Chapter 4

Building the Work Breakdown Structure
The Work Breakdown Structure (WBS)

- The Work Breakdown Structure (WBS) is a hierarchical description of the work that must be done to complete the project as defined in the Project Overview Statement (POS).
- Several processes can be used to create this hierarchy.
Decomposition

- Decomposition is breaking down work into a hierarchy of activities, tasks, and work packages.

- Important to the overall project plan because it allows you to estimate the duration of the project, determine the required resources, and schedule the work.

- The complete decomposition will be developed by using the completeness criteria discussed later.
Uses for the WBS

The WBS has four uses:

**Thought process tool**
- It helps the project manager and the project team visualize exactly how the work of the project can be defined and managed effectively.
- Not unusual to consider alternative ways of decomposing the work until project manager is comfortable.

**Architectural design tool**
- Is a picture of the work of the project and how the items of work are related to one another.

**Planning tool**
- Gives the project team a detailed representation of the project as a collection of activities that must be completed in order for the project to be completed.

**Project status reporting tool**
- Project activities are consolidated (rolled up) from the bottom as lower-level activities are completed.
- As work is completed, activities will be completed.
- WBS defines milestone events that can be reported to senior management and to the customer.
There is no one correct way to create the WBS. The choice is subjective and based more on the project manager’s preference than on any other requirements. If try to follow one approach and find that it is making the project work more confusing rather than simpler, text’s advice is simply to throw away the work you have done and start all over again with a fresh approach.
Approaches to Building WBS
– continued

There are three general approaches to building the WBS:

**Noun-type approaches**
- Define the deliverable of the project work in terms of the components (physical or functional) that make up the deliverable. (Currently recommended by PMI)

**Verb-type approaches**
- Define the deliverable of the project work in terms of the actions that must be done to produce the deliverable.
- Include the design-build-test-implement and project objectives Approaches.

**Organizational approaches**
- Define the deliverable of the project work in terms of the organizational units that will work on the project.
- Includes the department, process, and geographic location approaches
Noun-Type Approaches

Physical decomposition

- In projects that involve building products, it is tempting to follow the physical decomposition approach.
- Take a bicycle for example. Its physical components are frame, wheels, seat, fork, rims, gears, brakes, and so on. If each is to be manufactured, this approach may produce a simple WBS that is easily understood by all concerned parties.

Functional decomposition

- Can build the WBS using the functional components of an item.
- Using the bicycle example, we can build the WBS using the functional components of the bicycle. The functional components include the steering system, gear-shifting system, braking system, and pedaling system.
Representing the WBS

Indented outline Version WBS for a Bicycle

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Verb-Type Approaches

Design-build-test-implement

- Commonly used in those projects that involve a methodology, such as application systems development, for example.
- These are just representative categories.
- When the detail-level activity schedules are summarized up to them, they present a display of meaningful information to the recipient of the report.
- Remember, the WBS activities at the lowest levels must always be expressed in verb form.
  - After all, we are talking about work, and that implies action, which, in turn, implies verbs.

Objectives

Similar to the design-build-test-implement approach.
(Used when progress reports at various stages of project completion are prepared for senior management)
Verb-Type Appr.
Design-build-test-implement

Representing the WBS

1.0
Modernize Financial Analysis System
- Labor Hours 440 Cost $31700
- Other Resources Cost $5000

1.1 Design Phase
1.1.1 Design Part 1
- Labor Hours 60 Cost $4200
- Other Resources Cost $250
- Design Input Screens
- Design Input Processing

1.1.2 Design Part 2
- Labor Hours 80 Cost $5000
- Other Resources Cost $250
- Design Matrix Update
- Design Analysis Options
- Design Reporting Options
- Milestone

1.2 Programming Phase
- Labor Hours 120 Cost $8400
- Other Resources Cost $3000
- Program Input System
- Program Matrix Update
- Program Analysis Options
- Program Reporting Options
- Milestone

1.3 Testing & Transition Phase
- Labor Hours 180 Cost $13500
- Other Resources Cost $1500
- Conduct System Test
- Conduct Integration Test
- Conduct Training
- Transition to Operations
- Milestone
Representing the WBS

Level 1

Aircraft System

Level 2

Aircraft Systems WBS (MIL-HDBK-881)

Air Vehicle
- Airframe
- Propulsion
- Application Software
- System Software
- Com/Identification
- Navigation/Guidance
- Central Computer
- Fire Control
- Data Display and Controls
- Survivability
- Reconnaissance
- Automatic Flight Control
- Central Integrated Checkout
- Antisubmarine Warfare
- Armament
- Weapons Delivery
- Auxiliary Equipment

SE/Program Mgmt
- DT&E
- OT&E
- Mockups
- T&E Support
- Test Facilities

System T&E
- Equipment Services
- Facilities

Training
- Tech Pubs
- Engrg Data Support
- Data Management Data
- Data Depository

Data
- Test and Measurement Equipment
- Support and Handling Equipment

Peculiar Support Equipment
- Test and Measurement Equipment
- Support and Handling Equipment

Common Support Equipment
- Sys Assembly, Installation and Checkout on Site
- Contractor Tech Support
- Site Construction
- Site/Ship Vehicle Conversion

Op/Site Activation
- Construction/Conversion/Expansion
- Equipment Acquisition or Mod Maintenance

Industrial Facilities
- Initial Spares and Initial Repair Parts

Level 3
Each activity must possess six characteristics to be considered completely decomposed.

- Status/completion is measurable
- Start/end events are clearly defined
- Activity has a deliverable
- Time/cost is easily estimated
- Activity duration is within acceptable limits
- Activity Independence
The project manager can ask for the status of an activity at any point in time during the project.

- If the activity has been defined properly, that question is answered easily.
- A simple metric that has met with some success is to compute the proportion of tasks completed as a percentage of all the tasks that make up the activity:
  ✓ Although it may seem somewhat inaccurate, it is a good technique (It doesn’t say anything about the quality of the Work, best of all, it is quick).
Start/end events are clearly defined (Bounded)

- Each activity should have a clearly defined start and end event.
- Once the start event has occurred, work can begin on the activity.
- The deliverable is most likely the end event that signals work is closed on the activity.
Deliverable

- The result of completing the work that makes up the activity is the production of a deliverable.
- It is a visible sign that the activity is complete:
  - Could be an approving manager’s signature, a physical product or document, the authorization to proceed to the next activity or some other sign of completion
- The deliverable(s) from an activity is output from that activity, which then becomes input to one or more other activities that follow its completion.
Cost/Time Estimate

- Each activity should have an estimated time and cost of completion.
- Being able to do this at the lowest level of decomposition in the WBS allows you to aggregate to higher levels and estimate the total project cost and the completion date.
- This experience at lower levels of definition gives you a stronger base on which to estimate activity cost and duration for similar activities.
While there is no fixed rule for the duration of an activity, text recommend that activities have a duration of less than two calendar weeks. (Common practice in many organizations)

Exceptions when the activity defines process work, such as will occur in many manufacturing situations.

The danger you avoid is longer-duration activities whose delay can create a serious project-scheduling problem.
Activity Independence

- It is important that each activity be independent.
- Once work has begun on the activity, it can continue reasonably without interruption and without the need of additional input or information until the activity is complete.
- The work effort could be contiguous, but it can be scheduled otherwise for a variety of reasons:
  - You can choose to schedule it in parts because of resource availability, but you could have scheduled it as one continuous stream of work.
- Avoid the temptation to micromanage an activity:
  - Best practices suggest that you manage an individual’s work down to units of one week.
Generating the WBS

❖ Text suggests the best way to generate the WBS is as part of the Joint Project Planning JPP session.
❖ There may be as many as 10 to 20 participants involved in building the WBS, so gathering around a computer screen won’t do the job.
❖ Text suggests use Post-It notes, marking pens, and plenty of whiteboard space.

❖ It is sloppy, but it gets the job done

Two approaches can be used to identify the project activities:
1. Top-Down approach
2. Bottom-up approach
Top-Down approach

- The top-down approach begins at the goal level and successively partitions work down to lower levels of definition until the participants are satisfied that the work has been sufficiently defined.
- Once the project activities have been defined, they will be at a sufficient level of detail to allow you to estimate time, cost, and resource requirements first at the activity level and then aggregate to the project level.
- Once the activities are described, you can sequence the project work so that as many activities as possible are performed in parallel, rather than in sequence.
Bottom-up approach

- More like a brainstorming session than an organized approach to building the WBS.

- Each group makes a list of the activities that must be completed in order to complete the first-level activity. To do this, they proceed as follows:

  1. Someone in the group identifies an activity and announces it to the group. If the group agrees, then the activity is written on a slip of paper and put in the middle of the table. Process repeats itself until no new ideas are forthcoming. (Brainstorming!)
2. The group then sorts the slips into activities that seem to be related to one another. This should help the planning team add missing activities or remove redundant ones.

3. Once the team is satisfied it has completed the activity list for the first-level breakdown, each group then reports to the entire planning team the results of its work.

4. Final critiques are given, missing activities added, and redundant activities removed.
Using JPP Session to Build WBS

To create the WBS, assemble a facilitator, the project manager, the core members of the project team, and all other managers who might be affected by the project or who will affect the project:

- Important to have the expertise and the decision makers present who can give input into the WBS.

- This exercise should be continuous; you do not want to interrupt it while you go looking for input from people who should already be in the session.

- The tools are low-tech (Post-It notes, marking pens, and whiteboards), and they greatly facilitate the orderly completion of the task.
The WBS is on the left, and each task’s start and finish date are shown on the right using a calendar timescale.
Primavera Systems, Inc, which was founded in May 1983, was a private company based in Pennsylvania (USA) which develops software solutions for the Project Portfolio Management market. On January 1, 2009, Oracle Corporation took legal ownership of Primavera.