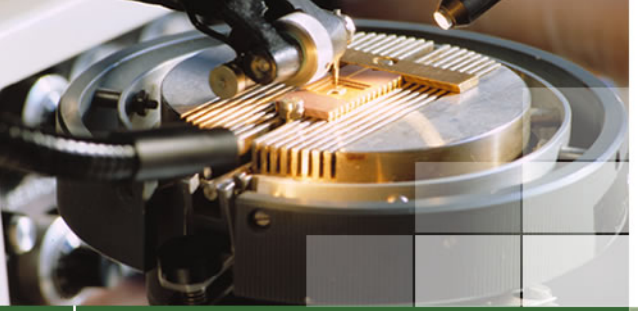

POLITECNICO DI MILANO

Dipartimento di
Elettronica e Informazione

Planning and Managing Software Projects 2012-13

Class 7

Work Breakdown Structure (WBS)

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Credits

- This slides are largely based on Prof. John Musser class notes on “Principles of Software Project Management”
- Original slides are available at http://www.projectreference.com/
- Reuse and republish permission was granted

Agenda

- Today
  - Review Classes 5 and 6
  - Work Breakdown Structures (WBS)
- Next Class
  - Estimation

Classes 5 and 6 Review

- Phases in details
  - Know the 7 phases
  - Understand the steps in each phase
  - Know the primary goals, characteristics and issues of each
- Lifecycles
  - Know a representative sample
  - Waterfall and variation, 1-2 iterative ones
  - Learn a bit about XP and other Agile methods
  - Matching Lifecycles to Project
- Planning (introduction)
  - Primary Planning Steps
  - Documents

Estimation

- "Predictions are hard, especially about the future"

  - Yogi Berra*

- 2 Types: Lucky or Lousy?

* http://en.wikipedia.org/wiki/Yogi_Berra

Planning, Estimating, Scheduling

- What's the difference?
- Plan: Identify activities. No specific start and end dates.
- Estimating: Determining the size & duration of activities.
- Schedule: Adds specific start and end dates, relationships, and resources.

Project Planning: A 12 Step Program

1. Set goal and scope
2. Select lifecycle
3. Set team form
4. Start team selection
5. Determine risks
6. Create WBS
7. Identify tasks
8. Estimate size
9. Estimate effort
10. Identify task dependencies
11. Assign resources
12. Schedule work

How To Schedule

1. Identify “what” needs to be done
   - Work Breakdown Structure (WBS)
2. Identify “how much” (the size)
   - Size estimation techniques
3. Identify the dependency between tasks
   - Dependency graph, network diagram
4. Estimate total duration of the work to be done
   - The actual schedule

WBS & Estimation

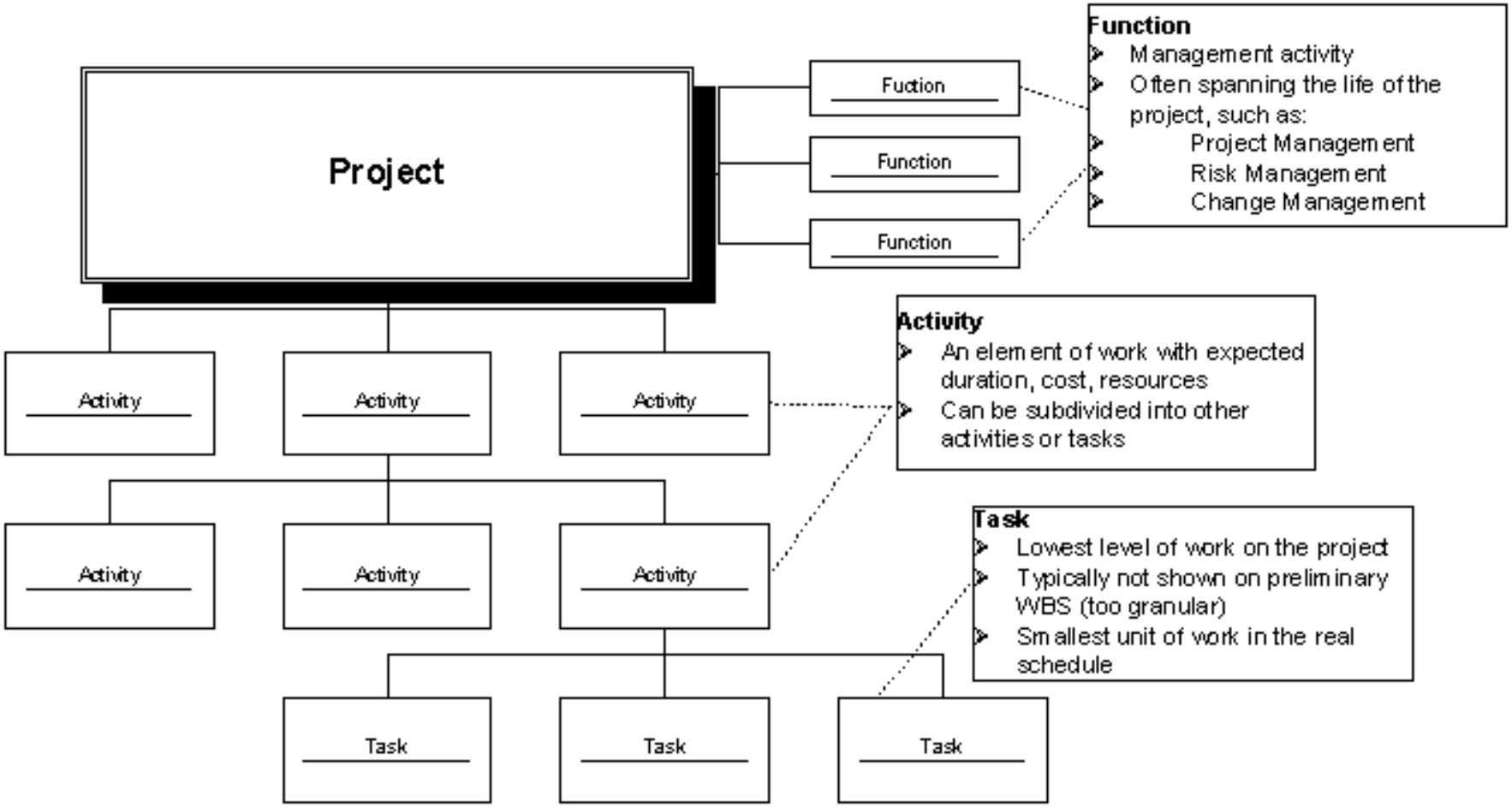
- How did you feel when I asked
  - "How long will your project take?"
- Not an easy answer to give right?
- At least not if I were are real customer on a real project
- How can you manage that issue?

Partitioning Your Project

- You need to decompose your project into manageable chunks
- ALL projects need this step
- Divide & Conquer
- Two main causes of project failure
  - Forgetting something critical
  - Ballpark estimates become targets
- How does partitioning help this?

Project Elements

- A Project: functions, activities, tasks



Work Breakdown Structure: WBS

- Hierarchical list of project's work activities
- 2 Formats
  - Outline (indented format)
  - Graphical Tree (Organizational Chart)
- Uses a decimal numbering system
  - Ex: 3.1.5
- Includes
  - Development, Mgmt., and project support tasks
- Shows "is contained in" relationships
- Does not show dependencies or durations

Contract vs. Project WBS

- Contract WBS (CWBS)
  - First 2 or 3 levels
  - High-level tracking
- Project WBS (PWBS)
  - Defined by PM and team members
  - Tasks tied to deliverables
  - Lowest level tracking

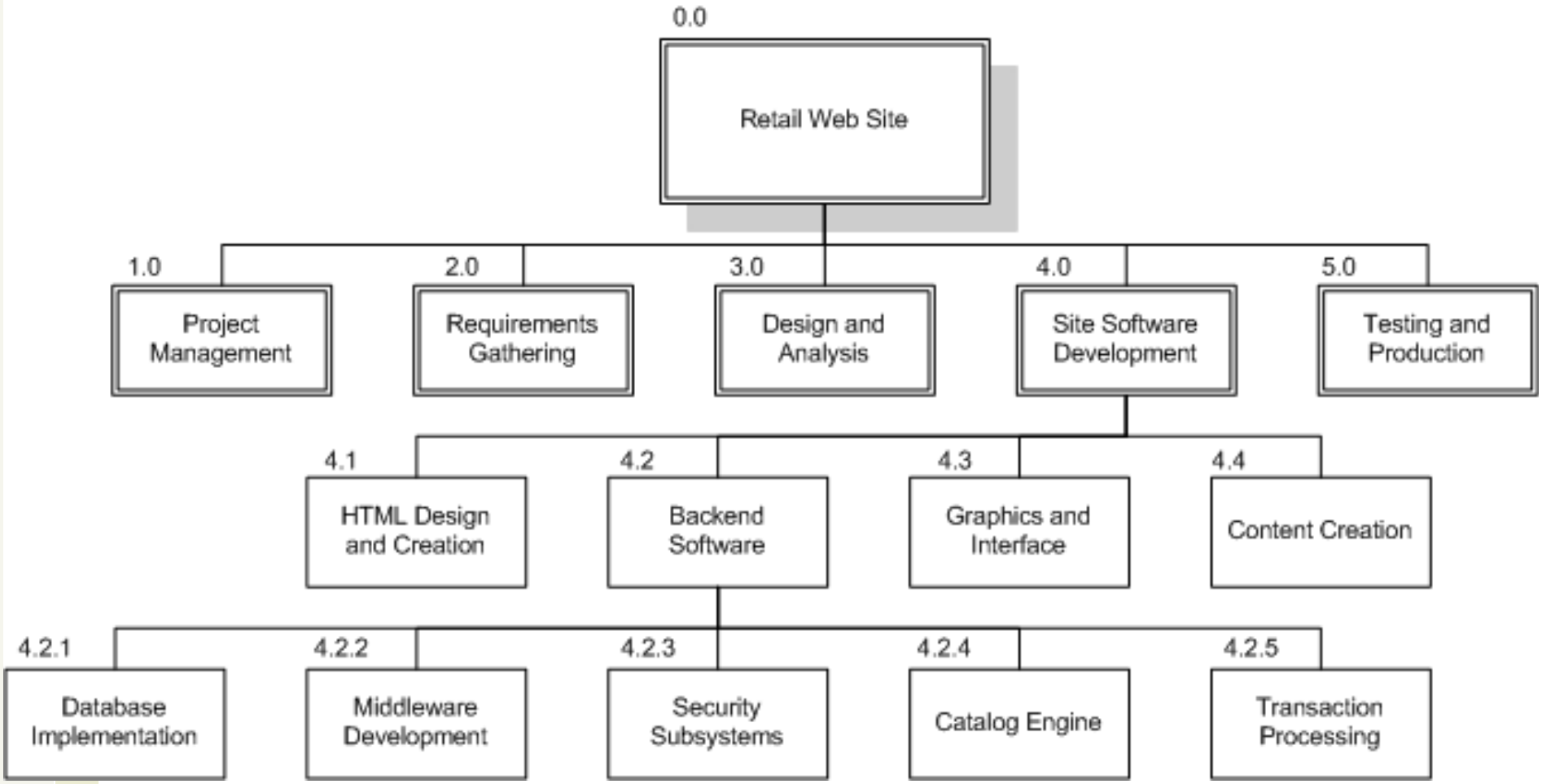
A Full WBS Structure

- Up to six levels (3-6 usually) such as

Managerial levels	1	Total Program
	2	Project
	3	Task
Technical levels	4	Subtask
	5	Work Package
	6	Level of Effort

- Upper 3 can be used by customer for reporting (if part of RFP)
- Different level can be applied to different uses
  - Ex:
    - Level 1: authorizations
    - Level 2: budgets
    - Level 3: schedules

Chart Format Example



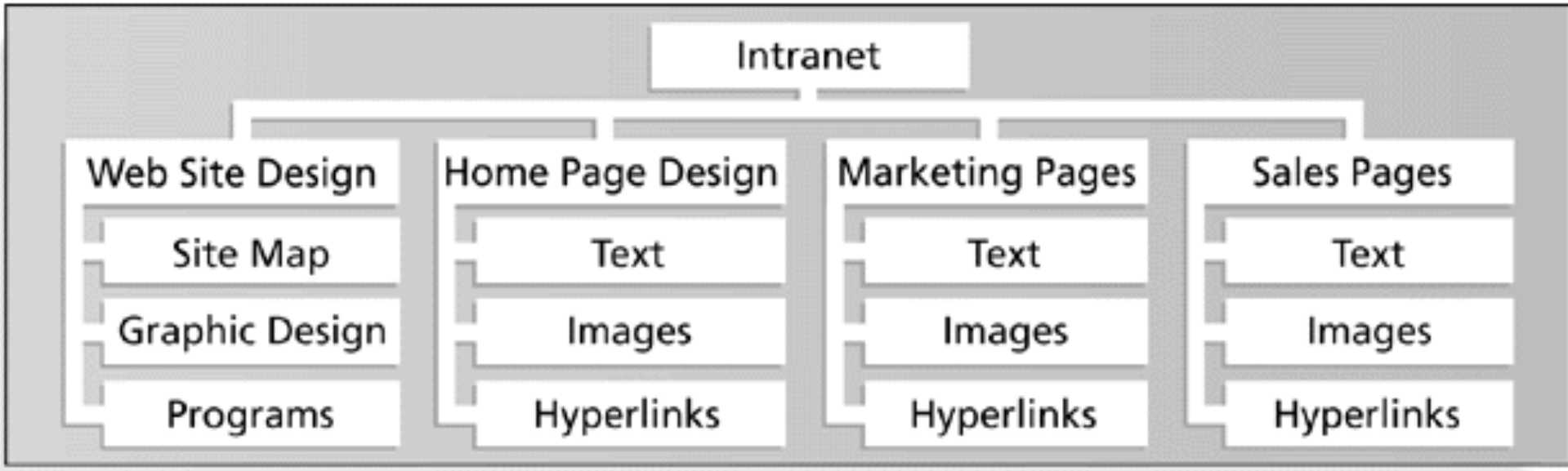
Outline Format Example

Retail Web Site
1.0 Project Management
2.0 Requirements Gathering
3.0 Analysis & Design
4.0 Site Software Development
    4.1 HTML Design and Creation
    4.2 Backend Software
        4.2.1 Database Implementation
        4.2.2 Middleware Development
        4.2.3 Security Subsystems
        4.2.4 Catalog Engine
        4.2.5 Transaction Processing
    4.3 Graphics and Interface
    4.4 Content Creation
5.0 Testing and Production

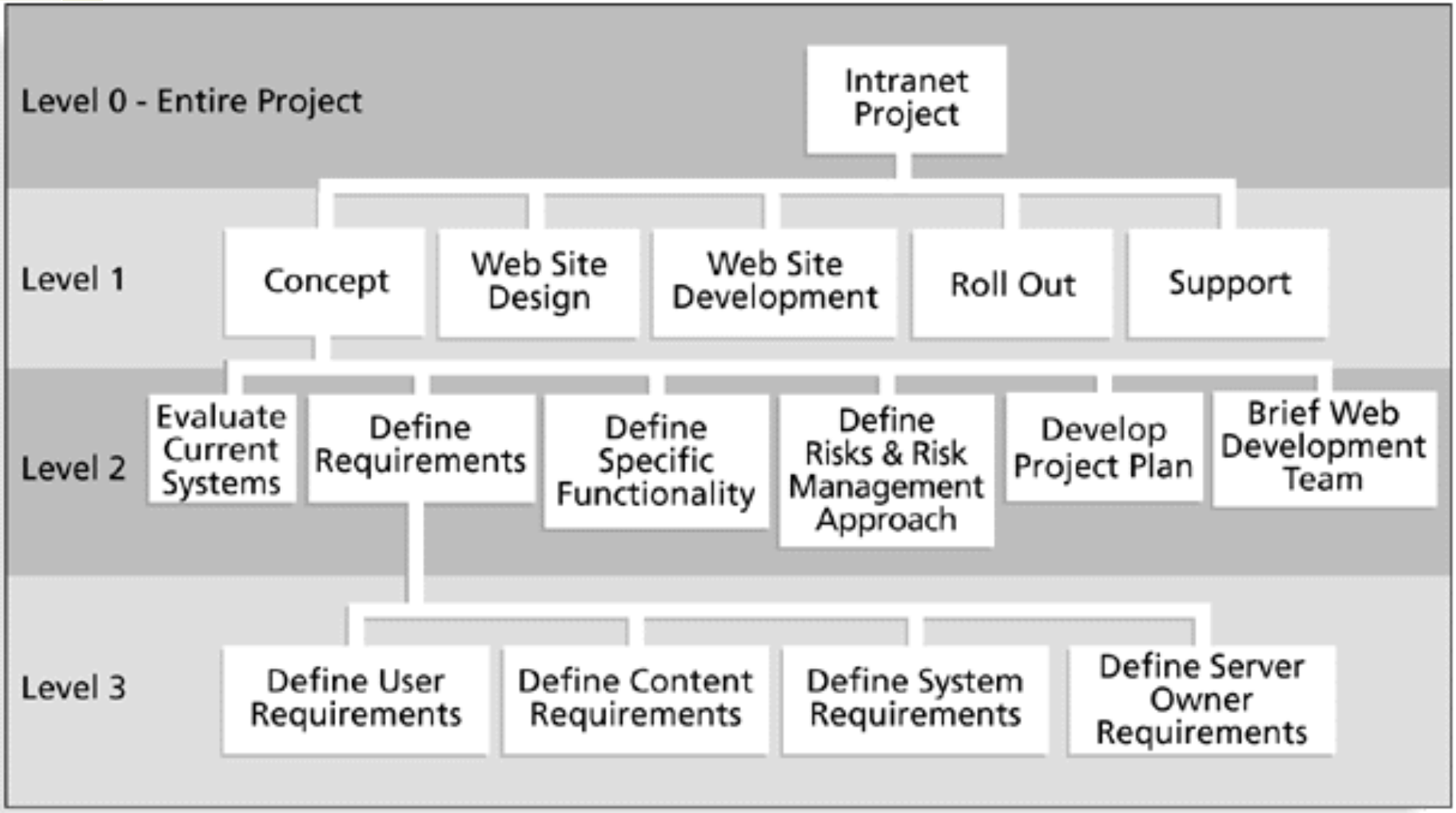
Types

- Process WBS
  - a.k.a Activity-oriented
  - Ex: Requirements, Analysis, Design, Testing
  - Typically used by PM
- Product WBS
  - a.k.a. Entity-oriented
  - Ex: Financial engine, Interface system, DB
  - Typically used by engineering manager
- Hybrid WBS: both above
  - This is not unusual
  - Ex: Lifecycle phases at high level with component or feature-specifics within phases
  - Rationale: processes produce products

Product WBS Example



Process WBS Example



Outline WBS with Gantt Chart

Microsoft Project

File Edit View Insert Format Tools Project Window Help

No Group

Concept

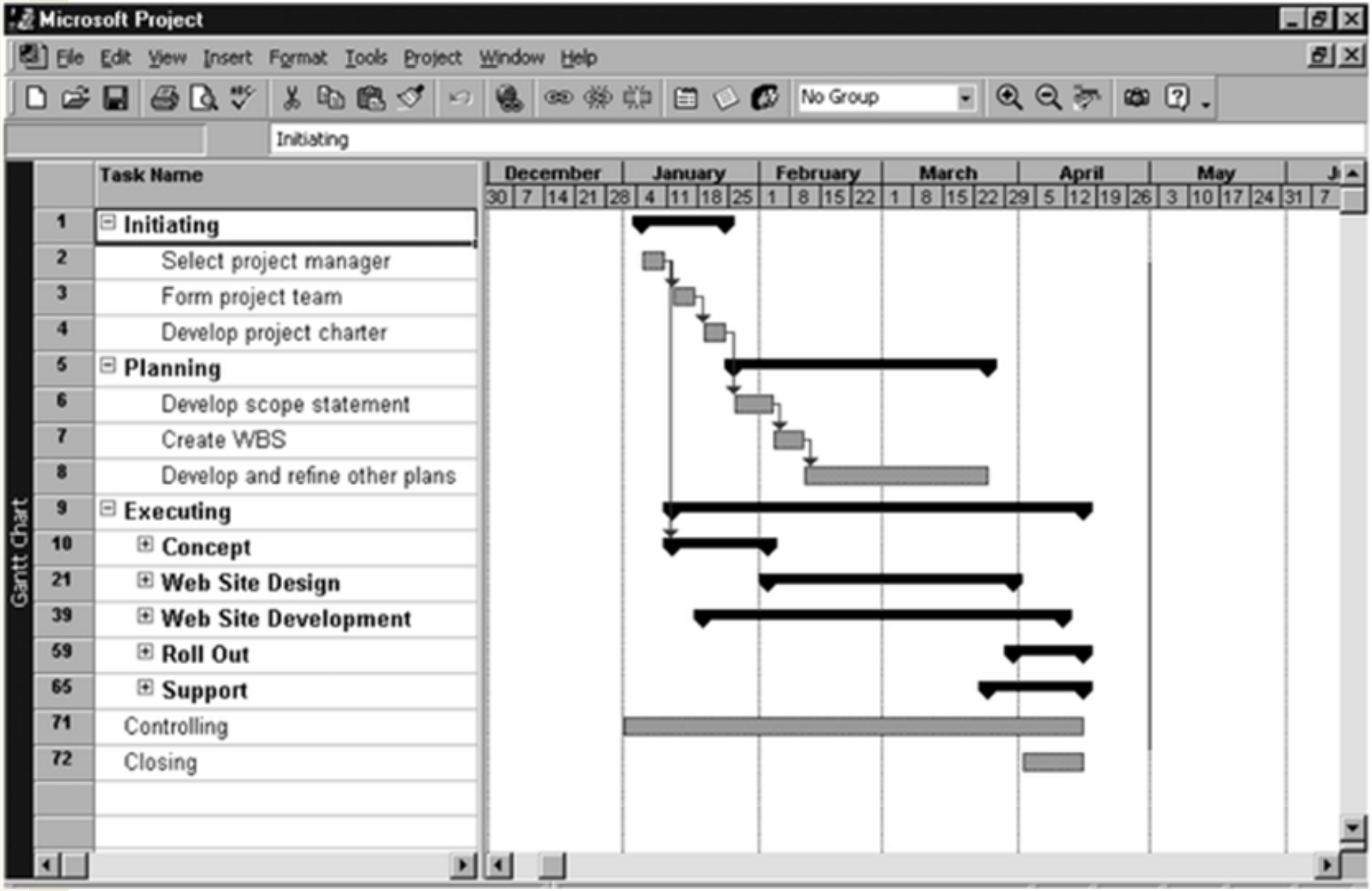
	Task Name
1	Concept
2	Evaluate current systems
3	Define Requirements
4	Define user requirements
5	Define content requirements
6	Define system requirements
7	Define server owner requirements
8	Define specific functionality
9	Define risks and risk management approach
10	Develop project plan
11	Brief web development team
12	Web Site Design
30	Web Site Development
50	Roll Out
57	Support

Gantt Chart

January February March April

21 28 4 11 18 25 1 8 15 22 1 8 15 22 29 5 12 19 26 3

WBS by PMI Process Groups



Less Frequently Used Alternatives

- Organizational WBS
  - Research, Product Design, Engineering, Operations
  - Can be useful for highly cross-functional projects
- Geographical WBS
  - Can be useful with distributed teams
  - NYC team, San Jose team, Off-shore team

Work Packages

- Generic term for discrete tasks with definable end results
- Typically the “leaves” on the tree
- The “one-to-two” rule
  - Often at: 1 or 2 persons for 1 or 2 weeks
- Basis for monitoring and reporting progress
  - Can be tied to budget items (charge numbers)
  - Resources (personnel) assigned
- Ideally shorter rather than longer
  - Longer makes in-progress estimates needed
  - These are more subjective than “done”
  - 2-3 weeks maximum for software projects
  - 1 day minimum (occasionally a half day)
  - Not so small as to micro-manage

Wrap Up (so far)

- List of Activities, not Things
- List of items can come from many sources
  - SOW, Proposal, brainstorming, stakeholders, team
- Describe activities using “bullet language”
  - Meaningful but terse labels
- All WBS paths do not have to go to the same level
- Do not plan more detail than you can manage

WBS & Chosen Lifecycle

- PM must map activities to chosen lifecycle
- Each lifecycle has different sets of activities
- Integral process activities occur for all
  - Planning, configuration, testing
- Operations and maintenance phases are not normally in plan (considered post-project)
- Some models are “straightened” for WBS
  - Spiral and other iterative models
  - Linear sequence several times
- Deliverables of tasks vary by chosen lifecycle

Techniques

- Top-Down
- Bottom-Up
- Analogy
- Brainstorming
  - Post-its on a wall
- Rolling Wave
  - 1st pass: go 1-3 levels deep
  - Gather more requirements or data
  - Add more detail later

Top-down

- Start at highest level
- Systematically develop increasing level of detail
- Best if
  - The problem is well understood
  - Technology and methodology are not new
  - This is similar to an earlier project or problem
- But is also applied in majority of situations
- Advantages
  - Quick
  - Can be done when only part of the requirements is understood
- Disadvantages
  - May lack important details specific to the project that have never occurred in earlier projects

Bottom-up

- Start at lowest level tasks
- Aggregate into summaries and higher levels
- Disadvantages
  - Time consuming
  - Needs more requirements complete
- Advantages
  - Detailed

Analogy

- Base WBS upon that of a “similar” project
- Use a template
- Analogy also can be estimation basis
- Advantages
  - Based on past actual experience
- Disadvantages
  - Needs comparable project

Brainstorming

- Approach
  - Generate all activities you can think of that need to be done
  - Group them into categories
- Both Top-down and Brainstorming can be used on the same WBS
- Remember to get the people who will be doing the work involved (buy-in matters!)
- Advantages
  - Detailed
  - Buy-in
- Disadvantages
  - Time consuming

Rolling Wave

- 1st pass: go 1-3 levels deep
- Gather more requirements or data
- Add more detail later
- Advantages
  - Quick
  - Works with poorly understood requirements
  - Mitigates the risk of forgetting important items
  - Detailed
- Disadvantages
  - Time consuming

WBS are Basis of Many Things

- Network scheduling
- Costing
- Risk analysis
- Organizational structure
- Control
- Measurement

Guidelines Part 1

- Should be easy to understand
- Some companies have corporate standards for these schemes
- Some top-level items, like Project Mgmt. are in WBS for each project
  - Others vary by project
- What often hurts most is what's missing
- Break down until you can generate accurate time & cost estimates
- Ensure each element corresponds to a deliverable

Guidelines Part 2

- How detailed should it be?
  - Not as detailed as the final MS-Project plan
  - Each level should have no more than 7 items
  - It can evolve over time
- What tool should you use?
  - Excel, Word, Project
  - Org chart diagramming tool (Visio, etc)
  - Specialized commercial apps
- Re-use a “template” if you have one

Put yourself at work :-)

- Divide in 5 groups
- Develop a WBS for a software project that aims at delivering an online music store (e.g., iTunes)
- Choose one of the following types and stick to it
  - Process
  - Product
  - Hybrid
- Choose one of the following approaches and stick to it
  - Top-Down
  - Bottom-Up
  - Brainstorming
- Use outline format
- You have 30 minutes
- When you're ready come to the white board and write your WBS in the space I reserve for the group
- We will discuss your WBS together

Homework – 2: WBS

- Create a WBS for your project
  - Please think this through. You're the PM now!
- Guidelines
  - Do it at managerial level (see slide 14)
    - 4-7 nodes at 1st level
    - 2-5 nodes at 2nd level (per each node at 1st level)
    - You can go deeper at your discretion
    - Include project management tasks
  - As we covered in class, you can use either a process, product or hybrid approach
    - For most of your projects I suspect the process approach would work best at managerial level.
  - Follow the standard hierarchical numbering scheme for WBS structures
  - Use outline format

Homework – 2: WBS

- Submission
  - Use the tool you prefer between Notepad/Word/Excel
  - Add homework-2 to the appropriate folder in the dropbox folder of your project

Optional Readings

- McConnell: 8 “Estimation”