Deployment of Telecommunications Networks

Definition

A telecommunications network is the combination of numerous network elements that are required to support voice, data, or video services in local or long-distance applications. A telecommunications network is the foundation of all telephony activity; it is the network that connects the end user to virtually anywhere in the world through the use of copper cable, coaxial cable, and fiber cable—or through wireless technology such as microwave or satellite.

The deployment of the telecommunications network is the final stage of the process, and it requires experts from a number of different disciplines, including design (outside plant and central office [CO]), construction (outside-plant cable placing), and CO equipment installation and testing. The most effective way to manage this stage of the process is to use a company that serves as a single point of contact with project-management expertise and that can manage every aspect of the entire job (see Figure 1).

Figure 1. Deployment of a Telecommunications Network

[Diagram of deployment process]

Network Design
- COE
  - Power
  - Switch
  - Transport
- Outside Plant
  - Copper
  - Fiber
  - Coaxial
  - Wireless

Resource Management & Procurement/Material Management

Build
- Outside Plant
  - Buried
    - Underground
  - Aerial
  - Building
  - Submarine
  - Wireless
  - Switch
  - Transport
  - Power
- SLAT
  - TEST/AC/DC

Commission

Service/Maintenance
- Preventive
- Emergency Service
- Cable Restoration
- OSS
Overview

The recent deregulation of the telecommunications industry has opened up a whole new line of business in the area of installation and construction of telecommunications networks. For the most part, these businesses are made up of small companies that can offer partial solutions to large projects, with only a few companies offering total turnkey solutions.

Major carriers, particularly regional Bell operating companies (RBOCs), are beginning to recognize a recent lack of quality control from a number of small vendors. The world is experiencing a shortage of skilled resources and increased costs and yet remains reluctant to hire and train people. As a result, there has been a movement to a small number of large preferred suppliers. Consequently, the recent trend in the telecommunications industry is to move away from using numerous small contractors who are able to complete various pieces of the project, and head toward outsourcing the deployment of entire networks to companies that can serve as a single source supplier. Some of the key benefits of outsourcing to a company that provides turnkey solutions are as follows:

- project management—ensures on-time, on-budget, and quality completion of the project
- high quality of service (QoS) and workmanship
- resources—large number of highly skilled technicians on staff
- continuous training of resources—leading-edge technology
- size and affiliations—financial stability

Topics

1. Project Management
2. Understanding the Process
3. Service and Maintenance
4. Benefits of Using a Single Source Supplier for Deploying Telecommunications Networks
5. The Future of Outsourcing in the Telecommunications Industry
   - Self-Test
   - Correct Answers
   - Glossary
1. Project Management

Project management is the application of knowledge, skills, tools, and techniques to project activities in order to meet or exceed customer needs and expectations from a project. Meeting or exceeding customer needs and expectations invariably involves balancing competing demands, scope, time, cost, and quality.

In the installation and construction of a telecommunications network, the project manager oversees the entire project from start to finish and is responsible for maintaining a smooth operation in each step of the deployment of the network. The project-management component of the job emphasizes efficiency by the creation of a comprehensive work schedule that eliminates duplications and maintains continuity, which in turn leads to cost savings.

Dealing with a single supplier that offers a single point of contact for all aspects of the project is beneficial in many ways. A company that offers a full package of services helps improve cycle times, ensures consistent quality throughout the project, and provides significant cost savings. The project manager is accountable for the success of every phase of the project and ensures that even the largest projects are completed on time, on budget, and according to the highest quality standards.

Figure 2 outlines the project-management knowledge areas, including the processes that a project manager must follow in order to manage a project effectively:

- **project integration management**—describes the processes required to ensure that the various elements of the project are properly coordinated.

- **project scope management**—outlines the processes required to ensure that the project includes all of the work required to complete the project successfully.

- **project time management**—includes the processes required to ensure timely completion of the project.

- **project cost management**—describes the processes required to ensure that the project is completed within the approved budget.

- **project quality control**—outlines the processes required to ensure that the project will satisfy the needs for which it was undertaken.

- **project human resources management**—includes the processes required to make the most effective use of the people involved with the project.
• **project communication management**—describes the processes required to ensure timely and appropriate generation, collection, dissemination, storage, and ultimate disposition of project information.

• **project risk management**—outlines the processes concerned with identifying, analyzing, and responding to project risk.

• **project procurement management**—describes the processes required to acquire goods and services from outside the performing organization.

**Figure 2. Overview of Project Management Knowledge Areas and Processes**

2. **Understanding the Process**

To appreciate the value of using a single source provider with project-management capabilities, one must understand all of the components involved in deploying a telecommunications network.

A simple analogy to describe the process for deploying an integrated telecommunications network today is that of a new subdivision that has just been developed. Within this subdivision, 500 new homes must be connected to the existing telephone network in the community. This example assumes that a remote-access node will be built within the subdivision. The process of connecting this subdivision to the local-access network switch, which connects to the long-distance access switch, which, in turn, connects to the rest of the world, is a multiple-step process (see Figure 3).
Step 1: Outside-Plant Network Design (Engineering)

In keeping with the analogy mentioned earlier in the tutorial, the outside-plant designer for the project is responsible for route selection between the houses in the new subdivision and any reinforcement to the local switching center. In the design, the outside-plant designer can plan for the placement of underground, buried, aerial, submarine, or building cable installation or wireless installation, depending on a number of factors including the terrain, existing infrastructure, environment, etc. Specifically, the network designer is responsible for the following:

- route planning
- identifying right-of-way requirements and potential design conflicts
- negotiating right-of-ways
- determining specialized design, plan, and digital mapping requirements
- preparing preliminary designs based on clients’ specifications
- developing firm price quotations based on preliminary design and estimating tables
- providing as-built plans and specifications
- completing final design and specifications for installation and ongoing design changes as required during installation
• identifying material requirements and providing material ordering input to client or external suppliers as required

**Step 2: CO Design (Engineering)**

The design of the CO involves understanding what equipment must be installed to make the network work. Keeping with the subdivision analogy, we are assuming that there will be a remote-access node in the subdivision. In this particular example, the designer will be responsible for the following:

- determining what equipment must be added to the existing switching center
- determining the sizing of the access node
- designing the transport system between the remote and the host
- determining the digital equipment and transport system that will be used between the switch and the remote
- reviewing the power system to see if it must be reinforced (power study)

**Step 3: Outside-Plant Construction**

Once the design and specifications have been determined, the installation of the cable (copper, fiber, or coaxial) must be installed to those specifications. This work is generally performed by highly skilled splicing and line technicians who are qualified to place and connect cable in a variety of outside-plant networks, including live circuits. Their responsibilities also include testing continuity and troubleshooting in existing networks. If it is determined that wireless technology is to be used, the infrastructure (i.e., towers) are built at this stage.

**Step 4: CO Equipment Installation**

The next step is to install and commission the specialized equipment to make the whole network work. Most CO and switching equipment is housed in a localized switching center or access nodes (remote switch) that is located within the subdivision that links back to the switching center. The CO equipment (COE) technicians are suppliers trained to install the specialized equipment that routes the calls to the appropriate switch. Some of the many types of equipment that must be installed and maintained by these technicians are as follows:
• **switching equipment**—including Nortel digital multiplex system (DMS) technology

• **transport equipment**—such as channel banks, fiber multiplex transport (FMT), digital access and cross-connect system (DACS), Newbridge, and various miscellaneous peripherals (i.e., asynchronous transfer mode [ATM], frame relay, and network-management hardware)

• **access remote**—includes remote carrier urban (RCU) 600/900, DMS–1U, remote switch concentrator (RSC), and remote line concentrating module (RLCM), which are installed into various walk-in cabinets and environmentally controlled manhole enclosures

• **FMS equipment**—patch panels, routers, bridges, and active hubs

• **power**—The technicians regularly install, replace, and upgrade rectifiers, inverters, batteries, and mechanized frame administration (MFA) power plants. They also install grounding into COs, access nodes, and customer-owned telephone rooms that are required to meet the grounding standards.

• **synchronous optical network (SONET) transport**—The COE technicians are also experienced in building large Internet protocol (IP) networks and are supplier-trained to do system lineup and test (SLAT), including software upgrades on live equipment and optimization. They are also trained in optical carrier–3 (OC–3), OC–3E, OC–12, OC–48, OC–192, access nodes, and access node express.

### Step 5: Commissioning

The commissioning of the newly installed network involves testing to make sure the network is up to specifications before it is turned on. Once it is determined that everything is operating according to specifications, it will be integrated into the live network.

### 3. Service and Maintenance

Given the size and the multiple components involved in building an integrated telecommunications network, it stands to reason that a certain level of service and maintenance of the network is required to keep it running without interruption.
Preventive maintenance is ongoing. It requires testing and checking the network regularly to ensure that no incomplete areas exist. If a problem is found early, it can often be repaired or replaced without ever causing a disruption of service.

Another aspect of maintenance falls under the category of emergency restoration. Whether the situation involves a downed line or a major natural disaster caused by a tornado, hurricane, or flood, damaged cables must be repaired quickly; otherwise, customers are left without service. A full turnkey solution is often required in an emergency situation.

4. Benefits of Using a Single Source Supplier for Deploying Telecommunications Networks

Using a single point of contact to design, build, and commission a telecommunications network involves many obvious benefits:

- lowers overall costs
- reduces cycle time
- includes performance measurement
- regulates quality and safety
- incorporates environmental management
- utilizes advanced administrative solutions
- offers professional, highly skilled, and experienced workforce
- ensures the project will be completed on time, on budget, and according to the highest quality standards

Turnkey solutions to large-scale projects save money. By using a single supplier with project-management abilities, it has been proven that overall costs for a project can be reduced by 15 to 20 percent.

The theory is that using one company to coordinate all aspects of the job, including resource planning (people, equipment, material management), work schedule, and cost management, will reduce cycle time and duplication and maintain continuity for the project. This will, in turn, reduce costs for materials, equipment, and human resources, as it will not allow for any downtime and overlap as a result of bad planning.
Performance measurement is not a possibility when multiple suppliers are used to complete a project; however, performance measurement is crucial to ensuring quality in the finished project. A single source supplier, who regularly measures the performance of its resources, ensures that the project will be completed on time, on budget, and to the highest quality standards.

Quality and safety standards are important in ensuring that a job is completed to clients’ expectations without unnecessary delay. Utilizing a company that has established processes and procedures for health and safety, quality, customer service, performance measurement, environmental issues, and training and development will ensure that the work is completed according to the highest standards.

5. The Future of Outsourcing in the Telecommunications Industry

There is a significant trend toward outsourcing in the telecommunications industry. Suppliers in North America currently deal with numerous contractors and are finding that they are losing control of the costs and the quality of work. More and more, carriers are realizing the benefits of outsourcing to third parties so as to offer services such as customer-care and billing systems, network planning, and construction and operations support systems (OSSs).

Currently, 60 percent of service providers are outsourcing to third parties, but that number is projected to increase to 74 percent within two years. At present, 28 percent of service providers report that they outsource network planning and construction (i.e., deployment of the network) to third parties, and this number is projected to increase to 38 percent in the near future.

Data networks are altering the makeup of today’s networks; as a result, suppliers in North America are expanding their networks to provide greater broadband to their customers. This is usually accomplished in one of two ways: through new construction or by retrofitting existing networks. Other trends include placing fiber and remotes closer to the home and upgrading switches. As a result, there are not enough installers for these areas, and existing installers cannot handle the peak load.

As the workload increases, the demand for quality installation and construction services increases as well. Using a large company with a permanent/long-term employee base as a single source supplier will ensure that the skilled manpower will be available to complete the project to the highest quality standards while controlling costs and schedule.
Self-Test

1. The design and build of an integrated telecommunications network is an intricate process that requires experts from the following disciplines:
   a. network design and CO equipment installation
   b. network design, outside-plant construction, and CO equipment installation
   c. outside-plant construction and CO equipment installation
   d. none of the above

2. An integrated telecommunications network can consist of copper cable, fiber cable, coaxial cable, and wireless.
   a. true
   b. false

3. The project manager is accountable for the success of every phase of the design, build, and commissioning of the integrated telecommunications network.
   a. true
   b. false

4. The network designer is responsible for which of the following?
   a. identifying material requirements
   b. route planning
   c. installing equipment
   d. identifying and negotiating right of ways
   e. b and d only
   f. a, b, and d only

5. The technicians who perform the outside plant construction are only trained to install copper networks.
   a. true
b. false

6. COE technicians are qualified to install which of the following equipment?
   a. OC–3, OC–48, and OC–192
   b. switching equipment, including Nortel DMS 100 and 200
   c. FMS equipment, patch panels, routers, and active hubs
   d. none of the above
   e. a, b, and c

7. COE and outside-plant technicians are qualified to work on live wires and equipment without interrupting existing service.
   a. true
   b. false

8. Using a single source supplier offers which of the following benefits?
   a. experienced and trained technicians
   b. reduced cycle times
   c. ensured on-budget and on-time completion of the job
   d. all of the above
   e. none of the above

9. Performance measurement is not a possibility when multiple suppliers are used to complete a project.
   a. true
   b. false

10. The current trend is to move away from outsourcing in the telecommunications industry.
    a. true
    b. false
Correct Answers

1. The design and build of an integrated telecommunications network is an intricate process that requires experts from the following disciplines:
   a. network design and CO equipment installation
   b. **network design, outside-plant construction, and CO equipment installation**
   c. outside-plant construction and CO equipment installation
   d. none of the above
   See Definition.

2. An integrated telecommunications network can consist of copper cable, fiber cable, coaxial cable, and wireless.
   a. **true**
   b. false
   See Definition.

3. The project manager is accountable for the success of every phase of the design, build, and commissioning of the integrated telecommunications network.
   a. **true**
   b. false
   See Topic 1.

4. The network designer is responsible for which of the following?
   a. identifying material requirements
   b. route planning
   c. installing equipment
   d. identifying and negotiating right of ways
   e. b and d only
   f. **a, b, and d only**
5. The technicians who perform the outside plant construction are only trained to install copper networks.
   a. true
   b. false

See Topic 2.

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See Topic 2.

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   b. reduced cycle times
   c. ensured on-budget and on-time completion of the job
   d. all of the above
   e. none of the above

See Topic 3.
9. Performance measurement is not a possibility when multiple suppliers are used to complete a project.

   a. true
   b. false

   See Topic 3.

10. The current trend is to move away from outsourcing in the telecommunications industry.

    a. true
    b. false

    See Topic 4.

**Glossary**

**AC**
alternating current

**ATM**
asynchronous transfer mode

**CO**
central office

**COE**
central office equipment

**DACS**
digital access and cross-connect system

**DC**
direct current

**DMS**
digital multiplex system

**FMS**
fiber management system

**FMT**
fiber multiplex transport
IBDN
integrated building distribution network

IBN
integrated business network

IP
Internet protocol

MFA
mechanized frame administration

OC–12
SONET optical carrier at 622.08 Mbps

OC–192
SONET optical carrier at 9953 Mbps

OC–3
SONET optical carrier at 155.52 Mbps

OC–48
SONET optical carrier at 2488.32 Mbps

OSS
operations support system

QoS
quality of service

RBOC
regional Bell operating company

RCU
remote carrier urban

RLCM
remote line concentrating module

RSC
remote switch concentrator

RSU
remote switching unit

SLAT
system lineup and test
**SONET**

synchronous optical network