

Chapter 5

**Project Planning.
Project Scope.
Work Breakdown Structure.**

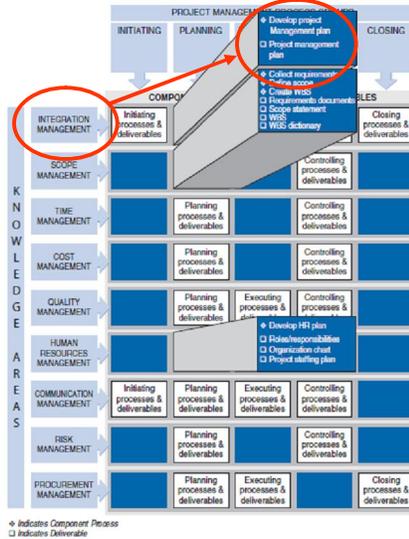
1

Objectives

- Acquire a general understanding of the parts of the project management plan
- Understand the importance of discovering and documenting stakeholder **requirements**
- Understand how to create a detailed **scope statement** and **work breakdown structure (WBS)**
- Learn how to match the right person, with the needed skill set, to the appropriate activity

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Project Planning. Integration Management KA.



Project Planning starts with the **Project Plan Development process**, which is a part of the Integration Management knowledge area.

The single deliverable from this process is the **Project Management Plan** – a consistent coherent document; it consists of deliverables for each of the other 8 Knowledge Areas (KAs).

Project Plan = Telling the team “WHAT TO DO”

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Project Management Plan: Main Components

- Scope management plan (Chapter 5) Lab 1
- Work breakdown structure (WBS) (Chapter 5) Lab 1
- Human Resource management plan (Chapter 5) Lab 1
- Time (schedule) management plan (Chapter 6) Lab 2
- Cost management plan (Chapter 6) Lab 2
- Quality management plan (Chapter 7) Lab 3
- Process improvement plan (Chapter 7) Lab 3
- Communication management plan (Chapter 7) Lab 3
- Risk management plan (Chapter 8) Lab 4
- Procurement management plan (Chapter 9) Lab 4

Many organizations not only have documented business templates for each part of the plan to speed up development of the plan and to maintain consistency across projects but also may have slightly different standard formats, based on different project characteristics, such as size, complexity, length, and risk level.

For example, a small, low-risk project would have a shorter and less formal project planning document than a large, complex project with members of the project team spread out all over the world.

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Attributes of Good Project Plans

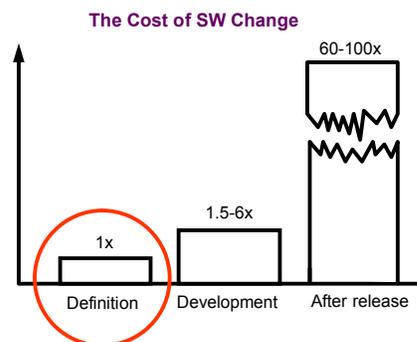
- Plans should be **dynamic**
- Plans should be **flexible**
Things always happen during the project to change each of these four constraints so plans should be built to accommodate room for issues/problems/delays.
- Plans should be **updated as changes occur** (Integrated Change Control)
- Plans should first and foremost **guide project execution**
- Plans should **never** assume the team will **work overtime**, at least not at the start

Assuming that the only way to hit the project plan objectives for 1) scope, 2) time, 3) cost, and 4) quality is to schedule over time at the very beginning is a sure recipe for disaster.

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What the main reason to create Project Plan? The answer: Project Cost and Project Time

- The **Cost of Software Change Law** is a very well-known law (see on the right).
- Errors found "upstream" during the **planning phase cost on the order of 200 times less to fix than errors found "downstream"** during the building of the product.
- Planning "forecasting", "seeing into the future" is not an easy task
- T. Capers Jones (1998) summed it up this way: "The seeds of major software disasters are usually shown in the first three months of commencing the software project. Hasty scheduling, irrational commitments, unprofessional estimating techniques, carelessness of the project management function are the factors that tend to introduce terminal problems."



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Project Plan Creation and *Analysis Paralysis*

- Although planning is crucial, project teams must be careful to **avoid over-planning**
- The project planning must be appropriate to the size, complexity, and risk of the project (small and easy projects -> small planning; large and complex projects -> significant planning efforts.
- Project managers must be careful to avoid what is known as "**analysis paralysis**" -- getting stuck in the analysis phase, trying to get everything defined perfectly

In software development, analysis paralysis typically manifests itself through exceedingly long phases of project planning, requirements gathering, program design and data modeling, with little or no extra value created by those steps. When extended over too long a timeframe, such processes tend to emphasize the organizational (i.e., bureaucratic) aspect of the software project, while detracting from its functional (value-creating) portion.

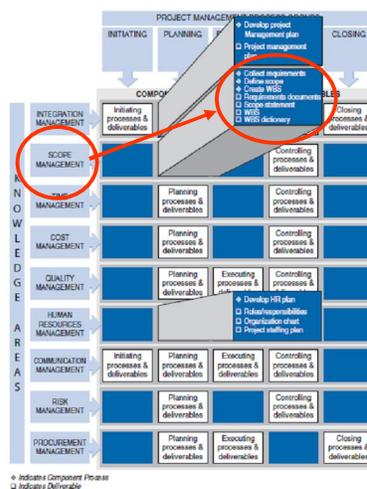
Analysis paralysis often occurs due to the lack of experience on the part of business systems analysts, project managers or software developers, as well as a rigid and formal organizational culture.

Analysis paralysis is an example of an anti-pattern. Agile software development methodologies explicitly seek to prevent analysis paralysis by promoting an iterative work cycle that emphasizes working products over product specifications.

CS590 "SE" vs. CS593 "SE of WebApp" courses

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From Integration Management KA to Scope Management KA



Scope Management consists of 3 processes:

1. Collect **Requirements**
2. Define **Scope**
3. Create **WBS (Work Breakdown Structure)**

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SW Requirements Engineering

A **requirement** is a singular documented need of what a particular product or service should be or perform. It is a statement that identifies a necessary **attribute, capability, function, characteristic, or quality of a system** in order for it to have value and utility to a user.

- 1) **Business requirements** describe in business terms **WHAT** must be delivered or accomplished to provide value.
- 2) **Product requirements** describe **properties, functions and attributes** of a system or product (which could be one of several ways to accomplish a set business requirements.)
- 3) **Process requirements** describe **HOW activities performed by the developing organization** (methodologies to be followed, and constraints that the organization must obey.

Main topics (or, components)*):

- Functional and nonfunctional system requirements
- Business rules
- Impacts on any other systems and/or departments
- Support and training requirements
- Acceptance criteria for each requirement or set of requirements
- Quality requirements

**) Multiple details are available in CS 592 course*

SW Requirements: An Example



Microsoft Office 2010 system requirements

- Features and benefits
- Top 10 reasons to try
- Compare suites
- Buy Office
- Pricing information
- Volume licensing
- Frequently asked questions
- System requirements**

2010 Office suites and 2010 Office programs

- ↳ Office Home and Student 2010
- ↳ Office Home and Business 2010
- ↳ Office Standard 2010
- ↳ Office Professional 2010
- ↳ Office Professional Plus 2010
- ↳ Office University 2010
- ↳ Access 2010
- ↳ Excel 2010
- ↳ InfoPath 2010
- ↳ OneNote 2010
- ↳ Outlook 2010
- ↳ Microsoft Outlook 2010 with Business Contact Manager
- ↳ PowerPoint 2010
- ↳ Publisher 2010
- ↳ SharePoint Workspace 2010
- ↳ Visio 2010 (Standard, Professional, Premium)
- ↳ Word 2010

Source: <http://office.microsoft.com/en-us/products/microsoft-office-2010-system-requirements-HA101810407.aspx>

Office Professional 2010

COMPONENT	REQUIREMENT
Computer and processor	500 MHz or faster processor
Memory	256 MB RAM; 512 MB recommended for graphics features, Outlook Instant Search, and certain advanced functionality. ¹
Hard disk	3.0 GB available disk space
Display	1024x576 or higher resolution monitor
Operating system	Windows XP (must have SP3) (32-bit), Windows 7, Windows Vista with Service Pack (SP) 1, Windows Server 2003 with SP2 and MSXML 6.0 (32-bit Office only), Windows Server 2008, or later 32- or 64-bit OS.
Graphics	Graphics hardware acceleration requires a DirectX 9.0c graphics card with 64 MB or more video memory.
Additional Requirements	Certain Microsoft(R) OneNote(R) features require Windows(R) Desktop Search 3.0, Windows Media(R) Player 9.0, Microsoft(R) ActiveSync(R) 4.1, microphone, audio output device, video recording device, TV/AVI-compatible digital camera, or scanner; sharing notebooks requires users to be on the same network.
	Certain advanced functionality requires connectivity to Microsoft Exchange Server 2003, Microsoft SharePoint Server 2010, and/or Microsoft SharePoint Foundation 2010.
	Certain features require Windows Search 4.0.
	Send to OneNote Print Driver and Integration with Business Connectivity Services require Microsoft .NET Framework 3.5 and/or Windows XPS features.
	Internet Explorer (IE) 8 or later, 32 bit browser only; IE7 or later required to receive broadcast presentations. Internet functionality requires an Internet connection.
	Multi-Touch features require Windows 7 and a touch enabled device.
	Certain inking features require Windows XP Tablet PC Edition or later.
	Speech recognition functionality requires a close-talk microphone and audio output device.
	Internet Fax not available on Windows Vista Starter, Windows Vista Home Basic, or Windows Vista Home Premium.
	Information Rights Management features require access to a Windows 2003 Server with SPI or later running Windows Rights Management Services.
	Certain online functionality requires a Windows Live™ ID.
Other	Product functionality and graphics may vary based on your system configuration. Some features may require additional or advanced hardware or server connectivity. www.office.com/products .

¹ 512 MB RAM recommended for accessing Outlook data files larger than 1GB.

² GHz processor or faster and 1 GB RAM or more recommended for OneNote Audio Search. Close-talking microphone required. Audio Search not available in all languages.

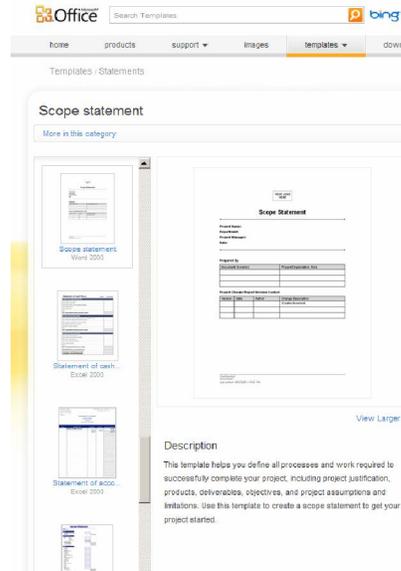
Scope Statement

Scope refers to *all (100%)* of the work involved in creating the products of the project and the processes used to create them

Scope statement describes the characteristics of the product that the project was created to deliver.

Scope statements may take many forms depending on the type of project being implemented and the nature of the organization. However, a baseline scope statement should contain:

- The project name
- The project owner, sponsors, and stakeholders
- The project charter (roles and responsibilities, identities of stakeholders, etc.)
- The problem statement
- The project goals and objectives
- The project requirements
- The project deliverables
- The project non-goals (what is out of scope)
- Milestones (timetable, schedule)
- Cost estimates



Source: <http://office.microsoft.com/en-us/templates/scope-statement-TC001142564.aspx>

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Work Breakdown Structure (WBS)

- **Work breakdown structure (WBS)** is a method used to define group of project's discrete work elements in a way that helps organize and define the total work scope of the project.

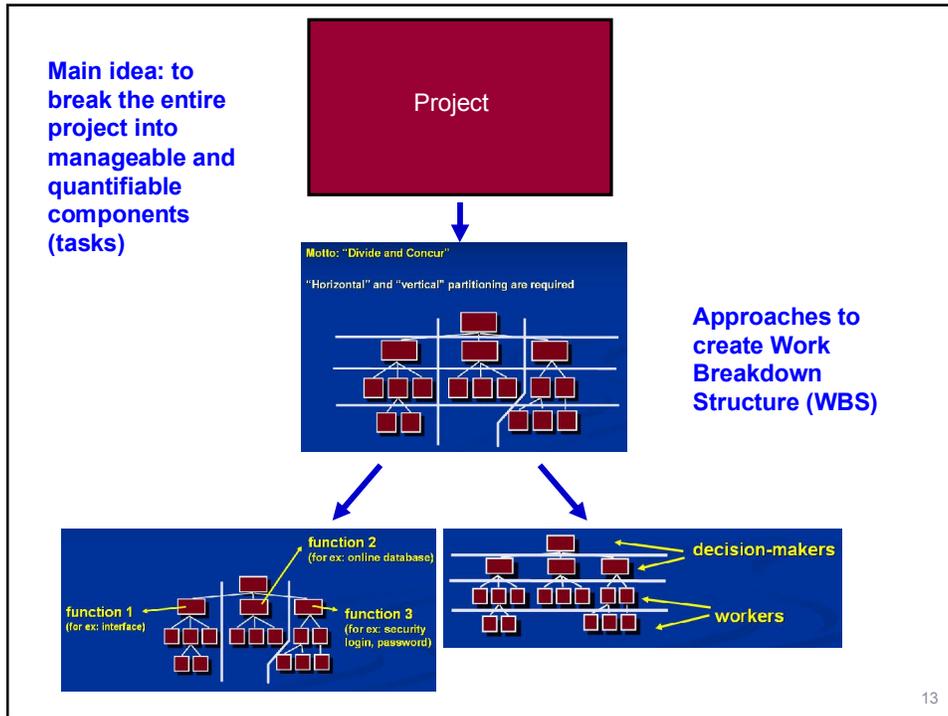
- **WBS element** may be a
 - a task,
 - a product,
 - data,
 - a component,
 - a service, or
 - any combination of these elements.

100% rule:

- The WBS represents 100 percent of the work required to produce the final products, and, therefore,
- All tasks must add up to 100% of the total scope and should not go over 100% (No "I forgot to add ..." statements at all after project WBS has been approved)

Column 0	Column 1	Column 2	Duration	Predecessors
1	1	SPM Project Team5		
2	1.1	Project Initiation		
3	1.1.1	Develop project charter	4 days	
4	1.1.2	Develop Statement Of Work	6 days	3
5	1.1.3	Develop preliminary scope development	2 days	3,4
6	1.1.4	Develop preliminary architectural model	3 days	3,4,5
7	1.1.5	Project initiation complete	0 days	3,4,5,6
8	1.2	Project plan		
9	1.2.1	Develop scope management plan	1 day	2
10	1.2.2	Develop change management plan	1 day	9
11	1.2.3	Develop initial descriptive budget	9 days	9,10
12	1.2.4	Develop schedule	1 days	10,11
13	1.2.5	Develop quality management plan	1 days	12
14	1.2.6	Develop human resource plan	2 days	10,13
15	1.2.7	Develop risk management plan	1 day	10,14
16	1.2.8	Project plan complete	0 days	9,10,11,12,13,14,15
17	1.3	Project Execution		
18	1.3.1	Release 1		
19	1.3.1.1	Analysis phase	17 days	8
20	1.3.1.2	Design phase	14 days	19
21	1.3.1.3	Construction phase	11 days	20
22	1.3.1.4	Validation phase	11 days	21
23	1.3.1.5	Deployment phase	2 days	22
24	1.3.1.6	Closeout	1 day	23
25	1.3.1.7	Release 1 Complete	0 days	24
26	1.3.2	Release 2		
27	1.3.2.1	Analysis phase	8 days	18
28	1.3.2.2	Design phase	7 days	27
29	1.3.2.3	Construction phase	8 days	28
30	1.3.2.4	Validation phase	5 days	29
31	1.3.2.5	Deployment phase	1 day	30
32	1.3.2.6	Closeout	1 day	31
33	1.3.2.7	Release 2 Complete	0 days	32
34	1.3.3	Execution complete	0 days	
35	1.4	Project Closeout	1 day	17
36	1.5	Project Complete	0 days	35

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Building the WBS

Various approaches can be used to build the WBS:

1. **Analogy approach:** A WBS is first created by looking for a similar projects done in the past and using its WBS as a starting point. SE Design Concept: "Do NOT reinvent the wheel" (check web sites of similar projects)
2. **Top-down approach:** Start with the largest items of the project and keep breaking them down into smaller and smaller parts
3. **Bottom-up approach:** Start with the detailed tasks and roll them up
4. **Thread-based approach:** Concentrate on most important items first

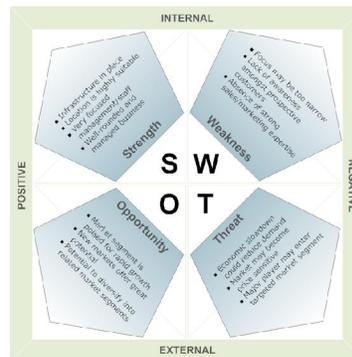
Using guidelines:
Some organizations, like the DoD, National Science Foundation (NSF) provide guidelines/requirements for preparing a WBS

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Be a professional: be able to generate a list of advantages and weaknesses (potential problems) of any idea, approach, method, technique, SW, etc.

SWOT analysis: Strengths – Weaknesses – Opportunities - Threats

Internal	Strengths <ul style="list-style-type: none"> ✓ Your specialist marketing expertise. ✓ A new, innovative product or service. ✓ Location of your business. ✓ Quality processes and procedures. ✓ Any other aspect of your business that adds value to your product or service. 	Weaknesses <ul style="list-style-type: none"> ✓ Lack of marketing expertise. ✓ Undifferentiated products or services (i.e. in relation to your competitors). ✓ Location of your business. ✓ Poor quality goods or services. ✓ Damaged reputation.
	Opportunities <ul style="list-style-type: none"> ✓ A developing market such as the Internet. ✓ Mergers, joint ventures or strategic alliances. ✓ Moving into new market segments that offer improved profits. ✓ A new international market. ✓ A market vacated by an ineffective competitor. 	Threats <ul style="list-style-type: none"> ✓ A new competitor in your home market. ✓ Price wars with competitors. ✓ A competitor has a new, innovative product or service. ✓ Competitors have superior access to channels of distribution. ✓ Taxation is introduced on your product or service.
External		



The analogy approach: a sample

Analyze Analogy Approach: Advantages and Issues

Advantages:

- Is the **fastest** path to a completed WBS
- Is a **valuable tool for brainstorming** a new project and looking for deliverables
- Enhances cross-project **consistency**
- **Improves budget** and time estimates
- **Improves resource allocations**

Issues:

- Ensure that the previous WBS is completely understood and similar
- Ensure the previous WBS is accurate and updated
- Critically review the previous WBS and its appropriateness for the new project

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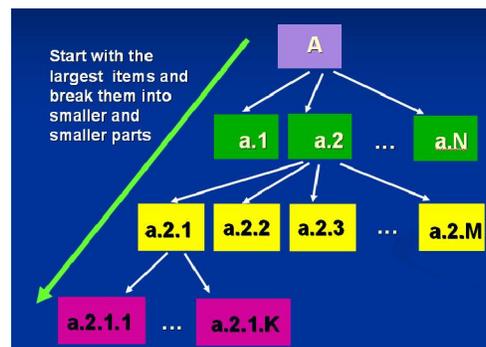
Top-Down Approach: Advantages and Issues

Advantages:

- Ensures projects are **organized logically** based on the nature of the project
- Promotes **stakeholder participation** in the planning phase of the project
- Can create a **greater understanding** of the entire project by all participants

Issues:

- Need to make sure major objectives are not forgotten
- Make sure to decompose the tasks to appropriate levels
- Can be time consuming, must guard against "analysis paralysis"
- Cost and time estimates are more difficult to create and generally less accurate than under the analogy approach



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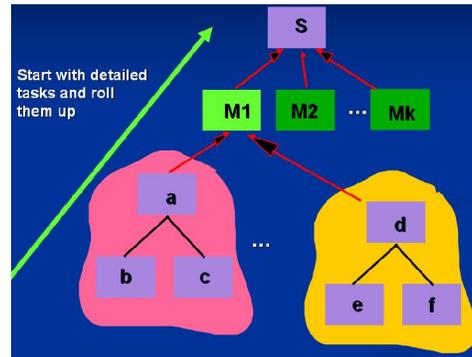
Bottom-Up Approach: Advantages and Issues

Advantages

- May lead to a more complete list of tasks and detailed description of tasks
- Promotes participation of various stakeholders in the planning phase of the project
- Can create a greater understanding of the entire project by all participants

Issues

- Difficult to retain focus on the "big picture"
- Need to make sure major objectives are not forgotten
- Harder to get organized into logical steps or phases



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Thread Approach: Advantages and Issues

Advantages

- Generally the most important stakeholder objectives done first
- Greater control and focus of the brainstorming sessions
- Promotes stakeholder participation in the planning phase of the project
- Can create a greater understanding of the entire project by all participants

Issues

- Make sure to not lose focus of the "big picture"
- May lose site of the effect one objective may have on another
- Increases the need for communication
- More successful when the project leader and team has a good understanding of the project's objectives



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Which Approach to Choose? Some recommendations ...

- **In case of the existence of a similar project:**
would lead you to the **analogy approach** which if done correctly is the fastest and most accurate method

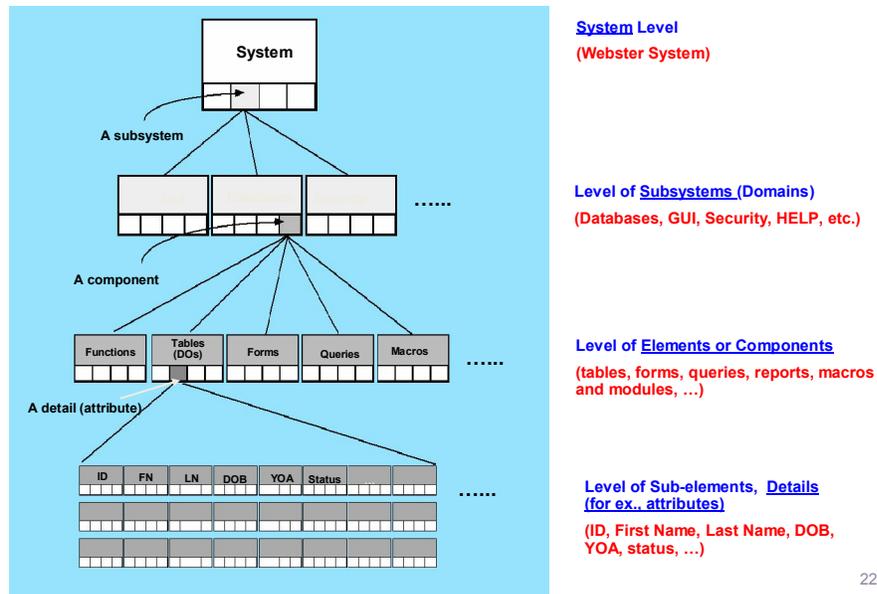
- **In case of an evolutionary type of project:**
depends on experience level of the project manager and team:
 - if **little experience**, choose the **top-down approach**;
 - if **many years of experience** then choose a **bottom-up approach**

- **In case of a revolutionary type of project:**
- if the product or process is very unique, never anything like it before in this company or by this team then choose **the top-down approach**

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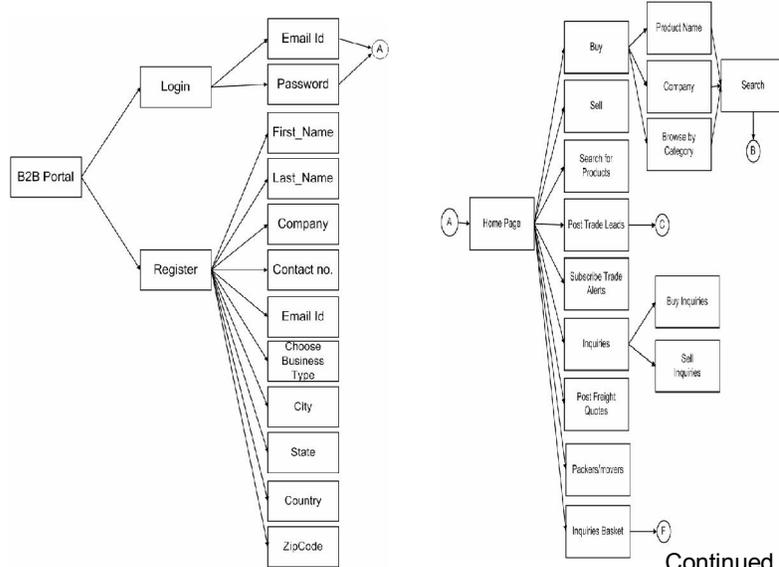
WBS Structure Example: Hierarchical Design-Based Form

Webster Software System -- A Hierarchical Design Model
(system, subsystems, and component design)



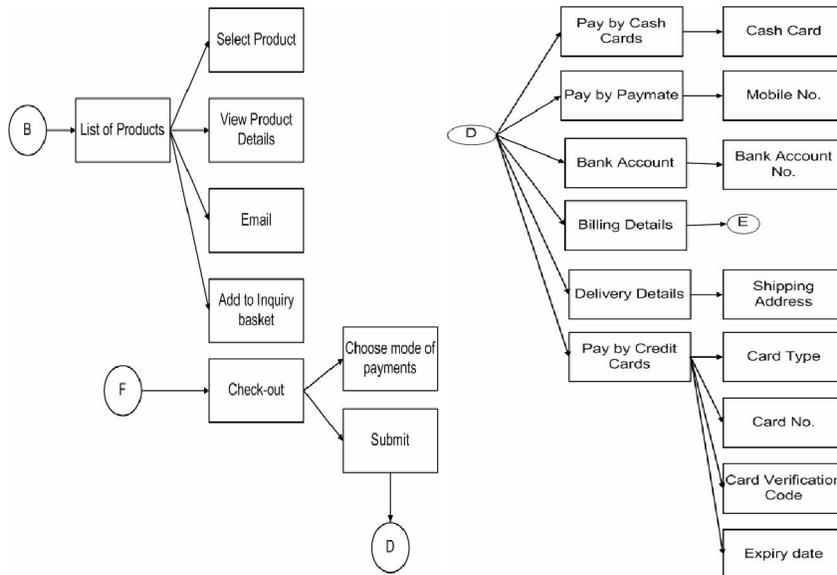
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WBS Example: Decision Tree-Based Form

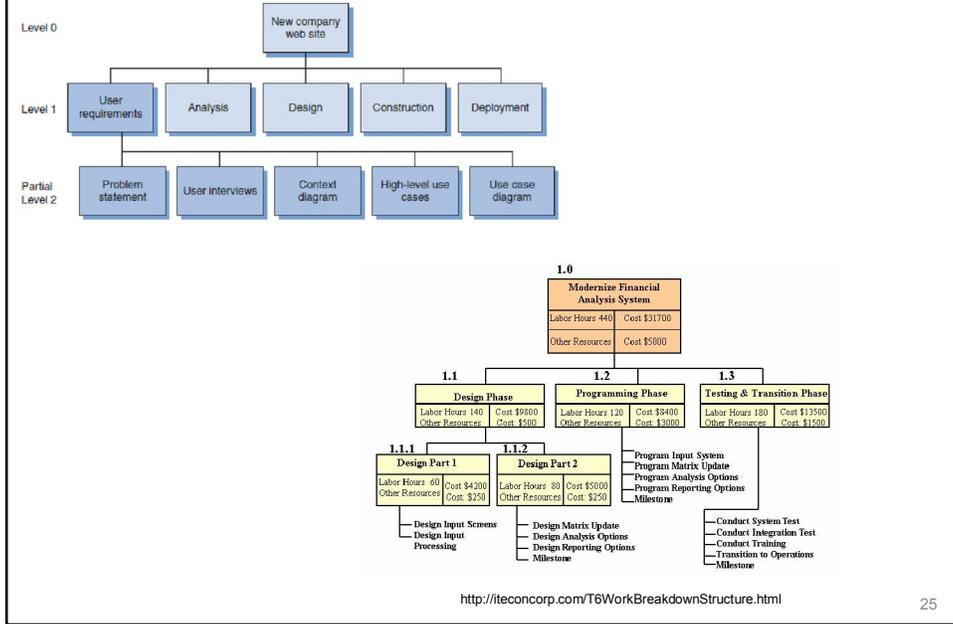


Continued... 23

WBS Example: GUI Hierarchical Design Model



WBS Examples: Process-Based Form



WBS Example: Tabular Form

(to be used in
CS591 Lab 1, and
CS591 Lab 2)

		Normal	Predecessors
1	Project Initiation		
1.1	Develop project charter	5 days	
1.2	Develop Statement Of Work	8days	1.1
1.3	Develop preliminary scope development	2days	1.2
1.4	Develop preliminary architectural modal	5days	1.3
1.5	Project initiation complete	2days	1.4
2	Project plan		
2.1	Develop scope management plan	2days	1
2.2	Develop change management plan	5days	2.1
2.3	Develop initial descriptive budget	10days	2.1, 2.2
2.4	Develop schedule	3days	2.2, 2.3
2.5	Develop quality management plan	4days	2.4
2.6	Develop human resource plan	3days	2.5
2.7	Develop risk management plan	1 day	1
2.8	Project pain complete	1 day	2.1 - 2.7
3	Project Execution		
3.1	Release 1		
3.1.1	Analysis phase	15days	2
3.1.2	Design phase	10days	3.1.1
3.1.3	Construction phase	8days	3.1.2
3.1.4	Validation phase	15days	3.1.3
3.1.5	Deployment phase	3days	3.1.4
3.1.6	Closeout	1day	3.1.5
3.1.7	Release 1 Complete	2days	3.1.6
3.2	Release 2		
3.2.1	Analysis phase	15days	3
3.2.2	Design phase	10days	3.2.1
3.2.3	Construction phase	8days	3.2.2
3.2.4	Validation phase	15days	3.2.3
3.2.5	Deployment phase	3days	3.2.4
3.2.6	Closeout	1day	3.2.5
3.2.7	Release 2 Complete	2days	3.2.6
3.3	execution complete		
4	project closeout	2days	3
5	project complete	1days	4

Basic Principles for Creating a WBS

- The WBS represents 100% of the work required to produce the product.
As soon as you define more than 100% of the scope, you have committed to doing more than you agreed to - scope creep has begun (100% Rule)
- Each WBS element represents a single deliverable
- Each deliverable is distinct
- Accountability for each task can be assigned to one team member
- Not all elements of the WBS need to be decomposed to the same depth
- Have all reporting and control mechanisms been included
- Be prepared for changes

Dictionary:

- Control accounts – accounting or finance department assigned account codes used in the accounting system to track costs
- Statement of work – describing the details of the work involved in creating each deliverable
- Responsible organization – who is responsible for each deliverable
- Schedule for major milestones
- Contract information if outside vendor involved
- Quality requirements
- Estimate of cost and resources required

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Chapter 5.

Project Planning.
Project Scope.
Additional (optional) information.

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Project Management Plan: A Development Process Guidelines

- A project plan is a document used to coordinate all project planning documents
- Its main purpose is to guide project execution
- Project plans assist the project manager in leading the project team and assessing project status
- Project performance should be measured against a baseline project plan
- Building the plan should not be done in secret or in isolation; the whole project team needs to participate

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SW Project Plan and SW Analysis Paralysis

<http://www.thoughtclusters.com/2009/09/software-analysis-paralysis/>

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About

By Krishna, June 16, 2009

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Software Analysis Paralysis

By Krishna, September 22, 2009

Programmers and managers are obsessed with finding the best way to solve a particular challenge. This is a good thing because that is what quality is all about. Sometimes, though, it can be taken to extremes and the project gets stuck in discussions of minutiae.

I was reminded about this when I read about the **Chandler project** in **Scott Rosenberg's "Dreaming in Code"**. Much of the book is about the innumerable discussions that the team members had about requirements and design which lead to the project being at standstill for significant periods of time. Also how they kept second-guessing themselves and changing decisions in mid-stream.

This is not unique to Project Chandler. Projects go through this phase where the programmers need to understand their end goals and how they plan to get there. The question is how much time do you plan to spend on it and how soon you can make decisions to get on with the construction phase? Where is the point at which you have diminishing returns from further analysis?

I wrote a post sometime back about the **pitfalls of soft coding**, which is writing an application in such a way that the user can configure its features ad infinitum. Soft coding exists, in part, because the team could not make a decision about what the user wants. Instead, the project team kicks the decision to the user's court.

You can also see this in design, where there is a lot of hand-writing about writing loosely coupled code. The idea is that you should be able to remove any class or library at any time, plug in a replacement and just have to change one line in a configuration file without compiling. So much engineering effort goes into writing such maintainable code, when in reality, most of the code will never be changed again in the lifetime of the product. And most of such decoupling is quite unnecessary because it could easily be substituted by someone taking two minutes to change the code.

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What Is Project Scope?

- **Scope** - refers to **all (100%)** of the work involved in creating the products of the project and the processes used to create them
- A **deliverable** - is a particular product produced as part of a project, such as hardware or software, planning documents, or meeting minutes
- **Scope management plan** describes how the project team will
 - define the scope,
 - develop the detailed scope statement,
 - define and develop the work breakdown structure (WBS),
 - verify the scope, and
 - control the scope
- A **scope statement** describes the characteristics of the product that the project was created to deliver.

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Scope Statement Depends on:

1. Project **size**, including the number of people, dollar value, duration, and geographic span
2. Degree of **risk** to the business
3. **Cash requirements**, such as length of time for return on investment and initial cash requirements
4. **Technology** utilized (for example, maturity, experience of current staff)
5. **Project team experience** with technology, business, and industry
6. **Nature of the deliverables**, such as whether this is a new product or service, an upgrade, or a repair
7. **Strategic importance** of the project to the organization
8. **Project definition** (for example, whether the requirements are undefined, partially defined, or poorly defined)

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