

# The Role of Software Architecture in Managing Complexity

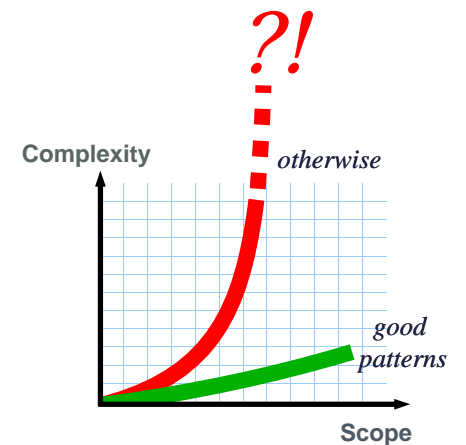
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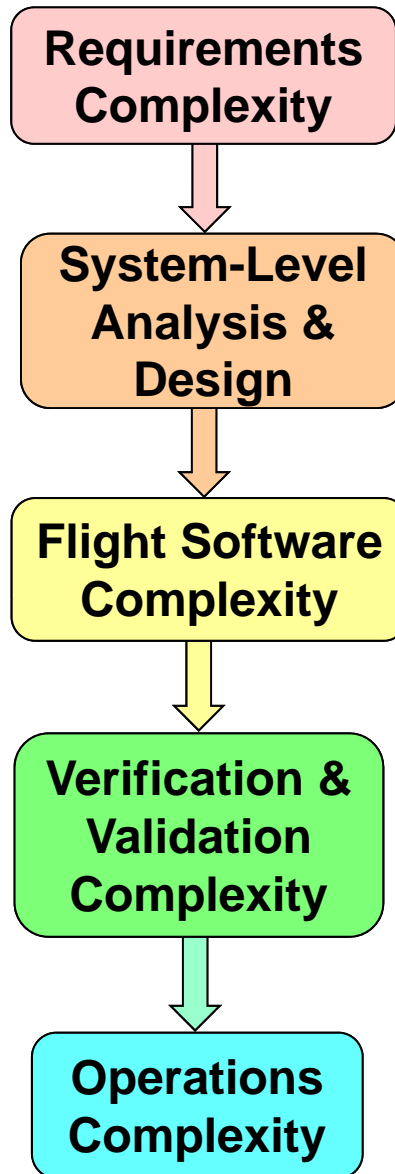
# The Message

- **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**



Source: Bob Rasmussen, JPL

# JPL Span of Software Architecture Concerns



- Architecture *should* address **quality attributes**
  - performance, availability, maintainability, modifiability, security, testability, operability, etc.
  - Watch for unsubstantiated or ambiguous rqmts
- 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]