



Several Clouds

# Public Cloud Services

Prepared for  
**Faculty of Mathematics and Informatics (FMI)**



Several Clouds

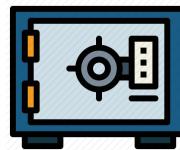
# AWS S3



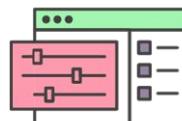
Amazon S3



Object-level storage



Designed for 99.999999999% durability



Event triggers



# Amazon S3 use case 1

Storing and distributing static web content and media



`https://[BucketName].s3.[aws-region].amazonaws.com`

`https://[BucketName].s3.[aws-region].amazonaws.com/homepage.html`





Several Clouds

# Amazon S3 use case 2

Host entire static websites



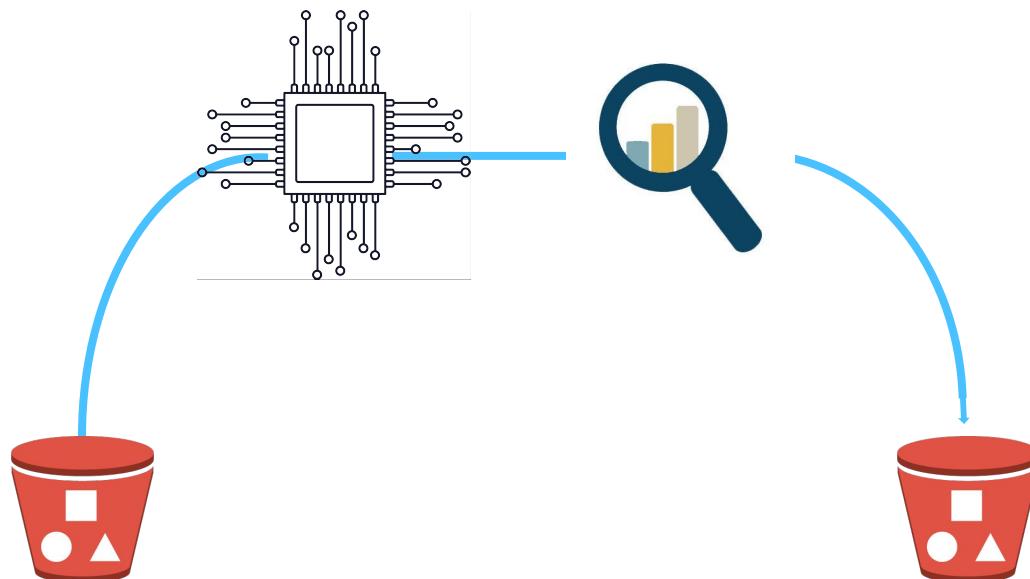
HTML files, images, videos, and client-side scripts



Several Clouds

# Amazon S3 use case 3

Data store for computation and large-scale analytics



Financial transaction analysis

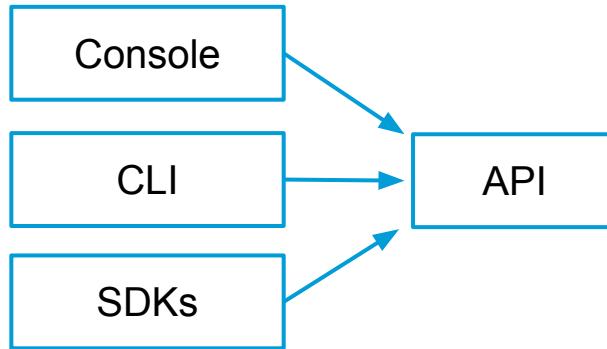
Clickstream analytics

Media transcoding



Several Clouds

# Moving data into Amazon S3



Any file types

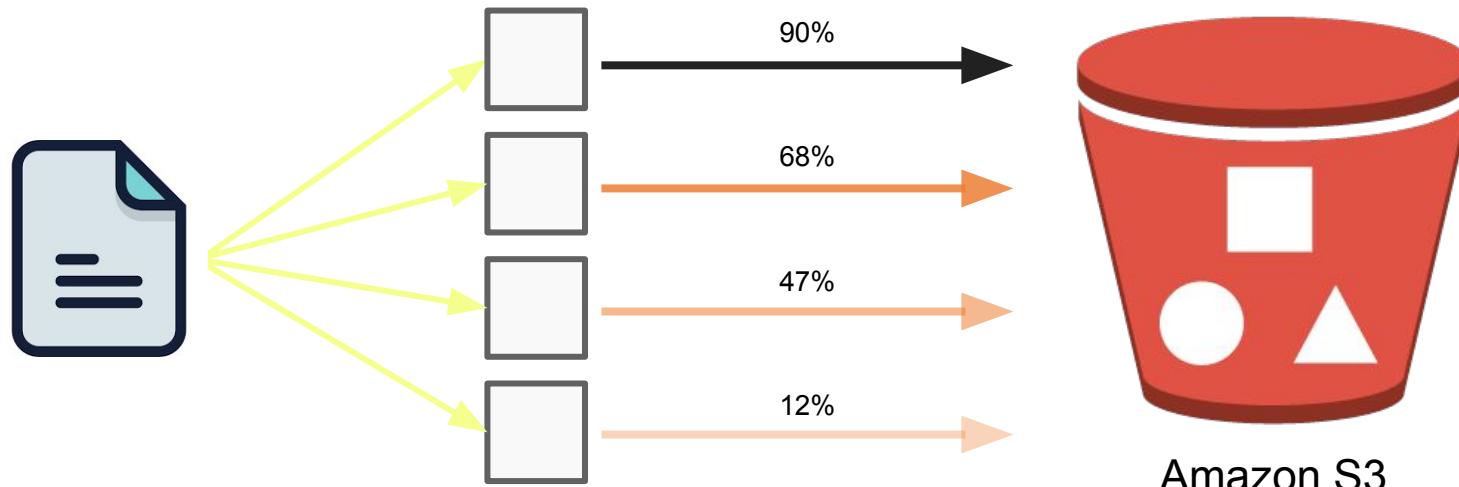


Unlimited number  
of objects



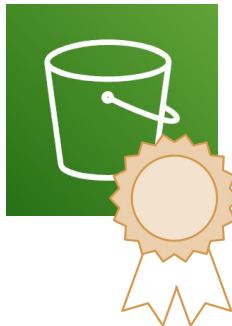
Several Clouds

# Amazon S3 multipart upload





# When should you use Amazon S3?



## Good use cases

When you need to write once, read many times

Spiky data access

Large number of users and diverse amounts of content

Growing data sets

## Not ideal use cases

Block storage requirements

Frequently changing data

Long-term archival storage





# Amazon S3 costs



**Pay only for what you use, including:**

GBs per month

Transfer OUT to other Regions or the internet

PUT, COPY, POST, LIST, and GET requests

**You do NOT have to pay for:**

Transfer IN to Amazon S3

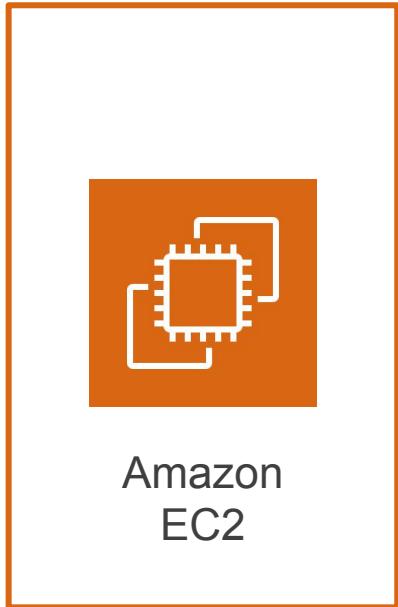


Transfer OUT to Amazon EC2 in the same Region, or to Amazon CloudFront

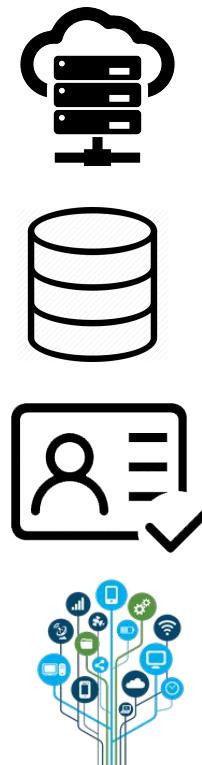


Several Clouds

# What needs can Amazon EC2 address?



Amazon  
EC2



Web hosting

Database  
s

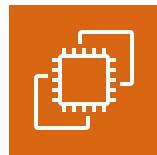
Authentication

Anything a server can do



Several Clouds

# Virtual machines vs. physical servers



Amazon EC2 can solve some problems that are more difficult with an on-premises server.

When using **disposable** resources



Data-driven decisions



Quick iterations



Free to make mistakes



Several Clouds

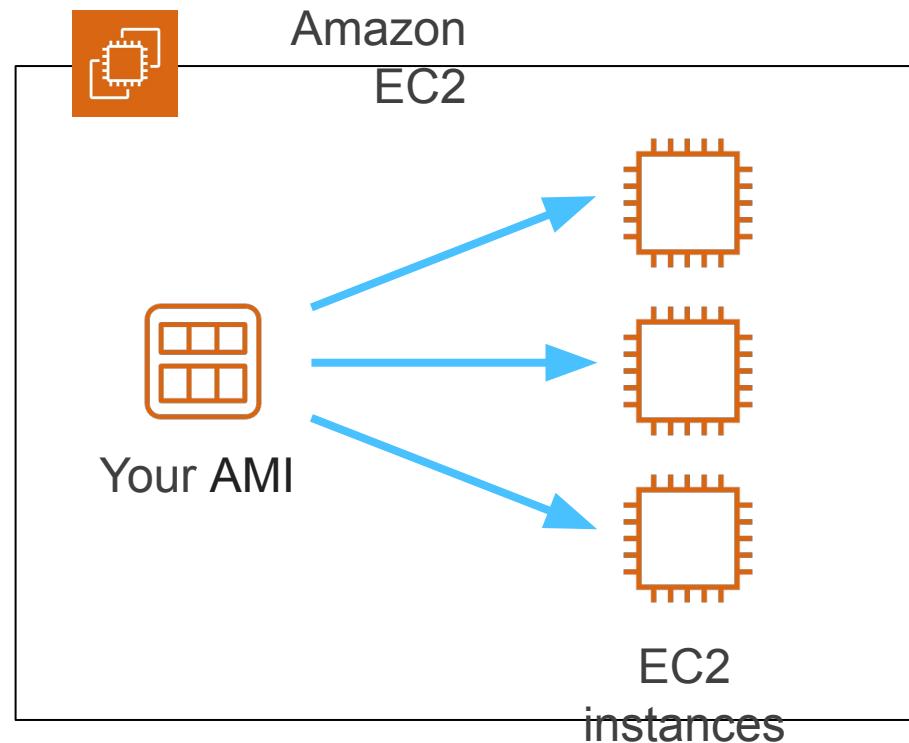
# Amazon Machine Images (AMIs)

AMIs include:

A template for the root volume  
(copy of the boot drive)

Launch permissions

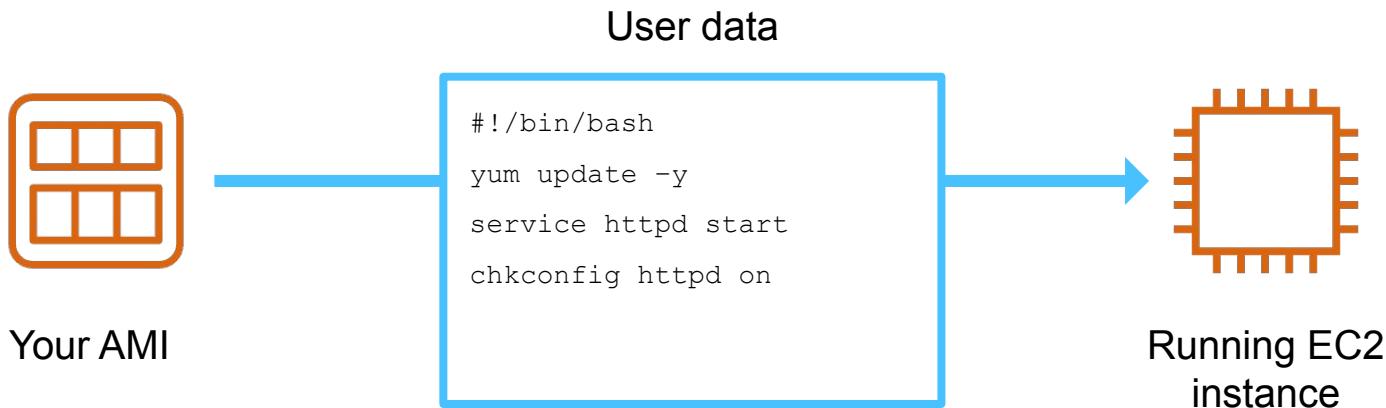
A block device mapping





Several Clouds

# EC2 User Data





# EC2 instance types

**m5.large**

**m** is the family name

**5** Is the generation number

**large** is the size of the instance

## Examples

t3.larg  
e

c5.xlarg  
e

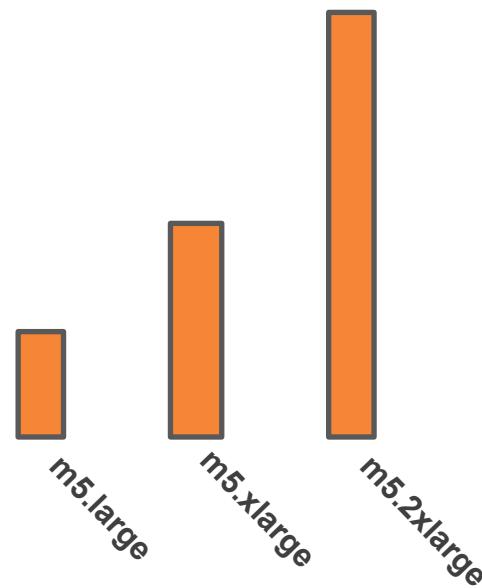
p3.2xlarg  
e



# EC2 instance types

Model	vCPU
m5.large	2
m5.xlarge	4
m5.2xlarge	8
m5.4xlarge	16
m5.12xlarge	48
m5.24xlarge	96

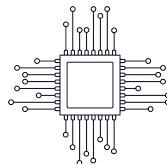
Scaling vertically





Several Clouds

# EC2 instance types



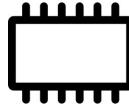
General purpose

6 available selections



Compute optimized

3 available selections



Memory optimized

7 available selections



Accelerated computing

4 available selections



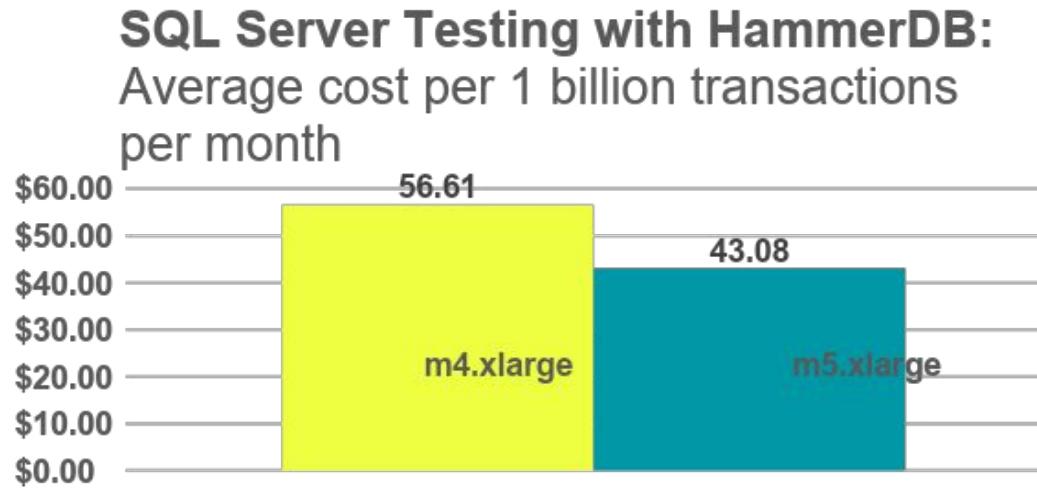
Storage optimized

3 available selections



# Instance generations and cost

Instances in newer generations generally have better price-to-performance ratios

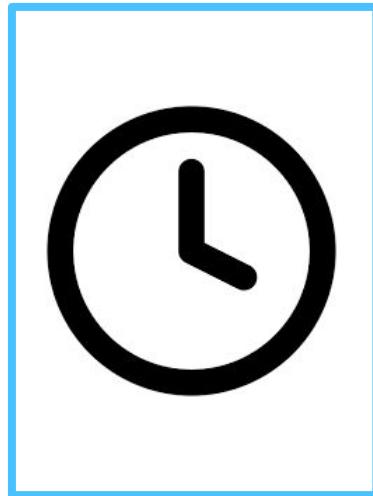




Several Clouds

# EC2 pricing options

On-demand instances



Reserved  
instances

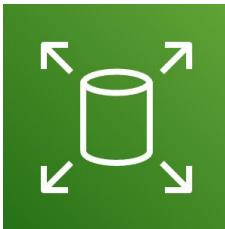


Spot  
instances





# EC2 Storage Options



Amazon  
EBS

Amazon Elastic Block Store (Amazon EBS) is an easy-to-use, high-performance block storage service designed for use with Amazon EC2.

- Replicating within the Availability Zone, offering 99.999% availability
- Offers four different volume types at various price points and performance benchmarks
- Enables you to increase storage without any disruption to your critical workloads

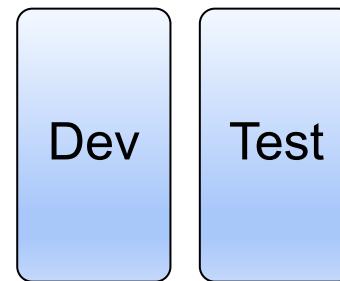


Several Clouds

# What is VPC



Your private network  
space in the AWS Cloud



Provides logical isolation  
for your workloads



Allows custom access  
controls and security  
settings for your resources



# Amazon VPC specifics



Amazon  
VPC



A VPC is a virtual network dedicated to your AWS account



Exists either in the IPv4 or IPv6 address ranges



Enables you to create specific CIDR ranges for your resources to occupy



Provides strict access rules for inbound and outbound traffic.

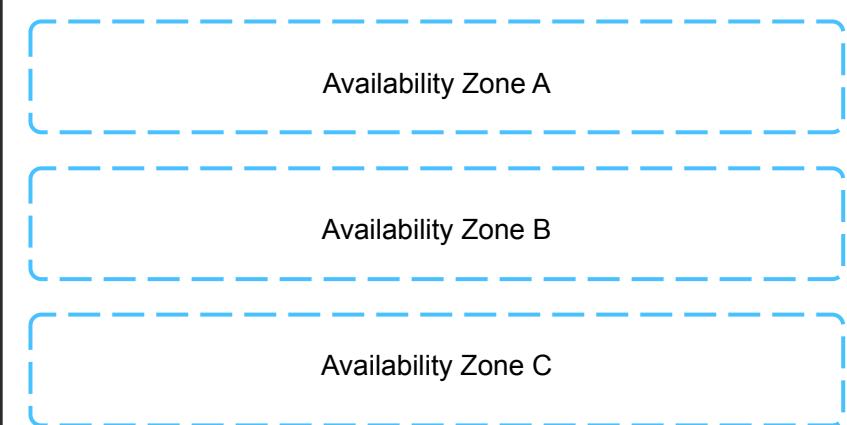


Several Clouds

# Deploying a VPC



VPCs deploy into **1** of all the AWS Regions



A VPC can host resources from **any** Availability Zone within its Region



Several Clouds

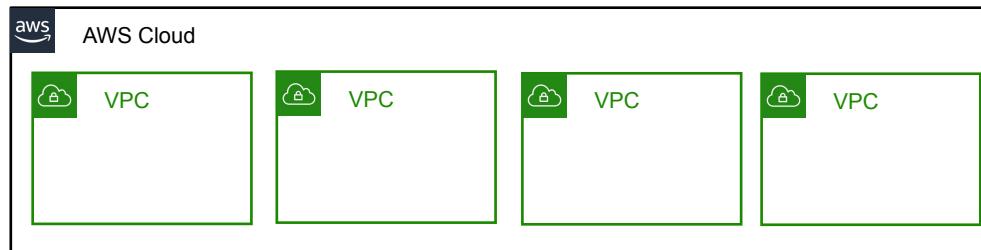
# Multi-VPC pattern

Best suited for:

- Single team or single organizations, such as managed service providers
- Limited teams, which makes it easier to maintain standards and manage access

Exception:

- Governance and compliance standards may require greater workload isolation regardless of organizational complexity





Several Clouds

# Examples



Data store instances



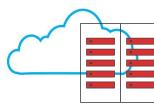
Private subnet



Batch processing instances



Private subnet



Back-end instances



Private subnet



Web application instances

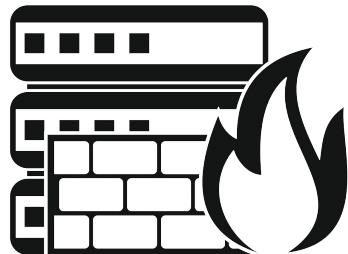


Public or private subnet

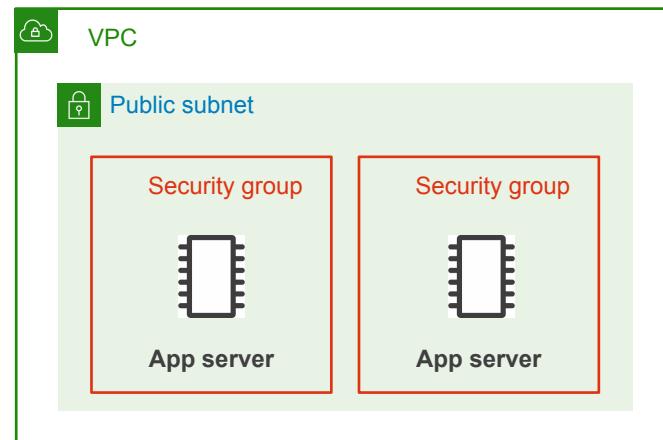


Several Clouds

# Security groups



- **Virtual firewalls** that control inbound and outbound traffic into AWS resources
- Traffic can be **restricted** by any IP protocol, port, or IP address
- Rules are **stateful**





# Relational Database example

Yo  
u

- App optimization
- Scaling
- High availability
- Database backups
- DB s/w patches
- DB s/w installs
- OS patches
- OS installation
- Server maintenance
- Rack and stack
- Power, HVAC, net

If you host your databases  
**on-premises**



Several Clouds

# Relational Database example

You -

- App optimization
- Scaling
- High availability
- Database backups
- DB s/w patches
- DB s/w installs
- OS patches
- OS installation
- Server maintenance
- Rack and stack
- Power, HVAC, net

If you host your databases  
**on-premises**

- OS installation
- Server maintenance
- Rack and stack
- Power, HVAC, net

If you host your databases  
**in Amazon EC2**





Several Clouds

# Relational Database example

Yo  
u

- App optimization
- Scaling
- High availability
- Database backups
- DB s/w patches
- DB s/w installs
- OS patches
- OS installation
- Server maintenance
- Rack and stack
- Power, HVAC, net

If you host your databases  
**on-premises**

Yo  
u

- App optimization
- Scaling
- High availability
- Database backups
- DB s/w patches
- DB s/w installs
- OS patches

- OS installation
- Server maintenance
- Rack and stack
- Power, HVAC, net

If you host your databases  
**in Amazon EC2**





Several Clouds

# Relational Database example

You →

App optimization

- Scaling
- High availability
- Database backups
- DB s/w patches
- DB s/w installs
- OS patches
- OS installation
- Server maintenance
- Rack and stack
- Power, HVAC, net



If you host your databases in  
**a managed AWS database service**



Several Clouds

# Amazon database options

## Relational databases



Amazon  
RDS

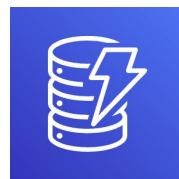


Amazon  
Redshift



Amazon  
Aurora

## Non-relational databases



Amazon  
DynamoDB



Amazon  
ElastiCache



Amazon  
Neptune

There are more databases – these are just common examples.



Several Clouds

# RDS

## RDS Engines:

- MS SQL
- Oracle
- MySQL
- PostgreSQL
- MariaDB
- Aurora
  - MySQL
  - PostgreSQL



PostgreSQL



Amazon Aurora





Several Clouds

# What problems can containers solve?

Getting software to **run reliably in different environments**



Developer's  
workstation



Production

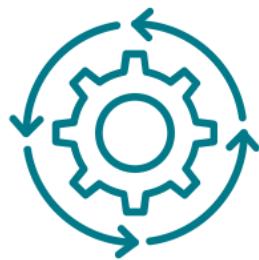


Test  
environment



Several Clouds

# Container benefits



Repeatable



Self-contained running environments

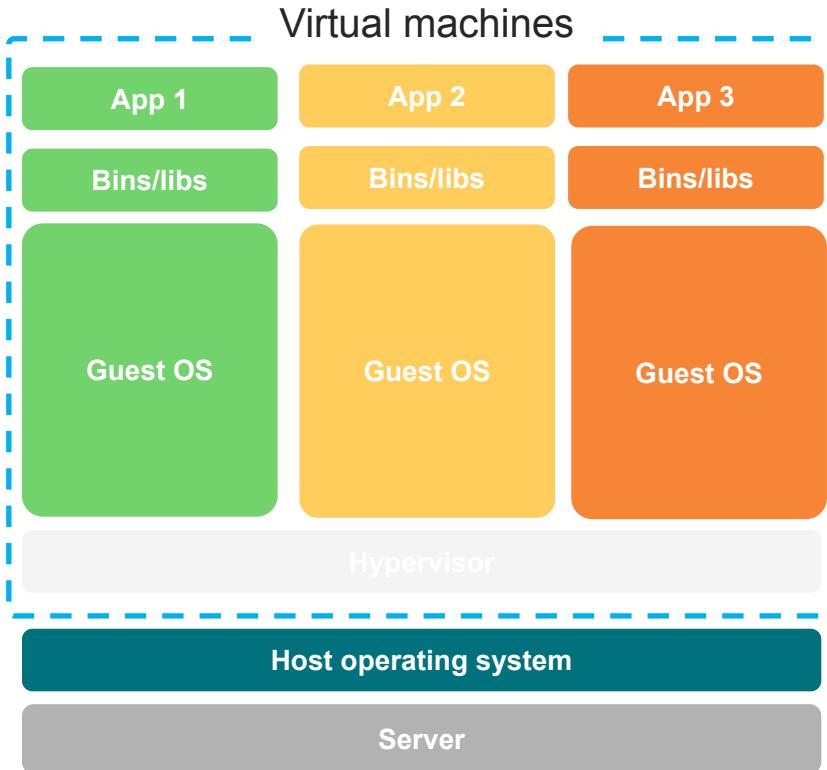


Faster to wind up and down than VMs

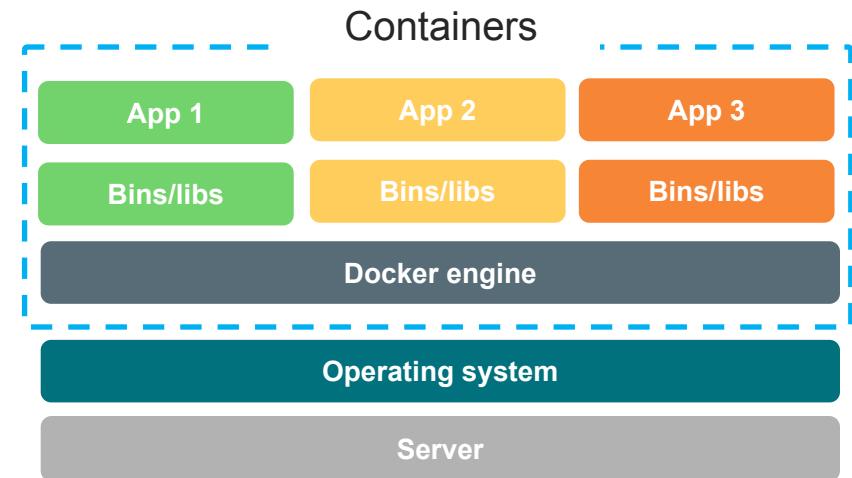


Several Clouds

# Virtual machines vs. containers



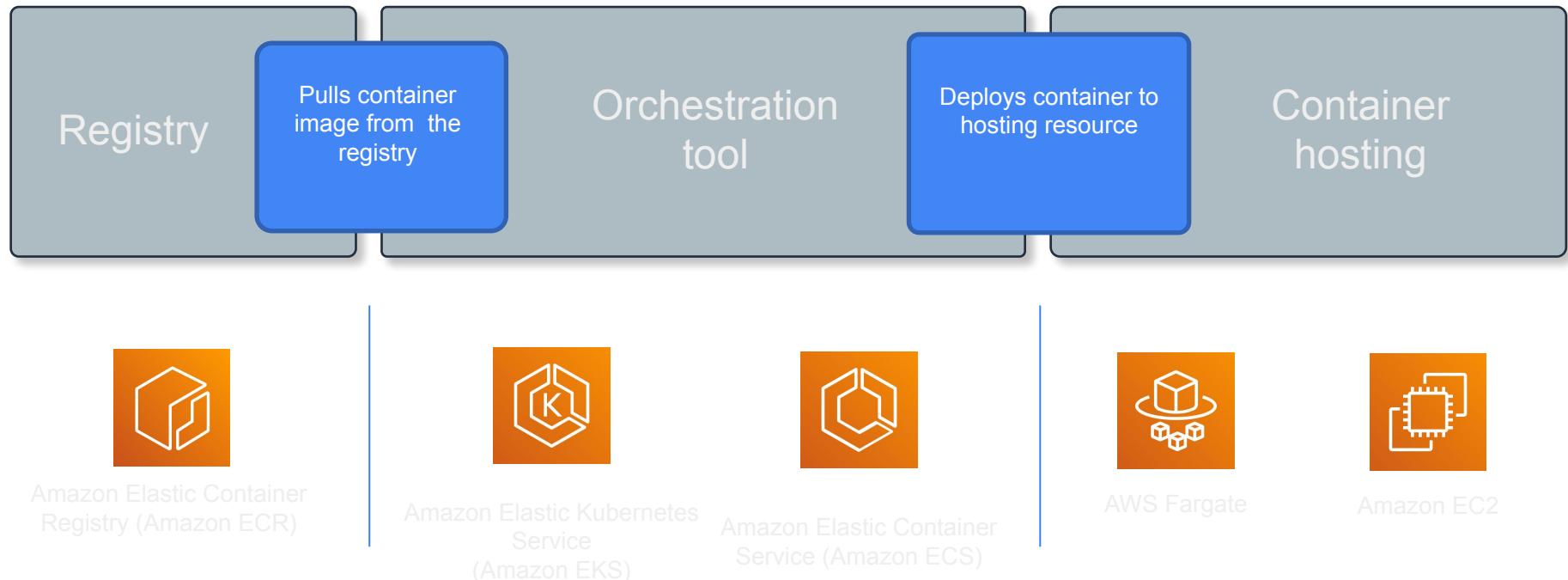
In general: VMs abstract hardware, while containers abstract operating systems





Several Clouds

# Containers on AWS





Several Clouds

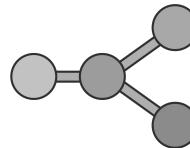
# Amazon Container Service



Amazon ECS



Amazon Elastic Container Service (Amazon ECS) orchestrates the running of containers



Maintains and scales the fleet of nodes running your containers



Removes the complexity of standing up the infrastructure



Several Clouds

# AWS Fargate



AWS Fargate

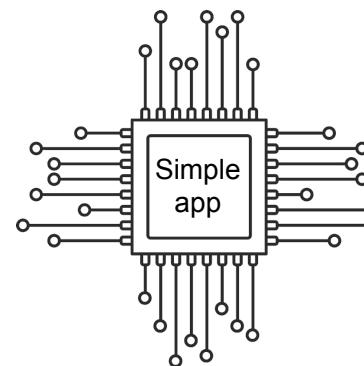
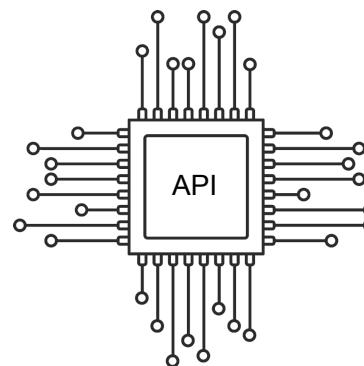
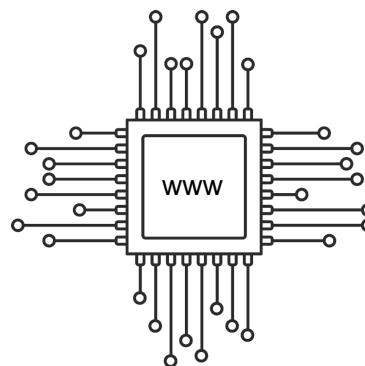
- Fully managed container service
- Provisioning and managing clusters
- Management of runtime environment
- Scaling



Several Clouds

# Is your architecture efficient?

Are you using whole instances to support services that perform only  
one function?

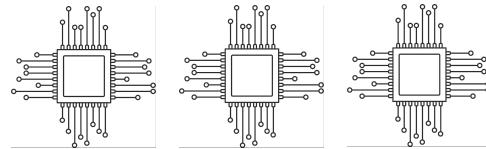




Several Clouds

# Is your architecture efficient?

Are you using whole instances to support services that perform only  
one function?



Using other services to manage:



HA and FT



Monitoring  
fleet health



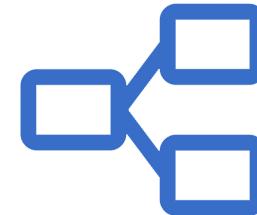
Capacity



Several Clouds

# Serverless computing

Building and running apps and services **without managing servers**



Focus on your application, not configuration

Use compute resources **only upon request**

Build a **microservice** architecture



Several Clouds

# AWS Lambda



AWS Lambda

- Fully managed compute service
- Runs stateless code
- Supports Node.js, Java, Python, C# , Go, and Ruby
- Runs your code on a schedule or in response to events (e.g., changes to data in an Amazon S3 bucket or an Amazon DynamoDB table)
- Can run at the edge



Several Clouds

# Lambda – how it works





Several Clouds

# Lambda – event sources

Amazon S3

DynamoDB

Amazon SNS

Amazon SQS

CloudWatch Events

Target Group (ALB)

AWS IOT Button

Many more

Lambda  
function



Runs your instructions  
for up to  
**15 minutes**





Several Clouds

# Lambda

Lambda **handles**:

- Servers
- Capacity needs
- Deployment
- Scaling and fault tolerance
- OS or language updates
- Metrics and logging



# Lambda

Lambda **handles**:

- Servers
- Capacity needs
- Deployment
- Scaling and fault tolerance
- OS or language updates
- Metrics and logging

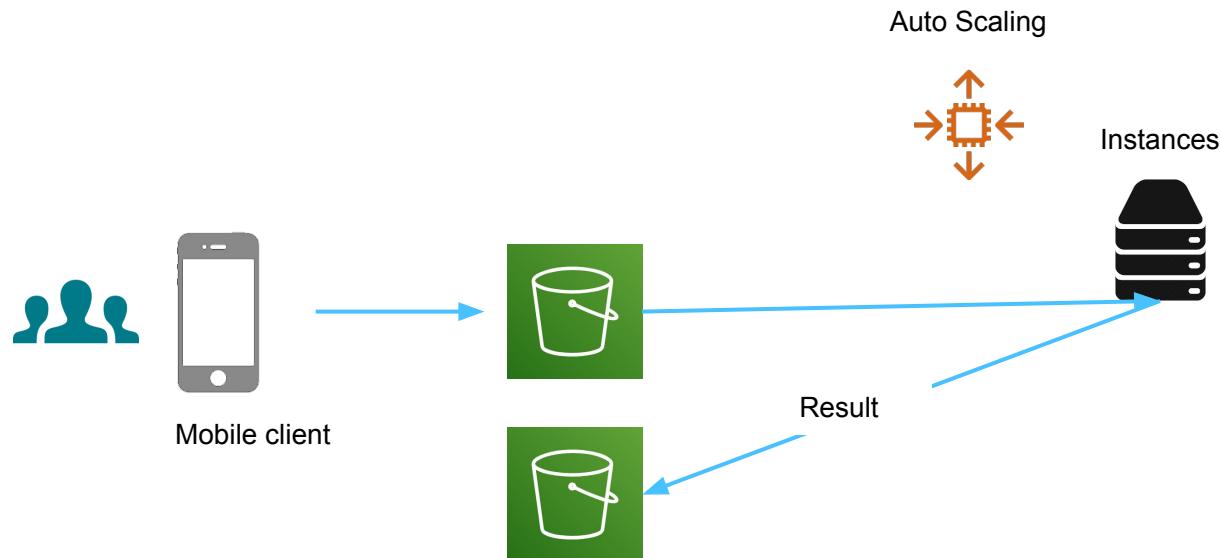
Lambda **enables** you to:

- Bring your own code (even native libraries)
- Run code in parallel
- Create backends, event handlers, and data processing systems
- Never pay for idling resources



Several Clouds

# Image processing

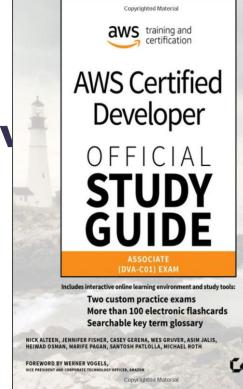




Several Clouds

# Image processing - Serverless





Sev

# Resources

- <https://aws.amazon.com/what-is/cloud-native/>
- <https://awsstash.com/?search=%22serverless%22>
- <https://aws.amazon.com/serverless-workshops/>
- <https://aws.amazon.com/certification/certified-developer-associate/>
- <https://aws.amazon.com/blogs/architecture/lets-architect-serverless-architecture-on-aws/>
- <https://reinvent.awsevents.com/>
- <https://www.coursera.org/specializations/aws-nodejs-serverless-development>



Several Clouds

# Thank you!

[daniel@severalclouds.com](mailto:daniel@severalclouds.com)

<https://www.linkedin.com/in/danielrankov/>

<https://www.meetup.com/aws-bulgaria/>