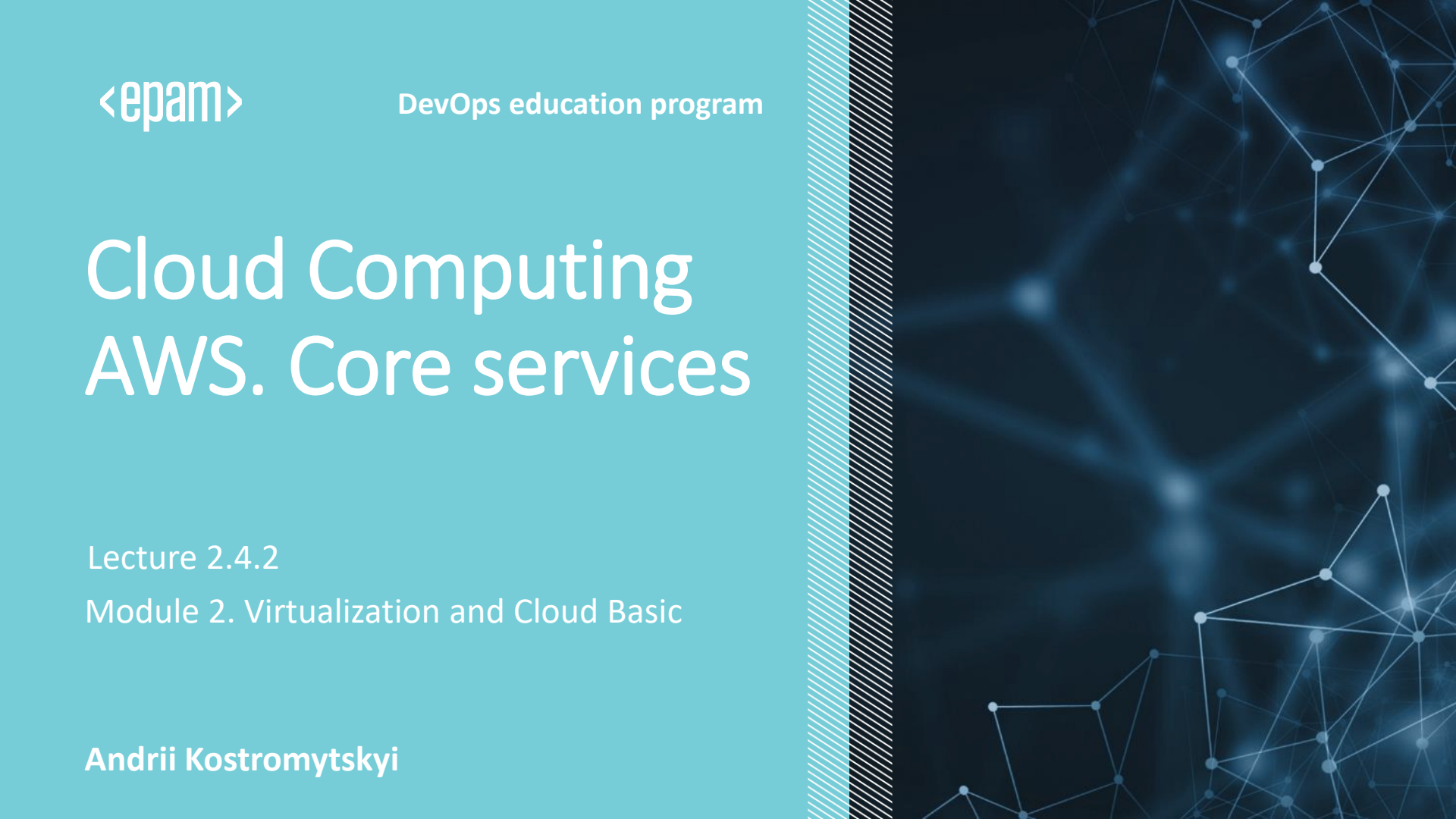

epam
DevOps education program
Cloud Computing
AWS. Core services
Lecture 2.4.2
Module 2. Virtualization and Cloud Basic
Andrii Kostromytskyi

Agenda

- AWS Services
- Q&A

AWS Documentation

- Find user guides, developer guides, API references, tutorials, and more.
  - https://docs.aws.amazon.com/
- *Whitepapers* are also available at https://aws.amazon.com/whitepapers/:
  - Overview of Amazon Web Services
  - How AWS Pricing Works
  - The Total Cost of (Non) Ownership of Web Applications in the Cloud

AWS pricing model

Compute
- Charged per hour/second
  (second - Linux only)
- Varies by instance type

Storage
- Charged typically per GB

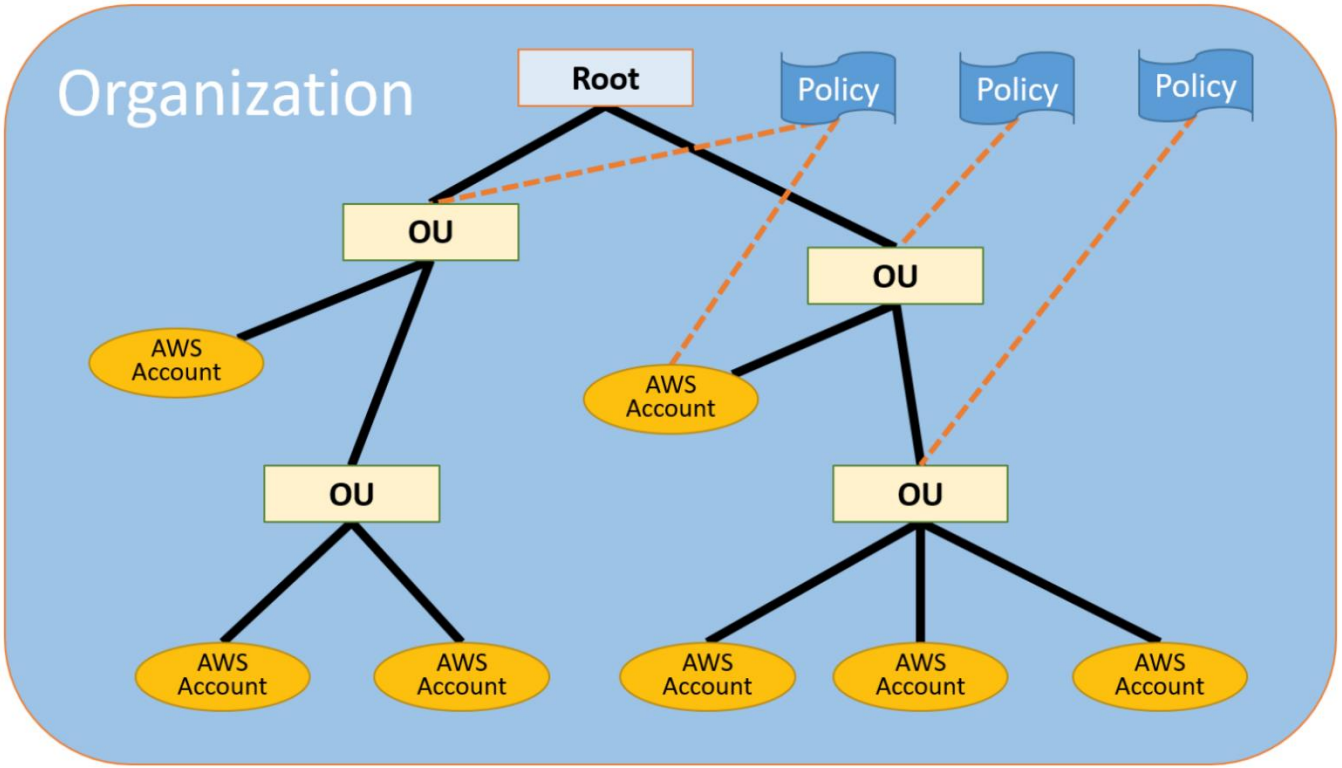
Data transfer
- Outbound is aggregated and charged
- Inbound has no charge (with some exceptions)
- Charged typically per GB

- Pay for what you use
- Pay less when you reserve
- Pay less when you use more and as AWS grows

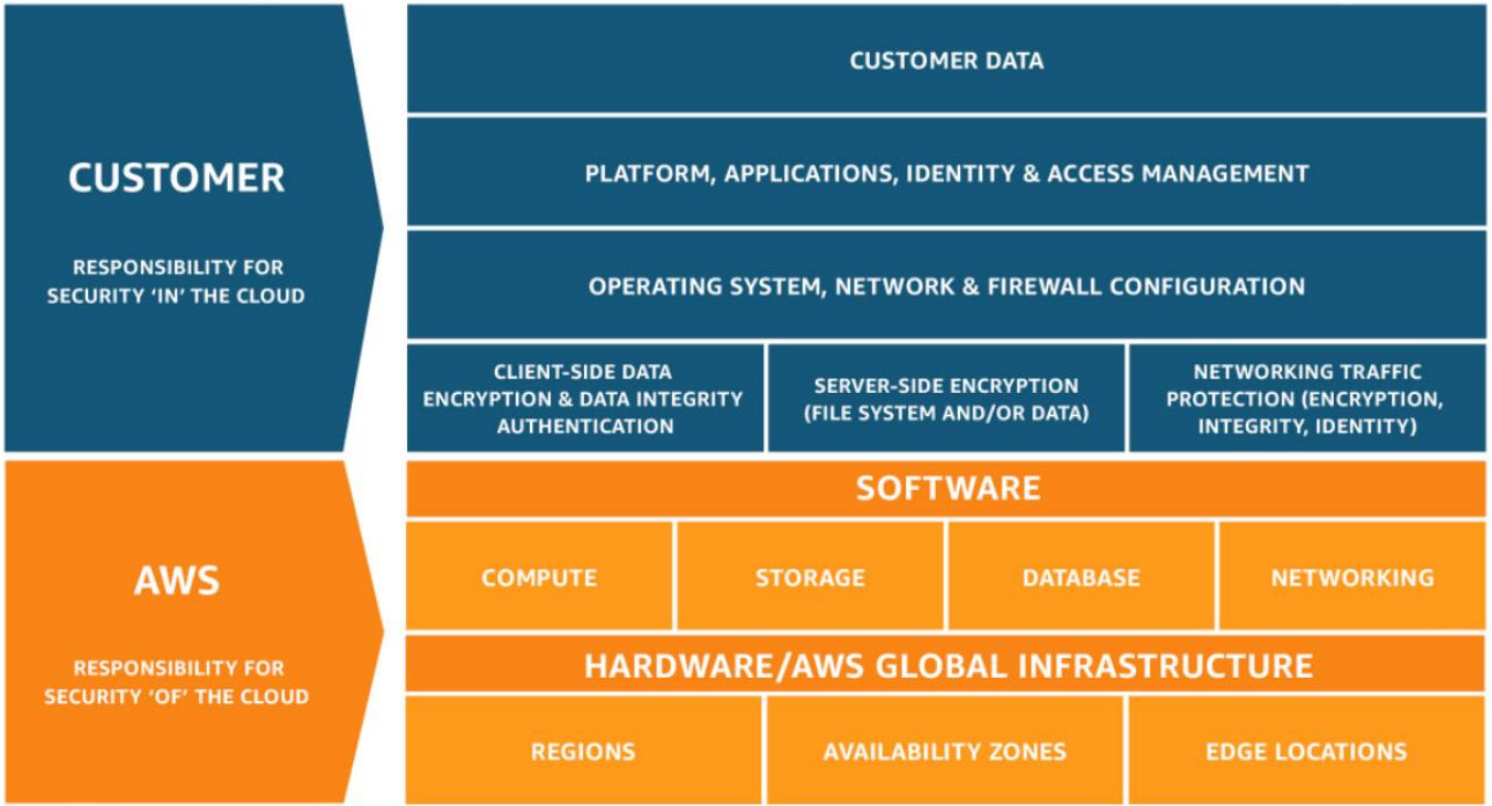
Services with no charge
- Amazon VPC
- Elastic Beanstalk
- Auto Scaling
- AWS CloudFormation
- AWS IAM
- …

AWS Pricing Calculator

AWS Organizations

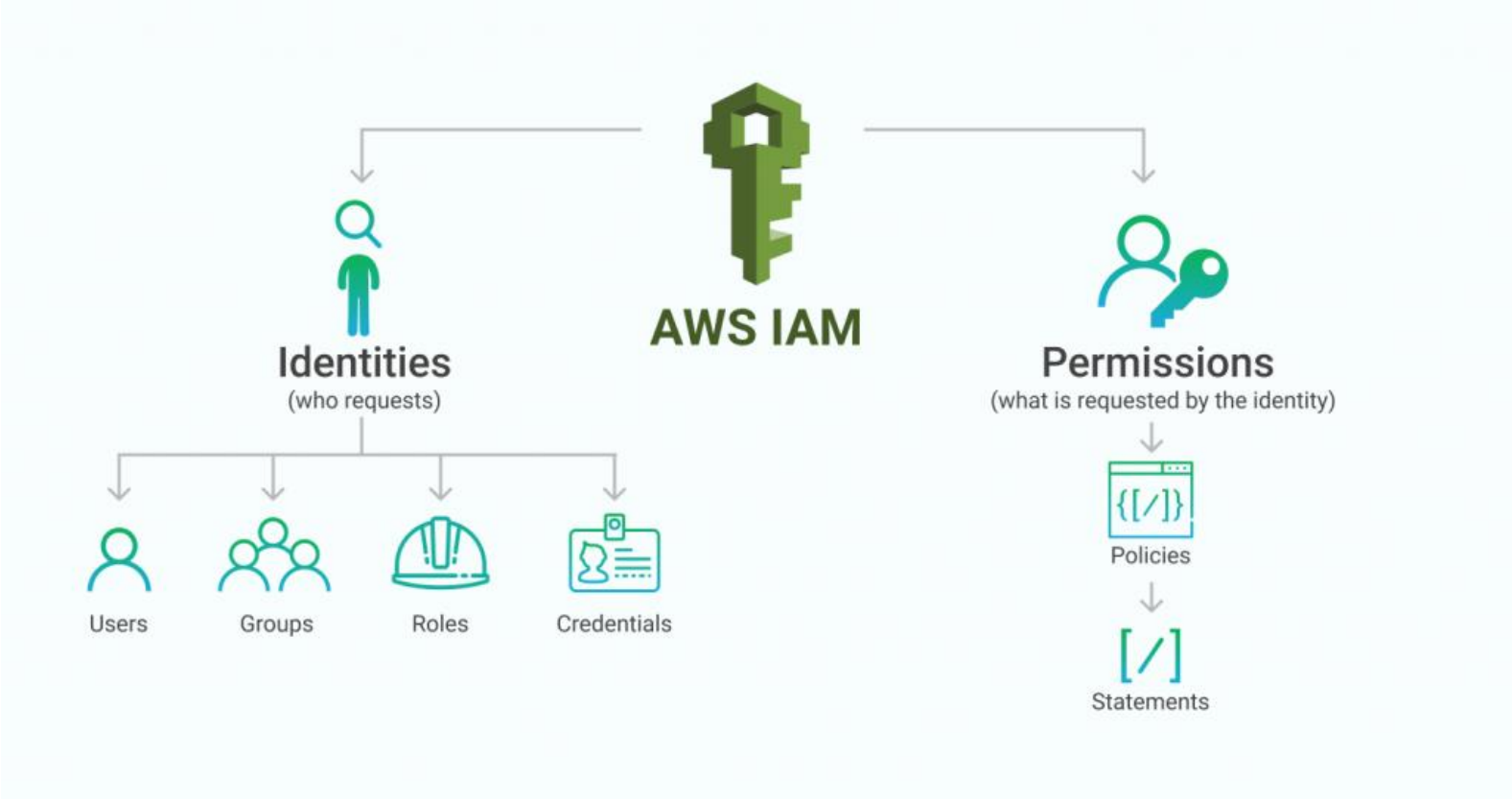


AWS shared responsibility model



IAM

IAM: Essential components



IAM: Essential components

IAM user

A **person** *or* **application** that can authenticate with an AWS account.

IAM group

A **collection of IAM users** that are granted identical authorization.

IAM policy

The document that defines **which resources can be accessed** and the **level of access** to each resource.

IAM role

Useful mechanism to grant a set of permissions for making AWS service requests.

AWS Identity and Access Management (IAM)

- Manage IAM Users and their access
- Manage IAM Roles and their permissions
- Manage federated users and their permissions

A **policy** is an object in AWS that, when associated with an identity or resource, defines their permissions.

Permissions in the policies determine whether the request is allowed or denied.

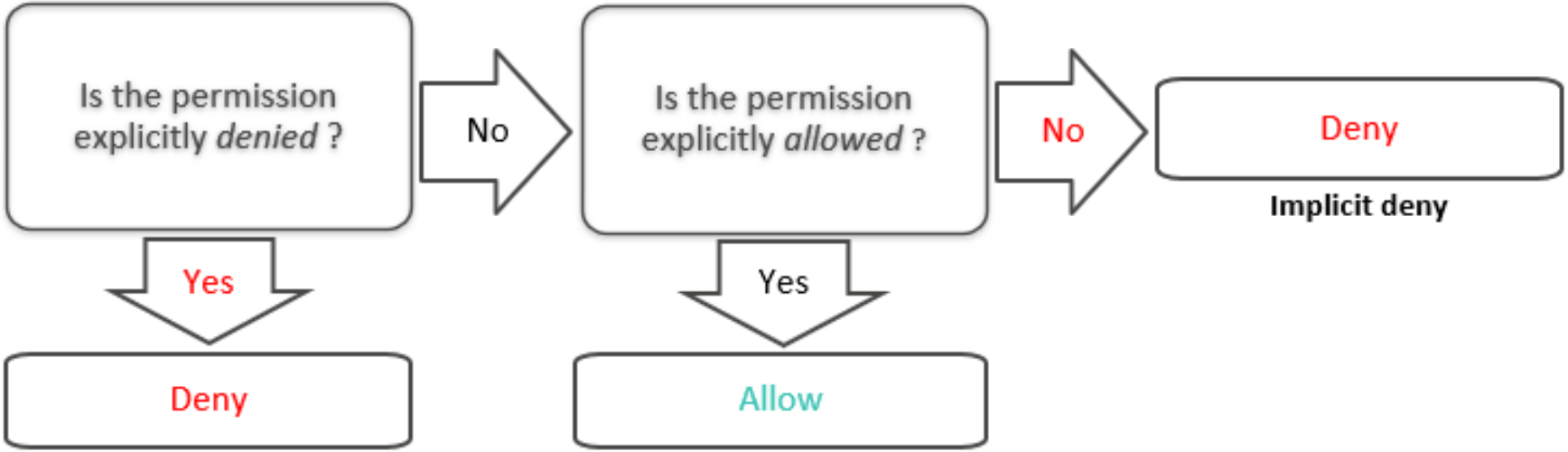
Most policies are stored in AWS as JSON documents.

IAM policies define permissions for an action regardless of the method that you use to perform the operation

Policy Types (six types of policies)

- Identity-based policies – Attach managed and inline policies to IAM identities (users, groups to which users belong, or roles). Identity-based policies grant permissions to an identity.
- Resource-based policies – Attach inline policies to resources. The most common examples of resource-based policies are Amazon S3 bucket policies and IAM role trust policies. Resource-based policies grant permissions to a principal entity that is specified in the policy. Principals can be in the same account as the resource or in other accounts.
- Permissions boundaries – Use a managed policy as the permissions boundary for an IAM entity (user or role). That policy defines the maximum permissions that the identity-based policies can grant to an entity, but does not grant permissions. Permissions boundaries do not define the maximum permissions that a resource-based policy can grant to an entity.
- Organizations SCPs – Use an AWS Organizations service control policy (SCP) to define the maximum permissions for account members of an organization or organizational unit (OU). SCPs limit permissions that identity-based policies or resource-based policies grant to entities (users or roles) within the account, but do not grant permissions.
- Access control lists (ACLs) – Use ACLs to control which principals in other accounts can access the resource to which the ACL is attached. ACLs are similar to resource-based policies, although they are the only policy type that does not use the JSON policy document structure. ACLs are cross-account permissions policies that grant permissions to the specified principal entity. ACLs cannot grant permissions to entities within the same account.
- Session policies – Pass advanced session policies when you use the AWS CLI or AWS API to assume a role or a federated user. Session policies limit the permissions that the role or user's identity-based policies grant to the session. Session policies limit permissions for a created session, but do not grant permissions. For more information, see Session Policies.
  https://docs.aws.amazon.com/en_us/IAM/latest/UserGuide/access_policies.html

How IAM determines permissions



IAM Policy Simulator

Securing a new AWS account

1. Stop using the account root user as soon as possible

2. Enable multi-factor authentication (MFA).

3. Use AWS CloudTrail

4. Enable a billing report, such as the AWS Cost and Usage Report

COMPUTE SERVICES

Categorizing compute services

Services	Key Concepts	Characteristics	Ease of Use
• Amazon EC2	• Infrastructure as a service (IaaS) • Instance-based • **Virtual machines**	• Provision virtual machines that you can manage as you choose	A familiar concept to many IT professionals.
• AWS Lambda	• **Serverless** computing • Function-based • Low-cost	• Write and deploy code that executes on a schedule or that can be triggered by events • Use when possible (architect for the cloud)	A relatively new concept for many IT staff members, but easy to use after you learn how.
• Amazon ECS • Amazon EKS • AWS Fargate • Amazon ECR	• **Container-based** computing • Instance-based	• Spin up and execute jobs more quickly	AWS Fargate reduces administrative overhead, but you can use options that give you more control.
• AWS Elastic Beanstalk	• Platform as a service (PaaS) • For **web applications**	• Focus on your code (building your application) • Can easily tie into other services—databases, Domain Name System (DNS), etc.	Fast and easy to get started.

EC2

Functionality EC2

- Create an Amazon Machine Image (AMI) that will contain your applications, libraries, data, and related configuration settings. Or use pre-configured image templates for work;
- Download AMI on Amazon S3. Amazon EC2 provides AMI storage tools. Amazon S3 provides secure, reliable, and fast storage for storing images;
- Use Amazon EC2 Web Service to configure security and network access
- choose the type (s) of the operating system that you need, run, complete, or control several AMIs as needed using the Web Service API or various management tools that are provided;
- determine the need to work in several places, use a static IP or other options;
- Pay only for the resources you intend to consume, such as time or data transfer.

Amazon EC2 Instance Types

General Purpose

T3 | M5 | M5a | T2 | M4 | T3a (Coming Soon)

Compute Optimized

C5 | C4

Memory Optimized

R5 | R5a | R4 | X1e | X1 | High Memory | z1d

Accelerated Computing

P3 | P2 | G3 | F1

Storage Optimized

H1 | I3 | D2

Тип инстанса	Виртуальные ЦПУ*	Память (ГиБ)	Хранилище (ГБ)	Сетевая производительность	Физический процессор	Тактовая частота (ГГц)
t3.nano	2	0,5	Только EBS	Низкая	Процессор Intel Scalable	2,5
m4.16xlarge	64	256	Только EBS	25 гигабит	Intel Xeon E5-2686 v4	2,3

Choosing the right Amazon EC2 Instance

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General Purpose	Compute Optimised	Storage Optimised	Memory Optimised	Memory Intensive	High Memory Intensive	I/O Optimised	Bare Metal High I/O	GPU	GPU Compute	Burstable
M5	C5	D2	R5	X1/X1e	Z1	I3	I3m	G3	P3	T3

Intel® AVX-512
Intel AES-NI
Intel® Turbo Boost Technology

Choosing the right Amazon EC2 Instance

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Consider the following when choosing your instances:

- Core Count
- Memory Size
- Storage Size & Type
- Network Performance
- CPU Technologies

EC2

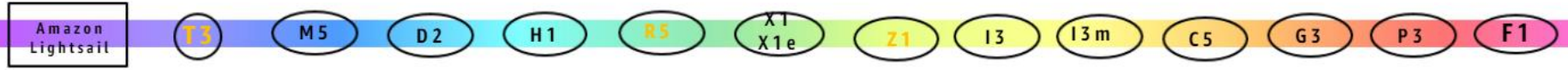
Find out more: https://aws.amazon.com/ec2/instance-types/

M5a

Powered by AMD

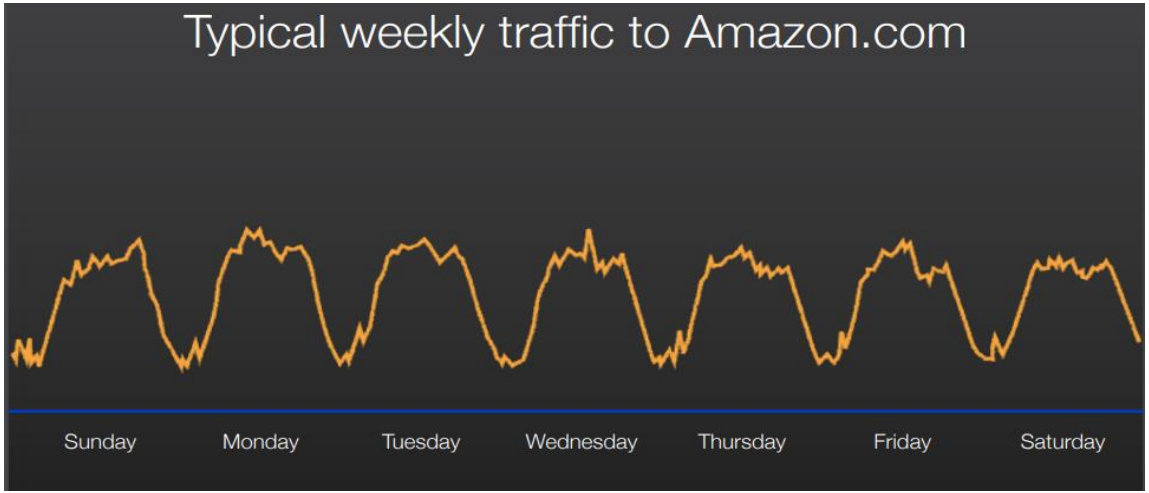
R5a

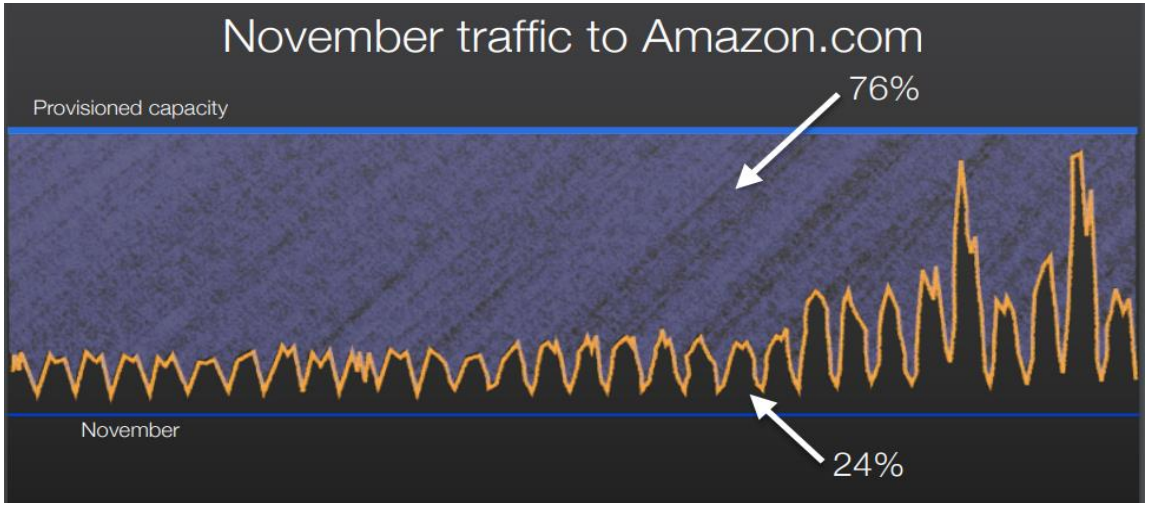
- Choose between processors on AWS general purpose and memory optimized instances
- 10% lower prices on AMD-based instances
- Most applications can run on AMD-based variants with little to no modification



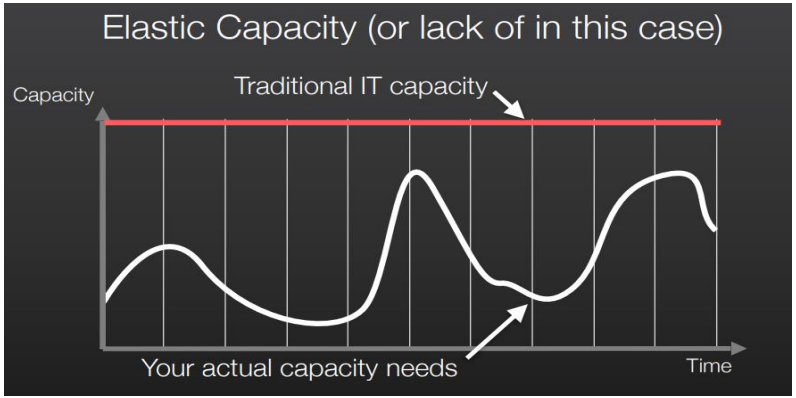
Virtual Private Servers	Burstable	General Purpose	Dense Storage	Big Data Optimized	Memory Optimized	Memory Intensive	High-Memory Intensive	High I/O	Bare Metal High I/O	Compute Intensive	Graphics Intensive	General Purpose GPU	FPGA
		M5d			R5d		Z1d			C5d			

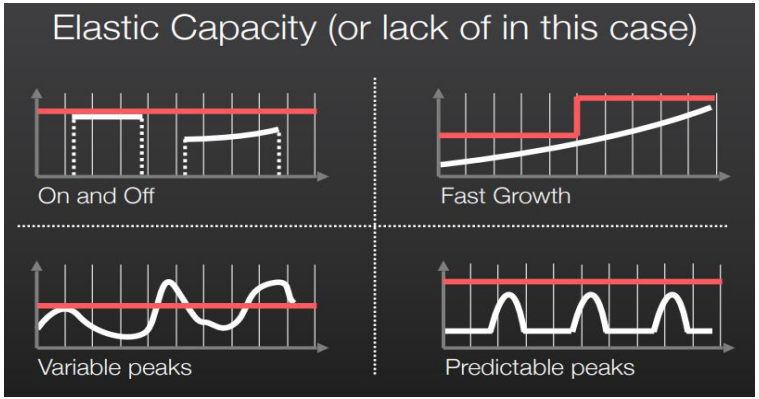
- NVMe-based SSD block level instance storage physically connected to the host server
- High-speed, low latency local block storage

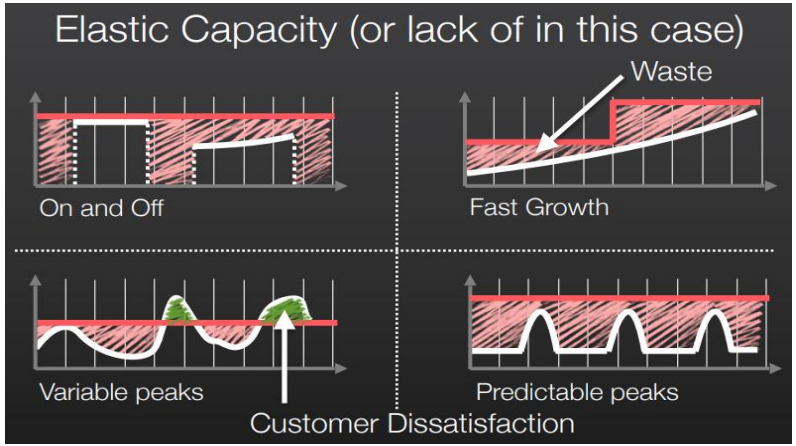

Typical weekly traffic to Amazon.com
Sunday
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday

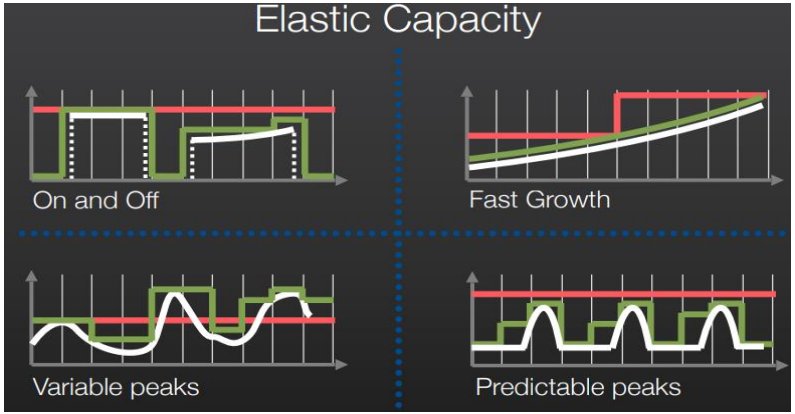

November traffic to Amazon.com
Provisioned capacity
76%
November
24%

Elastic Capacity









Choosing the Right Amazon EC2 Instances

Find out more: https://aws.amazon.com/ec2/pricing/

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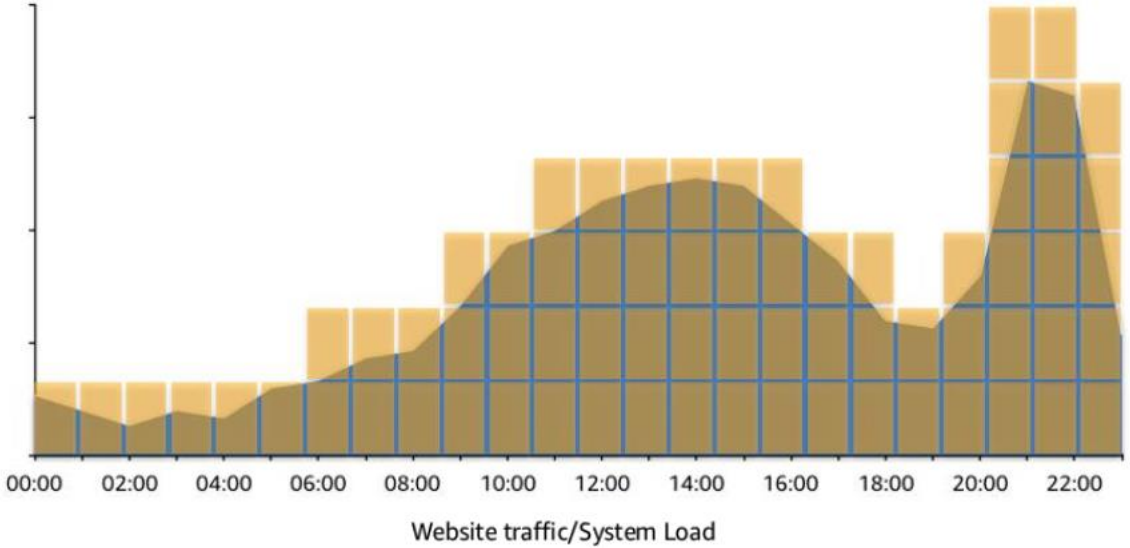
Bigger instances aren't always better!



6 x t3.medium

70 Instance hours @ $0.0456 per Hour

$3.192 per day

EC2 Instances Powered by Intel Technologies

Find out more: https://aws.amazon.com/ec2/

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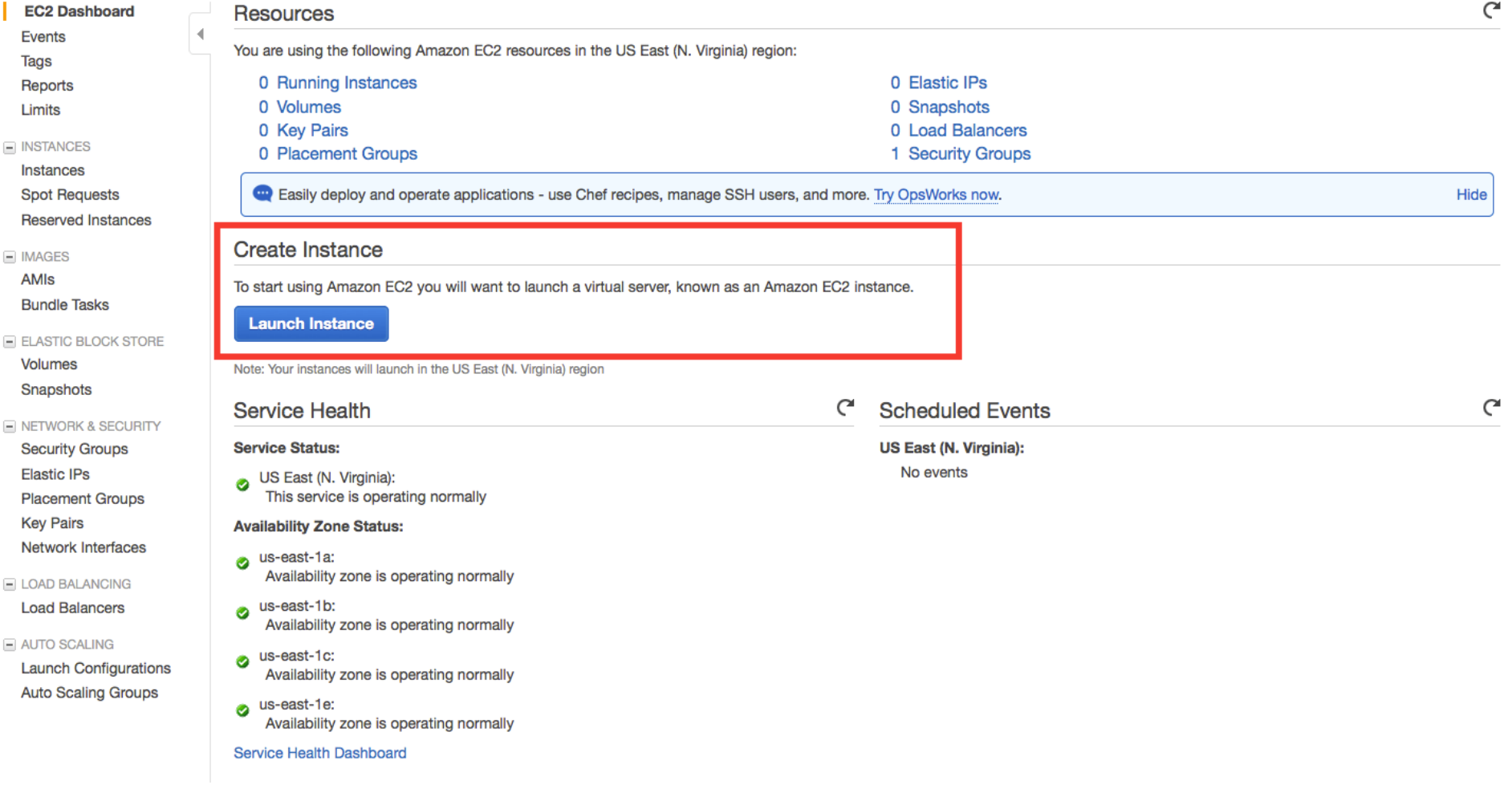
EC2 Instance Type	Compute Optimized		General Purpose			Memory Optimized			Storage Optimized		
	C5	C4	M5	M4	T2	X1	X1e	R4	H1	I3	D2
Intel Processor	Xeon Platinum 8175M	Xeon E5 2666 v3	Xeon Platinum 8175M	Xeon E5 2686 v4 2676 v3	Xeon Family	Xeon E7 8880 v3	Xeon E7 8880 v3	Xeon E5 2686 v4	Xeon E5 2686 v4	Xeon E5 2686 v4	Xeon E5 2676 v3
Intel Processor Technology	Skylake	Haswell	Skylake	Broadwell Haswell	Yes	Haswell	Haswell	Broadwell	Broadwell	Broadwell	Haswell
Intel AVX	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Intel AVX2	Yes	Yes	Yes	Yes	-	Yes	Yes	Yes	Yes	Yes	Yes
Intel AVX-512	Yes	-	Yes	-	-	-	-	-	-	-	-
Intel Turbo Boost	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Storage	EBS-only	EBS-only	EBS-only	EBS-only	EBS-only	SSD EBS-Opt	SSD EBS-Opt	-	HDD	SSD	HDD


EC2 Dashboard
Events
Tags
Reports
Limits
INSTANCES
Instances
Spot Requests
Reserved Instances
IMAGES
AMIs
Bundle Tasks
ELASTIC BLOCK STORE
Volumes
Snapshots
NETWORK & SECURITY
Security Groups
Elastic IPs
Placement Groups
Key Pairs
Network Interfaces
LOAD BALANCING
Load Balancers
AUTO SCALING
Launch Configurations
Auto Scaling Groups
Resources
You are using the following Amazon EC2 resources in the US East (N. Virginia) region:
0 Running Instances
0 Volumes
0 Key Pairs
0 Placement Groups
0 Elastic IPs
0 Snapshots
0 Load Balancers
1 Security Groups
Easily deploy and operate applications - use Chef recipes, manage SSH users, and more. Try OpsWorks now.
Hide
Create Instance
To start using Amazon EC2 you will want to launch a virtual server, known as an Amazon EC2 instance.
Launch Instance
Note: Your instances will launch in the US East (N. Virginia) region
Service Health
Service Status:
US East (N. Virginia):
This service is operating normally
Availability Zone Status:
us-east-1a:
Availability zone is operating normally
us-east-1b:
Availability zone is operating normally
us-east-1c:
Availability zone is operating normally
us-east-1e:
Availability zone is operating normally
Service Health Dashboard
Scheduled Events
US East (N. Virginia):
No events

1. Choose AMI | 2. Choose Instance Type | 3. Configure Instance | 4. Add Storage | 5. Tag Instance | 6. Configure Security Group | 7. Review

Step 1: Choose an Amazon Machine Image (AMI)

Cancel and Exit

An AMI is a template that contains the software configuration (operating system, application server, and applications) required to launch your instance. You can select an AMI provided by AWS, our user community, or the AWS Marketplace; or you can select one of your own AMIs.

- Quick Start
- My AMIs
- AWS Marketplace
- Community AMIs

Free tier only

1 to 22 of 22 AMIs

Amazon Linux AMI 2015.03.1 (HVM), SSD Volume Type - ami-0d4cfd66
Amazon Linux — Free tier eligible
The Amazon Linux AMI is an EBS-backed, AWS-supported image. The default image includes AWS command line tools, Python, Ruby, Perl, and Java. The repositories include Docker, PHP, MySQL, PostgreSQL, and other packages.
Root device type: ebs Virtualization type: hvm
Select — 64-bit

Red Hat Enterprise Linux 7.1 (HVM), SSD Volume Type - ami-12663b7a
Red Hat — Free tier eligible
Red Hat Enterprise Linux version 7.1 (HVM), EBS General Purpose (SSD) Volume Type
Root device type: ebs Virtualization type: hvm
Select — 64-bit

SUSE Linux Enterprise Server 12 (HVM), SSD Volume Type - ami-aeb532c6
SUSE Linux — Free tier eligible
SUSE Linux Enterprise Server 12 (HVM), EBS General Purpose (SSD) Volume Type. Public Cloud, Advanced Systems Management, Web and Scripting, and Legacy modules enabled.
Root device type: ebs Virtualization type: hvm
Select — 64-bit

Ubuntu Server 14.04 LTS (HVM), SSD Volume Type - ami-d05e75b8
Ubuntu — Free tier eligible
Ubuntu Server 14.04 LTS (HVM), EBS General Purpose (SSD) Volume Type. Support available from Canonical (http://www.ubuntu.com/cloud/services).
Root device type: ebs Virtualization type: hvm
Select — 64-bit

Microsoft Windows Server 2012 R2 Base - ami-cd9339a6
Windows — Free tier eligible
Microsoft Windows 2012 R2 Standard edition with 64-bit architecture. [English]
Root device type: ebs Virtualization type: hvm
Select — 64-bit

Are you launching a database instance? Try Amazon RDS. Hide
Amazon RDS
Amazon Relational Database Service (RDS) makes it easy to set up, operate, and scale a relational database of your choice (MySQL, PostgreSQL, Oracle, SQL Server) in the cloud. It provides cost-efficient and resizable capacity while managing time-consuming database management tasks, freeing you up to focus on your applications and business. Learn more.
Launch a database using RDS

Microsoft Windows Server 2012 R2 with SQL Server Express - ami-8359f1e8
Windows
Microsoft Windows Server 2012 R2 Standard edition, 64-bit architecture, Microsoft SQL Server 2014 Express edition. [English]
Root device type: ebs Virtualization type: hvm
Select — 64-bit

Step 2: Choose an Instance Type

Amazon EC2 provides a wide selection of instance types optimized to fit different use cases. Instances are virtual servers that can run applications. They have varying combinations of CPU, memory, storage, and networking capacity, and give you the flexibility to choose the appropriate mix of resources for your applications. Learn more about instance types and how they can meet your computing needs.

Filter by: All instance types | Current generation | Show/Hide Columns

Currently selected: t2.micro (Variable ECUs, 1 vCPUs, 2.5 GHz, Intel Xeon Family, 1 GiB memory, EBS only)

	Family	Type	vCPUs	Memory (GiB)	Instance Storage (GB)	EBS-Optimized Available	Network Performance
☑	General purpose	t2.micro Free tier eligible	1	1	EBS only	-	Low to Moderate
☐	General purpose	t2.small	1	2	EBS only	-	Low to Moderate
☐	General purpose	t2.medium	2	4	EBS only	-	Low to Moderate
☐	General purpose	t2.large	2	8	EBS only	-	Low to Moderate
☐	General purpose	m4.large	2	8	EBS only	Yes	Moderate
☐	General purpose	m4.xlarge	4	16	EBS only	Yes	High
☐	General purpose	m4.2xlarge	8	32	EBS only	Yes	High
☐	General purpose	m4.4xlarge	16	64	EBS only	Yes	High
☐	General purpose	m4.10xlarge	40	160	EBS only	Yes	10 Gigabit
☐	General purpose	m3.medium	1	3.75	1 x 4 (SSD)	-	Moderate
☐	General purpose	m3.large	2	7.5	1 x 32 (SSD)	-	Moderate
☐	General purpose	m3.xlarge	4	15	2 x 40 (SSD)	Yes	High
☐	General purpose	m3.2xlarge	8	30	2 x 80 (SSD)	Yes	High

Cancel | Previous | Review and Launch | Next: Configure Instance Details

Step 7: Review Instance Launch

Please review your instance launch details. You can go back to edit changes for each section. Click **Launch** to assign a key pair to your instance and complete the launch process.

Improve your instances' security. Your security group, launch-wizard-1, is open to the world.

Your instances may be accessible from any IP address. We recommend that you update your security group rules to allow access from known IP addresses only.
You can also open additional ports in your security group to facilitate access to the application or service you're running, e.g., HTTP (80) for web servers. Edit security groups

AMI Details

Edit AMI

Free tier eligible

Amazon Linux AMI 2015.03.1 (HVM), SSD Volume Type - ami-0d4cfd66

The Amazon Linux AMI is an EBS-backed, AWS-supported image. The default image includes AWS command line tools, Python, Ruby, Perl, and Java. The repositories include Docker, PHP, MySQL, PostgreSQL, and other packages.

Root Device Type: ebs Virtualization type: hvm

Instance Type

Edit instance type

Instance Type	ECUs	vCPUs	Memory (GiB)	Instance Storage (GB)	EBS-Optimized Available	Network Performance
t2.micro	Variable	1	1	EBS only	-	Low to Moderate

Security Groups

Edit security groups

Security group name launch-wizard-1
Description launch-wizard-1 created 2015-09-11T13:35:57.265-07:00

Type	Protocol	Port Range	Source
SSH	TCP	22	0.0.0.0/0

Instance Details

Edit instance details

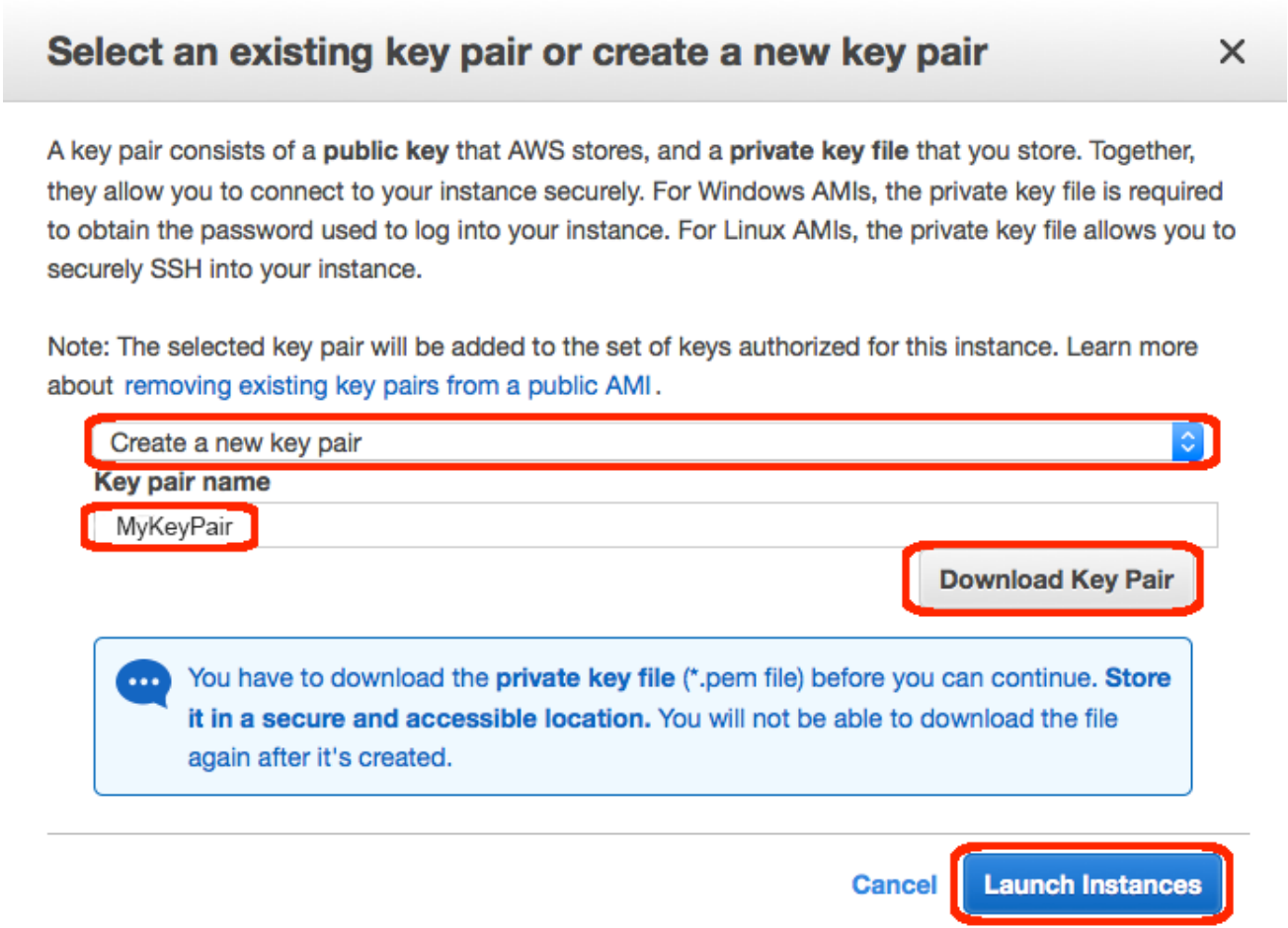
Storage

Edit storage

Tags

Edit tags

Cancel Previous Launch


Select an existing key pair or create a new key pair
A key pair consists of a public key that AWS stores, and a private key file that you store. Together, they allow you to connect to your instance securely. For Windows AMIs, the private key file is required to obtain the password used to log into your instance. For Linux AMIs, the private key file allows you to securely SSH into your instance.
Note: The selected key pair will be added to the set of keys authorized for this instance. Learn more about removing existing key pairs from a public AMI.
Create a new key pair
Key pair name
MyKeyPair
Download Key Pair
You have to download the private key file (*.pem file) before you can continue. Store it in a secure and accessible location. You will not be able to download the file again after it's created.
Cancel
Launch Instances

S3

Cloud storage Amazon S3

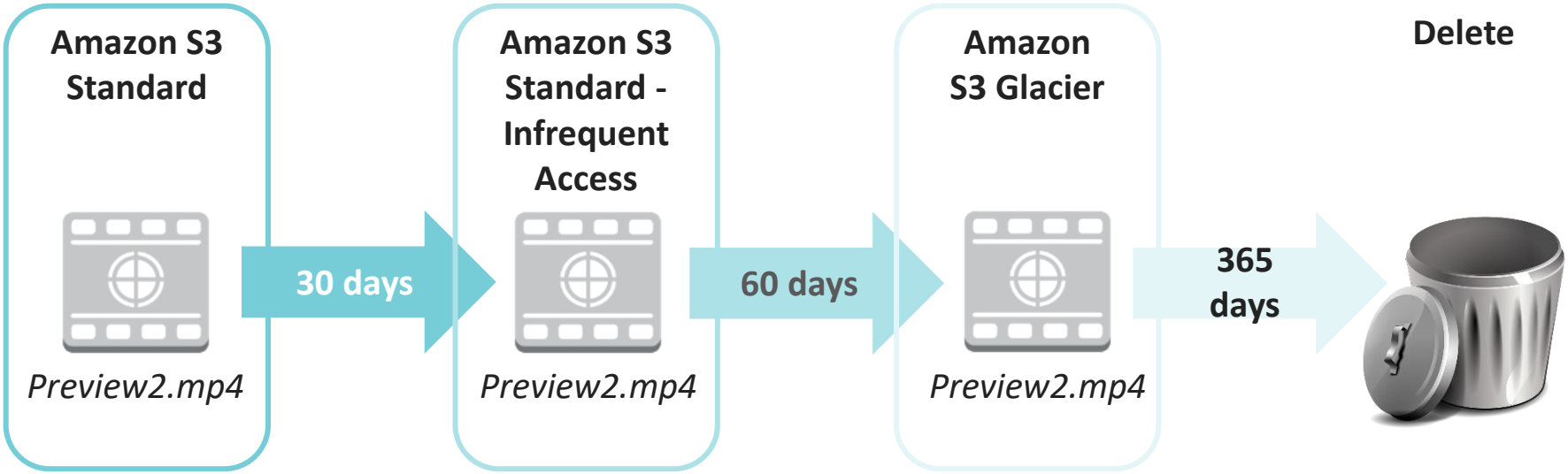
Storage classes

- Amazon S3 Standard
- Amazon S3 Intelligent-Tiering
- Amazon S3 Standard-Infrequent Access (Amazon S3 Standard-IA)
- Amazon S3 One Zone-Infrequent Access (Amazon S3 One Zone-IA)
- Amazon S3 Glacier
- Amazon S3 Glacier Deep Archive

Security and compliance

- Amazon S3 supports three different types of encryption.
- S3 offers high-tech integration with AWS CloudTrail to register, monitor and store repository API calls for audit purposes.
- Amazon S3 is the only cloud storage platform with Amazon Macie that uses machine learning to automatically detect, classify, and protect sensitive data in AWS.
- S3 supports security standards and certificates of compliance, including PCI DSS, HIPAA / HITECH, FedRAMP, the EU Data Protection Directive, and FISMA, which helps customers comply with the requirements of virtually all supervisors around the world.

Lifecycle policies



OTHER

Amazon VPC

Find out more: https://aws.amazon.com/ru/vpc/

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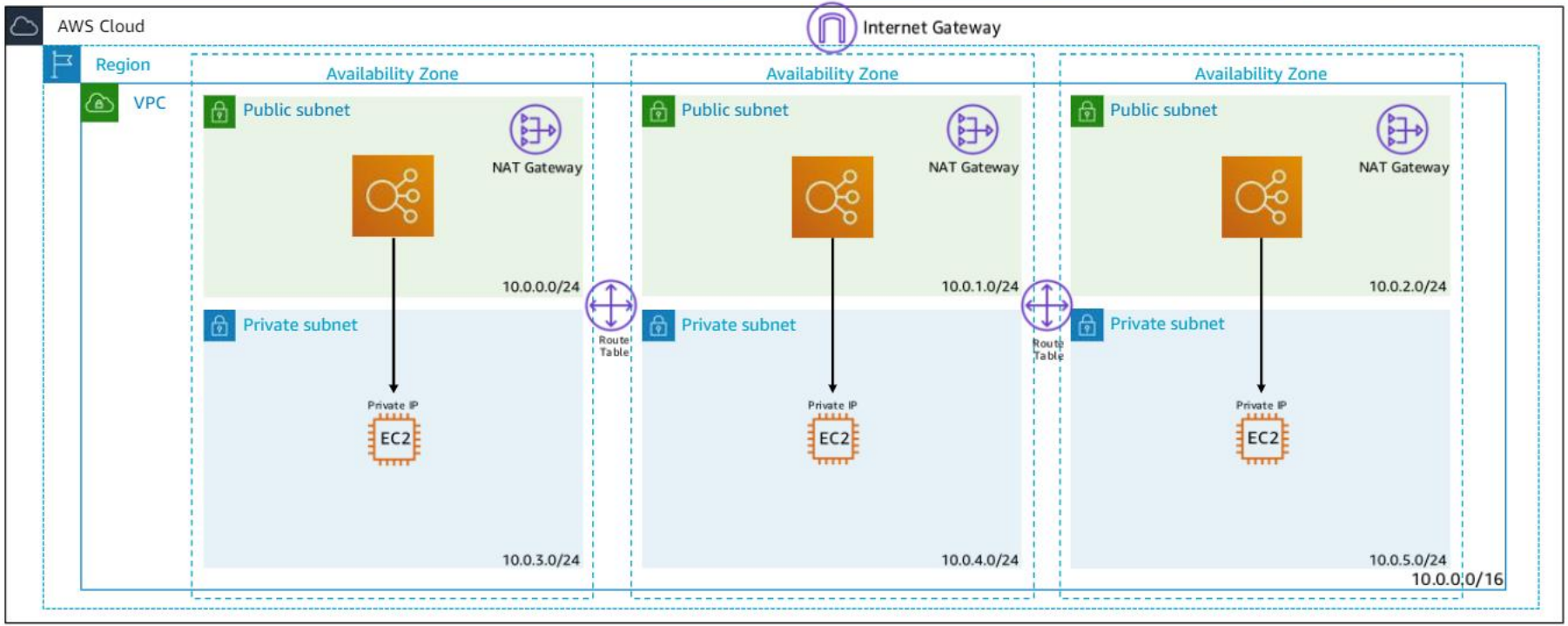
- Private, virtual network in the AWS Cloud
- Similar constructs as on-premises network
  - You choose your own subnet
- Customizable network configurations to meet your needs
  - Its possible to have public and private subnets
  - Control traffic between subnets with NACLs

Amazon VPC

Security Groups

Find out more: https://docs.aws.amazon.com/vpc/latest/userguide/VPC_SecurityGroups.html

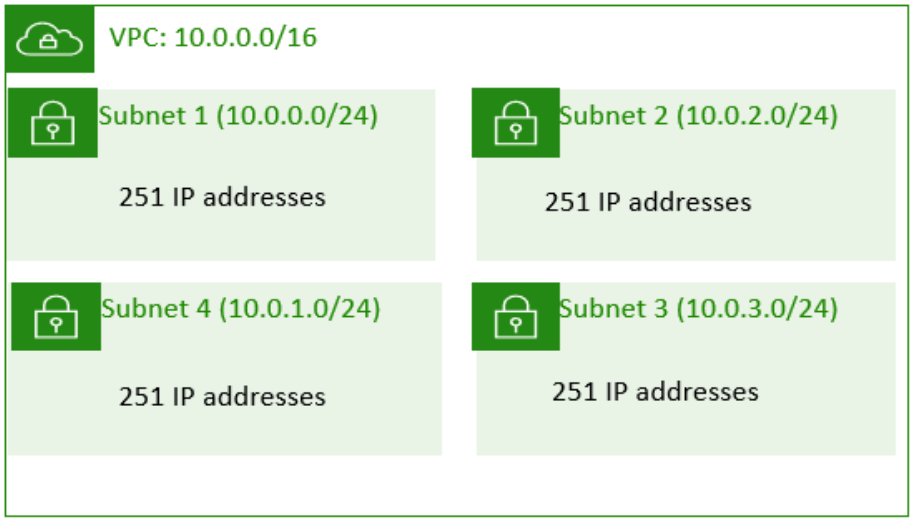
AWSOME DAY
ONLINE CONFERENCE



IP addressing

x.x.x.x/16 or 65,536 addresses (max) to
x.x.x.x/28 or 16 addresses (min)

Example



IP Addresses for CIDR block 10.0.0.0/24	Reserved for
10.0.0.0	Network address
10.0.0.1	Internal communication
10.0.0.2	Domain Name System (DNS) resolution
10.0.0.3	Future use
10.0.0.255	Network broadcast address

Container Services

Find out more: https://aws.amazon.com/containers/

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ECR

- Secure Container Registry
- Integrated with IAM

ECS

- AWS Container platform
- Fully Managed Control Plane
- Tight integration with AWS services

EKS

- Managed Kubernetes Service
- Native Kubernetes experience
- Open source

Fargate

- No servers to manage
- ECS compatible
- Pay for resources not instances

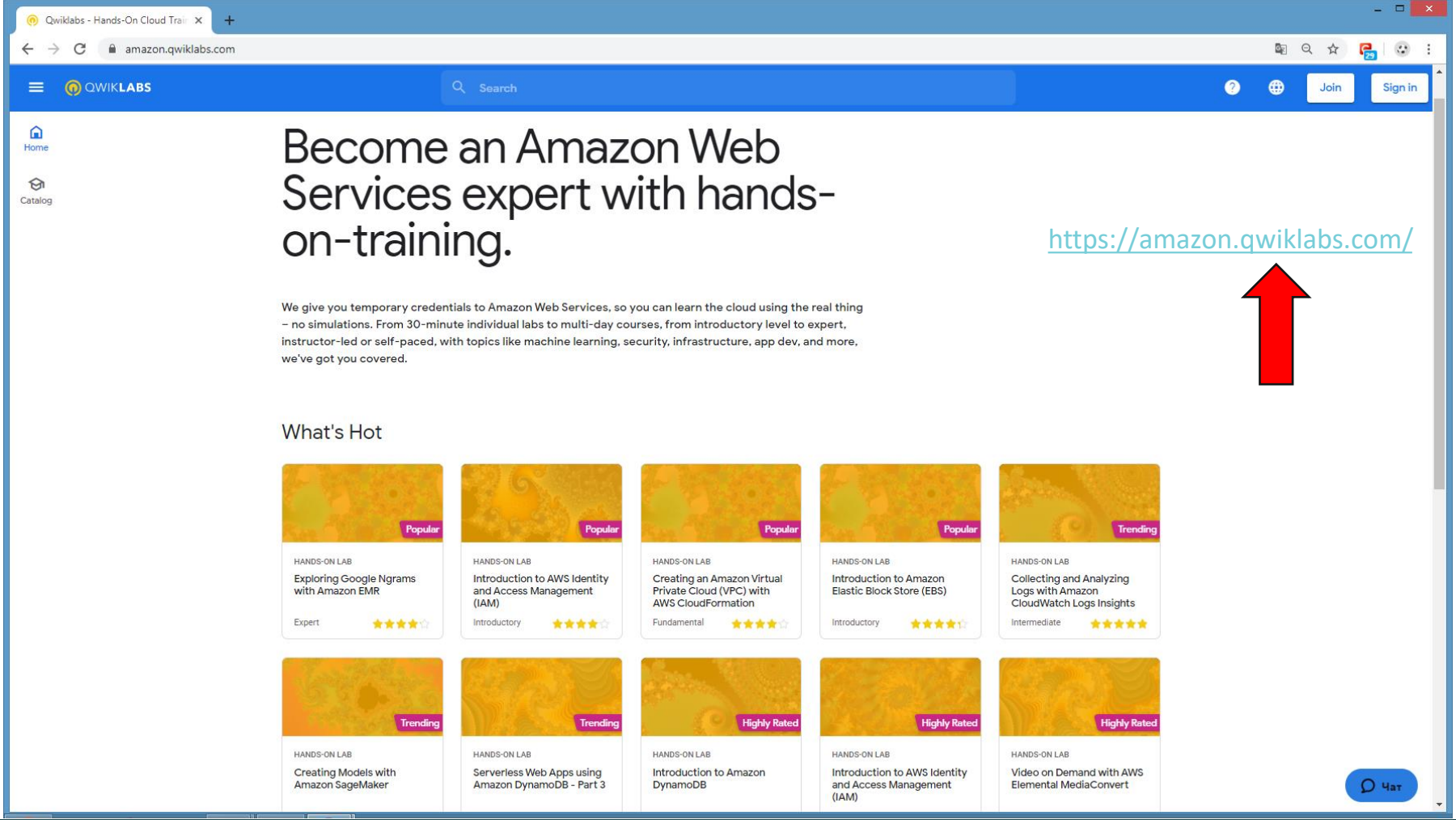
Example of use AWS Lambda

You can configure data processing in AWS Lambda immediately after downloading it to Amazon S3. For example, in Lambda you can create image thumbnails, change video encoding, index files, process logs, check content, and aggregate and filter data - all in real time.

15 must have AWS services/tools/options

	EC2 instances
1	AMI
2	Scaling
	AWS Storage & CDN
3	S3
4	EBS
	AWS Database
5	RDS
6	MySQL
7	DynamoDB

	AWS Networking
8	VPC
9	DHCP
10	Route53
11	Load Balancer
	AWS Monitoring
12	CloudWatch
	AWS Management Tools
13	CloudFormation
14	Trusted Advisor
	AWS Security & Identity
15	IAM, IAM Roles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Q & A

Thank you!