Measurement of Requirements: A Case Study

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Vision (Hallucination?)

- Be able to predict size and cost of systems that use COTS products, existing artifacts from a reuse library, and new software, in a changing technology environment with some real-time and mission-critical characteristics.
A Little History

- C, C++, GUI tools, reusable core of in-house software, COTS
- High levels of reuse (>90% in one project), often low savings.

Many original assumptions are invalid:

- Proprietary communications network (NASCOM) is necessary
- No COTS solutions work well in this domain
Problem is early in Life Cycle

- Must incorporate reusable components, COTS into process at requirements or design level
- Must have flexible development process
- Requirements are traditional, functionally specified
Options for Landsat-7 Ground Control System

- Use existing Requirements Generation System – 93.3% of cost of new
- Map requirements to COTS, reusable components – 6.4% of cost of new
- Rewrite requirements, describe using function points – 18.6% of cost of new
- Incorporate reuse into function points
Rewrite requirements, function points, reuse

- Perform a function point analysis of existing system requirements.
- While doing this, map each set of function points to a revised requirement.
- Compare revised requirements to those of components.
- Perform function point analysis of identified components
Process requires considerable domain knowledge.

Organization and assessment of components is called domain analysis, a major technique in the reuse community.

Easier to evaluate each needed component than to evaluate each component in reuse library.
Requirements, function points - Reuse-based cost models

- Must-be life-cycle based
- Must be related to the organization’s cost estimation process
- Must reflect life cycle phase where reuse occurs
- Must reflect percentage of artifacts reused and reuse level
Reuse Levels

- Transported (verbatim) reuse
- Converted reuse (1-25% changed)
- Adapted reuse (25-50 % changed)
- New (more than 50% changed)
Cost = cost to develop reqs, design
+ sum over all modules of
  \{\text{reuse level} \times \text{cost of code, integration, maint.}\}
+ cost to purchase COTS
+ special maintenance costs
+\ldots + 12.5\% \text{ reuse overhead}
Results

- Three distinct function point counts used
- Cost estimates of 27.1%, 32.9%, 45.5% of cost of new development
- Range of values is within acceptable limits
- Actual costs in 30% range
Recommendation

- Pick a standard for function point counting and use it
- Use reuse-based cost model for estimation with COTS or reuse library
- Next step - larger baseline
- Share data