Cloud Web Services

UNIT-1
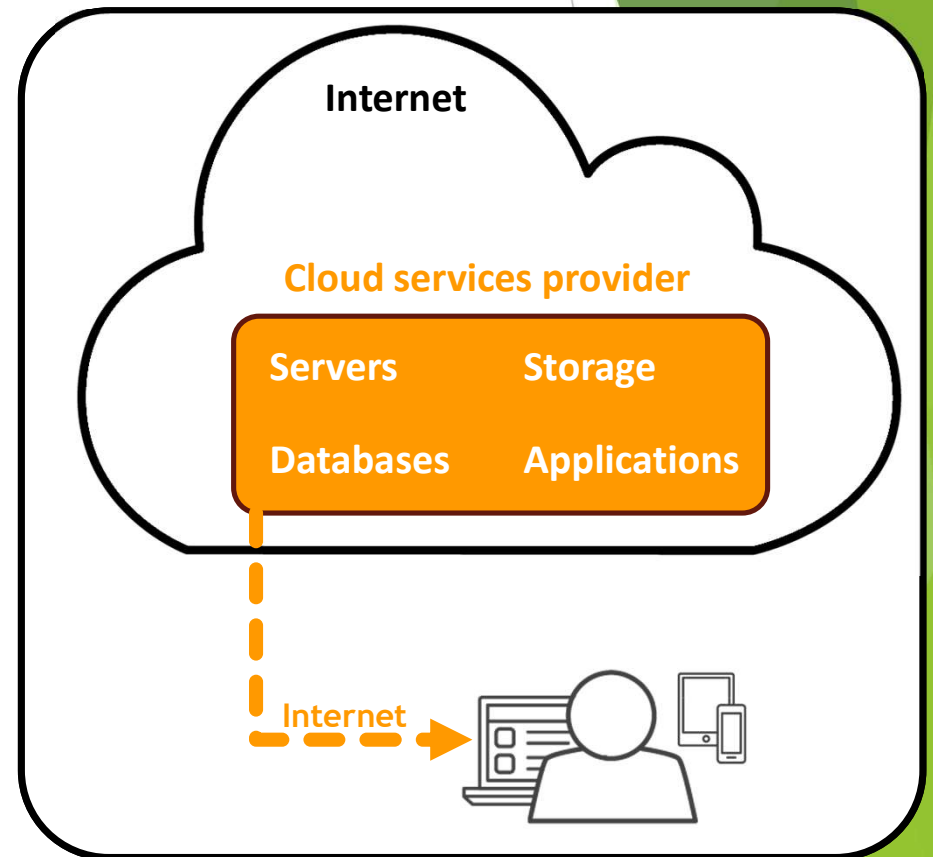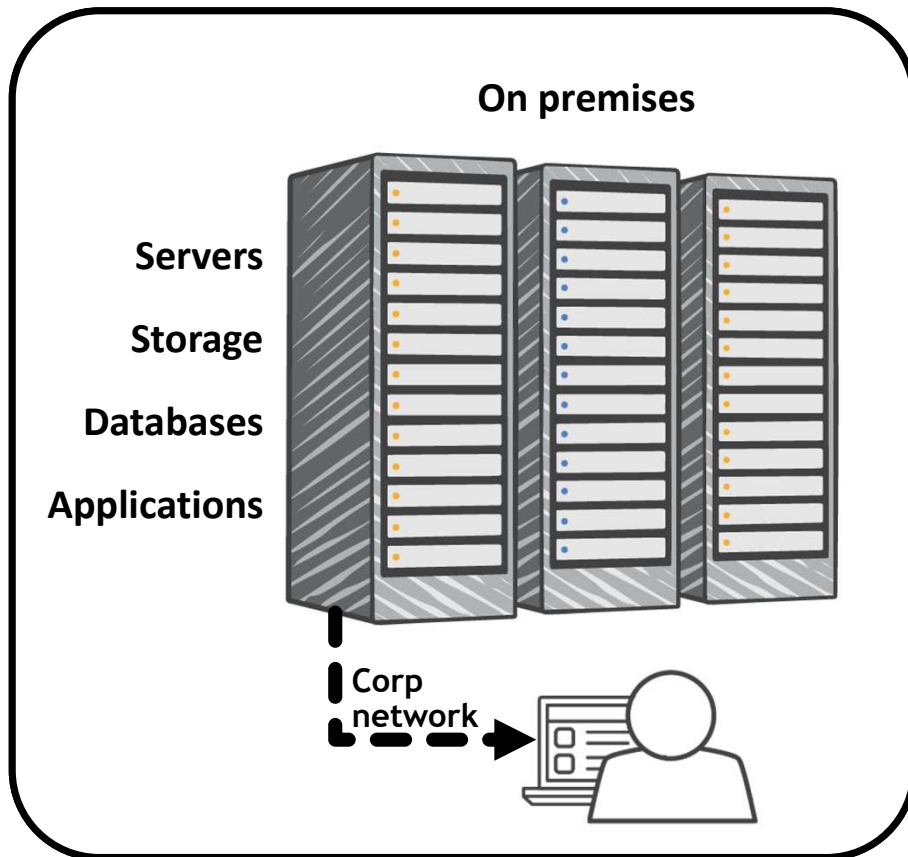
Introduction to Cloud Computing And Amazon Web Services

Topics to be covered

- Introduction to Cloud Computing And Amazon Web Services

- Introduction to Cloud Computing, Cloud Service Delivery Models (IAAS, PAAS, SAAS), Cloud

- Deployment Models (Private, Public, Hybrid and Community), Cloud Computing Security,

- Introduction to Amazon Web Services, Why Amazon? Use Cases, AWS Storage Options,

- AWS Compute Options, AWS Database Options, AWS Workflow Automation and

- Orchestration Options, AWS Systems Management And Monitoring Options, AWS Virtual

- Private Cloud Introduction, Pricing Concepts.

What is Cloud

▶ In a traditional on-premises IT environment, all the physical components required to run business systems were owned, operated, maintained, and housed by the company.

▶ A user would connect and log on to the corporate network to access resources.

▶ This would include things like corporate applications, file sharing, and storage.

▶ The cloud provides access to the same or similar resources through the internet, hosted by a cloud services platform.

What is Cloud

On premises

Servers

Storage

Databases

Applications

Corp network →

Internet

Cloud services provider

Servers   Storage

Databases   Applications

Internet →

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Problems with traditional IT approach

▶ Pay for the rent for the data center

▶ Pay for power supply, cooling, maintenance

▶ Adding and replacing hardware takes time

▶ Scaling is limited

▶ Hire 24/7 team to monitor the infrastructure

▶ How to deal with disasters? (earthquake, power shutdown, fire…)

Can we externalize all this? ... Cloud

Cloud Computing Definition

▶ Cloud computing is the on-demand delivery of compute power, database storage, applications, and other IT resources.

▶ Through a cloud services platform with pay-as-you-go pricing

▶ You can provision exactly the right type and size of computing resources you need

▶ You can access as many resources as you need, almost instantly

▶ Simple way to access servers, storage, databases and a set of application services

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How does it work?

▶ AWS owns and maintains the network-connected hardware

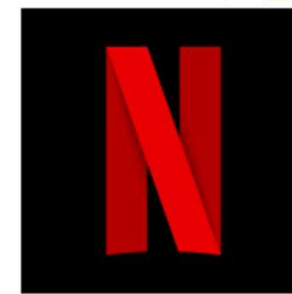▶ You provision and use what you need
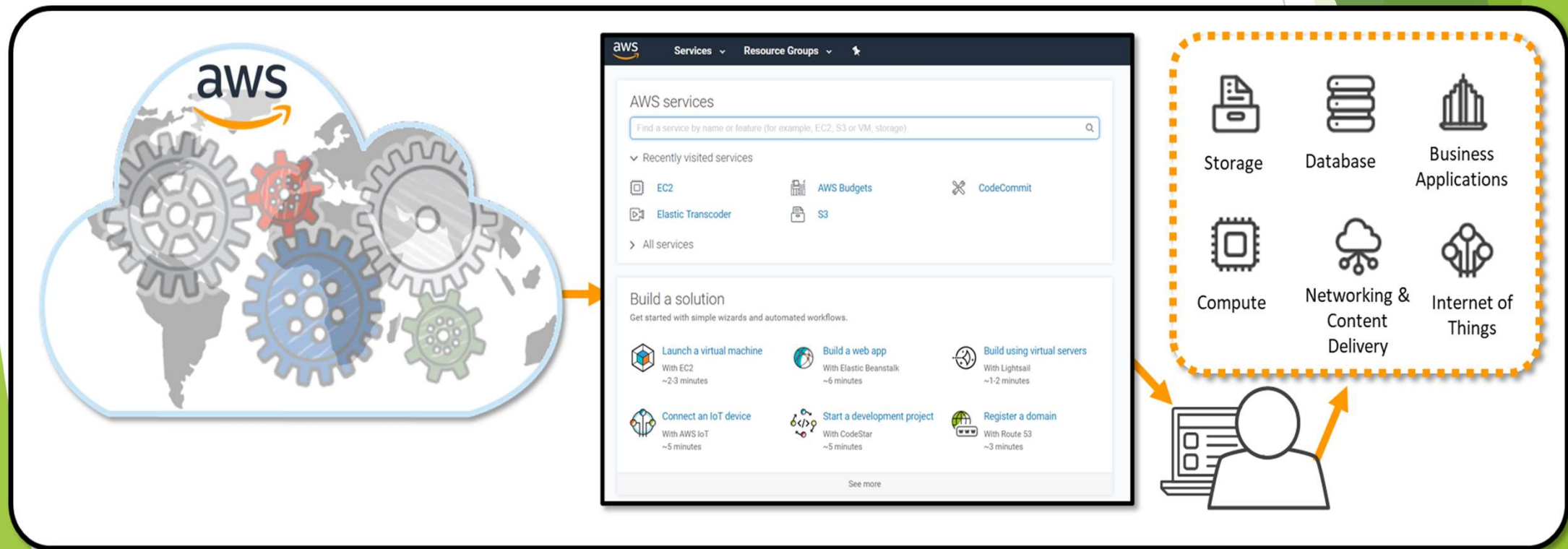
Cloud Services Examples

1. E-mail cloud service
2. Pay for ONLY your emails stored (no infrastructure, etc.)

1. Cloud Storage Service

2. Originally built on AWS

Netflix

1. Built on AWS

2. Video on Demand

Characteristics of Cloud Computing

▶ On-demand self service

- ▶ Users can provision resources and use them without human interaction from the service provider.

▶ Broad network access

- ▶ Resources available over the network and can be accessed by diverse client platforms.

▶ Multi-tenancy and resource pooling

- ▶ Multiple customers can share the same infrastructure and applications with security and privacy.
- ▶ Multiple customers are serviced from the same physical resources.

Characteristics of Cloud Computing

▶ Rapid elasticity and scalability

    ▶ Automatically and quickly acquire and dispose resources when needed.

    ▶ Quickly and easily scale based on demand.

▶ Measured service

    ▶ Usage is measured, users pay correctly for what they have used.

CAPEX ,OPEX, TOC

- ▶ Capital Expenditures (CAPEX)
  - ▶ Company's major, long-term expenses.
  - ▶ Include physical assets, like buildings, equipment, machinery, and vehicles.

- ▶ Operating Expenses (OPEX)
  - ▶ Company's day-to-day expenses.
  - ▶ Like employee salaries, rent, utilities, property taxes, and cost of goods sold

- ▶ Total cost of ownership (TCO)
  - ▶ Estimation of the expenses associated with purchasing, deploying, using and retiring a product or piece of equipment.

Advantages of Cloud Computing

▶ Trade capital expense (CAPEX) for operational expense (OPEX)

   ▶ Pay On-Demand: don't own hardware

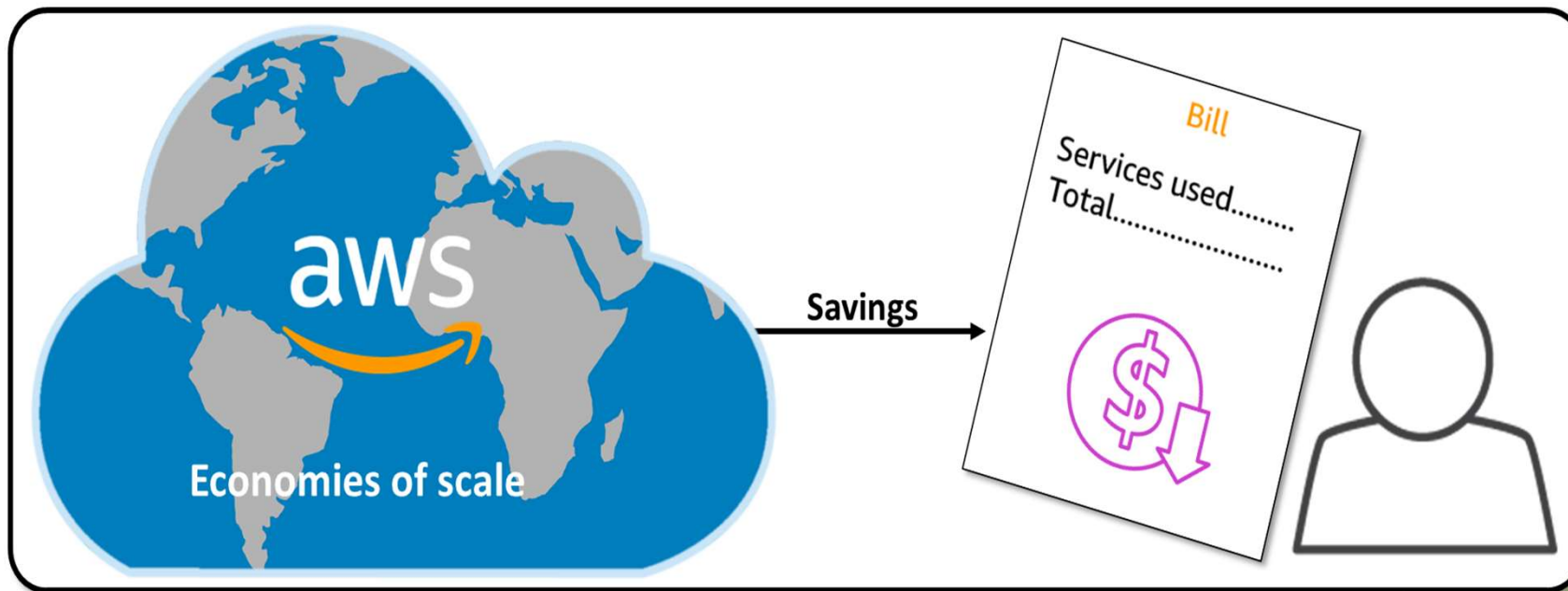   ▶ Reduced Total Cost of Ownership (TCO) & Operational Expense (OPEX)

Data center investment based upon forecast

Pay only for the amount you consume

Advantages of Cloud Computing

► Benefit from massive economies of scale

  ► Prices are reduced as AWS is more efficient due to large scale.

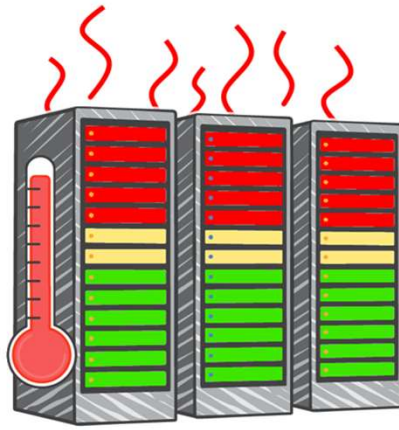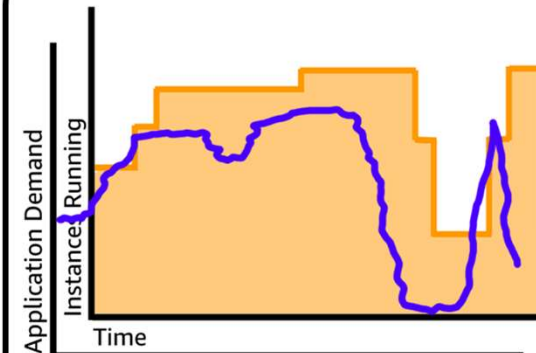# Advantages of Cloud Computing

▶ Stop guessing capacity

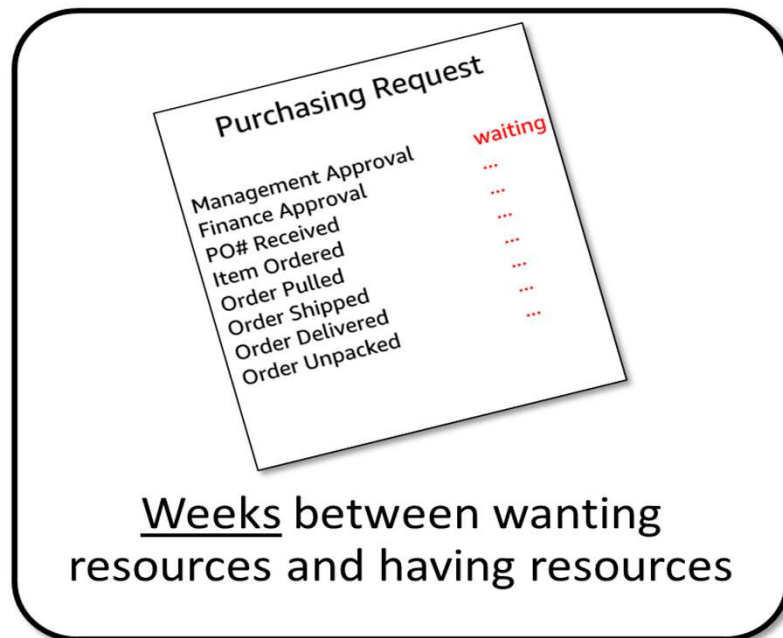   ▶ Scale based on actual measured usage

Overestimated server capacity

Underestimated server capacity

Scaling on demand
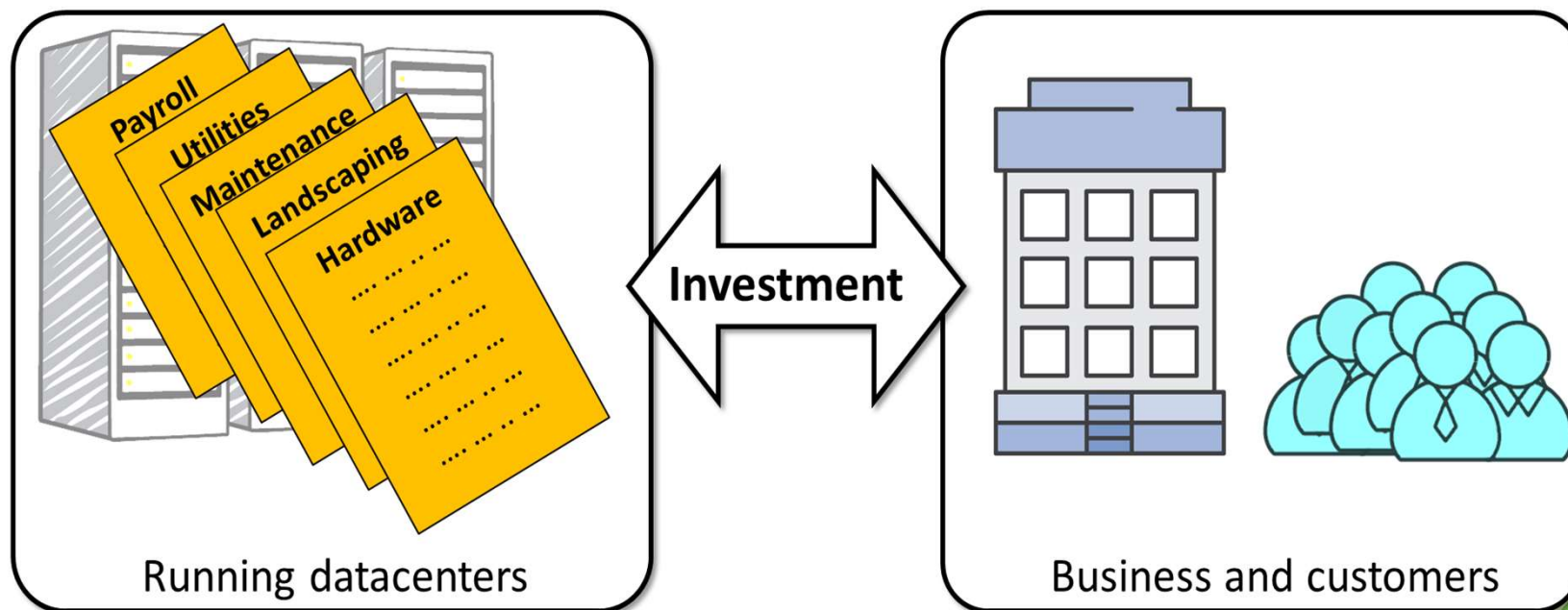
Advantages of Cloud Computing

▶ Increase speed and agility

  ▶ New IT resources are only ever a click away

Weeks between wanting resources and having resources


Minutes between wanting resources and having resources

Advantages of Cloud Computing

▶ Stop spending money running and maintaining data centers.

  ▶ Focus on projects that differentiate your business instead of focusing on the infrastructure.

Running datacenters — Investment — Business and customers

Advantages of Cloud Computing

▶ Go global in minutes

  ▶ leverage the AWS global infrastructure
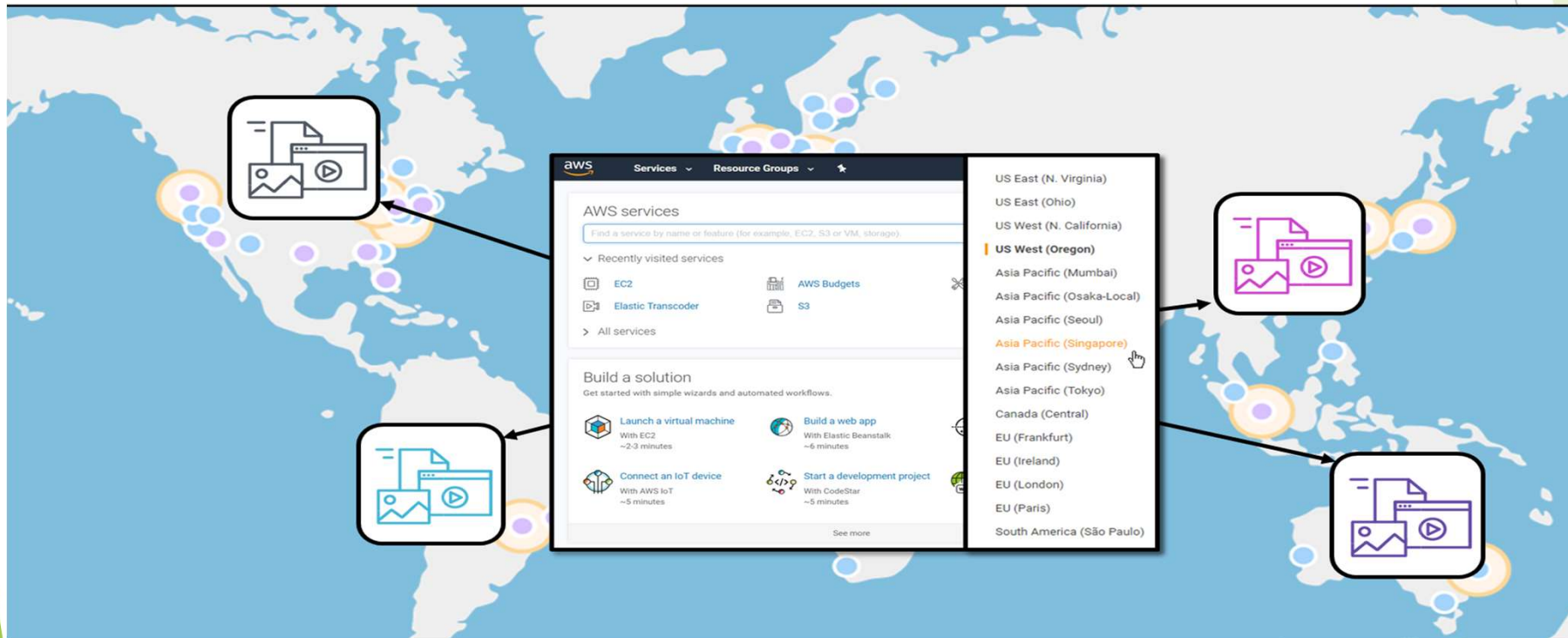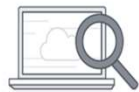
Advantages of Cloud Computing

▶ AWS Security

  ▶ Puts strong safeguards in place to help protect customer privacy.

  ▶ All data is stored in highly secure AWS data centers.

Keep your data safe

Meet compliance requirements

Save money

Scale quickly

Problems Solved by the Cloud

▶ Flexibility

  ▶ Change resource types when needed.

▶ Cost-Effectiveness

  ▶ pay as you go, for what you use

▶ Scalability

  ▶ Accommodate larger loads by making hardware stronger or adding additional nodes.
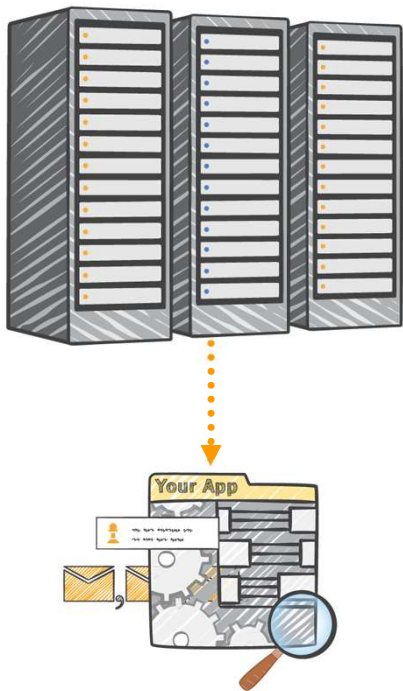
▶ Elasticity

  ▶ Ability to scale out and scale-in when needed

Problems Solved by the Cloud
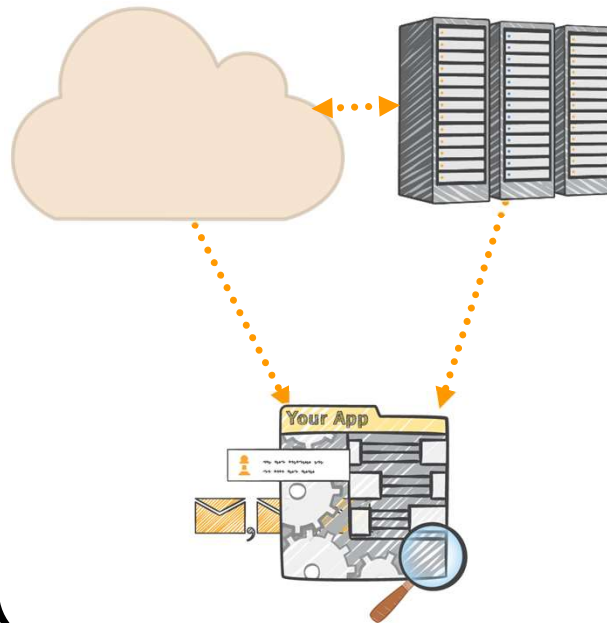
▶ High-availability and fault-tolerance

    ▶ Build across data centers

▶ Agility

    ▶ Rapidly develop, test and launch software applications

Cloud Computing Deployment Models

On premises / private

Hybrid

Cloud / public
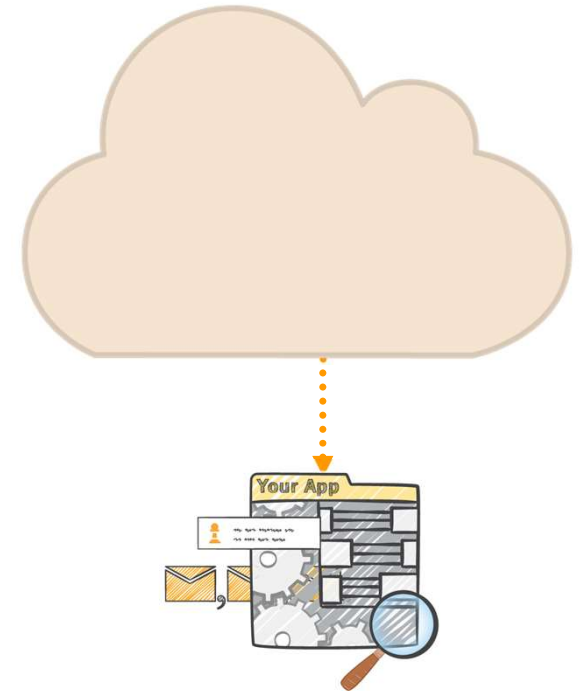
On Premises / Private Cloud

▶ Cloud services used by a single organization

▶ Not exposed to the public.

▶ Complete Control

▶ Security for sensitive applic

▶ Meet specific business needs

On premises / private

Your App
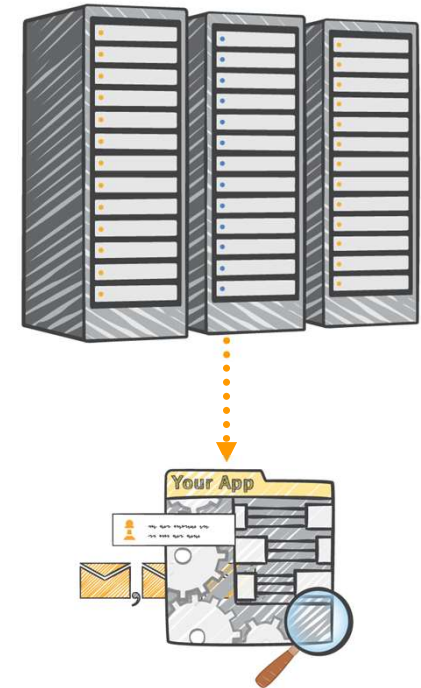
Public Cloud

▶ Cloud resources owned and operated by a third-party cloud service provider delivered over the Internet.

▶ Provides all advantages of Cloud Computing
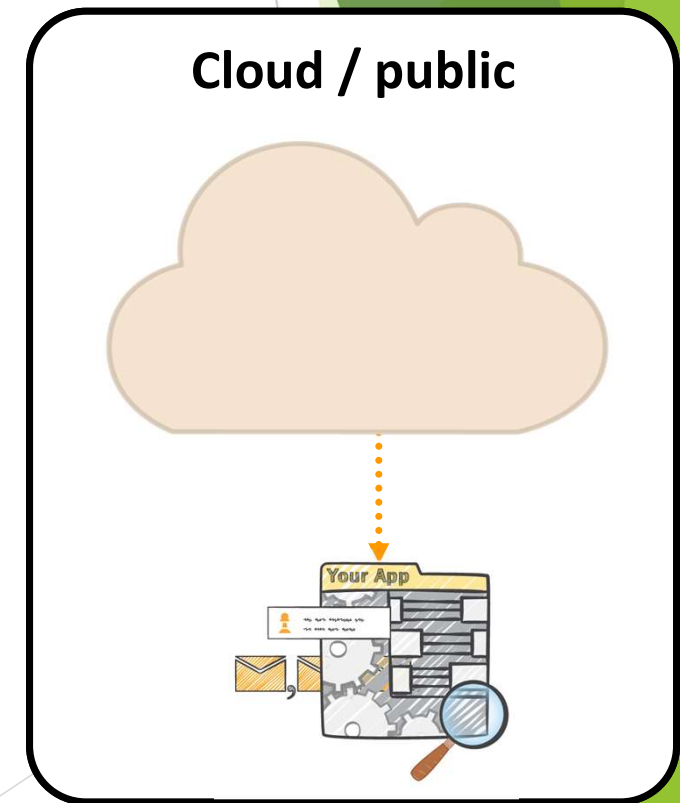
Cloud / public

Hybrid Cloud

▶ Keep some servers on premises and extend some capabilities to the Cloud.

▶ Control over sensitive assets in your private infrastructure.

▶ Flexibility and cost effectiveness of the public cloud.
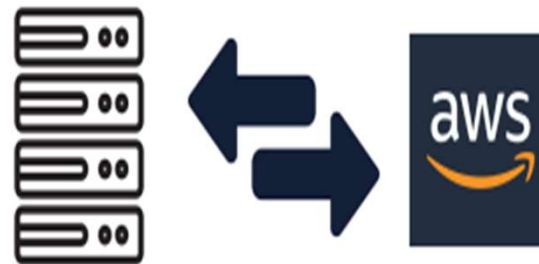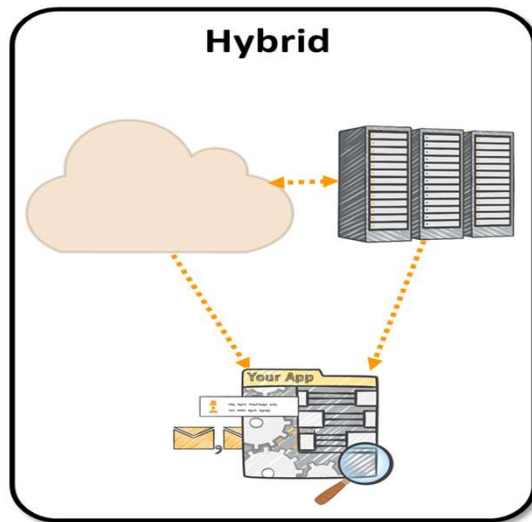
Types of Cloud Computing

Software as a Service (SaaS)
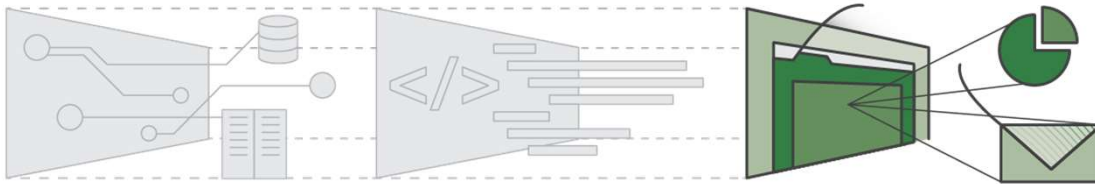
Platform as a Service (PaaS)
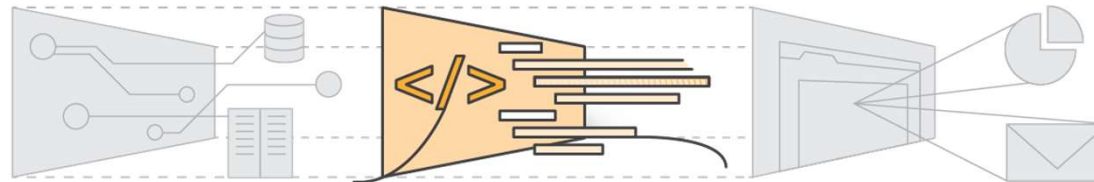
Infrastructure as a Service (IaaS):
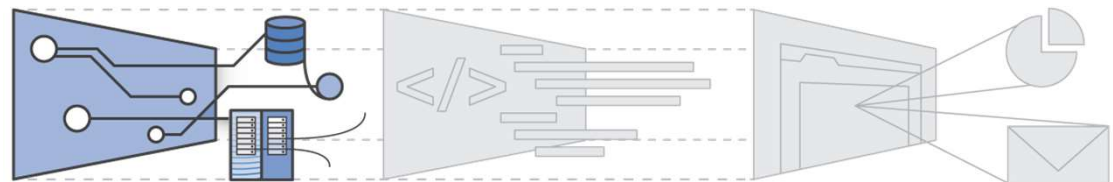
Infrastructure as a Service (IaaS)

- Provide building blocks for cloud IT
- Provides networking, computers, data storage space
- Highest level of flexibility
- Easy parallel with traditional on-premises IT

Infrastructure as a Service (IaaS)

Applications
Data
Runtime
Middleware
O/S
Virtualization
Servers
Storage
Networking

Managed by you   Managed by others

Platform as a Service (PaaS)

▶ Removes the need for your organization to manage the underlying infrastructure

▶ Focus on the deployment of applications.

▶ Focus on management of your applications.

Platform as a
Service
(PaaS)

| Applications |
| Data |
| Runtime |
| Middleware |
| O/S |
| Virtualization |
| Servers |
| Storage |
| Networking |

Managed by you
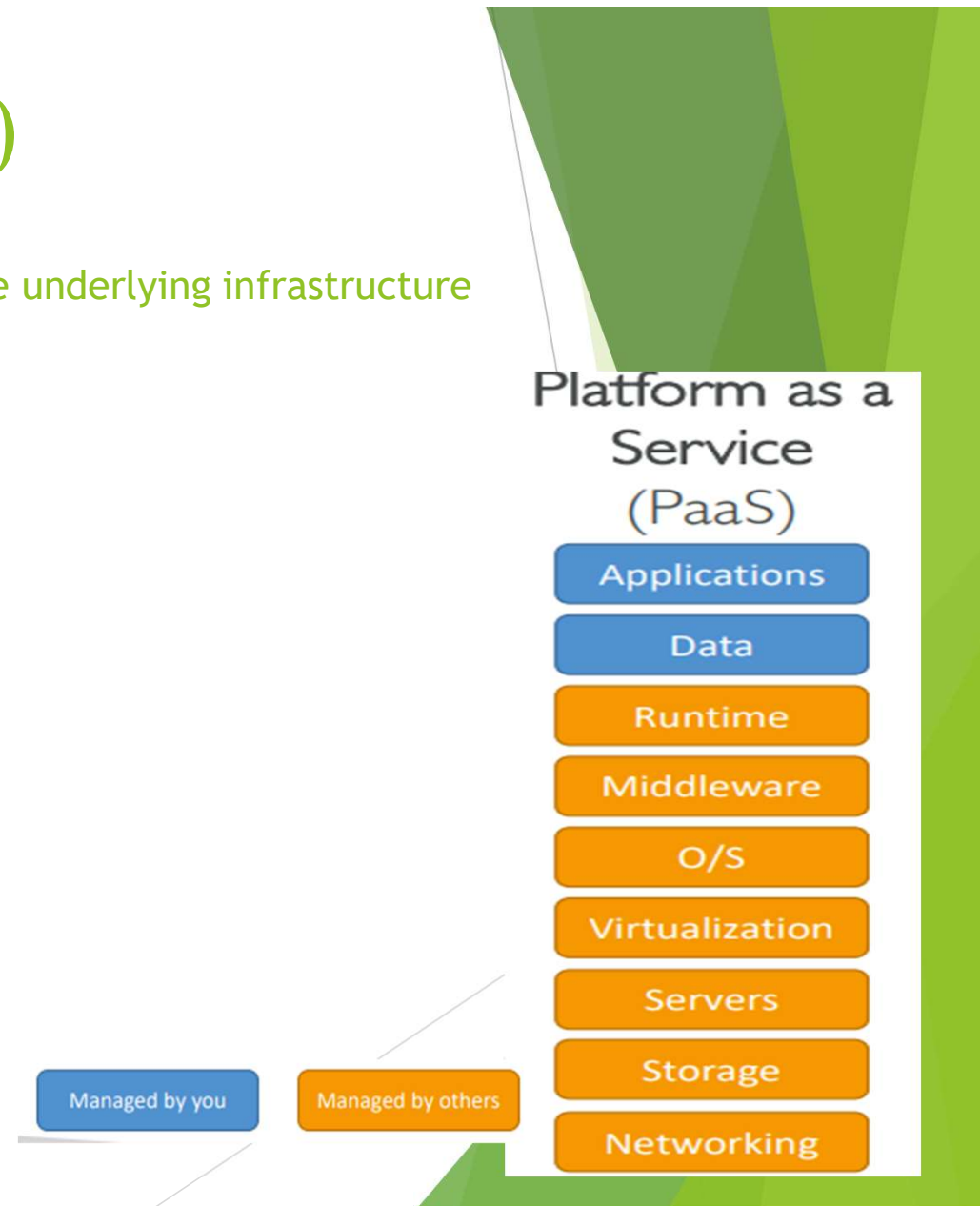
Managed by others

Software as a Service (SaaS)

▶ Completed product that is run and managed by the service provider.

Software as a Service (SaaS)

Applications

Data

Runtime

Middleware

O/S

Virtualization

Servers

Storage

Networking
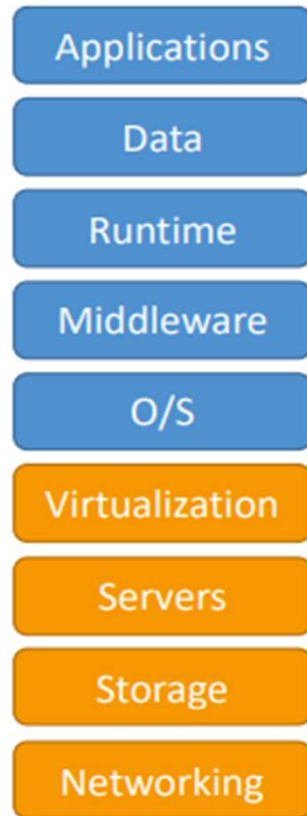
Managed by you | Managed by others

Example of Cloud Computing Types

▶ Infrastructure as a Service

　　▶ Amazon EC2 (on AWS)

　　▶ GCP, Azure, Rackspace, Digital Ocean, Linode

▶ Platform as a Service

　　▶ Elastic Beanstalk (on AWS)

　　▶ Heroku, Google App Engine (GCP), Windows Azure (Microsoft)

▶ Software as a Service

　　▶ Many AWS services (ex: Recognition for Machine Learning)

　　▶ Google Apps (Gmail), Dropbox, Zoom

What is Amazon Web Services ?

▶ **Amazon Web Services (AWS)** is a collection of **remote computing services (web services)** that together make up a **cloud computing platform**, offered over the Internet by Amazon.com.

▶ AWS is located in **11 geographical 'Regions'**. Each Region is **wholly contained within a single country** and all of its data and services **stay** within the designated Region.

▶ Each Region has **multiple 'Availability Zones'**, which are **distinct data centers** providing AWS services. Availability Zones are **isolated from each other** to prevent outages from spreading between Zones. However, Several services **operate across** Availability Zones (e.g. S3, DynamoDB).

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AWS global infrastructure

Over 1 million active
customers across 190 countries

2,000+ government agencies

5,000+ educational institutions

17,500+ nonprofits

11 regions

30 Availability Zones

53 edge locations

What is AWS Offering?

▶ **Low Ongoing Cost:, pay-as-you-go** pricing with **no up-front expenses** or long-term commitments.

▶ **Instant Elasticity & Flexible Capacity: (scaling up and down)** Eliminate guessing on your infrastructure capacity needs.

▶ **Speed & Agility:** Develop and deploy applications faster Instead of waiting weeks or months for hardware to arrive and get installed.

▶ **Apps not Ops:** Focus on projects. Lets you shift resources away from data center investments and operations and move them to innovative new projects.

▶ **Global Reach:** Take your apps global in minutes.

▶ **Open and Flexible:** You choose the development platform or programming model that makes the most sense for your business.

▶ **Secure:** Allows your application to take advantage of the multiple layers of operational and physical security in the AWS data centers to ensure the integrity and safety of your data.

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Infrastructure Services

http://aws.amazon.com/ec2/

Infrastructure Services

http://aws.amazon.com/vpc/

http://aws.amazon.com/s3/

http://aws.amazon.com/ebs/

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EC2
Virtual Servers in the Cloud

Amazon Elastic Compute Cloud (EC2)

Infrastructure Services
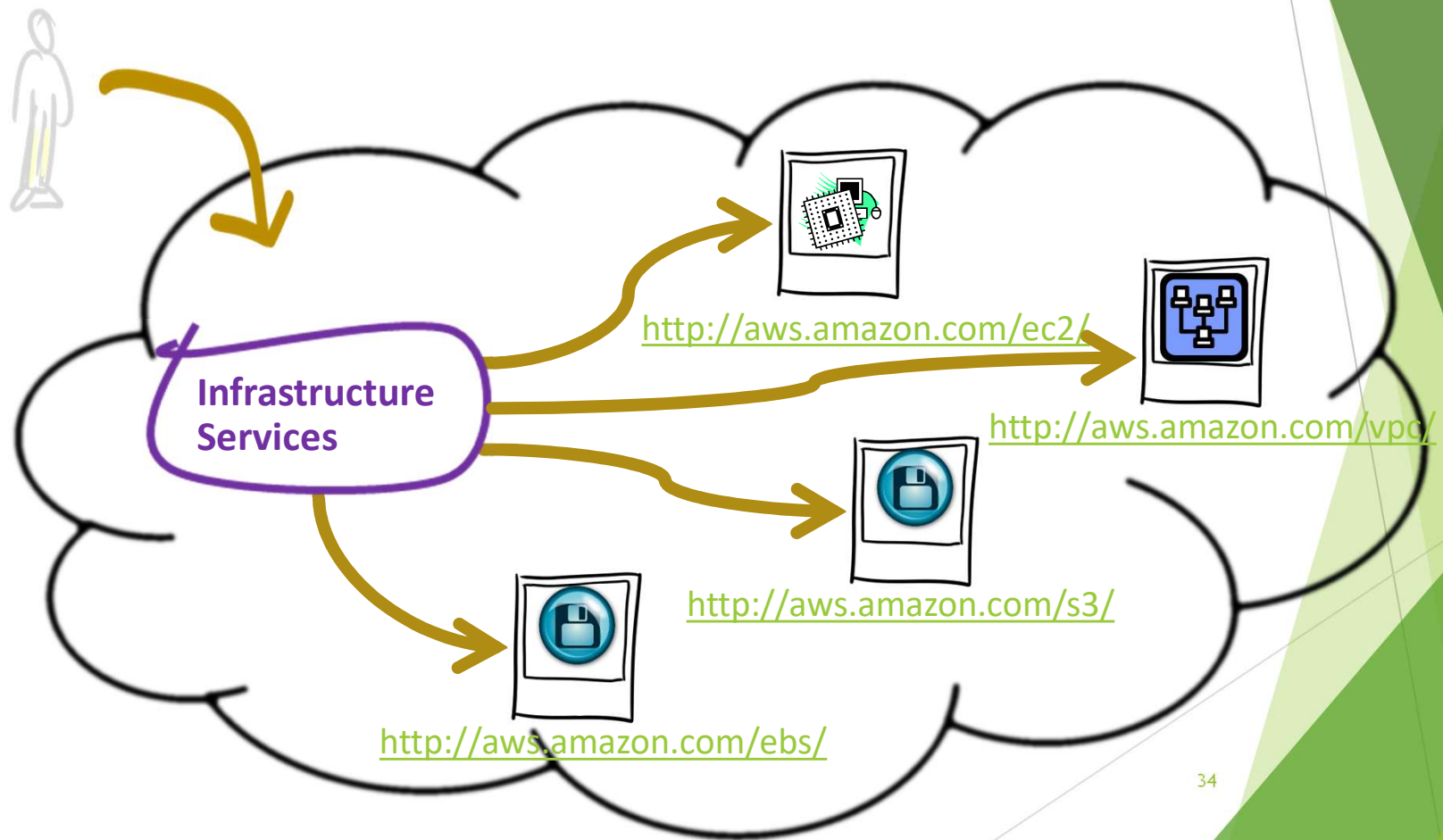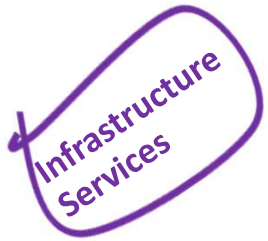
▶ A web service that provides **resizable compute capacity** in the cloud.

▶ EC2 allows **creating Virtual Machines (VM) on-demand**. Pre-configured **templated Amazon Machine Image (AMI)** can be used get running immediately. Creating and sharing your own AMI is also possible via the **AWS Marketplace.**

▶ **Auto Scaling** allows **automatically scale of the capacity up** seamlessly during **demand spikes** to maintain performance, and **scales down** during **demand slow** to minimize costs.

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EC2
Virtual Servers in the Cloud
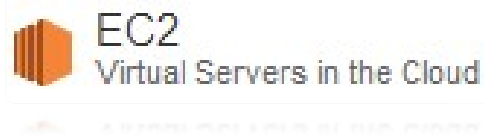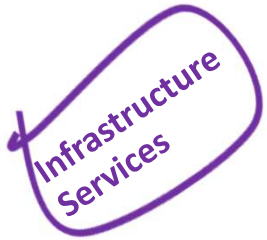
Amazon Elastic Compute Cloud (EC2)

▶ **Elastic Load Balancing** automatically distributes incoming application traffic across multiple Amazon EC2 instances.

▶ Provide tools to build **failure resilient applications** by launching application instances in **separate Availability Zones**.

▶ Pay only for resources actually consume, **instance-hours.**

▶ **VM Import/Export** enables you to easily import virtual machine images from your existing environment to Amazon EC2 instances and export them back at any time.

S3
Scalable Storage in the Cloud
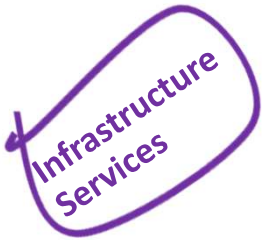
Amazon Simple Storage Service (S3)

▶ Amazon S3 provides a simple web services interface that can be **used to store and retrieve any amount of data, at any time, from anywhere on the web**.

▶ Write, read, and delete objects containing from **1 byte to 5 terabytes of data each**. The **number of objects** you can store is **unlimited**.

▶ Each object is stored in a **bucket** and retrieved via a unique, developer-assigned **key**.

  ▶ A bucket can be stored in **one of several Regions**.

  ▶ You can **choose a Region** to **optimize for latency, minimize costs, or address regulatory requirements**.

  ▶ Objects stored in a Region **never leave the Region** unless you transfer them out.

▶ **Authentication mechanisms** are provided to ensure that data is kept secure from unauthorized access.

  ▶ Objects can be made **private or public, and rights can be granted to specific users**.

  ▶ S3 charges based on per GB-month AND per I/O requests AND per data modification requests.

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Amazon Relational Database Service (RDS)

Platform Services

RDS
Managed Relational Database Service

- **Amazon RDS** is a web service that makes it easy to set up, operate, and scale a **relational database in the cloud**.

- Amazon RDS gives access to the capabilities of a **familiar MySQL, Oracle or Microsoft SQL Server database engine.**

  - Code, applications, and tools already **used with existing databases can be used with RDS**.

- Amazon RDS **automatically patches the database software and backs up the database**, **storing the backups for a user-defined retention period** and **enabling point-in-time recovery**.

- Amazon RDS provides **scaling** the **compute resources** or **storage capacity** associated with the Database Instance.

- **Pay** only for the resources actually consumed, **based on the DB Instance hours consumed**, **database storage**, **backup storage,** and **data transfer**.

  - **On-Demand DB Instances** let you pay for compute capacity by the hour with no long-term commitments.

  - **Reserved DB Instances** give the option to make a low, one-time payment for each DB Instance and in turn receive a significant discount on the hourly usage charge for that DB Instance.

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CloudWatch
Resource and Application Monitoring

Amazon CloudWatch

▶ Amazon **CloudWatch** provides **monitoring for AWS cloud resources** and the applications customers run on AWS.

▶ Amazon CloudWatch lets you **programmatically** retrieve your **monitoring data**, view **graphs**, and **set alarms** to help you troubleshoot, spot trends, and **take automated action** based on the state of your cloud environment.

▶ Amazon CloudWatch enables you to monitor your AWS resources **up-to-the-minute in real-time**, including:

  ▶ Amazon EC2 instances,

  ▶ Amazon EBS volumes,

  ▶ Elastic Load Balancers,

  ▶ Amazon RDS DB instances.

▶ Metrics such as **CPU utilization**, **latency**, and **request counts** are provided automatically for these AWS resources.

▶ Customers can also supply their **own custom application and system metrics**, such as **memory usage**, **transaction volumes**, or **error rates**.

SWF
Workflow Service for Coordinating Application
Components

Amazon Simple Workflow Service (SWF)

▶ **Amazon SWF** is a **task coordination** and **state management service** for cloud applications.

▶ Using Amazon SWF, you **structure** the various **processing steps** in an application that **runs across one or more machines** as a set of "**tasks**."

▶ Amazon SWF **manages dependencies** between the tasks, **schedules** the tasks for execution, and runs any logic that needs to be **executed in parallel**.

▶ The service also **tracks** the tasks' **progress**.

▶ As the **business requirements change**, Amazon SWF makes it **easy to change application logic** without having to **worry about the underlying state machinery** and **flow control**.

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Continue...

AMAZON SIMPLE WORKFLOW SERVICE (SWF)

Key Points

Service to coordinate work across distributed components

Unit of work is called TASK which is represented as ACTIVITY in SWF

Tasks are done by WORKERS which could be run on EC2 or on premises

SWF assigns tasks to workers and monitors their progress and manages their state

A program gets state of each task and accordingly act on the workflow

Actors in Workflow: Workflow Starters, Deciders, Activity Workers

Tasks could be : Activity Tasks, AWS Lambda Tasks, Decision Tasks

Workflow Closing state could be Completed, Cancelled, Failed or Timed Out

VPC
Isolated Cloud Resources

Amazon Virtual Private Cloud (VPC)

▶ **Amazon VPC** lets you **provision** a **logically isolated section** of the Amazon Web Services (AWS) Cloud.

▶ You have **complete control** over your virtual networking environment, including:

   ▶ selection of your own **IP address range**,

   ▶ **creation of subnets**, and

   ▶ **configuration of route tables** and **network gateways**.

▶ VPC allows **bridging with an onsite IT infrastructure** with an **encrypted VPN connection** with an **extra charge per VPN Connection-hour**.

▶ There is **no additional charge** for using Amazon Virtual Private Cloud, aside from the normal Amazon EC2 usage charges.

Pricing of the Cloud

- ▶ AWS has 3 pricing fundamentals
- ▶ Compute
  - ▶ Pay for compute time
- ▶ Storage
  - ▶ Pay for data stored in the Cloud
- ▶ Data transfer OUT of the Cloud
  - ▶ Data transfer IN is free

Use the right pricing model for the job

▶ AWS offers several pricing models depending on product. These include:

▶ **On-Demand Instances** let you pay for compute or database capacity by the hour or second (minimum of 60 seconds) depending on which instances you run with no long-term commitments or upfront payments.

▶ **Savings Plans** are a flexible pricing model that offer low prices on Amazon EC2, AWS Lambda and AWS Fargate usage, in exchange for a commitment to a consistent amount of usage (measured in $/hour) for a one- or three-year term.

▶ **Spot Instances** are an Amazon EC2 pricing mechanism that let you request spare computing capacity with no upfront commitment and at discounted hourly rate (up to 90% off the on-demand price).

▶ **Reservations** provide you with the ability to receive a greater discount, up to 75 percent, by paying for capacity ahead of time. For more details, see the Optimizing costs with reservations section.

AWS Resources and Certification

- https://aws.amazon.com/certification/?nc2=sb_ce_co
- https://www.awsacademy.com/SiteLogin
- https://aws.amazon.com/free