



Several Clouds

Public Cloud Services

Prepared for

Faculty of Mathematics and Informatics (FMI)

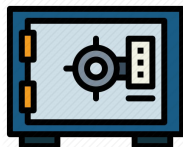
AWS S3



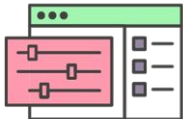
Amazon S3



Object-level storage



Designed for 99.999999999% durability



Event triggers



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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)

[https://\[BucketName\].s3.\[aws-region\].amazonaws.com/homepage.html](https://[BucketName].s3.[aws-region].amazonaws.com/homepage.html)





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Amazon S3 use case 2

Host entire static websites



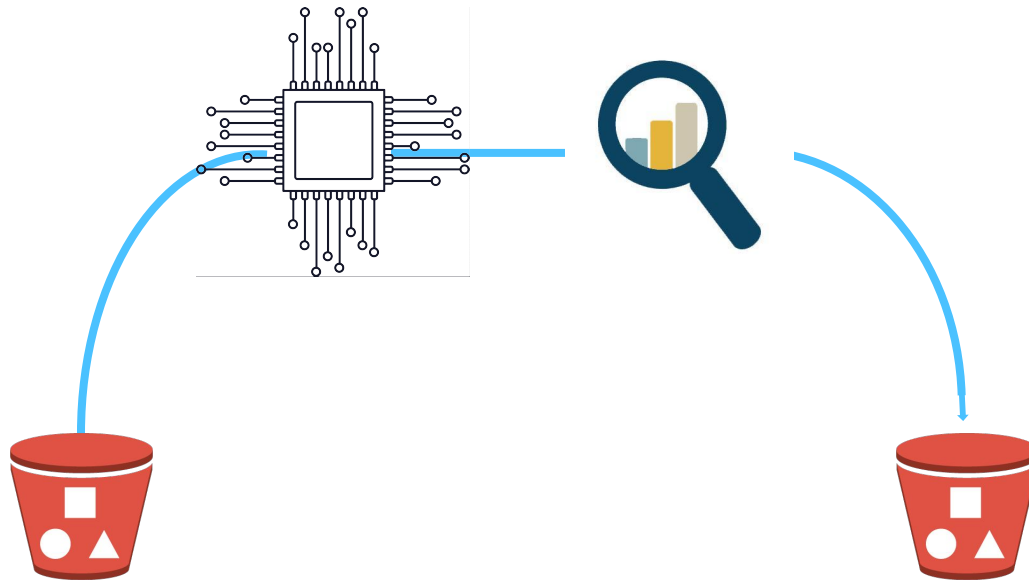
HTML files, images, videos, and client-side scripts



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Amazon S3 use case 3

Data store for computation and large-scale analytics

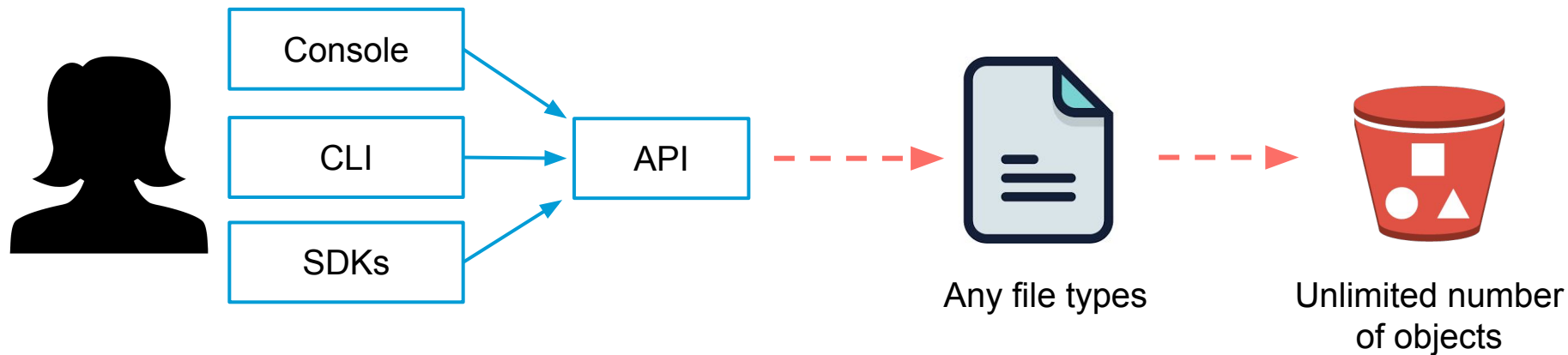


Financial transaction analysis

Clickstream analytics

Media transcoding

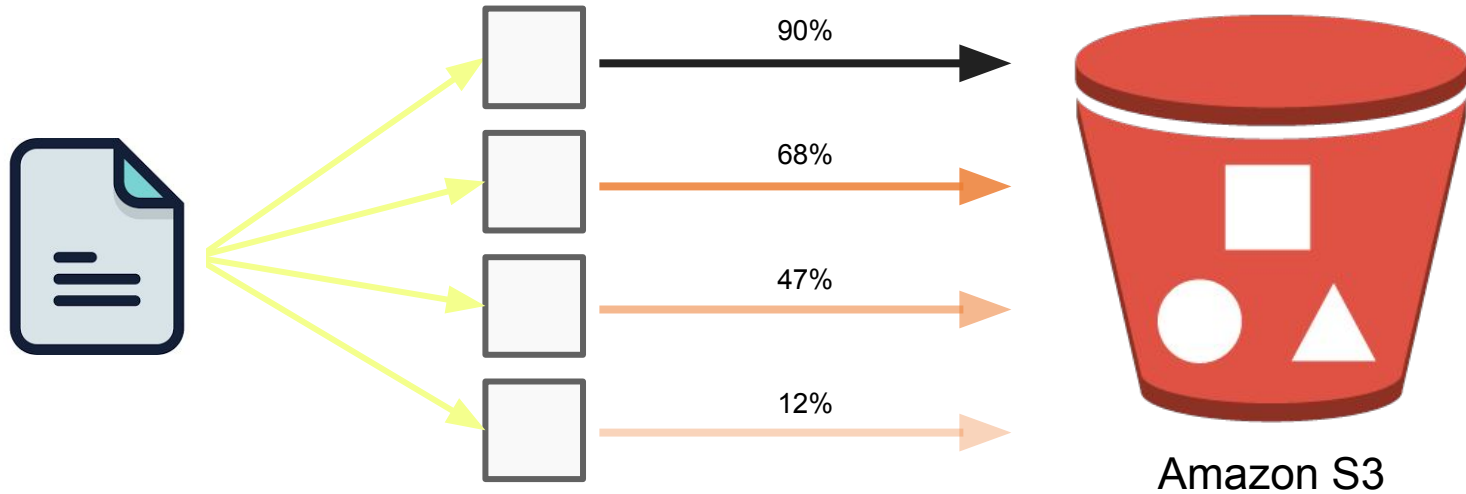
Moving data into Amazon S3





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Amazon S3 multipart upload





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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





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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

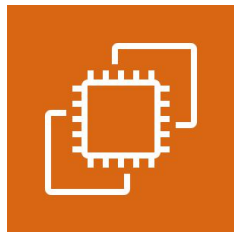
Transfer OUT to Amazon EC2 in the same Region, or to Amazon CloudFront





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What needs can Amazon EC2 address?



Amazon
EC2



Web hosting



Database
s



Authentication

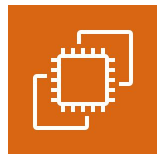


Anything a server can do



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Virtual machines vs. physical servers

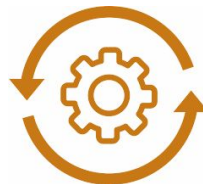


Amazon EC2 can solve some problems that are more difficult with an on-premises server.

When using **disposable** resources



Data-driven
decisions



Quick iterations



Free to make
mistakes



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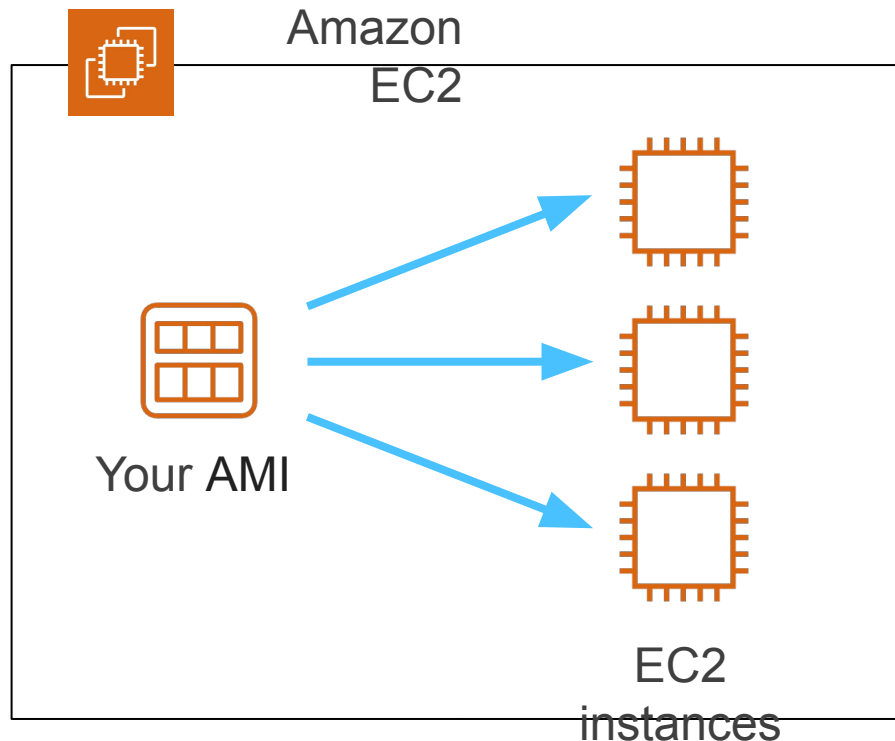
Amazon Machine Images (AMIs)

AMIs include:

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

Launch permissions

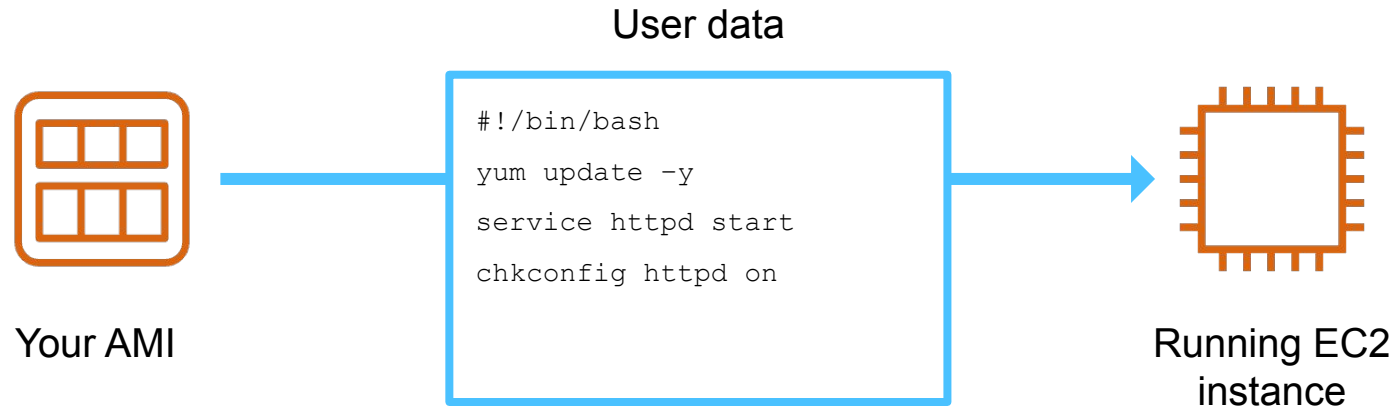
A block device mapping





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EC2 User Data





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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

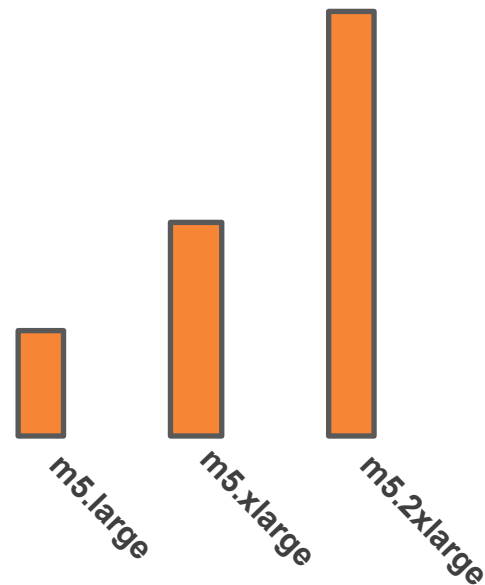


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EC2 instance types

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

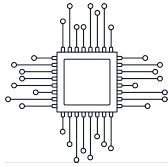
Scaling vertically





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EC2 instance types



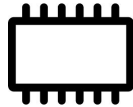
General purpose

6 available selections



Compute optimized

3 available selections



Memory optimized

7 available selections



Accelerated computing

4 available selections



Storage optimized

3 available selections



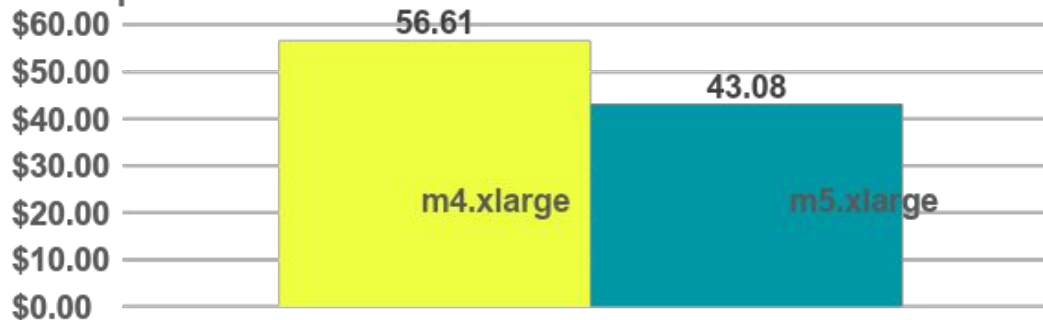
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Instance generations and cost

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

SQL Server Testing with HammerDB:

Average cost per 1 billion transactions per month

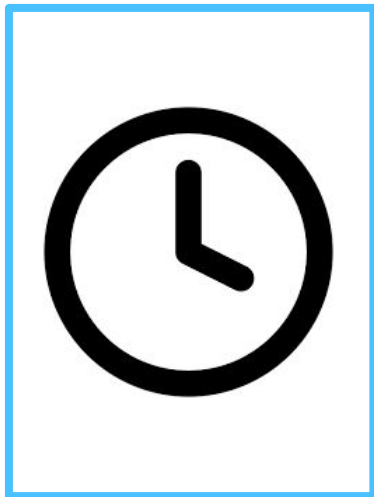




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EC2 pricing options

On-demand instances



Reserved instances



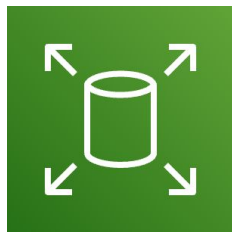
Spot instances





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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

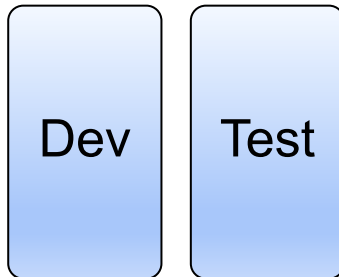


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What is VPC



Your private network
space in the AWS Cloud



Provides logical isolation
for your workloads



Allows custom access
controls and security
settings for your resources



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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

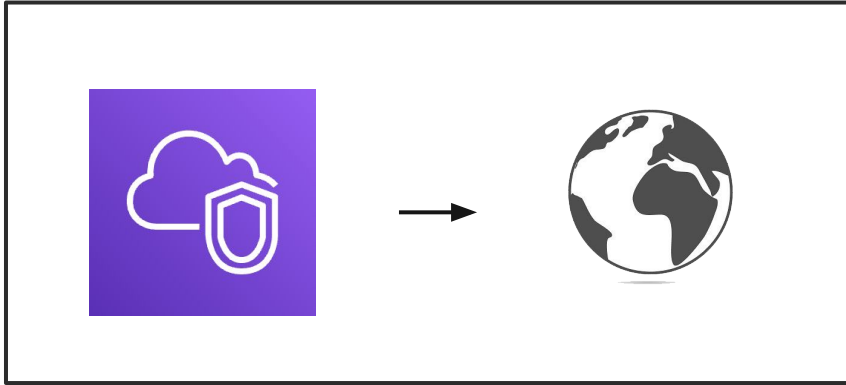


Provides strict access rules for inbound and outbound traffic.



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Deploying a VPC



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



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



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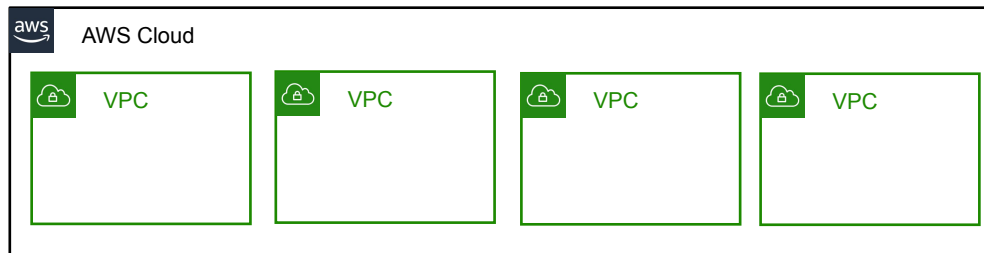
Multi-VPC pattern

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



Examples



Data store instances



Private subnet



Batch processing instances



Private subnet



Back-end instances



Private subnet



Web application instances

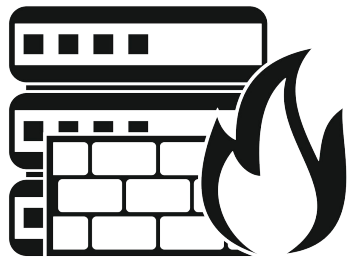


Public or private subnet

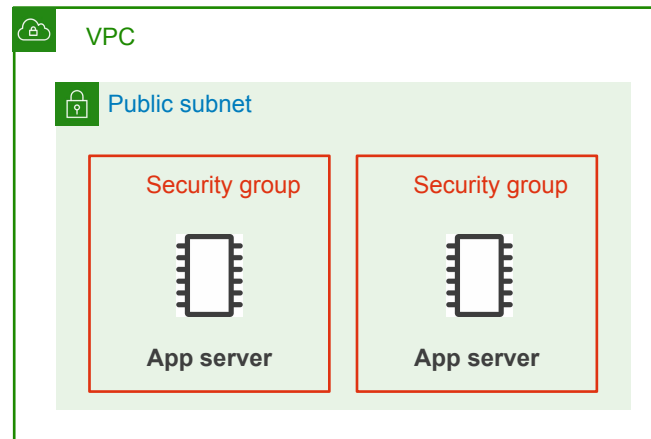


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Security groups



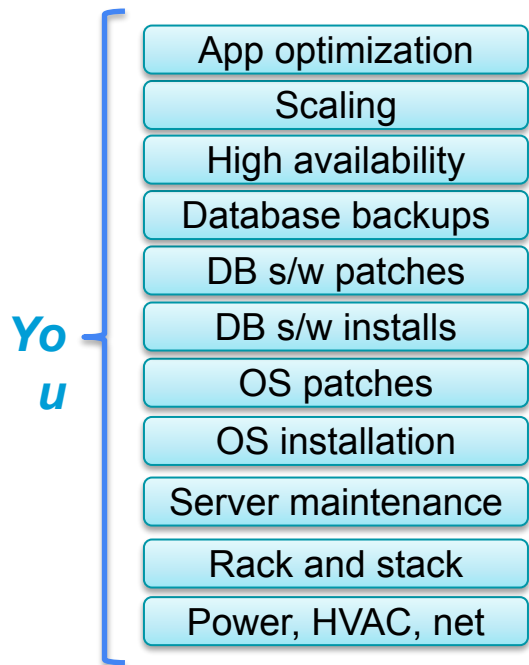
- Virtual firewalls that control inbound and outbound traffic into AWS resources
- Traffic can be restricted by any IP protocol, port, or IP address
- Rules are stateful





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Relational Database example

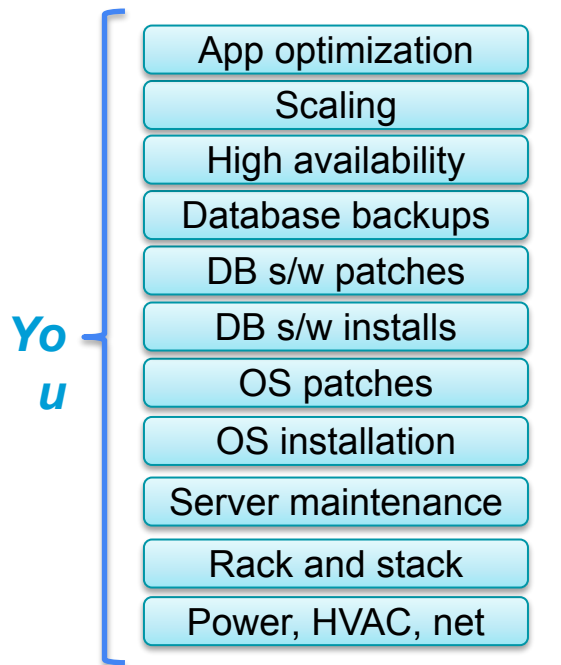


If you host your databases
on-premises

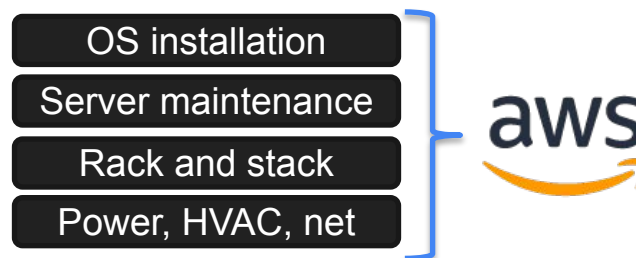


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Relational Database example



If you host your databases
on-premises

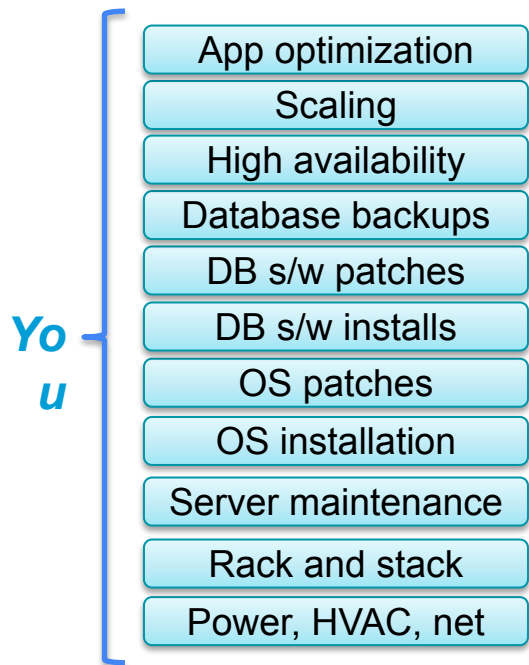


If you host your databases
in **Amazon EC2**

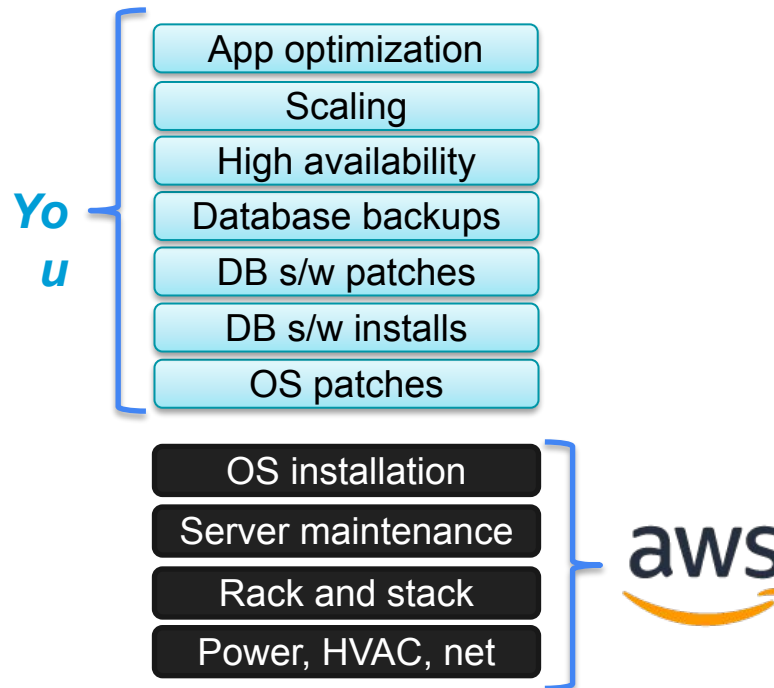


Several Clouds

Relational Database example



If you host your databases
on-premises

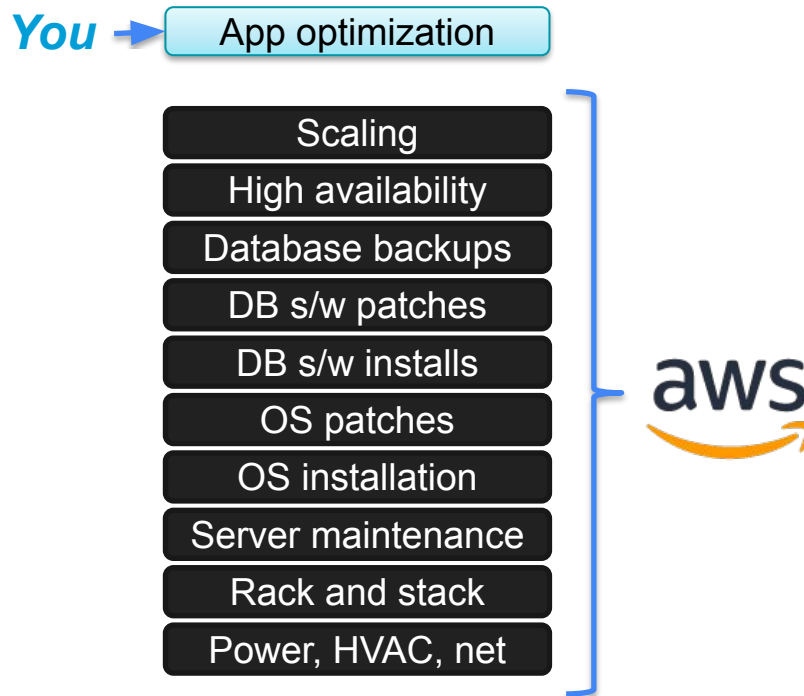


If you host your databases
in **Amazon EC2**



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Relational Database example



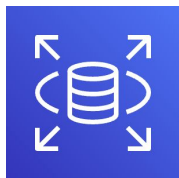
If you host your databases in
a managed **AWS** database service



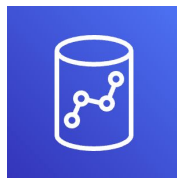
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Amazon database options

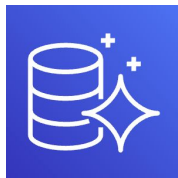
Relational databases



Amazon
RDS

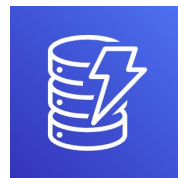


Amazon
Redshift

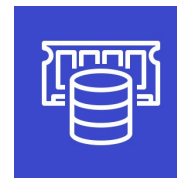


Amazon
Aurora

Non-relational databases



Amazon
DynamoDB



Amazon
ElastiCache



Amazon
Neptune

There are more databases – these are just common examples.

RDS



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RDS Engines:

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



PostgreSQL



Amazon Aurora

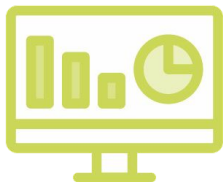




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What problems can containers solve?

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



Developer's
workstation



Production



Test
environment



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Container benefits



Repeatable



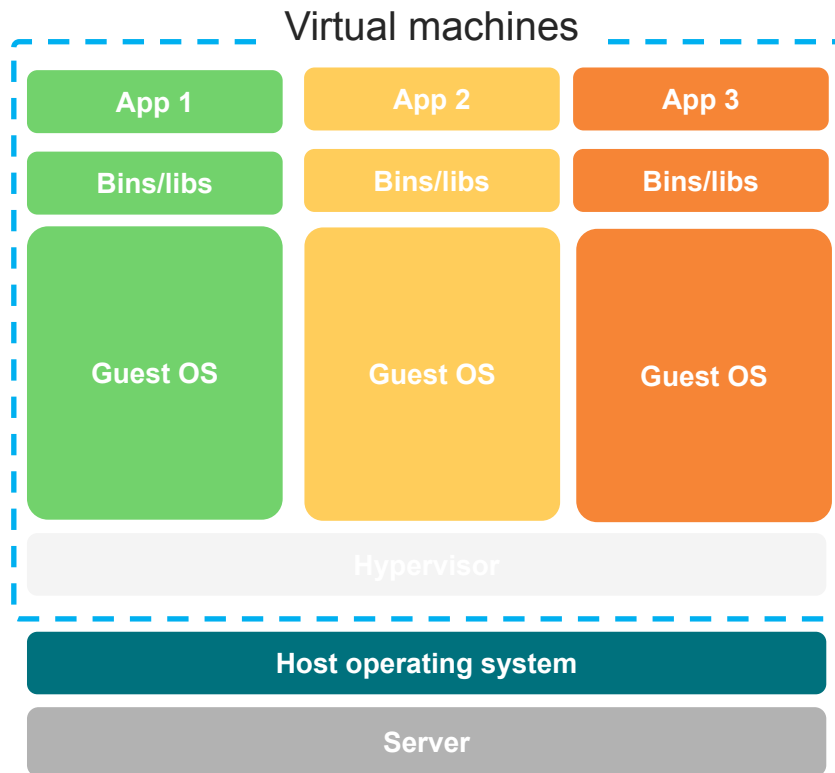
Self-contained running
environments



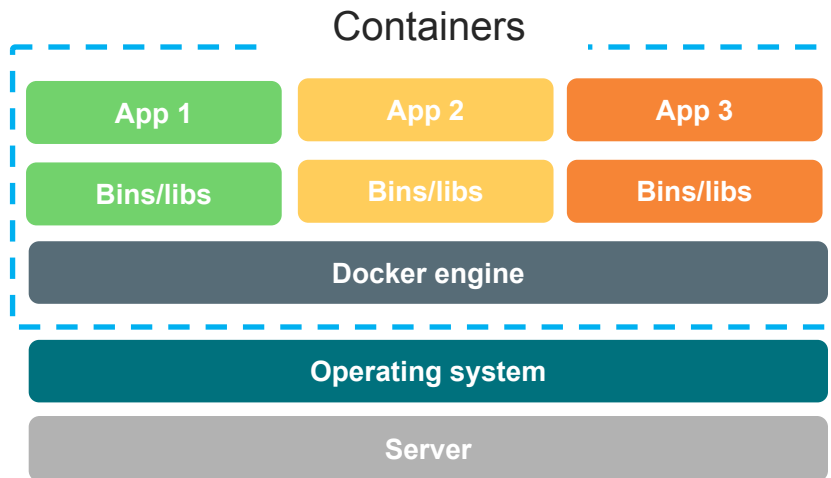
Faster to wind up and
down than VMs



Virtual machines vs. containers



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





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Containers on AWS



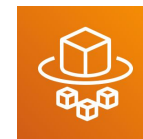
Amazon Elastic Container
Registry (Amazon ECR)



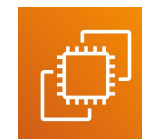
Amazon Elastic Kubernetes
Service
(Amazon EKS)



Amazon Elastic Container
Service (Amazon ECS)



AWS Fargate



Amazon EC2



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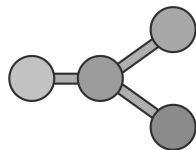
Amazon Container Service



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



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AWS Fargate



AWS Fargate

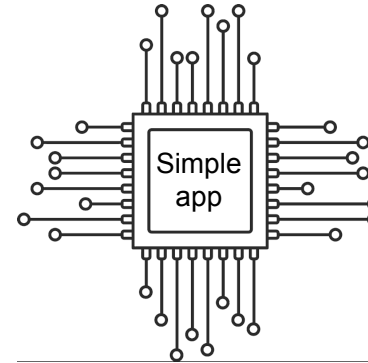
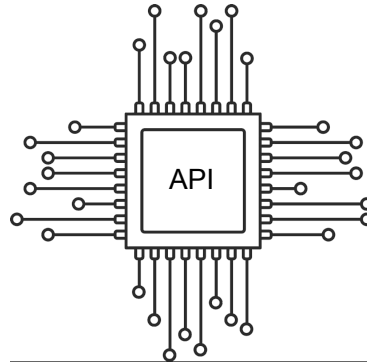
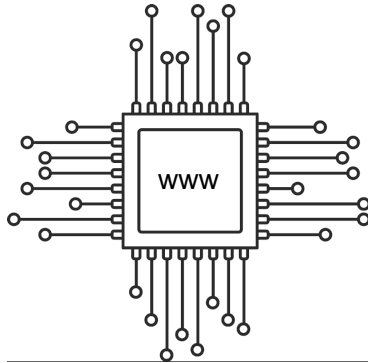
- Fully managed container service
- Provisioning and managing clusters
- Management of runtime environment
- Scaling



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Is your architecture efficient?

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

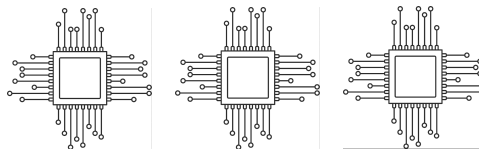




Several Clouds

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



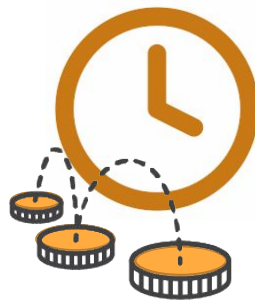
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Serverless computing

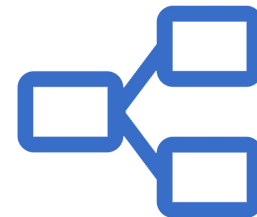
Building and running apps and services **without managing servers**



Focus on your application, not
configuration



Use compute resources
only upon request



Build a **microservice**
architecture



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AWS Lambda



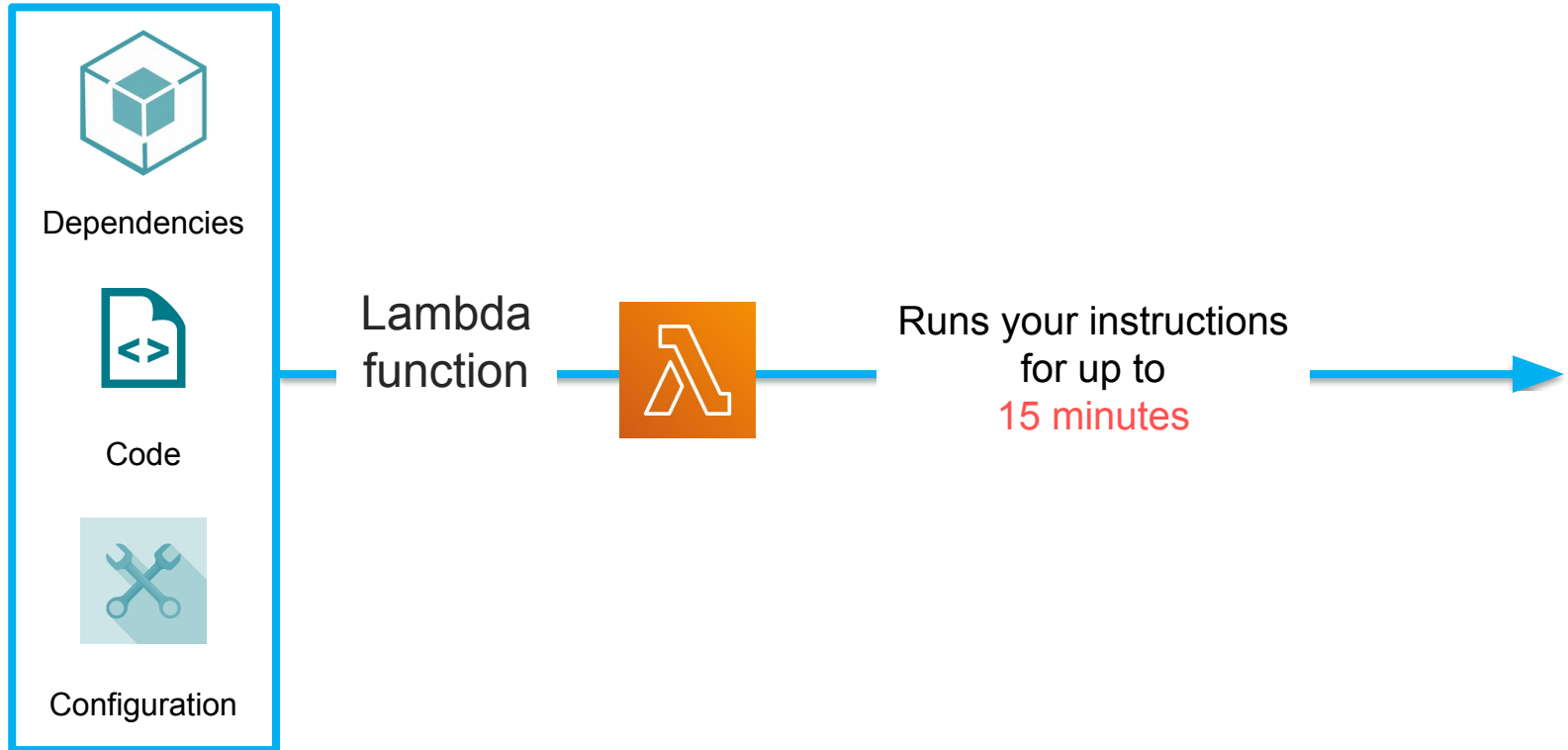
AWS Lambda

- 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

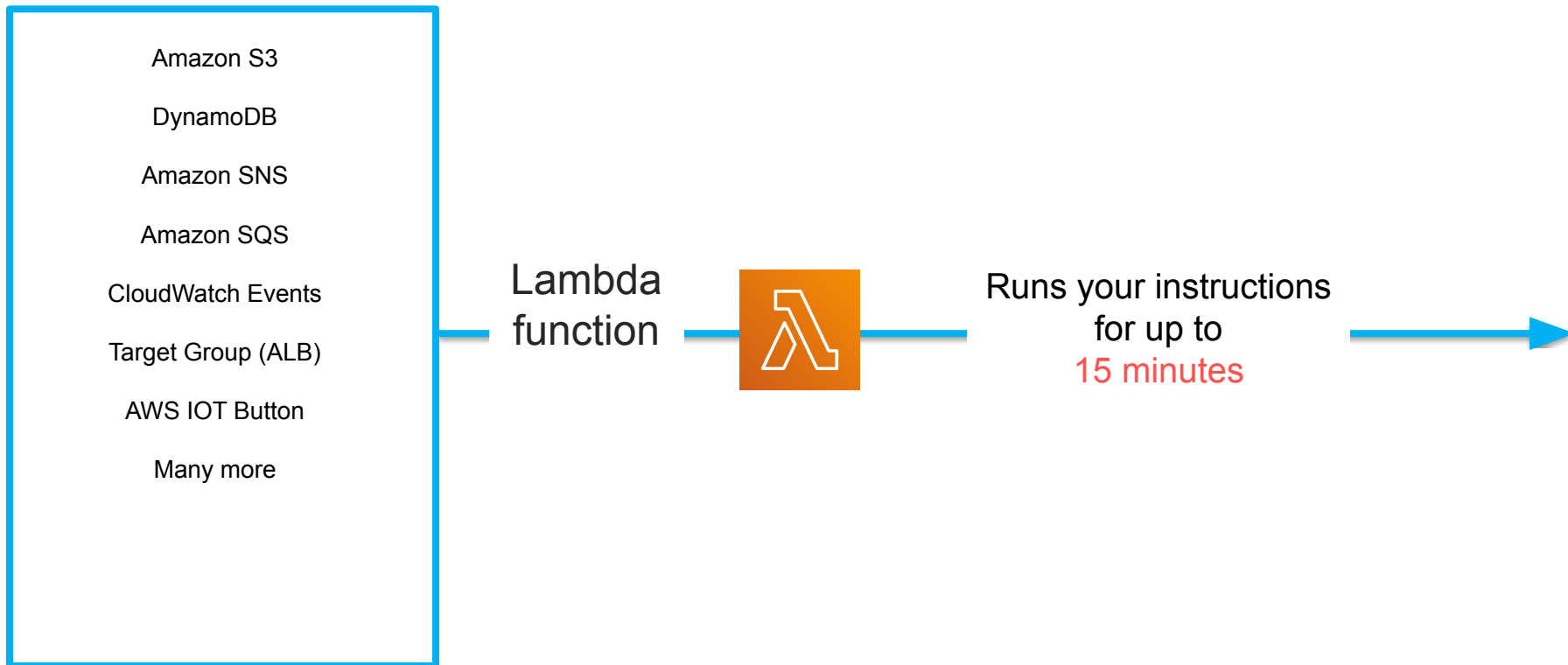
Lambda – how it works





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Lambda – event sources





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Lambda

Lambda **handles**:

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



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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

Image processing

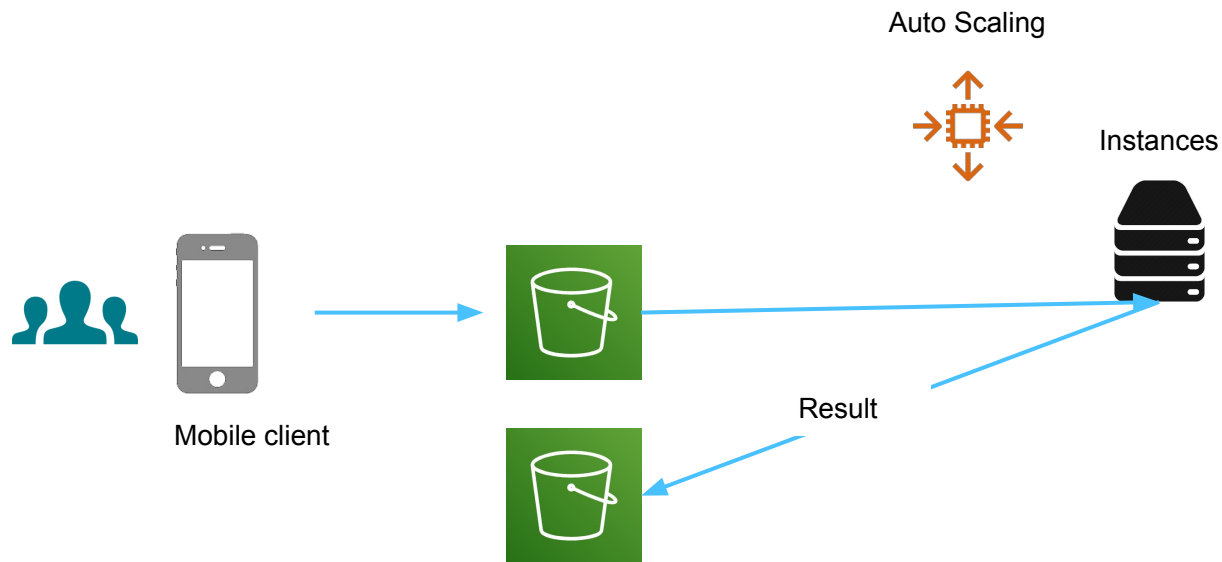
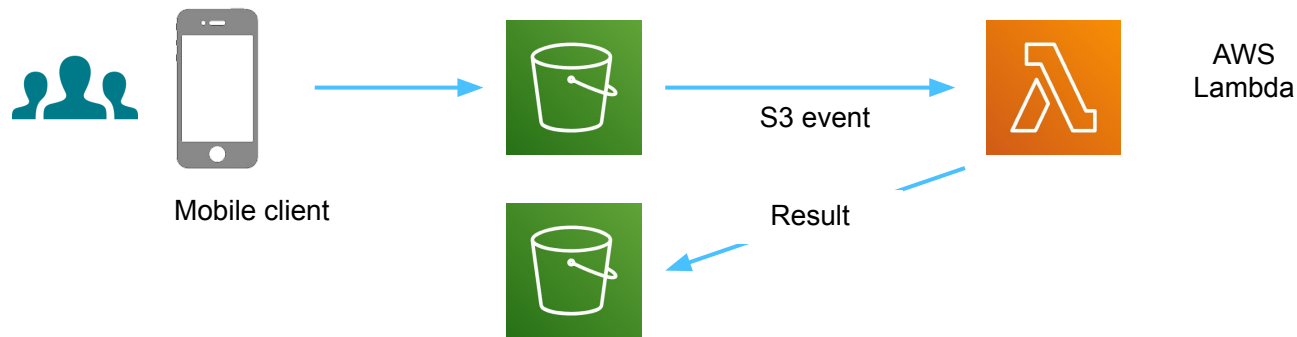


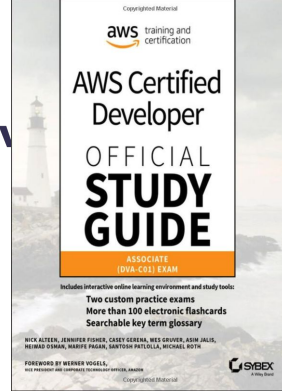
Image processing - Serverless



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>

Sev





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Thank you!

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

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