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2000407113
Establishing a Software Cost Estimating Process

Society for Software Quality
Washington DC Area Chapter
RoundTable - 24 January 2000

Robert Chin
Naval Air Warfare Center - Aircraft Division
Software Engineering Division, Code 4.1.K
Patuxent River, MD 20670
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Presentation Outline

• Introduction
• Working Group Plan
• Where are we? - A Survey
• Developing a Process
• What’s Next? - Miles to Go
Introduction

- Many software-intensive programs are experiencing cost and schedule over-runs
- The senior leadership believes that poor software cost estimates are a major contributor
- A Software Cost Estimating Working Group was chartered in February 1999 to establish a formal process to develop credible estimates
Working Group Plan

- A relatively short timeframe and a shoestring budget (part-time personnel/local travel only) dictated our approach
- Seek and sort out best practices to incorporate into process
- Identify the tools, data and documents to support the process
- Working group composition
  - Electronics / Software Engineers
  - Cost Analysts / Industrial Engineers / Operations Research Analysts
  - Advisory Group (Software and Cost Managers)
Where are we? - A Survey

- To determine how projects are developing software cost estimates. We asked about:
  - Software effort type (i.e., Concept Exploration, System Development, System Enhancement, Corrective Maintenance)
  - Sizing techniques used
  - Effort/Cost and schedule techniques used
  - Level of satisfaction with cost estimating techniques
  - Project characteristics (e.g., application domain, software size, language(s), SEI-CMM level of developer/maintainer)
Where are we? - A Survey

- Ground Rules
  - All survey participants (projects and individuals) shall remain anonymous outside the core Working Group members
  - No attribution of survey responses
Where are we? - Survey Results

- Survey Project Characteristics
  - Total Lines of Code ranged from 4,000 - 1,500,000 for
    25 projects
  - Programming Languages: Ada, Fortran, C, C++,
    Assembly Language, PL/1, Pascal, Microcode
  - Application Domain: Mission Computer, Navigation,
    Flight Control, Communications, Mission Planning,
    Test Software, Weapons Targeting and Control, and
    Display Processing
Where are we? - Survey Results

- Most projects do not have a formally documented process for estimating software costs (3 of 25 projects)
- Projects that maintain a historical data base of completed and on-going software efforts produce the best estimates
- Training to perform software cost and schedule estimates is lacking
- Most projects lack historical data to perform software cost estimates, but are beginning to collect historical data
- Estimating software size is the most critical and least well performed activity
Where are we? - Survey Results

- Changes (e.g., requirements, schedule, funding, facility resources, etc.) during project execution often render initial estimates obsolete.

- Sizing techniques that worked best are: Analogy, Expert Judgement (i.e., Delphi Technique) and Decomposition

- Effort/schedule estimating techniques that worked best are: Analogy, Decomposition and Expert Judgement
  - Suspect that parametric models did not produce better results due to lack of historical data to calibrate models
Developing a Process - Approach

• The working group developed a process framework that projects/organizations tailor to meet their need because "One size does not fit all".
• The role and activities of each organization involved in developing an estimate was described in a deployment flowchart and companion description document.
  – Describes "what" needs to be done.
• An estimating guide was developed to specify the "how to" part of the process.
  – For the folks who will be developing estimates
Developing a Process - Working Group Interaction

- Although English was everyone’s primary language we had to learn each others “software” and “cost” dialects
  - Cost folk’s experience was primarily with hardware
- Drawing pictures (i.e., process flowchart) and writing things down (process description document & guidebook) helped communication
Developing a Process - Expectation Control

- Some managers understood that it would take literally years of collecting and analyzing actual data to gradually improve estimates.
- However, other managers were seeking a Silver Bullet.
- Improving software estimates is an evolutionary process.
- Software estimate is only one of several contributors to cost and schedule over-runs.
What’s next? - Miles to go

- Develop training materials to implement the process
- Software estimating process needs to be tested
  - Pilot project with two independent estimating teams
- Provide training, tools and collect estimate vs. actual data to support the process
- Establish a measurement and analysis program to assess process performance and provide feedback for process improvement
- Integrate the software estimating process with on-going corporate Software Business Process Re-engineering initiatives (i.e., reach Software Engineering Institute Capability Maturity Model Level 5)
Lessons Learned

• Assign a staff with a dedicated number of hours per week authorized by management in writing. Do not assign as a collateral duty.

• Clearly define the scope and document your plan
  – Disseminate widely to manage expectations early

• If you do a survey, keep it short. Responses should not require a lot of “leg-work” or research
  – You can always follow-up for more info
  – Do surveys verbally, but give folks a heads-up

• Verify quality of materials/data sources before incorporating it into your plan
Lessons Learned

- The 20/80 percent rule is true (i.e., 20% of the people do 80% of the work)
- Do what you can with the resources (i.e., funding) you are given, you will never get what you need
  - leverage, leverage, leverage
- Put yourself in the user’s shoes, keep things as simple as possible to facilitate understanding
- Think twice, speak once
Back-Up Materials
Software Cost Estimating Process

Inputs
- Project Information (e.g., MNS, ORD, System & SW Specs, Change/Problem Reports, etc.)
- Local Project Specific Historical Data Base

PMA / Project Engineer / ASPO / Class Desk
- P1. Request for Software Cost and Schedule Estimate

Software (SW) Engineering Division 4.5.7
- S1. Establish Project Need with Customer
- S2. Identify available project data.
- S3. Develop Effort and Schedule Estimating Strategy
- S4. Collect & Analyze Data for Size and Effort /Schedule Techniques

Cost Department 4.2
- C1. Establish Project Need with Customer
- C2. Establish Cost Technical and Programmatic Baseline
- C3. Identify/ Request Baseline Parameters
- C4. Collect & Evaluate Baseline Parameters
- C5. Develop Cost Estimate

Outputs or Products

Updated: 6/17/99
Software Cost Estimating Process

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*Naval Center for Cost Analysis

**Process Diagram**

- **A**: S5. Apply Sizing techniques
- **B**: C6. Develop Cost Estimating Approach
- **C**: C7. Collect/Analyze Cost, Technical & Programmatic Data
- **D**: C8. Develop/Refine Cost model
- **E**: C9. Execute Model