Reference Architecture

“A Reference Architecture for Web Servers”
by Hassan, Holt – SWAG UoW
Reference Architecture

Definition

- “A reference architecture for a domain defines the fundamental components of the domain and the relations between them”
- “A reference architecture for a domain is an architectural template for all the software systems in the domain”
Automobile

- attributes
  - transportation
  - wheels
  - steering
  - speed / gears
Is This an Automobile?

But this meets the attribute list
Example 2
Properties

Domain

• what is a domain?
• reference architecture covers a whole domain

Fundamental components

• universal abstractions
  – applicable across the domain
• interaction of these abstractions

Template

• a product architecture is an instantiation of the reference architecture
Availability

- **well known for mature domain**
  - compilers, operating systems

- **absent for new domains**
  - web servers
Benefits

Documentation
  • captures the main ideas and components across domain
  • provides a higher level abstraction for architecture itself
    - we don't have to reinvent the wheel or the architecture

Communication
  • provides a common vocabulary
    - the wheel is too big
    - braking distance of the car is reasonable
    - 0 to 60 in 10 seconds
Benefits

Evaluation

- aids in the comparison of the different product architectures in the **same domain**
  - electric vs. hybrid
  - sedan vs. coupe
“Web Server Reference Architecture”

- **Domain:**
  - web servers, application servers

- **Web servers**
  - Apache
  - AOL Server
  - Jigsaw
# Summary of Web Servers

<table>
<thead>
<tr>
<th>Web Server</th>
<th>Dev Type</th>
<th>1st Release</th>
<th>Code Size (KLOC)</th>
<th>Impl</th>
<th>Arch stable for (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apache</td>
<td>Open source</td>
<td>April 1995</td>
<td>80</td>
<td>C</td>
<td>5</td>
</tr>
<tr>
<td>AOL Server</td>
<td>Commercial</td>
<td>May 1995</td>
<td>164</td>
<td>C &amp; TCL</td>
<td>-</td>
</tr>
<tr>
<td>Jigsaw</td>
<td>Educational</td>
<td>May 1996</td>
<td>106</td>
<td>Java</td>
<td>2.5</td>
</tr>
</tbody>
</table>
Deriving a Reference Architecture

Process

- **step 1**: derive a conceptual architecture for each
  - *propose* a conceptual architecture
    - using domain knowledge and available documentation
  - *refine* the conceptual architecture
    - using the concrete architecture
  - **QUESTION**: did we not say that a reference architecture should be an input artifact to a conceptual architecture?
Deriving a Reference Architecture

Process

- **step2**: derive a reference architecture from step 1
  - **propose** a reference architecture based on
    - domain knowledge
    - common structure between the conceptual architecture
  - **refine** the reference architecture
    - using the conceptual architecture (from step 1)
Web Server Reference Architecture
Architectural Style

- follows pipes & filter architectural style
  - hmmm.... does it really?
  - what other architectural styles better define web servers?
Reference Architecture

Main subsystems

- reception
- request analyzer
- access control
- resource handler
- transaction log

Support subsystem

- utility
- operating system abstraction (OSAL)
Subsystems

Reception

- process the request from client
- transforms the HTTP request into internal system representation
- virtual extension of the browser/user
  - browser capabilities, preferences etc
- concurrency & load balancing
  - should be able to handle multiple concurrent requests
Request Analyzer

- operates on the internal representation of the HTTP user request
- maps a logical resource to a physical resource
  - www.test.com/test.cgi ➤ /public_html/testing/scripts/test.pl
- can provide additional features
  - correction of typing errors
  - case insensitivity
Access control

- **authentication**: who are you?
- **authorization**: are you allowed?

Resource handler

- **process a request**
  - retrieves a file or executes a script
- **generate a response**
  - usually an HTML document
Flexibility of Reference Architecture

Intent

• “To be useful a reference architecture must be flexible enough to encompass many product architectures”

• what does flexibility mean?
• security flexibility
• concurrency flexibility
Reference & Conceptual Mapped

Apache

- reception
- record transactions
- request analysis
- access control

- Translation
- Core
- Logging
- MIME type
- Response
- Util
- OSAL

Legend:
- Subsystem
- control flow
- all depend on
Mapping

- mapping of three conceptual architectures to a reference architecture
- subsystem organization is the main difference and not the subsystem responsibility
- reference architecture is abstract
  - does not depend on
    - development methodology
    - platform
    - implementation concerns
Conclusion

Reference architecture

- provides a global template across a domain
- helps better understand and communicate the architecture
- enables a comparison of different architectures in the same domain