

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

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and

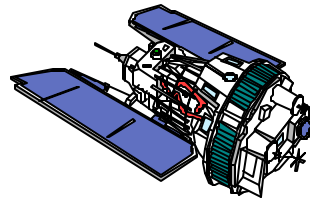
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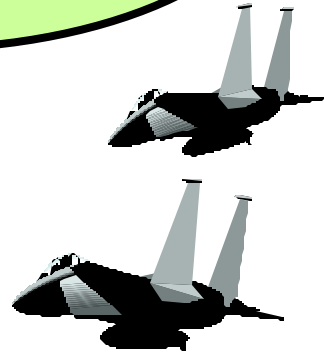
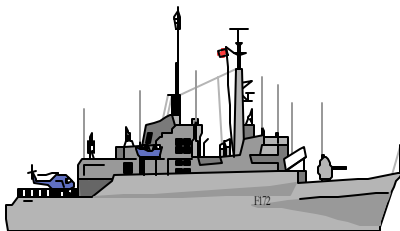
Presentation Key Points

- 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?



Northrop Grumman ES³



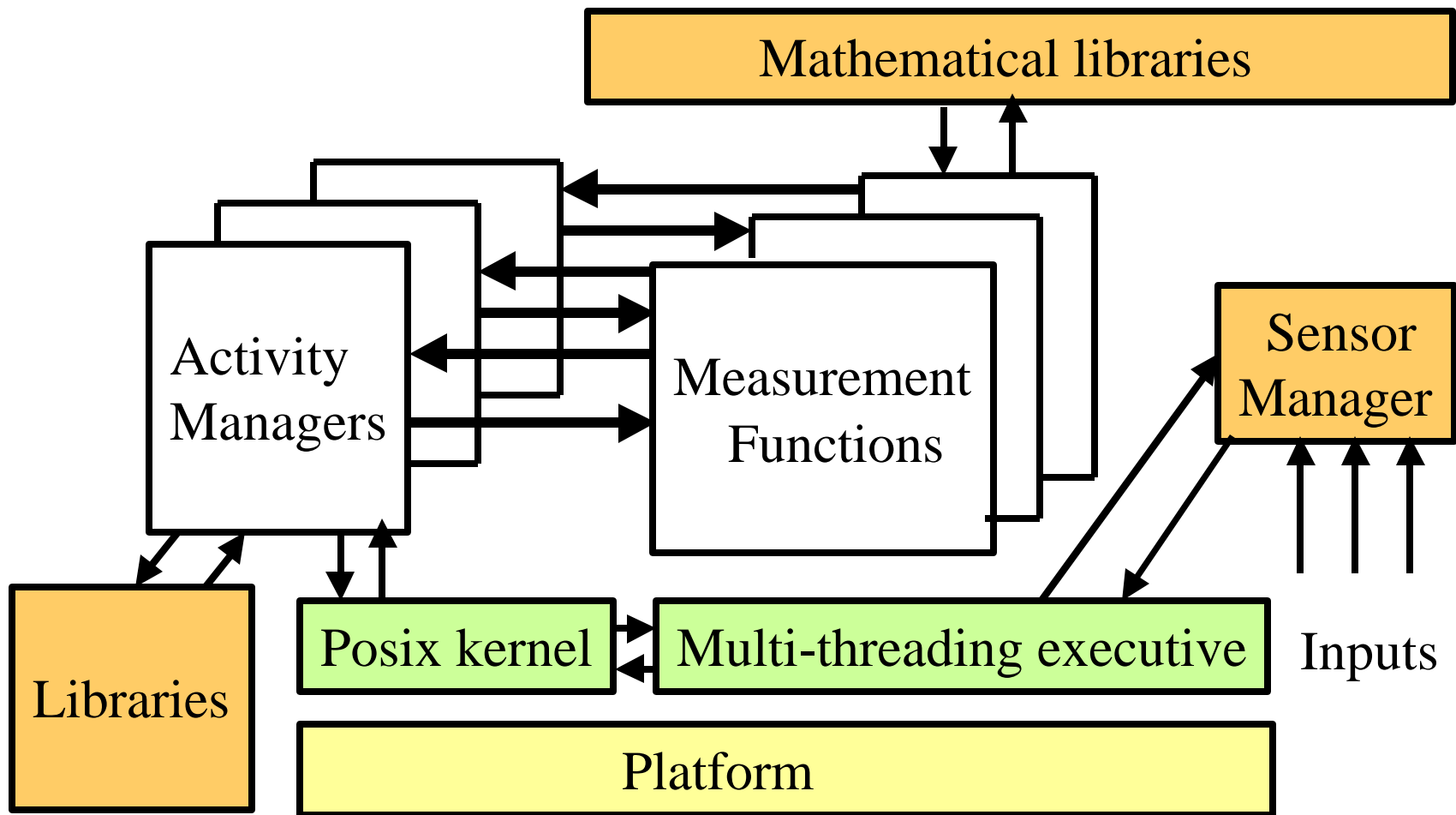
Organizational Profile

- > 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



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