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20 Years of Architecture

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A Pre-history of Software Architecture

- Information-hiding Principle
  - ("On the criteria …" Parnas, 1972)
- Hierarchical Structure
  - ("On a buzzword …" Parnas, 1974?)
- Data Encapsulation
  - ("Some conclusions from an experiment … Parnas, ???)
  - ("Modularization and hierarchy in a family of operating systems", Habermann/Flon/Cooprider 1975)
- Separate dependency specs from code
  - ("Programming-in-the-Large …" DeRemer and Kron, 1975?)
- Module Guide
  - ("The modular structure of complex systems", Parnas, Clements, Weiss 1984)
- Software Engineering Institute (Habermann, 1984)

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Hard Problems in Modularity

Modules should decouple development tasks

- Which ones?
- How far into the future?
- Can't decouple them all

Anticipating Change

- Marketplace
- Stakeholders
- Technology

Measuring Modularity

- Detecting modularity errors using code structure and change sets.
  - Files that change together, not due to static dependency
  - Prof. Yuanfang Cai and students, Drexel University
- Predicting future change using structure measures and change history
  - Prof. Alan MacCormack, MIT/Harvard Business School and students
  - Analyzing Siemens projects

Hard Problems in Systems-of-Systems

Technology Stacks

- Specialization forces us to rely on third-party components
- A recent small project imported 15 technologies.
- Bigger project: 300 open source components, 30 distinct licenses
- Lose control over aggregated quality attributes
  - E.g. telephone switch reliability.
    - Four VoIP switch HW/SW vendors
    - Third-party server hardware
    - 18 month server market window
    - How reliable is the hardware?

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Hard Problems in Architecture Description

Maintainable Architecture Descriptions

- Subsystem tree is almost enough
- Other information has diminishing return

System Architecture

- Mostly Software Architecture
- Add physical/mechanical/electrical components
- Cross-domain communication, trust, and engagement.
- Requires “real” engineering education