

Industrial-strength Architecture Design Decisions

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Rankings - Top 100 university

9/4/2017 | 2

Founded in 1614

- #80 Times Higher Education Worldwide
- #59 Academic Ranking of World Universities
- #86 U.S. News 'Best Global Universities Ranking'





Research Philosophy

- > Core business: Software Architecture
- > With Dutch & European industry (real problems)
 - Embedded Systems & Enterprise Applications
- > Automated Software Engineering
- > Evidence-based Software Engineering
 - Evidence matters empirical research methods



Söftware



Outline

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> Paradigm shift

- > How far have we come?
- > Making it work
- > Wrapping up



Eureka! Architecting is about making decisions



Paradigm shift - solution vs. how we got there

Design alternatives, decisions & rationale



Expertise, skills, previous successes, patterns, best practices

> Goals, constraints, concerns, requirements assumptions, risks

> > Context, business,

technologies

environment, market



Models & Views



Major milestones in academia & industry





The rise of Architecture Decisions



Tofan, Galster, Avgeriou, Schuitema IST '14

CNN Money

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1. Software Architect

Median pay: \$124,000 Top pay: \$169,000 10-year job growth: 23%

In the same way an architect designs a house, software architects lay out a design plan for new programs. That usually means leading a team of developers and engineers, and making sure all the pieces come together to make fully-functioning software.

What's great: New problems come up

all the time and new technologies arise, making each day different, and keeping professionals in demand. "I'm pinged at least once or twice a week for new opportunities," said software architect Christopher Felpel. "There's just a lot of work out there, and that doesn't surprise me." -- Jillian Eugenios

Quality of life ratings:

Personal satisfaction: A | Benefit to society: B | Telecommuting: A | Low stress: A



Christopher Felpel, software architect/consultant

Business Markets

2015 🖤

1 of 100

NEXT

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Outline

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"The life of a software architect is a long (and sometimes painful) succession of suboptimal decisions made partly in the dark" P. Kruchten





State of Practice

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- > Decision making art instead of craft
 - Reasoning ad-hoc
 - Based on own experience and expertise
 - Subject to biases and fallacies
- Not likely to document decisions
 - Decisions incomplete or out of date



van Heesch and Avgeriou WICSA 2011



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- > Documenting decisions?
 - Aware of importance but mostly personalization
 - Depends heavily on project context
- > Where to find decisions?
 - Requirements & functional/logical/UML views
 - Word/Powerpoint/Visio/wiki
- > Views à la ISO/IEC 42010?
 - Aware but not in use (or any systematic approach)

Capilla, Jansen, Tang, Avgeriou, Babar JSS '16



What about the tools?

120 out of 144 primary focus on decision documentation



Tofan, Galster, Avgeriou, Schuitema IST '14





Capilla, Jansen, Tang, Avgeriou, Babar JSS '16

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Tool	CAP	MGM	SHA	DOC	EVO	REU	REA	UCT	COL	PER	ASS
1 st Generation											
RAT	Х	Р		Р			Х		Х		Х
Archium	Х	Р		X			Р				
PAKME	Х	Х	Р		Х			6	Р		
ADDSS	Х	Х			X				Р		
AREL	Х	Р				/			Х		Р
ratic											
Eagle	Х	Х				×			Х	Х	
Adkwik	Х	Х	Х						Х		
SEURAT	Х	Р		Р	•		Р				Х
KA	Х	Х					-		Х	Р	Р
ADDM	Х	Х	Х						Х	Х	
ADDSS 2.0/2.1	Х	Х			X			-	Р	Р	
3 rd Generation											
SAW	Х	Х		X		1		Х	Х		Р
ADvISE	Х	x		Х		Х		N	X		Х
Decision Architect	Х	X	Х	Х	Х		-		Х	Р	Р
RGT	Х	Р	Х	Х	Х				Х		Х



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- Poor embedding in tool chain
- > Disconnected from design process
- > Effort-intensive
- Lack of (industrial-strength) evidence
- Not all stakeholder concerns framed

Tip of the iceberg?

Implicit Decisions



Outline

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- > Build a tool with and for the industry
 - Requirements interviews with software architects
 - Analysis of existing documentation
 - Frequent feedback
 - Extensive validation in 2 case studies





Decision Architect

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- > Add-in for Enterprise Architect
- > Based on 4+1 Decision viewpoints
- Lightweight and just-in-time
 - Optional use of viewpoints
 - Before/after the fact
- > Traceability
- > Reporting

http://decisions.codeplex.com/

Decision Documentation Framework







Decision Viewpoints: Overview

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Relationship



Stakeholder



Chronology



	Concern	< <challenged>> Use TaggedValues for state changes</challenged>	<crejecture Use mo baselin state cl</crejecture
he view.	Feature	**	+
scision	Feature	••	e
e aining	Usability	**	
ificantly	Efficiency	?	23
	Maintainability		



Forces

Detail

van Heesch, Avgeriou, Hilliard, JSS 2012 van Heesch, Avgeriou, Hilliard, WICSA 2012



Building the evidence

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- > Usefulness
- > Ease of use
- Contextual factors
- > Add-in used during daily work

Manteuffel, Tofan, Avgeriou, Koziolek, Goldschmidt, JSS '16

Perceived Usefulness	4000 Group	1 molecular	en e	C. M. S. L.	And the second
Job Relevance					
(c1) Add-in covers all aspects of decision documentation	-		•		
(c2) Relevance of viewpoints depends on project and decisions	•			-	
(c3) High relevance of relationship view	•				
(c4) High relevance of detail view	•		•	-	
(c5) Partial relevance of forces view	•		•		_
(c6) Partial relevance of stakeholder involvement view	•	•	•	•	
(c7) Partial relevance of chronology view	-	-			
(c8) High relevance of tracing	•	•	•	•	
(c9) High relevance of reporting		-		•	_
(c10) Positively satisfied	•	•	•	+(•
(c11) Indicated intention to use add-in in upcoming project		•	•	•	•
Output Quality					
(c12) Increased time investment in decision documentation	•	•			
(c13) Add-in improves quality of the decision documentation	• (•	•	
Productivity	Ţ				
(c14) Supports design and decision process	•	+(•	•
(c15) Improved knowledge internalization	•	-	•		•
(c16) Improved knowledge sharing and reuse	•		•	•	
(c17) Improved maintenance and evolution of decisions	•	•	•		



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"Basically everything is targeted that is needed for a decision documentation."

"I don't have to use another tool for all my decisions but I can do it directly where I spend most of my design work; that's a really big effect for me"

"Sometimes it's enough to look at the relations to understand the rationale behind a decision".

"I would just create more documentation because I have this tool."





Of special interest: Variability

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- Relevance of viewpoints highly specific
- > Large variation, even within one company
 - Agility vs. formality
 - Distributed vs. local
 - Multi-disciplinary vs. mono-disciplinary





Outline

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- > Paradigm shift
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- > Making it work
 - Decisions in design space exploration
- Conclusions and future work



- > For a common mobile infrastructure solution
- > Exploring design space is crucial for platforms
 - Basis for several applications
 - Wide problem and solution space
- > Design decisions at the core
- Different stakeholders and concerns
 - Custom decision views required



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van Heesch, Jansen, Pei-Breivold, Avgeriou, Manteuffel, JSS '17



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Longitudinal Technical Action Research

- > adapt decision viewpoints
- version evaluate the use of the adapted viewpoints
 1st round
- immediately after presenting results to stakeholders
 2nd round
- > two years later how projects actually benefited



Stakeholders

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- Platform Software Architect
- Platform Product Manager
- Platform Architecture Reviewer
- Platform Software Engineer
- > Product Software Architect
- > Product Manager



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- > What key decisions need to be made for the platform?
- > What decisions are subject to product variability?
- > What is an efficient decision roadmap for the platform?
- > How sustainable is a specific decision?



Adapted forces view

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Concerns and Forces	Stakeholder 1	Stakeholder 2	Stakeholder 3	Average Prio	Variance	
Concern: Deployability						
13.1. Specialized "App" stores	5	4	4	4	0,2	
13.2. Private/public cloud solution	2	3	4	3	0,7	
13.3. Push updates	2	2	3	2	0,2	
13.4. Vendor distribution channel	1	5	3	3	2,7	
13.5. Replacement of devices	4	4	4	4	0	
Concern: Device Management						
14.1. Device Usage Monitoring	2	3	4	3	0,7	
14.2. Application usage monitoring/diagnostics	1	4	3	3	1,6	
14.3. Remote Device Management	4	4	3	4	0,2	
14.4. Real-time support	1	3	4	3	1,6	



New view: Decision roadmap

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MS 1



Voice of evidence

"[Forces viewpoint] did help me to view all the alternatives, and benefits and drawbacks"
"Here is a stunning amount of data on this one slide"
"Overall that was so easy to understand and you could quickly recall something and recognize your overall requirements"

-- 2 years later--

"I think the biggest [help was] in terms of agreeing where we want to invest."

"[We] simply followed the proposed path"



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Key take-aways

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- > One size-fits-all does not work
- Embed in process and tooling
 - Lightweight and just-in-time
 - Usability
- > Involve stakeholders
- > Build evidence



Eating our own dog food

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- Decision Documentation for Microsoft Visio
- > Focus: Decision Reuse







https://rationally.github.io



Thank you

Credits:	Christian Manteuffel				
Dan Tofan	Heiko Koziolek				
Uwe van Heesch	Thomas Goldschmidt				
Anton Jansen	Hongyu Pei-Breivold				

http://www.cs.rug.nl/~paris/





Further reading

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