It’s Hard to Make Product Line, Architecture and Reuse Concepts Work in Practice

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Presentation Key Points

• Product lines, architectures and reuse make good business sense to firms in the business
• We have been trying to use these concepts for over a decade
• The primary barriers to effective use are political and managerial, not technical
• Customer help is needed in order for us to put these techniques to work
• Because you are Level 4 doesn’t mean your process addresses use of these techniques
Who Are We?

Organizational Profile

- > 800 software engineers
- Average experience > 12 yrs
- Real-time systems our bread and butter (F16, ETRAC, etc.)
- Level 4 organization
- Organization distributed
  - Maryland, Illinois, Connecticut
- Multiple lines of business
  - Airborne radars - Air defense
  - Space sensors - Others
What We Tried - A Little History

• 1989 – First Initiative
  – Library-centric approach developed under USAF sponsorship
  – Built a hypertext library
  – Library selected by OSD for I-CASE
  – Never caught on in-house
    • Limited incentives
    • Hard to find the right stuff
    • Projects not in control

• 1995 – Second Attempt
  – Architecture-centric approach developed under IR&D
  – Developed reference architecture for each line of business
    • Hired the talent
    • Built domain model using modes as delimiter
    • Took best-of-breed architectures as starting points
Example Radar Architecture

- Platform
- Posix kernel
- Multi-threading executive
- Activity Managers
- Measurement Functions
- Mathematical libraries
- Sensor Manager
- Inputs
- Libraries
Technical = Easy Part

- Fanning architecture out and getting projects to share assets = hard part
  - Few incentives for projects
  - Customer makes it difficult
  - Infrastructure non-supportive
  - Many organizational and political barriers

- What worked and what didn’t in practice
  - Having business case = NO (let the other guy do it)
  - Platform groups = NO
  - Taxes = NO
  - Rewards = YES (free help)
  - Making it part of the preferred process = YES
  - Aligning product lines with lines of business – YES
Other Lessons Learned

- Ownership right to assets are emotional issue
  - Develop architecture and preferred assets on own dollars
- Security can be a driver especially when dealing with FMS
- Need a chief software engineer in each line of business – owns/promotes use of architecture

- Have SEPO architect the process to address sharing & architectures
  - Architecture reviews
  - Milestone definitions
  - Use of Integrated Product Teams
  - CM – shared versus reusable distinctions
- Keep the talent around to help projects (free)
Is It Worth All Of The Pain?

• We believe so because:
  – Using populated reference architectures, we can build an air defense system in half the time
    • Done it for Algeria, Egypt, Thailand, etc.
  – Using preferred parts, we can prototype a system and demonstrate it works while others can’t
    • Done it for airborne surveillance and fighter aircraft
  – Using best-of-breed architectures, we can deliver systems with 10X reliability within a line of business – doing it consistently for our customers
A Few Suggestions To Conclude

**Recommendations**

- The USAF needs to work the non-technical issues as hard as the technical ones.
- The SEI needs to address product lines, architectures, and reuse in the CMMI.
- All of us need to pool our experiences.