Overview: USC-SEI-CeBASE Workshop on COTS-Based Systems

Barry Boehm, USC-CSE
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Outline

- USC-CSE Highlights, 2000
- USC-CSE Affiliates and Calendar
- Objectives of This Workshop
- Candidate Working Groups and Procedures
- Wednesday Agenda
  - Hello from Jack Ferguson
USC-CSE Highlights, 2000

- New Ph.D.'s: Alex Egyed (Teknowledge), Jongmoon Baik (Motorola)
- Boehm honorary Sc.D. (UMass), INCOSE Fellow, IEEE Mills Award
- COCOMO II book and CD
- Commercially-based EasyWinWin (GroupSystems.com)
- NSF-ITR CeBASE grant with UMaryland, UNebraska, Mississippi State U.

USC-CSE Affiliates (33)

- Commercial Industry (16)
  - Automobile Club of Southern California, C-Bridge, EDS, Fidelity Group, Galorath, Group Systems.Com, Hughes, IBM, Lucent, Marotz, Microsoft, Motorola, Rational, Sun, Telcordia, Xerox
- Aerospace Industry (9)
  - Boeing, Draper Labs, GDE Systems, Litton, Lockheed Martin, Northrop Grumman, Raytheon, SAIC, TRW
- Government (3)
- FFRDC's and Consortia (4)
  - Aerospace, JPL, SEI, SPC
- International (1)
  - Chung-Ang U. (Korea)
**USC-CSE Affiliates’ Calendar**

<table>
<thead>
<tr>
<th>Date</th>
<th>Event Description</th>
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<tr>
<td>June 22, 2000</td>
<td>Easy WinWin Web Seminar</td>
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<td>July 25-26, 2000</td>
<td>Easy WinWin Hands-on Tutorial</td>
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<td>July 27, 2000</td>
<td>Tutorial: Transitioning to the CMMI via MBASE</td>
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<td>August 24-25, 2000</td>
<td>Software Engineering Internship Workshop</td>
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<td>September 13-15, 2000</td>
<td>Workshop: Spiral Development in the DoD (Washington DC; with SEI)</td>
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<td>October 24-27, 2000</td>
<td>COCOMO/Software Cost Modeling Forum and Workshop</td>
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<td>February 6-9, 2001</td>
<td>Annual Research Review, COTS-Based Systems Workshop (with ICSE, CeBASE)</td>
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<tr>
<td>February 21-23, 2001</td>
<td>Ground Systems Architecture Workshop (with Aerospace, SEI)</td>
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<td>February 21, 2001</td>
<td>LA SPIN, Tom Kohl, COTS-Based Systems Processes</td>
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<tr>
<td>March 28, 2001</td>
<td>LA SPIN, High Dependability Computing</td>
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<td>May 2001</td>
<td>Annual Affiliates’ Renewal</td>
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<td>May-June 2001</td>
<td>Rapid Value/RUP/MBASE Seminar (with C-Bridge, JPhD community)</td>
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**Center for Empirically-Based Software Engineering (CeBASE) Strategic Vision**

- **Strategic Framework**
  - Strategic Processes:
    - Targeting G/L: Empirical Methods
  - Tactical Processes:
    - Model Integration (MBASE), WinWin Spiral

- **Empirical Methods**
  - Quantitative
    - Experimental
    - Observational Analysis
    - Parametric Models
    - Dynamic Models
  - Quantitative Relationships

- **Experience Base (Context, Results)**
  - Project, Context Attributes
  - Empirical Results, References
  - Implications and Recommended Practices
  - Experience Feedback Comments

Initial focus: COTS-based systems; Defect Reduction

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2/7/01 USC-CSE
### Top 10 Risk Items: 1989 and 1995

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<thead>
<tr>
<th>1989</th>
<th>1995</th>
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<tr>
<td>1. Personnel shortfalls</td>
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<tr>
<td>2. Schedules and budgets</td>
<td>2. Schedules, budgets, process</td>
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<td>3. Wrong software functions</td>
<td>3. COTS, external components</td>
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<tr>
<td>4. Wrong user interface</td>
<td>4. Requirements mismatch</td>
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<tr>
<td>5. Gold plating</td>
<td>5. User interface mismatch</td>
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<td>6. Requirements changes</td>
<td>6. Architecture, performance, quality</td>
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<tr>
<td>7. Externally-furnished components</td>
<td>7. Requirements changes</td>
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<tr>
<td>8. Externally-performed tasks</td>
<td>8. Legacy software</td>
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<tr>
<td>10. Straining computer science</td>
<td>10. Straining computer science</td>
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### CeBASE Software Defect Reduction Top-10 List
- [http://www.cebase.org](http://www.cebase.org)

1. Finding and fixing a software problem after delivery is often 100 times more expensive than finding and fixing it during the requirements and design phase.
2. About 45-65% of the effort on current software projects is spent on avoidable rework.
3. About 80% of the avoidable rework comes from 20% of the defects.
4. About 80% of the defects come from 20% of the modules and about half the modules are defect free.
5. About 90% of the downtime comes from at most 10% of the defects.
6. Peer reviews catch 60% of the defects.
7. Perspective-based reviews catch 35% more defects than non-directed reviews.
8. Disciplined personal practices can reduce defect introduction rates by up to 75%.
9. All other things being equal, it costs 50% more per source instruction to develop high-dependability software products than to develop low-dependability software products. However, the investment is more than worth it if significant operations and maintenance costs are involved.
10. About 40-50% of user programs have nontrivial defects.
Prospective CeBASE CBS Top-10 List

1. The main sources of CBS-specific development effort are Glue Code, COTS Tailoring, COTS Assessment and COTS Volatility (COCOTS database)
2. CBS projects can easily overrun budgets and schedules by factors of 4 (Garlan et al., 1995; USC term papers)
3. CBS effort distributions vary by CBS type (COCOTS database)
4. Hypothesis: Most glue code effort levels can be predicted reasonably well by parametric models (COCOTS data)
5. Hypothesis: CBS costs can be estimated via architectural mismatch analysis (UMD, USC)
6. Hypothesis: CBS evolution costs dominate CBS development costs (Lockheed Martin)
7. Hypothesis: Glue-code inspection yields will be lower than new-code inspection yields (UMD)
8. Hypothesis: CBS costs vary as the square of the number of independently-developed COTS products (USC, UMD)
9. Hypothesis: CBS projects are twice as likely to be totaled as non-CBS projects (UMD, USC)
10. Hypothesis: Half of the totaled CBS projects result from trusting in vendor vaporware (UMD, USC)

Data Highlights

Mean % of Total COTS Effort by Activity (+/- 1 SD)

- Assessment: 49.07% ± 7.57%
- Tailoring: 50.99% ± 7.48%
- Glue Code: 61.25% ± 0.88%
- System Volatility: 20.27% ± 2.35%

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COTS Tailoring Effort Variation

(% projects in COTS database)

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<tr>
<th>Device Drivers</th>
<th>GUI</th>
<th>Networking</th>
<th>OS</th>
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<td>3</td>
<td>(3)</td>
<td>(4)</td>
<td>(3)</td>
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COCOTS Glue Code Model Estimates vs. Actuals

Estimated PM vs. Actual PM

Estimated PM = 62%
Workshop Objectives

- Address key COTS-based system challenges and opportunities
- Assess new directions in COTS-based system development and evolution
- Provide guidelines for USC-CSE/SE/CEBASE research, Affiliate activities
  - Needs, priorities, risks, opportunities
- Stimulate further USC-CSE/SE/CEBASE/Affiliate collaboration

Top Level Agenda

- Wed: 8 am - 4 pm: CBS Presentations
  4 - 5 pm: Working groups context setting
  5 - 7 pm: Reception
- Thurs: Working groups
  12:00-2:00 pm: Lunch and plenary session
- Fri. am: Working group reports; USC-CSE response; wrap-up
  - End by 11:30 am
Proposed Working Groups
(Coordinators; Scribe)

1. CBS Process Issues (Carney, Port; Al-Said)
2. CBS Architecture Issues (Seacord, Medvidovic; Roshandel)
3. CBS Post-Deployment Issues (Oberndorf, Reifer, Betsy Clark)
4. CBS Metrics and Predictive Models (Abts, Brad Clark)
5. CBS Dependability Issues (Basili, Brown; Lee)

Working Group Guidelines

- Product: briefing, preferably with notes and priorities
- Topics should include:
  - Most critical issues in area
  - Most promising opportunities
  - Results from prioritization surveys
  - Research suggestions: general, CSE/SEI/CeBASE, CSE Affiliates