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A Tutorial on:

“Lifecycle Management for Telecommunication Networks”

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Tutorial Based on Book

- **Lifecycle Management for Telecommunication Networks**
- **Two intended audiences**
  - Professional Handbook
    - Individuals, corporations
    - Training seminars/courses
  - University Textbook
    - Capstone course in undergraduate telecom programs
    - Graduate course in telecom programs
- **Status**
  - Draft book complete
  - In process of selecting publisher; target publication by Fall 2010
  - Looking for feedback on content
- **If interested in book, please contact author at asnow@ohio.edu**
Typical Telecommunications Network Environment
Network Infrastructure and Application Convergence

[Diagram showing PSTN, Internet, Satellite, CO, ISP, Headend, Telephone, PC, TV connected to a central Convergence point]
There are Many Stakeholders in the Telecommunication Network Domain

- Consumers
- Corporate/Nonprofit/Government Organizations
  - Users
  - Network and System Administrators
  - Executives
- Service Providers
  - Traditional Carriers
  - Internet Service Providers
  - Cable
- Policymakers
  - Regulators
  - Legislators
  - Consumer Advocates
- Equipment and System Vendors
Why is this Challenging?

- Each network is unique - Spatially, in usage, and in offered services
- Projects are often migration or upgrades rather than fresh starts
- The network is often part of a larger project or system, such as an IT project
- It is difficult to separate performance requirements from end user applications
- Everyone is an expert -- users mistake vendor solutions for requirements
- Project management visibility is difficult because of geographic dispersion
- It is easy to underestimate the largest cost component – operations & maintenance
- Rapid technological evolution makes network deployments ripe for obsolescence and unsuccessful emerging standards
- A myriad of service providers and product vendors results in complex decisions and tradeoffs
- Convergence complicates the ability to offer consistent quality of service to all traffic types and applications
- Projects are not properly separated from day-to-day network operations for in-place networks
- No extant PM methodology is dedicated to network integration
Overview of Lifecycle Management

• A combination of
  – Lifecycle management
  – Project management
  – Systems engineering
Roles in a Project

• **The Project Manager:** *The one person responsible for achieving project objectives and satisfying the customer.*

• **The Customer:** *The customer is the individual or organization who pays for the project.*

• **User:** *Users are the individuals or organization receiving beneficial use of the delivered product or service.* In some projects, the customer and user are the same entity while on others they are two different entities.

• **Executive Management:** *The manager responsible for seeing that the organization using the product or service is successful.* The project manager may or may not report to the executive manager – often these two individuals are in different companies.

• **Experts:** *The individuals who provide expertise in order to perform project task activities.*
Network Project Management Methodology

- **Network Project Life Cycle**: Tailored for type of project and complexity
- **Tools and Techniques**: Applied consistently throughout the life of a project
- **Teamwork**: Team members participate throughout the life of the project
- **Communication**: Use common Terminology amongst team members
Network Lifecycle Stages

A “Waterfall” Lifecycle Approach

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Network Lifecycle Stages and Phases
Control Gates

• **Control gate**: A lifecycle phase go/no-go decision point, usually accompanied with a review of phase objectives and documentation.

• Should include appropriate project stakeholders

• Can be a formal presentation

• Outcomes:
  – Green Light: proceed to next project phase
  – Yellow Light: must address minor deficiencies before proceeding
  – Red Light: (1) redo phase, or (2) terminate project
Outline

PART ONE  INTRODUCTION
Chapter 1  Network Lifecycle and Project Management Methodology
Chapter 2  Network Project Archetypes

PART TWO  NETWORK PROJECT DEFINITION
Chapter 3  Network User Requirements
Chapter 4  Network System Requirements
Chapter 5  Network Concept Definition
Chapter 6  Network Specification
Chapter 7  Network Project Planning

PART THREE  NETWORK PROJECT IMPLEMENTATION
Chapter 8  Network Source Selection
Chapter 9  Network Design and Integration

PART FOUR  NETWORK OPERATIONS
Chapter 10  Network Deployment
Chapter 11  Network Operations & Maintenance

PART FIVE  PROJECT MANAGEMENT ELEMENTS
Chapter 12  Project Configuration Management

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Network Project Archetypes

• Network project “archetyping” is the process of comparing the anticipated network effort to the characteristics of a set of archetypal network projects, and placing the proposed effort into one of these known project categories
Network Project Archetypes

Network Enhancement

Network Infrastructure

New Network Initiative

Network Integration

Network Operations
Network Project Archetypes

• **New network initiative** project is typically a “fresh start” in that the project creates a new network that did not exist before, rather than modifying an existing network.

• **Network enhancement** project is a major enhancement to an existing network.

• **Network operations and maintenance** project is incremental functionality/performance refinements to an existing network that has been deployed and turned over to an operational organization.

• **Network integration** project provides the network services required to support an Information Technology (IT) Project

• **Network infrastructure** project provides network/communication utilities or infrastructure within a new or existing building
Network Definition Stage

• **Network Requirements**: Defines what the user network needs (user requirements) and the criteria for selecting the best solution (system requirements)

• **Network Concept Definition**: Describes the best approach for solving the user network needs, by way of the selected network architecture

• **Network Specification**: States how well the network must work to satisfy user needs, by specifying the attributes of the major components in the network architecture necessary to meet system requirements

• **Network Project Planning**: Develops a plan for acquiring a network solution, allowing the project team to commit to a project budget and schedule.
# Network Definition

## Stages & Phases

<table>
<thead>
<tr>
<th>MAJOR ACTIVITIES</th>
<th>Network User Reqs Phase</th>
<th>Network Concept Definition Phase</th>
<th>Specification Phase</th>
<th>Network Planning Phase</th>
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<tbody>
<tr>
<td>Collect Network User Reqs</td>
<td>Establish Project Control Board</td>
<td>Tradeoff Candidate Net Concepts</td>
<td>Allocate Sys Reqs to Major Network Components</td>
<td>Select Acquisition Approach</td>
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<tr>
<td>Validate Requirements</td>
<td>Derive Network System Requirements</td>
<td>Identify Risks</td>
<td>Develop Verification Approach</td>
<td>Develop Network Project</td>
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<tr>
<td>Prepare Initial Plan</td>
<td>Define Concept Selection Criteria</td>
<td>Assess Technical Feasibility</td>
<td>Develop Major Component Specs</td>
<td>Implement Network Plan</td>
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<td></td>
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<td>Estimate LifeCycle Costs</td>
<td>Trace Component Specs to Sys Reqs</td>
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## Products

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<td>Traceability Matrix</td>
<td>Network Concept of Operations</td>
<td>Major Component Specifications</td>
<td>- Tasks</td>
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<td>Concept Selection Criteria</td>
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<td>- Schedules</td>
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<td>- Responsibilities</td>
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## Control Gates

|---------------|---------------------------------|---------------------------------|-----------------------------------|--------------------------|--------------------------------------|
Pay Me Now or Pay Me Later

![Chart showing proper spending profile vs. improper spending profile with network stages and O&M costs]

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User Requirements are Solution Free

• **User Requirement:** A capability needed by the user(s) to solve a problem or achieve an objective, or support a business process.

  – Operational Needs and Capabilities
  – Schedule Requirement for New Capabilities
  – Interface Requirement to Retained Systems

• **User requirements are “solution free”**

• **Want:** A perceived need that is often a proposed solution, often costs too much, may not be deliverable on time, can be technically infeasible and/or represents high risk.

  – “I want a Mercedes.” vs. “I need transportation.”
  – “I want a cell phone” vs. “I need to call McAllen, TX four times a day”
Types of Users

• Executive management users,
• Network administrator users, and
• Network/end product users.
Example of Different User Perspectives on Same General Need

• “Without revenue I can’t make a profit. Because of the limitations of our voice and IT system, our inside salespeople are losing sales.”

• “The current call center equipment is hard to maintain and requires too many people to keep it running. In addition, I need network management capabilities well beyond what I now have.”

• “As an inside salesperson, I can tell you right now that I need to see a screen telling me how many incoming calls I have queued up. When I answer a call, I could work faster if I knew who is calling and, if the caller is an existing client, could see their account information already displayed.”

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### User Requirements Example:
**Peak Voice Traffic Between Locations**

#### Peak Hour Call Volume

A - Chicago Office  
B - Columbus Office  
C - McAllen Office  
D – Through PSTN

#### Peak Hour Call Duration

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**OUTGOING CALLS/HR**

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<tr>
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**OUTGOING HR/CALL**

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<td>0.05</td>
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</table>
Gathering Requirements

• Documentation review,
• Interviews,
• Surveys and
• Focus groups.
Network System Requirements

• Network system requirements are the set of attributes the network must have in order to satisfy the network user requirements.

• User requirements must be translated into system requirements -- statements that can be proven or verified.

• System requirements are also solution and implementation free – does not describe a technical solution or “How to”

• System requirements are used:
  – As the basis for considering and choosing a network architecture
  – To “accept” the system after rollout/deployment at end of a project

• Systems requirements are verified through
  – Demonstration
  – Test
  – Analysis
  – Inspection
## Deriving System Requirements

### ERLANGS (Calls/Hr) x (Hr/Call)

<table>
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<tr>
<th>LOCATION</th>
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<th>A</th>
<th>B</th>
<th>B</th>
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<td>4</td>
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### Aggregated by Location into “Traffic Matrix”

<table>
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<th>ERLANGS</th>
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<tbody>
<tr>
<td>LOCATION</td>
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<td>FROM</td>
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<td>B</td>
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<td>C</td>
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</table>
System Requirements are Solution Free

Chicago Office (A)

Columbus Office (B)

Public Telephone Sys. (D)

McAllen Office (C)

11.9 E
14.25 E
22 E
11 E
8 E
10 E
10.25 E
7.1 E
Network System Requirements are often “Embedded” in IT System Requirements

**User Requirement:** “Response to queries shall not negatively impact the ability of the financial analyst to process two loans per hour.”

**IT System Requirement:** “A characteristic user database query and response shall average 3-seconds, and not exceed 6-seconds, 95% of the time.”

**Network System Requirement:** “The time for a characteristic database query and response to traverse the network shall average 0.2-second and not exceed 0.4-seconds, 95% of the time.”
Example of Embedded Requirement

• Example: A user complains that the LAN is too slow, because it uses a 10Mbps Ethernet and takes too long to transfer large files (1MB) regularly used in the conducting business.

• The IT department asks the network group to upgrade the LAN to 100Mbps.

• The network manager asks for a demonstration by the user during the lunch hour when no one else is using the LAN or the Server and finds the transfer to take 12 seconds.

• Ignoring overhead bits from protocols, the network manager calculates that the file is transferred across the network in 0.8 seconds, as seen on next page.
Latency Estimates

CLIENT → LAN → SERVER

- Fetch a file from the Server
- 10 Mbps Ethernet
- 1 MByte File

\[ L_{TOTAL} = L_{CLIENT} + L_{LAN} + L_{SERVER} \]

\[ L_{LAN} = \frac{\text{Volume (b)}}{\text{Capacity (b/s)}} = \frac{8 \text{ Mbits}}{10 \text{ Mbits/s}} = 0.8 \text{ S} \]

If \( L_{TOTAL} \) is observed to be 12s in the demonstration, then the network manager should recommend:

- a) Upgrading the LAN to 100 Mbps
- b) Upgrade the server
- c) Upgrade the client
Characteristics of “Good” System Requirements

• **Complete** - defines which User Network Requirements will be satisfied
• **Consistent** in that one system requirement does not conflict with another
• **Correct** – no errors exist that will affect designing a solution
• **Clear** – there is only one possible interpretation
• **Traceable** – there is an audit trail to at least one user requirement
• **Verifiable** – able to show that the network meets the system requirement
• **Implementation Free** – does not describe a technical solution or “How to”
Tracing Requirements

<table>
<thead>
<tr>
<th>User Requirements</th>
<th>System Requirements</th>
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<td>UR 3</td>
<td>SR 3</td>
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<td>UR n</td>
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UR3 – missed requirement
SR2 – superfluous requirement
# System Requirement Validation

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</table>

- Demo
- Test
- Analysis
- Inspect
System Requirement Taxonomy
Network Ubiquity Requirements

• **Fixed Location**
  – At one physical location for the foreseeable future, such as a telephone in an office)

• **Migrant Location**
  – At one physical location while in use, but location can change, such as a laptop with wireless capability in a building)

• **Mobile Location**
  – Physical location subject to continuous movement, such as a cellular phone)
Reliability

\[ R = e^{-\lambda t} = e^{-t/MTTF} \]
Reliability Examples

• **Reliability Example 1:**
  – What is the chance a local telecommunications switch with an MTTF of 5 years will operate without failure for 5 years?
  \[ R_{5-Yrs} = e^{-\lambda \cdot t} = e^{-t/MTTF} = e^{-5/5} = e^{-1} = 0.368 \]

• **Reliability Example 2:**
  – What is the chance a switch with an MTTF of 5 years will operate without failure for 1 year?
  \[ R_{1-Yrs} = e^{-\lambda \cdot t} = e^{-t/MTTF} = e^{-1/5} = e^{-0.2} = 0.818 \]

• **Reliability Example 3:**
  – What is the chance a switch with an MTTF of 5 years will operate without failure for 1 week?
  \[ R_{2-Yrs} = e^{-\lambda \cdot t} = e^{-t/MTTF} = e^{-(1/52)/5} = e^{-0.00385} = 0.996 \]
Maintainability

• Service Maintainability is the chance a failed service will be restored by a specified period of time

\[ M = 1 - e^{-\mu \cdot t} \]

\[ u = \frac{1}{MTTR} \]

• Maintainability Example
  – A DS3 digital circuit has an MTTR of 12 minutes. What is the chance the DS3 will be recovered for use in 1 minute?

\[ M_{1\text{Min}} = 1 - e^{-\mu \cdot t} = 1 - e^{-t/MTTR} = 1 - e^{-1/12} = 1 - e^{-0.0833} = 0.080 \]
Availability

Historical

\[ A = \frac{UPTIME}{INTERVAL \_TIME} \]

Predictive

\[ A = \frac{MTTF}{MTTF + MTTR} \]
Predictive Availability Example

• A telecommunications service has an MTTF of 620 hours and an MTTR of 30 minutes.

• What is the availability of the service? How many hours per quarter can we expect the service to be down?

\[
A = \frac{MTTF}{MTTF + MTTR} = \frac{620}{620.5} = 0.99919
\]

\[
U = 1 - A = 0.00081
\]

\[
Down\_Time = 0.00081 \cdot 24hrs \cdot 30\text{day} \cdot 3\text{months} = 1.74\text{Hours}
\]
Outage Profile

Time

SV = SEVERITY OF OUTAGE
D = DURATION OF OUTAGE
Network Concept Definition

**USER COMMUNITY**
- Network User
- Network Administrator
- Executive Management

**USER REQUIREMENTS**
- Network Concept
- Network System Requirements

**USER SCRUTINY**
- Will this network meet my needs?
- Do I understand how the network will operate in my environment?
- Are the network life cycle costs acceptable?

**USER CONCURRENCE**
Objective: Pick the “Best Approach”
Lifecycle Skills Mix

<table>
<thead>
<tr>
<th>Skill Type</th>
<th>Comfort With Uncertainty</th>
<th>Risk Taking Ability</th>
<th>Attention To Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network Innovator</td>
<td>High</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Network Implementer</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Network Refiner</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
</tr>
</tbody>
</table>

Team Composition

Definition Stage: [Diagram]
Implementation Stage: [Diagram]
Operations Stage: [Diagram]
A Network System Perspective
Another Network System Perspective

Public Switched Telephone Network System

Voice Communication Function

Transmission Subsystem

Switching Subsystem

Signaling Subsystem

Carrier Personnel

Interaction

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Network System Decomposition

Public Switched Telephone Network System

Transmission Subsystem
- Trunking CI
- Local Loop CI

Switching Subsystem
- Local SW CI
- Tandem SW CI

Signaling Subsystem
- Access CI
- Transport CI
Linking Equipment Specs to User Requirements
Specifying Equipment Reliability and Maintainability

<table>
<thead>
<tr>
<th>CI</th>
<th>MTTF (hours)</th>
<th>MTTR (hours)</th>
<th>Availability</th>
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</thead>
<tbody>
<tr>
<td>User Station</td>
<td>35,040</td>
<td>0.25</td>
<td>0.999992865</td>
</tr>
<tr>
<td>Voice Wiring</td>
<td>87,600</td>
<td>1</td>
<td>0.999988585</td>
</tr>
<tr>
<td>PBX</td>
<td>87,600</td>
<td>1</td>
<td>0.999988585</td>
</tr>
<tr>
<td>Multiplexer</td>
<td>64,560</td>
<td>1</td>
<td>0.999984511</td>
</tr>
<tr>
<td>Leased Line</td>
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<td>0.1</td>
<td>0.999988585</td>
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<tr>
<td>Multiplexer</td>
<td>64,560</td>
<td>1</td>
<td>0.999984511</td>
</tr>
<tr>
<td>PBX</td>
<td>87,600</td>
<td>1</td>
<td>0.999988585</td>
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<tr>
<td>Voice Wiring</td>
<td>87,600</td>
<td>1</td>
<td>0.999988585</td>
</tr>
<tr>
<td>User Station</td>
<td>35,040</td>
<td>0.25</td>
<td>0.999992865</td>
</tr>
</tbody>
</table>

**Voice Call Availability** 0.999904814

SR = 0.9999
Allocating Sys Requirements to Equipment Specs

Network System

Network Subsystem

Network Configuration Item

Network System Requirement
### SR Allocation Illustration

<table>
<thead>
<tr>
<th>User Requirements</th>
<th></th>
<th>Network Definition Stage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>User Requirements</strong></td>
<td></td>
<td><strong>Net. System Requirements</strong></td>
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<td><strong>Net. System Requirements</strong></td>
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<tr>
<td><strong>Network Specs</strong></td>
<td></td>
<td><strong>Network Specs</strong></td>
</tr>
<tr>
<td><strong>CI Design Specs</strong></td>
<td></td>
<td><strong>Part of Network Implementation Stage</strong></td>
</tr>
</tbody>
</table>

**User Requirements**

- UR 53: The Network Operator shall be able to monitor Usage on the network

**Net. System Requirements**

- SR 92: The network administrator shall be alerted within 10 sec. whenever traffic exceeds an operator selected threshold.

**Network Specs**

1. Router CI shall have SNMP capability
2. The Net Mgt server CI shall have SNMP capability
3. The Net Mgt server CI shall have SNMP MIB capability
4. The Net Mgt server CI shall send alerts to the console
5. The Net Opns Console CI shall display alerts in red

**CI Design Specs**

Part of Network Implementation Stage
Planning Phase

• A complete plan includes the following:
  – Tasks/subtask definition
  – Schedule/milestones for tasks/subtasks
  – Resources required for each task/subtask
  – Responsibility for each task/subtask

• Proceed at your own hazard without a complete plan!
Planning – First Define the Necessary Work

1.0

1.1 Data Communications Subsystem

1.2 Voice Communications Subsystem

1.3 Network Management Subsystem

1.2.1 PBX

1.2.2 Numbering Plan

1.2.3 Wiring

1.2.4 Training

1.2.3.1 Design

1.2.3.2 Acquire

1.2.3.3 Install

1.2.3.4 Test

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Developing Gantt and Critical Path Schedules

<table>
<thead>
<tr>
<th>ID</th>
<th>WBS</th>
<th>Task Name</th>
<th>Month 1</th>
<th>Month 2</th>
<th>Month 3</th>
<th>Month 4</th>
<th>Mk</th>
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<tr>
<td>1</td>
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<td>2</td>
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<td>16</td>
<td>23</td>
<td>30</td>
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<tr>
<td>2</td>
<td>1.2</td>
<td>Voice Communications</td>
<td>6</td>
<td>13</td>
<td>20</td>
<td>27</td>
<td>4</td>
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<tr>
<td>3</td>
<td>1.2.1</td>
<td>PBX</td>
<td>11</td>
<td>18</td>
<td>25</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>1.2.2</td>
<td>Wiring</td>
<td>22</td>
<td>29</td>
<td>16</td>
<td>10</td>
<td>6</td>
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<tr>
<td>5</td>
<td>1.2.2.1</td>
<td>Create Design</td>
<td>13</td>
<td>20</td>
<td>27</td>
<td>11</td>
<td>8</td>
</tr>
<tr>
<td>6</td>
<td>1.2.2.2</td>
<td>Acquire Materials</td>
<td>16</td>
<td>23</td>
<td>30</td>
<td>4</td>
<td>13</td>
</tr>
<tr>
<td>7</td>
<td>1.2.2.3</td>
<td>Install Wiring</td>
<td>19</td>
<td>26</td>
<td>33</td>
<td>5</td>
<td>21</td>
</tr>
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<td>8</td>
<td>1.2.2.4</td>
<td>Perform Testing</td>
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<td>29</td>
<td>16</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>9</td>
<td>1.2.2.5</td>
<td>Acceptance Review</td>
<td>13</td>
<td>20</td>
<td>27</td>
<td>11</td>
<td>8</td>
</tr>
<tr>
<td>10</td>
<td>1.2.3</td>
<td>Numbering Plan</td>
<td>13</td>
<td>20</td>
<td>27</td>
<td>11</td>
<td>8</td>
</tr>
<tr>
<td>11</td>
<td>1.2.4</td>
<td>Training</td>
<td>13</td>
<td>20</td>
<td>27</td>
<td>11</td>
<td>8</td>
</tr>
</tbody>
</table>
Hierarchical Schedules

Master Schedule

| CIR | PDR | CDR | TRR | DRR |

Summary Schedule

| 1.1.1 | 1.2.1 | 1.3.1 | 1.4.1 | 1.5.1 |

Detailed Schedule

| 1.1.1.1 | 1.1.1.2 | 1.1.1.3 | 1.1.1.4 | 1.1.1.5 | 1.1.1.6 |

Customer/Executive Management

Project Network Schedule

Task Manager (Experts)
Identifying Who is Responsible for Work

Work Breakdown Structure

Organization Breakdown Structure

J. Jones
3.3 Design

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Estimating Cost of Project

- **Labor**: Categories, level of expertise, hours required, hourly price
- **Materials**: Equipment, software, raw materials, tools and non-consumable supplies
- **Other Costs**: Travel, reproduction, consumable supplies
Implementation Stage

• **Network Source Selection**: Acquire external resources (services/products)

• **Network Design**: Develop a detailed network design to allow network integration and deployment/rollout

• **Network Integration**: Build, configure, integrate, test, and stage network equipment in preparation for network deployment/rollout
# Network Implementation Stage

## Stages & Phases

<table>
<thead>
<tr>
<th>Network Source Selection Phase</th>
<th>Network Design Phase</th>
<th>Network Integration Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prepare Request for Proposal(s)</td>
<td>Evaluate Proposals</td>
<td>Update Network Implementation Plan</td>
</tr>
<tr>
<td>Select Vendor(s)</td>
<td>Update Network Specifications</td>
<td>Prepare &quot;Design-to&quot; Specifications</td>
</tr>
<tr>
<td>Prepare Request for Quote(s)</td>
<td>Identify Resources</td>
<td>Update Verification Plan</td>
</tr>
<tr>
<td>Negotiate Contract(s)</td>
<td>Commit Resources</td>
<td>Verify Design meets Performance Reqs</td>
</tr>
<tr>
<td>Develop Evaluation Plan</td>
<td>Develop Network Integr. Approach</td>
<td>Prepare Network Maintenance Manuals</td>
</tr>
<tr>
<td>Commit Resources</td>
<td>Develop Network Deployment Approach</td>
<td>Prepare Network Manuals</td>
</tr>
<tr>
<td>Develop Evaluation Plan</td>
<td>Conduct Pilot(s)/ Create Prototype(s)</td>
<td>Perform Testing</td>
</tr>
</tbody>
</table>

## Major Activities

- Prepare Request for Proposal(s)
- Select Vendor(s)
- Prepare Request for Quote(s)
- Negotiate Contract(s)
- Develop Evaluation Plan
- Commit Resources
- Develop Network Integr. Approach
- Develop Network Deployment Approach
- Conduct Pilot(s)/ Create Prototype(s)
- Prepare Verification Procedures
- Prepare Network Operation Manuals
- Prepare Network Manuals
- Perform Testing

## Products

- RFPs
- Signed Contract(s)
- Revised Network Implementation Plan
- Network "Design-to" Specifications
- Network "Build-to" Specifications
- Maintenance Manuals
- Proposal RFP Evaluation Plan
- Project Team Assignments
- Verification Plan
- Traceability Matrix
- Operations Manuals
- Equipment RFQs
- Network Integration Plan
- Verification Procedures
- Test Results
- Initial Network Deployment Plan
- Pilot(s)/Prototype(s)
- Final Network Deployment Plan

## Control Gates

- Proposal Evaluation Review (PER)
- Contract Award Review (CAR)
- Network Project Implementation Review (PIR)
- Network Preliminary Design Review (PDR)
- Network Critical Design Review (CDR)
- Test Readiness Review (TRR)
Negotiated Procurements
Solicitation Vocabulary

- **Solicitation** – Request for Proposal (RFP)
- **Buyer** – the customer or client who issues the RFP desiring systems and services
- **Seller** – the firm or group of firms responding to the RFP, also called the “supplier” or “bidder”
- **Prime Contractor** – the lead firm for the proposed system/services who is to be legally responsible to the buyer for the required system/services, and who will manage the effort if there is a win. Sometimes referred to as the “Integrator”.
- **Subcontractor** – a firm responsible to the prime for a portion of the buyer’s system and/or services.
- **Vendor** – a firm providing equipment to a prime or subcontractor.
- **Incumbent** – firm(s) already performing work or providing equipment for/to the buyer which is identical, or similar, to that requested in the RFP.
- **Bid-No Bid Review** – a control gate used by a prospective bidder to decide whether to bid on an RFP or not
- **Red Team Review** – a control gate used by a prospective bidder to insure the proposal is compliant, responsive and competitive.
# Design in the Lifecycle

<table>
<thead>
<tr>
<th>Phase</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>User Requirement</td>
<td>Data transfer between Columbus OH and McAllen TX</td>
</tr>
<tr>
<td>System Requirement</td>
<td>Peak Information Transfer Rate (ITR) of 985 Kbps between Columbus and McAllen</td>
</tr>
<tr>
<td>Network Concept Phase</td>
<td><em>High speed digital line between Columbus and McAllen, a major component</em></td>
</tr>
<tr>
<td>Specification Phase</td>
<td><em>DS1 digital circuit (1.544 Mbps) between Columbus and McAllen</em></td>
</tr>
<tr>
<td>Source Selection Phase</td>
<td>Vendors selected</td>
</tr>
<tr>
<td>Design Phase</td>
<td><em>DS1 line from Verizon</em></td>
</tr>
<tr>
<td></td>
<td>Columbus: 386 High Street Suite 1100, Rm 101</td>
</tr>
<tr>
<td></td>
<td>McAllen: 525 Main St., Suite 200, Rm 21</td>
</tr>
</tbody>
</table>
Network Systems Integration

• Perform critical design
• The purpose of the network integration phase is also to
  – Assemble
  – Configure
  – Integrate
  – Test, and
  – Stage network equipment in preparation for network deployment/rollout.
• Includes
  – Development of Network Operations manuals
  – Network Maintenance manuals, and
  – Reporting of test results.
Critical Design Example

Verizon DS-1 Termination

4’6”

5’0”

1’4”

SW Wall Suite 101

Line Entry

1.25” Hole

1” PVC Sleeve

Caulked
# Network Operations Stage

## STAGES & PHASES

<table>
<thead>
<tr>
<th>MAJOR ACTIVITIES</th>
<th>Network Deployment Phase</th>
<th>Network Opns &amp; Maintenance Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prepare Site(s)</td>
<td>- Demo</td>
<td>Acceptance</td>
</tr>
<tr>
<td></td>
<td>- Test</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Analysis</td>
<td>Update</td>
</tr>
<tr>
<td></td>
<td>- Inspect</td>
<td>Documentation</td>
</tr>
<tr>
<td></td>
<td>Conduct Site(s)</td>
<td>Review</td>
</tr>
<tr>
<td></td>
<td>Operator Training</td>
<td>Lessons Learned</td>
</tr>
<tr>
<td></td>
<td>Conduct Network Review</td>
<td></td>
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</tbody>
</table>

## PRODUCTS

<table>
<thead>
<tr>
<th>MAJOR ACTIVITIES</th>
<th>Network Deployment Stage</th>
<th>Network Opns &amp; Maintenance Phase</th>
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</thead>
<tbody>
<tr>
<td>Network Installed</td>
<td>Signed</td>
<td>Activity Reports</td>
</tr>
<tr>
<td>Network</td>
<td>Signed Acceptance</td>
<td></td>
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<tr>
<td>Procedures</td>
<td>Updated</td>
<td>Failure Reports</td>
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<tr>
<td>Facility</td>
<td>Documented</td>
<td>Network Modifications</td>
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<td>Certification</td>
<td>Training</td>
<td>Training Certificates</td>
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<tr>
<td></td>
<td>Network Certificate</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lessons Learned</td>
<td>Periodic Network Performance Report</td>
</tr>
</tbody>
</table>

## CONTROL GATES

- Deployment Readiness Rev. (DRR)
- Network Test Readiness Rev. (TRR)
- Network Acceptance Rev. (NAR)
- Periodic Network Perf. Review (NPR)
Operations Stage

• **Network Deployment**: Culminate the project with an operational network that is installed, tested, documented, accepted, and turned over to the operations and maintenance organization.
  - Detailed design documentation used to install network at customers site
  - Well developed transition and back-out plans are required
  - System Requirements are the criteria for acceptance
  - SR are accepted through DTAI (demo, test, analysis, and inspection)
Network Operations
Operations Stage

• Operations & Maintenance:
  – Operate the network system for the remaining lifetime of the network
  – In a way that satisfies the ongoing mission of the enterprise or users utilizing the network.
  – The O&M organization must insure timely delivery of network functionality, performance, and uptime.
    • Fault Management
    • Performance Management
    • Security management
    • Configuration Management
    • Accounting Management
  – The network will most likely evolve through
    • O&M projects
    • Network Enhancement projects
Configuration Management

- Configuration Management Plan
  - Procedures
  - Approval Levels
  - Responsibilities
  - Forms

- Approved Project Baseline (B/L)
  - Cost
  - Schedule
  - Technical
    - Rqmts.
    - S/W
    - H/W
    - Documents

- Identify Potential Change
  (Internal / External)

- Create RFC

- CM Librarian
  - Log In
  - Assign No.
  - Distribute

- Engineering Review Board (ERB)
  B/L Impact Assessment.

- Project Configuration Control Board (PCCB)

- Revise Project Baseline
  - Cost
  - Schedule
  - Technical
  - Project Plan

- Disseminate
  To All Team Members

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Too Much Change Can Doom a Project

Operations & Maintenance

Deployment

Design/Integration

Source Selection

Planing

Performance

Concept Def.

Rqmt

Investment
(Time & Money)

Definition Period

Implementation Period

Operations Period

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Self Assessment Q1

• You are a network analyst at Boeing. You accompany your boss, the Director of Network Services, to brief the President the Boeing Aircraft Company on the new digital services you would like to procure to support design and manufacturing. You brief the network concept and technology for the new services and then your boss proudly tells the President that this new network system will save the company $1.2M per year. The President replies “I drop over $2M dollars on the shop room floor everyday. So at this point, I really don’t care about your proposal or the technology. If I were to use your technology, how many more 747s can I produce a month? Come back in a month with an answer and I will consider your proposal.”

A. I have no idea how to answer this question
B. I have an idea how to answer this question, and with enough time could figure it out.
C. I am confident I know exactly how to go about answering the question
Self Assessment Q2

• You are on a project team at a corporation considering leasing Virtual Private Network (VPN) services from a telecommunication service provider to interconnect your 55 nationwide offices. The vendor tells you the mean time between failures (MTBF) for their VPN service is 4200 hours (about once every ½ year). You share this good news with your project manager and a major internal customer, the Vice President for Sales, telling them this indicates the network rarely breaks down. The VP insists you relate this statistic to her business mission. You ask what she means and she says, “Well, for instance, if we use such a network, what’s the chance that a salesperson will be able to successfully place their weekly orders sometime during the business day on Friday’s?”

A. I have no idea how to answer this question
B. I have a pretty good idea how to answer question, and with enough time could figure it out.
C. I am confident I know exactly how to go about answering the question
A junior network consultant at Accenture is tasked to assess the network enhancement needs of a client. The consultant visits and the client’s VP tells her he wants a 100Mbps backbone LAN, a firewall, and some T3 (45 Mbps) access lines to the Internet. In addition, he wants her to design this system and recommend a vendor to put in the network. Months after implementation, the VP complains to her manager that the system is not allowing his workers to be productive and is too expensive. Exasperated, the junior consultant says she gave him what he asked for, so she cannot understand why he was upset with her services. The VP replies – “Hey, I hired Accenture and paid your premium rates to do the right thing and keep me out of trouble. Now I have egg on my face – Accenture let me down.”

In retrospect, how could this situation have been prevented by the junior consultant?

A. I have no idea how to answer this question
B. I have a pretty good idea how to answer question, and with enough time could figure it out.
C. I am confident I know exactly how to go about answering the question
Before & After Self Assessment

STUDENT SELF ASSESSMENT
ITS 444 FALL 06

PERCENTAGE RESPONSES

A-NO IDEA  B-HAVE IDEA NEED TIME  C-KNOW EXACTLY HOW

RESPONSE TO 18 SITUATIONAL QUESTIONS

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Questions?
Feedback

• Review Book
  – Write a short review?
  – Provide errata and suggestions?
• Contact me at asnow@ohio.edu