西北大学 Northwest University

# Chapter 5: Project Scope Management

西北大学 信息科学与技术学院

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# Learning Objectives

1. Understand the ***importance*** of good project scope management
2. Describe the ***process of planning*** scope management
3. Discuss ***methods for collecting and documenting requirements*** to meet stakeholder needs and expectations
4. Explain the ***scope definition process*** and describe ***the contents of a project scope statement***
5. Discuss the process for ***creating a work breakdown structure*** using the analogy, top-down, bottom-up, and mind-mapping approaches

# Learning Objectives

6. Explain the ***importance of validating scope*** and how it relates to defining and controlling scope
7. Understand the ***importance of controlling scope*** and approaches for preventing scope-related problems on information technology (IT) projects
8. Describe how ***software*** can assist in project scope management

# Opening case

Kim Nguyen正在召开一个项目组首次会议，讨论她所负责的IT升级项目的工作分解结构。

公司正在优先开发几个因特网应用软件，这个IT升级项目要编制并实施一个计划，让公司所有员工的IT设备在9个月内达到新的公司标准。

该新标准规定每个台式机或笔记本电脑的最低配置要求，包括处理器型号、内存大小、硬盘容量、网络接口类型以及安装的软件等。

Kim知道要进行升级，他们必须首先为公司2000多名员工列出一个所有现有硬件、网络和软件的清单。

# Opening case

Kim和其他干系人一块制定了项目章程和初步的范围说明书。项目章程包括项目的粗略成本和进度估算，以及关键干系人的签字；初步的范围说明书对项目范围相关的软件、硬件和网络需求以及其他信息提供了初始的界定。

Kim召集项目团队人员和其他干系人开会是为了进一步对项目范围进行界定。**项目会涉及哪些工作？由谁做？如何才能避免可能的范围蔓延？**她想通过这次会议征集大家对这些问题的看法。

公司首席执行官Walter Schmidt擅长于这一类大型项目管理，他使用一种新的项目管理系统使每个人对项目的状态和进度进行全面和细致的了解。

Kim知道好的WBS是范围、时间、和成本绩效的基础，但她并不清楚怎样着手**建立WBS或分配成本。她该怎么做呢?**

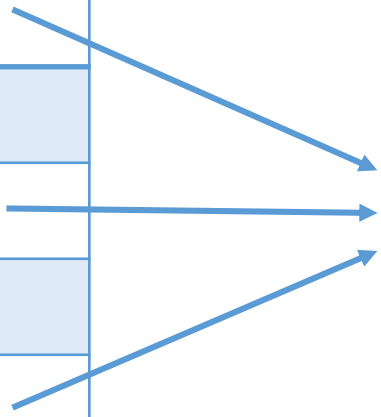
# Main Contents

1. What is project scope management ?
2. Planning scope management
3. Collecting requirements
4. Defining scope
5. Creating WBS
6. Validating scope
7. Controlling scope
8. Using Software to Assist in Project Scope Management

# 1. What is project scope management ?

**Table 1-2 What helps projects succeed?**

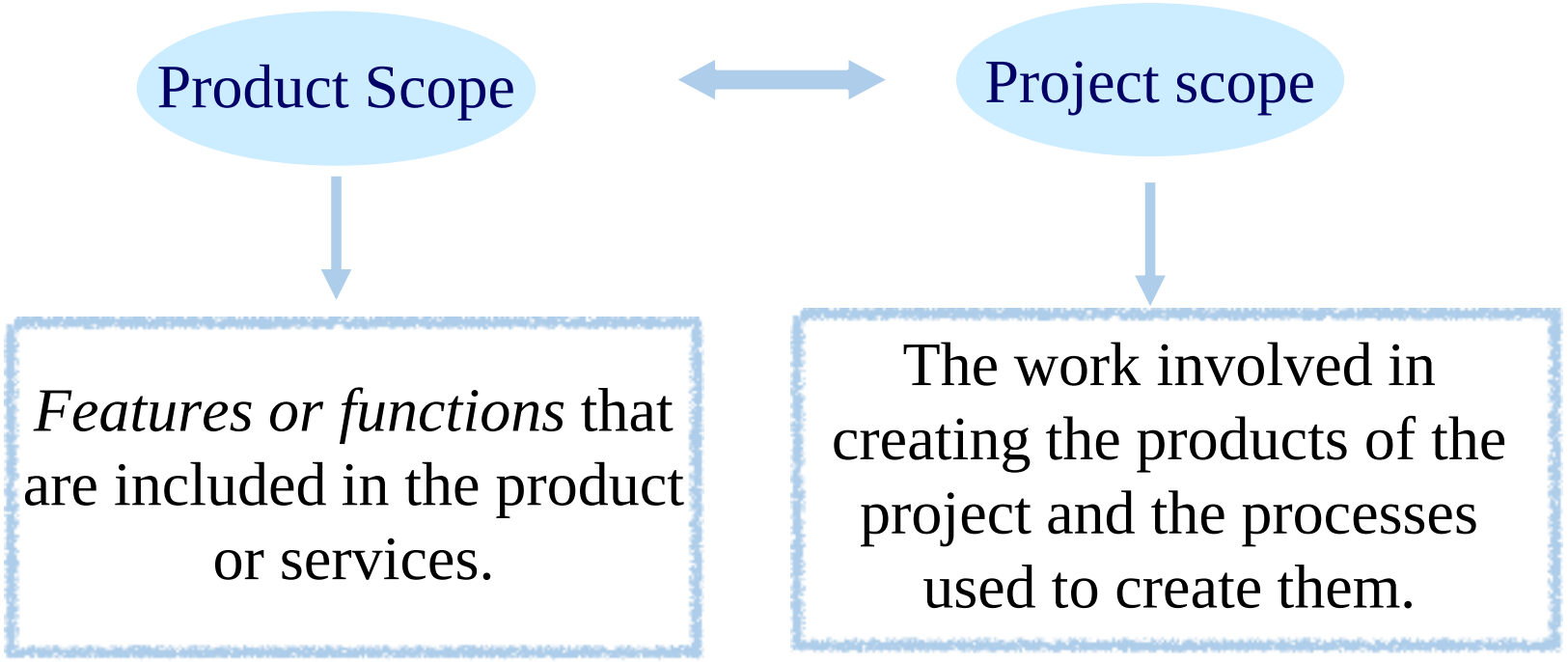
| |
|---|
| 1. User involvement |
| 2. Executive support |
| 3. Clear business objectives |
| 4. Emotional maturity |
| 5. Optimized scope |
| 6. Agile process |
| 7. Project management expertise |
| 8. Skilled resources |
| 9. Execution |
| 10. Tools and infrastructure |



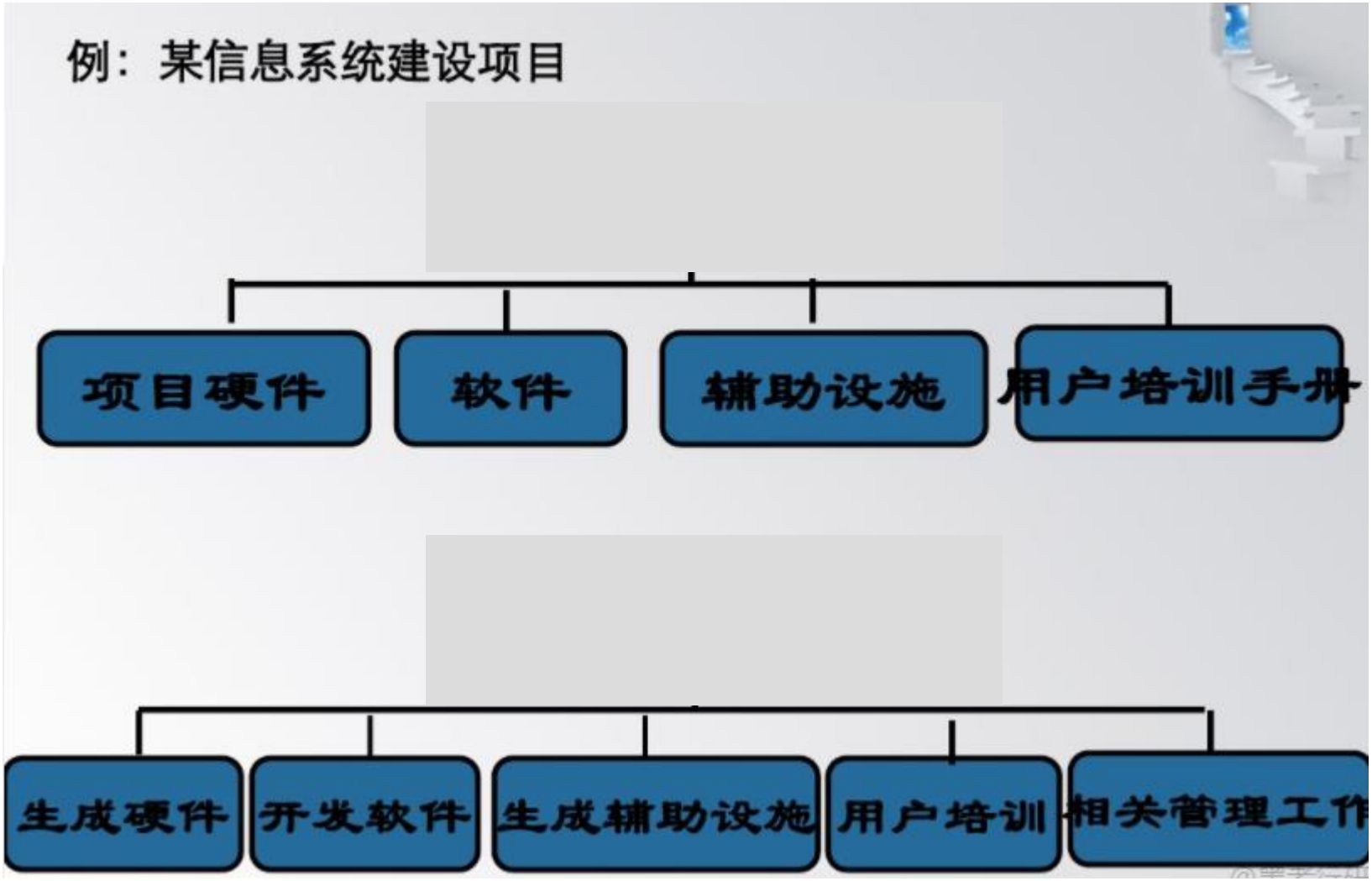
*Elements of project scope management*

# 1. What is project scope management ?

**Scope** refers to all the ***work*** involved in creating the products of the project and the ***processes*** used to create them.



# 1. What is project scope management ?



# 1. What is project scope management ?

**Project scope management** includes the processes involved in defining and controlling what work ***is or is not included*** in a project.

- *It ensures that the project team and stakeholders have the same understanding of what products the project will produce and what processes the project team will use to produce them.*
- ***Effective scope management can ensure that the project only does what must be done to avoid scope spread and useless work.***

# 1. What is project scope management ?

- **Planning scope:** determining how the project's scope and requirements will be managed
- **Collecting requirements:** defining and documenting the features and functions of the products produced during the project as well as the processes used for creating them
- **Defining scope**: reviewing the project charter, requirements documents, and organizational process assets to create a scope statement
- **Creating the WBS:** subdividing the major project deliverables into smaller, more manageable components
- **Validating scope**: formalizing acceptance of the project deliverables
- **Controlling scope**: controlling changes to project scope throughout the life of the project

# Scope management — 6 main processes

## Planning

**Process: Plan scope management**

**Outputs:** Scope management plan, requirements management plan

**Process: Collecting requirements**

**Outputs:** Requirements documentation, requirements traceability matrix (RTM)

**Process: Define scope**

**Outputs:** Project scope statement, project documents updates

**Process: CreateWBS**

**Outputs:** Scope baseline, project documents updates

## Monitoring and controlling

**Process: Validate scope**

**Outputs:** Accepted deliverables, change requests, work performance information, project documents updates

**Process: Control scope**

**Outputs:** Work performance information, change requests, project management plan updates, project documents updates organizational process assets updates

**Project start** → **Project finish**

# 2. Planning scope management

**Inputs:** project management plan, project charter,

enterprise environmental factors,

organizational process assets

**Tools and techniques:** expert judgment, meetings

**Outputs:** *scope management plan*,

requirements management plan

***Note !***

*Scope management plan is a subsidiary part of the project management plan.*

*It can be informal and broad or formal and detailed, based on the needs of the project.*

# 2. Planning scope management

**A scope management plan includes:**

- How to prepare a detailed project scope statement
- How to create a WBS
- How to maintain and approve the WBS
- How to obtain formal acceptance of the completed project deliverables
- How to control requests for changes to the project scope


范围管理计划

项目名称: _____ 制表日期: _____

工作分解结构 ( WBS ):

WBS 词典

范围基准维护

可交付成果验收

范围和需求整合

# 2. Planning scope management

**Inputs:** project management plan, project charter,

enterprise environmental factors,

organizational process assets

**Tools and techniques:** expert judgment, meetings

**Outputs:** scope management plan,

*requirements management plan*

# 2. Planning scope management

**Requirement:**

(1) A condition or capability needed by a *user* to solve a problem or achieve an objective.

(2) A condition or capability that must be met or possessed by a *system or system component* to satisfy a contract, standard, specification, or other formally imposed document.

(3) A *documented representation* of a condition or capability as in 1 or 2.

*What are the processes involved in requirement engineering ?*

*What are the categories can requirements be broken down into ?*

# 2. Planning scope management

**Requirement management plan** documents how project requirements will be analyzed, documented, and managed.

**It includes:**

- How to plan, track, report requirements activities
- How to perform configuration management activities
- How to prioritize requirements
- How to use product metrics
- How to trace and capture attributes of requirements


需求管理计划

项目名称: _____ 制表日期: _____

收集：

分析：

分类：

文档化：

优先级：

度量：

可追溯性结构：

跟踪：

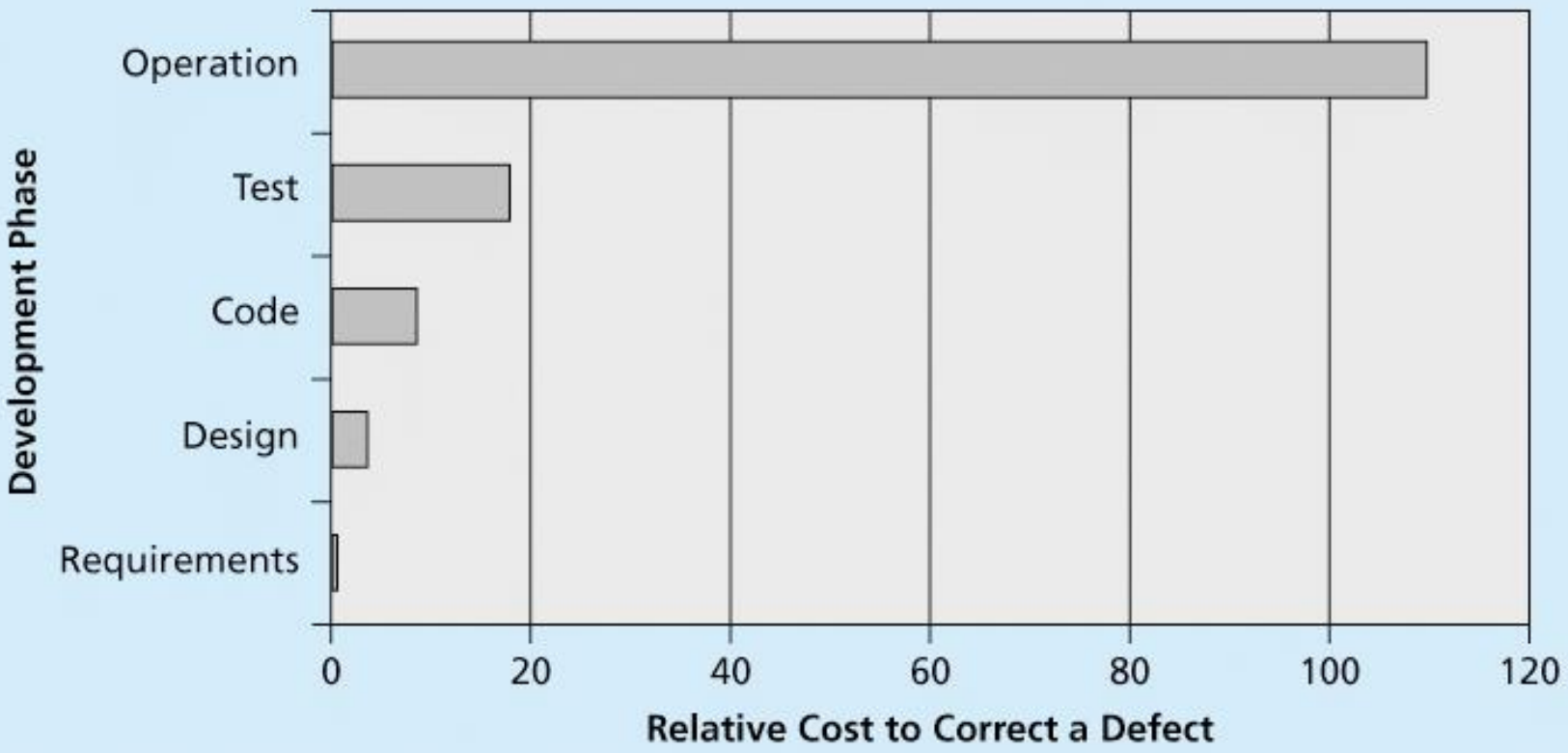
报告：

生效：

配置管理：

# 3. Collecting requirements

**Figure 5-2. Relative Cost to Correct a Software Requirement Defect**




*Source:* Robert B. Grady, "An Economic Release Decision Model: Insights into Software Project Management." *Proceedings of the Applications of Software Measurement Conference* (Orange Park, FL: Software Quality Engineering, 1999), pp. 227–239.

# 3. Collecting requirements

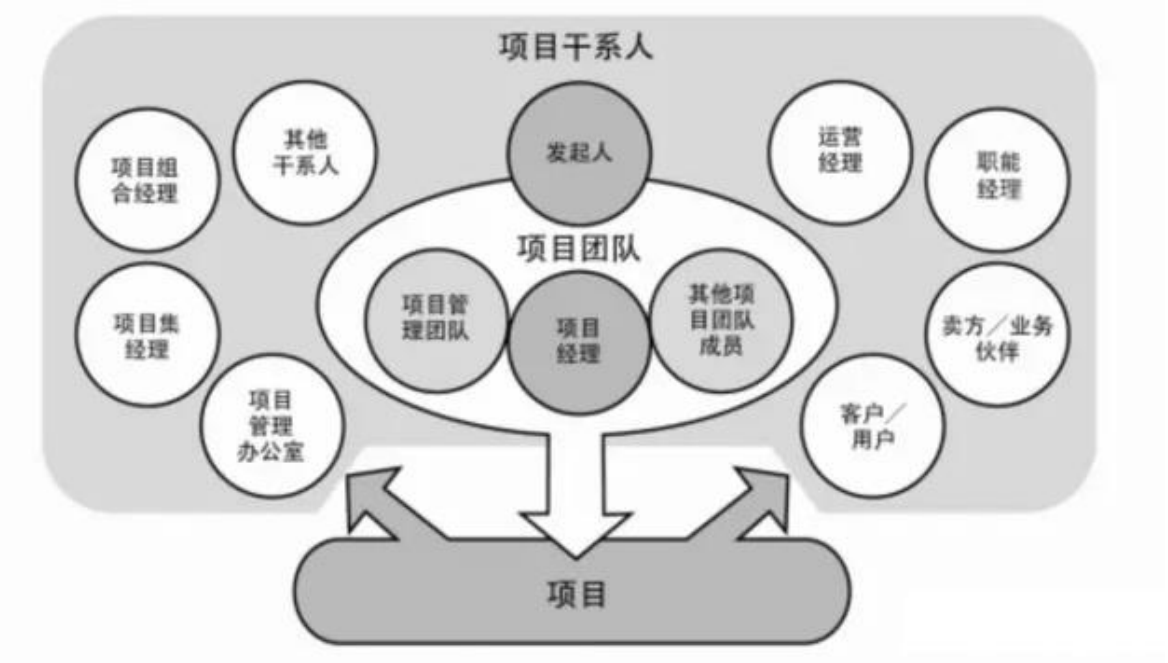
**There are several ways to collect requirements:**

- Brainstorming
- Interviewing stakeholders
- Holding focus groups and facilitating workshops
- Using group creativity and decision-making techniques
- Questionnaires and surveys
- Observation
- Prototyping and document analysis
- Benchmarking or generating ideas by comparing

# 3. Collecting requirements

**Collecting requirements:**

- Clients
- Customers
- Users
- Technical engineers
- Lawyers and audits
- Domain expertise
- Market researchers
- ……



# 3. Collecting requirements

## Requirements documentation:

**SMART**

- S：Specific
- M：Measurable
- A：Achievable
- R：Relevant
- T：Time table

需求文件

项目名称: _____ 制表日期: _____

| 序号 | 需求 | 干系人 | 分类 | 优先级 | 验收标准 | 测试或确认 | 阶段或发布 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

## It includes:

- Business
- Stakeholder
- Solution
- Transition and readiness
- Project
- Quality

# 3. Collecting requirements

## Requirements documentation:

**需求说明书**

1.描述当前局面的不足以及项目启动的原因

2.可跟踪的业务目标和项目目标

3.功能要求（需求清单或模型）

4.非功能性要求（如服务水平、绩效、安全

5.质量要求

6.验收标准

7.体现组织指导原则的业务规则

8.对组织其他领域的影响

9.对执行组织内部或外部团体的影响

10.对支持和培训的需求

11.对需求有关的假设条和制约因素

# 3. Collecting requirements

**Statistics on Requirements for Software Projects(2011 Survey)*:**

- *Eighty-eight percent* of the software projects involved enhancing existing products instead of creating new ones
- *Eighty-six percent* of respondents said that customer satisfaction was the most important metric for measuring the success of development projects
- *Eighty-three* percent of software development teams still use Microsoft Office applications such as Word and Excel as their main tools to communicate requirements

# 3. Collecting requirements

**Steps to document the requirements:**

(1) review the project charter, refer to the scope and requirements management plan

(2) review stakeholder register and stakeholder management plan

**Requirements documents are often** generated by software and include text, images, diagrams, videos, and other media.

# 3. Collecting requirements

**Requirements Traceability Matrix（RTM ）**is a table that lists requirements, their various attributes, and the status of the requirements to ensure that all are addressed.

**The main purpose of an RTM** is to maintain the *linkage* from the source of each requirement through its decomposition to implementation and validation.

| Requirement No. | Name | Category | Source | Status |
|---|---|---|---|---|
| R32 | Laptop memory | Hardware | Project charter and corporate laptop specifications | Complete. Laptops ordered meet requirement by having 4GB of memory. |

# 4. Defining scope

**Good scope definition helps:**

- improve the accuracy of time, cost, and resource estimates
- defines a ***baseline*** of performance measurement and project control
- aids in communicating clear work responsibilities

**The main tools and techniques:**

- Expert judgement
- Product analysis
- Alternatives generation
- Facilitated workshops

# 4. Defining scope

**Inputs:**

- project charter
- scope management plan
- requirements documentation
- organizational process assets

**Outputs:**

- project scope statement
- project documents updates

# 4. Defining scope

**A scope statement** is a document that describes the ***consensus*** on the scope of the project among all project stakeholders.

- It is the basis for future project or project phase acceptance decisions.
- It is the main basis for identifying and determining changes to the scope of the project.

*Do you think it is helpful to document any other information, files or documents in the project scope statement ?*

- *Product specification*
- *Supporting documents*

# 4. Defining scope

**Project scope statement includes:**

- Product scope description
- Product user acceptance criteria
- Detailed information on all project deliverables
- Project exclusions
- Constraints
- Hypothetical conditions


项目范围说明书

项目名称: _____ 制表日期: _____

项目范围描述：

项目可交付成果：

产品验收标准

项目除外责任：

项目制约因素：

项目假设条件

# 4. Defining scope

## Scope Statement (Version xx)

**Project Title:**
**Date:** → → **Prepared by:**

**Project Justification:**

**Product Characteristics and Requirements:**

1. →
2. →
3. →
4. →

**Summary of Project Deliverables**
**Project management-related deliverables:** business case, charter, team contract, scope statement, WBS, schedule, cost baseline, status reports, final project presentation, final project report, lessons-learned report, and any other documents required to manage the project.
**Product-related deliverables:** research reports, design documents, software code, hardware, etc.

1. →
2. →
3. →
4. →

**Project Success Criteria:**

# 4. Defining scope

**Project Charter:**
Upgrades may affect servers…

**Project Scope Statement, Version 1:**
Servers: If additional servers are required to support this project, they must be compatible with existing servers. If it is more economical to enhance existing servers, a detailed description of enhancements must be submitted to the CIO for approval. See current server specifications provided in Attachment 6. The CEO must approve a detailed plan describing the servers and their location at least two weeks before installation.

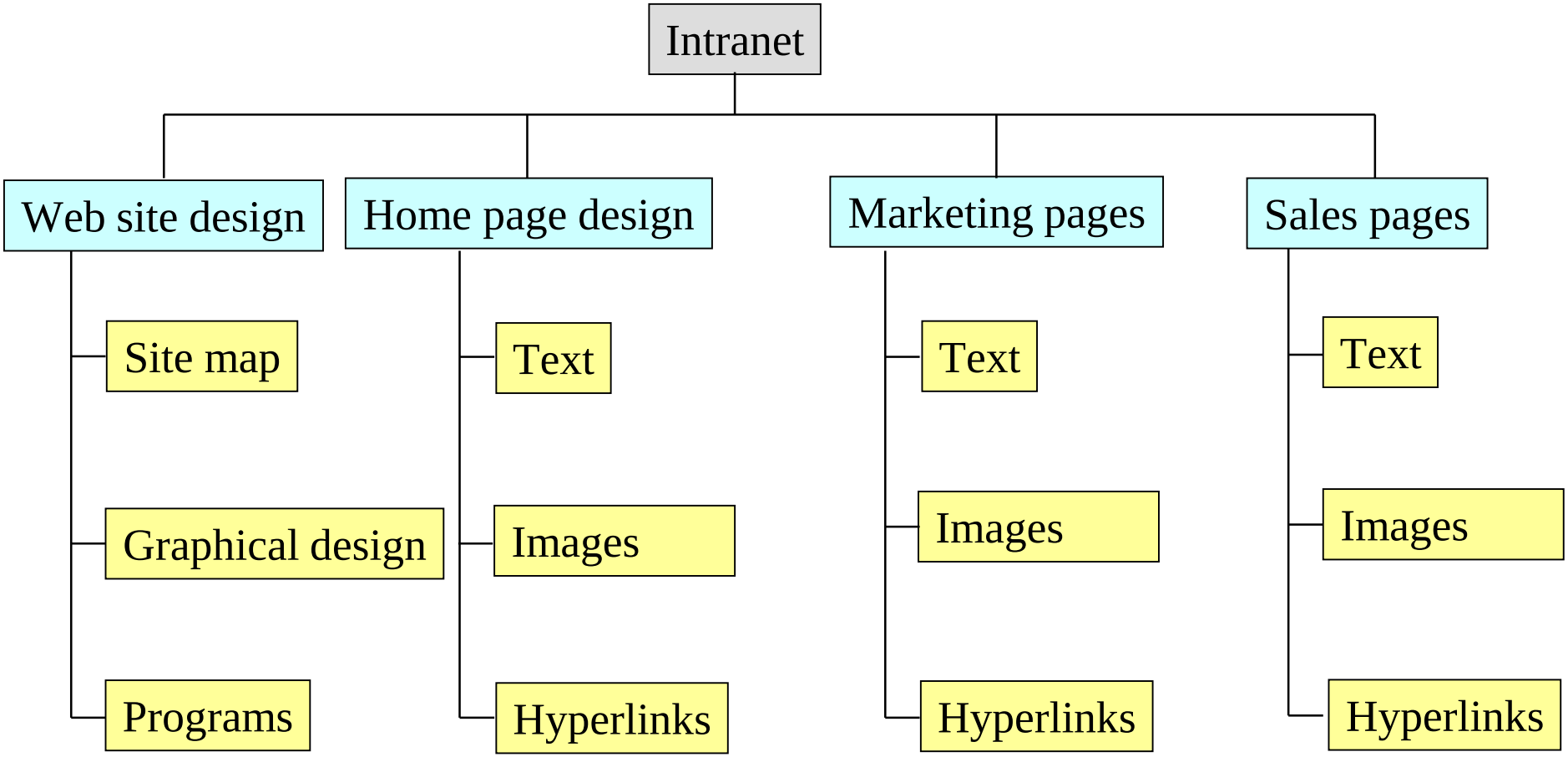
**Project Scope Statement, *Version 2*:**
Servers: This project will require purchasing 10 new servers to support Web, network, database, application, and printing functions. Virtualization will be used to maximize efficiency. Detailed descriptions of the servers are provided in a product brochure in Attachment 8, along with a plan describing where they will be located.

# 5. Creating the WBS

- A **WBS** is a ***deliverable-oriented*** grouping of the work involved in a project that defines the total scope of the project
- WBS is ***a foundation document*** that provides ***the basis*** for planning and managing project schedules, costs, resources, and changes
- **Decomposition** is subdividing project deliverables into smaller pieces
- A **work package** is a task at the lowest level of the WBS
- The ***scope baseline*** includes the approved project scope statement and its associated WBS and WBS dictionary

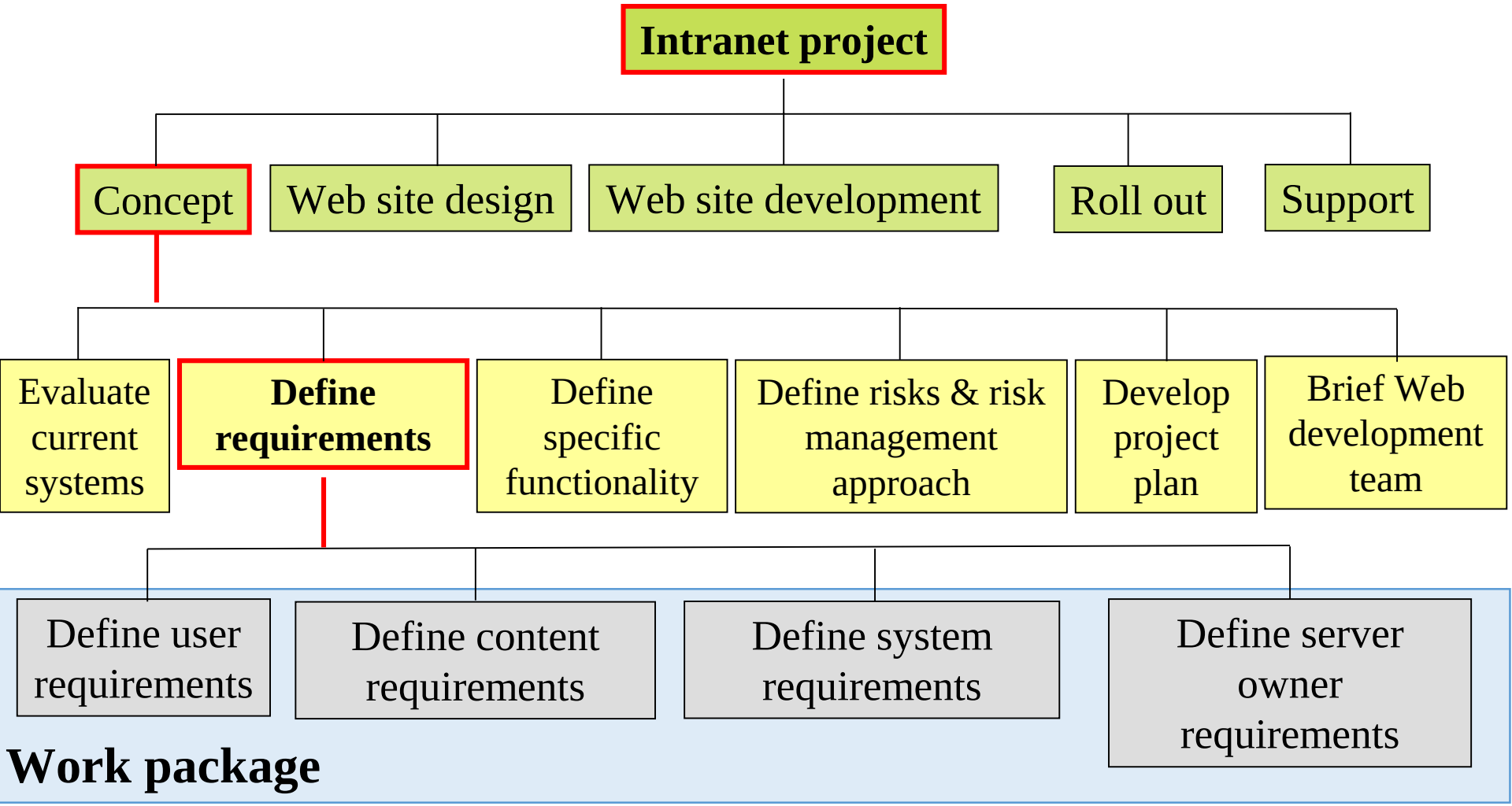
# 5. Creating the WBS

Sample intranet WBS organized by **product**



# 5. Creating the WBS

Sample intranet WBS organized by **phase**



# 5. Creating the WBS

- 1.0 Concept
  - 1.1 Evaluate current systems
  - 1.2 Define requirements
    - 1.2.1 Define user requirements
    - 1.2.2 Define content requirements
    - …
  - 1.3 Define specific functionality
  - 1.4 Define risks & risk management approach
  - …
- 2.0 Web site design
- 3.0 Web site development
- 4.0 Roll out
- 5.0 Support

# 5. Creating the WBS

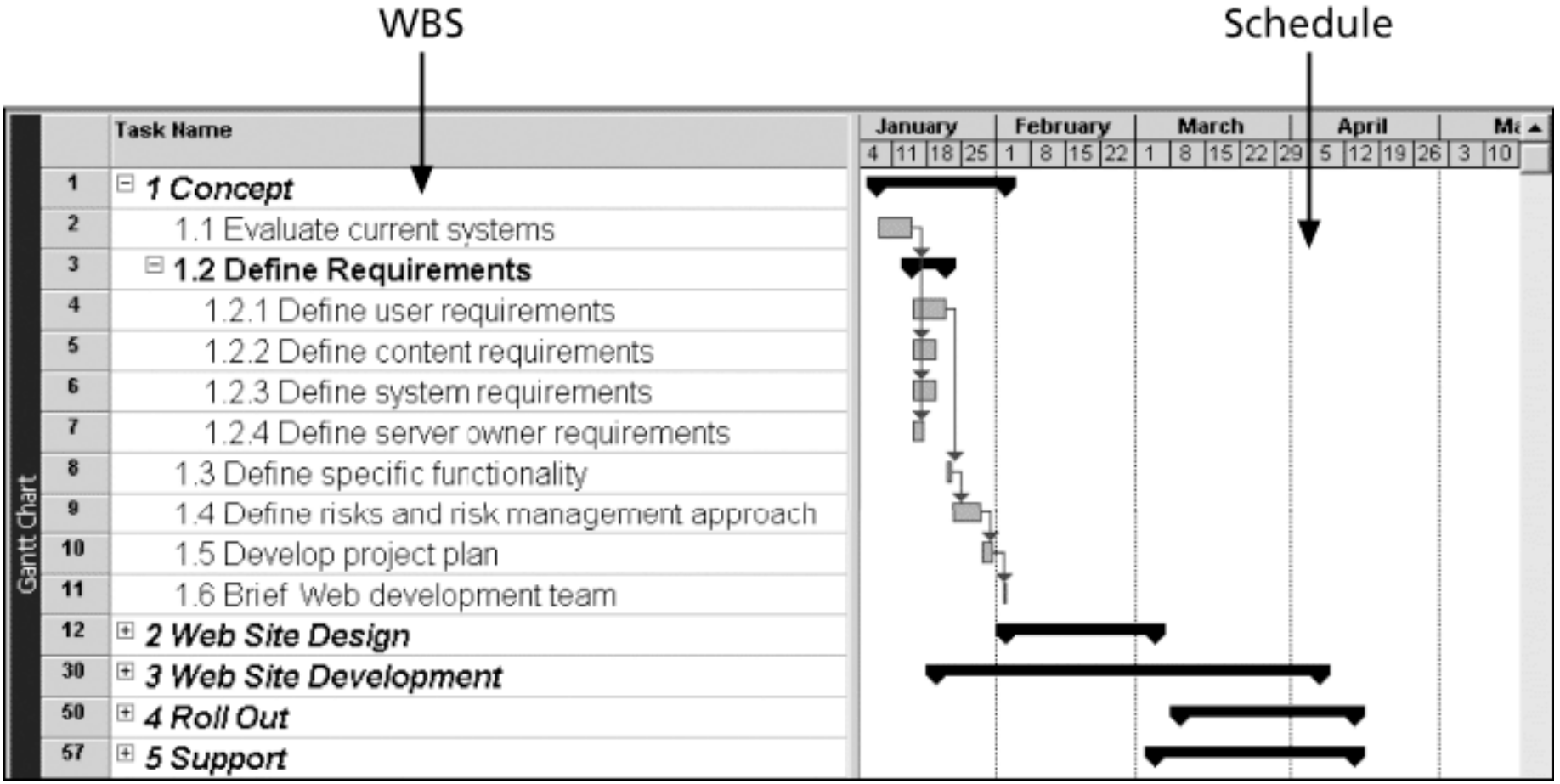
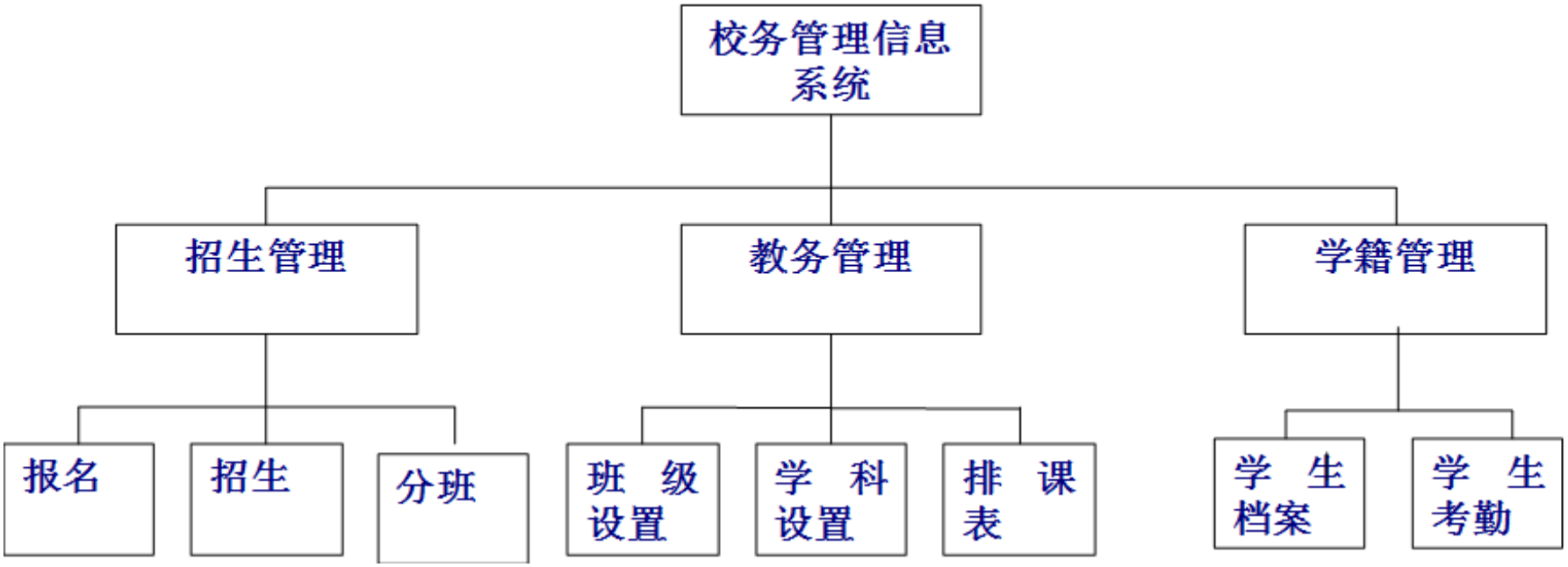



**Figure 5-5. Intranet WBS and Gantt Chart in Microsoft Project**

# 5. Creating the WBS

**The main ways of working breakdown:**

- According to the product composition of the project
- According to the stage of project implementation
- According to the organizational structure of the project



# 5. Creating the WBS

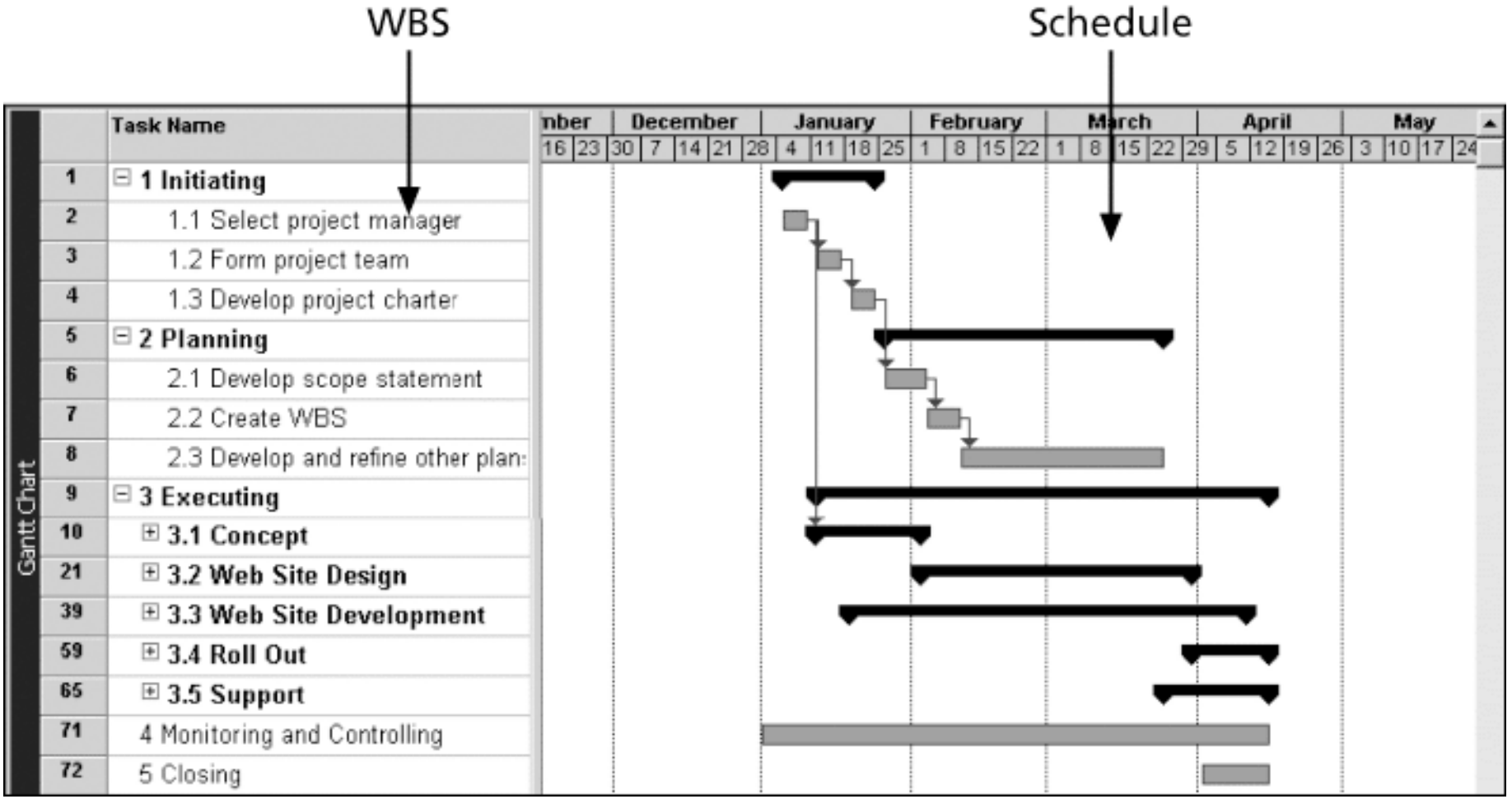



**Figure 5-6. Intranet Gantt Chart Organized by Project Management Process Groups**

# 5. Creating the WBS

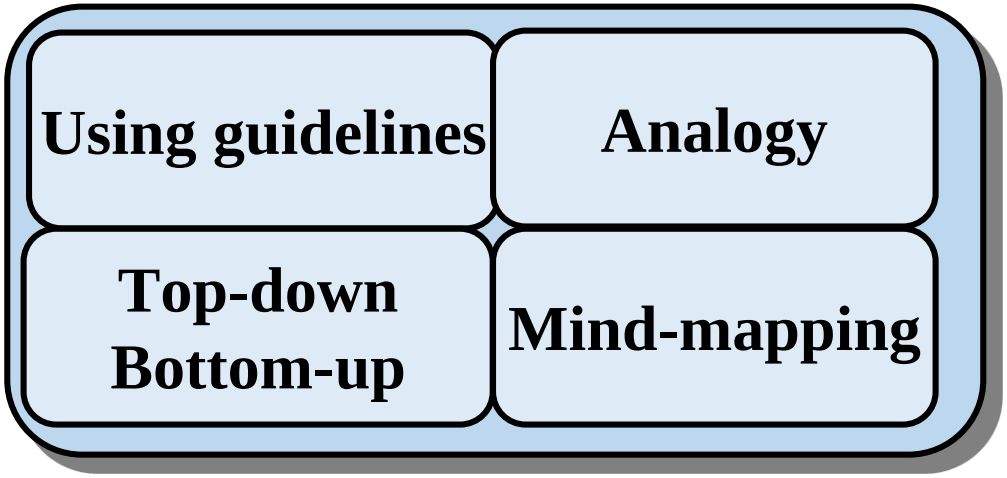
- It is very difficult to create a good WBS.
- To create a good WBS, you must understand the project and its scope and ***incorporate the needs and knowledge*** of the stakeholders.
- The project manager and the project team must decide as a group ***how to organize the work and how many levels*** to include in the WBS.
- ***People who will do the work should help to plan the work by creating the WBS.***

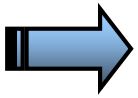
# 5. Creating the WBS

- When creating WBS, it should be noted that the decomposed activities should meet at least four requirements:
  - (1) The work decomposed **is necessary and sufficient** to complete the corresponding deliverables of the upper layer.
  - (2) **Work independence.** That is, once the work starts, it can be completed without interruption.
  - (3) **Judgment of work completion**. That is, you can clearly judge whether the work has started, how much work has been completed, and whether the work has been completed.
  - (4) **Work deliverables**. That is to clarify what results will be obtained after the work is completed.

# 5. Creating the WBS

## Approaches to developing WBS

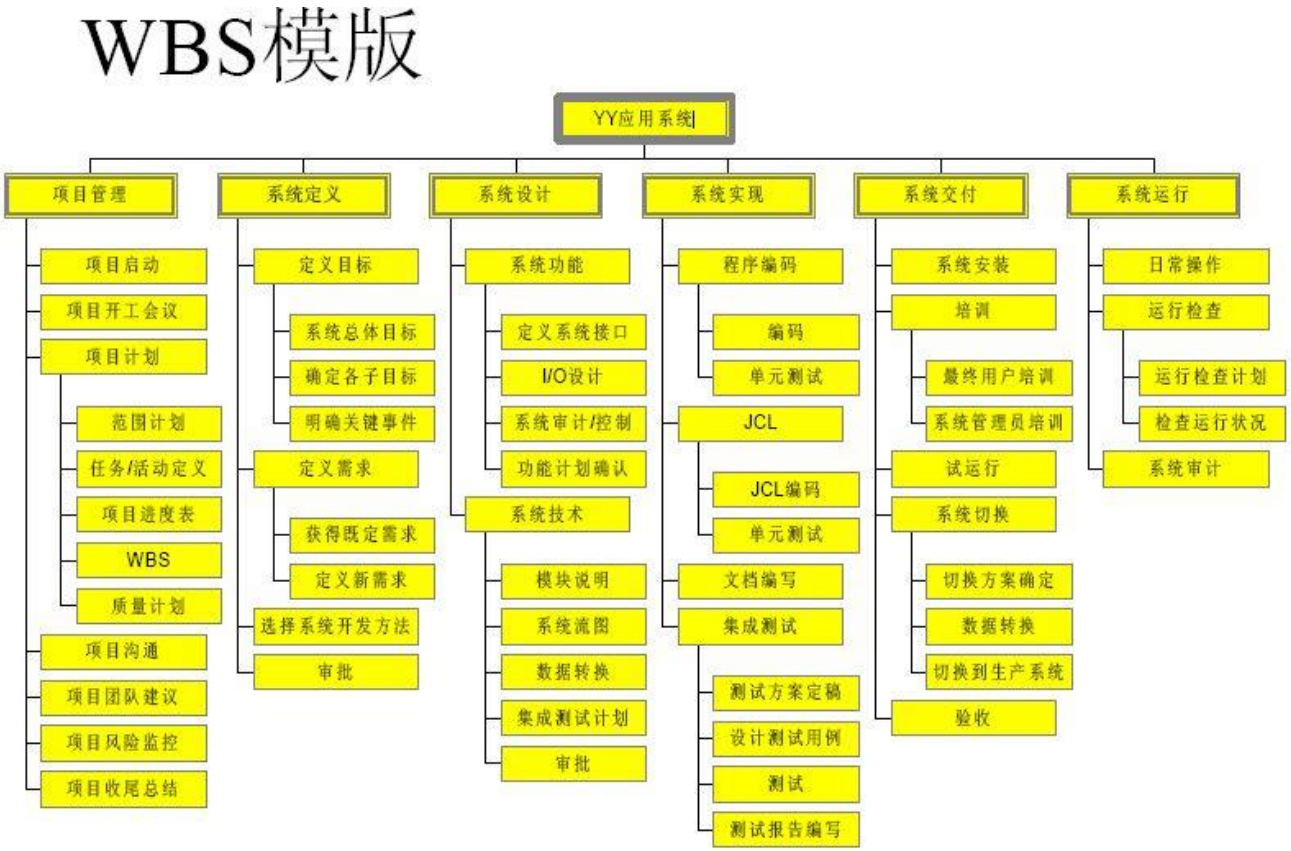


**Combining multiple methods is the best way.**

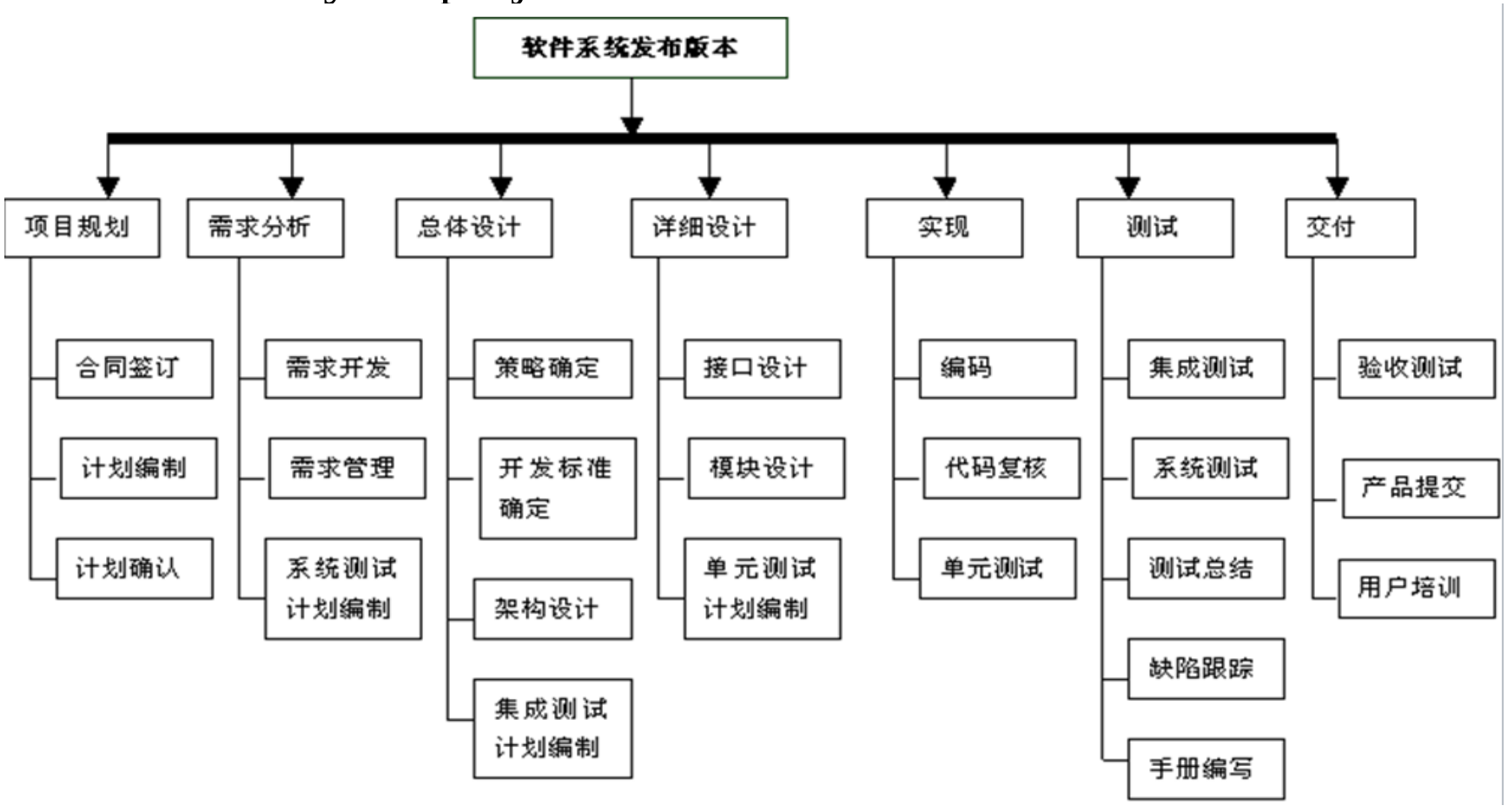
# 5. Creating the WBS

- **Using guidelines:** Some organizations, like the DOD, provide guidelines for preparing WBSs



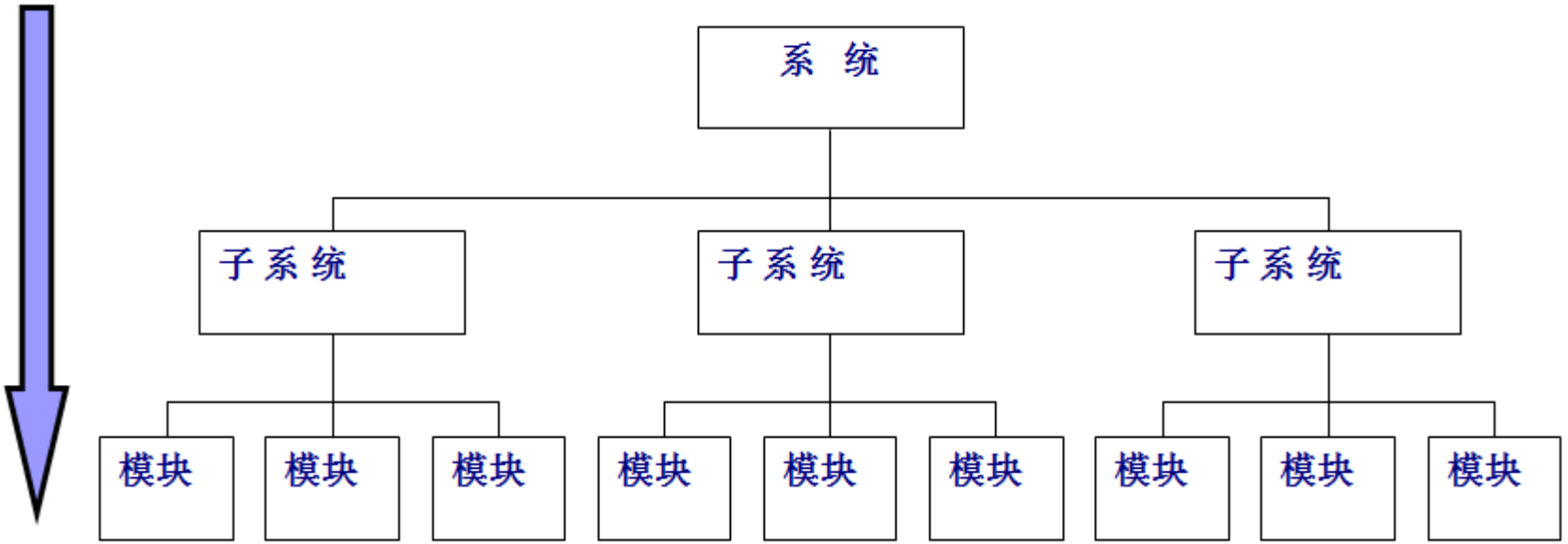
# 5. Creating the WBS

- The **Analogy approach**: Review WBSs of similar projects and tailor to your project



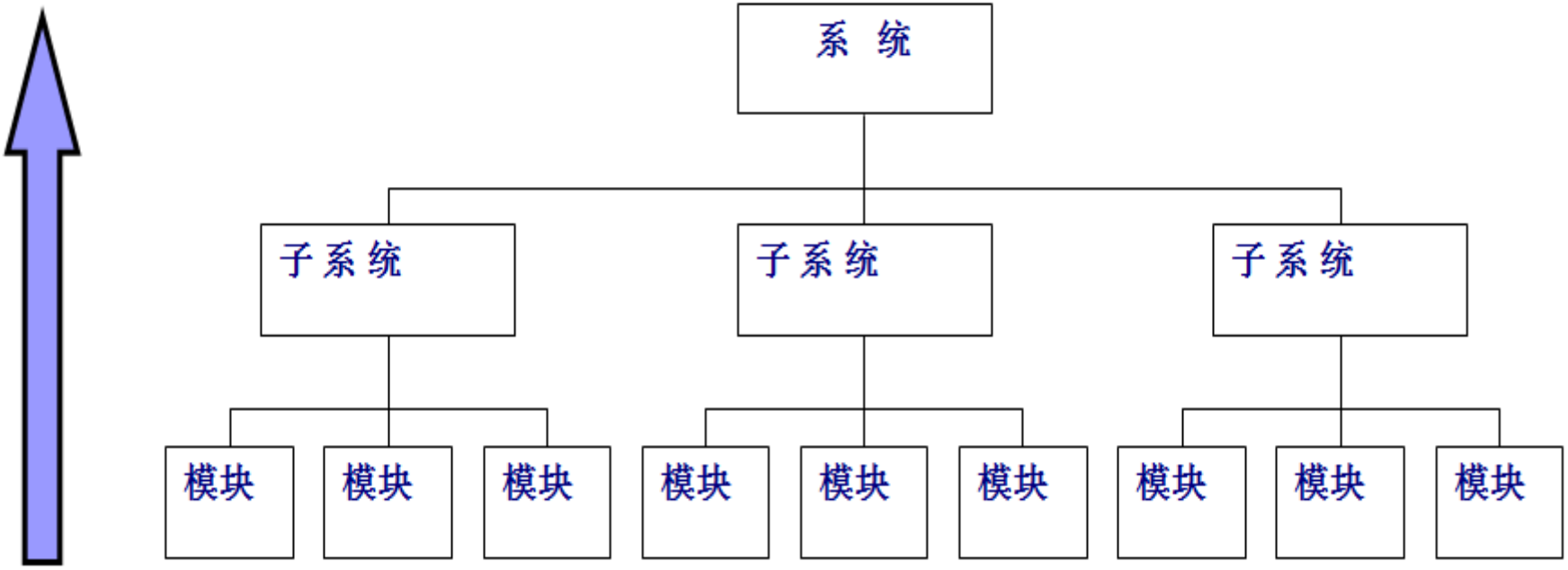
# 5. Creating the WBS

- The **Top-down approach**: Start with the largest items of the project and break them down



# 5. Creating the WBS

- The **Bottom-up approach**: Start with the specific tasks and roll them up

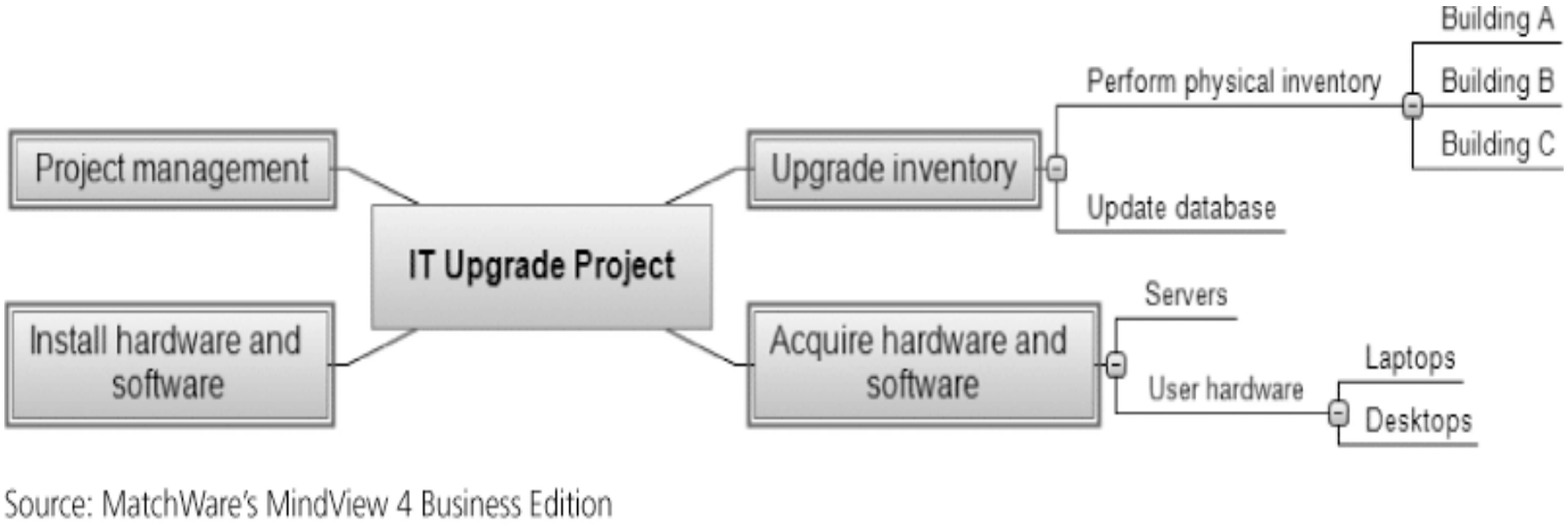


# 5. Creating the WBS

- Mind-mapping approach: a technique that uses branches radiating out from a core idea to structure thoughts and ideas

# 5. Creating the WBS

## Approaches to developing WBS

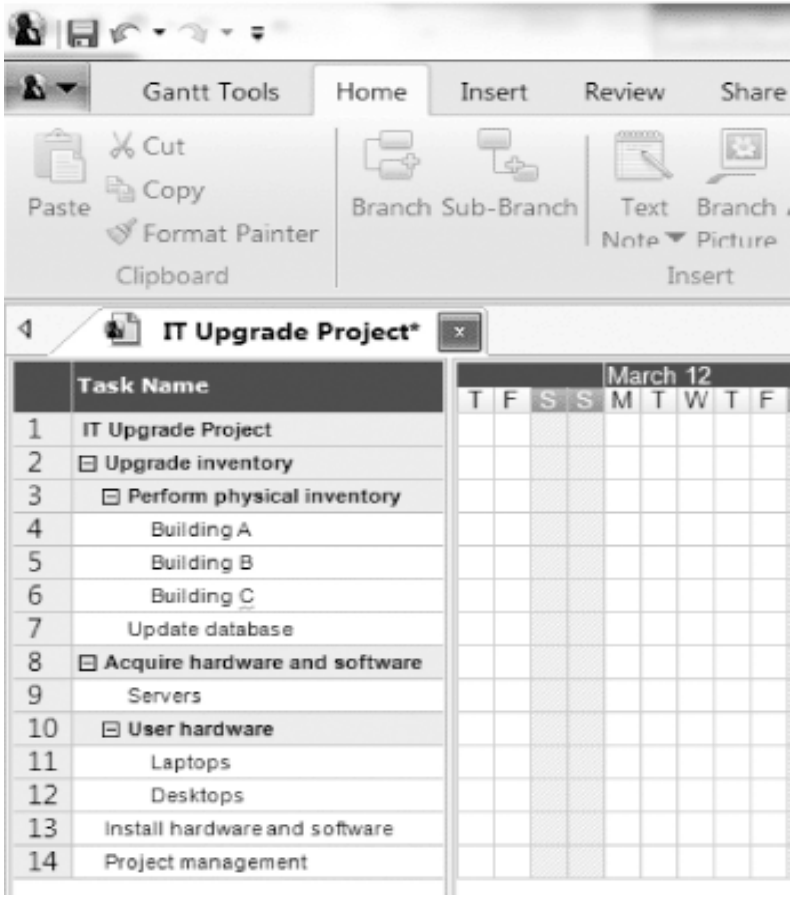



Source: MatchWare's MindView 4 Business Edition

Figure 5-7. Sample Mind-Mapping Approach for Creating a WBS

# 5. Creating the WBS

MindView 4.0 Gantt Chart




Project 2010 Gantt Chart

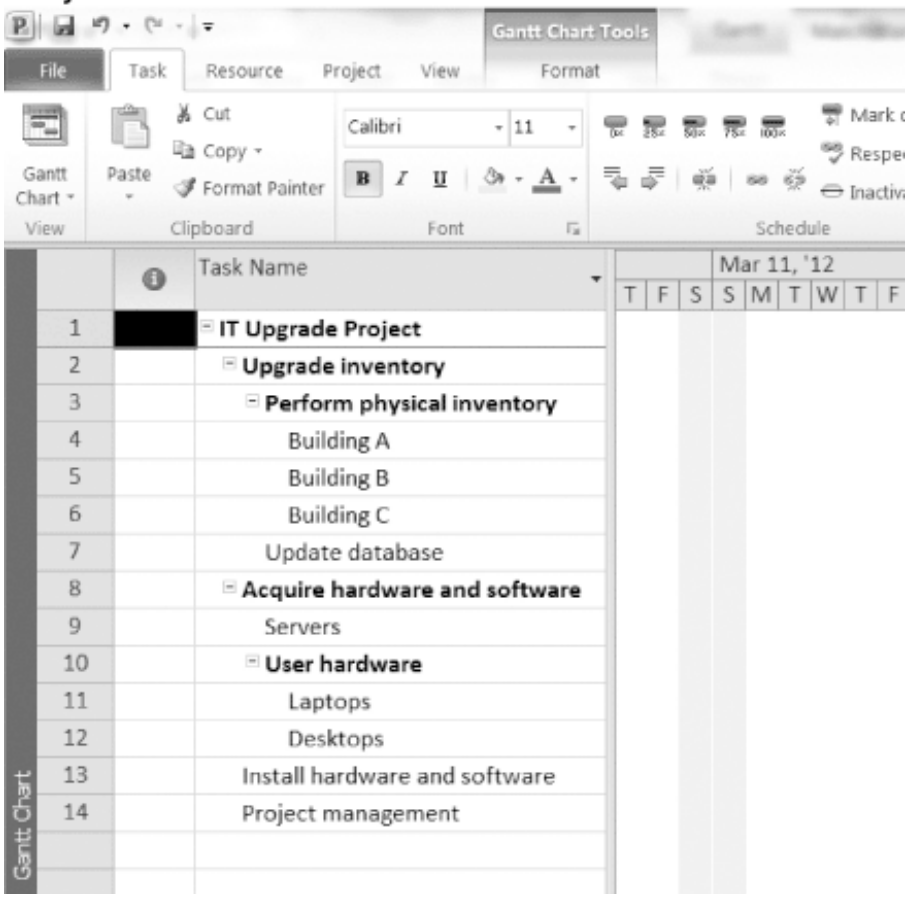



Figure 5-8. Gantt Charts With WBS Generated From a Mind Map

# 5. Creating the WBS

## The WBS Dictionary and Scope Baseline

- Many WBS tasks are vague and must be explained more so people know what to do and can estimate how long it will take and what it will cost to do the work

- A **WBS dictionary** is a document that describes detailed information about each WBS item

# 5. Creating the WBS

## WBS dictionary

| WBS dictionary entry March 20 |
|---|
| **Project Title:** Information Technology (IT) Upgrade Project |
| **WBS Item Number**: 2.2 |
| **WBS Item Name:** Update Database |
| **Description**: The IT department maintains an *online database of hardware and software* on the corporate intranet. However, we need to make sure that we know exactly what hardware and software employees are currently using and if they have any unique needs before we decide what to order for the upgrade. *The task will involve* reviewing information from the current database, producing reports that list each department's employees and location, and updating the data after performing the physical inventory and receiving inputs from department managers. *Our project sponsor will send a notice* to all department managers to communicate the importance of this project and this particular task. In addition to general hardware and software upgrades, the project sponsors will ask the department managers to provide information for any unique requirements they might have that could affect the upgrades. *This task also includes* updating the inventory data for network hardware and software. After updating the inventory database, we will send an e-mail to each department manager to verify the information and make changes online as needed. Department managers will be responsible for ensuring that their people are available and cooperative during the physical inventory. *Completing this task is dependent on WBS Item Number 2.1*, Perform Physical Inventory, and must precede WBS Item Number 3.0, Acquire Hardware and Software. |

# 5. Creating the WBS

## WBS dictionary

| WBS 词典 | | | |
|---|---|---|---|
| 控制包编号# | 工作包编号# | 更新日期 | 负责人/单位 |
| 工作包说明 | | | |
| 验收标准 | | | |
| 交付成果 | | | |
| 假设因素 | | | |
| 分配资源 | | | |
| 工作历时 | | | |
| 里程碑 | | | |
| 成本 | | | |
| 到期日期 | | | |
| 依赖关系： 紧前： | | 紧后： | |
| 批准人： | | 项目经理： | 日期： |

# 5. Creating the WBS

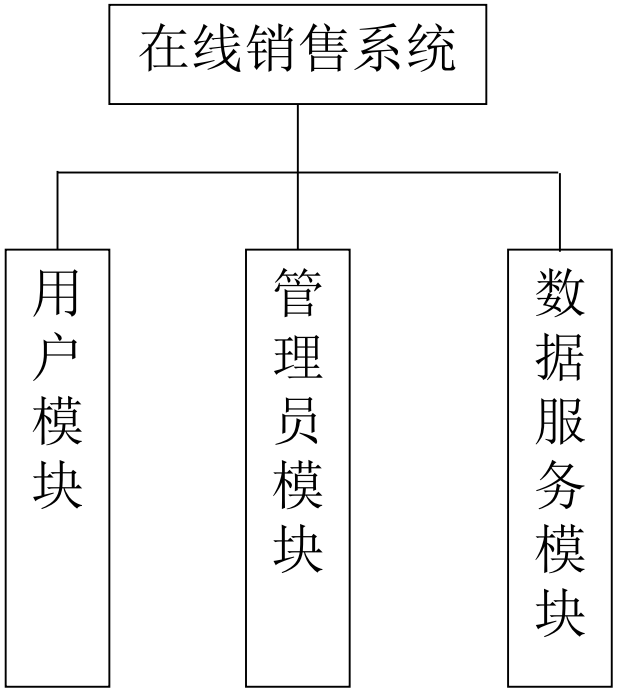
## Advice for creating a WBS and WBS dictionary

- A unit of work should appear *at only one place* in the WBS.
- *The work content of a WBS item is the sum of the WBS items below it.*
- A WBS item is the responsibility of *only one person*, even though many people might be working on it .
- The WBS must be *consistent with the way work actually will be performed*; it should serve the project team first, and serve other purposes only if practical.
- Project *team members* should be involved in developing the WBS to ensure consistency and buy-in.
- Each WBS item must be documented in a WBS dictionary to ensure *accurate understanding* of the scope of work included and not included in that item.
- The WBS must be a *flexible* tool to accommodate inevitable changes while properly maintaining control of the work content in the project according to the scope statement.

# 5. Creating the WBS

## Homework

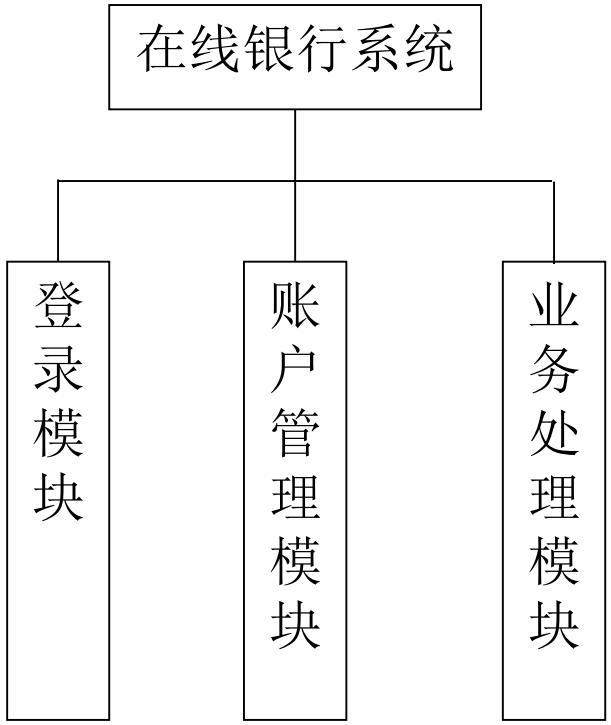
| 模块名称 | 子功能 |
| --- | --- |
| 用户模块 | 用户信息维护 |
| | 商品查询 |
| | 订购商品 |
| | 订单维护 |
| 管理员模块 | 商品信息维护 |
| | 内部员工信息维护 |
| | 订单处理 |
| | 销售情况查询 |
| 数据服务模块 | 客户信息 |
| | 订单信息 |
| | 销售情况 |



# 5. Creating the WBS

## Homework

| 模块名称 | 子功能 |
| --- | --- |
| 登录模块 | 登录 |
| 账户管理模块 | 账户查询 |
| | 修改账户信息 |
| | 紧急挂失 |
| 业务处理模块 | 历史业务记录查询 |
| | 转账 |



# Scope management — 6 main processes

**Planning**
**Process: Plan scope management**
**Outputs:** Scope management plan, requirements management plan
**Process: Collecting requirements**
**Outputs:** Requirements documentation, requirements traceability matrix (RTM)
**Process: Define scope**
**Outputs:** Project scope statement, project documents updates
**Process: Define WBS**
**Outputs:** Scope baseline, project documents updates

**Monitoring and controlling**
**Process: Validate scope**
**Outputs:** Accepted deliverables, change requests, work performance information, project documents updates
**Process: Control scope**
**Outputs:** Work performance information, change requests, project management plan updates, project documents updates organizational process assets updates

**Project start** → **Project finish**

# 6. Validating scope

It is very difficult to create a good scope statement and WBS for a project， It is even more difficult to verify project scope and minimize scope changes

**Scope creep** — the tendency for project scope to keep getting bigger and bigger. **A bad thing or a good thing?**

**Scope validation** involves formal *acceptance* of the completed project deliverables.

This acceptance is often achieved by a customer inspection and then sigh-off on key deliverables.

# 6. Validating scope

**Cause of  Scope creep**

-Fuzzy or non refined scope definition

-Lack of any formal scope or requirements management

-The process of collecting product requirements is inconsistent

-Lack of stakeholder involvement

-Project running time is too long

**Control Scope creep measures**

-Track project schedule, resources and performance in real time

-Provide multiple views to visualize the project

-The team can share all project related information

-Create a change control process to review and approve changes

-Powerful reports can be accessed to make data-driven decisions

# 6. Validating scope

**Inputs:**

- Scope management plan
- Scope baseline
- Requirements documentation
- RTM
- Validated deliverables
- Work performance data

**Tools and techniques:**

- Inspection
- Group decision-making techniques

**Outputs:**

- Accepted deliverables
- Change requests
- Work performance information
- Project documents updates

# 7. Controlling scope

***Scope control*** involves controlling changes to the project scope.

Goals of scope control are to：

- influence the factors that cause scope changes
- assure changes are processed according to procedures developed as part of integrated change control, and
- manage changes when they occur

**Variance** is the difference between planned and actual performance.

# 7. Controlling scope

**Inputs:** project management plan, work performance data,

requirements documentation, RTM,

organizational process assets

**Tools and techniques:** variance analysis、trend analysis

**Outputs:** work performance information

change requests

project management plan updates

project documents updates

organizational process assets updates

# 7. Controlling scope

## Best Practices for Avoiding Scope Problems

- Keep the scope realistic. Don't make projects so large that they can't be completed. Break large projects down into a series of smaller ones
- Involve users in project scope management. Assign key users to the project team and give them ownership of requirements definition and scope verification
- Use off-the-shelf hardware and software whenever possible. Many IT people enjoy using the latest and greatest technology, but business needs, not technology trends, must take priority
- Follow good project management processes. As described in this chapter and others, there are well-defined processes for managing project scope and others aspects of projects

# 7. Controlling scope

**Suggestions for improving user input:**

- Develop a good project selection process for IT projects.
- Have users on the project team.
- Have regular meetings with defined agendas.
- Deliver something to project users and sponsors on a regular basis.
- Do not promise to deliver what the team cannot deliver in a particular time frame
- Locate users with the developers.

# 7. Controlling scope

## Suggestions for reducing incomplete and changing requirements:

- Develop and follow a requirements management process that includes procedures for determining initial requirements.
- Employ techniques such as prototyping, use case modeling, and JAD.
- Put all requirements in writing and keep them current and readily available.
- Create a requirements management database for documenting and controlling requirements.
- Provide adequate testing to verify the products perform as expected.
- Use a process for reviewing requested requirements changes from a systems perspective.
- Emphasize completion data.
- Allocate resources specifically for handling change requests.

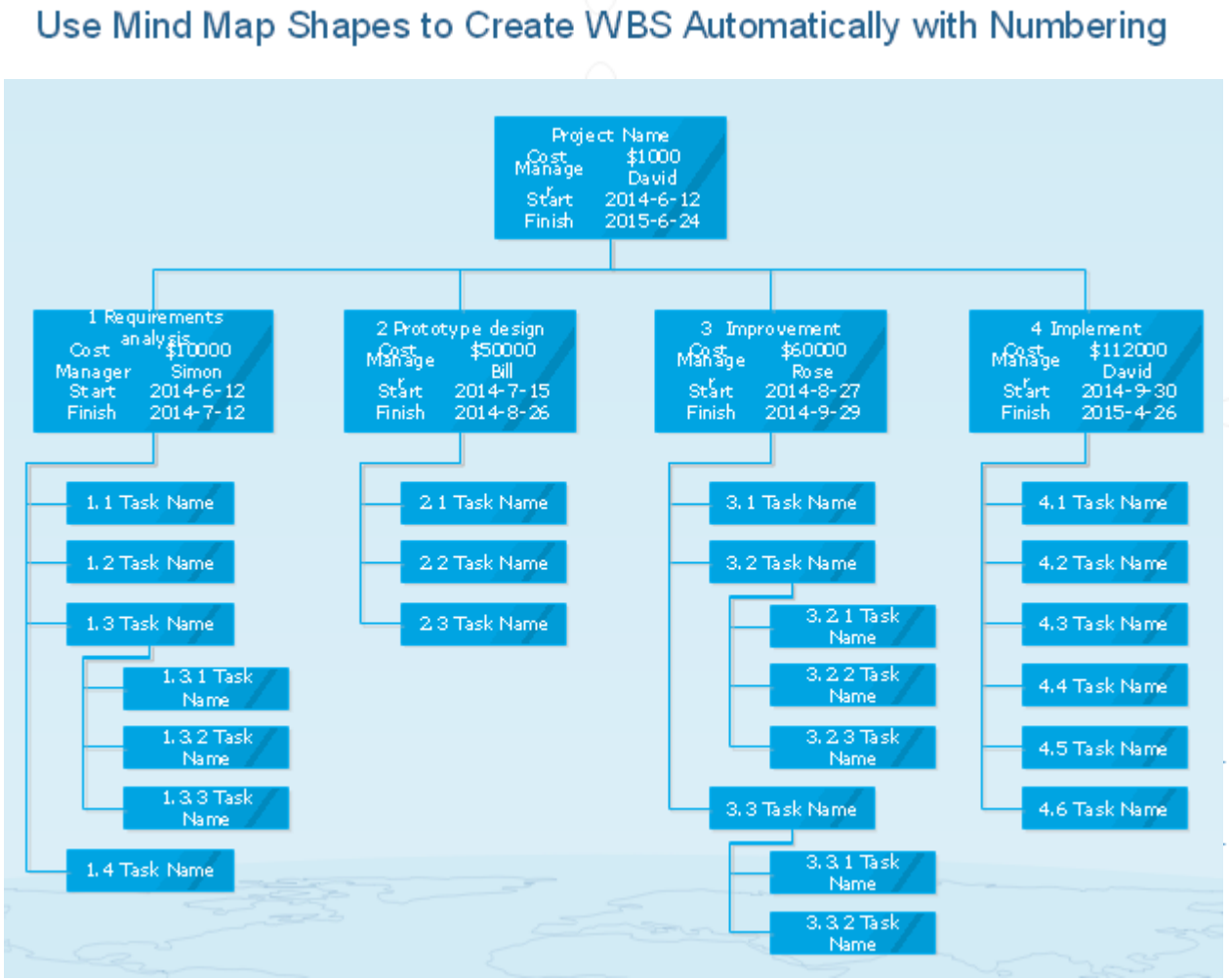
# 8. Using Software to Assist in Project Scope Management

- *Word-processing software* helps create several scope-related documents
- *Spreadsheets* help to perform financial calculations, weighed scoring models, and develop charts and graphs
- Communication software like *e-mail and the Web* help clarify and communicate scope information
- Project management software helps in creating a WBS, the basis for tasks on a Gantt chart
- Specialized software is available to assist in project scope management

# 8. Using Software to Assist in Project Scope Management

**Some useful tools for graphs and figures:**

- 亿图图示
- Visio
- WBS Chart Pro
- Mind Master
- Free Mind
- Mind Mapper
- Mind Manager
- Processon.com



# Chapter Summary

- Project scope management includes the processes required to ensure that the project addresses all the work required, and only the work required, to complete the project successfully。
- Main processes include
  - Planning  scope management
  - Collect requirements
  - Define scope
  - Create WBS
  - Validate scope
  - Control scope