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The Role of Software Architecture in Managing Complexity

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The Message

- **Software is a system’s “complexity sponge”**
 - Software most easily accommodates new functions
 - Software enables hardware standardization
 - Software accommodates evolving understanding

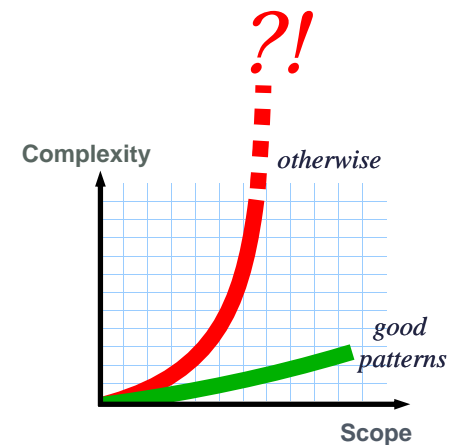
- **Software complexity is a growing problem**

- **Complexity is an issue of understanding**

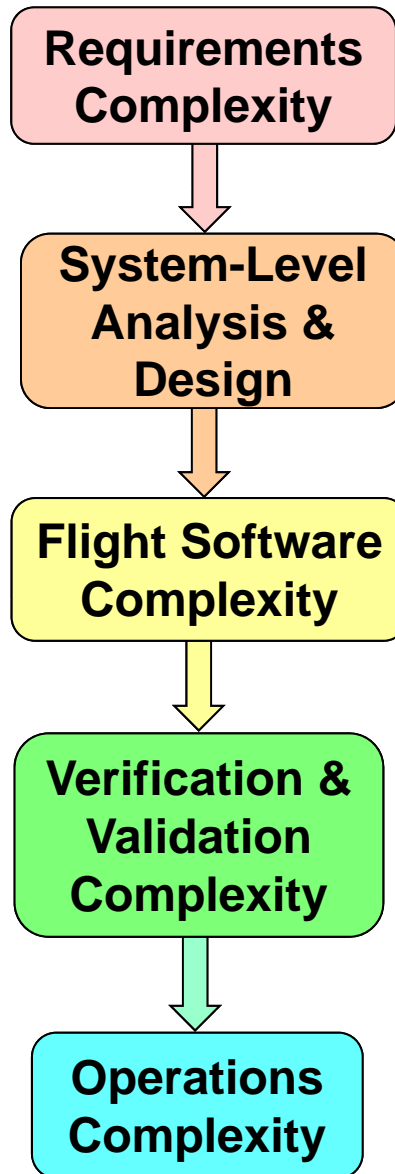
- **The key to understanding is in patterns, which are used extensively in software**
 - Hierarchies • Abstractions • Structure

- **Architecture is the job of choosing and exploiting good patterns**

- **To address complexity, our software architectures must improve**



JPL Span of Software Architecture Concerns



- Architecture *should* address **quality attributes**
 - performance, availability, maintainability, modifiability, security, testability, operability, etc.
 - Watch for unsubstantiated or ambiguous reqmts
- Architecture *should* address **analyzability** and **implementability**
- Architecture *should* address **principles of design**
 - Identify and follow control architecture principles
 - Leverage appropriate architectural patterns
- Architecture *should* address **verifiability**
 - Can simplify or complicate verification
- Architecture *should* address **operability**
 - Inadequate architecture complicates operations
 - Operational workarounds raises risk

- **“Architecture reviews tend to increase quality, control cost, and decrease budget risk.”**
 - [Bass, Clements, and Kazman, *Software Architecture in Practice*, 1998]
- **“In our experience, the average [architecture] review pays back at least twelve times its cost.”**
 - [Daniel Starr and Gus Zimmerman, *STQE Magazine*, July/August 2002]
- **Beneficial side effects:**
 - Team members gain a better understanding of their project
 - Cross-organizational learning is enhanced
 - Architecture reviews ...
 - get management attention without personal retribution
 - assist organizational change
 - [Maranzano et al, *IEEE Software*, March/April 2005]