Deciding the work to be Performed (Work Breakdown Structure)
Goals of the Unit

• Understanding the transition from project goals to the project schedule

• Introducing the Work Breakdown Structure notation
Initiate

Assess Feasibility

Plan

Formalize Goals

Define Schedule

Define Costs

[Obtain Approval]

Execute & Monitor

Collect Outputs

Develop

Kick Off Activities

Close

Collect Outputs

Release

Change Control & Configuration Management

Quality Management

Risk Management

Human Resource Management
What is a WBS?

A **Work Breakdown Structure** (WBS for short) is a (deliverable-oriented) hierarchical decomposition of the work to be executed by the project team to accomplish projects objectives and create the required deliverable.
WBS Example

1. Software System

1.1 Configuration Management
1.2 Main Requirements
1.3 Mobile Client Development
1.4 Appstore Deployment
1.5 Dev. Tools Procurement
1.6 User Manual

1.3.1 Detailed Requirements
1.3.2 Architecture
1.3.3 Code
1.3.4 Tests

1.3.4.1 Unit Tests
1.3.4.2 System Tests
1.3.4.3 Integration Tests
WBS: Remarks

• Two formats
  – Graphical tree (Vision, Graffle, LibreOffice, ...)
  – Textual outline (MS Word, Text Editor, Outliner, ...)

• Uses a decimal numbering system to identify elements (Ex: 3.1.5)

• Shows “is contained in” relationships

• Does not show dependencies nor durations
Why is it useful?

- A WBS establishes the basis for:
  - **Defining the work to be performed** in a project
  - Showing how various **activities are related to the project objectives**
  - Establishing a **framework for defining, assigning, and monitoring work and costs**
  - Identifying the **organizational elements** responsible for accomplishing the work
WBS Rules of the Thumb

• Everything (and nothing else) is in place:
  – **The 100% rule:** make sure all work items are there (product oriented WBS are better suited for this kind of rule)
  – **The ME rule (Mutually Exclusive rule):** make sure there are no overlaps in the definition of the elements (see coupling, below)
  – **No need to make it balanced:** all paths do not have to go to the same level

• Quality of the WBS is high (*)
  – **Coherence:** tasks within a work package should have the same goal;
  – **Coupling:** work package dependencies should be minimised, so that team members can work independently;
  – **Continuity:** production work packages should be full-time to maximise efficiency;
  – **Cost:** bottom level work packages should require between one man-week and one man-month of effort.

(*) Criteria taken from the ESA standards for software development
When do you stop?

• Simple answer: at the work-package level (which, btw, could be composed of more elementary activities, which, however, you do not want to trace)

• However: how big is a work-package?
  – According to “DOD and NASA Guide to PERT COST”: leaves of the WBS should be no more than 3 months of work or $100,000 of expenditure
  – According to other standards: 1-2 weeks for 1-2 people

• Mind you though, the level of details depends on the size of the project...
WBS Types (1/3)

• **Product WBS**
  – It develops according to the structure of the outputs that need to be produced
  – It can start from a Product Breakdown Structure, when defined

• **Process WBS**
  – It develops according to the phases in which a project is organized
  – For instance: Requirements, Analysis, Design, Testing

• **Hybrid WBS: both of the above**
  – It mixes process and product
  – For instance: life-cycle phases at higher levels; component at lower levels
WBS Types (2/3)

• Organizational WBS and Geographical WBS
  – Higher levels are organizational units
  – Lower levels collect the work which is under the responsibility of a Unit.
  – Can be useful for highly cross-functional projects

• Geographical WBS
  – Higher levels are geographically distributed teams (e.g. NY team, Trento Team)
  – Lower levels collect the work under the responsibility of a team

• Remarks: according to the PMBOK, these are not WBS’s. In any case, they are less commonly used.
WBS Type (3/3)

- **PWBS:** Program (project) WBS, used to coordinate all projects (systems)

- **CWBS:** Contract WBS, basis for subcontracting system development

- (Used by NASA)
Product WBS Example

- Software System
  - Requirements Document
  - Architecture Document
  - Front End
  - Middleware
  - Back End
    - Site Templates
    - Web Pages
    - SQL Schema
    - DB Data
    - Admin Intf
      - Dynamic Pages
      - Static Pages
Process WBS Example

- System Development
  - Requirements Analysis
  - Analysis and Design
  - Coding
    - Cycle 1
    - Cycle 2
    - Integration
  - Testing
    - System Test
    - Acceptance Test

Scenarios Analysis
Security Req. Analysis
Supportability Requirements Analysis
WBS Dictionary

• A WBS dictionary helps further specify the entries of a WBS

• It might contain title, number, detailed description of the element, quantities, associated work, contractual items

• Rules of the thumb:
  – it can be done for each entry in the tree.
  – follow the definition: increase the details as you move down the tree
  – a good practice is doing it for the leaves (work-packages)
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<th>Work package number</th>
<th>1</th>
<th>Start date or starting event:</th>
<th>Month 1</th>
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<td>P2</td>
<td>P3</td>
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<tr>
<td></td>
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