

MAXIMIZE THE  
BUSINESS VALUE  
OF SOFTWARE

## Establishing Project and Organizational Measures

Mike Evanoo, CQE  
Consulting Services, Senior Principal Consultant

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# Agenda

- ❖ Purpose and Scope of Measurement Systems
- ❖ IT Industry Guidance on Measurement Systems
  - ISO 15939
  - CMMI
  - Practical Software and Systems Measurement (PSM)
- ❖ Best Practices In Developing IT Measures
- ❖ Using a Measurement Construct
- ❖ Measurement Construct Examples
- ❖ Measurement Display (“Dashboard”) Examples
- ❖ Best Practices In Maintaining IT Measurement Systems
- ❖ Best of the Best Practices
- ❖ Final Discussion / Wrap-up

# Why Measure?

- ❖ If you can't measure it, you can't manage it!
- ❖ ***Lord Kelvin said it best:***
  - ***When you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge of it is of a meager and unsatisfactory kind; it may be the beginning of knowledge, but you have scarcely, in your thoughts, advanced it to the stage of science.***
  - **Sir William Thompson, Lord Kelvin (1824-1907) .**

# Challenges in Measuring in IT

- ❖ IT industry is primarily behavior based, therefore difficult to measure
- ❖ Although the national measurement standards body (i.e., National Institute of Science and Technology - NIST) has embarked on studies, there are not yet clearly defined international standard measures for IT
  - IFPUG standard for function points is the closest but still doesn't have the rigor usually expected in a true measurement standard.
- ❖ In many ways, though, the IT industry measures are NOT really that different!

# Guidance

## ❖ ISO 15939, Software Measurement Process

- Provides standard definitions consistent with metrology definitions
- Provides a proven approach to measures

## ❖ CMMI

- Measurement and Analysis provides a proven approach and a reasonable set of best practices for how to set up a measurement system that is aligned to ISO 15939
- Generic Practices and other Process Areas (such as Project Monitoring and Control) provide specific suggestions on what to measure

## PSM

- The book provides guidance in the how, examples for what, and helpful direction and tips for setting up a measurement system aligned to ISO 15939.

# Good News: Guidance from all sources is aligned

Practical Software Measurement

**ISO/IEC 15939**  
**Software Measurement Process**

**CMMI**

Measurement  
and Analysis  
Process Area

**ISO/IEC SC 7 Standards**

12207 Software Life Cycle Processes  
(revision of supporting processes)

15288 System Life Cycle Processes  
(measurement concepts)

9126 Software Product Quality  
(terminology coordinated)

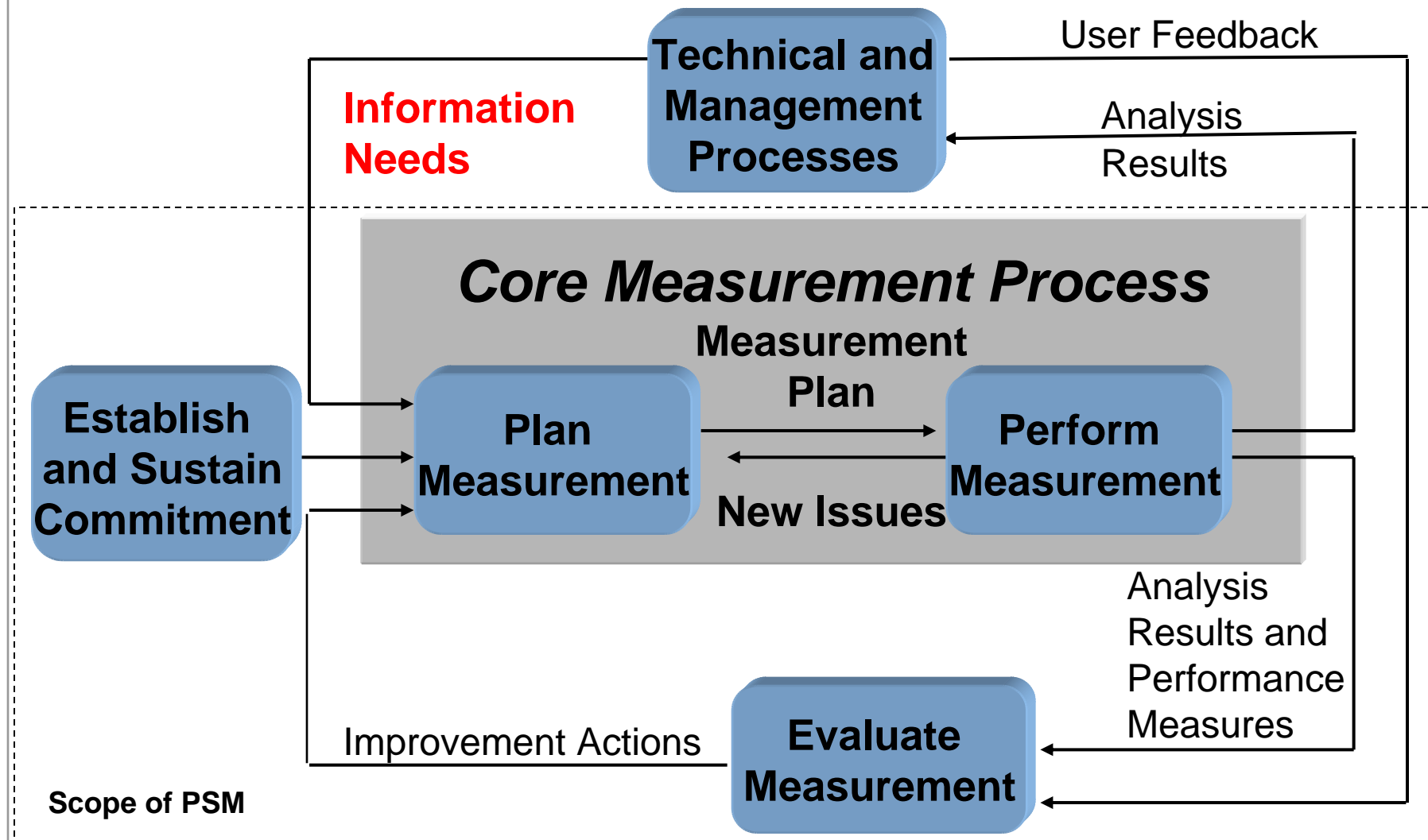
14598 Evaluation of Software Products  
(terminology coordinated)

**ISO 9000-3:**  
**Application of ISO**  
**9001:2000 to**  
**Software**

(purpose and  
outcomes of  
measurement)

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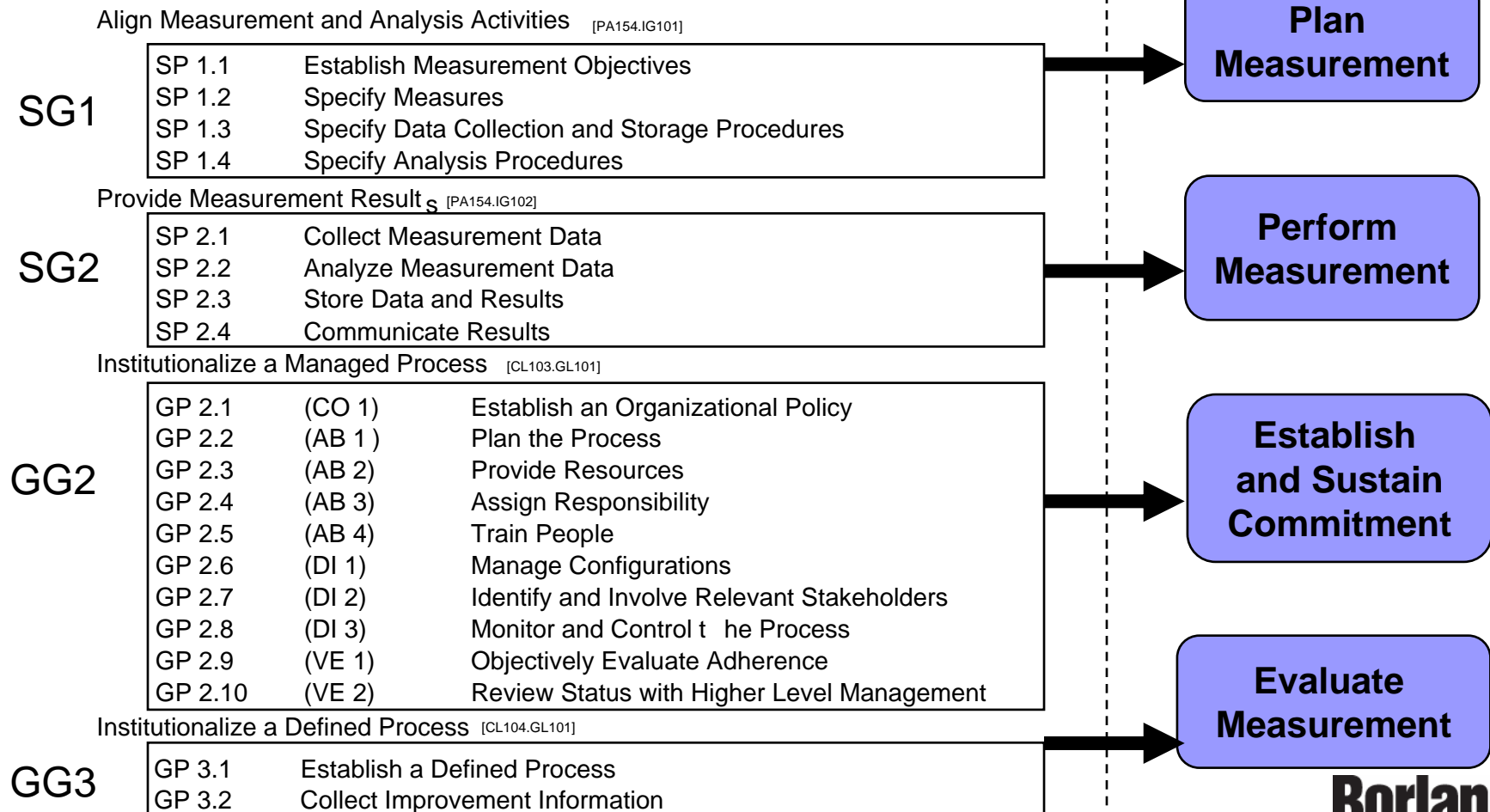
# PSM Measurement Process



# CMMI Measurement and Analysis Process Area, ISO 15939 and PSM Alignment

**Measurement and Analysis** - The purpose of Measurement and Analysis is to develop and sustain a measurement capability that is used to support management information needs.

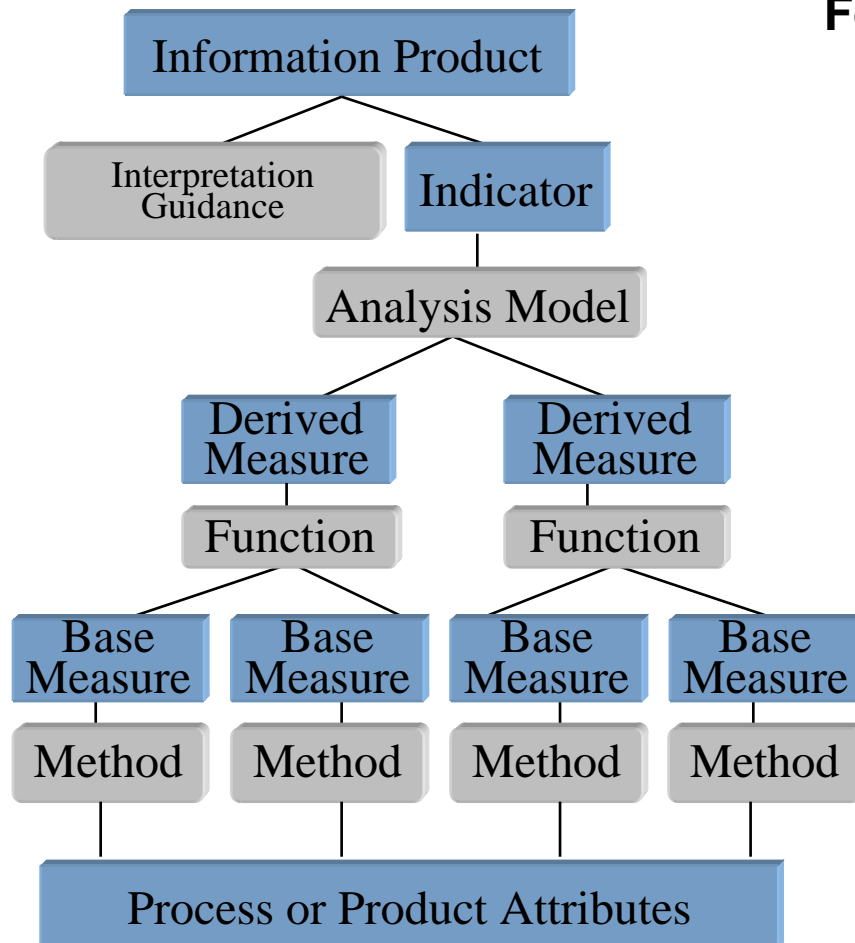
PSM & ISO 15939



# Best Practices: Developing a Measurement System

- ❖ **Establish and sustain commitment**
  - Only measure to obtain information necessary for the business
  - Institute regular (periodic) reviews by management using collected measures (and QA results, if appropriate).
- ❖ **Plan the Measurement Process**
  - Refer to Specific Goal 1 in CMMI and Planning in PSM
    - Identify the information needs and measurement objectives
    - Identify measures (including operational definitions)
    - Identify collection procedures
    - Identify analysis techniques (at least first level analysis)
    - Identify communications necessary to provide information to those with info needs
    - Identify storage mechanism for measures and related information
- ❖ **Perform Measurement**
  - Follow the plan - But allow flexibility
  - Adapt measures collected to meet information needs as necessary
    - Dwight D. Eisenhower said: “A plan is worthless, but planning is everything”

# Defining Measures to Support Decisions: Use the Measurement Construct

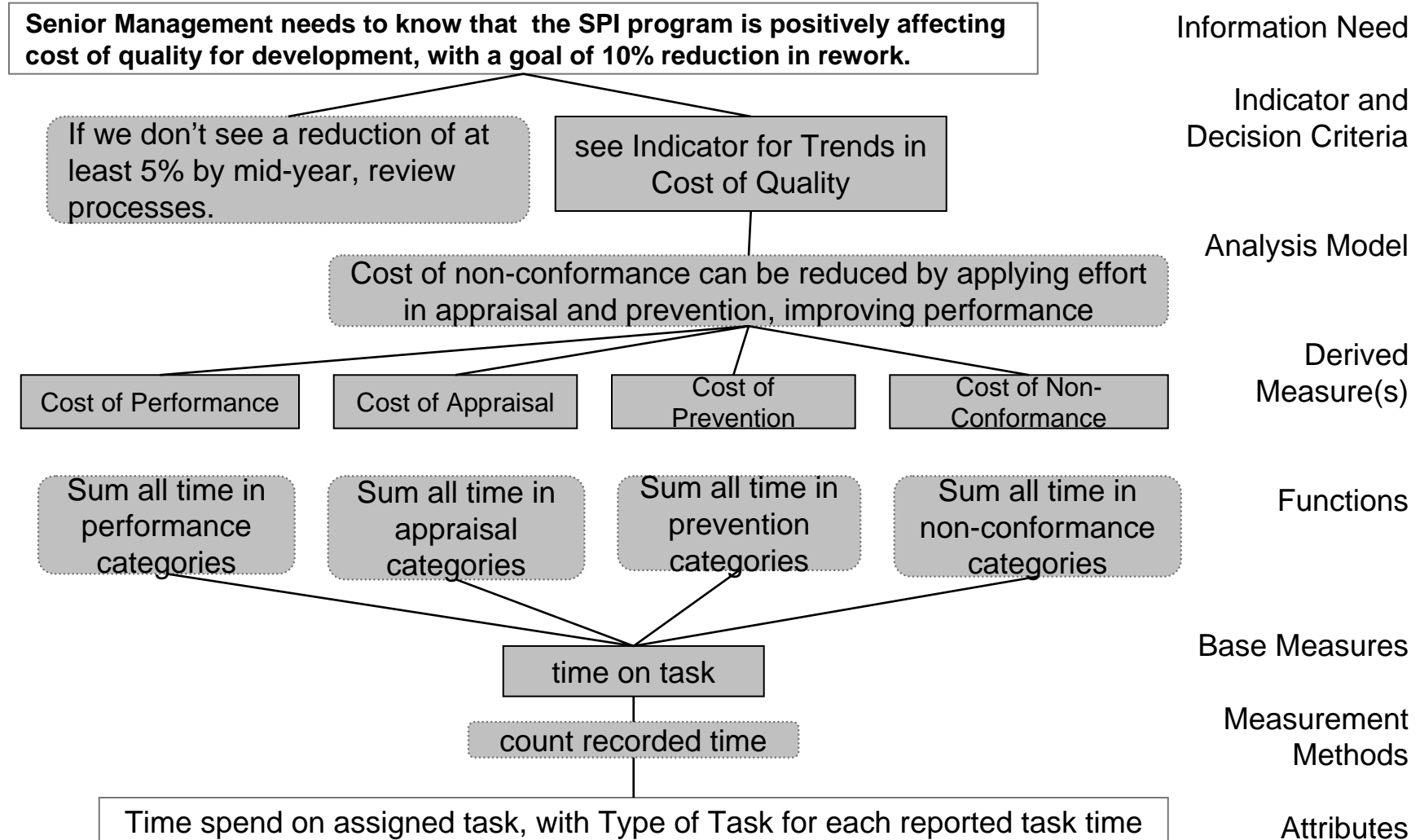


For an information need, identify

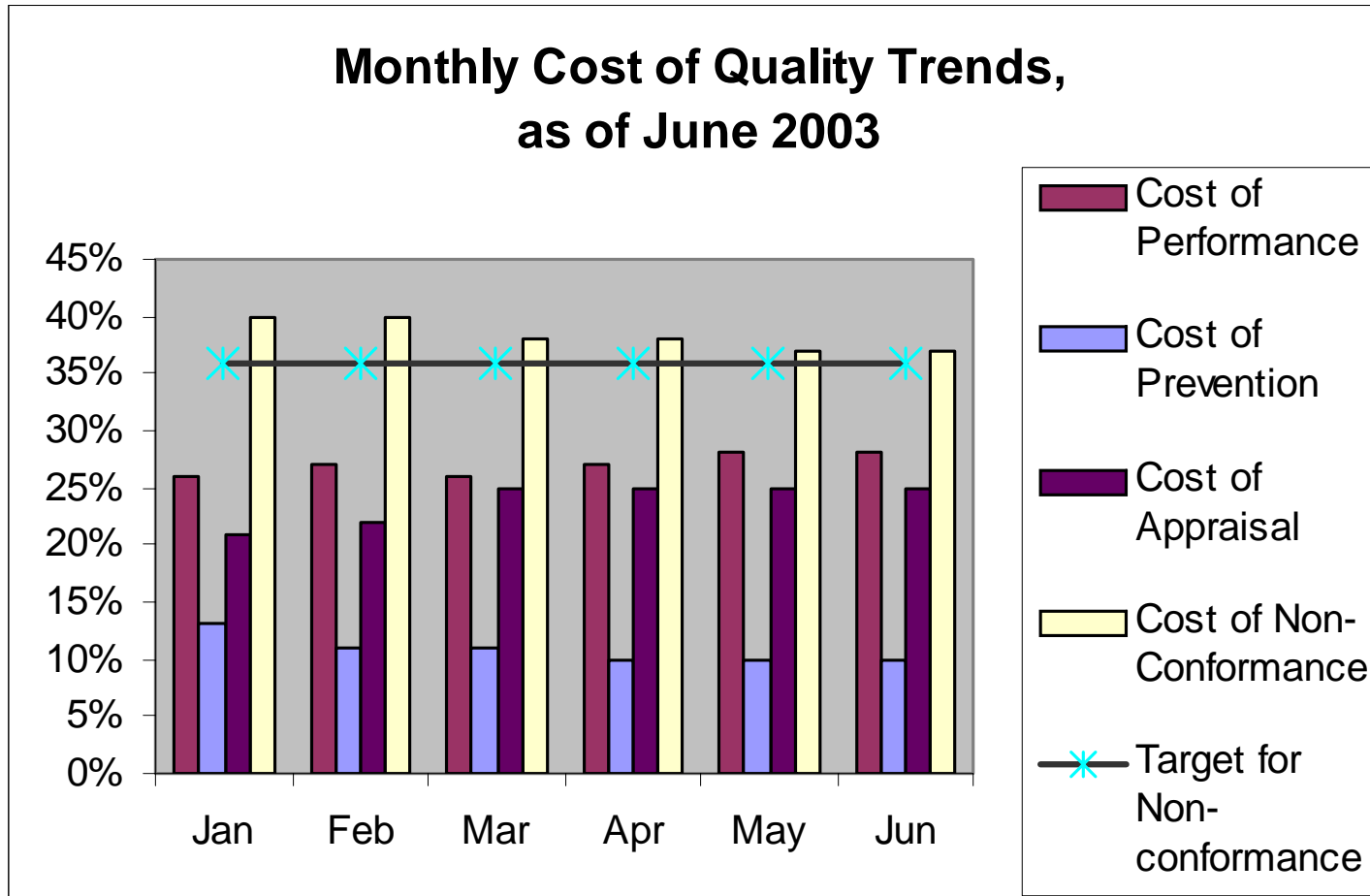
- the *Information Product*, which can be composed of
- one or more *Indicators*, using
- *Interpretation Guidance*, based on
- *Analysis Model*, which reflects relationships among
- *Derived Measure(s)*, which are developed using
- *Functions*, over *Derived* and/or
- *Base Measures*, which are developed using
- *Methods* of measuring
- *Process or Product Attributes*

Source: Jack McGarry, Beth Layman et al, *Practical Software Measurement: Objective Information for Decision Makers*, Addison-Wesley Publishing Company, Reading MA, 2002

# Example Measurement Construct: Objective to Reduce Cost of Rework by 10%



# Example Indicator for 10% Rework Reduction



# Example Analysis Model and Decision Criteria for the Indicator

<b>Analysis Model</b>	<i>Describe how the analysis of the indicator should be done. As needed, describe the underlying model of expected relationships between component measures and their behavior over time.</i>
	This year's goal with respect to the cost of quality model is to reduce the cost of non-conformance. We are holding approximately constant the amount of time we spend in prevention activities, but increasing our efforts in reviews and inspections. Thus, we expect our appraisal costs to go up, with more than a similar reduction in non-conformance costs. If we can reduce the non-conformance costs, while holding prevention costs approximately the same, we should see the effort going into the cost of performance.
<b>Decision Criteria</b>	<i>Identify thresholds, limits, and targets used to trigger action or further investigation.</i>
	If the amount of effort going into the reviews does not show a favorable trend of at least 5% by mid-year, we need to examine how the processes are being used.
<b>Measures Used</b>	<i>Identify the measures are used to generate this indicator (derived or base).</i>
	Derived Measure: Cost of Performance for month x Derived Measure: Cost of Appraisal for month x Derived Measure: Cost of Prevention for month x Derived Measure: Cost of Non-conformance for month x

# Example Derived Measure: Cost of Prevention

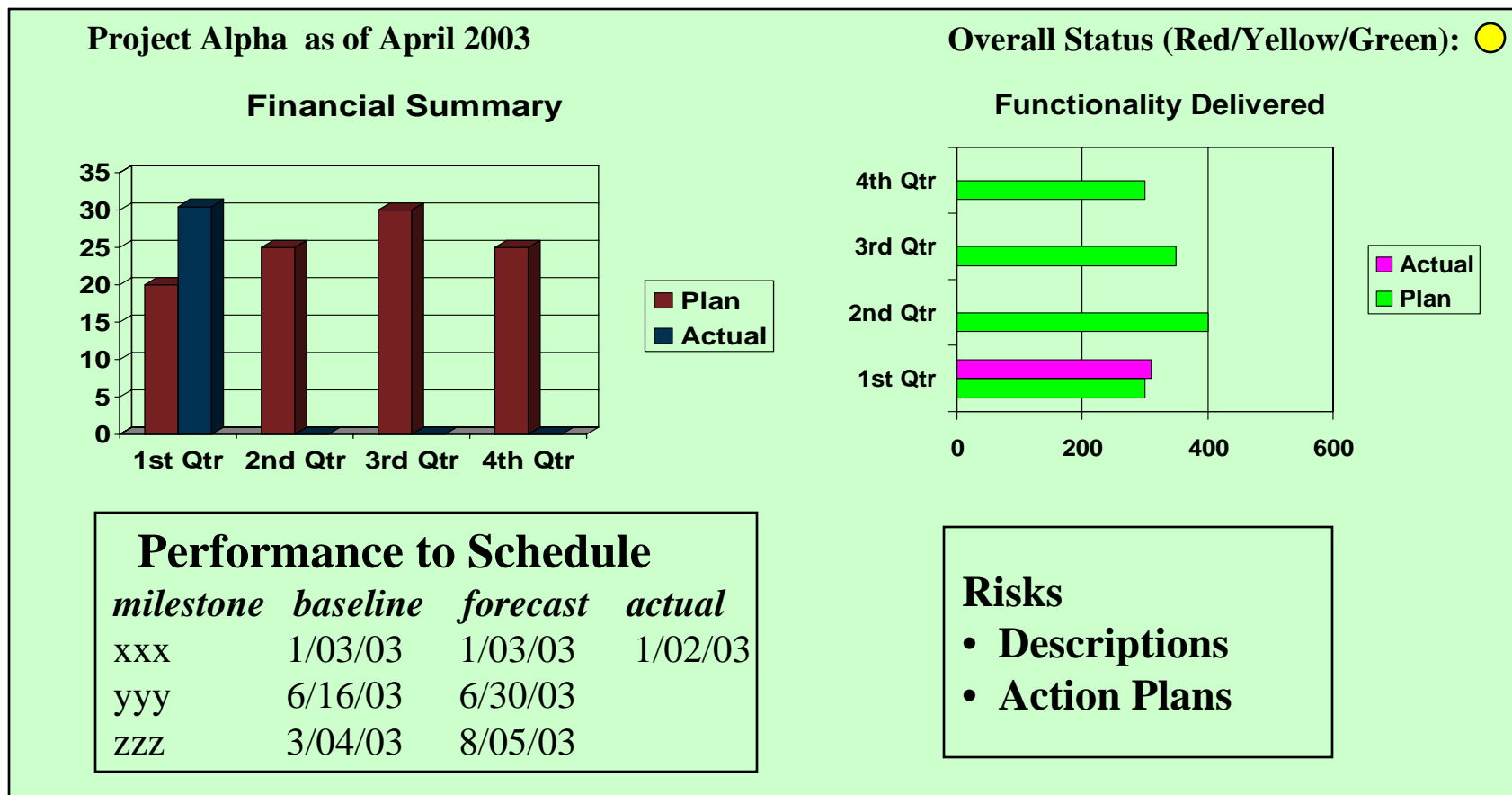
<b>Derived Measure:</b>	<b>Cost of Prevention for month x</b>
<b>Measures Used</b>	<i>List the names of the base or derived measures used to develop this derived measure.</i>
	Time on Task
<b>Measurement Function</b>	<i>Provide the formula used to calculate the derived measure.</i>
	<p>Sum the amount of time spent on tasks from these categories:</p> <ul style="list-style-type: none"> <li>- training</li> <li>- process development and maintenance</li> <li>- tools selection and installation</li> <li>- quality improvement projects</li> <li>- measurement and analysis</li> <li>- root cause analysis</li> </ul> <p>Divide this by the grand total of all time spent on all tasks.</p>
<b>Type of Aggregation</b>	<i>Describe how data will be aggregated (across tasks, teams, projects, etc.)</i>
	Across all individuals in the organization, across all working days of the month

# Example Base Measure: Time on Task

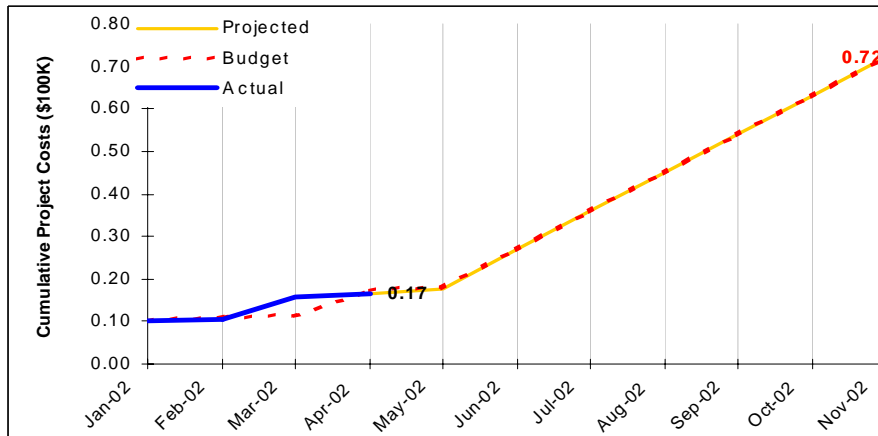
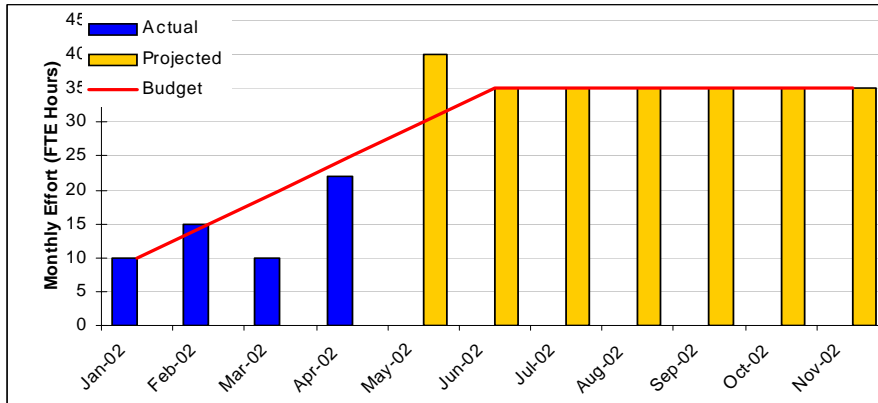
<b>Base Measure:</b>	Time on Task
<b>Relevant Entities</b>	<i>Identify objects to be measured (project tasks, defect reports, work products, etc.)</i>
	Time spent on an assigned task (by an individual during a given day)
<b>Attributes</b>	<i>Identify the property or characteristic of the object to count or quantify.</i>
	Category of work [with a selection list that includes all the types of tasks needed to segment the time into the 4 cost of quality categories – ex. Planning, building requirements, fixing defects...]
<b>Units of Measurement</b>	<i>Identify the standard unit (hour of time, page of text, line of code, simply</i>
	Hours of effort [tracked to level of half-hours, no less]
<b>Measurement Method (How)</b>	<i>Identify the counting rule(s) to calculate the base measure.</i>
	use actual hours entered on daily timesheet entries by each individual
<b>Implementation Approach (Who, When, How Often)</b>	<i>Identify the tools, personnel, or other mechanisms that gather the measure, how often, and where the information will be stored.</i>
	Organization web-based time recording mechanism, available at each individual's workstation, where time can be entered throughout the day or at the end of the day; entry must be done daily, or individual is not able to leave the building [special check by badge reader!]

# Example of Key Measures Dashboard for Projects

- ❖ Tracked by a large IT organization, to manage the portfolio and to monitor impact of process improvement



# Example Project Composite Dashboard



## Schedule situation

Milestone	Curr	Last
Envision Start	●	●
Vision/Scope	●	●
Planning Ends	●	●
Devel Complete	●	●
V&V Complete	●	●
Beta Start	●	●
Beta Live	●	●
GA	●	●
Project Closed	●	●

- Delay more than 60 days
- Delay more than 30 days
- On Target or Early

## Cost situation

Current		Forecast	
Month	Total	Month	Total
●	●	●	●

- Deviation more than 30%
- Deviation more than 15%
- Meeting budget

# Example Monthly Project Status Report - 1

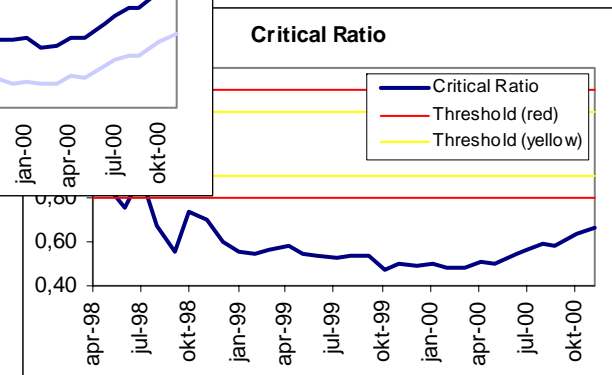
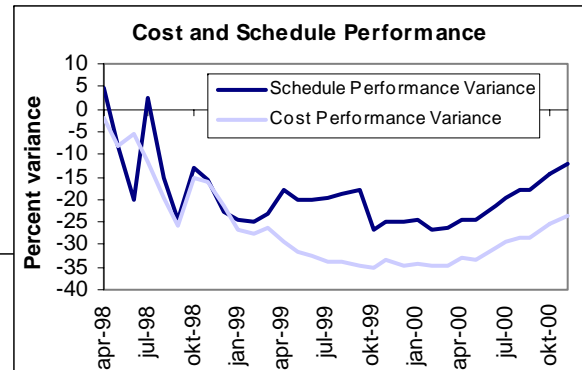
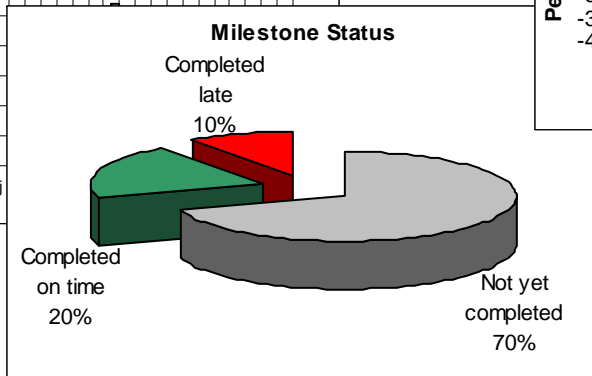
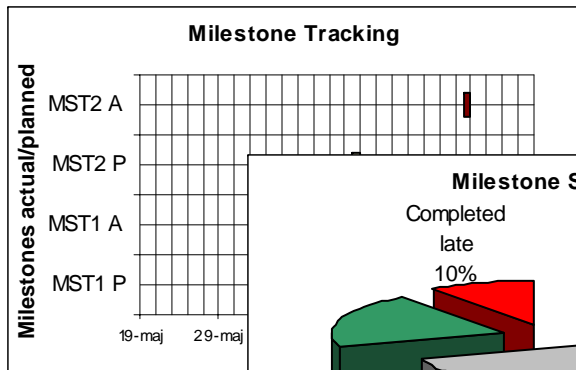
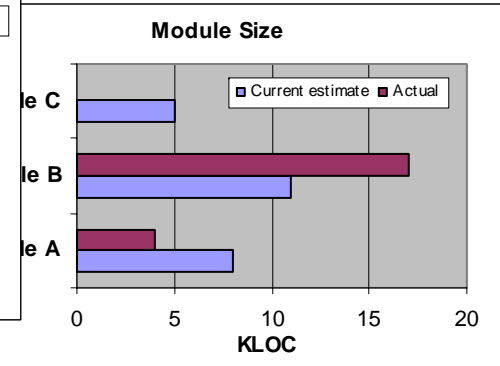
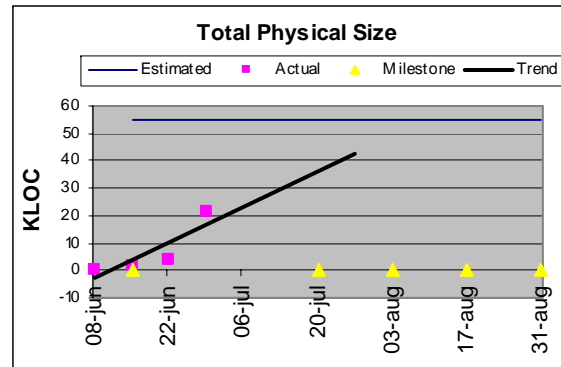
<b>&lt;Project Name&gt; Monthly Status Report</b>							
Tech. Effectiveness	Size	Cost	Schedule	Quality	Process Performance	Customer Satisfaction	Risk
<b>Technology Effectiveness</b>							
<b>Size</b>							
<b>Cost and Effort</b>							
<b>Schedule</b>							
<b>Quality and Process Performance</b>							
<b>Risk and Customer Satisfaction</b>							

Quick Overview

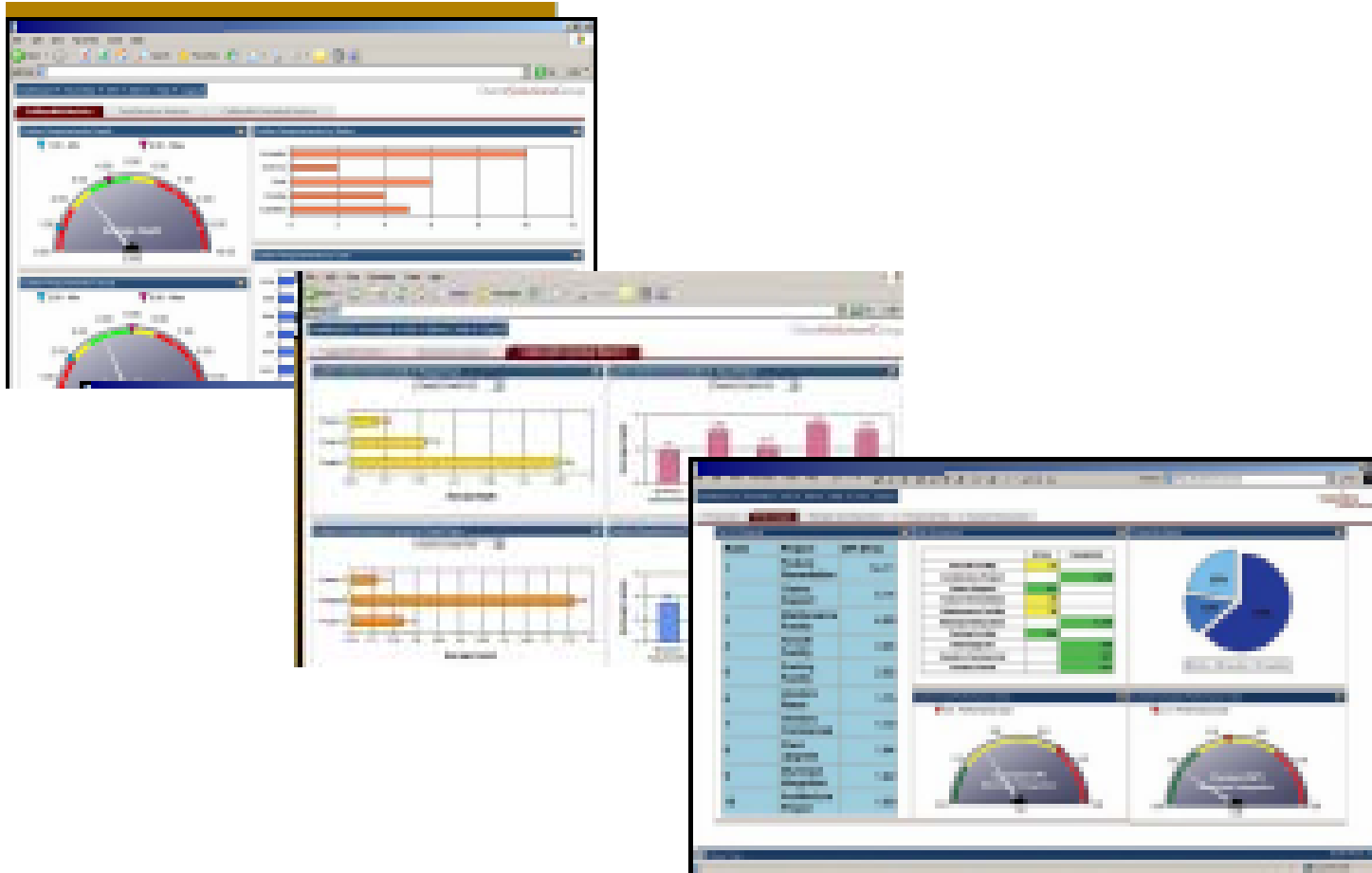
Supporting Comments

# Example Monthly Status Report - 2

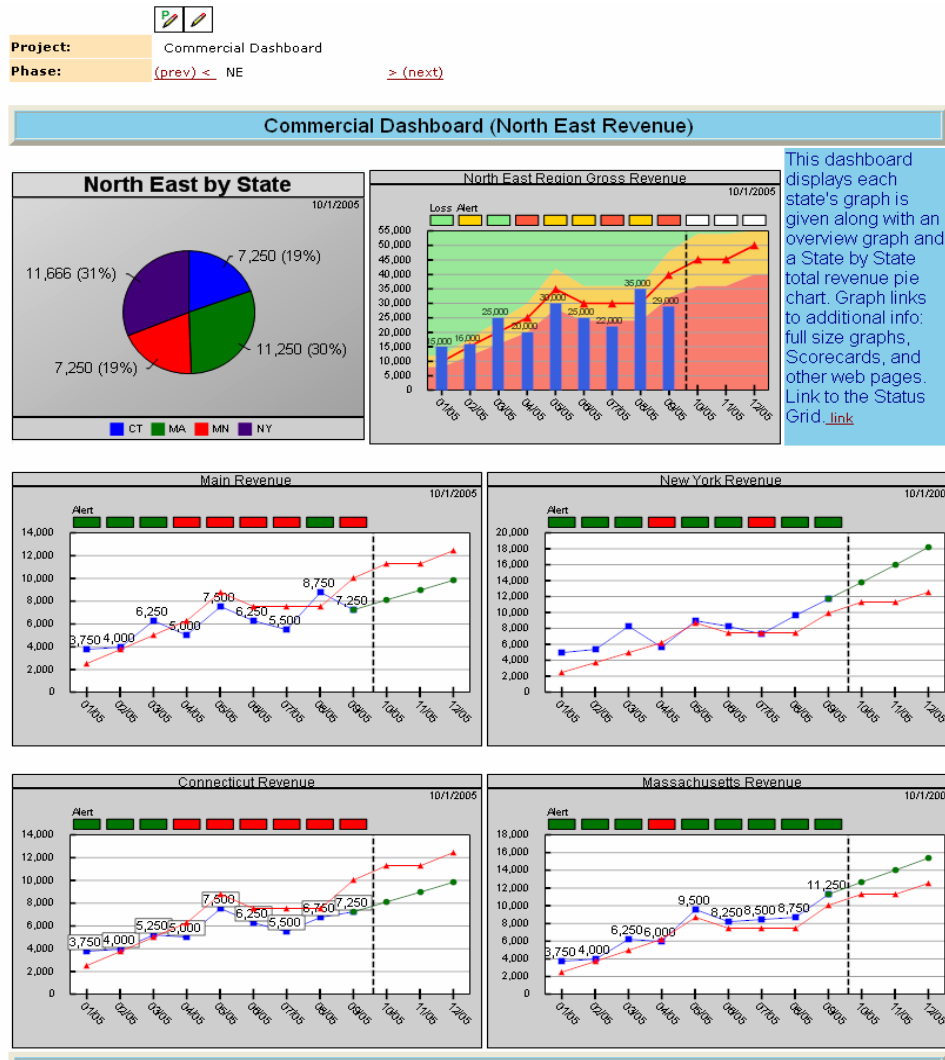
Suite of indicators for each area of reporting, available from the intranet, for review by project managers, team members, and business managers



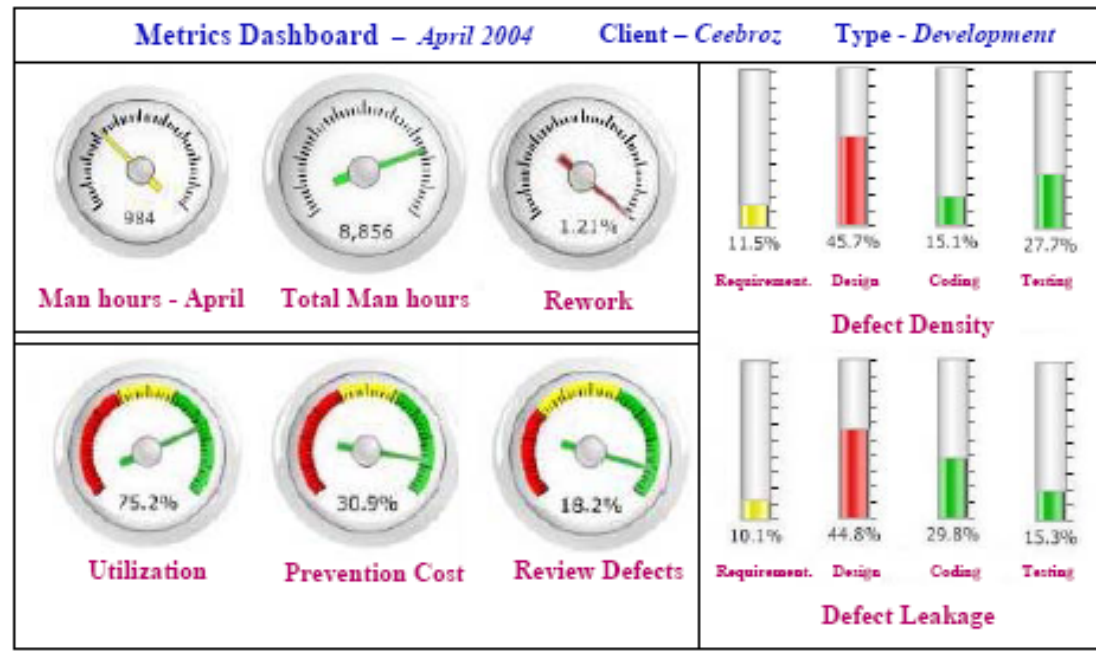
# Dashboards using Business Objects Interface



# DataDrill Example Screen



# Example Dashboard from Narasyanan – SEPG 2005



© Sridhar Narayanan

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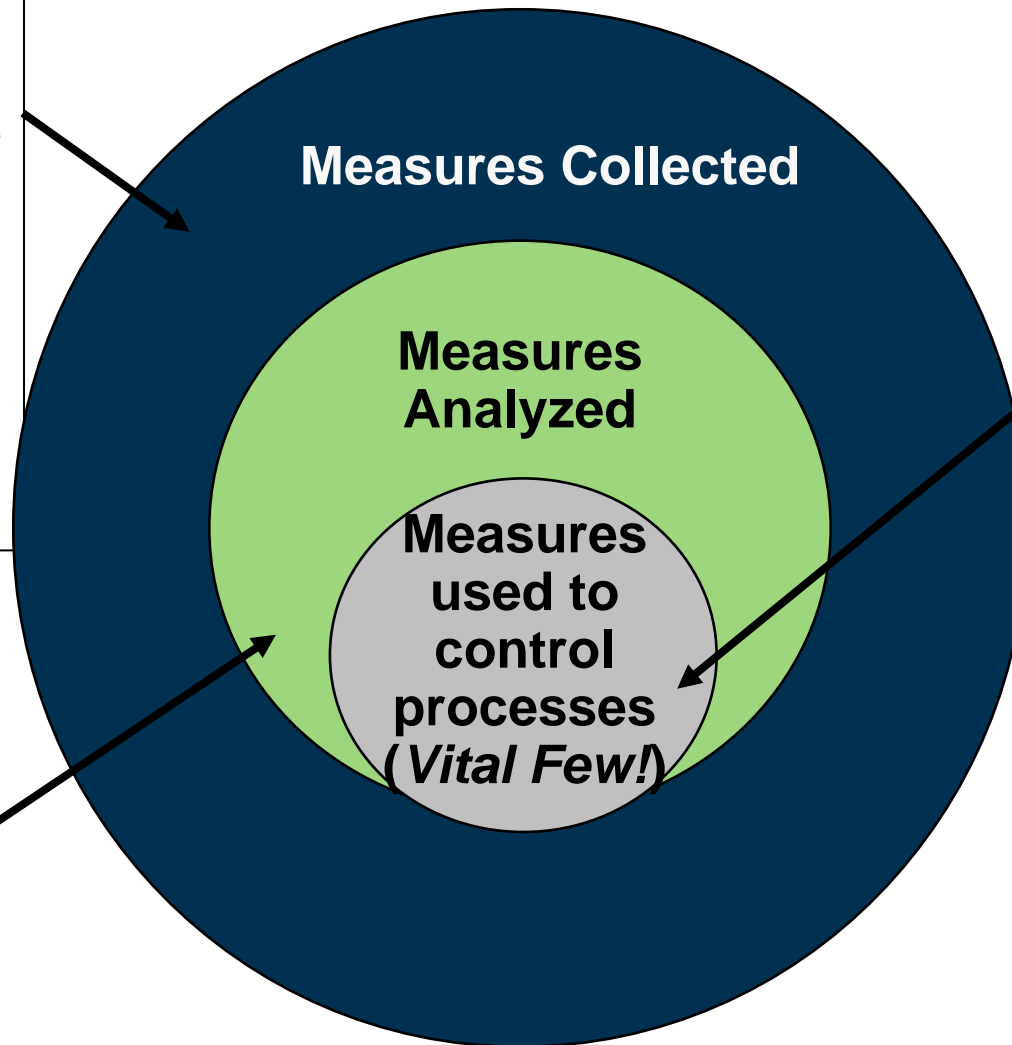
# Best Practices: Maintaining a Measurement System

- ❖ Review, with the users of measures (should be leadership team, at least), the value obtained for each measure collected during periodic measurement reviews.
- ❖ Review the data for integrity and currency; the repository for security; the reports for usability, etc.
- ❖ Review the data gathering processes, to see if they can be improved

# Best of the Best Practices: “Vital Few” are Controlled and Resources are Focused

A lot of measures are collected on projects, some are only used for historical purposes and organizational purposes beyond the project.  
(e.g. – size)

Some subset of the measures collected are analyzed to actively manage the project.  
(e.g. – estimated vs actual effort)



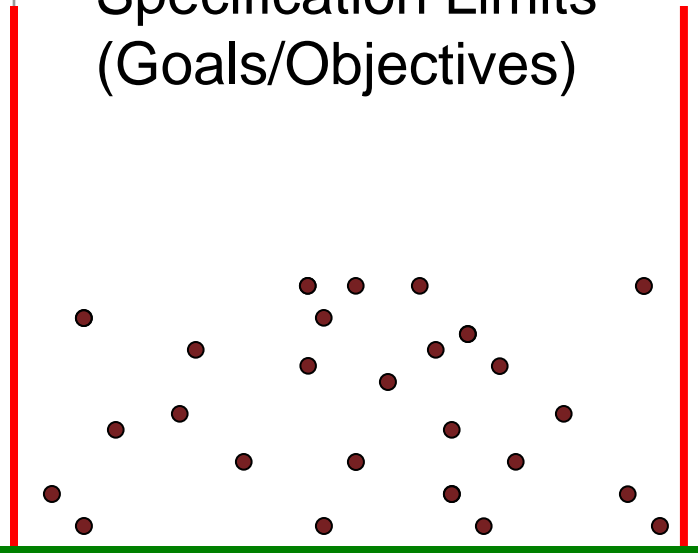
A very small subset of the measures collected and analyzed are used to **statistically control the sub-processes**. These are directly linked to the strategic and tactical goals **of the project and organization**.  
(e.g. – Time to Market/schedule fidelity, Reliability/discovered defects)

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# Best of the Best Practices: Variation Focus – “Listen” to the Voice of the Process

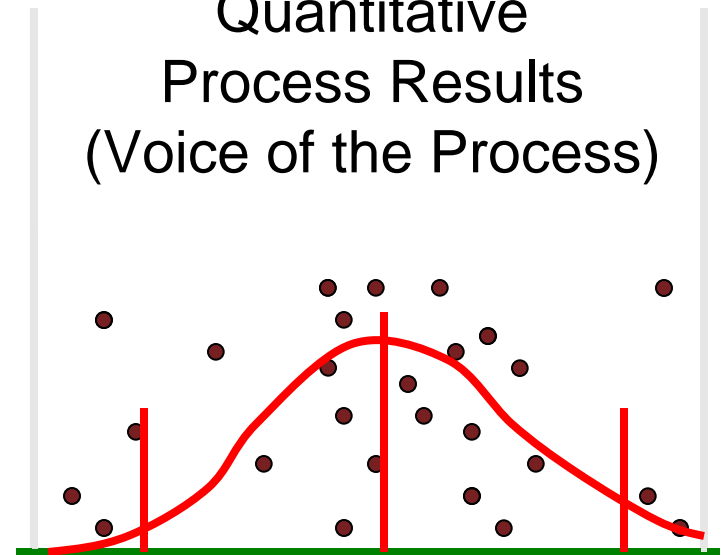
## Level 2/3 View

Specification Limits  
(Goals/Objectives)



## Level 4/5 View

Quantitative  
Process Results  
(Voice of the Process)



# Wrap-up

❖ Action Items, Parking Lot, Notes Review

❖ Questions???

❖ References:

- PSM Info:

  - <http://www.psmc.com/> , <http://www.psmc.com/PSMBook.asp>

- ISO 15939

  - <http://www.iso.ch/iso/en/CatalogueDetailPage.CatalogueDetail?CSNUMBER=29>

- CMMI:

  - <http://www.sei.cmu.edu/cmmi/>

❖ Contact Info:

**Mike Evanoo, CQE**

Senior Principal Consultant

Six Sigma Black Belt, SCAMPI® Lead Appraiser

Consulting Services, Borland Software Corporation

Phone: 937-376-9809

Mobile: 937-572-8029

Fax: 937-376-8171

E-mail: Mike.Evanoo@Borland.com

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