Software Architecture Design Reasoning and Thinking

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In this working session, we want to draw on everyone’s experience to explore the thinking and reasoning issues that you have encountered about software architecture design thinking and reasoning, to find ways to help designers think and reason better.
Participant Presentations
The people problem? – architects and developers

- Cognitive biases
- Ivory tower architecting
- “Small & stealthy” decision-making (by individual developers)
- No discussion of rationale before making decisions -> only after the fact
People problems – client, management & business side

• Cognitive biases (again, always, everyone)
• No care about good design/architecture -> they only want features & short-time gains
• Communication problems between business <-> development team
• Hard to measure the impact of bad decisions:
• There is a really long road from bad decisions to problems:
  • problem -> (bad) decision -> (...) -> lose of resources/gains
Agile related problem?

- Many small decisions in every iteration
- Ad-hoc decisions
- No thinking about the bigger picture
- Fixation/Anchoring on certain agile aspects
  - “Customer collaboration over contract negotiation” -> client pressure on continuous changes
  - “Working software over comprehensive documentation” -> no documentation, knowledge vaporization
Ideas/Solutions

- Add new rules "to the game" ---> (how do we popularise this?)
  - make critique a routine
  - make people that came up with the idea to come up with at least 2 disadvantages
  - think about the rationale before deciding on anything

- Pair architecting

- Debiasing:
  - Inform about cognitive biases
  - Anchor them on some "worst case scenarios" on purpose
  - Ask, Ask, Ask.. Why? What do you mean? What do you want?

- Prioritize decisions? -> it is hard to focus on every problem

- Show management/business/client what was lost to convince them of the importance of the problem
Diverse Design Reasoning

• Acknowledge that you are making decisions
  • Biases and inexperience may be an impediment
• Martial diversity to make better decisions
  • Social/Professional Diversity: different people with different backgrounds involved in decisions
  • Technical Diversity: different solutions to problems
Social/Professional Diversity

- Democratize design decisions into the whole team
  - Requires lightweight activities in every day processes
  - E.g., standup meetings, architecture decision records
- Encourage/mandate senior engineers to seek opinions from different stakeholders
  - Move away from “culture of blame”
  - Do decision reviews in same spirit as code reviews
  - Lead by example
- Just make teams diverse
Technical Diversity

- Recognize multiple solutions to a problem
  - Often fall back on known-good past solutions that might not apply in current context
  - Requires and educational / exploratory ethos that seeks out solutions
  - A catalog of design patterns / decisions?
Design Thinking and Reasoning Issues and Counter-Measures

Thinking and Reasoning Behaviours
- Cognitive biases
- Bounded rationality
- Personality
- Cultural background – consensus/quick decision/ivory tower
- Satisficing
- More ...

development issues (observable/undetected)
- Avoid blames or making decisions (reverse incentive)
- Making unrealistic assumptions
- Disagreements between team members (Finns vs Swedish)
- Do not document design rationale
- Favors near term solution rather than long term solution
- Ignore constraints
- More ...

counter measures
- Need to suggest why a decision is bad
- Policy changes (e.g. equal gender opportunity in recruitment)
- Pair architecting
- Apprenticeship
- Share design rationale documentation responsibility
- Reflection
- Syllogism
- New Development Practices
- More ...
It’s the Incentives, Stupid

- Cognitive biases are not going away.
- Our current research isn’t making (enough of) a dent.
- Architects and managers will continue to favor short-term over longer-term, and heroism over planning.
- Unless… something changes in how architects are judged and rewarded.
- Why do pilots and surgeons make heavy use of checklists?
- Therefore… we need to:
  1. *push* for stronger emphasis on professional responsibility
  2. *provide* strong evidence -- empirical studies -- that demonstrate the fallacies of short-term thinking and heroic efforts.
  3. *change* how SE students are trained (largely focusing on small, well-understood problems, and on development rather than maintenance).
Discussion Outcomes - Knowledge Areas

Need better understanding of

- the biases that humans bring to the process of design
- how our cognitive limitations (memory, attention, etc.) affect the design process.
- how our social structures and environments change the process of decision making.
- how personality types affect design decisions
- the business forces and constraints that shape our work environments and put pressures on architects
Discussion Outcomes - Solution Areas

Methods that guide the design process.
Checklists that help in lightweight analysis of decisions.
Taxonomies of design decisions to help ensure completeness and consistency.
Reflection as a standard practice in design.
Architecting as a team rather than as an individual.
Continuous tracking of technical (design) debt
Engineering the right incentives/nudges to promote good behavior.
Documenting rationale and context, and not just decisions.
Creating the empirical evidence that all of the above actually help!