

Cloud computing

Introduction

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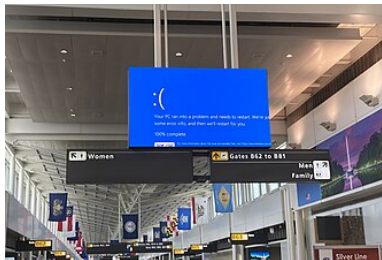
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What are the cloud challenges?



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July 19, 2024, Top cloud provider outage:
chaos in airlines, hospitals, banks...
business relying on cloud systems.

2021 French data center on fire:
outages and finally all data and
backups lost.



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Recent: <https://aws.amazon.com/message/101925/>

<https://azure.status.microsoft/en-us/status/history/>



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Who is responsible?

We have outsourced our IT services...

Definition

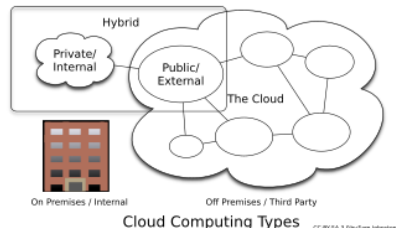
One can outsource architecture creation and operations, but one can never outsource responsibility (Schmidt 2006)

...so you are still the IT department.



Which model for cloud computing

Platform as a service? Infrastructure as a service? In-house? Public cloud? Hybrid? Multicloud?
Assess risk for business value:



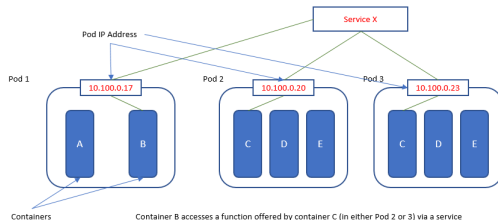
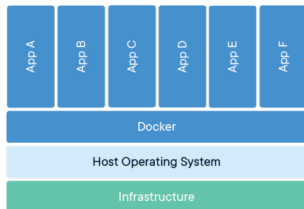
- Burst computing?: peak demands, experiments, offline
- Starting up a project without capex capabilities?
- A major outage on the cloud provider: is it critical?
- Your cloud provider changes conditions: portability?
- Reduce single-provider dependency?
- Pricing? E.g. NetApp volume 2TB (400€/month) vs compute engine 2TB (200€/month)
- Security and privacy?

Requirements for cloud services:

- **High availability:** load balancing, scalability, geographic distribution, fault tolerance, failover systems, hot/rolling updates
...
- **Disaster recovery:** infrastructure + services + data
- **Risk and costs assessment:** major outage critical services, potential cascading effects, lost working hours, lost revenue
 - Minimise the risk of a downtime
 - Minimise the risk of losing data

Engineering has the answer

- Cloud computing is the art for large-**scaling distributed** computing in a **microservices** based model
- Shifting software engineering towards: **DevOps**, continuous deployment, **Infrastructure as code**, **virtualization**...
- Data redundancy and distributed storage : different kinds of **Database Management Systems**

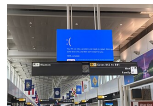
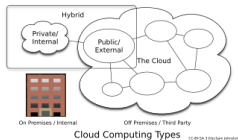


©Wikimedia commons **Containerization & orchestration: Docker, Kubernetes**

How should it be



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No firefighting. No disturbing when at the café. Sleeping at night.

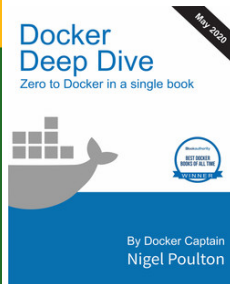
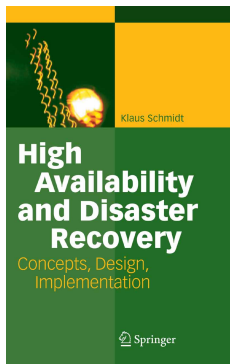


Jean Béraud



Vincent van Gogh

Some books



Biblio: (Schmidt 2006) https://discovery.upc.edu/permalink/34CSUC_UPC/8e3cvp/alma991005248477406711

(Poulton 2020) https://discovery.upc.edu/permalink/34CSUC_UPC/8e3cvp/alma991005249877806711



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What is the cloud?



What is the cloud? (DevOps perspective)

Definition

DevOps automates cloud computing to enable large-scale high-availability systems in a service-based model defined by Infrastructure as Code

Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. (Mell i Grance 2011)



Cloud computing:

Definition

Maintaining high availability, disaster recovery, and risk management in cloud systems while balancing cost efficiency

Cloud bursting:

Definition

Burst the extra workload to external third-party cloud services

→ **High Performance Computing** (elective course)

More on Data:

→ **Non-relational Database Systems** (compulsory course)

→ **Advanced Relational Database Systems** (elective course)



Mell, Peter i Timothy Grance (set. de 2011). **The NIST Definition of Cloud Computing**. Special Publication 800-145. Gaithersburg, MD: National Institute of Standards i Technology (NIST). doi: 10.6028/NIST.SP.800-145.



Poulton, Nigel (2020). **Docker deep dive. Zero to Docker in a single book**. 2a ed. Birmingham: Packt Publishing. ISBN: 9781835087916. URL: https://discovery.upc.edu/permalink/34CSUC_UPC/8e3cvp/alma991005249877806711.



Schmidt, Klaus (2006). **High availability and disaster recovery. Concepts, design, implementation**. Berlin: Springer. ISBN: 9783540345824. URL: https://discovery.upc.edu/permalink/34CSUC_UPC/8e3cvp/alma991005248477406711.