software architectures









Objectives

provide an introduction to the concept of software architecture and its various implementations

provide the opportunity to acquire theoretical and practical understanding of the different dimensions of a software architecture



practical issues lectures: Internef 237 exercises: Internef 143



doplab.unil.ch/software-architecture

evaluation

a written exam at the regular exam session

> written or oral exam at the retake session, depending on the number of candidates





amazon **webservices**

some development tools



Apache NetBeans IDE





COVEQT

students are expected to possess basic knowledge of programming and algorithms, typically acquired through a course like Algorithms and Computational Thinking

this is a brand-new course on an important innovation-driven domain, so expect some changes along the journey



Okay, but what is a



public class Figure private JsonObject json

SOFTAIQYE

lass Figure c Figure(JsonObject

String toString()

gWriter writer = new StringWri createWriter(writer).write(jso



software...

the nature of the software is unique and brings it closer to a living organism than to an inert and passive artifact

because of its unique nature, software is at the heart of the digital transformation and makes this transformation profound

... can be continuously corrected, extended, refactored, optimized





an algorithm is a finite and unambiguous sequence of operations used to solve a problem

the word "algorithm" comes from Muhammad ibn Musa al-Khwarizmi, Latinized to Algoritmi, a Persian mathematician who lived in Baghdad in the 9th century

he was the first to describe a systematic procedure (actually an algorithm) for constructing solutions to linear and quadratic equations

the nature of software

software is closely related to the notion of algorithm



the software revolution

this is the essence of digital transformation

software is not longer being simply used as support for existing human activities but rather becoming the driver of profound changes in the way we do things and even the source of totally new activities

- the "old" mindset
- Align software usage to existing business practices
- business is the driver, software is merely a support

the "new" mindset

a new mindset

extend business models to support new digital channels • embrace the intrinsic fungibility offered by software

property of goods or services whose individual instances are capable of mutual substitution



digital disruption is what happens when you let others drive the digital transformation of your business

did jõu knöw...

- ... the largest taxi company owns no vehicles?
- ... the largest accommodation provider owns no building?
- ... the most valuable retailer has no inventory?
- ... the largest travel agency has no public offices?

digital disruption typical sequence of events

- I. digitization dematerializes the product and makes the existing business more efficient
- 2. some digital technology innovation makes the product fungible but existing actors do not see it
- 3. some outsider who understands the potential of that digital innovation disrupt the market by proposing a cheaper and/or better alternative

digital disruption the example of the record industry

– Phonograph (Edison)

– Gramophone (Berliner)

– Walkman (Sony)

– Standard 78rpm

– CD (Philips/Sony)

digital disruption the example of the record industry

1999 – Napster Service

1998 – MPMan (10 to 30 songs)

000	iTunes						
	Hey Mama			O kanua	0		
	Late Registration (b	ootleg)	Q kanye		S	
	0:13	_	-4:07	56 o	f 4842	Browse	
Source	Music Audiobooks Podcasts Videos	Book	lets Art	ist Album Name			
🕞 Library	Name		Kind	Date Added	Time	Artist	
💎 Podcasts	Drop For Mixtapekings (Outro Pt. 2)	0	MPEG audio file	8/13/05 13:37	0:40	Kanye Wes	
👺 Party Shuffle	☑ One Night Extravaganza	0	MPEG audio file	8/13/05 13:37	4:10	Jamie Fox:	
🛜 Radio	Veak Ass Producer Rap Segment	0	MPEG audio file	8/13/05 13:37	2:50	Kanye Wes	
🔻 🅞 Music Store	🗹 Gold Digger	0	MPEG audio file	8/13/05 13:37	3:06	Kanye Wes	
`₩ Shopping Cart	🗹 Diamonds	0	MPEG audio file	6/24/05 23:20	3:59	Kanye Wes	
Purchased	🗹 Diamonds (Remix)	0	MPEG audio file	6/24/05 22:19	3:50	Kanye Wes	
phaedo's Music	Corners		MPEG audio file	6/19/05 14:29	3:55	Common 1	
Normal Playlists	🗹 kanye west - diamonds are fore	0	MPEG audio file	5/22/05 21:02	3:59	Kanye Wes	
The Smart Playlists	📣 🗹 Hey Mama	0	MPEG audio file	3/21/05 8:08	4:20	Kanye Wes	
Alt. Rock	🗹 Niggas Gossip	0	MPEG audio file	3/21/05 8:08	3:55	Kanye Wes	
	In wow	0	MPEG audio file	3/21/05 8:08	2:25	Kanye Wes	
	jeous	0	MPEG audio file	3/21/05 8:08	2:10	Kanye Wes	
	rovise	0	MPEG audio file	3/21/05 8:08	4:22	Kanye Wes	
p.	e	0	MPEG audio file	3/21/05 8:08	2:47	Kanye Wes	
	ed to Know	0	MPEG audio file	3/21/05 8:08	3:54	Kanye Wes	
and the second	A Movie	0	MPEG audio file	3/21/05 8:08	2:12	Kanye Wes	
	of Your Mind	0	MPEG audio file	3/21/05 8:08	5:41	Kanye Wes	
and the second se	alls Down		MPEG audio file	4/28/04 23:21	3:40	Kanye Wes	
	/e west feat. glc-heavy hit	0	MPEG audio file	4/3/04 18:27	3:01	Kanye Wes	
	/e west feat. jay-z & saul		MPEG audio file	4/3/04 18:27	4:30	Kanye Wes	
	re west feat. twista & jaim		MPEG audio file	4/3/04 18:27	4:06	Kanye Wes	
	e west-family business		MPEG audio file	4/3/04 18:27	4:38	Kanye Wes	
A CONTRACTOR OF A CONTRACTOR O	/e west-home (bonus)		MPEG audio file	4/3/04 18:27	4:02	Kanye Wes 🔻	
and and a second se) 4 1 + (
num .	56 songs, 3.2 hours, 259.3 MB						
			2	200 I — iTun	es (sof	twāre)	
					``	/	
$ \langle \rangle \rangle \rangle$							
1 100 200							
F.II							

2001 – iPod (1000 songs)

digital disruption the example of the record industry

was building audio devices

co-invented the compact disk

invented the walkman

owned a record company

understood software

digital disruption

ONE BILLION CUSTOMERS— CAN ANYONE CATCH THE CELL PHONE KING? ELIEVE IT

DYING WITHOUT

COLLEGI

COSTS

PLUS 11 GADGETS WE LOVE

November 2007

this.json = json; public String toString() StringWriter writer = new eturn writer.toString public String **asStri** StringWriter writ public class Figure this.json = json return json public String toString() StringWriter writer = new StringWriter(); Json.createWriter(writer).write(json); return writer.toString(public String asString() StringWriter writer = new S tringWriter writer = new StringW Json.createWriter(write return writer.toStri public String asString() StringWriter writer ringWriter writer = new StringWrit on.createWriter(writer).write(json

public class Figure { private JsonObject json

ôkay, sô what is a

Overall, macroscopic system structure.

Garlan & Shaw (1994). An Introduction to Software Architecture.

The important stuff—whatever that is.

Fowler, M. (2003). Design – Who needs an architect? IEEE Software. 20 (5)

That which is fundamental to understanding a system in its environment

no strict consensus but an overall agreement

software architecture multiple definitions

Architecture is the fundamental organization of a system embodied in its components, their relationships to each other, and to the environment, and the principles guiding its design and evolution. [IEEE 1471 Standard]

[ISO/IEC/IEEE 42010 Standard]

software architecture

LIFECYCLE PHASE	TYPICAL QUE
 Development Associated Terms designing programming coding static 	 how effective and efficient are the how are the different functional an with? how is the growing complexity of how easy is it to correct bugs and are side effects possible? if so, how
 Deployment Associated Terms distribution provisionning curating / updating 	 on how many processors / machine how many distinct tiers are being how do remote pieces of software how is distributed trust and security
Operation Associated Terms • execution-time • run-time • monitoring/profiling • dynamic	 who is managing the machines rule where are those machine located? how do I monitor my running software how do I update my running software how is scalability achieved?

ESTIONS

algorithms I am using? nd technical concerns dealt

my code base managed? add new functionalities? ow are they managed?

nes will my code be deployed? used for deployment? e communicate? ity ensured?

nning my software?

ware?

vare?

the software lifecycle as guide

beware

decision made in each phase influences the other phases

	FRIDAY	8:30 - 10:00	10:15 - 11:00	11:15 - 12:00		
1	Sep 20	course overview	discover development tools	assess your programming skills		
2	Sep 27	programming paradigms – a refresher course	basic object-oriented and functional programming exercises			
3	Oct 04	programming methodology and tools	programming methodology and tools execises			
4	Oct 11	modularity, unit testing and separation of concerns	separation of concerns remote invocations and transactions			
5	Oct 18	modularity and unit testing exercises	remote invocations and transactions exercises			
6	Oct 25	separation of concerns persistence and object-relational mapping	object-relational mapping exercises			
7	Nov 01	basics of web applications	web application exercises			
8	Nov 08	THEMATIC WEEK				
9	Nov 15	asynchronous interactions	asynchronous intera	actions exercises		
10	Nov 22	basics of web services services and micro-services	web services and micro-services exercises			
11	Nov 29	basics of distributed trust with blockchains	blockchain exercises			
12	Dec 06	basics of mobile applications	mobile application exercises			
13	Dec 13	cloud computing- virtualization and devops	virtualized services exercises			
14	Dec 20	cloud computing – containerized services and clustering	containerized services an	d clustering exercises		

software architecture a tentative plan

