GSAW 2002 COTS Integration
Breakout Session Summary

COTS Integration:
How Far Have We Come?
Problems and Solutions in 2002

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Breakout Session Goals

• View the topic of COTS integration from multiple perspectives
  ❖ Integrator
  ❖ Vendor
  ❖ Cost
  ❖ Participants
• Identify solutions and successes
  ❖ What factors contributed to the successes?
• Identify ongoing and new problems and issues
  ❖ What factors contributed to the problems?
  ❖ How can the problems be reduced or eliminated in the future?
• Update survey on COTS upgrade release frequency
What Happened

• **Introductions**
  ❖ Session participants included Aerospace, industry, academia, acquirers, users, and cost estimators

• **Integrator perspective**
  ❖ "Integration and Maintenance with the COBRA Architecture" - Tim Spinney, The Aerospace Corporation

• **Vendor perspective**
  ❖ "Integration: Reinventing an Expensive Wheel" - Larry McQueary, Talarian

• **Cost perspective**
  ❖ "Costing COTS Integration" - Marilee Wheaton, TRW

• **32 participants with lively discussion**
• **Collected data for COTS upgrade release survey**
"Integration and Maintenance with the COBRA Architecture" -- Tim Spinney

- Maintenance paradigm not updated to reflect new realities of COTS-Based System (CBS) sustainment
  - Insufficient funds budgeted for COTS upgrades
  - Management reassigns COTS upgrade budgets to efforts considered higher priority
  - License costs are a large portion of minimal maintenance budget

- Solutions:
  - Middleware-based architecture with loose coupling of functional areas
  - Small number of COTS products
  - Written back-out plan for every COTS product upgrade
“Integration: Reinventing an Expensive Wheel”  -- Larry McQueary

• Solutions:
  ❖ Don’t overlook or underestimate the infrastructure of the software architecture
  ❖ Use loosely coupled components
  ❖ Adhere to standardized interfaces
  ❖ Thoroughly evaluate COTS products (including possible vendor relationships)
  ❖ Prototype use of COTS products
  ❖ Enter into a partnership with the vendor and communicate
  ❖ Utilize vendor training and consulting capabilities
    ✦ Don’t develop in a vacuum
  ❖ Buy the maintenance that you need (e.g., 24/7 support)

“Despite discussion to the contrary, using COTS is still cheaper and more effective than building”
“Costing COTS Integration” -- Marilee Wheaton

- Use lessons already learned
- Use cost risk analysis to estimate cost of uncertainties in CBS development
  - Define, estimate and analyze risk in each component
- Use cost models that incorporate COTS-related costs (e.g., COCOTS, SEER-SEM)
- Need to estimate size of COTS (not just SLOC), amount of functionality used, and COTS cost drivers
- Collect COTS integration data to provide a historical basis for better estimates
  - Calibrate the cost models with your data
“Costing COTS Integration” -- Marilee Wheaton

- Be sure to include all COTS-related costs, especially those not included in the cost model estimates (e.g., licenses, training)
- Expect glue code to have a lower productivity than custom software
- Cost of COTS versus custom development needs to be evaluated for the full life cycle (not just development)
  - Distribution of costs will be different for COTS and custom development projects
Conclusion

• CBS development and sustainment has inherent uncertainties beyond the control of the acquirers, developers and users

• Effective CBS development and sustainment requires a change of processes and attitudes across the entire life cycle and among all parties
  - Acquirers
  - Developers
  - Users
  - Integrators
  - Procurement
  - Contracts
Survey on COTS Upgrade Release Frequency

1. In your experience, what is the average duration between releases of a given COTS Product?
   - GSAW 99 = 6.3 months
   - GSAW 00 = 8.5 months
   - GSAW 01 = 8.75 months
   - GSAW 02 = 9.6 months (range: 6 to 18)

2. For system(s) with which you have experience, how frequently are system upgrades released that incorporate COTS software upgrades?
   - GSAW 02 = 20.5 months (range: 4 to 70)
Backup Charts
Key for following charts:
- “Gn” indicates GSAW 2001 issue and ranking
- “A” indicates 2000 Aerospace study issue
Product Issues

- Requirements vs. COTS capabilities (G1)
- Integration of
  - Multiple COTS products (G2)
    - Incompatibilities among COTS products (A)
  - COTS products with new/reuse software (G5)
- COTS independent architecture (G3)
  - Designing architectures for COTS evolution (A)
  - Designing in safety, security, supportability (A)
- Mission risk (G6)
- Cross platform portability (G11)
- Standards: good, bad, ugly? (G14)
- API breakage (“unplug and replay”) (G15)
- Dormant functionality or features (G18)
- Adverse effects of product upgrades on system (A)
Process Issues - Developer

- Robust initial and periodic COTS product evaluation (A)
- Prototyping in a system context (A)
- Testing in operational context (G12)
  - Regression testing of upgrades in system context (A)
- Adapting software and systems engineering processes for CBS development and maintenance (A)
- Still need systems and software engineering (A)
- Need enhanced CM processes (A)
- Planning for COTS upgrades and evolution during development and maintenance (A)
- Selection of hardware platforms with availability of COTS software as key criterion (A)
Process Issues - Customer and User

- Acquisition and support strategies (G16)
- Adapting customer/user processes to CBS acquisition, operations and maintenance (A)
- Processes for trading cost, schedule, requirements, and O&M concepts (A) against COTS capabilities
  - Need requirements prioritization (A)
- Need contracts compatible with CBS development and maintenance (A)
- Standardized processes for safety certification and security accreditation of CBS needed (A)
- Standardized license processes to ensure suitability of licenses and maintaining currency (A)
Resource Issues

- Cost vs. benefit of upgrading (G7)
- Acquiring and maintaining CBS skills (G9)
- Accurately costing all aspects of CBS development and maintenance (A)
- Optimal scheduling of upgrades (A)
- Increased computer resources for upgrades (A)
- Modifying COTS is a BAD idea! (A)
- Need cost and schedule management reserves (A)
- Reallocating time and effort across life cycle (A)
  - More time for evaluation, prototyping and analysis (A)
  - Less time for implementation; more time for integration (A)
Marketplace Issues

- **Product maturity (G4)**
  - Dropped or de-emphasized platforms and products (A)
  - Changes in fees and fee structure for licenses and services (A)
- **Marketplace maturity (G8)**
  - Vendor volatility (A)
- **Vendor responsiveness (G17)**
  - Changes in type and quality of vendor support (A)
- **Definition of COTS (=“for sale”) (G19)**
- **Suitability of licenses for user application (e.g., expiring keys, export restrictions) (A)**
- **Release schedule, content and quality unpredictable (A)**
- **Rapid technology turnover and limited support of past releases (A)**
Intergroup Interaction Issues

- Customer resistance to COTS--NIH (G10)
- Excessive customer bias toward COTS (A)
- Vendor relationships (G13)
- Establishing and maintaining active partnership between customer, developer and user (A)
- Need flexible and efficient responses to unexpected impacts by customer/user (A)
Resources

• **CeBASE COTS**
  - http://www.cebase.org/

• **CeBASE COTS Lessons Learned site**
  - http://fc-md.umd.edu/ll/index.asp

• **SEI’s COTS-Based Systems Initiative**
  - http://www.sei.cmu.edu/cbs/

• **International Conference on COTS-Based Software Systems (ICCBSS - “ice cubes”)**
  - http://seg.iit.nrc.ca/iccbss/
Aerospace Publications


  - Includes paper and briefing charts
Aerospace Publications (Continued)
