

A Brief Journey Through History - From Distributed Objects over SOA to Microservices

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PhD Student, Postdoc

2007 - 2014





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The Death Of Microservices?

David Mooter, Principal Analyst MAY 22 2023

<https://www.forrester.com/blogs/the-death-of-microservices/>

Return of the Monolith: Amazon Dumps Microservices for Video Monitoring

A blog post from the engineering team at Amazon Prime Video has been roiling the cloud native computing community with its explanation that, at least in the case of the video monitoring, a monolithic architecture has produced superior performance over a microservices and serverless-led approach.

May 4th, 2023 7:23am by [Joab Jackson](#)

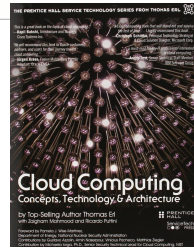
<https://thenewstack.io/return-of-the-monolith-amazon-dumps-microservices-for-video-monitoring/>

***“You cannot understand
what is happening **today**
without understanding
what **came before.**”***

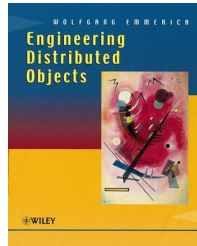
[Steve Jobs]



~2005



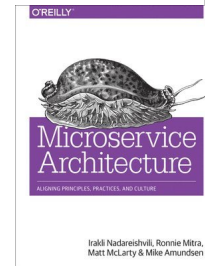
~2013



~2000



~2007



~2016





What has changed?

Why are people excited?

What did we carry over?

What did we leave behind?



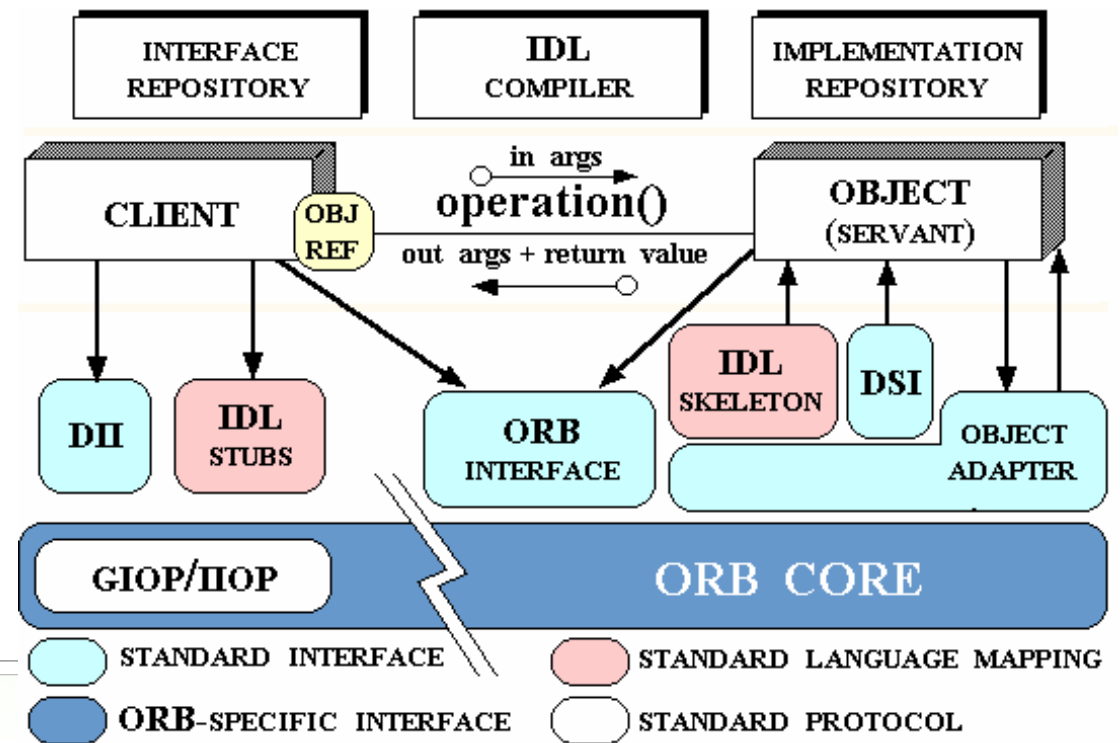
Distributed Objects

~ 2000



Key idea:

Make invoking “objects” on remote servers look as similar as possible to calling a local object.



Why were we excited?

“Build distributed systems without knowing anything about networks!”

```
public class Client
{
    public static void main (String[] args) throws Exception {
        ...
        Hashtable env = new Hashtable();

        ...

        Context ic = new InitialContext(env);

        Hello hello = (Hello) ic.lookup(serviceURL + objectName);
        System.out.println(hello.helloWorld());
    }
}
```



Service-Oriented Architecture

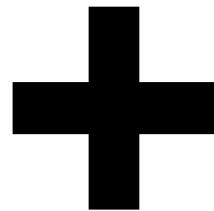
(or: Web services)

~ 2005

What has changed?



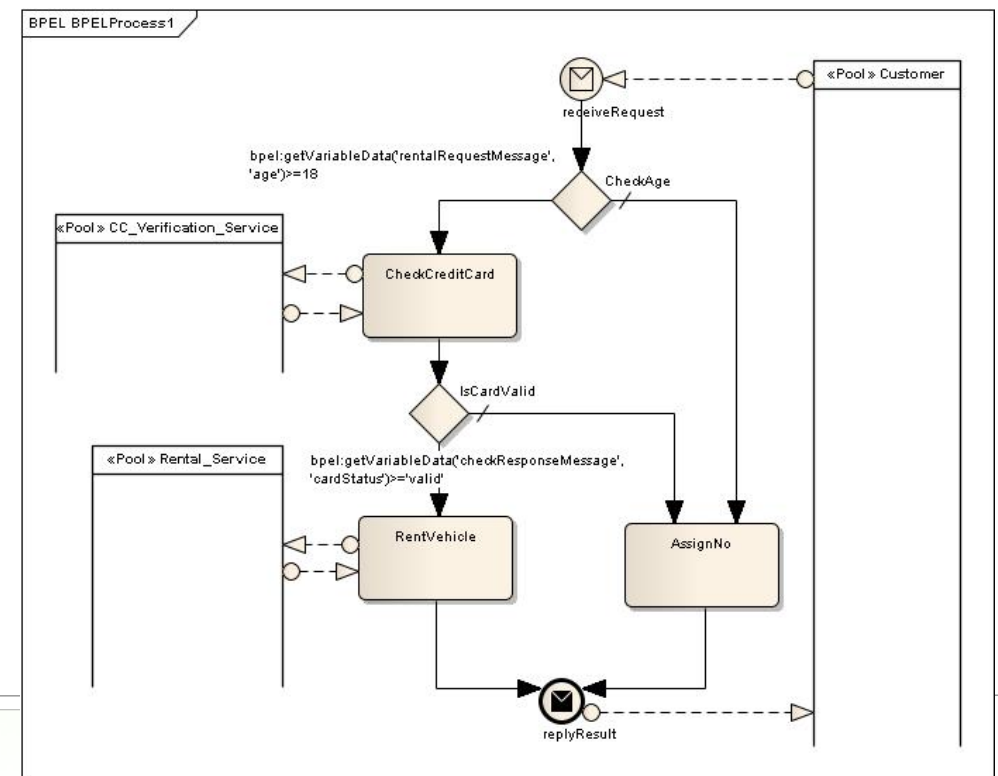
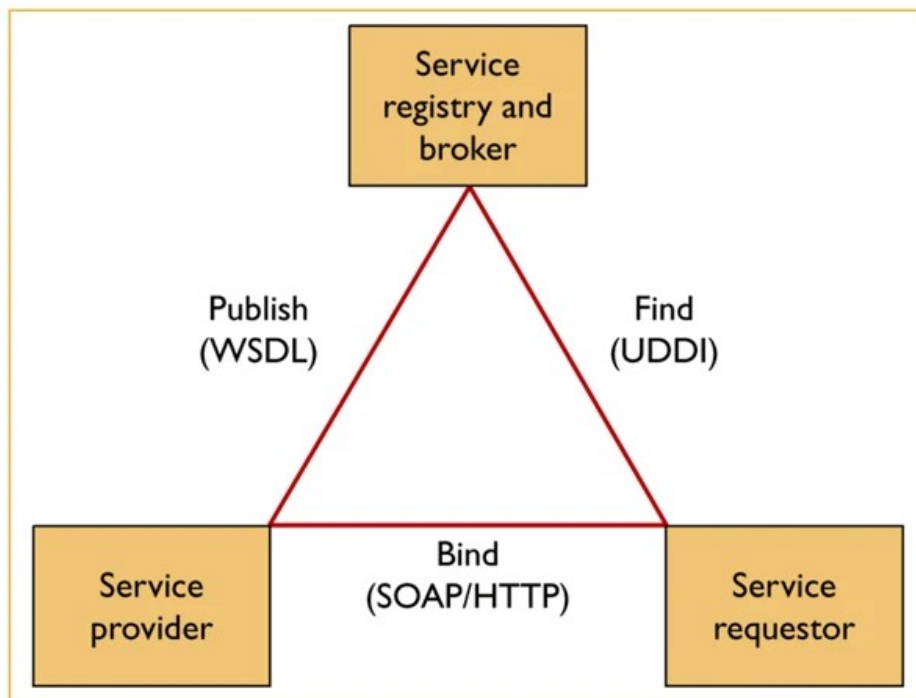
What has changed?



Why were we excited?

<https://community.sparxsystems.com/white-papers/617-89iconix-process-for-service-oriented-architecture-a-roadmap-for-soa-development-w-web-services>

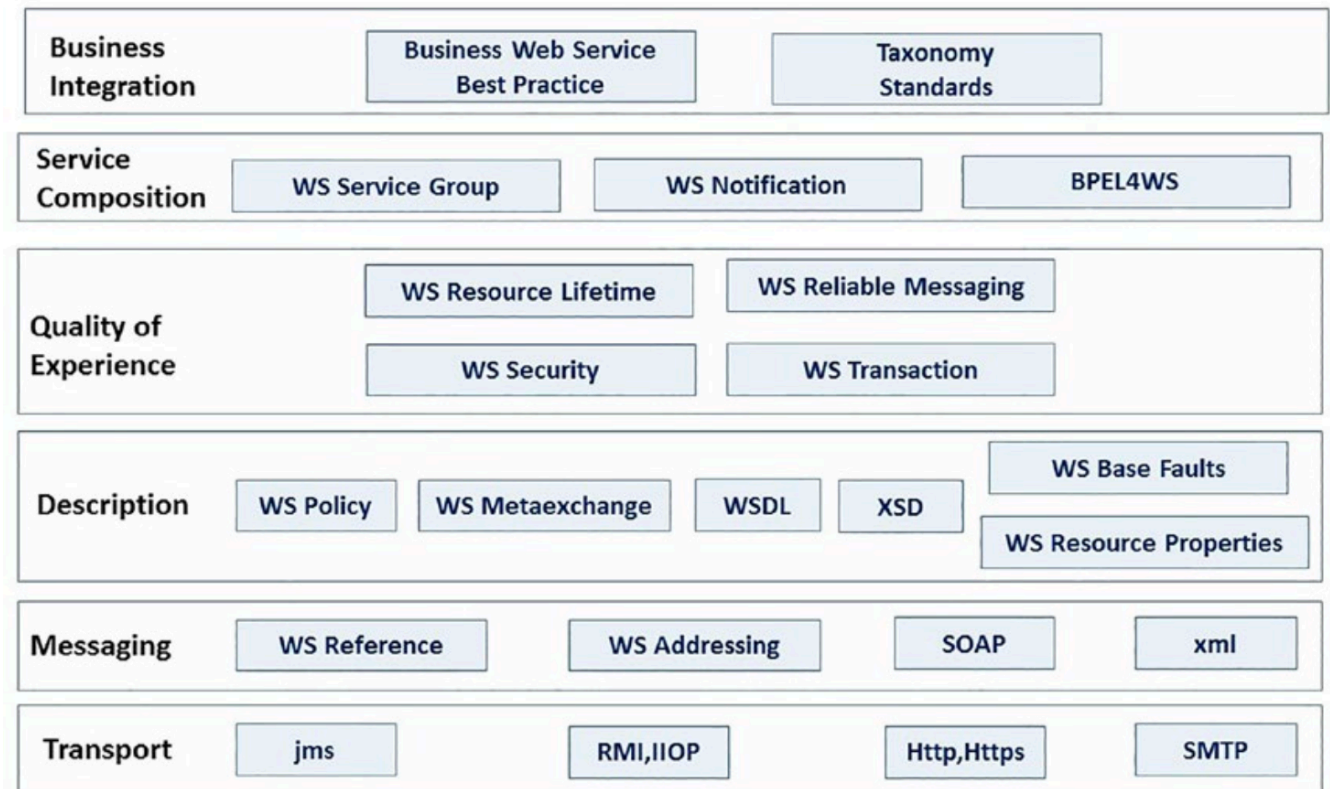
“Entire systems will be built by finding and composing pre-existing services.”



SOA was *all about* standards

WS-* So, so many standards

SOA Standards



Subramanian R, K., Kumar Kattumannil, D.S. (2022). Enterprise Architecture. In: Event- and Data-Centric Enterprise Risk-Adjusted Return Management. Apress, Berkeley, CA. https://doi.org/10.1007/978-1-4842-7440-8_5

What did we carry over?

Lots of underlying concepts

Remoting, contracts,
language independence,

...

What changed?

*Small objects turned into **big** services*

Technology turned into standards

REST (or: “small” Web services)

~ 2007



What has changed?

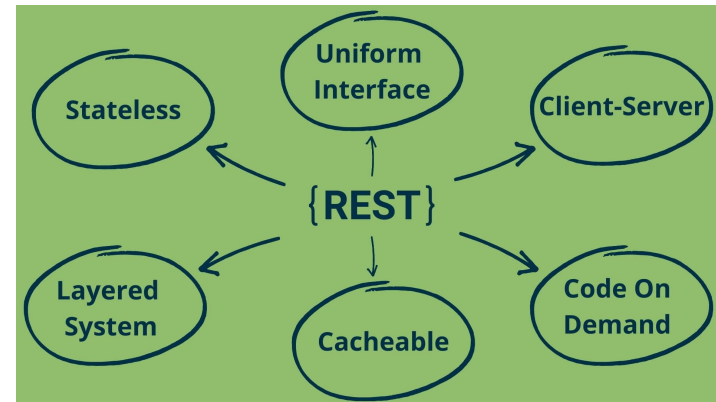
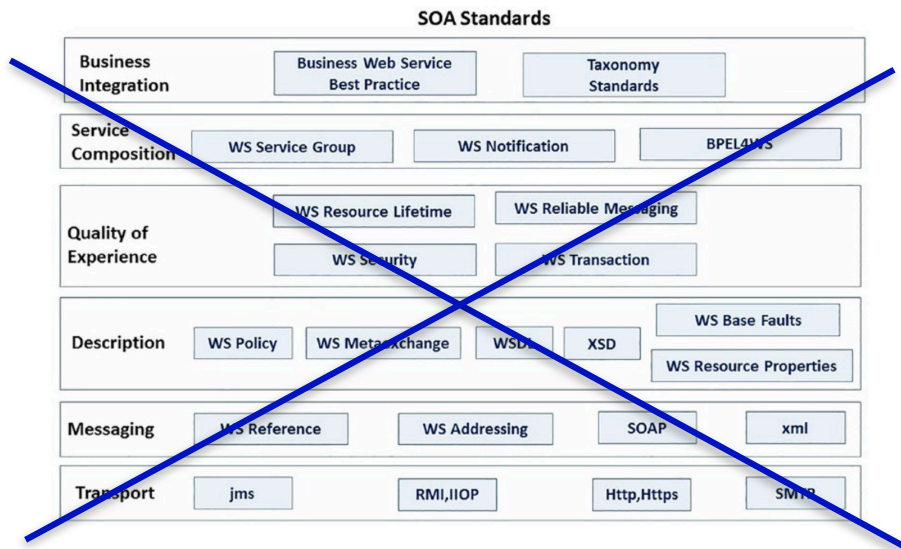


What has changed?



Why were we excited?

“WS- turned into HTTP / URI + six simple architectural principles.”*



What did we carry over?

Nobody doubted the value of service-orientation *per se*

What changed?

Implementation-wise - everything

REST is not like WS-*, but it's also not like Distributed Objects

Evolution Through Reduction

REST did not claim new features, nor (necessarily) better performance

REST was defined by what it **didn't** entail:

- No** interface description language (WSDL)

- No** communication protocol on top of HTTP (SOAP)

- No** deep-rooted connection to XML

- (Almost) **no** standards

Aside: Cloud Computing

From ~ 2013 on



I am cheating ... cloud computing isn't an evolutionary stage on the same scale at all.

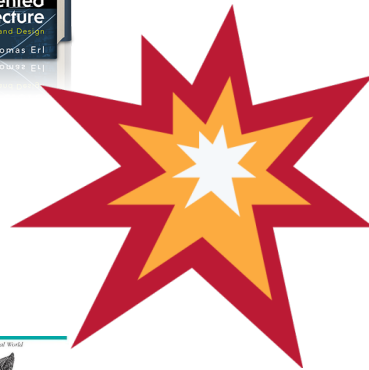
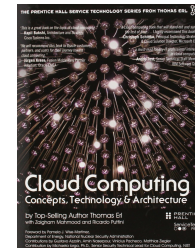
But it certainly **impacts** what came after.

Microservices

From ~ 2015 on



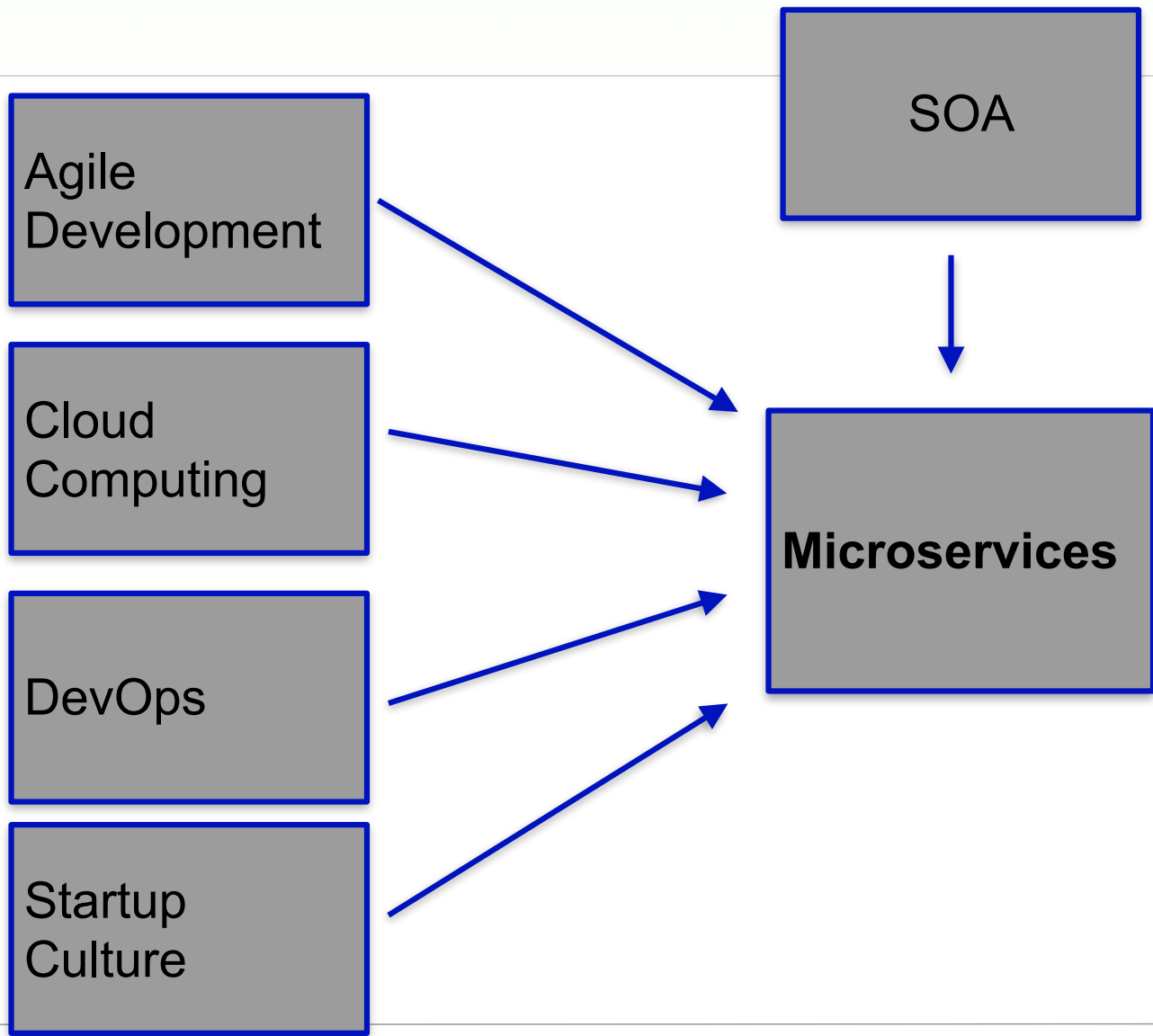
Microservices



SOA



Microservices



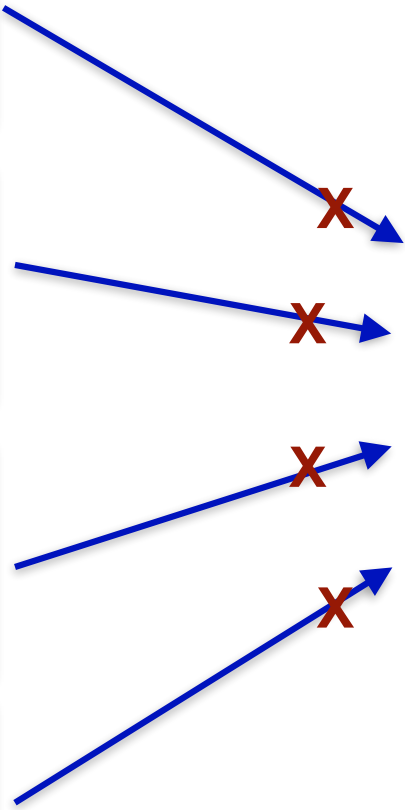
Agile
Development

Cloud
Computing

DevOps

Startup
Culture

SOA



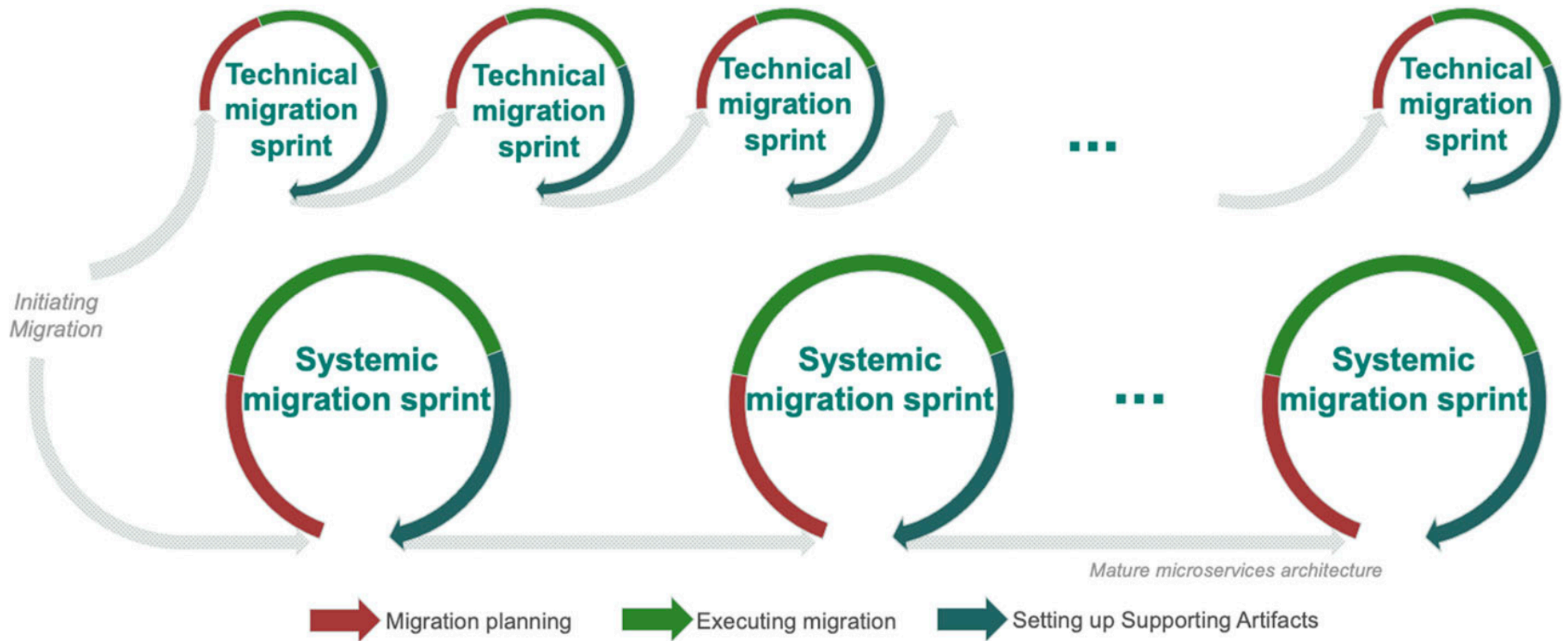
Are Microservices even about software architecture?

Three pillars:

Organization (2-pizza rule, Inverse Conway Manoeuvre)

Process & Delivery (Independent deployment)

Technical Architecture



An empirical study of the systemic and technical migration towards microservices. Hamdy Michael Ayas, Philipp Leitner, and Regina Hebig. Empirical Software Engineering, May 2023

What did we carry over?

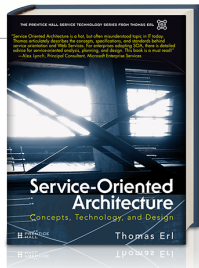
SOA concepts continue to remain intact

So do core REST ideas

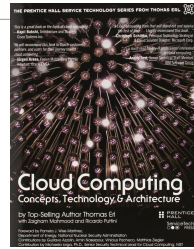
Focus on principles over standards

What changed?

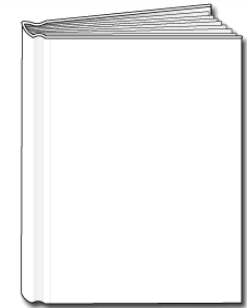
Massive broadening of what is part of
“architecture”



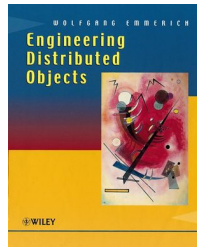
~2005



~2013



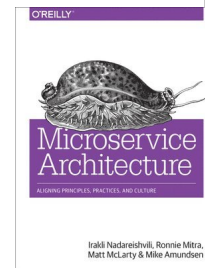
????



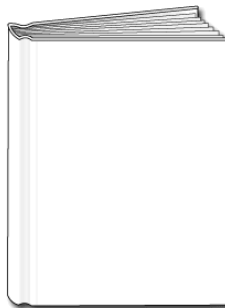
~2000



~2007



~2016



????

What are the next evolutionary steps?

Let's look at some candidates ...

Serverless?

The return of service composition

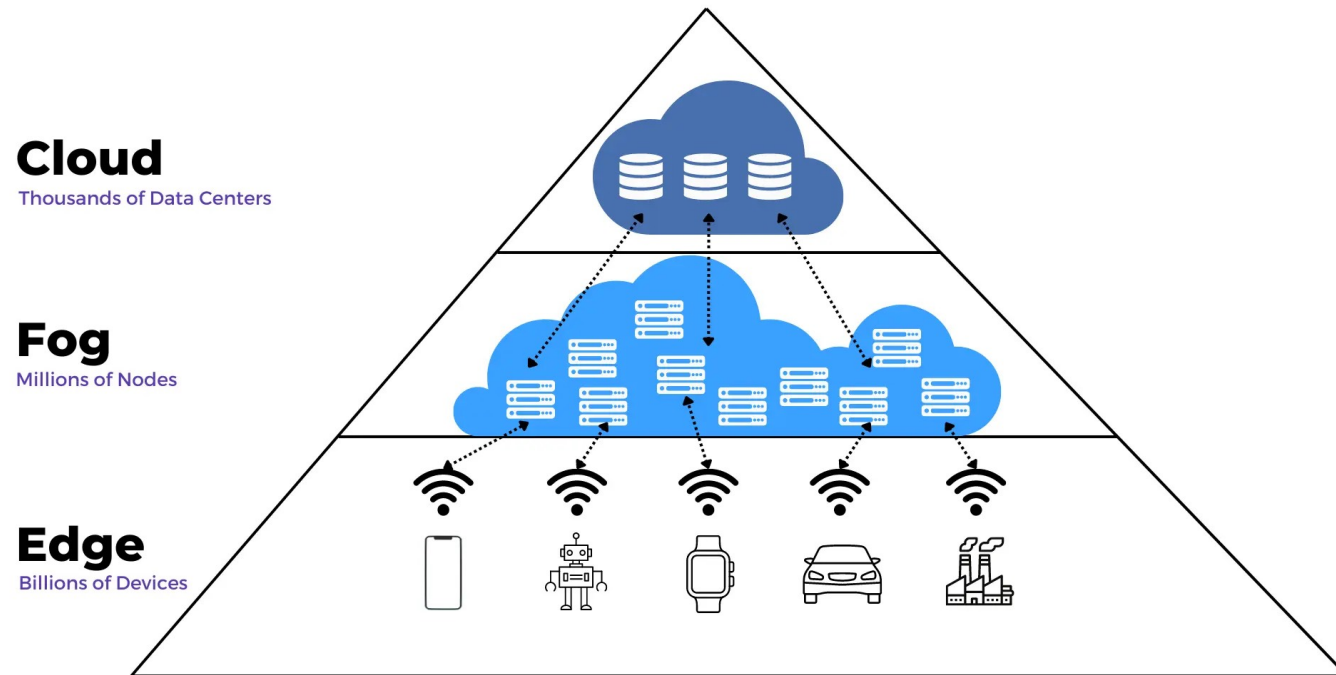
#44: Advancing Serverless Workflow Efficiency: Integrating Functional Programming Constructs and DAG-Based Execution

Speaker: Nimród Földvári

Cloud Computing Fundamentals

Philipp Leitner, Erik Wittern, Josef Spillner, Waldemar Hummer. A mixed-method empirical study of Function-as-a-Service software development in industrial practice, Journal of Systems and Software, Volume 149, 2019

Edge, Fog computing - Internet of Things?



Academic Panel: Advancing Fog and Cloud Computing Continuums: Insights from the NebulOuS R&D Project
Wednesday, April 2nd, 2025
09:00 - 10:30

Room Fonseca e Costa

Plenary Room: Visconti

SPEAKER:



Aaron Ding

Edge AI (2.0) For Future Computing

#27: Optimization of Cloud-Native Application Execution over the Edge-Cloud Continuum Enabled by DVFS

Speaker: Georgios Kontos

Edge Cloud and Fog Computing

#29: Idempotency in Service Mesh: For Resiliency of Fog-Native Applications in Multi-Domain Edge-to-Cloud Ecosystems

Speaker: Mays Al-Naday

Cloud Computing Enabling Technology

#25: WFQ-Based SLA-Aware Edge Applications Provisioning

Speaker: Fábio Diniz Rossi

Edge Cloud and Fog Computing

AI engineering?

📍 Plenary Room: Visconti

SPEAKER:



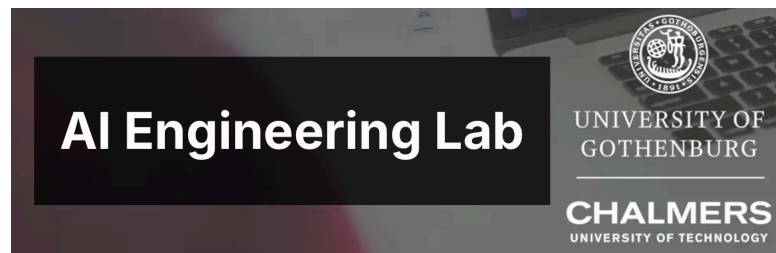
Sonia Ben Mokhtar

Decentralised Machine Learning As an Enabler of Decentralised Online Services

#12: Data Orchestration Platform for AI Workflows Execution Across Computing Continuum

Speaker: Gabriel Ioan Arcas

Cloud Computing Fundamentals



<https://www.chalmers.se/en/projects/ai-engineering-lab/>

Quantum computing?

#23: Operations Patterns for Hybrid Quantum Applications

Speaker: Martin Beisel

Cloud Computing Platforms and Applications

Quantum Software Engineering: Roadmap and Challenges Ahead

JUAN M. MURILLO, JOSE GARCIA-ALONSO, and ENRIQUE MOGUEL, Universidad de Extremadura, Spain

JOHANNA BARZEN and FRANK LEYMANN, University of Stuttgart. Institute of Architecture of Application Systems, Germany

SHAUKAT ALI, Simula Research Laboratory, Norway

TAO YUE, Beihang University, China

PAOLO ARCAINI, National Institute of Informatics, Japan

RICARDO PÉREZ-CASTILLO, IGNACIO GARCÍA RODRÍGUEZ DE GUZMÁN, and MARIO PIATTINI, University of Castilla-La Mancha, Spain

ANTONIO RUIZ-CORTÉS, I3US Institute, SCORE Lab, Universidad de Sevilla, Spain

ANTONIO BROGI, University of Pisa, Italy

JIANJUN ZHAO, Kyushu University, Japan

ANDRIY MIRANSKY, Toronto Metropolitan University, Canada

MANUEL WIMMER, Johannes Kepler University Linz, Austria

So ... are Microservices “dead”?

So ... are Microservices “dead”?

No, we just got used to many of the key ideas

DevOps, cloud-native, ...

References

Engineering Distributed Objects. Wolfgang Emmerich. Wiley. ISBN: 978-0-471-98657-7. June 2000.

Service-Oriented Architecture: Concepts, Technology, and Design. Thomas Erl. Prentice Hall PTR. ISBN: 978-0-13-185858-9. 2005.

RESTful web services. Leonard Richardson and Sam Ruby. O'Reilly. ISBN: 978-0-596-52926-0. May 2007.

Cloud Computing: Concepts, Technology & Architecture. Thomas Erl, Ricardo Puttini, and Zaigham Mahmood. Prentice Hall Press, USA. ISBN: 978-0-13-338752-0. May 2013.

Microservice Architecture: Aligning Principles, Practices, and Culture. Irakli Nadareishvili, Ronnie Mitra, Matt McLarty, and Mike Amundsen. O'Reilly Media, Inc. ISBN: 978-1-4919-5625-0. August 2016.