Initial Experiences in Software Process Modeling

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Agenda

- Introduction and Overview
- Selected Model Descriptions
- Demonstrations
- Lessons Learned and Future Work
Introduction

- Litton GCS has used process modeling in the areas of managerial training, project and organizational modeling
- Using system dynamics to create mostly small-scale models
- SEPG is responsible for organizational analysis and training, and develops the models
- Many of these efforts are in the early stages.

Process Maturity

- GCS is SEI-certified at CMM Level 4
- Process simulation is being used to support continued improvements
- Existing process performance baselines provide leverage in developing and calibrating meaningful simulation models
Overview of Models

- Project level models
  - planning of specific projects
  - Brooks' Law and hiring issues
  - earned value model
  - requirements volatility
  - detailed (peer review) walkthrough model

- Multi-project or departmental level models
  - domain learning
  - product-line reuse processes
  - resource contention among projects

Overview of Models (cont.)

- Training applications
  - earned value techniques
  - productivity estimation
  - requirements volatility effects
  - extrapolation of project tracking indicators
  - project control

- Some of these are interactive “flight training” simulations
Characterization of Case Studies

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<th>Process</th>
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Earned Value Model

[Diagram of Earned Value Model]

UI Union

Gain and Control

Integrated Product Delivery

Earned Value Model
Brooks’s Law Model

Basic model assumptions:
- New personnel require training by experienced personnel to come up to speed
- More people on a project entail more communication overhead
- Experienced personnel are more productive than new personnel, on average

Project Planning and Control

- Using pilot to raise the visibility of certain planning issues and to monitor the project
- Major model elements
  - Incremental development
    - Incremental COCOMO staffing profile translated into manpower addition and transfer rates
  - Brooks’ Law effects
  - Hiring delays
  - Earned value
  - Requirements volatility
Peer Review Model

- An inspection model has been modified for other types of peer reviews, particularly walkthroughs
- Basic calibration parameters
  - nominal productivity
  - review efficiency
  - design defect density
  - code defect density
  - average design defect amplification
- Project specific parameters
  - job size
  - COCOMO effort parameter
  - schedule constraint
- Management decision parameters
  - design walkthrough practice (percent of design packages reviewed)
  - code walkthrough practice (percent of code reviewed)
Core Software Reuse Study

- A product-line reuse model is being developed to analyze the dynamics of reusing software shared among many projects
- **Problem statement**: product-line reuse is a major risk item
  - planned reuse levels are rarely met on a project
  - economics not well-known
  - large impact due to side effects of changes
  - the half-life of reuse components is usually underestimated
- A core software library is shared among projects within a specific product line
  - over a dozen projects use the core reuse library simultaneously
  - changes to the core by one project often adversely affect other projects, since side effects create new problems that often lead to cost and schedule overruns.
- The reuse process is currently being instrumented in order to parameterize the model
Lessons Learned

- Simulation enables sharing of a process vision and discussion against common models
  - Focused studies on common issues and problems have improved our management vision and actions
  - Helps managers understand the key factors in complex scenarios
  - Improves planning and management processes
- Even small models are highly valuable for providing insight into dynamic trends
  - Smaller is often better
- Simulation supports both organizational and individual learning
- Advantages to using simulation in the classroom vs. traditional methods
  - Impart information in a more meaningful and dynamic way
  - Live demonstrations keep up student interest
  - Hands-on interactivity serves to drill in the learning experience

Future Work

- Complete studies in progress
- Continue integrating simulation into process improvement initiatives
  - Raise visibility with management and identify advantages of simulation
  - Spread results to rest of organization
  - Per Barry Richmond: "10% of the organization should model, the other 90% use the models"
- Plan for model evolution
- Document the modeling process and lessons learned