Top-Down Network Design

Chapter One

Analyzing Business Goals and Constraints

Copyright 2010 Cisco Press & Priscilla Oppenheimer

1

Top-Down Network Design

- Network design should be a complete process that matches business needs to available technology to deliver a system that will maximize an organization's success.
  - In the LAN area it is more than just buying a few devices.
  - In the WAN area it is more than just calling the phone company.

2

Start at the Top

- Don't just start connecting the dots.
- Analyze business and technical goals first.
- Explore divisional and group structures to find out who the network serves and where they reside.
- Determine what applications will run on the network and how those applications behave on a network.
- Focus on Layer 7 and above first.

3

Layers of the OSI Model

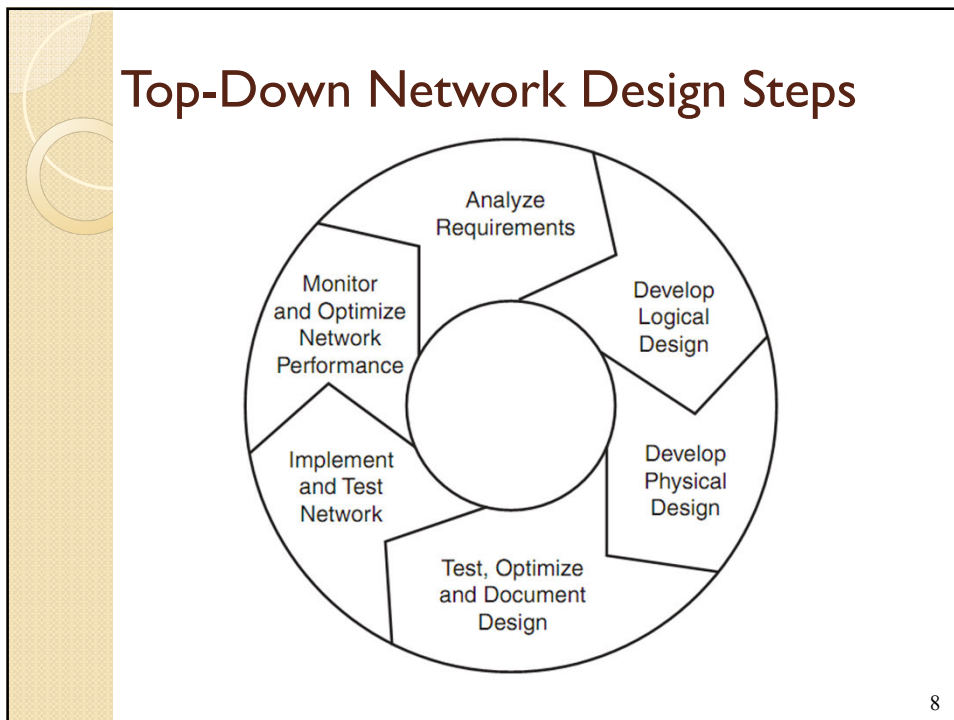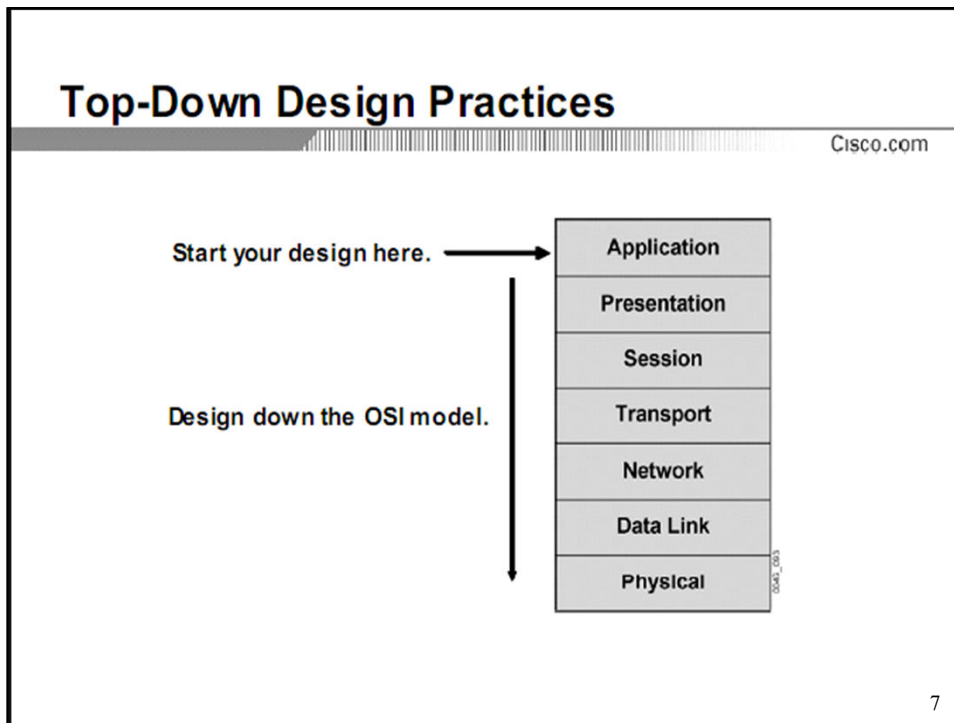|		
7. Application Layer	**Provision of interfaces** to applications	
6. Presentation Layer	**Format conversion** such as encryption and compression	
5. Session Layer	**Provision of session management** for individual application	
4. Transport Layer	Provision of **data transfer service** (TCP/UDP)	
3. Network Layer	**Decision of communication path** across the network (IP Address)	
2. Data Link Layer	**Decision of communication path between** adjacent nodes and data transfer (MAC Address)	
1. Physical Layer	**Electrical connection**	

4

Structured Design

- A focus is placed on understanding data flow, data types, and processes that access or change the data.
- A focus is placed on understanding the location and needs of user communities that access or change data and processes.
- Several techniques and models can be used to characterize the existing system, new user requirements, and a structure for the future system.
- A logical model is developed before the physical model.
  - The logical model represents the basic building blocks, divided by function, and the structure of the system.
  - The physical model represents devices and specific technologies and implementations.

5

Systems Development Life Cycles

- Typical systems are developed and continue to exist over a period of time, often called a systems development life cycle (SDLC).

6

Top-Down Design Practices

Cisco.com

Start your design here. ⟶

| Application |
| Presentation |
| Session |
| Transport |
| Network |
| Data Link |
| Physical |

Design down the OSI model.

7

Top-Down Network Design Steps

- Analyze Requirements
- Develop Logical Design
- Develop Physical Design
- Test, Optimize and Document Design
- Implement and Test Network
- Monitor and Optimize Network Performance

8

Network Design Steps

- Phase 1 – Analyze Requirements
  - Analyze business goals and constraints
  - Analyze technical goals and tradeoffs
  - Characterize the existing network
  - Characterize network traffic

9

Network Design Steps

- Phase 2 – Logical Network Design
  - Design a network topology
  - Design models for addressing and naming
  - Select switching and routing protocols
  - Develop network security strategies
  - Develop network management strategies

10

Network Design Steps

- Phase 3 – Physical Network Design
  - Select technologies and devices for campus networks
  - Select technologies and devices for enterprise networks

11

Network Design Steps

- Phase 4 – Testing, Optimizing, and Documenting the Network Design
  - Test the network design
  - Optimize the network design
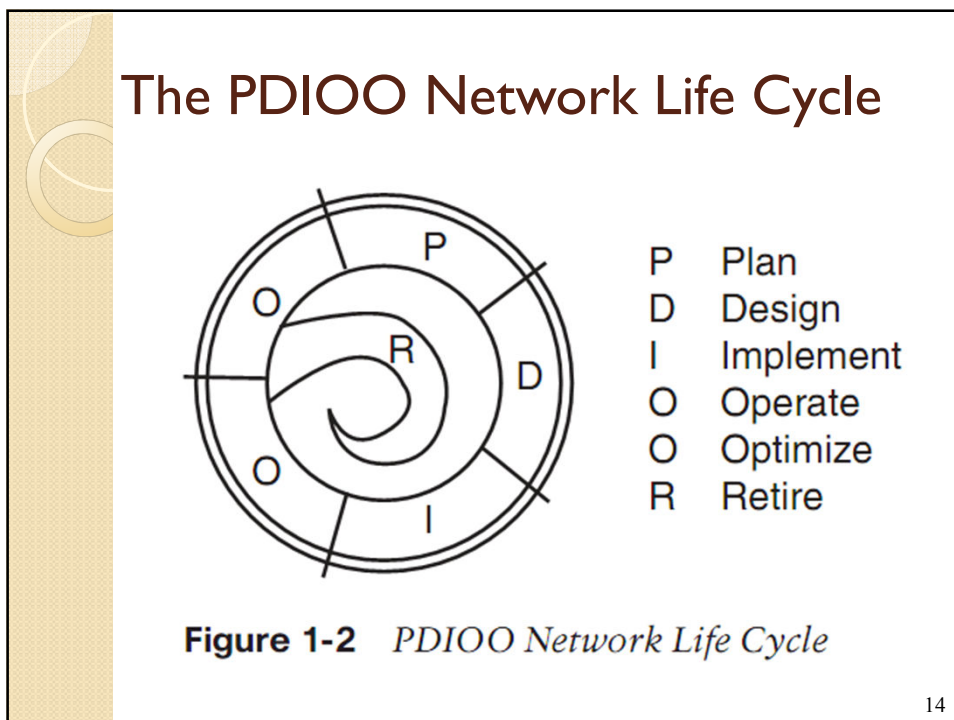 - Document the network design

12

Top-Down to Bottom-Up Approach Comparison

Cisco.com

	Top-Down Approach	Bottom-Up Approach
Benefits	• Incorporates organization's requirements • Gives the big picture to organization and designer	• Allows a quick response to a design request • Facilitates design based on previous experience
Disadvantages	• Is more time-consuming than bottom-up approach	• Implements no or little notion of actual organizational requirements • May result in inappropriate network design

13

The PDIOO Network Life Cycle

P   Plan
D   Design
I   Implement
O   Operate
O   Optimize
R   Retire

Figure 1-2   *PDIOO Network Life Cycle*

14

Business Goals

- Increase revenue
- Reduce operating costs
- Improve communications
- Shorten product development cycle
- Expand into worldwide markets
- Build partnerships with other companies
- Offer better customer support or new customer services

15

Recent Business Priorities

- Mobility
- Security
- Resiliency (fault tolerance)
- Business continuity after a disaster
- Network projects must be prioritized based on fiscal goals
- Networks must offer the low delay required for real-time applications such as VoIP

16

Business Constraints

- Budget
- Staffing
- Schedule
- Politics and policies

17

Organizational Constraints

Cisco.com

Organizational Constraint	Gathered Data	Comments
Budget	Amount of money to spend	Identify the amount of money the organization is willing to spend
Personnel	List available personnel and their expertise	Specify the number of network engineers that have to attend the additional training
Policy	List preferred standards, protocols, vendors, applications	Determine if the organization is willing to buy equipment from new vendor
Scheduling	Specify time frame	Use tools for resource assignment, milestones, critical-path analysis

18

Example: Organizational Constraints

Cisco.com

Organizational Constraint	Gathered Data	Comments
Budget	$650,000	Budget can be extended by maximum $78,000
Personnel	Engineers with CCNA certificates and CCNP certificates	Plans to hire new engineers in the network department
Policy	Prefers single vendor and standardized protocols	Current equipment—Cisco, prefers to stay with it
Scheduling	Plans to introduce new applications in the next nine months	New applications include video conferencing, groupware, and IP telephony

19

Collect Information Before the First Meeting

- Before meeting with the client, whether internal or external, collect some basic business-related information
- Such as
  - Products produced / Services supplied
  - Financial viability
  - Customers, suppliers, competitors
  - Competitive advantage

20

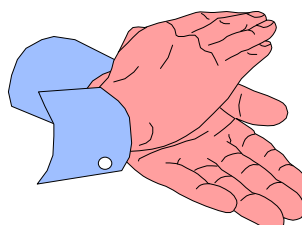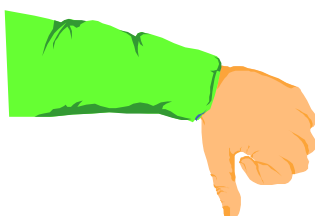## Meet With the Customer

- Try to get
  - A concise statement of the goals of the project
    - What problem are they trying to solve?
    - How will new technology help them be more successful in their business?
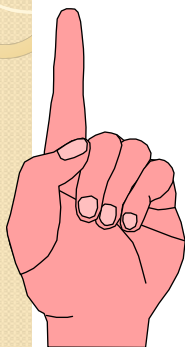   - What must happen for the project to succeed?

21

Meet With the Customer

- What will happen if the project is a failure?
  - Is this a critical business function?
  - Is this project visible to upper management?
  - Who's on your side?

22

Meet With the Customer

- Discover any biases
  - For example
    - Will they only use certain company's products?
    - Do they avoid certain technologies?
    - Do the data people look down on the voice people or vice versa?
  - Talk to the technical and management staff

23

Meet With the Customer

- Get a copy of the organization chart
  - This will show the general structure of the organization
  - It will suggest users to account for
  - It will suggest geographical locations to account for
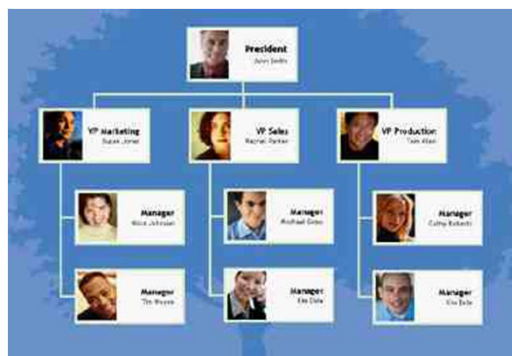
24

Meet With the Customer

- Get a copy of the security policy
  - How does the policy affect the new design?
  - How does the new design affect the policy?
  - Is the policy so strict that you (the network designer) won't be able to do your job?
- Start cataloging network assets that security should protect
  - Hardware, software, applications, and data
  - Less obvious, but still important, intellectual property, trade secrets, and a company's reputation

25

The Scope of the Design Project

- Small in scope?
  - Allow sales people to access network via a VPN
- Large in scope?
  - An entire redesign of an enterprise network
- Use the OSI model to clarify the scope
  - New financial reporting application versus new routing protocol versus new data link (wireless, for example)
- Does the scope fit the budget, capabilities of staff and consultants, schedule?

26

Assessing the Scope of the Network Design Process

Cisco.com

Scope of Design	Comments
Entire network	All branch office LANs upgraded to support FastEthernet technology
Campus	Redundant equipment and links
WAN	Solutions to overcome bottlenecks

27

Example: Assessing the Scope of the Network Design Process

Cisco.com

- Application—Designing voice transport
- Network—Designing routing, addressing
- Physical, data link—Choosing connection type

Application
Presentation
Session
Transport
Network
Data Link
Physical

28

Gather More Detailed Information

- Applications
  - Now and after the project is completed
  - Include both productivity applications and system management applications
- User communities
- Data stores
- Protocols
- Current logical and physical architecture
- Current performance

29

Network Applications

Table 1-1 *Network Applications*

Name of Application	Type of Application	New Application? (Yes or No)	Criticality	Comments

Example: Planned Applications

Cisco.com

Application Type	Application	Criticality (critical/important/ unimportant)	Comments
E-mail	Lotus Notes	Important	
Groupware	Lotus Notes	Critical	
Voice networking	IP telephony	Critical	The company is replacing regular telephony
Web browsing	MS IE, Opera, Netscape	Not important	
Video on demand	IP/TV	Critical	
Database	Oracle	Critical	All data storage will be based on Oracle
Customer support	Specific applications	Critical	

31

Summary

- Systematic approach
- Focus first on business requirements and constraints, and applications
- Gain an understanding of the customer's corporate structure
- Gain an understanding of the customer's business style

32

Review Questions

- What are the main phases of network design per the top-down network design approach?
- What are the main phases of network design per the PDIOO approach?
- Why is it important to understand your customer's business style?
- What are some typical business goals for organizations today?

33