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

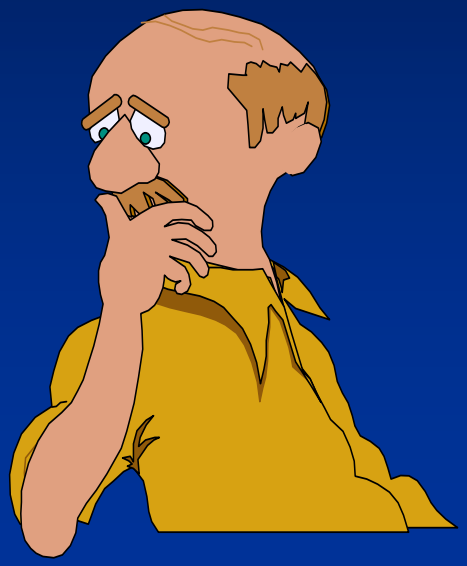
- **Step 1: CMM-Level-3 (in 2002)**
  - Preparation time = 24 Months
    (Faster than typical for 100-person company)
  - Qualification time = 2 ½ Months
- **Step 2: Move to CMMI-Level-3**
  - Currently pursuing CMMI-SE/SW, version 1.1, staged
  - CMMI-Level-3 Appraisal scheduled for April of 2005

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!

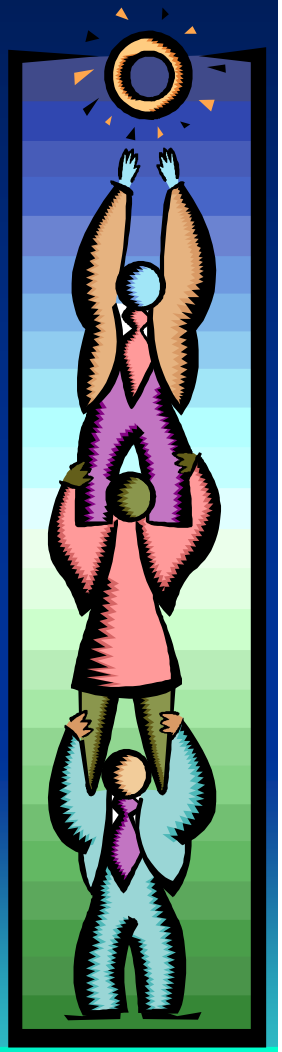
  (to avoid overloading the PMs)



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?

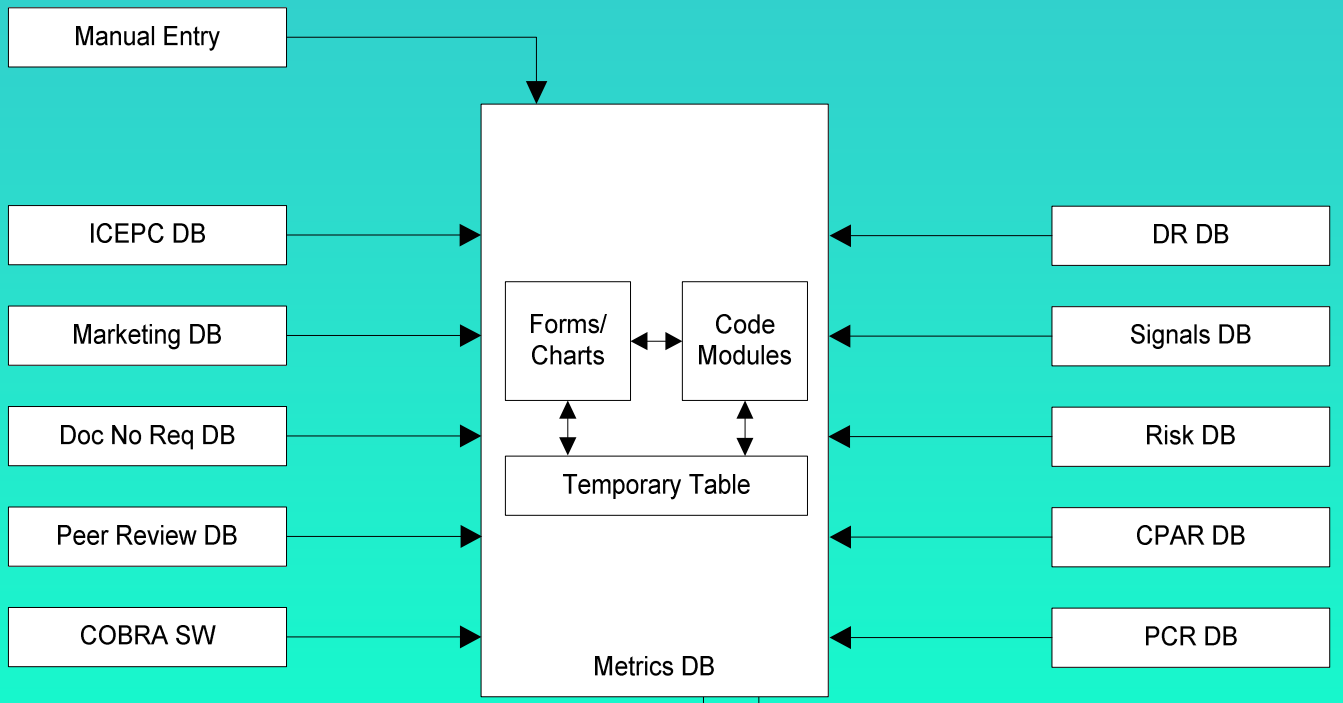
Observations and Solutions

- 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



Legend:

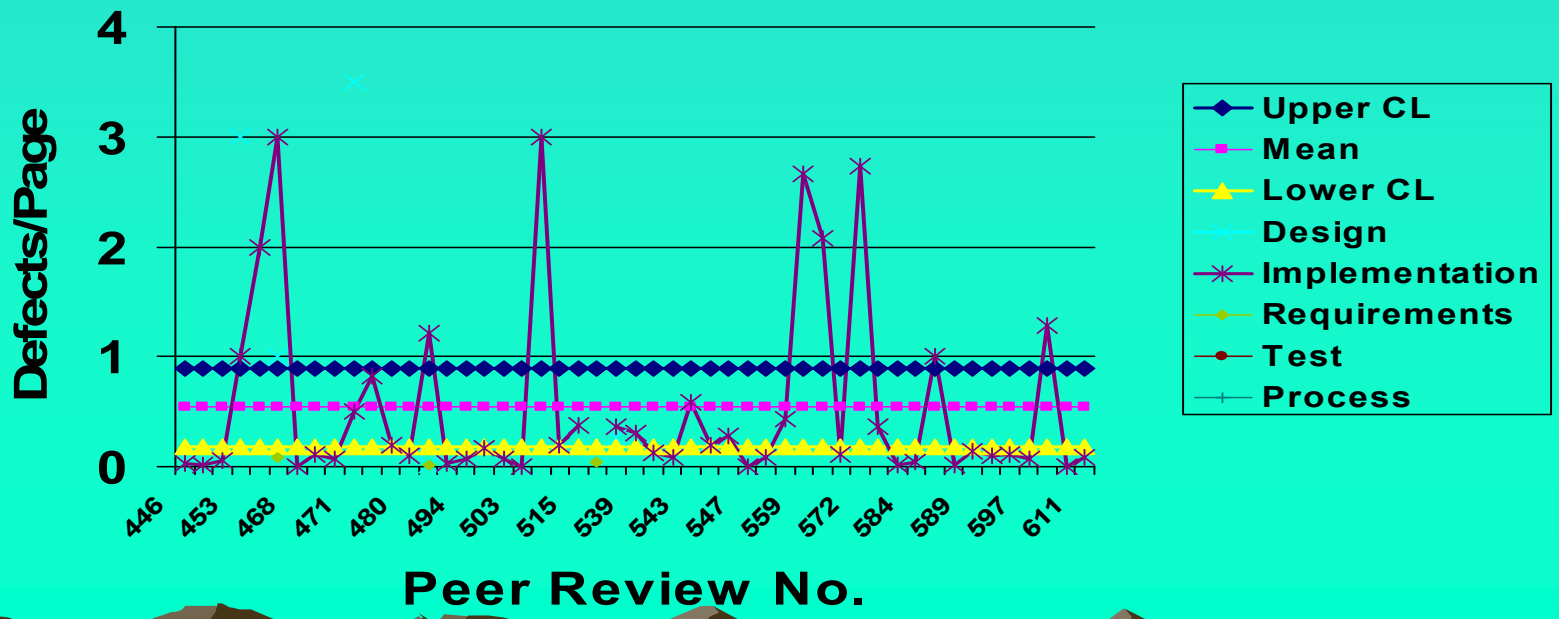
- CPAR - Corrective Preventive Action Request
- DB - Database
- Doc No Req - Document Number Request
- DR - Discrepancy Report
- ICEPC - Integrated Cost Estimating and Program Control
- PCR - Process Change Request
- SW - Software

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