Network Design and Management

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Week # 1

Chapter 1: Network Design

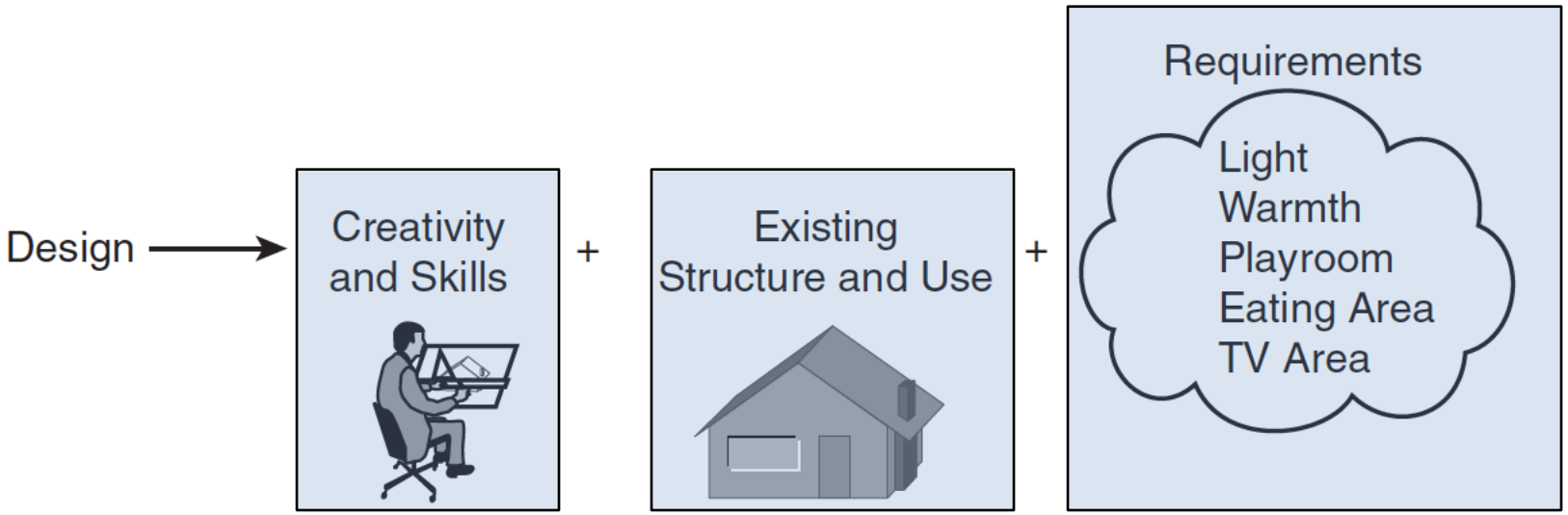
- What Is Design?
- Design Principles
- Modular Network Design

What is Design?

- FROM DICTIONARY:
  - Planning how to create something, or
  - The actual plans themselves

  - When Designing an Addition to a House, an Architect Needs to Have Knowledge of the **Existing Structure** and **the Requirements** for the Addition Along **with Skills and Creativity**.

Figure 1-1 *When Designing an Addition to a House, an Architect Needs to Have Knowledge of the Existing Structure and the Requirements for the Addition—Along with Skills and Creativity*



KEY POINT To determine the requirements for the addition, a good architect should ask probing questions. Determining the *actual requirements,* rather than your *perceived solutions,* is a key skill for a good architect.

Network Design

- **A network design is no different- but how?**
- **Understanding the requirements** for the network, as well as knowing how the **existing network is structured and used**, is key to understanding **how the new or updated network** should function and which features should be included.
- Understanding how the **features** operate,
  - what they do,
  - what their constraints are, and
  - what alternative approaches are available comes from both **training and experience.**

Design Principles

- **Cisco ?**

> The name "Cisco" was derived from the city name **San Francisco**, which is why the company's engineers insisted on using the lower case "cisco" in its early years.

- **Cisco** has developed the:

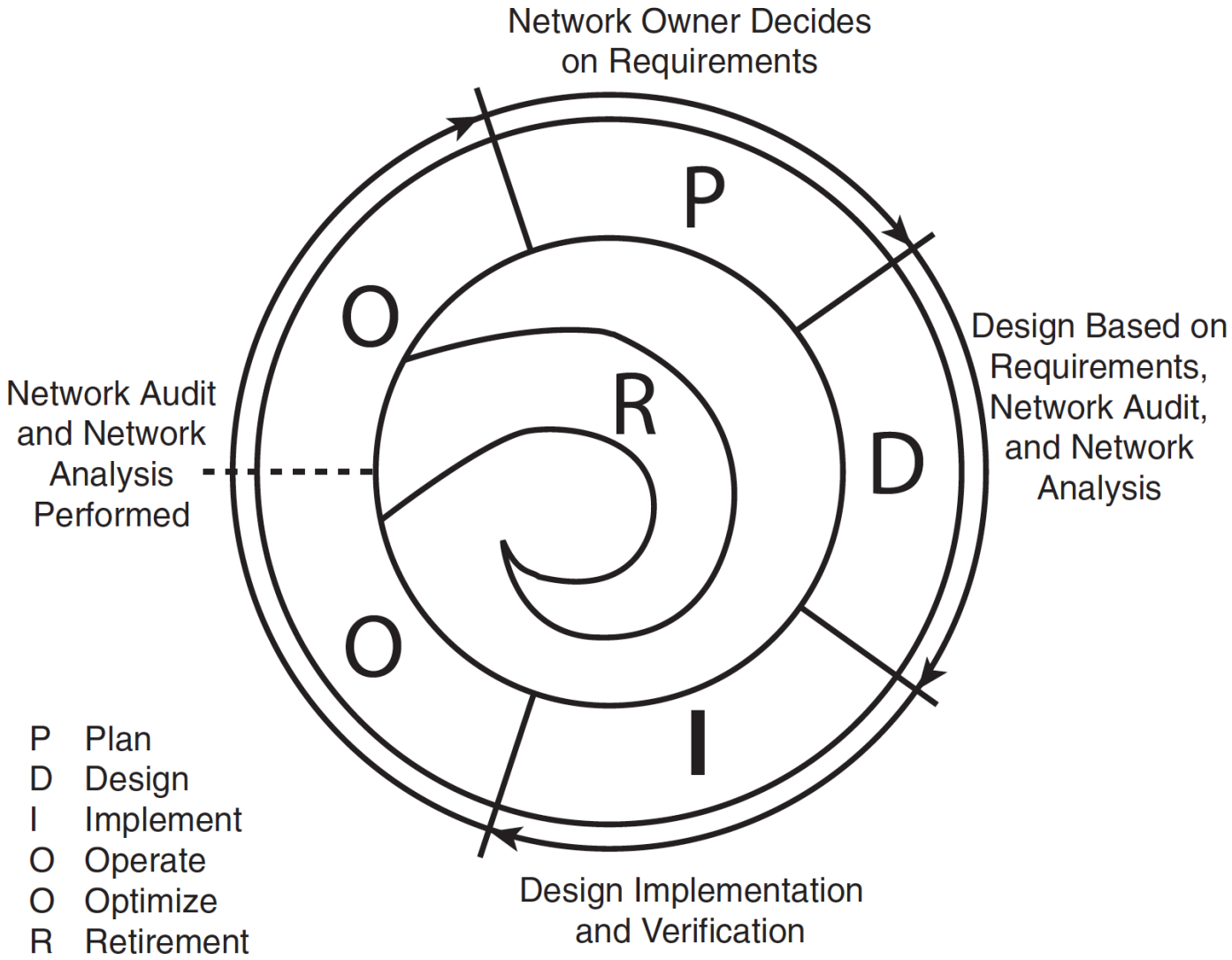
PDIOO

Plan-Design-Implement-Operate-Optimize

- network life cycle to describe the multiple phases through which a network passes.

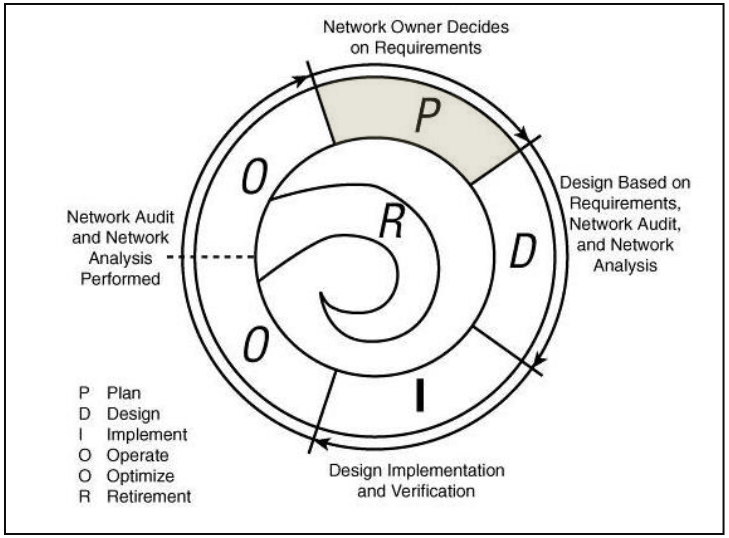
- This is the network design lifecycle – suggested by Cisco

Plan-Design-Implement-Operate-Optimize (PDIOO)



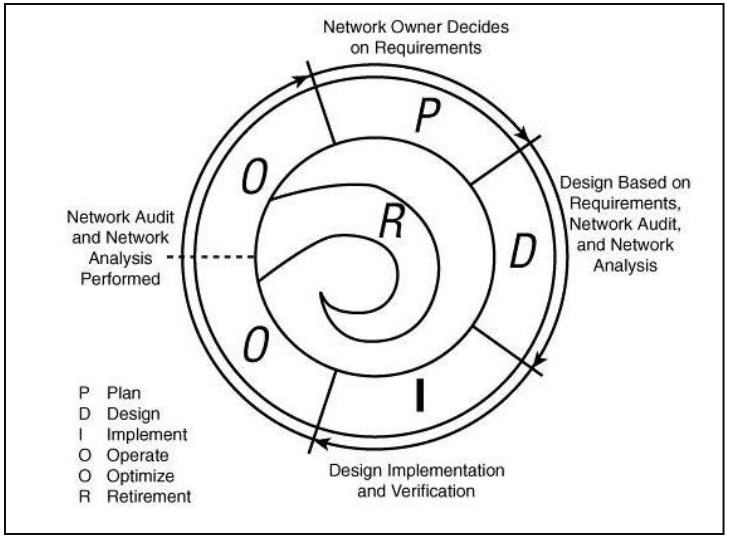
Plan-Design-Implement-Operate-Optimize (PDIOO)

- **PLAN PHASE-**
  - The detailed network **requirements** are identified, and
  - the **existing network** is reviewed.
- **DESIGN PHASE**
  - The **network** is **designed according** to the initial requirements and
  - additional data gathered during analysis of the existing network.
  - The design is **refined with the client**.
- **IMPLEMENT PHASE**
  - The network is built according to the approved design.



Plan-Design-Implement-Operate-Optimize (PDIOO)

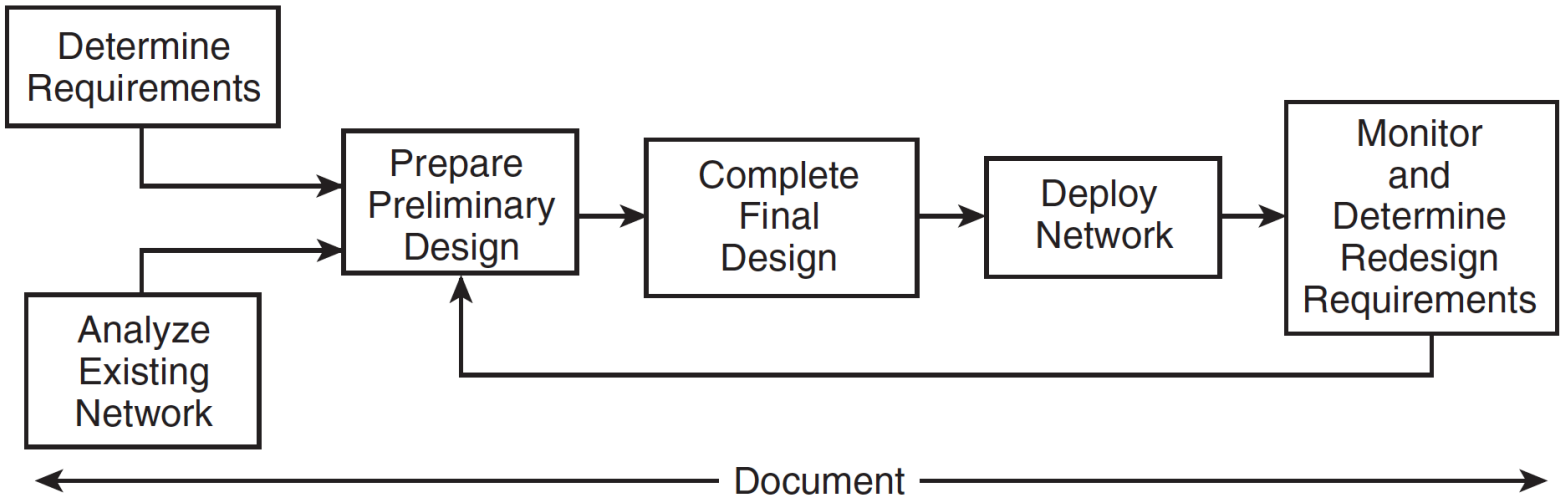
- **OPERATE PHASE**
  - The network is operational and is being monitored. This phase is the ultimate test of the design.
- **OPTIMIZE PHASE**
  - During this phase, issues are detected and corrected, either before problems arise or, if no problems are found, after a failure has occurred. Redesign might be required if too many problems exist.
- **RETIREMENT PHASE**
  - Although not part of the PDIOO acronym, this phase is necessary when part of the network is outdated or is no longer required.



Network Designing Tasks

- **Network design should include the following tasks**
    1. Determine requirements
    2. Analyze the existing network (if one exists)
    3. Prepare the preliminary design
    4. Complete the final design development
    5. Deploy the network
    6. Monitor, and redesign if necessary
    7. Maintain documentation
       (as a part of all the other tasks)

Network Designing Tasks



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Determining Requirements

- … is a part of the PDIOO **Plan phase**
- … related to **technical** and **business** issues.

- **TECHNICAL ISSUES** :
  - Applications that are to run on the network?
  - Internet connections required?
  - Addressing restrictions ?
  - Support for IP version 6 (IPv6) addresses?
  - Other protocols that are to run on the network?
  - Cabling requirements?
  - Redundancy requirements?

Determining Requirements

- **TECHNICAL ISSUES** (cont):
  - Use of proprietary equipment and protocols?
  - Existing equipment that must be supported?
  - Network services required, including quality of service (QoS) and wireless?
  - How security is to be integrated into the network?
  - Network solutions required ?
    (for example, voice traffic, content networking, and storage networking)
  - Network management
  - Support for existing applications
  - Bandwidth availability

Determining Requirements

- **BUSINESS ISSUES:**
  - **Budget**
    Capital (for new equipment) and operating (for ongoing expenses).
  - **Schedule**
    This could include the phasing out of older applications, hiring of new personnel, and so forth.
  - **People**
    Considerations include
    - who will install and operate the network,
    - what skills they have,
    - whether they require training,
    - whether any of these tasks will be outsourced, and so forth.

Determining Requirements

- **Legal**
  Issues include any restrictions on the use and storage of data collected, whether the organization has contractual obligations or opportunities related to the network (for example, long-term maintenance or lease contracts), and so forth.
- **History**
  Factors include examining the existing network's structure and determining whether any person or group will block changes or additions.
- **Policies**
  Consider whether current organizational policies might restrict the network design.

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Analyzing the Existing Network

- If this is a redesign of an existing network, the current network must be analyzed and understood.
- Sometimes an existing network … restrict the network design …
  - **for example**, the existing cabling might not be optimal but might have to be kept for cost reasons.
  - Analyzing the existing network is typically done during the **Optimize phase of the existing network**; it could also be considered as part of the **Plan phase for the new network.**

Analyzing the Existing Network

- We should analyze the network to determine both
  - what is good and
  - what should be changed

- For example, the network might include virtual private network (VPN) connections so that employees can access corporate files through the Internet. If the organization is satisfied with this feature, this portion of the network might not have to be changed.

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Preparing the Preliminary Design

- Preliminary design involves considering all the **network requirements and constraints (including the budget)**, and determining viable alternative solutions.
- The network owner is then consulted, and together an optimal solution is chosen; this solution is later developed into the final design.
- Both the preliminary design and final design are done during the **PDIOO Design phase**.

Preparing the Preliminary Design

- Two models that can be used for network design are examined
  1. **THE HIERARCHICAL MODEL AND**
  2. **THE CISCO ENTERPRISE COMPOSITE NETWORK MODEL**

Network Designing Tasks

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Completing the Final Design Development

- Developing the final design involves:
  - producing detailed drawings,
  - configuration specifications,
  - costing, addressing plans,
  - and any other information required for implementation.

- We can verify the design by implementing a **prototype network**, separate from the existing network.
- Alternatively, a **pilot network** can be implemented within a portion of the existing network to verify that the design is feasible.

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Deploying the Network

- Deployment of the network must **start** with a **plan** and a **schedule**.
- Deployment planning starts in the PDIOO **Design** phase and continues into the **Implement** phase.
- The **deployment plan** must include details of:

  what is to be **done** and **how** it is to be **done.**

- **Scheduling** … not only to identify **when** things will be done but also to determine **who** will do them, and **what impact** the deployment will have on the **existing network**.
- **Contingency plans –** plans for what happens if a problem occurs during the implementation, should also be included.
  - how the network will be returned to a known working state

Deploying the Network

- Any **training** required **for personnel** should be **planned** during this time.
- Any **contracts required** should be **negotiated** during this time.
- When the **plans**, **schedules**, **contracts**, and so on are in place, the network *can be implemented*.
- Any **problems** found in the design during this phase must be **corrected** and **documented**.

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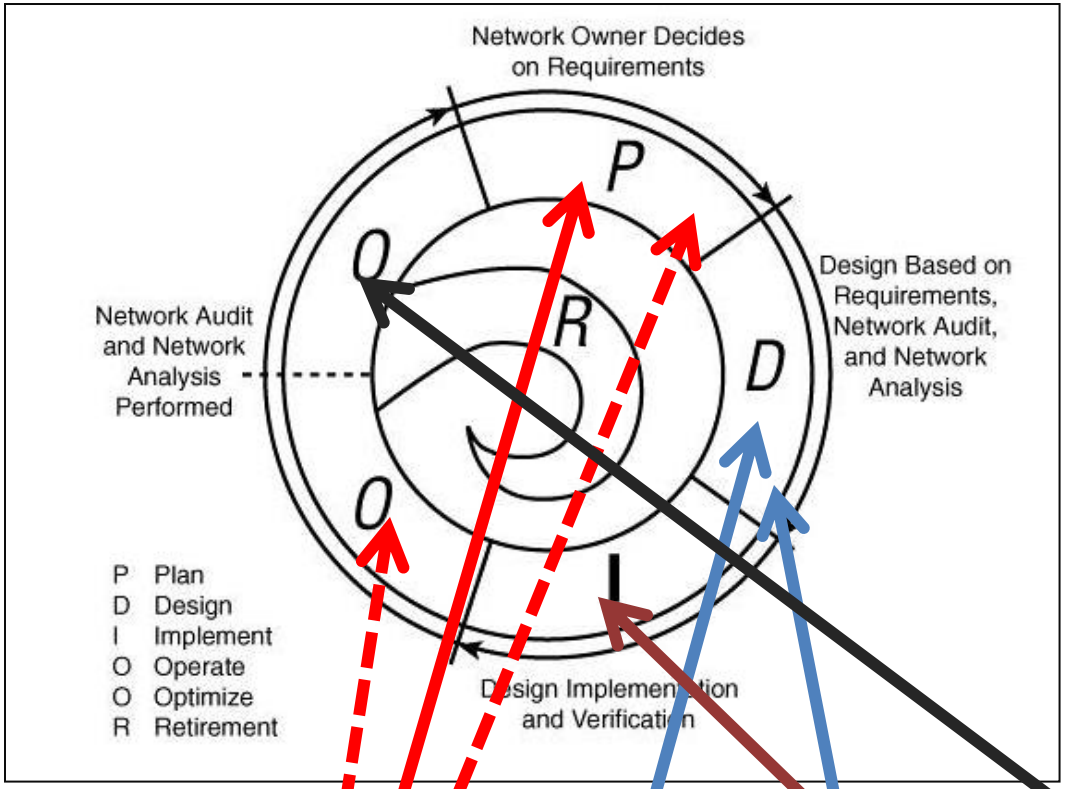
Monitoring and Redesigning

- After the network is operating, baseline operational statistics should be gathered so that values for a working network are known.
- The network should then be monitored for anomalies and problems.
  - If problems that require redesign occur, or if requirements change or are added, the appropriate design changes must be made and the entire design process should be repeated for that portion of the network.
- Monitoring and redesign take place in the PDIOO **Operate and Optimize phases**, and can lead back into the Plan and Design phases.

Documentation

- The design should be documented throughout the process.
- Should Include
  - All the agreed-to **requirements** and **constraints**
  - The **state** of the **existing network**, if any
  - **Preliminary design** options and a brief review of **why** the **final design** was chosen
  - **Final design details**
  - Results of any pilot or prototype testing
  - Deployment plans, schedules, and other implementation details
  - **Monitoring requirements**
  - Any other pertinent information



Relationship in between
PDIOO and Network Design Tasks