Arch Basics & NFPs

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What is SW architecture?

- Definition:
  
  “The set of principal design decisions about the system”

- Blueprint for construction and evolution.

- Encompasses:
  - Structure
  - Behaviour
  - Interaction
  - Non-functional properties
Prescriptive vs descriptive

- Prescriptive architecture dictates how the system will be built *a priori*.
  - (as-conceived)

- Descriptive architecture captures how the system was actually built after the fact.
  - (as-implemented)
Architectural degradation

- Drift
  - Introduction of changes that are not captured in the current architecture but do not violate it.

- Erosion
  - Introduction of changes that violate the current architecture.

- How can this happen?
Architectural recovery

- [ICSE 1999: Bowman, Holt, and Brewster]
- Conceptual architecture
  - How developers think about the system.
  - Focuses on meaningful relationships.
- Concrete architecture
  - How the system was actually built.
  - Necessary: the devil is in the details.
Components

- Elements that encapsulate processing and data at an architectural level.

- Definition:
  - Architectural entity that:
    - encapsulates a subset of functionality.
    - restricts access via explicit interface.
    - has explicit environmental dependencies.
Connectors

- Definition:
  - An architectural entity tasked with effecting and regulating interactions between components.
  - Connectors are often more challenging than components in large heterogeneous systems.
  - Often consists of method calls, but be much more.
  - Examples?
  - Often provide application-independent interaction mechanisms.
Configurations

- Bind components and connectors together in a specific way.

- Definition:
  - An architectural configuration, or topology, is a set of specific associations between the components and the connectors of the system’s architecture.
  - Differentiates a bag of components and connectors from an implementable system.
Architectural styles

- Some design choices are better than others.
  - Experience can guide us towards beneficial sets of choices (patterns) that have positive properties.
    - Such as?

- An architectural style is a named collection of architectural design decisions that:
  - Are applicable to a given context.
  - Constrain design decisions.
  - Elicit beneficial qualities in resulting systems.
NFPs

NFPs are constraints on the manner in which the system implements and delivers its functionality.

E.g.,

- Efficiency
- Complexity
- Scalability
- Heterogeneity
- Adaptability
- Security
- Dependability
FP vs NFP

- Products are sold based on their FPs.
  - e.g., Cell phone, Car, Tent.
- However, NFPs play a critical role in perception.
  - “This program keeps crashing”
  - “It doesn’t work with my [...]”
  - “It’s too slow”