

Wanton Integration of Everything Statistically Tantalizing (WIEST)

Or

How the WIEST Was Won

Topics to be Covered

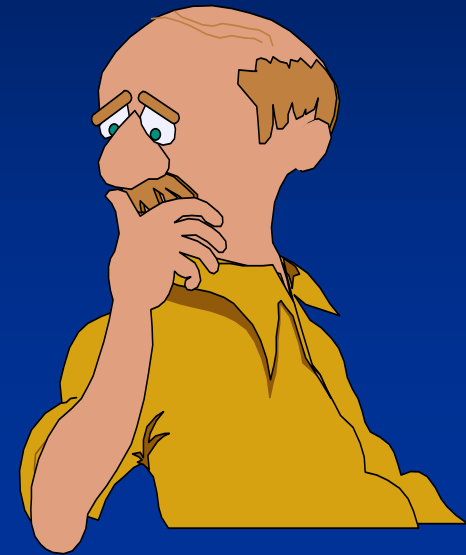
- CAE's CMM History
- Establishing the Metrics
- Trimming the List
- Automating the Metrics
- Benefits of Analysis
- Lessons Learned
- Recommendations

CAE's CMM History

- **Step 1: CMM-Level-3 (in 2002)**
 - Preparation time = 24 Months
(Faster than typical for 100-person company)
 - Qualification time = 2 ½ Months
- **Step 2: Move to CMMI-Level-3**
 - Currently pursuing CMMI-SE/SW, version 1.1, staged
 - CMMI-Level-3 Appraisal scheduled for April of 2005

Lets Improve Our Process!

- What do we want to measure?
 - EVERYTHING!
- What do PMs want to collect?
 - NOTHING!
(...or at least nothing too difficult...)
- How do we resolve this?
 - Automate everything!
(to avoid overloading the PMs)

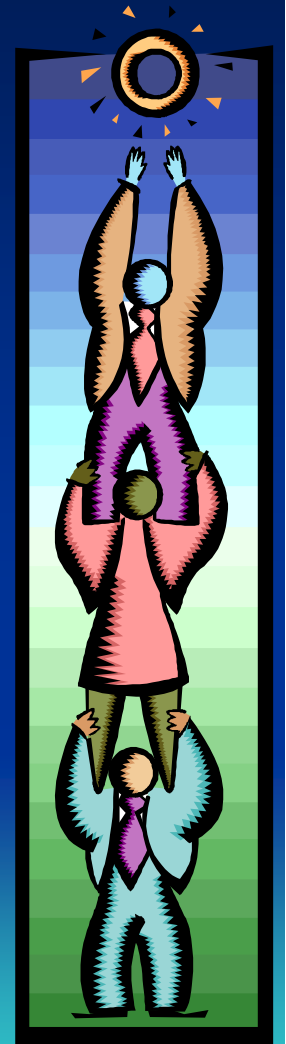


The First Step

Used the SEI Guidebook to establish
“Goal-Driven” metrics

– Reference

Park, Robert; Goethert, Wolfhart; Florac, William; Goal-Driven Software Measurement – A Guidebook. (CMU/SEI-96-HB-002). Pittsburgh, PA: Software Engineering Institute, Carnegie Mellon University, August 1996.



The Results

- Results: 50 metrics identified with 244 sub-categories
- Problem: This was too many
- The guidebook process did not result in a practical solution



What metrics should we report?

- **We sent a Message to the PMs and PEs**
 - We need to identify the most important metrics to report
- **Meeting held with PMs and PEs**
 - Each PM and PE wanted their own dozen metrics
 - After 3 hours, we managed to eliminate “2” of them
 - Most of the remaining 48 involved multiple sub-categories
- What should we do now?



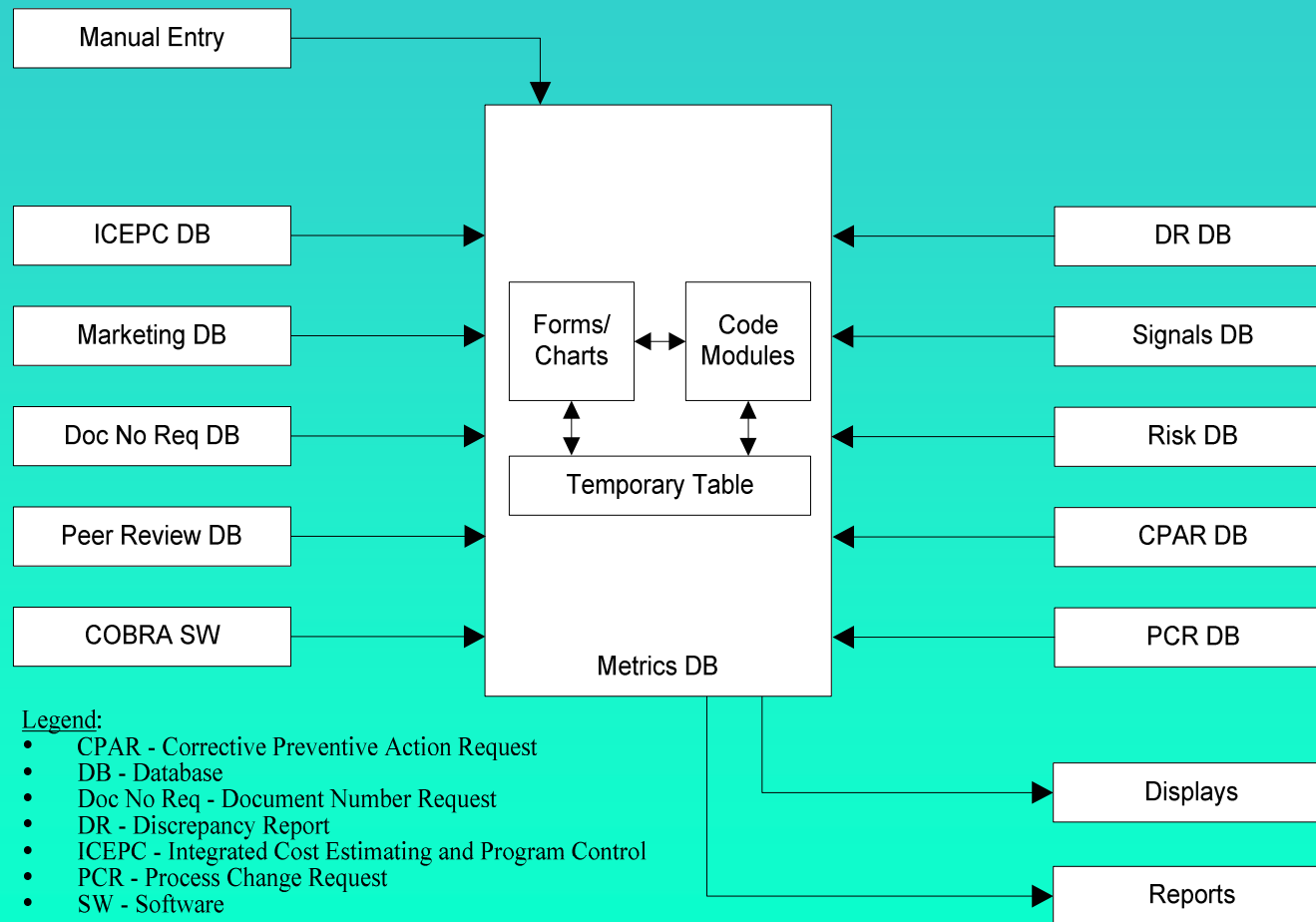
Observations and Solutions

- **Observations**
 - Non-engineering metrics already collected by other departments
- **Solutions Proposed**
 - Use existing EVMS software to track projects
 - Use a template to identify viable engineering metrics
 - Report summary of process metrics each month
 - Use detailed data to determine root causes of anomalies
 - Validate estimates and historical data

An Elegant Solution

- Develop a **Metrics Database** that **automatically gathers data** from all other databases
- **Generate monthly reports – automatically**
 - Derive metrics to track data within & between projects
 - Plot X-Bar & R charts automatically
 - Prompt PM/PE for any missing data
 - Allow PM/PE to print report “As Is” if desired

Database Interfaces

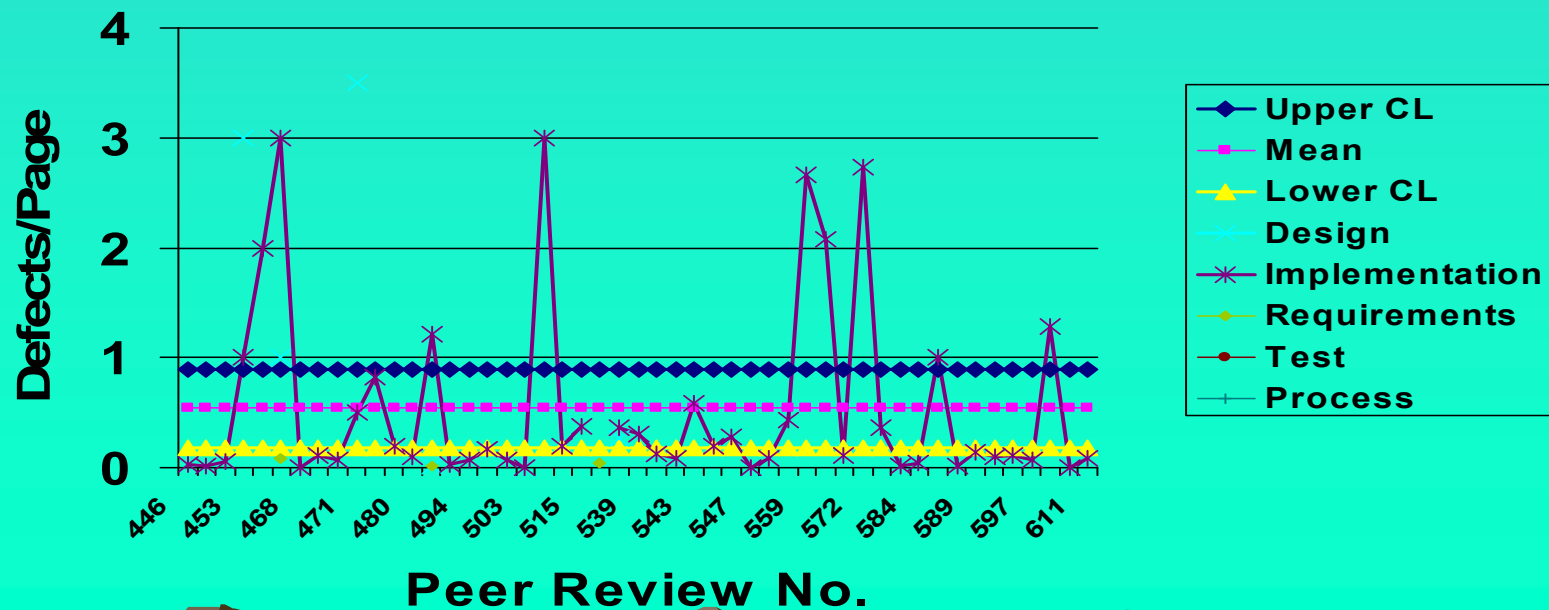


Charting the Data

- Problem
 - Data varied greatly between large and small projects (and products)
- Solution
 - Create derived metrics to Normalize the data
 - Plot Defects per page, MHs per Screen, etc.

Sample Derived Metric

- Plotted normalized “Defects-per-Page” metric for Peer Review data
- Analyzed outliers above the 3σ Statistical Control Limits
- Categorized the “Defects-per-Page” by type and by origin
- Documented “Assignable Cause” variation
- Identified Root Cause



Benefits of Analysis

Two types of problems were identified

– “Assignable Cause” Variation

- Root cause: “Implementation” was a default value (recorded in fields that were left blank)
- Recommendation: Correct the database

– “Common Cause” Variation

- Finding: Missing “Technical Editing” step in the Peer Review process resulted in typo’s and grammar errors
- Recommendation: Modify the process

Lessons Learned

- Original Metrics were not quite entirely optimized

(This is otherwise known as “*Why in the world did we ever decide to measure THAT*” Syndrome)

- Modified several metrics.
- Therefore databases had to be modified
- Therefore Work Instructions had to be updated
- Need to reduce revision effort:
 - Remove details from the work instructions
 - Include the details directly in the databases themselves
(as help screens and pop-up explanations)

More Lessons Learned

- Statistical Analysis of Infrequent Data
 - X-Bar and Range Charts are meant to display averages of frequently collected data
 - With data collected only once a month, there was nothing to average to generate monthly Range Charts
- Multiple Data Categories on a Single Chart
 - Multiple categories could be displayed on a single chart
 - Control Limits must be adjusted accordingly
 - Data categories must have compatible units

Common Problem

Customer Specified Metrics

- Typically our customers require specific metrics to be reported
- Frequently those metrics are different and require a change in our process
- This introduces additional effort in terms of training, learning curves and implementation

Implementation

- A Six-Sigma plan was used to reduce response time to Corrective/Preventive Action Requests (CPARS)
- Metrics were re-defined
 - Measurements (data points) were not identified as Metrics
 - Derived metrics were based on normalized composites of measurements and indicated the actual status of processes

Recommendation

Establish Standard Metrics

- Currently, every new customer requires the collection of a different set of metrics
- Having an initial SEI-approved set of standard metrics would greatly simplify a company's attainment of an initial level of CMMI compliance
- This set of metrics could be used as a starting point, and tailored for unique projects.
- This would guarantee an immediate level of commonality between projects and allow immediate comparisons between projects

QUESTIONS

Back-up slides follow

Automating the Appraisal Process

- CAE decided to automate collection and review of artifacts for the next CMMI Level 3 Appraisal
 - Planned to use hyperlinks to electronic documents
- Pit Falls:
 - Hyperlinks were made in Excel spreadsheets for each PA item in each matrix
 - Hyperlinks were made to documents on other drives
 - Hyperlinks were tested, but ceased to function after closing and re-opening matrix files if any hyperlinked documents were located on a different network drive
 - This delayed the collection process and wasted MHs

About the Authors

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Overview of CAE USA

- Located in Leesburg, VA, since 1996
 - Develop Engineering Control Systems for the US Navy
 - Employs approximately 100 personnel
- Parent company, CAE Inc., is based in Montreal
- CAE Inc. has been developing control systems for over 30 years.
 - Systems have been adopted for over 100 warships
 - In 16 navies around the world