Architectural Analysis

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Q1

Today

- Intro. to Architectural Analysis
- Design Studio: Smart Storage Solution

Software architecture: the large-scale motivations, constraints, organization, patterns, responsibilities, and connections of a system

Structure and connections

Components, connectors, and topology

One View of Architectural Analysis

- A specialization of requirements analysis focused on those requirements that strongly influence the large-scale structure and connections of the system
- Typically focused on “ilities”

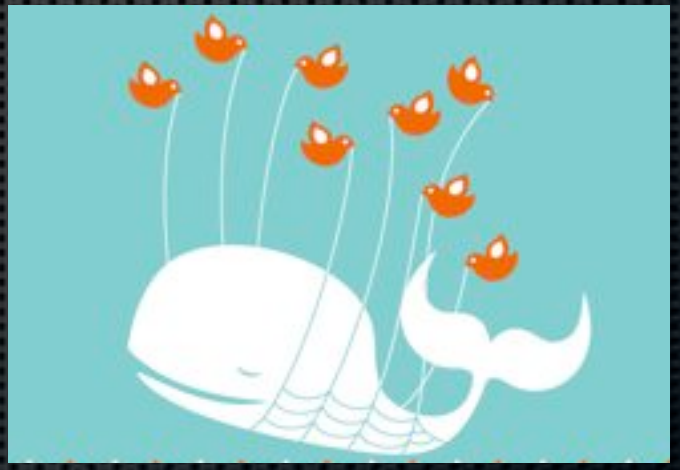
Why does Architectural Analysis matter?

- Reduce the risk of missing something important
- Avoid applying too much effort to low priority issues
- Align the product with business goals

Just an intro today.
AA is a main focus of CSSE 377

When do we do Architectural Analysis?

- Before the first iteration
  - Waterfall?
  - Nope, **risk** management
- Between every iteration



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Points of Change

- **Variation point**: points of change *in the existing system or requirements*
  - E.g., multiple tax calculators
- **Evolution point**: points of change that *may arise in the future* but aren't currently present
  - E.g., hand-held POS devices

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Goals of Architectural Analysis

- Identify and resolve non-functional requirements
- Identify variation points
- Identify *most probable* evolution points

Example Questions

- How do reliability requirements affect the design?
- How do licensing costs of subcomponents affect profitability?
- How do adaptibility/configurability requirements affect the design?
- How does branding affect the architecture?

Cartoon of the Day

Used by permission. http://notinventedhe.re/on/2009-11-23

Common Steps

- Identify the *architectural factors*
  - Non-functional requirements that have an impact on the architecture
  - Also functional requirements related to variation/ evolution points
- Analyze alternatives and create solutions → *architectural decisions*
- Document these decisions—*technical memos*

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Architectural Factors

- FURPS+ Requirements:
  - Functional
  - Usability
  - Reliability
  - Performance
  - Supportability
  - +
- Typically the *non-functional* quality attributes drive the architecture
  - Why?

Quality Scenarios

- Measure quality requirements
- Usually of the form <stimulus> <measurable response>
  - E.g., “When the completed sale is sent to the remote tax calculator, the result is returned within 2 seconds, measured in a production environment under average load conditions”

Pick your battles!

Factor Table in Supplementary Spec.

Factor	Measures and quality scenarios	Variability (current flexibility and future evolution)	Impact of factor (and its variability) on stakeholders, architecture and other factors	Priority for Success	Difficulty or Risk
Reliability—Recoverability					
Recovery from remote service failure	When a remote service fails, reestablish connectivity with it within 1 minute of its detected re-availability, under normal store load in a production environment.	current flexibility - our SME says local client-side simplified services are acceptable (and desirable) until reconnection is possible. evolution - within 2 years, some retailers may be willing to pay for full local replication of remote services (such as the tax calculator). Probability? High.	High impact on the large-scale design. Retailers really dislike it when remote services fail, as it prevents them from using a POS to make sales.	H	M
Recovery from remote product database failure	as above	current flexibility - our SME says local client-side use of cached "most common" product info is acceptable (and desirable) until reconnection is possible. evolution - within 3 years, client-side mass storage and replication solutions will be cheap and effective, allowing permanent complete replication and thus local usage. Probability? High.	as above	H	M

Technical Memos: Documenting Decisions

- Summarize the *issue*
- List the relevant *architectural factors*
- Describe the chosen *solution*
- Give the *motivation* for choosing the solution
- Note any *unresolved issues*
- Identify *alternatives considered*

Including rationale for rejecting alternatives

Lots of sample memos in the book

Q5

Architectural Decisions and Priorities

- First: inflexible constraints, safety and legal compliance
  - E.g., NextGen POS tax law compliance
- Second: business/organization goals
  - E.g., planned expansion into European market
- Third: other goals, including evolution points ordered by estimated probability

Separation of Concerns

Architectural factors are often *cross-cutting concerns*

- Some large-scale techniques for SOC:
  - Modularize into separate components
    - E.g., persistence service/façade, layered arch.
  - Use decorators
  - Use post-compilers or aspect-oriented techniques
  - Architecture description languages (ADLs)

Summary

- Architectural concerns are often related to *non-functional requirements*, including *business/organization goals*
- Architectural concerns involve system-level, *large-scale problems*. Solutions involve large-scale design decisions.
- Architectural analysis deals in *interdependencies and trade-offs*
- Architectural analysis requires *evaluation of alternative solutions*

Design Studio: Smart Storage System

Team describes problem and perhaps current solution (if any)	~5 min.
Class thinks about questions, alternative approaches. **Q7**	~3 min.
On-board design	~12 min.