9/20/13 MPUG LunchNLearn – Estimating Techniques and Building a WBS
Presented by: Larry Christofaro, EPM Solution Partners

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Questions /Contact Information

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Jason Rice's New Miracles
Jason Rice had 2 new additions to his family arrive last week. Congratulations to Jason and his family!!

Ethan James Rice, 19", 6 lbs

Seraphina Ann Rice, 19", 5.5 lbs

Agenda
- Definitions & Principles
- Levels of Estimates
- Estimating Techniques
- Building the WBS

Introduction
- <u>Audience</u>: Audience can include Project Managers, Program Managers, and those involved in managing projects & responsible for coordinating project estimates
- <u>What this Session Teaches</u>: Session provides insight on various project estimating techniques and how to turn results into an activity-based Work Breakdown Structure (WBS) for use with Microsoft Project
- <u>Caveat</u>: The terms & definitions in this presentation represent a summary of the many options and techniques available, and aren't intended as a single source of truth

Definition of an Estimate - Rule #1: Estimates are wrong
- An approximate calculation of quantity or degree of worth; "an estimate of what it would cost", "a rough idea how long it would take"
- Appraisal – a document appraising the value of something (as for insurance and taxation)
- Judge tentatively or form an estimate of quantities or time; "I estimate this chicken to weigh 3 pounds"
- A statement indicating the likely cost of some job
- A rough calculation or guess; a document (or verbal notification) specifying how much a job will probably cost; to calculate roughly, often from imperfect data
- A price given to a customer based on specifications provided by the customer. The price can change if the order specifications are not the same as the estimate specifications
- Estimation is a calculated approximation of a result – usable even if input data incomplete or uncertain

Principles & Best Practices (generic)
- We don't have an estimation problem; we have an estimating accuracy problem
- The resource doing the work should create the estimate
- Leverage historical data to "true" estimates
- Estimations are an art **and** a science. We unconsciously narrow our ranges when producing estimates.

Top-Down vs. Bottom-Up Estimates
- <u>Top-Down</u>: High level used to produce estimates quickly – used when a limited amount of detail is available. Can be comparison based, and used as a reasonability check for detailed estimates.
- <u>Bottom-Up</u>: Involves a significant level of detail – used when detailed estimates of effort and cost are required. Involves generating estimates of small units of work to build overall estimate, and used to determine project schedules and delivery times.

Precision vs. Accuracy - Rule #2: There are no facts about the future

- Precision: A measure of the detail in which a quantity is expressed
- Accuracy: Degree of closeness of a measured or calculated quantity to its actual (true) value. Accuracy is the degree of veracity while precision is the degree of reproducibility.
- Slings & Arrows: High accuracy but low precision – OR -- High precision but low accuracy
  - It's better to be accurate than precise
  - Using multiple levels of estimates & techniques will result in more accurate estimates

Getting Started: Define the Purpose of the Estimate

- Who is Requesting the Estimate: Executive, client, sponsor
- What is the Estimate Going to Be Used For: Annual plan, setting a budget
- What Degree of Accuracy is Needed: What needs to be estimated

What Needs to be Estimated? - Rule #3: It's the things you don't estimate that hurt you

- Scope: Define the boundaries of the project
- Effort: The time required in hours/days/etc. to deliver the agreed-upon scope
- Staffing: The number of people required to deliver the agreed-upon scope
- Schedule: Duration in time to deliver the agreed-upon scope
- Cost: Defines both the labor and non-labor costs of delivering the agreed-upon scope

What Does the PM Estimate?

What tends to get forgotten without PM oversight?

- Hardware acquisition (not necessarily cost of hardware), and ramp-up time for consultants & new hires
- Business events (signoffs, client communication, UAT, training)
- Project & Program Management, and PMO review
- Code freeze & deployment, and additional contingency (as agreed-upon with management)
- Transition to operations & process changes, closure, and feedback
- Risk (vacations, multiple locations, new technology) – Probability x Impact = Exposure

Common Causes of Misestimating

Need to apply risk & contingency when estimating. Common causes of misestimating include:

- Missing tasks, misread complexity, and ambiguity in requirements
- Optimistic assessment of productivity, and latencies (decisions, outgoing dependencies)
- Unknown (technology behaviors, use of tools, etc.)
- Lack of commitment/experience during estimating process

Levels of Estimates

1. Rough Order of Magnitude (ROM): Top down
2. Intermediate Estimating: Top down or bottom up
3. Definitive Estimating: Bottom up

ROM Estimating

Define the specifics around the scope:

- Provides a high level estimate, performed during project request/initiation
- Used for initial sizing and prioritization
- Designed for strategic planning, responding to "how big is the bread box".
- Used when higher range is acceptable or time does not permit more detailed estimates
- Can provide a confidence level in the range of +-50 to +-100% range

Intermediate Estimating

You can start understanding how your estimate fits when you get into the project:

- Used to define a preliminary plan
- Provides an estimate of work & initial budget
- Used to support a preliminary plan that does not require precise estimating
- Can include rolling wave estimating (more detailed estimates in the beginning of the project)
- Can provide a confidence level in the range of +-25 to +-50% range
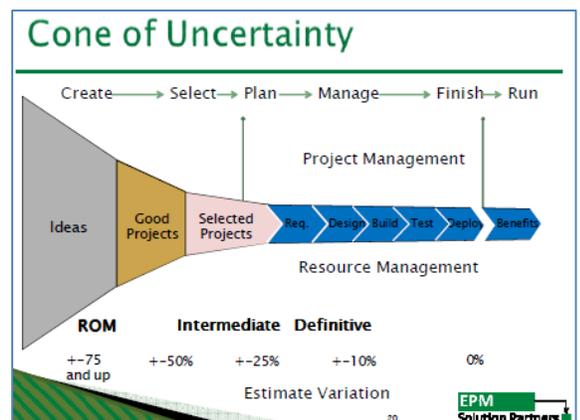
Definitive Estimating

- Describes and outlines project schedule, assignments & cost
- Used to develop precise estimates needed to tactically manage and complete a project
- Used to commit to as a project baseline
- Can provide a confidence level in the range of +-10 to +-25% range

Cone of Uncertainty

Weather maps are a cone of uncertainty, and so are Ideas to Projects that can have a confidence level that ranges from +-75 to 0%.

Estimating Techniques - Rule #4: There is no silver bullet

- Analogous Estimating
- Parametric Estimating
- PERT Estimating
- Function Point Analysis

Analogous Estimating (also known as Expert Judgment) - Rule #5: Individual results may vary

- Apply expert judgment and decide on an estimate
- Can be used for ROM or Intermediate estimates
  - o Some forms used for definitive estimates
  - o The difference is the level of detail that is estimated
- Make sure you document assumptions

Modified Forms of Analogous Estimating

- Delphi Estimating: Uses a group of SME's who develop estimates independently, discuss differences and assumptions, and go through one or more revision cycles
- Rock/Scissors/Paper (RSP): Common in Agile development – estimates are represented by a set of five options (2, 4, 8, 16, 32 hours)
- Planning Poker: Another Agile technique. Similar to RSP except for using a set of cards (0,1,2,3,5,8,13,20,40) – numbers can be complexity points or hours.

Parametric Estimating - Rule #6: History repeats itself

Parametric Estimating uses a statistical relationship between historical data and other variables to calculate an estimate. Standard relationships should always be reviewed to determine fit for specific areas:

- Construction: Estimating activity durations by dividing quantity of work by productivity rate. Example – cost of building wall based on the time it takes to build 10 feet.
- Software Development: Estimating line of code. Can be used to estimate remaining phases based on a single phase estimate.

Software Development Estimating Percentages & Example

Review the hours spent on prior plans – and take the norms into consideration. Past information can be used as guidelines. Assign hours to tasks, calc % to total, and compare to your standard to double-check numbers:

Phase	One man's view	Waterfall	Iterative
Initiation	3		
Requirements	12	5	10
Design	12	10	15
Build	32	30	25
Test	16	40	25
Train	4		
Deploy	6	5	5
Environment		5	10
Project Mgmt	15	5	10

	Task Name	Work
0	Demo 3 - Invoice schedule	4,834 h
1	Initiation	34.5 h
2	Initial Project Planning and Estimation	15 h
3	Project Plan and Documentation	8 h
4	Create Kick-Off Materials	5 h
5	Project Kick-Off Meeting	2.5 h
6	Initial Project Plan Definition	4 h
7	Business Requirements	27.5 h
8	Develop Scope and Business Requirements	27.5 h
9	Obtain Sign-Off of Scope and Business Requirem	0 h
10	Design and Engineering	781.75 h
11	Functional Design Creation	203.5 h
12	Obtain Sign-Off of Functional Design	1 h
13	Refine Initial Project Estimate - Finalized time, r	6.5 h
14	Obtain Approval on Revised Project Estimate	1 h
15	Create Technical Design document	503.5 h
16	Technical design signoff	0.25 h
17	Design reports	66 h
18	Design and engineering complete	0 h
19	Development and construction	2,220.75 h
20	Technical development support	270.5 h
21	Pre-development	383 h
22	R1 Development	289 h
23	R1 Development - 10 Days	76 h
24	R1 Development - MSPS SME Support	18 h
25	Database and deployment prep	181.5 h
26	Build invoicing bridge schema	90 h
27	Build deployment scripts	55.5 h
28	Build database triggers	36 h
29	Database and deployment complete	0 h

PERT Estimating

The PERT estimating tool that was a Project 2007 template is no longer available in MS Project. Note: Excel works better for values/hours, but Project works better with dates/schedule:

- Also known as the Three Point estimate
- Involves a process that includes 3 variations of estimates
  - Most optimistic
  - Most likely
  - Most pessimistic
- Typical formula (Pessimistic + (4 * likely) + Optimistic) / 6
- Allows for risk factors to be incorporated into the estimate
- Works well for high risk projects, and good use to test estimate ranges

Function Point Analysis

History is the key to estimating projects – have to keep actuals to be able to use them:

- Calculates a complexity (function points) and converts that to effort based on industry or organizational metrics
- Quantifies the functionality required by the system to the customer
- Uses 5 weighted variables
  - External inputs
  - External outputs
  - Logical internal tables
  - External queries
  - External interfaces
- Provides good "on the spot" estimates

Estimating Levels

Comparing Techniques

For more detailed estimates like PERT, you may want to do the estimates on the riskiest tasks. There are tools you can purchase to assist with estimating and probability.

Comparing Techniques
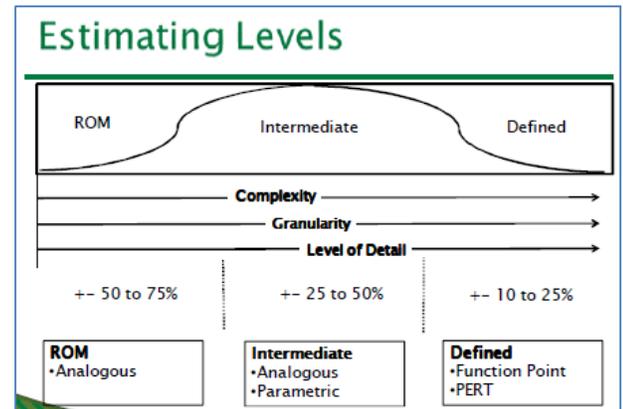
Techniques	Strengths	Weaknesses
Analogous	•Easy to use •Adds confidence of estimating results	•Similar project not always available
Parametric	•Provides detail without estimating entire project	•Requires historical metrics •Requires knowledge of project differences to the norm
Function Point	•Provides good "on the spot" estimates	•Requires expertise on conversion factor
PERT	•Good for high risk projects •Provides estimate ranges	•Can be time consuming

Demo – What Estimating Technique Was Used?
- Landscaping Plan / Parametric Estimating: Divided a landscaping project plan into pieces, did one piece of the work and then estimated the rest – used Parametric Estimating.
- Portfolio Process Design / Analogous Estimating: Look at different processes (simple, medium or complex), add hours/totals – based on what you want done/expert judgment – used Analogous Estimating.

What is a Work Breakdown Structure (WBS)?
A WBS reflects the total scope of the work for the project:
- WBS is **NOT**: Organizational hierarchy, strategy map, task list, project plan, project schedule or dates
- WBS is Input: WBS is used as inputs to cost estimating and the project schedule

Building the WBS - Rule #7: Predictable life cycle yields predictable estimates
The Work Breakdown Structure (WBS) needs to reflect how you want to do your work:
- What do you do once the estimates are complete
- What estimates don't always provide
  - Estimates don't always end with a plan of activities
  - Some estimates are too detailed for tracking
  - Estimates are not in a logical activity sequence
- Structure work into a deliverable/activity-based WBS
  - Activities should support the set of project deliverables
- The lowest level of the WBS is a work package
  - A work package is a unique set of work that can be handed off to a resource for completion
  - Produces a measurable deliverable

PPM Estimate Plan Example
You can use Excel to estimate – include each function & ask Developers to add hours needed to design, code, and unit-test. Lowest level of detail may not be what you want in the project plan:
- Rollup Detail: Can rollup detail into a set of tasks. If one person is going to do the tasks then you don't need to itemize them in the project plan – there will be other docs that will be used in the project.
- Streamline Tasks: Put the resource's hat on when creating the plan tasks – streamline tasks so you don't make extra work to report actual hours
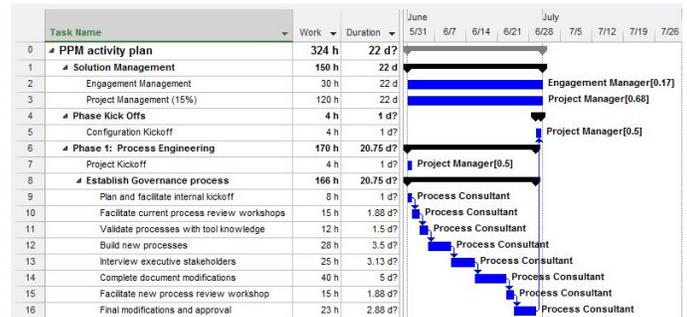
WBS Level of Detail Theories
There are many WBS level of detail theories, but it ultimately depends on the project:
- Hand-Offs: Make sure your departments are coordinated so that the task hand-offs happen as they should – resources need to understand the timing/schedule.
- Overall Schedule: PM's job in building the schedule is to make sure the team knows what's coming up, and that they're getting their activities done – you need to keep the overall schedule in mind.
- Summarized Detail/Assigned Tasks: Understand that even if estimates are done at a low level, that lowest level detail can be summarized into the plan's assigned tasks.

WBS Level of Detail Theories
- 1%–10% rule
  - Forecast Scheduling with Microsoft Project 2010, Eric Uyttewall
- 8–80 hours
  - The Missing Manual, Bonnie Biafore
- 8–40 hours
- No more than n number of tasks per resource per reporting period
- No longer than a reporting period
  - Define an Update Methodology, Andrew Lavinsky
- < 2 times the update cycle preferred (not > 3 times)
  - PMI
- Some maximum number of hours