Practical Earned Value Management Integrated with CMMI®-Compliant Processes
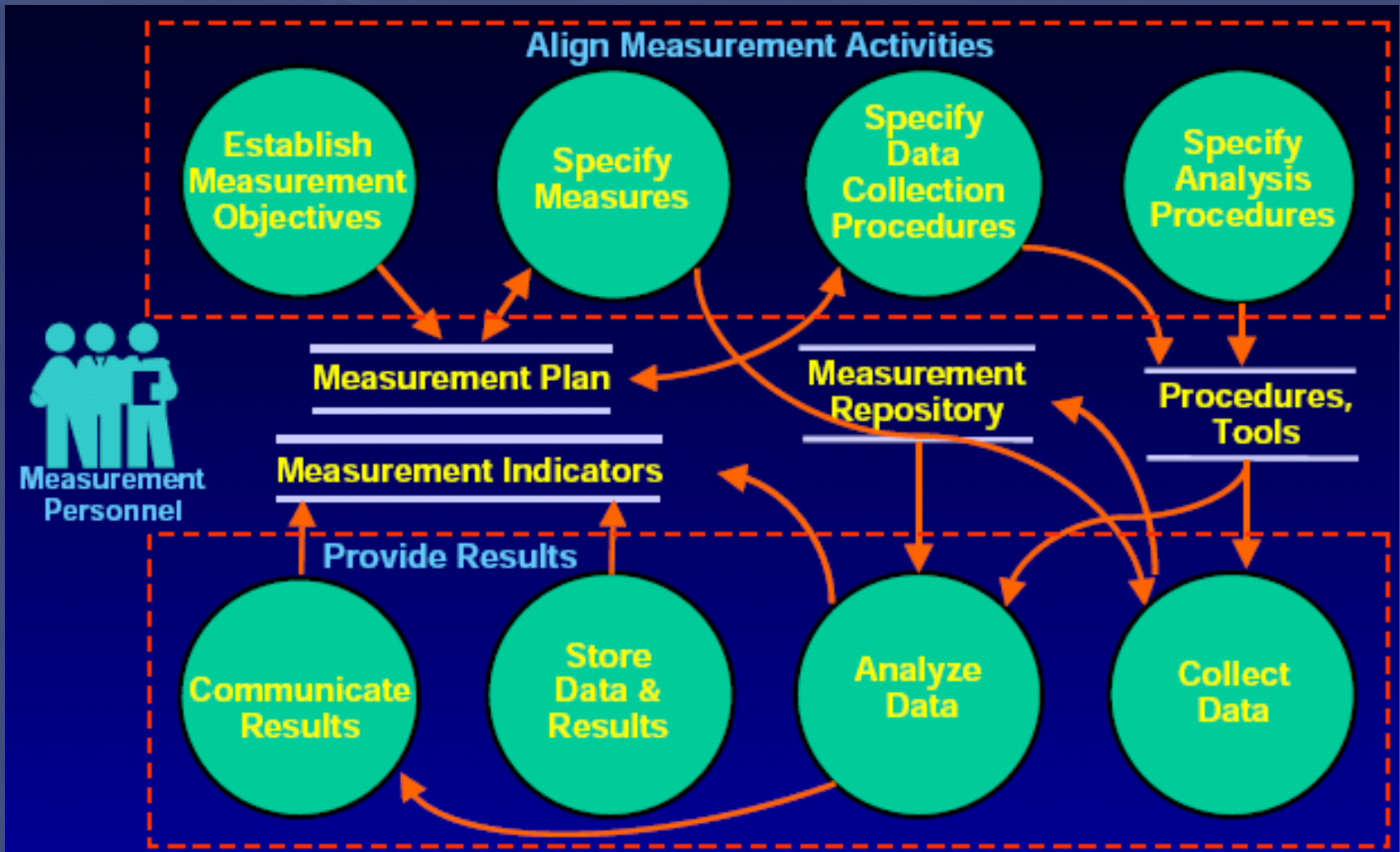
CMMI Technology Conference and User Group
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Dr. Donn Milton
pragma Systems Corporation

Zubrow, David. *Measurement in a Process Framework*. Process and Methodology Seminar, Toronto, Canada, 2003. http://www.sei.cmu.edu/sema/pdf/zubrow_framework.pdf

- Too many complex activities must be completed before any measurement and analysis can be performed

- Data collection is not integrated with process performance

- Concept of "measurement personnel with clipboards" is inefficient and ineffective

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- Eliminate onerous and error-prone data collection procedures

- Deal with the large number of measures required by the CMMI in a consistent manner

- Enable customization of measure definition and reporting

- Integrate data collection with day-to-day work

- Enable real-time, fact-based management insight

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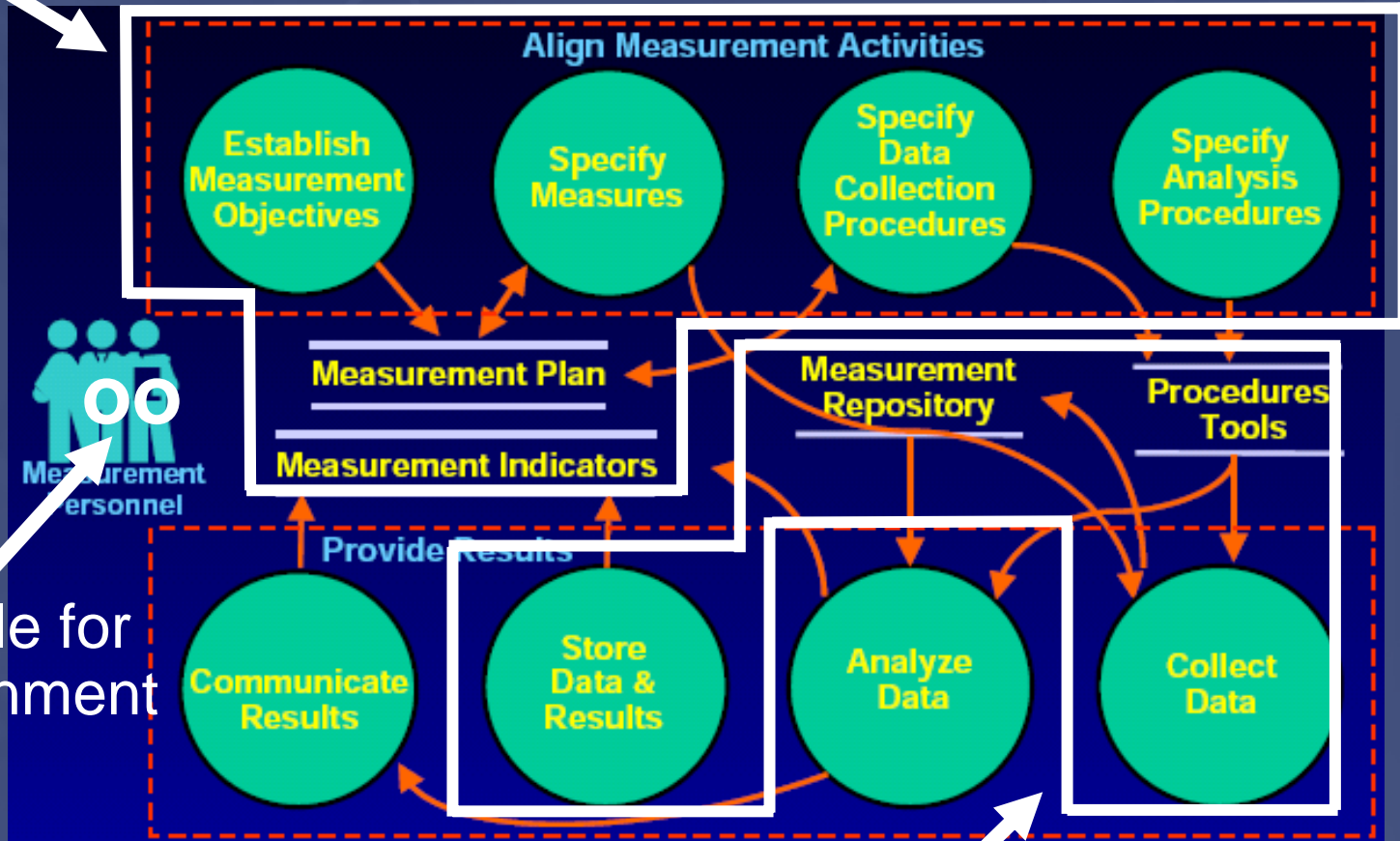
- Data is automatically captured at the source as user follows process steps

  - Timely

  - Accurate

  - Not subject to "revision"

  - No burden on users or measurement personnel

- As required or on a scheduled basis, a user initiates report generation

- Report generation accesses the Measurement Repository to retrieve relevant base measure data, generates and stores the report in the project repository

- Any other user can browse the stored report, with drill-down

processMax
THE PROCESS SOLUTION®

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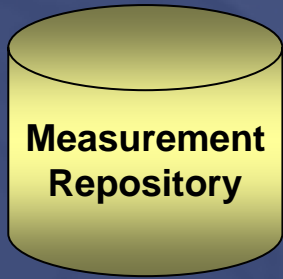
Defined Process
Organizational Programs Roles
Guidelines
Criteria, Methods, Forms
Plans, Reports, Data, Memos
Organizational Training Materials
Organizational Training Records
Organizational Library of Project Templates and Examples
Organizational Library of Project Data
Organizational Policies

Measurement Repository

Organization's Standard Project Process
♦ Defined Process
♦ Project Management Roles
♦ Project Technical Roles
♦ Templates
♦ Guidelines
♦ Criteria
♦ Methods
♦ Forms

Instantiate **Organization's Standard Project Process**

Formal Feedback Mechanisms

Project 1 Portal

Project N Portal

• • •

Project 1's personnel use this website

Project N's personnel use this website

Graphical Presentation of Indicators with 'Drill-Down'

Report Processing

Report Formats and Storage

Measurement Repository

Data Collection Services

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ISO/IEC 15939,

Software Engineering — Software Measurement Process

- Robust measurement process standard consistent with CMMI requirements

- ISO/IEC Measurement Information Model (MIM) provides structure that links information needs to relevant entities and their attributes

processMax — THE PROCESS SOLUTION

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

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

Measureable Concept

Measurement Function — Algorithm for combining two or more base measures

Base Measure

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

Measurement Method

Measurement Method — Operations mapping an attribute to a scale

Entity

Attribute

Attribute — Property relevant to information needs

© ISO/IEC 2002

- Measurement Objectives – 19
    - Approximately equivalent to the Purpose section of each Process Area (answers the question "Why are we measuring these particular items?"); associated with one or more Information Needs

- Information Needs – 24
    - Correspond approximately to PMC SP 1.1 and GP 2.8 of each Process Area; associated with one or more Indicators

- Indicators – 83
    - Trends or snapshots relying on Derived Measures and/or Base Measures

- Derived Measures – 115
    - Values that are functions of Base Measures and/or other Derived Measures

- Base Measures – 156
    - Information derived from a single attribute, independent of other Base Measures

Enables determination of schedule variance

Enables determination of "true cost variance", not distorted by schedule performance

→ *Not possible with traditional budget vs. actual cost tracking*

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- Plan all work for the program

- Integrate work scope, schedule, and cost objectives into a baseline plan

- Objectively assess accomplishments

- Analyze significant variance from the plan and forecast impacts

- Provide data for higher level management decision making and implementation

Earned Value Management Systems, ANSI/EIA-748-A-1998.

Look familiar?

Project Planning

SG 1 Establish Estimates

Estimates of project planning parameters are established and maintained.

SG 2 Develop a Project Plan

A project plan is established and maintained as the basis for managing the project.

Project Monitoring and Control

SG 1 Monitor Project Against Plan

Actual performance and progress of the project are monitored against the plan.

SG 2 Manage Corrective Action to Closure

Corrective actions are managed to closure when the project's performance or results deviate significantly from the plan.

CMMI Process Area	EVMS Guideline from EIA-748-A, Earned Value Management Systems, Jan. 2002) [Earned Value Management Maturity Model® Goal]
Project Planning	2.1a Work Breakdown Structure (WBS) [L2, Organizational, Goal 1] 2.1b Organization structure [L2, Organizational, Goal 2] 2.2a Schedule of authorized work [L3, Planning, Goal 1] 2.2b Progress indicators [L3, Planning, Goal 2] 2.2c,d Control account budget baseline [L2, Planning, Goals 1; L3, Planning, Goal 3] 2.2e Work packages [L2, Planning, Goal 2]
Project Monitoring and Control	2.4a,b Schedule/cost variance analysis [L2, Analysis, Goal 1] 2.4c Indirect cost variance [Level 3, Analysis, Goal 3] 2.4d Element summary [Level 3, Analysis, Goal 4] 2.4e Managerial actions [Level 2, Analysis, Goal 3] 2.4f Estimate at completion [Level 3, Analysis, Goal 5]
Integrated Project Management	2.1c Integration of plan, schedule, budget [L3, Organizational, Goal 1] 2.1e Integrate WBS and org structure [L3, Organizational, Goal 3] 2.2a Identification of task dependencies [L3, Planning, Goal 1] 2.2d Budgets for authorized work [L3, Planning, Goal 3] 2.4 a-f (see Project Monitoring and Control) 2.5a Incorporation of changes into budget and schedule [L2, Revisions, Goal 1] 2.5e Changes to performance measurement baseline [L2, Revisions, Goal 4]
Measurement and Analysis	2.2b Progress indicators [L3, Planning, Goal 2]

Solomon, Paul. *Using CMMI to Improve Earned Value Management,* CMU/SEI-2002-TN016

- Assign a target value to each scheduled work element (at an appropriate level of detail)

- As work elements are completed, their target values are "earned"

- Work progress is quantified by earned value, against which we can measure:

  - What was spent to perform the work

  - What was scheduled to have been accomplished

- Ensure that processes are integrated

- Eliminate process conflicts and redundancies

- Reduce rework that is inevitable from sequential implementation

- Enable a common startup approach

- ## Measurement Objective

  - Ensure the project is being performed within its planning parameters (PMC)

- ## Information Need

  - Monitor schedule, effort, costs, resources, and estimates for work product and task attributes (PMC SP 1.1)

- ## Indicator

  - Trend of Cumulative Earned Value (PMC SP 1.1, Subpractices 1 & 2)

- ## Derived Measures (top-level)
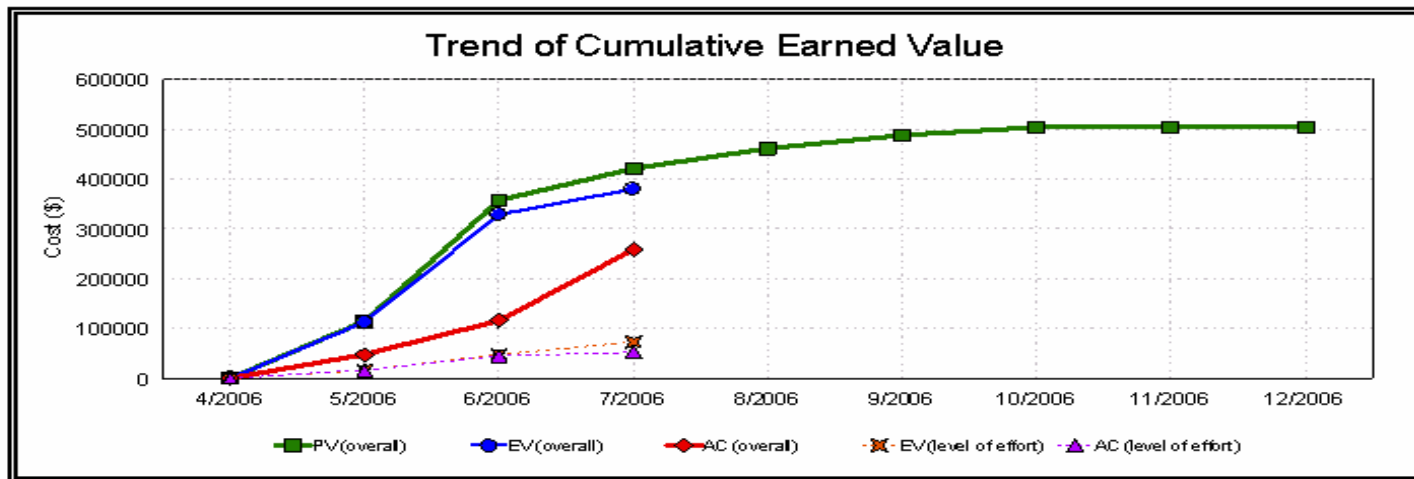
  - Planned Value, Earned Value, Actual Cost, Cost Variance, Cost Variance Percentage, Cost Performance Index, Schedule Variance, Schedule Variance Percentage, Schedule Performance Index, Estimated Cost at Completion

Earned Value

sum (Planned Cost to Date per Task where Task is Level of Effort,
Earned Value per Task Where Task is not Level of Effort)

Earned Value per Task Where Task is not Level of Effort

multiply (Percent Complete per Task where Task is not Level of Effort,
Planned Cost per Task where Task is not Level of Effort and
Actual Start Date is less than Date of Report)

Planned Cost per Task where Task is not Level of Effort and Actual Start Date is less than Date of Report

sum (Planned Other Direct Costs per Task,
Planned Labor Cost per Task where Task is not Level of Effort and
Actual Start Date is less than Date of Report)

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- CMMI measurement and reporting is automated and centralized

- Robust and flexible measurement definition is based on ISO/IEC Measurement Information Model

- Measurement data is collected at the source, with no burden on users or measurement personnel

- A standard set of measures is instantiated for each project

- Full integration of Earned Value Management with procedures fully compliant with CMMI

- Real-time, fact-based management insight through web-enabled graphical reporting