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WORK BREAKDOWN STRUCTURES

THE FOUNDATION FOR
PROJECT MANAGEMENT
EXCELLENCE

 WILEY

 **PMI**
Project Management Institute

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Table of Contents

[Title Page](#)

[Copyright Page](#)

[Preface](#)

[Foreword](#)

[Part I - Introduction To WBS Concepts](#)

[Chapter 1 - Background and Key Concepts](#)

[CHAPTER OVERVIEW](#)

[WORK BREAKDOWN STRUCTURES](#)

[DEFINING WORK BREAKDOWN STRUCTURES](#)

[IMPORTANCE OF THE WBS](#)

[WBS LESSON LEARNED: A BRIEF ILLUSTRATION](#)

[WBS CONCEPTS](#)

[DESCRIBING THE WBS](#)

[THE HOUSE METAPHOR-A CONSISTENT EXAMPLE](#)

[CHAPTER SUMMARY](#)

[REFERENCES](#)

[Chapter 2 - Applying WBS Attributes and Concepts](#)

[CHAPTER OVERVIEW](#)

[WBS ATTRIBUTES](#)

[WBS DECOMPOSITION](#)

[WBS IN PROJECTS, PROGRAMS, PORTFOLIOS, AND THE ENTERPRISE](#)

[WBS REPRESENTATIONS](#)

[WBS TOOLS](#)
[CHAPTER SUMMARY](#)
[REFERENCES](#)

[Part II - WBS Application In Projects](#)

[Chapter 3 - Project Initiation and the WBS](#)

[CHAPTER OVERVIEW](#)
[PROJECT CHARTER](#)
[PRELIMINARY PROJECT SCOPE STATEMENT](#)
[CONTRACTS, AGREEMENTS, STATEMENTS OF WORK](#)
[\(SOW\)](#)
[CHAPTER SUMMARY](#)
[REFERENCES](#)

[Chapter 4 - Defining Scope through the WBS](#)

[CHAPTER OVERVIEW](#)
[PRODUCT SCOPE DESCRIPTION](#)
[PROJECT SCOPE STATEMENT \(SCOPE DEFINITION\)](#)
[WORK BREAKDOWN STRUCTURE](#)
[BEGINNING WITH THE ELABORATED WBS](#)
[USE-RELATED CHARACTERISTICS](#)
[WBS DICTIONARY](#)
[DELIVERABLE- BASED MANAGEMENT](#)
[ACTIVITY- BASED MANAGEMENT](#)
[SCOPE BASELINE](#)
[ACCEPTANCE CRITERIA](#)
[CHAPTER SUMMARY](#)
[REFERENCES](#)

[Chapter 5 - The WBS in Procurement and Financial Planning](#)

CHAPTER OVERVIEW
BUILD VERSUS BUY DECISIONS
COST ESTIMATING
COST BUDGETING
COST BREAKDOWN STRUCTURE
CHAPTER SUMMARY
REFERENCE

Chapter 6 - Quality, Risk, Resource and Communication
Planning with the WBS

CHAPTER OVERVIEW
APPROACHING QUALITY, RESOURCE AND RISK
PLANNING
USING EXISTING TEMPLATES AND PROCESSES
CREATING PROCESSES TO SUPPORT THE PROJECT
UTILIZING THE WBS AS A BASIS FOR PROCESS
DEVELOPMENT
EMPLOYING THE WBS AND WBS DICTIONARY
THE WHOLE IS NOT GREATER THAN THE SUM OF ITS
PARTS — IT EQUALS PRECISELY 100% ...
EXAMINING PROCESS CONSIDERATIONS
COMMUNICATIONS PLANNING USING THE WBS AS A
FOUNDATION
DEVELOPING THE COMMUNICATIONS PLAN
THE COMMUNICATIONS MATRIX
THE HIERARCHY OF INFORMATION
THE MEETING MATRIX
CHAPTER SUMMARY
REFERENCES

Chapter 7 - The WBS as a Starting Point for Schedule
Development

CHAPTER OVERVIEW

DEMISTIFYING THE TRANSITION FROM THE WBS TO THE PROJECT SCHEDULE

PUTTING THESE CONCEPTS TO WORK

THE WBS IN HIERARCHICAL OUTLINE FORM

IDENTIFYING DEPENDENCIES BETWEEN SCOPE

ELEMENTS

REPRESENTING SCOPE SEQUENCE AND DEPENDENCY

CREATING A HIGH-LEVEL SCOPE SEQUENCE

REPRESENTATION

THE CONCEPT OF INCLUSION

THE SCOPE RELATIONSHIP DIAGRAM

CREATING A SCOPE DEPENDENCY PLAN

CHAPTER SUMMARY

REFERENCES

Chapter 8 - The WBS in Action

CHAPTER OVERVIEW

ACQUIRING THE PROJECT TEAM

DIRECTING AND MANAGING PROJECT EXECUTION AND INTEGRATED CHANGE MANAGEMENT

PERFORMING SCOPE MANAGEMENT

SCOPE MANAGEMENT AND THE TRIPLE CONSTRAINT

REVIEWING THE RELATIONSHIP WITH OTHER PROJECT

MANAGEMENT PROCESSES

PERFORMING QUALITY ASSURANCE

PERFORMING SCOPE VERIFICATION

CHAPTER SUMMARY

REFERENCE

Chapter 9 - Ensuring Success through the WBS

CHAPTER OVERVIEW

PROJECT PERFORMANCE MANAGEMENT

SCOPE

[SCHEDULE](#)
[COST](#)
[PLANNED VERSUS ACTUAL](#)
[STAKEHOLDER MANAGEMENT](#)
[CHAPTER SUMMARY](#)
[REFERENCES](#)

[Chapter 10 - Verifying Project Closeout with the WBS](#)

[CHAPTER OVERVIEW](#)
[PROJECT CLOSEOUT](#)
[ACCEPTANCE / TURNOVER / SUPPORT / MAINTENANCE](#)
[CONTRACT CLOSURE](#)
[PROJECT CLOSEOUT](#)
[CHAPTER SUMMARY](#)

[Part III - WBS For Project Management Decomposition](#)

[Chapter 11 - A Project Management WBS](#)

[CHAPTER OVERVIEW](#)
[ORGANIZATION OPTIONS FOR A PROJECT MANAGEMENT](#)
[WBS](#)
[PROJECT MANAGEMENT WBS COMPONENTS ALIGNED](#)
[WITH THE PMBOK GUIDE — THIRD EDITION](#)
[PROJECT MANAGEMENT WBS LITE](#)
[CHAPTER SUMMARY](#)
[A FINAL WORD](#)
[REFERENCE](#)

[Appendix A - Project Charter Example](#)

[Appendix B - Project Scope Statement Example](#)

[Appendix C - Project Management WBS Examples](#)

[Appendix D - Answers to Chapter Questions](#)

[Index](#)

WORK BREAKDOWN STRUCTURES: THE FOUNDATION FOR PROJECT MANAGEMENT EXCELLENCE

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Preface

So why write a book about Work Breakdown Structures? Actually, the answer is quite simple. In the vast body of project management literature, there is comparatively little written about Work Breakdown Structures (WBS) — and that is a problem. It is a problem because, not surprisingly, at this time in the evolution of Project Management as an advancing profession, the WBS has emerged as a foundational concept and tool. The WBS ensures clear definition and communication of project scope, while at the same time it performs a critical role as a monitoring and controlling tool. The WBS supports a variety of other Project Management processes — providing a baseline for planning, estimating, scheduling, and other “ing”-type activities. With the WBS performing this critical role, we believe it is important for Project Management literature to include additional material — and specifically, a detailed instructional text regarding Work Breakdown Structures.

This book is intended to be a beginning step in filling the information gap that exists between what is currently written about Work Breakdown Structures and what the authors have learned is needed by program and project managers today.

To be both specific and unscientific at the same time, if you were to stack all of the publications and writings about Work Breakdown Structures on a table, the pile would be an alarmingly scant 5 to 6 inches tall. We know this to be true — we’ve performed the experiment. Compare that with writings on risk management, project scheduling or the softer side of Project Management — negotiating, leading, managing projects, and so on, and the sky-scrapers of

literature on these subjects dwarf the one-story dwelling of information on Work Breakdown Structures.

This book takes a new approach to the discussion of Work Breakdown Structures. First, you will notice that the text is laid out as a typical project might be managed — from concept and planning through delivery and project closeout, while the role of the WBS is explained during each step of the effort. Additionally, we use a single, common metaphor for the WBS throughout the text. While we discuss many applications and formats for the WBS, and we expand on concepts and examples throughout the book, this single metaphor provides a cohesive thread for you to follow from beginning to end.

Most importantly, however, the book is designed to function not only as a text, but also as a desk reference. To date, the vast majority of writings about Work Breakdown Structures have provided guidance about development of the tool or explain the benefits derived from using the WBS as a basis for planning.

Here, we explain how the WBS is first developed, then applied and continually referenced throughout the life of a project. So as a practitioner, if you are beginning a new project and are interested in examining how the WBS is utilized during Initiating and Planning phases, you will find helpful information in the early chapters of the book. By contrast, if you are at the midpoint in a project, perhaps during Executing or Monitoring and Controlling phases, the central chapters will provide reference material and information about the interplay between the WBS and other key Project Management processes such as Staff Planning, Communications, Risk, Change and Schedule Management. (*PMBOK*[®] *Guide* — Third Edition, pp. 121-122, 205-214)

Finally, we present new concepts for Work Breakdown Structures in this book. These new concepts relate

specifically to what we will call *transition* activities. For example, woven throughout the chapters is the concept that during the life of a project, the WBS functions in different ways, depending on the phase of the project. For instance, during Initiating and Planning phases, the primary role of the WBS is to document and collect information, serving as a point of clarification that describes and defines — often in great detail — the boundaries of the project’s scope as well as the “deliverables” and outcomes of the project. During Executing and Monitoring and Controlling phases, the WBS transitions from its passive role as a collection of information to one of action, in the role of project decision support, utilized as a reference and source for control and measurement. This key transition brings the WBS to life during the evolution of a project and is explained in the book.

To detail the layout of the book, the following is a brief synopsis that includes the three major parts and content of each chapter.

Part I, “Introduction to WBS Concepts,” includes Chapters 1 and 2 of the book and is focused on the presentation of key baseline information regarding WBS constructs.

- In **Chapter 1** we present basic WBS concepts. This chapter provides background and foundational information on which the remainder of the book is based. Here, we include some general, some specific and a few very important definitions about Work Breakdown Structures. We also include a brief historic look at Work Breakdown Structures and introduce our key metaphor, the House example. More about this later.
- **Chapter 2** presents the WBS in more detail. In this chapter we discuss the key quality attributes of the WBS and explain the process of decomposition. We

also present and explain a variety of WBS representations and describe how the quality attributes for a WBS apply similarly to projects, programs, portfolios, and ultimately, the enterprise.

Part II, “WBS Application in Projects,” is the largest component of the book, comprising Chapters 3 through 10. It discusses the role of the WBS in each project phase from Initiating, through Planning, Executing, Monitoring, Controlling, and Closing. The chapters that make up the Planning discussions occupy the lion’s share of Part Two — and that is a natural outcome, because the WBS is predominantly, though not exclusively, a planning tool. The House Metaphor will frequently appear in these chapters, and will take many forms. We will use this metaphor to ground our discussions and to provide a consistent and familiar place to return to when the going (and the detail of our writing) gets tough.

- **Chapter 3** discusses the role of the WBS in the Initiating phase and includes reviews of the interaction between the WBS and the Project Charter, the Preliminary Scope Statement, contracts, agreements, Statements of Work (SOW) and Contract Statements of Work, which apply to project components that have been contracted or subcontracted to providers outside the project or program organization.
- **Chapter 4** reviews how the *Product* Scope Description and the *Project* Scope Statement are used to build and construct a refined Scope Baseline. In this chapter the initial construction of the Work Breakdown Structure occurs. Most importantly, in this chapter we explain the value of deliverable-based management as contrasted with an activity-based approach. Beyond this, key information and examples of the WBS

Dictionary are presented along with examples of criteria for product and project acceptance.

- In **Chapter 5** we examine in detail the role of the WBS in build versus buy decisions along with in-depth discussions of the role of the WBS in Cost Estimating and Cost Budgeting.
- **Chapter 6** addresses key interactions of the WBS during additional planning activities. These include detailed discussions of the WBS during Quality Planning, Staff Planning, Risk Identification and Planning as well as the role of the WBS in the most carefully planned project management process — Communications Planning.
- **Chapter 7** introduces new concepts that enhance the process of translating the Scope Management aspects of the WBS into a representation of elements that can be used to create the Network Diagram. This process is examined in detail, and ultimately a completely new representation of scope — the Scope Relationship Diagram is presented. In this chapter, we also explain how the various individual WBS elements are oriented and related to one another. The Scope Relationship Diagram is introduced to represent how various elements of scope interact, and can in turn be used as a basis for Project Schedule development. While this book is not intended to detail the process of network diagramming or schedule development, the subjects are discussed briefly to help ease the transition from WBS to Project Schedule.

The role of the WBS in Executing and Monitoring and Controlling phases is discussed in Chapters 8 through 10. In these chapters, we discuss how the WBS performs the foundational role as a reference point for all project execution processes and is used as a source for decision making when risks or changes must be addressed. It should

be noted here that we discuss Executing and Monitoring and Controlling activities together in this book. The Project Management Institute's *PMBOK® Guide* — Third Edition approaches this issue in two ways. In parts of Chapter 3 of the *PMBOK® Guide* — Third Edition, there is a clear separation between Executing and Monitoring and Controlling processes. A strong argument can be made, however, for describing the execution of a project as the work being performed within the effort while the Monitoring and Controlling process is simultaneously applied as the core Project Management activity that ensures the work is performed against the proper tasks, using the proper resources and is directed at the appropriate deliverables. The key theme, here, is that Executing and Monitoring and Controlling must be thought of as a common set of processes where Executing is the product-related activity and Monitoring and Controlling is performed as a guidance and management function over all other project activities. This concept is reinforced in the *PMBOK® Guide* — Third Edition. Figure 3.2 depicts how Monitoring and Controlling processes encompass and interact with all other project management process groups. The *PMBOK® Guide* — Third Edition defines this process: “The integrative nature of project management requires the Monitoring and Controlling process group interaction with every aspect of the other process groups” (*PMBOK® Guide* — Third Edition, p. 40).

As is the case in the Executing phase of a project and thereby, the Executing and Monitoring and Controlling portions of this book, Monitoring and Controlling activities are based largely on the scope definitions and detail provided by the WBS and the WBS Dictionary. Chapter 9 exposes the various functions of both the WBS and its associated Dictionary. These chapters should be truly seen as the “action” section of the book, representing the point in

a project, program or portfolio where managers must manage and leaders must lead. If Initiating, Planning and Executing phases of a project (and by coincidence, the layout of this book) can be considered the setup discussion, then Monitoring and Controlling can be seen as the action part, with a strong emphasis on the controlling activities. It is between these phases that the role of the WBS is “transitioned” from passive to active.

- **Chapter 8** is the where the proverbial rubber meets the Project Management “road”. In this phase of the project the WBS is transitioned from a planning tool to a decision support resource. The construction and design of this foundation tool is complete, and now the WBS is pressed into action as the source for decision guidance for the remainder of the project. In this chapter, we discuss how the WBS informs decisions that the Project Manager and stakeholders must make and aids in the process of Acquiring the Project Team (*PMBOK® Guide — Third Edition*, p. 209). Additionally, as the Project Manager leads and directs the project, the WBS guides Project Execution and provides the starting point for Change Management (Scope Management) and Quality Assurance. Beyond this, the WBS and WBS Dictionary provide a foundation and baseline for Action and Issue, Risk, Change, Budget/Financial and finally Earned Value Management (EVM).
- **Chapter 9** examines how the WBS and WBS Dictionary are used as the foundation for decision making regarding project Performance Management and the essential activities the Project Manager must address regarding Stakeholder Management.

In the last section of Part II, we have a single chapter that discusses project closeout and carefully examines the

activities the Project Manager must perform in order to successfully close, deliver and transition the completed project from the project team to the receiving organization or team. As in the Executing and Monitoring and Controlling project phases, this is a particularly active time for the WBS. Here it is used as a reference point to ensure all deliverables detailed in the WBS have been completed, delivered, accepted and turned over to the customer.

- **Chapter 10** includes a discussion of Scope Verification and Scope Management. These interactions within the project represent some of the most critically important activities of the project manager, program manager or leader, clearly articulating, communicating, reinforcing and protecting the boundaries established for the project. These boundaries are established through the Scope Statement, contracts and agreements that have been drafted and approved by the sponsor and key stakeholders. The WBS and WBS Dictionary are the key project documents/artifacts that represent these boundaries in a way that provides for the programmatic application of agreements within the project effort. This is the fundamental role of the WBS in a project management setting. Additionally in this chapter, we describe how customer acceptance criteria are referenced for each of the deliverables found in the WBS and described in the WBS Dictionary. Activities that signal completion are also included, such as training and warranty period coverage, support protocols, documentation turnover, contract closure, subcontract closure and formal sign-off and acknowledgment by the receiving organization.

The authors have included Part III of the book, “WBS for Project Management Decomposition,” to help project managers clearly communicate the process components

and outcomes that project managers routinely oversee during the performance of each project they lead. Though it is well understood that project managers perform an important, and perhaps critical, role in the delivery of projects, defining that role and the process deliverables associated with it has been a challenge for many. With this in mind, in Part III we discuss various ways of representing project management roles and deliverables that are an essential, often overlooked part of the project's work. Chapter 11 presents a focused discussion that describes various approaches for thoroughly and accurately representing project management in the WBS as an important component of the complete scope of the project.

- In **Chapter 11** we explain the origin of the WBS components we have included for Project Management and describe various approaches to the decomposition of the project management work present in nearly every project. In this chapter we provide a number of examples of the deliverables and outcomes that are seen as products of the project management process and share teachings about the best approach for specific projects. Most importantly, we have included two fully elaborated decompositions of the project management work as it is defined in The Project Management Institute's *PMBOK[®] Guide — Third Edition*. These two (complete) tables represent the views presented in the *PMBOK[®] Guide — Third Edition* and show the decomposition of project management deliverables by Process Group and by Knowledge Area as well. Your authors believe that the careful and accurate representation in the WBS of the project management work necessary to deliver a project is critical to the successful delivery of the

project itself, and have provided this chapter to help ease that process for you.

This book presents three important themes. First is the idea that the WBS *transitions* from a paper/planning exercise during Initiating and Planning phases of the project to an *action* and *work performance* management tool in Executing, Monitoring and Controlling, and Closing. The second key theme is that a significant transition occurs between the scope defined by the WBS and the task, activity and milestone lists that make up the start of project schedule development. The third theme presented is that Monitoring and Controlling occurs throughout a project, from Initiating through Closing, and it is not an isolated process that occurs following Execution.

This book brings together the collective experience of three veteran, battle-hardened program/project managers. We met initially as Project Management Institute volunteers, where we made up three quarters of the project core team for the development of PMI's *Practice Standard for Work Breakdown Structures* — Second Edition. Although each of us has been blessed with a variety of experiences leading large and small initiatives with budgets ranging from thousands of dollars to those in the tens of millions, we each had faced similar challenges and expressed similar concerns about the clarity and concreteness of Project Scope and objective statements and our ability to manage to specific defined deliverables, once the projects we had been chartered to deliver got under way. This book describes our methods for clarifying, addressing and resolving those challenges, and provides us an opportunity to share our successes and lessons learned — big and small, with you.

We would like to thank our spouses, children, pets, colleagues, partners and associates who have supported us during the development of this book for their unending

guidance, friendship, patience and love. Most importantly, one of our colleagues has had a significant impact on our writing — though he hasn't directly participated in the development of the book. We invoked his guidance and literate counsel as a regular part of our reviews and we are eternally grateful. George Ksander, we thank you for the countless contributions you've made to the quality of this effort. We would also like to extend a special thank you to Bob Argentieri and the folks at John Wiley & Sons, Inc for having faith in our vision — enough to encourage the development of the final product.

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Project Management Institute. 2004. *A Guide to the Project Management Body of Knowledge (PMBOK® Guide) — Third Edition*. Newtown Square, PA: Project Management Institute.

Project Management Institute. 2004. *Practice Standard for Work Breakdown Structures*. 2nd ed. Newtown Square, PA: Project Management Institute.

Foreword

The Work Breakdown Structure (WBS) is used as input for every other process of creating the schedule and the project budget. In that sense, the WBS is the foundation of the schedule and the budget as the foundation is for a house. If the foundation is weak the house will never be strong. It is hard to recover from a weak WBS. Needless to say, Eric and his team are focusing on a very important topic in this book. Rightfully they note that the available literature on this topic is thin. On the other hand, the WBS's we see in practice are often amazingly poor. This is not a paradox; the one explains the other perhaps. WBS's are an intuitive concept for some and an eternal mystery for others. It is time that some people wrap their mind around this issue. I think there is a real need for this book.

The book is like a handbook on how to implement *The Practice Standard for the WBS-2nd* Edition (published by PMI), another product of mostly this same team. These people were in fact so productive that the Practice Standard would have been a much thicker document were it not for the missive from PMI to keep the standard lean and mean. Not to worry, the team decided to simply publish all their brain products in this book as a separate publication.

The book builds entirely on top of the concepts in the PMBOK and the Practice Standard. It is valuable besides these standard documents in that:

- This book provides new processes that are the connecting dots between concepts explained on an abstract level in the standards. I liked for example the authors' new process of mapping out dependencies

between WBS-deliverables, which I think is an essential activity, particularly in large programs.

- This book provides new concepts. For example, the notion that monitoring and controlling occur during the entire project, not just during the PMBOK's '*Monitoring and Controlling*'. After all, who inspects the inspectors?
- This book provides new diagramming techniques. For example, the concept of defining relationships between scope elements cannot be found elsewhere. Other new things are the diagramming methods put forward by the authors: the *Scope Relationship Diagram* and the *Scope Dependency Plan*.

The authors take a courageous step by pushing the envelope for the betterment of our profession. I am personally very curious to see how these new processes, concepts and diagrams fare in the ocean of ideas and the often ferocious debates between thought leaders in our field.

There is no doubt in my mind that Eric Norman, Shelly Brotherton and Robert Fried have positioned themselves firmly in the category of project management thought leaders with this book. I encourage you to let them lead your mind for a few hours.

I hope you will enjoy reading this book as much as I did.

Eric Uyttewaal, PMP

Author of "Dynamic Scheduling with Microsoft Office Project 2003"

President of ProjectPro Corp.

Part I

Introduction To WBS Concepts

Chapter 1

Background and Key Concepts

“If you don’t know where you’re going,
any road will take you there”

Anon

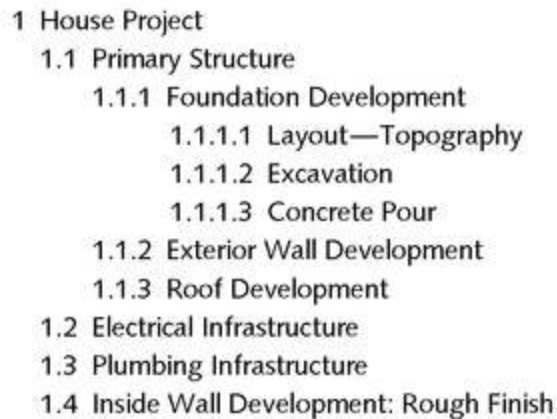
CHAPTER OVERVIEW

This chapter is placed up front not only because it is Chapter 1, but also because we wanted to provide background information for you before beginning the process of developing Work Breakdown Structures. This chapter introduces key concepts about the WBS that are discussed in much more detail later in the book, along with historic information about the emergence and evolution of the WBS over a number of decades. We also introduce the House metaphor.

The house what? The **House metaphor**. For our purposes, we will use the term metaphor here to mean a symbol or example that will represent how this concept can be applied in practice — although the example itself is fictitious. Actually, the House metaphor is a tool or rather, a section of a WBS from the construction of a house that we have developed for use throughout the book to help us illustrate our intended meaning — when words alone aren't enough to clarify and communicate key points or concepts. Following is an outline view of the House metaphor we will use, in one form or another, throughout the remainder of the text.

This metaphor is an important tool to cover at the beginning of the book because we will use it to describe, discuss and illuminate concepts throughout the text. We will use the House metaphor to illustrate examples, to provide a common, practical application of a topic or concept, and as a starting point for detailed examination of related topics.

Exhibit 1.1 House Metaphor — Outline Example



```
graph TD; 1[1 House Project] --> 1.1[1.1 Primary Structure]; 1.1 --> 1.1.1[1.1.1 Foundation Development]; 1.1.1 --> 1.1.1.1[1.1.1.1 Layout—Topography]; 1.1.1 --> 1.1.1.2[1.1.1.2 Excavation]; 1.1.1 --> 1.1.1.3[1.1.1.3 Concrete Pour]; 1.1 --> 1.1.2[1.1.2 Exterior Wall Development]; 1.1 --> 1.1.3[1.1.3 Roof Development]; 1 --> 1.2[1.2 Electrical Infrastructure]; 1 --> 1.3[1.3 Plumbing Infrastructure]; 1 --> 1.4[1.4 Inside Wall Development: Rough Finish];
```

1 House Project
1.1 Primary Structure
1.1.1 Foundation Development
1.1.1.1 Layout—Topography
1.1.1.2 Excavation
1.1.1.3 Concrete Pour
1.1.2 Exterior Wall Development
1.1.3 Roof Development
1.2 Electrical Infrastructure
1.3 Plumbing Infrastructure
1.4 Inside Wall Development: Rough Finish

At the highest level, this chapter will contain the following:

- A general description of the Work Breakdown Structure and its role in project management
- WBS background and history
- Key terms and definitions
- The House Metaphor

WORK BREAKDOWN STRUCTURES

Let us begin . . .

Work Breakdown Structures were first used by the U.S. Department of Defense for the development of missile systems as far back as the mid-1960s, and they have been a fundamental component of the Project Management lexicon for nearly as long. The concept of the WBS and the practices around its use were initially developed by the U.S. Department of Defense (DoD) and National Aeronautics and Space Administration (NASA) for the purpose of planning and controlling large acquisition projects whose objective was development and delivery of weapons or space systems (Cleland, Air University Review, 1964, p. 14). These projects

often involved many industrial contractors each with responsibility for separate components of the system and were managed by a central administrative office, either within a governmental agency or within one of the contracting firms which served as prime contractor. In this environment, the WBS was used to “. . . ensure that the total project is fully planned and that all derivative plans contribute directly to the desired objectives” (NASA, 1962).

The point is, that if true, and we assert right here that the statement is true, then the statement raises a question: “If the WBS is a fundamental building block for most projects, most of the time, then why are there so many conflicting viewpoints and approaches to development and use of Work Breakdown Structures?”

The answer to that question is somewhat elusive, and is one of the driving factors for writing this book. In the sections and chapters that follow we will examine various approaches to WBS development and will present a number of concepts, attributes, challenges and ultimately, recommendations for your consideration and use.

DEFINING WORK BREAKDOWN STRUCTURES

The *PMBOK[®] Guide* — Third Edition, defines a **Work Breakdown Structure** as “a deliverable-oriented hierarchical decomposition of the work to be executed by the project team to accomplish the project objectives and create the required deliverables. It organizes and defines the total scope of the project. Each descending level represents an increasingly detailed definition of the project work.” The WBS is decomposed into Work Packages. **Work Packages** are defined in two different ways in the *PMBOK[®] Guide* — Third Edition. In the text, Work Packages are said to

be the “lowest level in the WBS, and is the point at which the cost and schedule can be reliably estimated. The level of detail for Work Packages will vary with the size and complexity of the project. The **deliverable orientation** of the hierarchy includes both internal and external deliverables” (*PMBOK[®] Guide* — Third Edition, pp. 112, 114). Later in this chapter we provide the Work Package glossary definition for you.

There are a number of important concepts presented in this definition for the WBS. Of particular interest is the concept of deliverable orientation. The inclusion of these words is a key change from the definitions for the WBS in earlier editions of the *PMBOK[®] Guide* and reflects the expanded role the WBS performs in projects today. These changes are highlighted in [Table 1.1](#).

Today, the WBS is understood to be more than an organization of the work of the project. The current definition, with the inclusion of the deliverable orientation wording, indicates that the process of developing the WBS includes the definition and articulation of specific outcomes of the project—the end products and results. By doing so, it becomes a reference point for all future project activities.

[Table 1.1](#) WBS Definition — Changes by Version

(Sources: Project Management Institute, *The Project Management Body of Knowledge (PMBOK[®])*. PMI. Newtown Square: PA. 1987.; Project Management Institute, *A Guide to the Project Management Body of Knowledge (PMBOK[®] Guide)*. PMI. Newtown Square: PA. 1996.; Project Management Institute, *A Guide to the Project Management Body of Knowledge (PMBOK[®] Guide — Second Edition)* PMI. Newtown Square: PA. 2000.; Project Management Institute, *A Guide to the Project Management Body of Knowledge*

(*PMBOK*[®] *Guide* — Third Edition) PMI. Newtown Square: PA. 2004.)

The Project Management Body of Knowledge (<i>PMBOK</i> [®]) (1987)	A Guide to the Project Management Body of Knowledge (<i>PMBOK</i> [®] <i>Guide</i>) (1996)	A Guide to the Project Management Body of Knowledge (<i>PMBOK</i> [®] <i>Guide</i> —Second Edition) (2000)	A Guide to the Project Management Body of Knowledge (<i>PMBOK</i> [®] <i>Guide</i> —Third Edition) (2004)
A task-oriented 'family tree' of activities.	A deliverable-oriented grouping of project elements which organizes and defines the total scope of the project. Each descending level represents an increasingly detailed definition of a project component. Project components may be products or services.	A deliverable-oriented grouping of project elements which organizes and defines the total scope of the project. Each descending level represents an increasingly detailed definition of a project component. Project components may be products or services.	A deliverable-oriented hierarchical decomposition of the work to be executed by the project team to accomplish the project objectives and create the required deliverables. It organizes and defines the total scope of the project. Each descending level represents an increasingly detailed definition of the project work. The WBS is decomposed into work packages. The deliverable orientation of the hierarchy includes both internal and external deliverables.

This critically important concept will be expanded later in the book, but we want to point to this definition as a departure point for our writing as well as a point of reference for you. Deliverable orientation is one of the Core Characteristics for the WBS, which we will discuss in Chapter 2. It is a fundamental attribute that will allow your WBS to be more than “shelfware” for your project, and will enable it to perform a critical role as a baseline document for communication of scope and outcomes during the initial phases of your project. In later phases, the WBS performs an