Building a Measurement Information Model in Support of Diverse Organizations

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Presentation Overview

- About pragma Systems and processMax
- CMMI Measurement requirements & challenges
- ISO 15939 Measurement Information Model
- Implementation Approach
- Summary
• Founded 1990
• One of the first organizations licensed by SEI to perform assessments
• Software Process Improvement consulting and assessments for seven years
• First release of processMax in 1998
## Some of Our Customers

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<tr>
<th>Government</th>
<th>Government Contractor</th>
<th>Commercial</th>
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<tr>
<td>U.S. Navy</td>
<td>Northrop Grumman</td>
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<td>U.S. Army</td>
<td>General Dynamics</td>
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<td>National Institutes of Health</td>
<td>L3 Communications</td>
<td>Chicago Mercantile Exchange</td>
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More than 50 successful independent assessments or appraisals
Defined Processes

... includes all policies, procedures, guidelines, criteria, templates, and forms in role-based, step-by-step instructions, ready for use.

... fully compliant with the Capability Maturity Model® for Software (SW-CMM) or Capability Maturity Model Integration (CMMI).

Project Repository

... total document management with version control, change control, and process history.

Integrated Workflow

... automatic e-mail notification of tasking and actions
ProcessMax
Organization–Project Structure

Organizational Portal

- Organizational Programs Roles
- Templates
- Guidelines
- Criteria, Methods, Forms
- Plans, Reports, Data, Memos
- Organizational Training Materials
- Organizational Training Records
- Organizational Library of Project Examples
- Organizational Library of Project Data
- Organizational Policies

Measurement Repository

Instantiate Organization’s Standard Software Project Process for software development or maintenance projects

Formal Feedback Mechanisms

Project 1 Portal

- Project 1’s personnel use this website

Project N Portal

- Project N’s personnel use this website

Organization’s Standard Software Project Process
- Project Management Roles
- Project Technical Roles
- Templates
- Guidelines
- Criteria
- Methods
- Forms
SW-CMM:

- Measurement is decentralized and focused on satisfying individual KPAs

CMMI:

- Focus on measurement – “no longer in the fine print”
- Early emphasis at Maturity level 2 – M&A Process Area
- Other process areas (OPD, OPP, OPM, CAR, OID) have significant measurement content
- Also Generic Practices 2.8, 3.2, 4.1, 4.2, 5.1, 5.2
CMMI: ponderous and complex for appraisers, engineers, and managers

There are approximately 200 detailed measure-related requirements for Maturity Level 3 and another 60 for Maturity Levels 4 & 5.
Measurement & Analysis
(a Level 2 Process Area)

Align Measurement Activities

Establish Measurement Objectives → Specify Measures → Specify Data Collection Procedures → Specify Analysis Procedures

Measurement Plan

Measurement Indicators

Measurement Repository

Procedures, Tools

Provide Results

Communicate Results → Store Data & Results → Analyze Data → Collect Data

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Challenges

- Collecting data is very onerous and error prone
- CMMI more explicitly requires measurements, especially of process-oriented activities
- How to support large number of measures implied by the CMMI in a consistent way
- Diversity of target organizations – project types and size
- Need for customizability
- Measurement collection must be integrated with day-to-day work
Typical Situation

Process

Data

Tools

Measures
Why ISO IEC 15939 Standard?

- Robust ISO model meets CMMI requirements and ensures consistency across Process Areas.
- ISO Measurement Information Model (MIM) provides “structure linking information needs to the relevant entities and attributes of concern”
- Base Measures are mapped to processMax data entities
- Derived Measures are calculated from Base Measures
- Indicators are created from Base or Derived Measures to support Information Needs.
Key Relationships in MIM

Information needs

- Information Product
  - The outcome of the measurement process that satisfies the information needs

- Interpretation
  - Explanation relating the quantitative information in the indicator to the information needs in the language of the measurement users

- Indicator
  - Variable assigned a value by applying the analysis model to base and/or derived measures

- (analysis) Model
  - Algorithm for combining measures and decision criteria

- Derived Measure
  - Variable assigned a value by applying the measurement function to two or more base measures

- Derived Measure
  - Variable assigned a value by applying the analysis model to base and/or derived measures

- Base Measure
  - Algorithm for combining two or more base measures

- Base Measure
  - Variable assigned a value by applying the method to one attribute

- Measurement Method
  - Operations mapping an attribute to a scale

- Attribute
  - Property relevant to information needs

- Entity
  - Measureable Concept

- Attribute
  - Property relevant to information needs

- Measurement
  - Variable assigned a value by applying the analysis model to base and/or derived measures

- Measurement Function
  - Algorithm for combining measures and decision criteria

- Derived Measure
  - Variable assigned a value by applying the measurement function to two or more base measures

- Base Measure
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- Measurement Method
  - Operations mapping an attribute to a scale

- Attribute
  - Property relevant to information needs

- Information needs

- Entity

© ISO/IEC 2002
• Measurement Objectives – 18
  – Approximately equivalent to the Purpose section of each Process Area. They answer ‘Why are we measuring these particulars items?’ A Measurement Objective is associated with one or more Information Needs.

• Information Needs – 23
  – Correspond approximately to PMC SP 1.1 and GP 2.8 of each Process Area. An Information Need is associated with one or more Indicators, Derived Measures, and/or Base Measures.

• Indicators – 75
  – Trend or snapshots relying on Derived Measures and/or Base Measures

• Derived Measures – 35
  – Algorithms, programmed inside a report, relying on one or more Base Measures or other Derived Measures.

• Base Measures – 102
  – Defines what is to be measured, its source, when it is to be measured, how (i.e., count or record) it is to be measured, and data constraints, such as default values.
Information Need #4 Monitor project planning parameters

- Supported by ten indicators
- Example Indicator: Trend of planned versus actual schedule for tracked tasks and milestones
  - Derived Measure 44 Total date variance to track slippage per Milestone
  - Derived Measure 97 Variance of original planned date versus actual date per Milestone
  - Base Measure 64 Planned milestone date and name per Milestone
  - Base Measure 65 Actual milestone completion date per Milestone
  - Base Measure 76 Planned Start Date, Task Name, Task Type, and Task Category per Tracked Task
  - Base Measure 77 Planned end date per Tracked Task
  - Base Measure 78 Actual end date per Tracked Task
  - Base Measure 79 Actual Start Date, Task Name, Task Type, and Task Category per Tracked Task
Elements of solution

Graphical presentation of Information Needs with ‘drill-down’

- Report Processing
- Report Formats and Storage

Measurement repository

Data collection services & form capture
Approach

- Data is captured close to source and in a timely way.
  - As user follows process steps, measurement data is automatically gathered by system
  - … or via meaningful query … Rather than ask “Is your risk exposure high?”, ask “What would be the cost if this risk were to occur?” and relate this to management reserve.
- As required or on a scheduled basis, a reporting user or the system selects from template reports and generates report(s) to support Information Need(s).
- Report template accesses Measurement Repository and retrieves relevant base measure data and stores output in repository.
- Any other user can browse stored report(s) and drill-down to satisfy Information Need(s)
Trend of Planned versus Actual Number of Reviews per Review Type

**Project Name:** InterGalactic Computer Corporation (1.p.1.1)
**Display Date:** 10/14/2005

**Review Type**
- Milestone Review
- Progress Review
Summary & Benefits

- CMMI measurement is organized and centralized.
- Standard set of measures instantiated for each project, with customization and tailoring
- Data gathering is automated and interactive reporting is provided
- Consistent set of measures is used across the organization – process integrated with tools
- Transformation of measurement process from an onerous task typically performed by a small specialist team to an integrated approach where data is captured at source and often without any user effort
- Management insight through ‘best of breed’ graphical reporting
Thank you for your attention.

Questions?