure 7.2: Sales Process

## Order Handling Process



The Order Handling Process includes all the functions of:

- Accepting a customer's order for service, whether directly from the customer, from the Sales process, from the customer's agent (e.g., Outsourcer, another service provider)
- Tracking the progress of the order and updating the customer
- Notifying the customer when the order is complete

Orders can include new, change and disconnect orders for all or part of a customer's service, as well as cancellations and modifications to orders. For new customers and other cases according to the business rules of the specific service provider, this process is accountable for initiating and receiving credit check information. Pre-order activity that can be tracked is included in this process. The development of an order plan may be necessary when service installation is large, complex and/or is to be phased in. The need for preliminary feasibility requests (service inquiries) and/or pricing estimates are part of this process when certain requirements are requested and/or certain services are ordered.

The aim is to order the service the customer requested, support changes when necessary, keep the customer informed with meaningful progress of their order, and track and manage to successful and on-time completion. It must include a completion acceptance with the customer and should include a follow-up to be sure the service is working properly for the customer. The process begins with an order or, in some cases, pre-sale activity. The process ends with a completed order, a delighted customer and sufficient information to build or update a customer account record in trouble/problem handling, performance reporting and billing processes and systems.

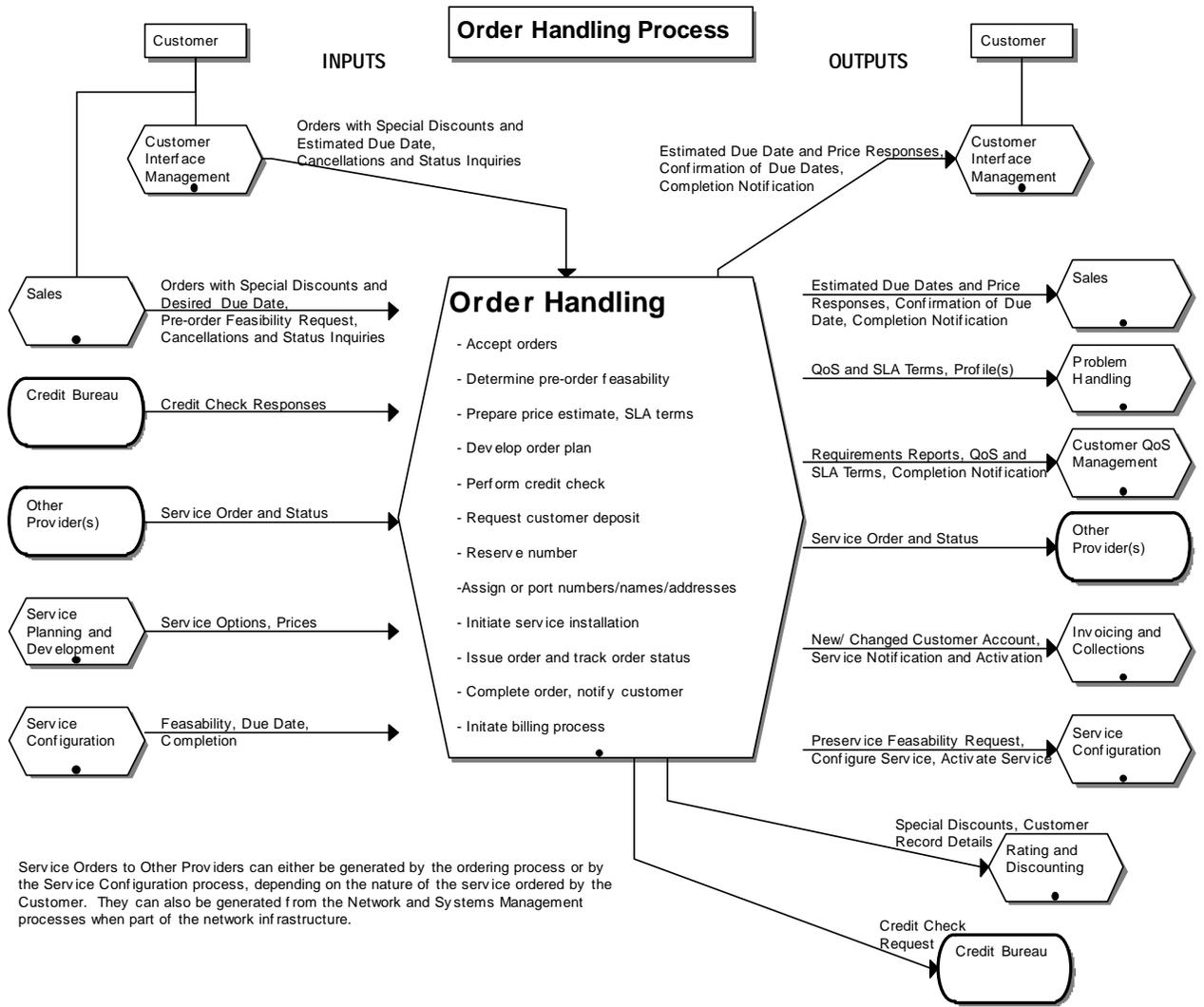
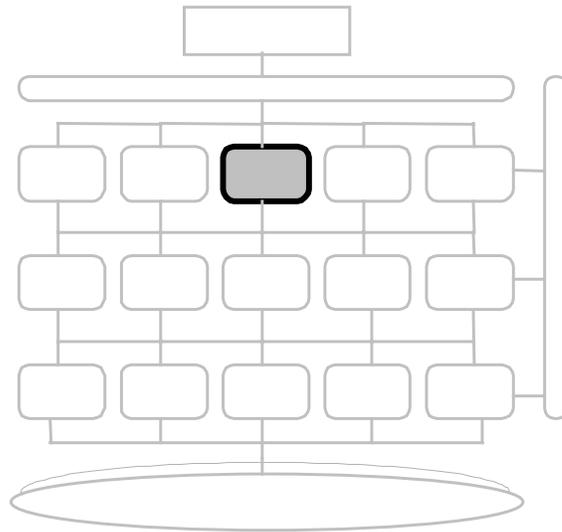


Figure 7.3: Order Handling Process

## Problem Handling Process

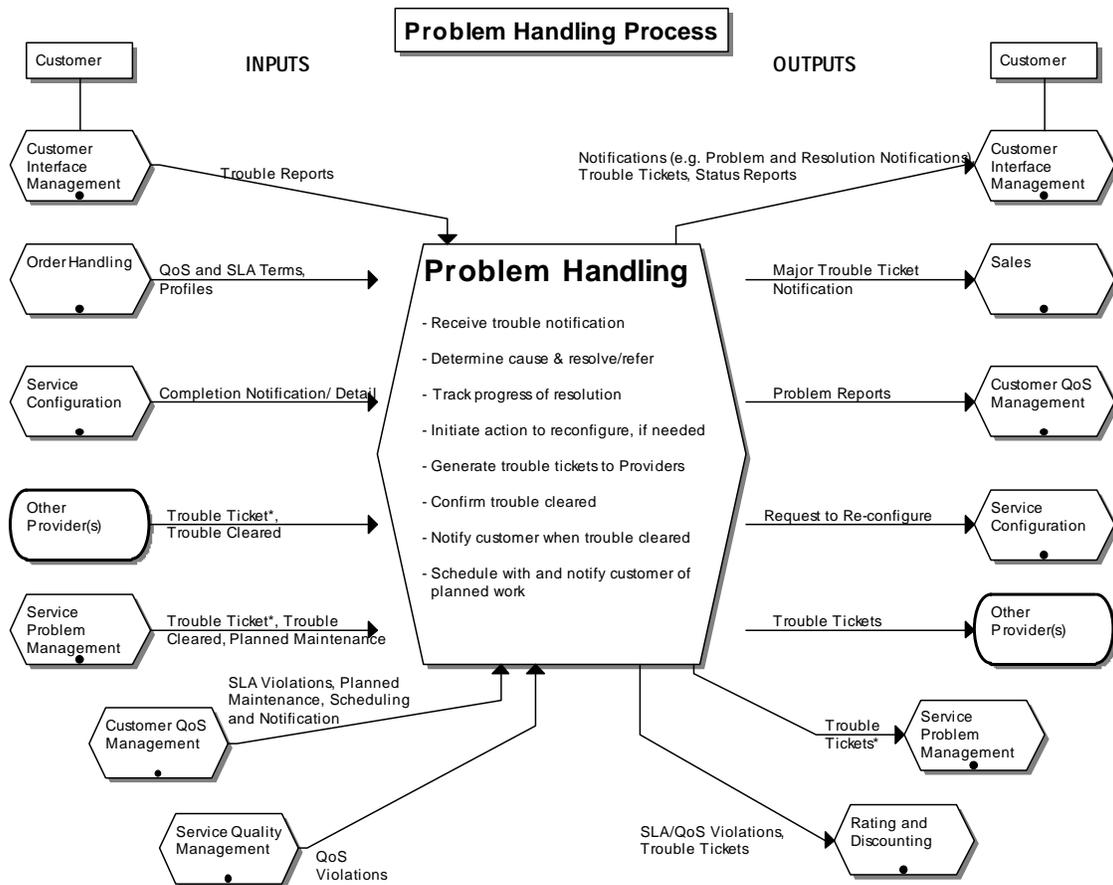


The Problem Handling Process is responsible to receive service complaints from customers, resolve them to the customer's satisfaction and provide meaningful status on repair and/or restoration activity—reactive part of process. This process is also responsible to be aware of any service-affecting problems detected by the Service Provider, including

- Notifying the customer in the event of a disruption (whether reported by the customer or not)
- Resolving the problem to the customer's satisfaction
- Providing meaningful status on repair and/or restoration activity

This proactive management also includes working with customers on planned maintenance outages.

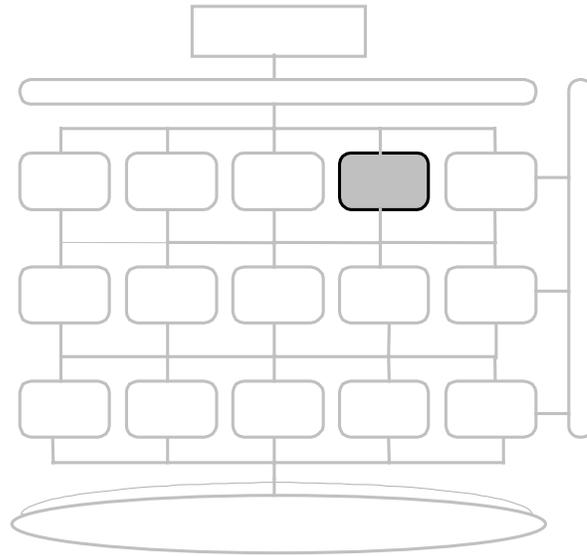
The aim is to have the largest percentage of problems proactively identified and communicated to the customer, to provide meaningful status and to resolve the problem in the shortest timeframe, preferably with no customer impact. The proactive process begins with a network or information technology generated trouble and creating a trouble ticket. It ends with timely status to the customer and resolution—restoration and/or repair. A customer repair completion acceptance, as well as a restoration acceptance, when a restoration is involved, is a basic requirement of the process. A follow-up contact to the customer to ensure the service repair is working properly should also be made. The process truly ends with logging all final information and the output of sufficient information to support SLA Reporting and generate outage credits on billing, as appropriate.



\* When a trouble is reported by the customer, a trouble ticket may be sent to Service Problem Management for correction. When a trouble is identified by Service Problem Management (via Service Quality Management or Network Maintenance or Network Maintenance and Restoration) then Problem Handling is notified in order to inform the customer of the problem.

**Figure 7.4: Problem Handling Process**

## Customer Quality of Service (QoS) Management



This process encompasses monitoring, managing and reporting of Quality of Service (QoS) as defined in Service Descriptions, Service Level Agreements (SLA), and other service-related documents. It includes network performance, but also performance across all of a service's parameters, e.g., Orders Completed On Time. Outputs of this process are:

- Standard (predefined) and exception reports, including; dashboards, performance of a service against an SLA
- Reports of any developing capacity problems
- Reports of customer usage patterns, etc.
- Performance reviews with the customer
- Responses to performance inquiries from the customer

For SLA and QoS violations, the process supports notifying Problem Handling and Service Quality Management. Customer QoS registers individual Customer SLA terms per Order Handling Process input.

The aim is to provide effective monitoring and reporting to manage to the commitments made to the customer. Monitoring and reporting must provide meaningful and timely performance and QoS support information (to both the customer and the service provider's management) across the parameters of the services provided. The aim is also to manage and report on action planned and

taken to assure service levels that meet specific SLA commitments or standard service commitments to the customer.

The process begins with receiving performance information from the physical service infrastructure, as well as receiving individual process and/or sub-process performance information. It ends with performance and quality reports to internal management and to the customer, updates to Problem Handling and SLA violation information to Billing for credits.

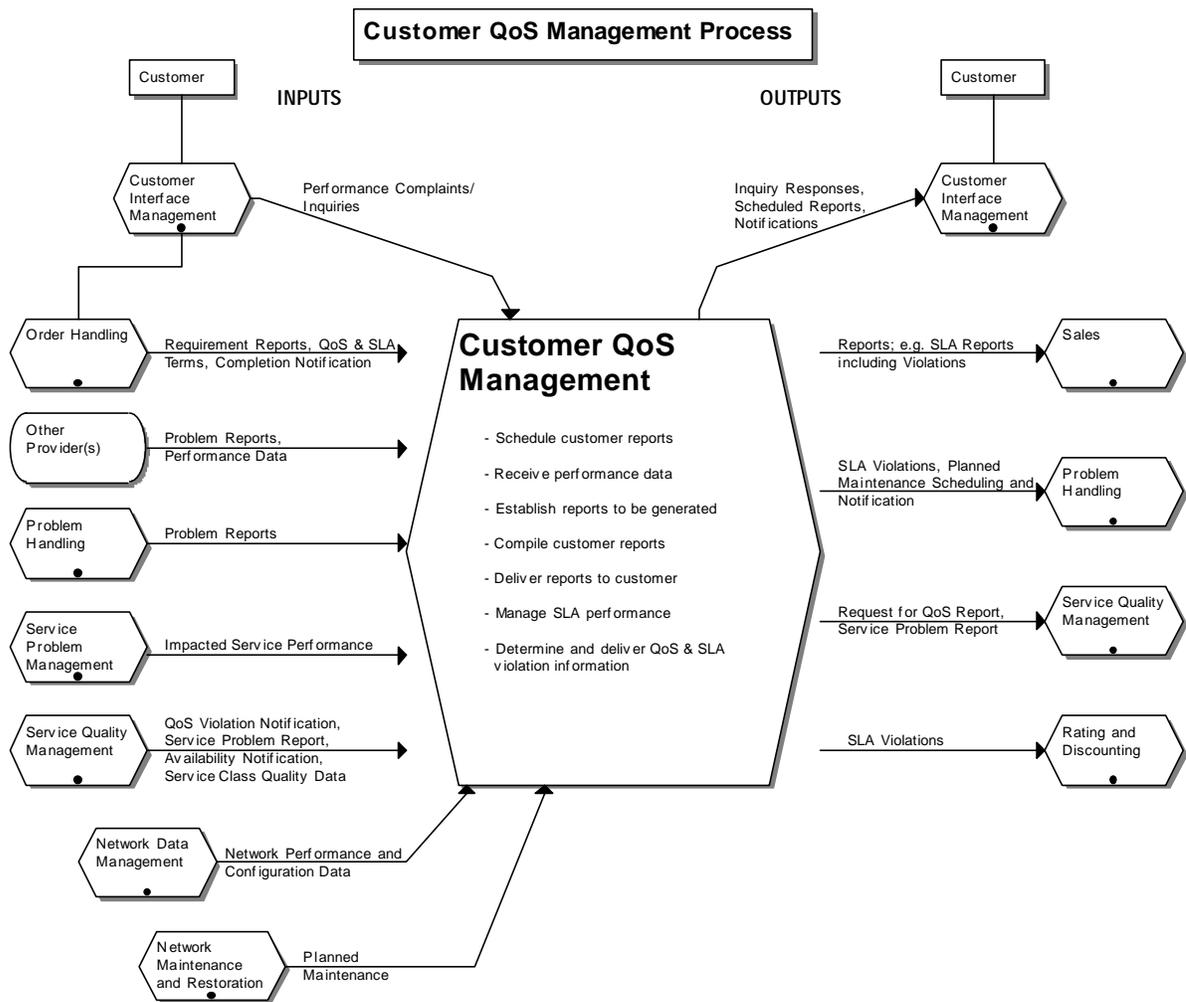
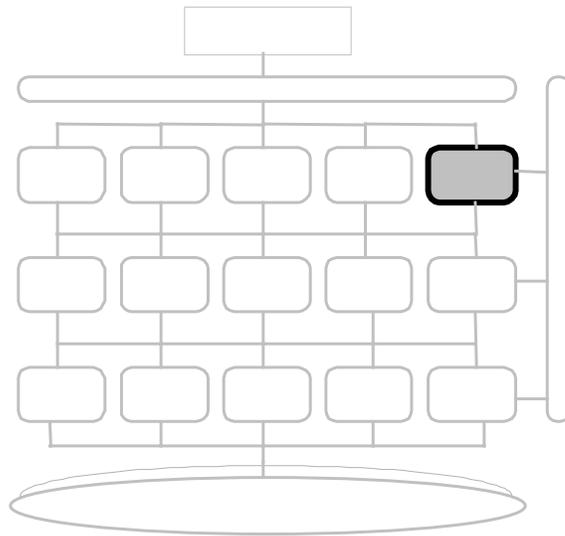


Figure 7.5: Customer Quality of Service Management

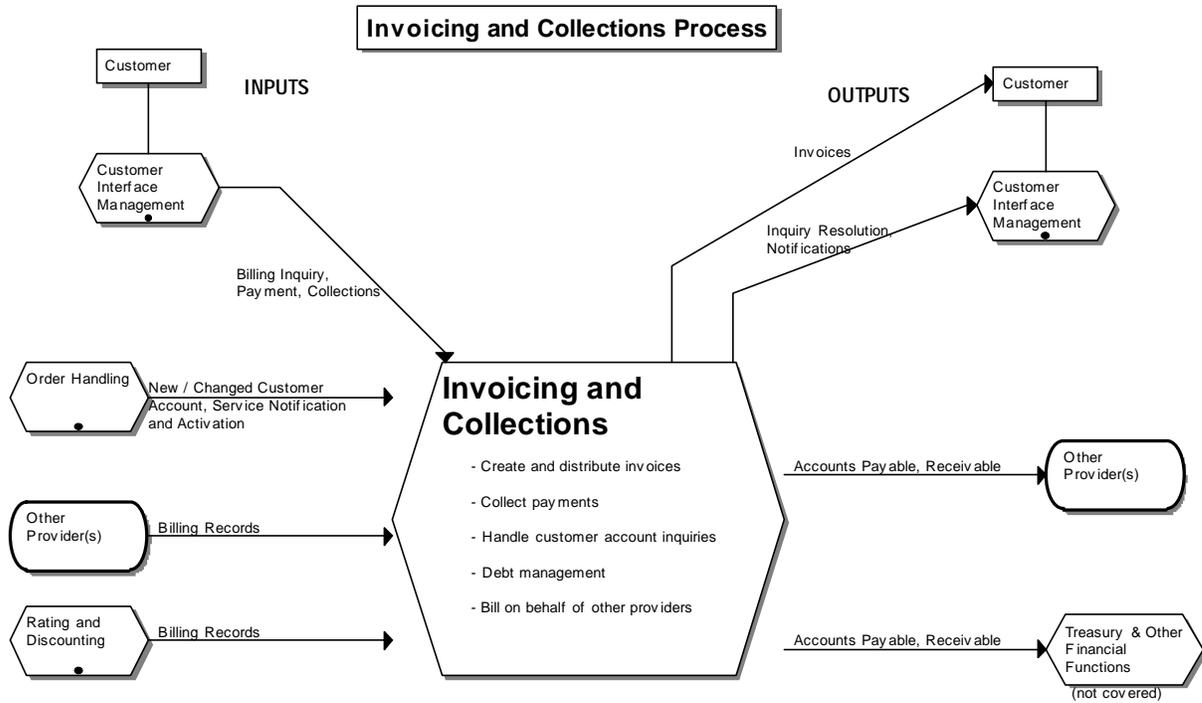
## Invoicing and Collection Process



This process encompasses sending invoices to customers, processing their payments and performing payment collections. In addition, this process handles customer inquiries about bills, provides billing inquiry status and is responsible for resolving billing problems to the customer's satisfaction. Final customer contact is required to notify the customer of the resolution and, when appropriate, when the billing adjustment will be on the customer's bill. This process accepts rated usage from the Rating and Discounting Process to render a total bill. Flat rate and non-recurring charges are applied from information provided on the completed Service Order.

More prevalent in billing than perhaps other processes today, many providers provide invoicing and collections functions for other providers as a service. For joint service arrangements, billing, invoicing, settlements and reconciliation between service providers may be involved.

The aim is to provide a correct bill and, if there is a billing problem, resolve it quickly with appropriate status to the customer. An additional aim is to collect monies due the service provider in a professional and customer supportive manner. The process begins with input from the Order Handling Process to set-up a customer account. It ends with correct billing of the customer and a satisfied customer.



**Figure 7.6: Invoicing and Collection Process**

## **Service Development and Operations Processes**

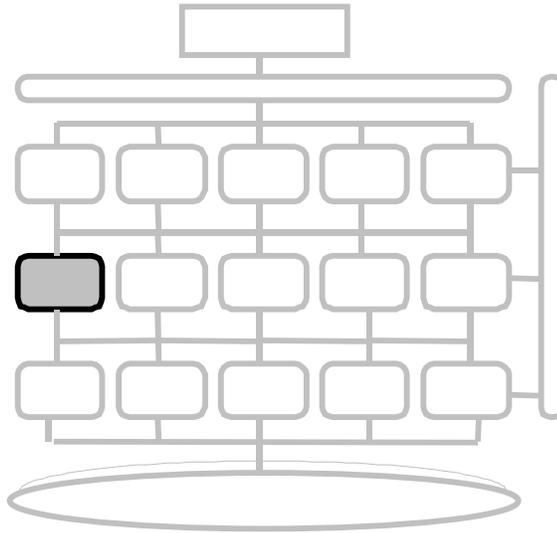
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These processes are generally "one step removed" from day-to-day direct customer interaction. Focus is on service delivery and management as opposed to the management of the underlying network and information technology. Some of these functions are done on a one-time basis, like designing and developing a new service or feature. Other functions involve service capacity planning, the application of a service design to specific customers or managing service improvement initiatives, and are closely connected with the day-to-day customer experience.

Although not shown in this diagram, these processes are accountable to the business management layer function of product management (the profit and loss accountability) to meet, at a minimum, targets set for:

- Speed to market for new service or feature introductions
- Service Quality, including performance and customer satisfaction
- Service Cost

## Service Planning and Development Process



This process encompasses:

- Designing technical and non-technical capabilities to meet specified market need(s) at desired cost. This can be a new service, new feature, service enhancement, upgrade or maintenance related.
- Negotiating joint service arrangements, e.g., SLAs with other providers, Mobile Services Roaming Agreements, Bilateral Agreements, etc.—Inter-Provider Agreements.
- Ensuring that the service (product) can be properly installed, monitored, controlled, and billed.
- Initiating appropriate process and methods modifications, as well as initiating changes to levels of operations personnel and assuring required training is performed to support service growth, new services, features or enhancements.
- Initiating any modifications to the underlying network or information systems to support the service requirements.
- Assuring that the technical capability works, that the operational support process, procedures, and systems function properly. This usually includes being involved in the network and service feature testing and then leading customer trials and Operations Readiness Testing prior to service introduction.
- Managing deployment and Controlled Introduction of a new service, feature, enhancement or other change to the service.
- Ensuring that sufficient capacity is available to meet forecasted sales.

The aim is rapid development and deployment of new services, service enhancements and/or capacity at specified cost, support and quality requirements. The process begins with a new service, feature, other concept/requirement, or a shortage of capacity. It ends with introduction of the new service, feature, other

service requirement or added capacity, including being able to sell, order, maintain, bill, report on and meet or exceed service quality, performance and cost targets.

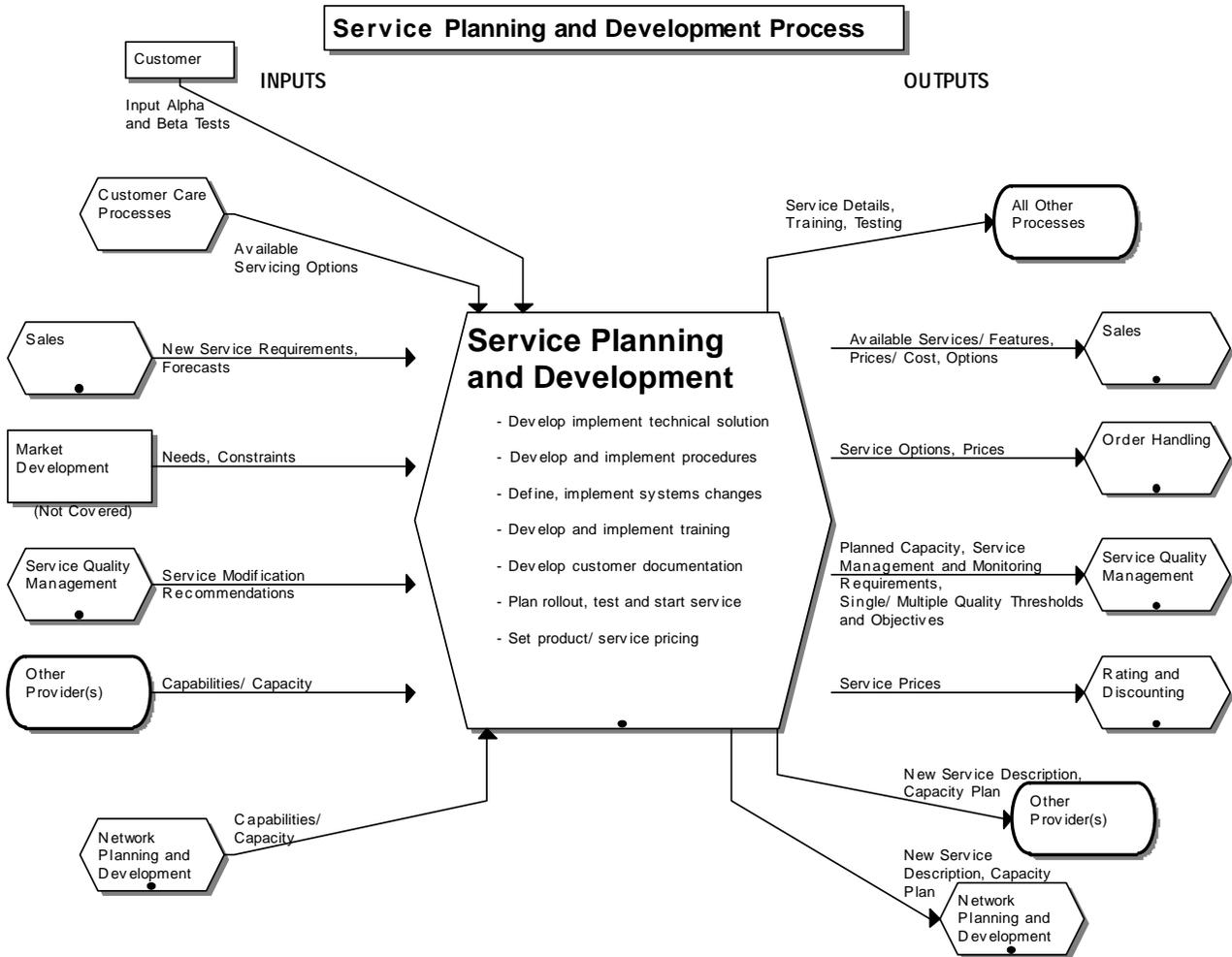
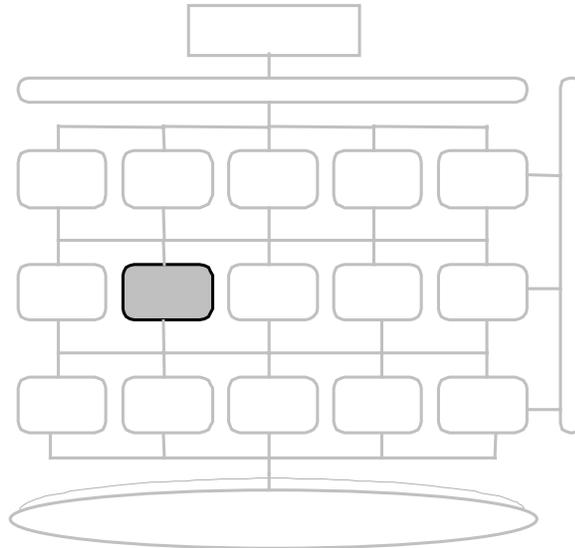


Figure 7.7: Service Planning and Development Process

## Service Configuration Process



This process encompasses the installation and/or configuration of service for specific customers, including the installation/configuration of customer premises equipment. It also supports the re-configuration of service (either due to customer demand or problem resolution) after the initial service installation. Service Configuration work is also frequently generated by service infrastructure needs to maintain performance or to add service specific capacity. Therefore, Service Configuration work would not be tied to configuring a specific customer instance for those cases. The Service Configuration Process interacts with the Network Provisioning Process and the Network Inventory Management Process to do physical implementation or installation work in the network and/or information technologies.

The aim is to correctly provide service configuration or re-configuration, including connection management activities, within the timeframe required to meet ever-decreasing service intervals in support of on-time delivery to customers. The process begins with a customer order or changes required to manage the service, such as re-routes. The process ends with on-time service configuration and installation work.

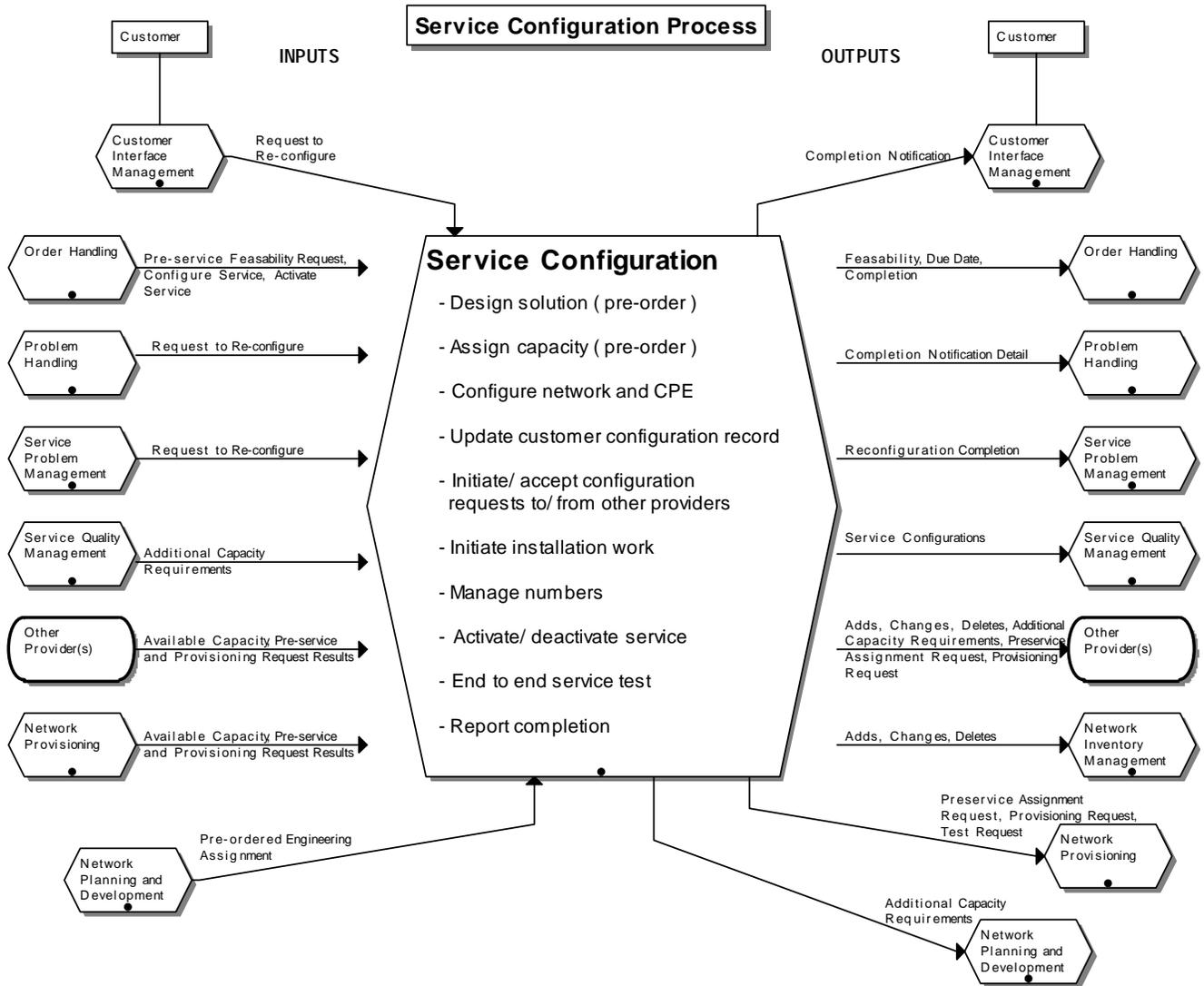
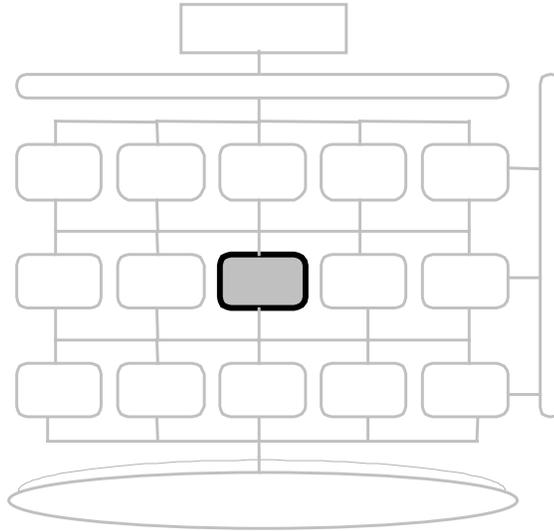


Figure 7.8: Service Configuration Process

## Service Problem Management Process

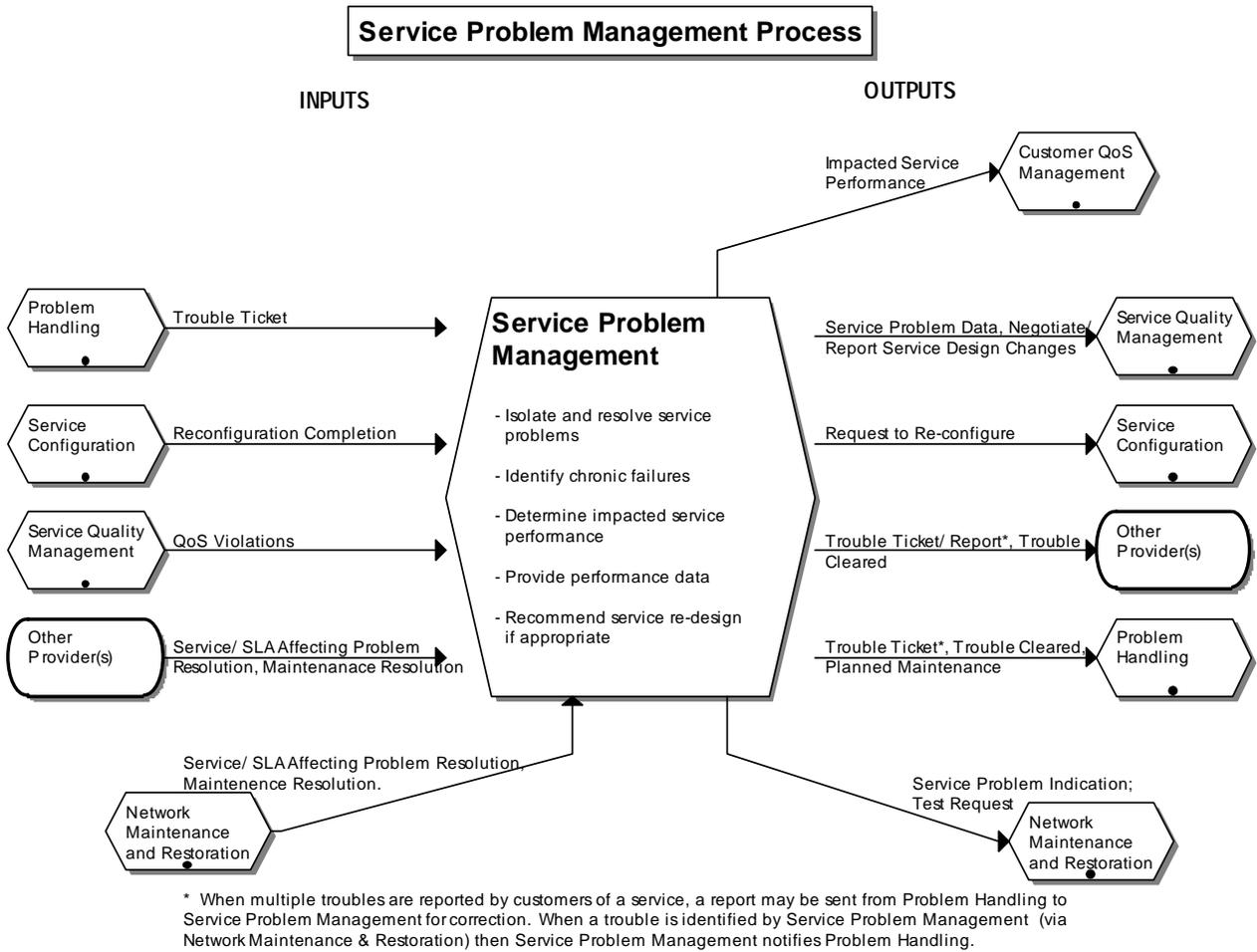


This process encompasses reporting on service problems and trouble performance, isolating the root cause of service-affecting and non-service-affecting failures and acting to resolve them. Typically, failures reported to this process affect multiple customers. Actions may include immediate reconfiguration or other corrective action. Longer-term modifications to the service design or to the network or information technology components associated with the service may also be required. This process is also accountable for providing support to the Problem Handling Process, i. e., providing more expertise when required to resolve a specific customer problem.

The aim is to understand the causes impacting service performance and to implement immediate fixes or identify quality improvement efforts required. The process starts with a service problem being identified by:

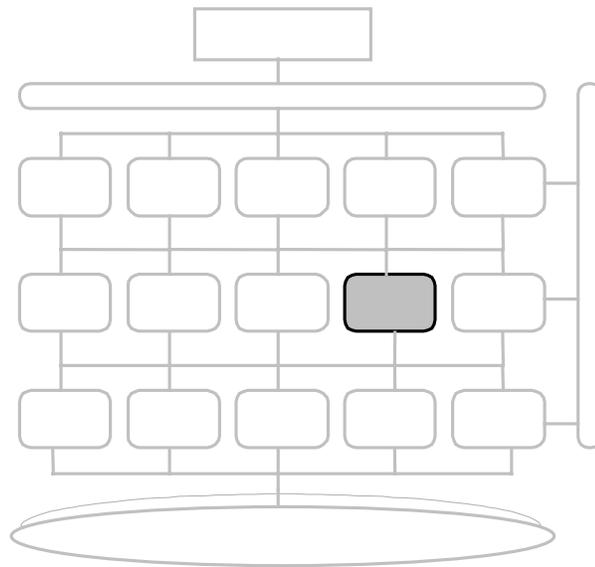
- The network and information technology infrastructure
- The Problem Handling Process (for a customer-specific, difficult problem or service issue related problems)
- The analysis of service and network trouble data, e.g., chronic problems and related root causes

The process ends with the service problem rectified, improvements made, improvement related development recommended or a decision made not to take action, and production of a root cause report or other analysis reports.



**Figure 7.9: Service Problem Management Process**

## Service Quality Management Process



This process supports monitoring service or product quality and cost on a service class basis in order to determine:

- Whether service levels and costs are being met consistently
- Whether there are any problems with or improvements that can be made for the service or product
- Whether the sale and use of the service is tracking to forecasts

This process also encompasses taking appropriate action to keep service levels within agreed targets for each service class and to either keep ahead of demand or alert the Sales Process to slow sales. This is the process that is accountable for Life Cycle Service Management. It is accountable for reporting service results to the Business Management Layer, usually Product Management. They are accountable for managing service performance to quality and cost targets in addition to reporting actions required or taken and their associated cost. If improvements are required to the service or the infrastructure to maintain or improve service results, this process provides recommendations and tracks that approved developments are completed and/or that other required actions are completed.

The aim is to provide effective service specific monitoring, to provide, meaningful and timely performance information and to ensure service performance meets or exceeds commitments. This information can be used for specific customers (to internal management and customers, through the Customer QoS Process). It is used for the management of specific services (to internal management and product management within the business management layer) across the parameters of the specific service or service family. This aim includes the monitoring, analysis, and reporting of service levels to meet SLA commitments or to meet standard commitments for the specific service or service class.

The Service Quality Management Process manages the service from first service (transfer from Service Development Process may occur at Controlled Introduction or upon General Availability, according to the processes of a given service provider) to retirement of the service. Therefore, the process begins with Service Introduction and includes the effective and efficient management and reporting of service results to meet or exceed the committed operations objectives. It ends with service retirement. Service Quality Management has an ongoing reporting function even when service objectives are being exceeded.

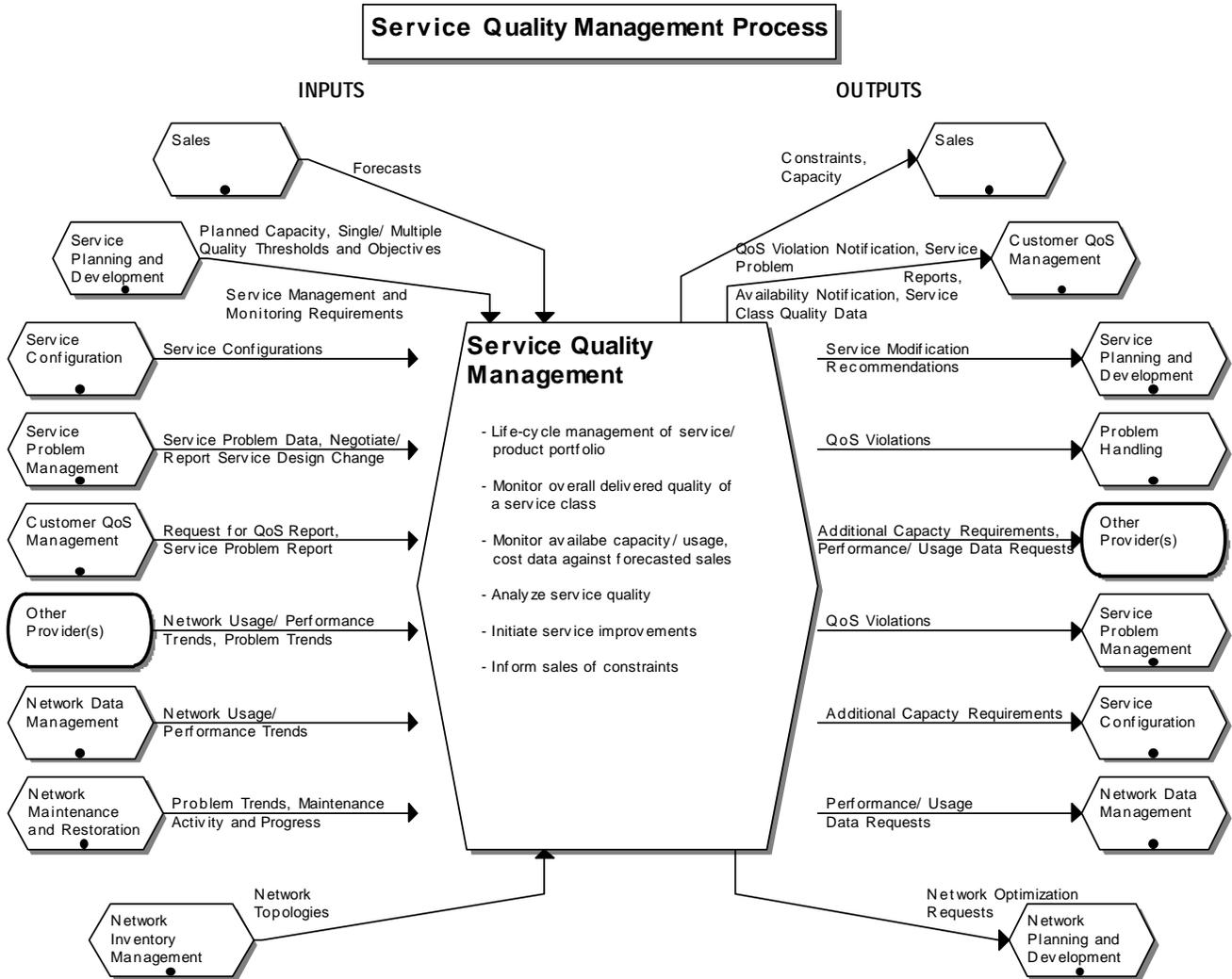
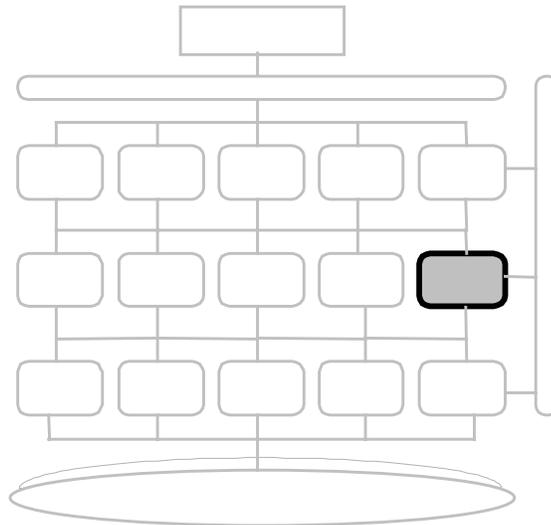


Figure 7.10: Service Quality Management Process

## Rating and Discounting Process



This process encompasses:

- Applying the correct rating rules to usage data on a customer-by-customer basis, as required for a usage based service
- Applying any discounts agreed to as part of the Ordering Process
- Applying promotional discounts and charges
- Applying outage credits
- Applying rebates or charges due because Service Level Agreements were not met or exceeded respectively
- Resolving unidentified and zero billed usage cases

For a usage billed service, one of the essential activities of Rating and Discounting is to match usage to a customer record. As with other processes, some providers provide rating and discounting functions for other providers as a service. For joint service arrangements, billing, invoicing, settlements and reconciliation between service providers may be involved.

The aim is to correctly apply charges, rate usage and to correctly apply discounts, promotions and credits. The process starts with registering a specific customer's identifiers for matching to usage and appropriate discounts, charges and/or credits. It ends with providing correct information for the billing invoice.



## **Network and Systems Management Processes**

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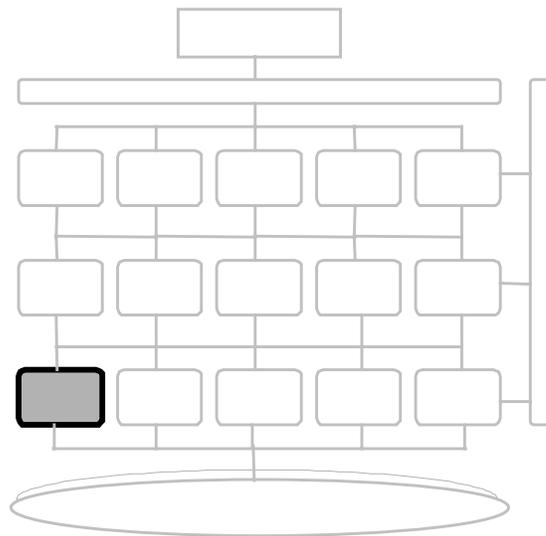
These processes are responsible for ensuring that the network and information technologies infrastructure supports the end-to-end delivery of the required services. The job of these processes is to implement the infrastructure required, ensure it runs smoothly, is accessible to services, is maintained and is responsive to the needs, whether directly or indirectly, of services and customers. Network and Systems Management is also the integration layer between the Element Management Layer and the Service Management Layer. Its basic function is to assemble information from the Element Management systems, and then integrate, correlate, and in many cases, summarize that data to pass on the relevant information to Service Management systems or to take action in the network.

Network Management is more than just a mediator between the EML and SML. Network Management processes have their own responsibilities; for example, Network Planning and Development (assuring complete infrastructure exists), Network Provisioning (implementing the infrastructure), Network Inventory Management (implementation and administration of the physical network), Network Maintenance and Restoration (assuring availability and maintenance of the infrastructure) and Network Data Management (collects data to manage the network and provide billing records). The important issue is that management responsibility will be placed at a level where adequate information is present, instead of shifting all responsibilities to Service Management.

The Network and Systems Management processes manage the complete service provider network and sub-network architecture. Much of the interface is through Element Management.

For a more thorough discussion of these processes, please refer to the TOM companion document, [TM Forum GB908, Network Management, Detailed Operations Map](#) available for free download on the TM Forum Web site, [www.tmforum.org](http://www.tmforum.org).

## Network Planning & Development Process



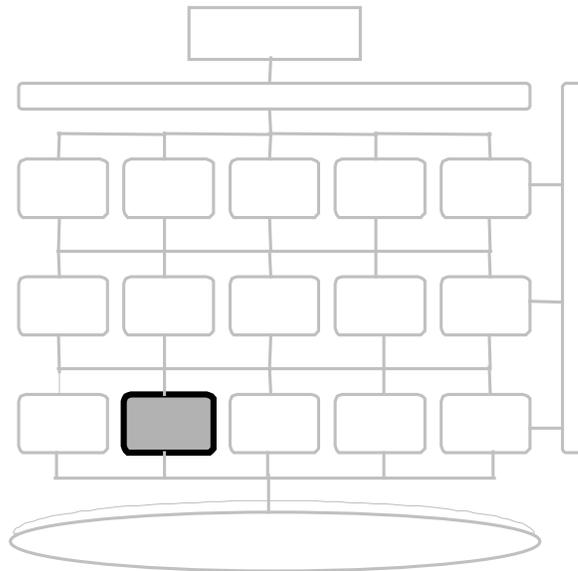
This process encompasses:

- Development and acceptance of network and information technology infrastructure strategies.
- Description of standard network configurations primarily for operational use.
- Definition of rules for networks, e.g., planning, installation, usage recording and maintenance, etc.
- Designing the network capabilities to meet a specified service need at the desired cost, i.e., the introduction of new technologies to support new services, features or enhancements.
- Design, deployment and introduction of new technologies for network and information technology cost reductions or quality improvements.
- Ensuring that the network can be properly installed, monitored, controlled, and billed,
- Ensuring that enough network capacity will be available to meet the forecasted demand. Based on the required network capacity, orders are issued to suppliers or other network operators (ONOs) and site preparation and installation orders are issued to Network Inventory Management or a third party network constructor (work orders). A design of the logical network configuration is provided to Network Provisioning.
- Supporting cases of un-forecasted demand.

The aim is to design, develop and deploy a low cost network and information technology infrastructure that meets the requirements of services provided on it. The process starts with a specific need or potential of a new technology and ends with deployment and availability in the network.



## Network Provisioning Process



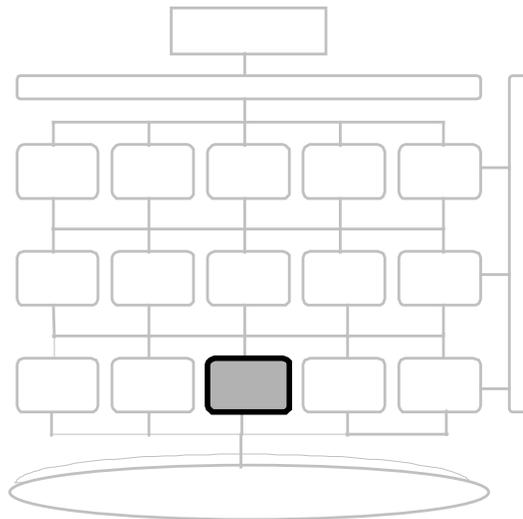
This process encompasses the configuration of the network, to ensure that network capacity is ready for provisioning and maintenance of services. It carries out Network Provisioning, as required, to fulfill specific service requests, network and information technology additions, changes, deletions and configuration changes to address network problems. The process must assign and administer identifiers for provisioned resources and make them available to other processes. The Network Provisioning Process administers the logical network and interfaces with the Network Inventory Management Process for physical installation or implementation in network or information technologies.

Note that the routine provisioning of specific instances of a customer service (especially 'simple' services such as POTS) may not normally involve Network Provisioning, but may be handled directly by the Service Provisioning or Customer Care Processes. For example, Network Provisioning could be done by the Order Handling Process by assignment from a pre-configured set.

The aim is configuration and installation of the logical and physical network. The process starts with a configuration and/or installation request from the Network Management Layer Processes or from the Service Configuration Process. It ends with the network being logically configured.



## Network Inventory Management Process



This process encompasses anything to do with physical network and information technology equipment and the administration of this equipment. The process is responsible for:

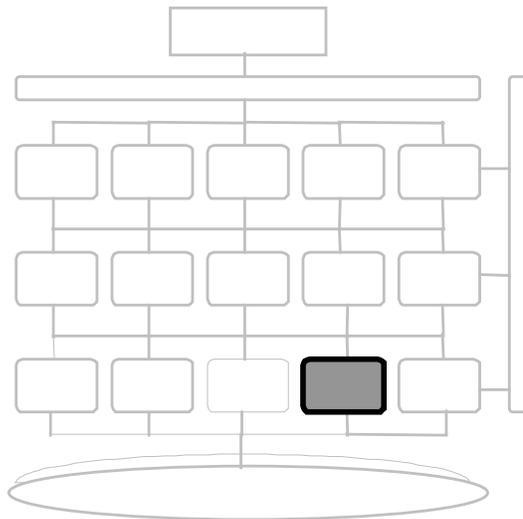
- Installation and acceptance of equipment
- The physical configuration of the network
- Managing the spare parts and the part return/repair sub-processes
- Software upgrades

Many service providers outsource to suppliers or require as a service from equipment suppliers some or many of the sub-processes, process activities or functions of this process, e.g., site work, repair, software upgrades, part, equipment or software inventory, etc.

The aim of this process is to install and administer the physical infrastructure. The process starts with a work order request for installation or implementation required by a network problem. It can also start as a result of the administration of the repair, faulty or spare part sub-processes. It ends with successful installation or implementation in the network.



## Network Maintenance & Restoration Process



This process encompasses maintaining the operational quality of the network, in accordance with required network performance goals. Network performance goals *are* or should be set to support the service levels of the services provided via the network infrastructure.

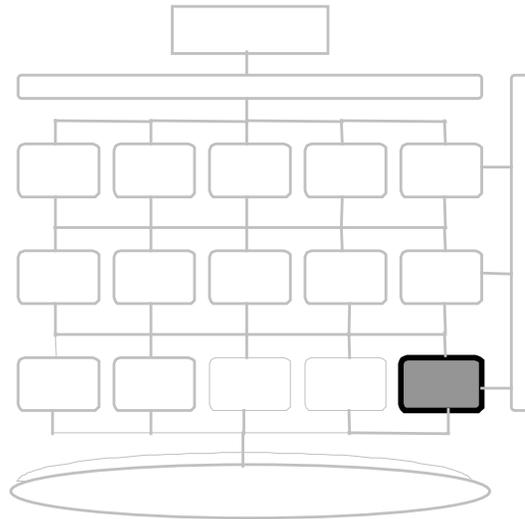
Network maintenance activities can be preventative (such as scheduled routine maintenance) or corrective. Corrective maintenance can be in response to faults or to indications that problems may be developing (proactive or potential service affecting). This process:

- Responds to problems
- Initiates tests
- Does analysis to determine the root cause and impact of problems
- Notifies the Service Quality Management Process of possible effects on quality
- Issues requests for corrective actions to the Network Provisioning Process or Element Management Systems, for example.

The aim is to maintain the network, to eliminate or minimize the impact of problems to services caused by the infrastructure, to restore or repair customer affecting troubles quickly, and to identify problems in the network prior to the problems becoming customer affecting problems. The process starts with an infrastructure-identified problem, a customer identified problem provided via the Service Management layer or analysis of infrastructure information and monitoring. The process ends with appropriate action being taken to maintain the physical infrastructure and/or fix a specific problem.



## Network Data Management Process



This process encompasses the collection of usage data and network and information technology events and data for the purpose of network performance and traffic analysis. This data may also be an input to Billing (Rating and Discounting) processes at the Service Management Layer, depending on the service and its architecture.

The process must provide sufficient and relevant information to verify compliance/non-compliance to Service Level Agreements and QoS levels. The Service Level Agreements themselves are not known at the NML. In the Service Development and Network Development Processes, specifications for monitoring must translate service requirements into what needs to be monitored (including the thresholds) in the infrastructure. The process must also provide sufficient usage information for rating and billing, again per translated specifications developed and implemented for a service in the Service Development and Network Development Processes.

In some cases, changes in traffic conditions or equipment failures in the network may trigger changes to the network for the purpose of traffic control or for providing service. Reduced levels of network capacity and/or performance can result in requests to Network Planning for more resources, to Network Provisioning for a reconfiguration, to Element Management Systems for specific actions in the elements themselves. This process adjusts thresholds, as necessary for performance needs.

The aim of this process is to ensure that the Network Performance goals are tracked, and that notification is provided when they are not met (threshold exceeded, performance degradation, etc.). This includes thresholds and specific requirements for usage collection or recording. This also includes monitoring for capacity, utilization, traffic and usage collection. The process begins with data from infrastructure elements and ends with correct reporting of infrastructure data and the accurate and timely identification of problems or potential problems in the infrastructure.

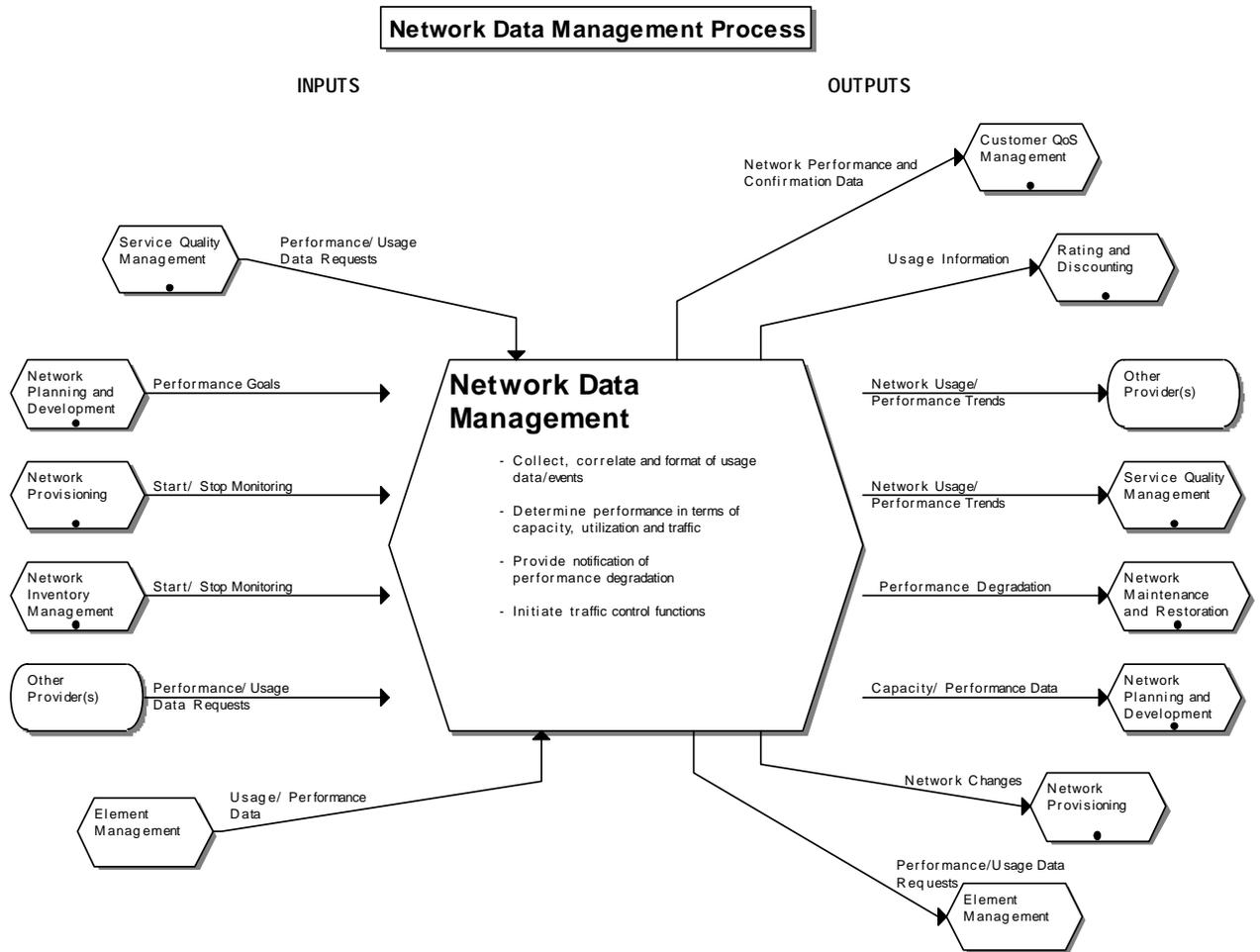


Figure 7.16: Network Data Management Process



## Chapter 8 - Using the Telecom Operations Map

Strategically the service provider must integrate and automate to be competitive in both processes and systems, especially since the dawn of e-business. This must be done such that it enables differentiation where critical, enables lower operations costs, enables use of common industry solutions to drive down system costs and enables decrease in time to market. The interactions among service providers and between service providers and suppliers must be based on a common operations management understanding to avoid cost and delay associated with customized solutions and misunderstanding.

The map can be used in a variety of ways to support these objectives. Many uses have been highlighted already. The basic purpose of the map is to provide a common framework to drive end-to-end process integration and automation for communications data services processes. It can be used by service providers internally and externally. It can be used by suppliers for identifying product developments and can be used for communication with their customers, the service providers. It is an excellent starting point for service providers to view their own process architecture and to architect or re-architect their processes, including determining their interface and automation requirements.

### Evaluation Framework

Within TeleManagement Forum, the Telecom Operations Map will continue to be used as a framework to evaluate and position all existing and future projects that may impact Service and Network Management Processes. In particular, the TeleManagement Forum program of implementation projects has been set up to encourage vendors to demonstrate how their products can work together to deliver automated, end-to-end process flow-through and process/function automation for one or more interfaces of the map. These projects are expected to demonstrate how they support the process interactions shown in this and more detailed documents. The TM Forum encourages 'write a little, do or test a little.' The Telecom Operations Map is the framework for trying, for testing and for detailed documentation. The TM Forum process results in:

- Business Agreements, which document requirements
- Information Agreements, which document information models
- Solution demonstrations
- Real products in the market

In addition, the TeleManagement Forum has produced a companion document (The *Technology Integration Map*, Reference 3) addressing technology selection issues

supporting the information flow at various points in the framework. The *Technology Integration Map* makes recommendations concerning which technologies are most appropriate to use in specific situations and how they should be integrated together (CMIP, CORBA, JAVA, WEB, etc). Application Building Block recommendations and a recommended System/Data Architecture will be available in the near future—some elements are available now. Together these documents will be used to guide vendors to achieve integrated solutions that more effectively support the needs of the service providers.

## **Communicating results**

The results of these projects have been and will continue to be publicly demonstrated. The details of the information flows between component applications are and will be documented for release as publications and Web downloads, as well as for inclusion in TM Forum's Common Information Facility. Requirements and information modeling work from all TM Forum teams are and will be released as publications and Web downloads, as well as documented in the CIF. As the baseline population of the CIF is completed, more and more definition will be available for the detailed interfaces at various reference points within the map framework. Ensuring increasing availability of products that work together in a standardized way to support true end-to-end process automation is supported by this process of:

- Providing broad availability to Evaluation Version requirements and object models
- Subsequently making widely available quality assured, implementation tested requirements and common object models

This support will be both for interfaces that are external to a service provider (to a customer or another service provider) and internal, within or between operations processes and systems.

Many service providers and vendors have made use of the TM Forum's Service Management Business Process Model document (which Telecom Operations Map Version 1.0 superceded) and/or the Telecom Operations Map Version 1.0 and 1.1 (both of which this Telecom Operations Map supercedes) to lay out a way to progress to more effective operations systems. This enhanced version, which includes feedback from that experience and testing and additions to the map to assure validity for IP, Mobile and Wireless Services, helps to further consolidate the direction of the industry for buyers and sellers. TM Forum is determined to ensure that its work will continue to link closely to this framework and that deliverables and demonstrated products will show real business benefits for those who choose to utilize the approach.

## **A basis for discussions**

Service providers are particularly encouraged to continue to use the Telecom Operations Map in discussions with their suppliers as a common reference point and terminology for procurement. They can use it internally with their staff as a way to

share a common vision of how their business needs to evolve to stay competitive in today's, and tomorrow's, marketplace. It should be used as the basis for discussion of service provider business process re-engineering, since it is the result of wide industry discussion among some of the world's leading experts.

For suppliers—vendors, the Telecom Operations Map gives unique insights about how service providers are structuring and restructuring their way of doing business now and in the future. It gives valuable information that will enable these suppliers to structure product offerings to meet those needs. It will also help suppliers and vendors to source third party applications that align with the Map, enabling them to build incremental solutions sales more cost effectively.

Finally, the Telecom Operations Map provides everyone with an industry terminology, reducing confusion and misunderstanding, and speeding up the procurement cycle.

## **Important Ways the Map is used**

In summary, just some of the ways service providers have and continue to use the TeleManagement Forum, Telecom Operations Map are for:

- Internal and external discussion (reduce debate)
- For Business Process Management—development/re-engineering
- Identifying and showing needs, developing requirements
- Developing interface requirements and information models
- Negotiating automated interfaces with partners
- Asking suppliers “where they fit on the map”

Just some of the key ways suppliers have and continue to use the TeleManagement Forum Telecom Operations Map are for:

- Better understanding of how service providers operate enabling development and the delivery of solutions and products that meet the customer need
- Identifying interfaces for solution delivery with other suppliers
- Determining interface and automation needs of service providers
- Showing customers ‘where they fit’
- Speak their customer's language

## **Identifying automation opportunities**

Not all of the processes shown in the Telecom Operations Map (Figure 5.1) have equal priority for automation. Many of the processes are considered high priority, since they are critical to success in a competitive, increasingly electronic environment.

Some level of automation in all processes is necessary to be competitive. Automation will generally focus on those areas where:

- High repetition of basic information flows is a characteristic
- High value is perceived in ensuring rapid reaction
- High quality (accuracy and consistency) is required
- End customers demand it

Most service providers are becoming focused around a customer-oriented view. To remain competitive the existing service providers and new entrants need to implement an integrated automation architecture.

## **Supporting documentation**

Supporting documentation for the Telecom Operations Map can be obtained from TM Forum via its Web (<http://www.tmforum.org>) and FTP sites. Business Agreements (business requirements), and Information Agreements (protocol neutral information models) and Solution Sets (protocol specific information models) are available for many process interfaces to TM Forum members. Results of TM Forum Catalyst Projects (implementation projects) are available to members as well.

In addition, TM Forum has produced a Detailed Operations Map for Network Management (Network Management Detailed Operations Map, Reference 2). It provides more detail of supporting functions and processes for network management than can be found in this document. It should be of interest to developers and to those who have more need to understand the complexities of Network Operations Management.

In addition, as mentioned earlier, three TOM Application Notes were released with this document:

- TOM Application Notes: Process Re-engineering, Development and Management, Simple Methodology Steps
- TOM Application Notes: Global Intranet Access Service
- TOM Application Notes: Mobile Services; Performance Management, Fraud and Roaming Agreement Management Special Considerations.

## References

### Related or Source Documents

The Telecom Operations Map uses a lot of the work done in the NMF Service Management Business Process Model (published in 1995). It also uses a great deal of work from the Network Management Detailed Operations Map, a companion document to the Telecom Operations Map.

The following Reference List provides information on these documents and other documents that have contributed to the development of the TeleManagement Forum Telecom Operations Map.

### Reference List

1. A Service Management Business Process Model, NMF, GB901, 1995.
2. SMART TMN™ Telecom Operations Map, NMF, GB910, Evaluation Version 1.0, October 1998
3. TeleManagement Forum Telecom Operations Map, NMF, GB910, Evaluation Version 1.1, April 1999
4. SMART TMN™ Technology Integration Map, NMF, GB909, Issue 1, April 1998
5. ITU-T TMN Recommendation M.3400 (TMN Management Functions, ITU-T, 4/97), M.3010 (Principles for a telecommunication management network, ITU-T), M.3200 (TMN Management Services, ITU-T, 1996) and Related Recommendations
6. GR-2869-CORE, Telcordia Technologies Generic Requirements for Operations Based Telecommunications Management Network (TMN) Architecture