

## TELECOMMUNICATION PROJECT MANAGEMENT

**Mostafa Hashem Sherif**

*AT&T, Middletown New Jersey, USA*

**Keywords:** project management, global telecommunications, service quality, service level agreement, disaster recovery.

### Contents

1. Introduction
2. Management of Standard Production
  - 2.1. The Networking Technologies
  - 2.2. The Operation Support Systems (OSS)
  - 2.3. Methods and Procedures (M&Ps)
  - 2.4. Content and Applications
3. Examples of Projects in Telecommunication Services
  - 3.1. Adding Capabilities to Public Networks
  - 3.2. Establishing Specialized Networks
  - 3.3. Temporary Networks
4. Characteristics of Projects in Telecommunication Services
  - 4.1. Complex Interfaces
  - 4.2. International dimension
  - 4.3. Multidisciplinary Activities
  - 4.4. No Mass Production
  - 4.5. Diverse User Community
  - 4.6. A Relatively Long Planning Stage
5. How are Public Telecommunication Services Developed?
  - 5.1. Opportunity Analysis and Concept Definition
  - 5.2. Product Definition and Project Set-Up
  - 5.3. Design and Procurement of Equipment
  - 5.4. Service Development
  - 5.5. Service Turn-up
  - 5.6. Business and Network Evolution
6. Concluding Remarks
- Acknowledgements
- Glossary
- Bibliography
- Biographical Sketch

### Summary

This chapter presents a project view of telecommunications, with particular emphasis on the development of service offers. We show how the establishment of telecommunication services is a multi-disciplinary and cross-functional endeavor that combines engineering and business skills within a regulatory framework. We also point to the distinct differences between the design and development of equipment and that of

public telecommunication services. We then illustrate these points by going through the various steps that are needed for the development, introduction, and operation of telecommunications.

## **1. Introduction**

Project management is the application of knowledge, skills, techniques and tools to align resources and achieve the objectives of the sponsors within specific constraints of cost, time, and quality. Formal project management techniques have become important in telecommunication services because of four main factors. First, telecommunication services have been unbundled as a consequence of regulatory and technological changes, as well as increased outsourcing. Thus, many independent entities need to cooperate despite opposing and conflicting agendas. Second, the planning and development of infrastructure projects typically last several years and may involve up to several thousand persons from many suppliers. Third, there are now many forms of telecommunication services, ranging from basic telephony using wireline or wireless access, to Internet or broadband services. Finally, new services must fit within an environment defined by already existing technical and organizational legacies. Thus, the introduction of new products is typically constrained by diverse factors such as legislation, standards, embedded customer base, interconnectivity agreements with other operators, etc. Clearly, telecommunications is an exceptional member of the family of industrial processes in the area of information processing.

Even though the contribution of the service sector is steadily growing, and in many economies exceeds that of manufacturing, telecommunications is still treated in a generic manner, without making the distinction between projects that are associated with services and those that are related to equipment development. Even worse, to many decision makers, modern telecommunication services are merely advanced equipment, strung together with fiber optics and running popular applications. This simplistic view overlooks all the groundwork that is needed to obtain a reliable, affordable and ubiquitous service.

The purpose of this chapter is to give the reader a more accurate sense of what it takes to establish successful telecommunication services. First, we define the scope of telecommunication services and give a few illustrative examples. Next, we present a set of characteristics to distinguish projects in telecommunication services from those related to equipment or product development. These differences are highlighted by a description of the various elements that are needed in the establishment of a service.

## **2. Management of Standard Production**

Offers of telecommunication services cover networking technologies in addition to operations support systems, methods and procedures applications, and content. Thus, the main components of telecommunication services are the:

- Networking technologies
- Operation support systems (OSSs)
- Methods and procedures (M&Ps) to run the network and

- Content and applications

The first three items are within the purview of the telecommunication operators, while the last is the responsibility of the user or of a specialized provider. Accordingly, from a networking viewpoint, the scope of the telecommunication projects in the service areas includes aspects related to the design of the network and the networking technology. Also included are the architecture of the operations support systems and the management of resources for the procurement, testing, installation, operation, maintenance, and billing of telecommunication services.

### **2.1. The Networking Technologies**

The networking technology component relates to the physical infrastructure, such as cables and transmission lines, the network elements such as switches and software-enabled capabilities, including messaging, call forwarding, and networked applications such as web hosting or storage networks. The equipment includes multiplexers, cross-connect, routing and switching equipment, power systems, and security systems, such as intrusion detection systems. In some cases, such as managed services, customer premise equipment (CPE) will be included.

### **2.2. The Operation Support Systems (OSS)**

The operations support systems component relates to the various network element management systems as well as systems used for provisioning, accounting, security, billing, etc. This component is essential for development, deployment and maintenance of high-quality network-based services using shared facilities, such as for public networks. They may be less important in the case of private and enterprise networks.

### **2.3. Methods and Procedures (M&Ps)**

The methods and procedures cover the installation, engineering, operations, maintenance, repair, and customer support aspects of the service. While some standardization and commonality exist among various service providers at the level of technology and support systems (because the equipment manufacturers offer similar equipment), the distinctive advantage of one service provider over the other resides in this component.

### **2.4. Content and Applications**

Finally, the contents and applications refer to content creation (e.g., customer relations management, disaster recovery, electronic data interchange, etc.) or content packaging (news, movies, voice mail, web hosting, weather reports or stock price, voice messaging, taxi services, catalogs and certificate management for electronic commerce, etc.). When content is essential for the growth of some services, the network or service operator uses their direct relationship with the end-users to act as an intermediary for content providers, as a distributor, and to collect payments (e.g., minitel, i-Mode or iTunes, etc.).

## **3. Examples of Projects in Telecommunication Services**

To illustrate the characteristics of telecommunication projects in the area of services, we divide them into three types:

- Projects related to adding capabilities into an existing public network
- Projects related to establishing a specialized business network
- Projects related to the establishment and removal of a temporary network

The relative importance of the constraints on quality, cost, and time varies for each category. More specifically, the main constraint on public services relates to quality; in enterprise networks, cost is the major concern, while timeliness is the most important considerations in the case of temporary installations.

### **3.1. Adding Capabilities to Public Networks**

This category of projects relates to the addition of new feature to an existing service in response to customer demands, government regulations, or the deployment of a new service. The challenge, of course, is to avoid or minimize any disruptions to the services offered because the changes are usually made in a live network. There are several reasons for these projects, such as the introduction of new technologies, new regulations, or the addition of capacity to meet growth in demand or the introduction of new services.

Replacements of obsolete technology are very common, e.g. analog equipment was gradually replaced with digital switches in the world-wide public switched telephone network. In public networks, these changes have to take place without affecting existing services.

As an example of the effect of new regulation, consider the case of local number portability, i.e., the capability to retain the customer telephone number, even when changing service providers.

Examples related to capacity increases include: 1) numbering changes, such as the adding of new area codes, 2) migration of existing traffic to different transmission facilities, for example, when a new undersea cable is introduced, 3) addition of dense wavelength division multiplexing (DWDM) equipment to augment bandwidth to long haul and metropolitan area networks without service disruption, etc.

Examples related to operations support include the introduction of new billing systems or the improvement of existing billing systems

Finally, the introduction of new services is illustrated with the addition of toll-free (800) numbers, call forwarding, incoming call signaling, etc., to the existing capabilities of the basic telephone service.

### **3.2. Establishing Specialized Networks**

Private networks are typically used by one enterprise or a government entity for its

internal communication, such as air traffic control networks. A federation of enterprises can also use a private network, particularly when the industry is organized in a tiered fashion such as in banking or in the global automotive industry. For example, the Society for Worldwide Interbank Financial Telecommunications (SWIFT)—established in 1987 by 239 banks in 15 countries—has its own private network to relay the interbank messages related to international fund transfers. European automobile manufacturers have established a network called ODETTE for the exchange of information between suppliers and car manufacturers. Similarly, the Automotive Network eXchange (ANX®) is the network of the Automotive Industry Action Group (AAIG) to link auto manufacturers with their suppliers in the U.S.

Private networks form an attractive alternative to public networks as a way to meet special requirements on security or cost. A telecommunication network is a cost-sharing arrangement among several users to meet their communication needs. Initially, external subsidies, usually by a government, sustain the growth of the network until it becomes large enough to attract subscribers willing to join to benefit from the networking effect because the cost per subscriber decreases as their number increases. At a certain network size, however, some potential users will add more cost than their contribution to the value of the networking arrangement, because their specific requirements are not economical to meet (e.g., remote locations, peculiar security arrangements, etc.). When this happens, the network expansion stops; and provided that the technology is ready and the regulations are favorable, those who could not join will band together to form other networking associations. This explains why cost is the main consideration in private networks unless they transport mission-critical traffic, in which case quality remains the most valuable attribute.

### **3.3. Temporary Networks**

Temporary telecommunication installations consist of several networks for voice, data or video that are associated with specific events such as major United Nations conferences or global sports events (e.g., the World Cup for soccer, the Olympic Games, etc.) or in relief operations. These projects have an absolute end-date to be met at any cost (including sacrificing some functionalities). They have two main purposes: to provide timely information to the participants in the event in question (weather, press conferences, meetings, press information systems, etc.) through a variety of access points (fixed-wire, mobile, radio, TV, satellite, etc.) and to connect them to the outside world. Thus, the local networks must integrate gracefully with other national (emergency, hospital and police services) and international networks (e.g., broadcast).

The management of temporary installations covers planning, training, installation, deployment, operation and finally, dismantling. Such networks do not include only the transmission and switching equipment but also customer care and network care systems to accommodate fault reports or inquiries. The capacity of such networks can be very huge, such as during the Olympic Games, and the traffic peaks to individual countries are random events that depend on athletic performance and, in some extreme cases, may exceed the allocated capacity.

## **4. Characteristics of Projects in Telecommunication Services**

From the previous examples, it is seen that projects in telecommunication services consist of a portfolio of sub-projects with the following characteristics:

- Complex interfaces (internally and externally)
- International orientation
- Multidisciplinary activities
- No mass production
- Diversity of user requirements
- Relatively long planning stage (even for temporary installations)

Let us consider these aspects.

#### 4.1. Complex Interfaces

The interfaces with vendors, sponsors and customers are numerous and intricate, particularly when consultants act as intermediaries or when tasks are outsourced. To facilitate discussion, we consider two types of interfaces: external interfaces to other entities participating in the service delivery, and internal interfaces among all systems and organizations used to deliver the service.

##### *External Interfaces*

For many services today, the service provider buys network services from a network provider and then resells them after adding some services such as Internet access, disaster recovery, international callback services, etc. The current architecture of telecommunication services is shown in Figure 1.

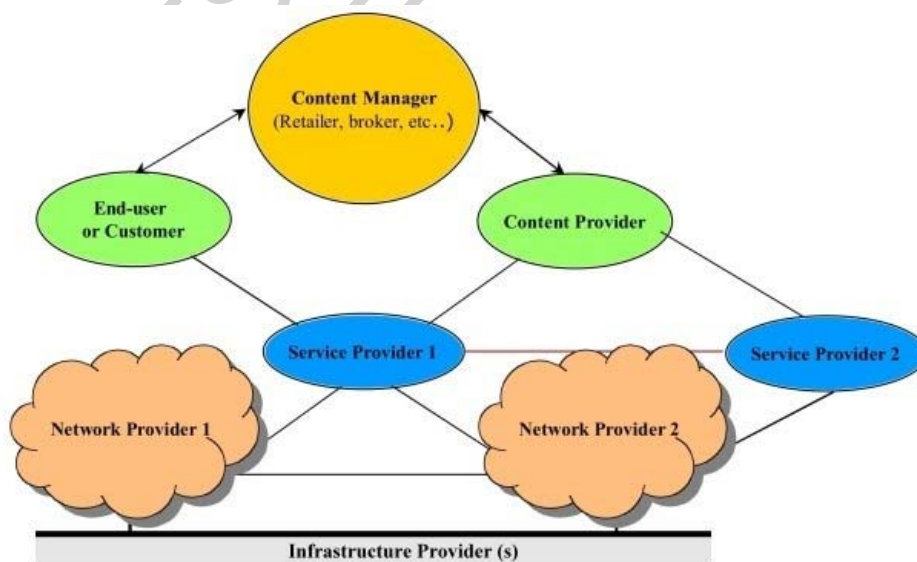


Figure 1: Contemporary architecture of telecommunication services

Clearly, in the contemporary architecture of telecommunication services, several

providers contribute to the delivery of telecommunication services to the end-users. They are infrastructure providers, network providers, service providers, and content providers. The infrastructure provider is responsible for the bandwidth (fiber cables, undersea cables, satellites, etc.). The network provider builds, operates, and maintains the network elements and infrastructure. Content providers are responsible for content creation (news, movies, voice mail, web hosting, weather reports, stock quotations, taxi services, etc.). They may also consolidate catalogs, store voice messages, provide answering services (call centers) or be a digital certification authority. The content manager is responsible for managing customer relationships, packaging contents from several content providers, facilitating electronic payments, acting as an exchange or a marketplace for electronic commerce, storing content, etc. Service providers can be call-back operators, Internet Service Providers (ISPs), providers of disaster recovery services, etc. They can be viewed as virtual network operators to underline the fact that they have no physical assets and that they buy connectivity from network providers. In turn, they concentrate on the management of customer relations as well as supplier management.

For example, in the case of a disaster recovery service, the service provider offers facilities to recover from failures by replicating the customer's data centers and rents the necessary infrastructure from the network provider. The network provider, in turn, designs a network configuration with pre-assigned (but inactive) backup ports and access circuits for each customer's data center. The infrastructure provider may own the access circuits. However, it is the end-customer that designates which circuits will be activated to ensure that mission-critical applications are minimally affected by the failure. Activation of the disaster recovery plan is triggered when the customer reports to the service provider a site failure and requests reconfiguration. The disaster recovery service provider, in turn, calls the infrastructure network provider to effect the change.

Cooperation among operators can vary from interconnection agreements to allow transport and delivery of customer's traffic, to telehousing of equipment, to a full service agency. In this case, the operators participate in the pre-sales discussions, in the ordering and provisioning of the product infrastructure and in the deployment of the necessary network elements and management systems. In complex infrastructure projects, such as in the installation of undersea cables, teams from several companies collaborate on the specifications, selection of equipment vendors and in defining the network architecture. They establish the financial and accounting procedures among the various partners. They manage the purchasing, installation and testing of the submarine cable terminal equipment.

### *Internal Interfaces*

The current architecture of OSS for public data networks is very similar to that of traditional telephony. In particular, systems for configuration management and for performance management, including alarm monitoring and maintenance systems, are only accessible by the network operator. Performance management concerns the monitoring of network operation through the collection of data from the network devices and the analysis of traffic data. The interfaces among the network management systems and the various support systems for operations within a given network remain

proprietary. This is problematic, in the long term, because the element management systems are vendor- and equipment-specific given the lack of interconnection standards and the instability of vendors as they merge, drop products or combine product lines. Furthermore, because of the lack of standardization, the exchange of trouble tickets and accounting data among network providers and their customers is not straightforward, particularly in the case of networks that span several administrative domains and operators.

#### **4.2. International dimension**

Telecommunication services usually have an international component. International communications have gone through several technological generations from the telegraph, to the telephone, telex, facsimile and the Internet. From an organizational viewpoint, business globalization has stimulated attempts to form "global carriers," i.e., carriers with a variety of activities in different regions of the world to serve the telecommunications needs of multinational corporations. These services span several countries and mobilize various resources in different companies. However, service lead-time (i.e., the waiting period before the service is available) depends on the bandwidth and the location within the country as well as negotiation with the venues owners for access and installation of the necessary equipment and cabling. During operation, different operators may have different policies for trouble reports and may use different formats for trouble tickets. Finally, help desk operations for customer contact may depend on the local holidays, vacations, time zone, work weeks, language, worker's rights, etc.

Some additional factors that should be taken into account are:

- Differences in licensing requirements, such as spectrum-management procedures, rules on the location of antennas or cell towers or the enforcement of service level agreements, the homologation of equipment or individual cards, etc.
- Account settlement and payment with many different currencies. The global carriers will need to identify cost components per country for taxation purposes, and devise ways to split the overall bills into the correct local currency for each country.
- Differences in legal systems concerning rights and obligations of content ownership, right to privacy, encryption, etc
- Regulatory constraints on voice communications (dial tone delay, connection to emergency services, communications available to the deaf, etc.) that vary from country to country.
- Availability of services and their reliability depend on the country, for example number portability or subscriber identification and numbering (i.e., telephone number) regarding telephone operator or service provider.
- Vendor support for the equipment is not the same in every country with respect to on-site maintenance, spares policy, board replacement service, etc.

In international projects, team members are quite dispersed among various countries, cultures, and technical disciplines, and may come from companies that compete with



each other. Thus, there is ample room for conflicts due to misunderstandings or opposing agendas. Working among different time zones gives a productivity advantage provided that there are no conflicts. Dealing with local talent requires knowledge that goes beyond the technical aspects of the project as related to cultural sensitivities, to representations of power and to the balance between power and knowledge. Travel restrictions for any reason, such as cost or security, make the coordination even more difficult. Methods of remote communications (telephone, facsimile, web-based collaboration tools, etc.) have their limitations, even when they are well designed, because cultural patterns of communications tend to favor specific collaborative tools.

### 4.3. Multidisciplinary Activities

Projects to establish or run telecommunication services are multidisciplinary and cross-functional. Implementation of telecommunication services involves several engineering disciplines (construction, physical design, mechanical, thermal, electrical, computer science, etc.) in addition to statisticians, marketing and legal professionals, etc. The operation and maintenance of the network require administrative skills for accounting, logistics, human resource management, etc. Many of these aspects are intertwined due to regulations as well as the nature of the various technologies used. For example, the construction of buildings and the installation of antennas must be fire- and earthquake-resistant. Environmental regulations control the placement of transmission towers to protect the population from radiation, while the installation of satellite antennas must take into account resistance to wind. Cables must be rodent-resistant. There are also other legal obligations in procurement and contract management or the use of frequency bands, etc. Wireless transmissions have to meet specific health laws as well as aesthetic standards. When different classes of service are offered to meet some marketing goals, this could translate into different types of licenses, each of which is subject to different laws and regulations for individual countries. Thus, in telecommunication services, risk analysis call upon a combination of engineering, financial and legal expertise.

-  
-  
-

TO ACCESS ALL THE 26 PAGES OF THIS CHAPTER,  
Visit: <http://www.eolss.net/Eolss-sampleAllChapter.aspx>

### Bibliography

AFITEP (2000). *Le management de projet — Principes et pratique*, 2<sup>nd</sup> ed., Paris, AFNOR. [A general presentation of project management for different project types: large industrial projects, small projects, maintenance projects, research and development, information, technology, etc.]

Calé, S. (2005). *La gestion des projets télécoms*, Paris, Lavoisier. [A guide to the various steps in the

design, implementation, test and turn-up of enterprise networks].

Desmond, C. L. (2004). *Project management for telecommunications managers*, Norwell, MA, Kluwer Academic Publishers. [A survey of key elements of project management relevant to telecommunication services].

Knutson, J., Ed. (2001). *Project management for business professional — A comprehensive guide*, New York, John Wiley and Sons. [The key points of project management as presented by the leading authorities in the field].

Noam, N. (1992). *Telecommunications in Europe*, New York, Oxford University Press. [Part I (chapters 1–6) considers the various forces (political, technical, economic) that have shaped the rise and the fall of the monopolies in public telecommunications].

Odan, A., K. Ward, C. Savolaine and, P. Hoath (2003). *Telecommunications quality of service management: From legacy to emerging services*, U.K., Institute of Electrical Engineers, Herts. [This book address the technical and human factors that affect the quality of service offers in telecommunications].

Rey, R. F., Ed., (1983). *Engineering and Operations in the Bell System*, 2<sup>nd</sup> ed., AT&T Bell Laboratories. [This is the classic book on telecommunications services. Though somewhat outdated, it remains a good starting point for serious readers].

Sherif, M. H. (2003). Technology substitution and standardization in telecommunication services. In: Egyedi, T. M., K. Krechmer and K. Jakobs (Eds.), *Proceedings of the 3<sup>rd</sup> IEEE Conference on Standardization and Innovation in Information Technology*, SIIT 2003, pp. 241–252. [This paper and the following two references complement my presentation].

Sherif, M. H. (2006a). *Managing projects in telecommunication services*, New York, John Wiley and Sons.

Sherif, M. H. (2006b). Projects in telecommunications services. In: Sherif, M.H. and K. Khalil (Eds.), *Selected papers from the 2004 IAMOT conference*, Oxford, Elsevier.

Sirén, N. (2003). *Risk management in telecommunications*, MBA dissertation, Buckinghamshire Chilterns University College, Chalfont St. Giles, U.K. [The only reference I could locate that is devoted exclusively to the financial, legal and technological risks encountered in telecommunication services]

Ward, E. (1998). *World-class service development*, Boston, Artech House. [A view of telecommunication service development from the trenches].

### **Biographical Sketch**

**Mostafa Hashem Sherif** was born in Egypt in 1950. He obtained a B.Sc. and M.Sc. in electronics and communications from Cairo University, Egypt, in 1972 and 1975 respectively, a Ph.D. in Engineering from the University of California, Los Angeles, USA in 1980 and an M.S. in the management of technology from Stevens Institute of Technology, Hoboken, New Jersey, USA in 1996. He is also a certified project manager from the Project Management Institute (PMI).

He has been with AT&T in various capacities since 1983 working in the areas of voice packetization, standardization, electronic commerce and software reliability for telecommunication systems. He is the author of *Protocols for secure electronic commerce*, 2<sup>nd</sup> ed., Boca Raton, Florida, CRC Press, 2003, *Managing projects in telecommunication services*, Piscataway, New Jersey, IEEE Press and John Wiley & Sons, 2006 and of the forthcoming book *Paiements électroniques sécurisés*, Lausanne, Switzerland, Presses polytechniques et universitaires romandes, 2007. He is a contributor to many books including *Management of technology: The key to prosperity in the third millennium*, T. M. Khalil, L. A. Lefebvre and R. M. Mason (Eds.), Oxford, UK, Elsevier, 2001, *Managing IP networks*, S. Aidarous and T. Plevyak (Eds.), Piscataway, New Jersey, IEEE Press, 2003, *Advanced topics in information technology standards and standardization research*, Vol. 1, K. Jakobs (Ed.), Hershey, Pennsylvania, Idea Group Publishing, 2006, and *Management of technology: New directions in technology management*, M. H. Sherif and T. Khalil (Eds.), Oxford, UK, Elsevier, 2006.

Dr. Sherif is the standards co-editor for the IEEE Communications Magazine and an associate editor of

the International Journal of IT Standards & Standardization Research.

UNESCO – EOLSS  
SAMPLE CHAPTERS