WICSA/ECSA 2012, Helsinki

Software Architecture: Past, Present, and Future Directions

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Past & Present
- impression from:

- **Dewayne E. Perry, Alexander L. Wolf**

Google Scholar: 2012-08-20: Cited by 1893
2. Intuition, Context, and Motivation

2.1 Developing an Intuition about Software Architecture

- Computing hardware architecture
- Network architecture
- Building architecture

Multiple views; Architectural styles; Style and engineering; Style and materials
2. Model of Software Architecture

- Software Architecture = \{ Elements, Form, Rationale \}
  - Elements:
    - processing elements;
    - data elements;
    - connecting elements.
2. Model of Software Architecture

• Example 1:

Croatia Downs Italy For Men's **Water Polo Gold**
2. Model of Software Architecture

• Example 2:
5. Some Benefits Derived from Software Architecture

• SA and Analysis
  – Consistency and Dependency Analysis
    • Consistency of architectural styles
    • Consistency of architectural constraints
    • ....
    • Establishment of dependencies between SA and design, SA and requirements
    • Implication of changes on SA on design and requirements and vice versa
  – SA and reuse
    • Reusing SA components (in contracts to executable components)
Present

- Software Architecture
  = \{ Elements, Form, Rationale \}

  Research
  Academia
  Theory

  Practice

  ADLs
  UML
  .....  

  Methods, Processes
  (ATAM, ...)

  Rationale
  Non-functional properties
  \rightarrow\ Quality attributes
Present ➔ Future – some questions

- Buschmann, Frank; Ameller, David; Ayala, Claudia P.; Cabot, Jordi; Franch, Xavier: Architecture Quality Revisited, Software, IEEE, July-Aug. 2012

- “nonfunctional quality is of little relevance for users and customers, but instead mainly a concern for architects.”
Present ➔ Future – some questions

- Buschmann, Frank; Ameller, David; Ayala, Claudia P.; Cabot, Jordi; Franch, Xavier: Architecture Quality Revisited, Software, IEEE, July-Aug. 2012

- “nonfunctional quality is of little relevance for users and customers, but instead mainly a concern for architects.”

Has Software Architecture became less interesting and less important since there already exists many solutions. Is it just a question to (re)use them?
Present → Future – some questions

- SA – What does it mean?
  - Software Architecture or System Architecture?

Example: Underwater robot

Other examples:
  - Systems of Systems
  - Software-intensive systems, Social systems,....
Present → Future – some questions

• SA – What does it mean?
  – Software Architecture or System Architecture?

  • Diversity of Hardware
  • Tight integration of Software and Hardware (SW is controlling HW)
  • Changes – system concerns, not software concerns
Present → Future, Challenges

- SA
  - From static SA to dynamic SA
  - From Design Models to Run-time models
  - From upgrading/updating ( $S(n)$-$S(n+1)$ ) to continuous change ( $S(x) = \int f(x)dx$ )
  - From structure to control
Present → Future, Challenges

• SA
  – From static to adaptive and **resilient** systems
  – From isolated to eco systems

<table>
<thead>
<tr>
<th>Well define system boundaries</th>
<th>Undefined boundaries states</th>
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<tbody>
<tr>
<td>System analysis</td>
<td>“Panarchical” system analysis</td>
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</table>
Present $\rightarrow$ Future $\rightarrow$ Future, challenges

inspiration $\rightarrow$ model $\rightarrow$ computation / architecture

*) Susan Stepney, Unconventional Computer Programming
Present -> Future -> Future, challenges

inspiration -> model -> computation / architecture

*) Susan Stepney, Unconventional Computer Programming
Future of Software Architecture

- Future of Software is future of SA
  - New unpredictable paradigms
  - New models, new languages, new practices