

Cost Estimation of Software Projects

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Unisys

Estimation does not have to be like this!



Measurement and Estimation of Software and Software Processes, Ph. D. thesis, S. Moser, University of Berne, Switzerland

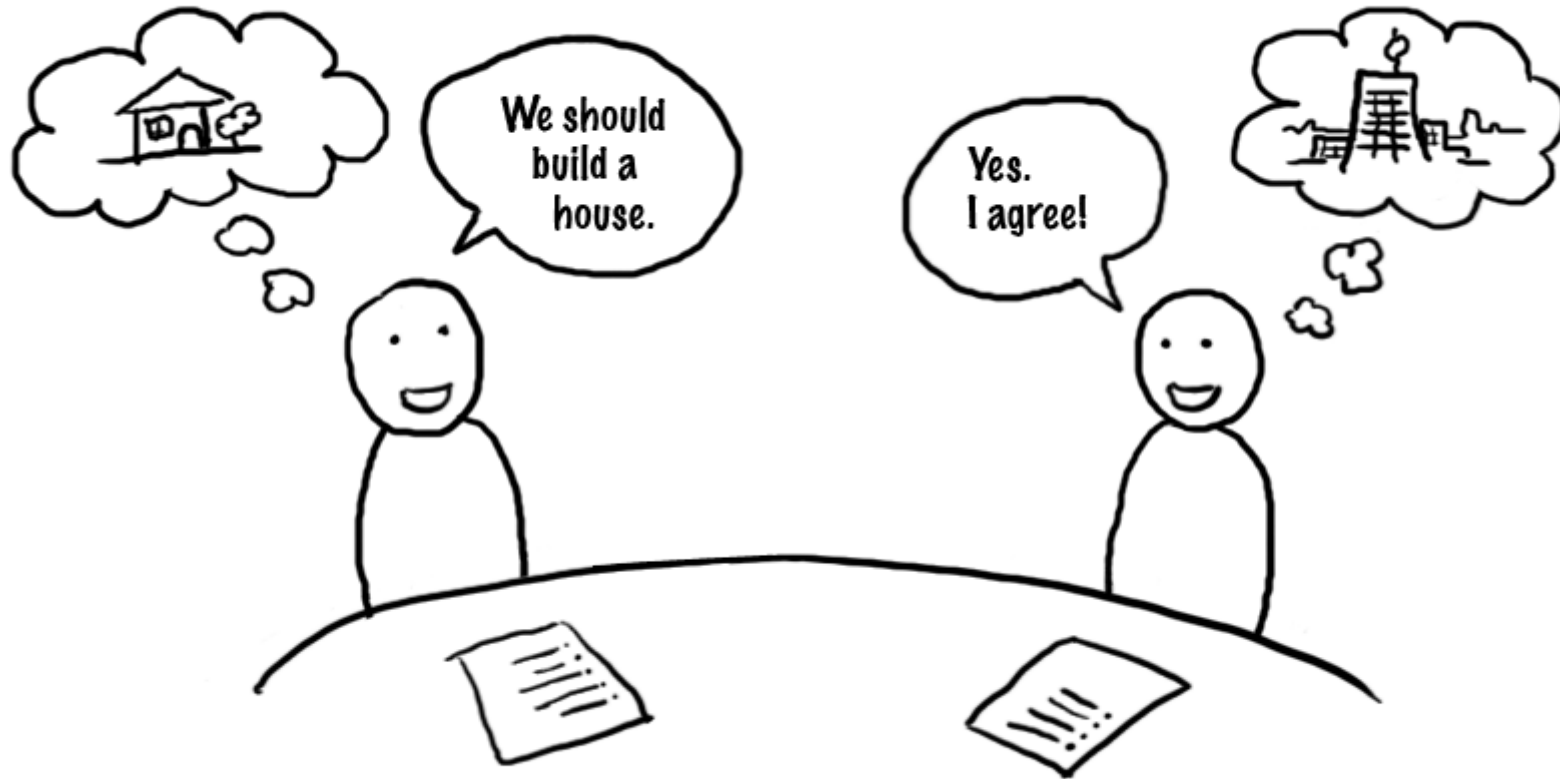
Overview

- Introduction
- Estimate Techniques
- Linear WBS Elements
- Non-linear WBS Elements
- Non-linear Estimation
- Conclusion

Introduction

- Software development estimates consist of a hybrid WBS
 - Linear and non-linear WBS elements
 - Software development effort varies non-linearly with time
- Linear work packages may be estimated using traditional techniques
- Non-linear work packages best practices use cost estimation tools

Estimation Techniques - Define Scope



Ryan Singer http://www.37signals.com/svn/archives2/illusion_of_agreement.php

Estimation Techniques - Types

- Top down estimation requires
 - A model based cost estimation tool
 - Measure of volume
 - Input for languages
 - Environment parameters
- Bottom up estimation requires
 - A detailed WBS
 - Estimates for each lowest element of WBS

Linear WBS Elements

- Examples are Workshops, Business Models, Deployment, Training, Roll-out, Warranty
- Develop detailed WBS
- Estimate each element (Delphi Technique)
- Roll-up

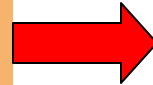
Non-linear WBS Elements

- Use a tool for top down estimate
 - Parametric
 - Model based
- Use bottom up estimate for validation

Note: Estimation tools may also estimate some linear WBS elements such as deployment effort

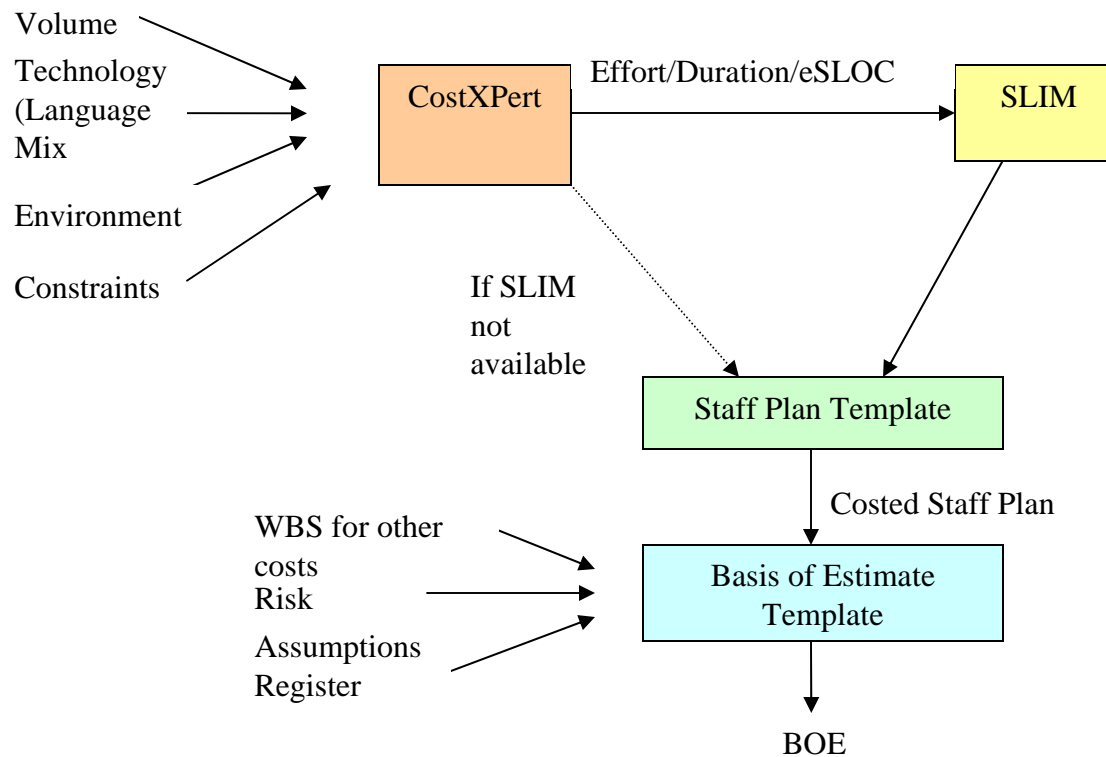
Non-Linear Estimation

- Scope
 - Requirements List
 - Visual Use Case Model (optional)
 - Volume Metric such as use case scenarios or function points
- Development Environment
- Tools & Technology
- Assumptions Register
- Constraints Register



- Overall Estimate
- Risk Register
- Estimate WBS

Non-Linear Estimation - Flow



Sample Output

Cost Xpert 3.3 Personal Edition

File Edit Reports Maintain Wizards Tools Help

Project | Volume | Environment | Constraints | Results

Method	Effort (PM)	Schedule (mth)
<input type="checkbox"/> SLOC	0.0	0.0
<input type="checkbox"/> 1-Function Points	0.0	0.0
<input type="checkbox"/> 2-Internet Points	0.0	0.0
<input type="checkbox"/> 3-Domino Points	0.0	0.0
<input checked="" type="checkbox"/> 4-UML Use-Case Pts	827.2	35.4
<input type="checkbox"/> 5-UML Class Method	0.0	0.0
<input type="checkbox"/> 6-MK II Function Pts	0.0	0.0
<input type="checkbox"/> 7-Object Metrics	0.0	0.0
<input type="checkbox"/> 8-GUI Metrics	0.0	0.0
<input type="checkbox"/> 9-Feature Points	0.0	0.0
<input type="checkbox"/> Capability Requirements	0.0	0.0
<input type="checkbox"/> Bottom Up	0.0	0.0

Labor Distribution Costs				Summary: Effort, Schedule and Cost	
Strategist	\$0.00	Test/QA	\$24,323.19	Effort (Person-Months)	827.2
Analyst	\$7,353.59	Copywriter	\$0.00	Schedule (Months)	35.4
Designer	\$29,068.57	Art & Media	\$0.00	Sub-Total	\$128,214.76
Programmer	\$54,031.02	Management	\$13,438.39	Wage Inflation (Schedule>12)	\$0.00
				System Integration Cost	\$0.00
				Final Cost	\$128,214.76

Summary | WBS | Risks | Labor | Maintenance | Deliverables

FSS19 v2 05Apr06 Effort: 827.2 Pers-Mth Schedule: 35.4 Months Cost: \$128,214.76

Sample WBS

W O R K B R E A K D O W N S T R U C T U R E - R A P I D S R T
 <CP80% RAPIDS RT 15Sep05 Comp75% >

WBS Tasks:

Task	Start Date	End Date	Duration (Mos.)	Effort (PHR)	Avg Staff (people)
Phase 2: Reqts & Design	10/17/2005	12/16/2005	2.00	1,090	3.5
Analysis/Software Requirements	10/17/2005	11/10/2005	0.82	436	3.4
Conduct needs analysis	10/17/2005	10/27/2005	0.35	174	3.2
Draft preliminary software specifications	10/27/2005	11/2/2005	0.23	87	2.5
Develop preliminary budget	11/2/2005	11/3/2005	0.07	65	6.3
Review/refine s/w specifications/budget ...	11/3/2005	11/5/2005	0.10	44	2.8
Develop delivery timeline	11/5/2005	11/10/2005	0.20	65	2.1
Design	11/10/2005	12/16/2005	1.22	654	3.5
Review preliminary software specifications	11/10/2005	11/21/2005	0.40	65	1.1
Develop functional specs/high level design	11/12/2005	12/1/2005	0.67	262	2.5
Develop prototype based on functionals...	11/28/2005	12/9/2005	0.39	262	4.3
Final verification functional specifications	12/9/2005	12/16/2005	0.26	65	1.6
Phase 3: Construct & Test	11/23/2005	3/4/2006	3.40	3,878	7.4
Development	11/23/2005	1/20/2006	1.91	1,745	5.9
Detailed Design	11/23/2005	12/28/2005	1.17	175	1.0
Develop code	12/16/2005	1/8/2006	0.77	785	6.5
Perform developer unit testing	12/28/2005	1/20/2006	0.77	785	6.5
System Testing	12/18/2005	3/1/2006	2.48	1,551	4.0
Develop test plans	12/18/2005	2/3/2006	1.56	310	1.3
Perform system integration testing	1/13/2006	2/17/2006	1.22	1,008	5.3
Perform system acceptance testing	2/17/2006	3/1/2006	0.46	233	3.3
Documentation	2/12/2006	3/4/2006	0.74	388	3.4
Develop and review help system	2/12/2006	2/28/2006	0.61	233	2.5
Develop and review user manuals	2/18/2006	3/4/2006	0.52	155	1.9
Pilot/Training	2/27/2006	3/4/2006	0.20	194	6.2

Milestones:

Milestone ID	Milestone Acronym	Milestone	Date	Months From Project Start*
2	LA	ELA B Lifecycle Architecture	12/16/2005	2.00
3	IOC	CONS Initial Oper Capability	3/4/2006	4.61

Conclusion

- Software projects estimation is challenging
- Scalability of work is non-linear
 - Group Intercommunication Formula
 - Shorter duration requires more effort
- Split WBS
 - Linear
 - Non-Linear – use model based tools