

# Introduction to the Cloud

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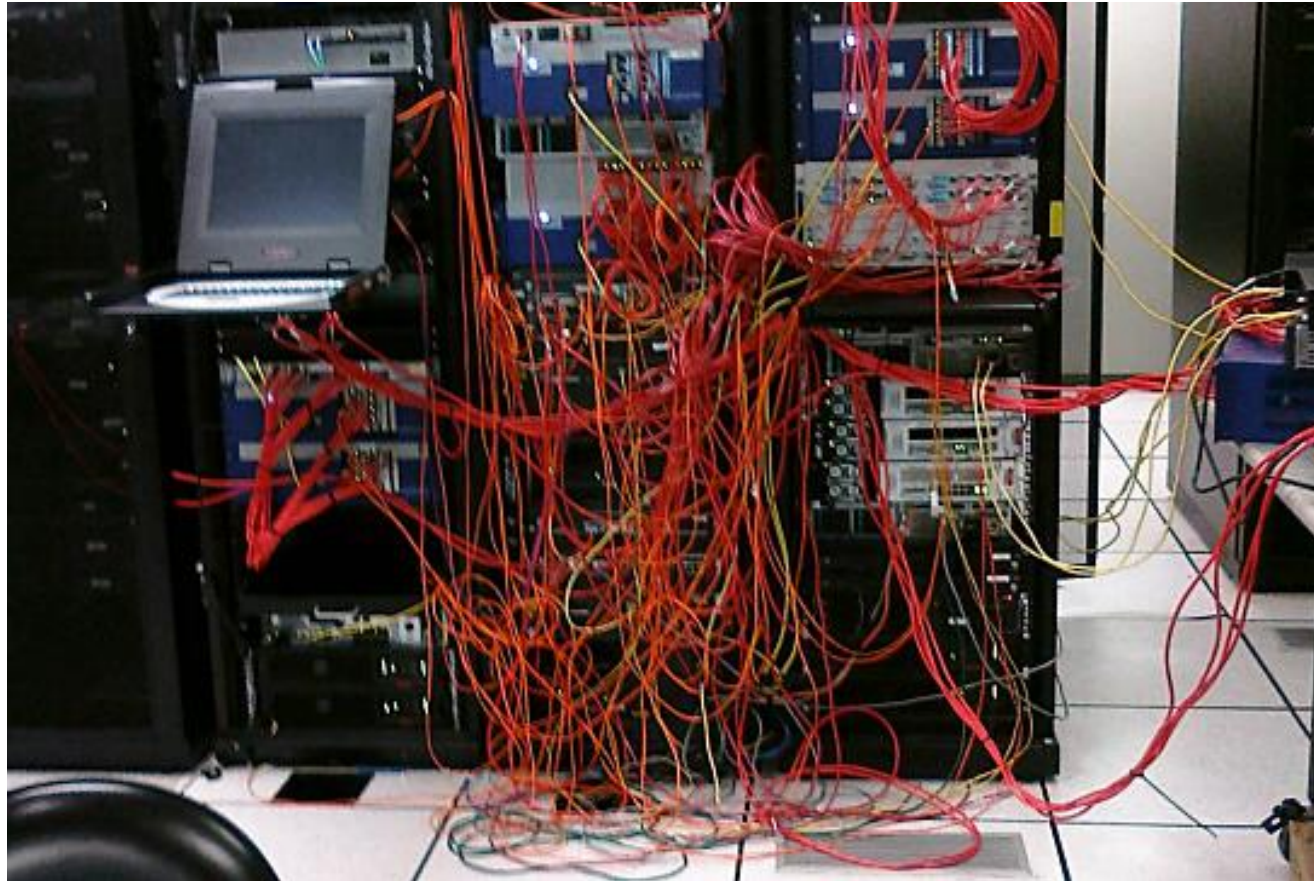
# Before the cloud...

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- If you needed a server, you had to:
  - Buy it
  - Install it
  - Maintain it
  - Replace it
  - Have an IT team

# Before the cloud...

- You often ended up with this:



# Before the cloud...

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- The same goes with:
  - Networking
  - Databases
  - User Management
  - And more...

# Before the cloud...

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- But there's more...





**BLACK  
FRIDAY**

Jan Feb Mar Apr May Jun Jul Aug Sep Oct **Nov**



60% CPU





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FRIDAY**

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**120% CPU**







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20% CPU



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**Nov**



**90% CPU**







# Before the cloud...

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- If you needed a server, you had to:
  - Buy it
  - Install it
  - Maintain it
  - Replace it
  - Have an IT team







The Cloud:

*Compute, Networking, Storage and other services*

*Managed by SOMEONE ELSE*



# Cloud Providers

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- Companies who build huge data centers
- Fill it with servers, networking, cooling, electricity etc.
- Design and install various services
- Make it publicly accessible

# Data Center



Microsoft Azure Datacenter in Washington

# Data Center



Microsoft Azure Datacenter in The Netherlands



# Cloud Services

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- Clouds are huge and the competition is fierce
- Offer a lot of additional services:
  - AI
  - IOT
  - Kubernetes
  - And lots more...

# In the cloud era...

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- If you need a server, you can:
  - Create it in the cloud within minutes
  - Use it as you wish
  - Pay for what you use
  - Shut it down when not needed
  - Automatically maintained, patched, secured, monitored



The Cloud:

*Compute, Networking, Storage and other services*

*Managed by SOMEONE ELSE*



# 5 Characteristics of Cloud Computing

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On-Demand Self Service

Broad Network Access

Resource Pooling

Rapid Elasticity

Measured Service

## On-Demand Self Service

- No human interaction is needed for resource provisioning
- Resource can be provisioned (created) with a click of a button
- Provisioning is available 24/7

## Broad Network Access

- Resources can be accessed from anywhere using the network
- Ideally high broadband
- No physical access is required at any time



## Resource Pooling

- Physical resources are shared between customers
- The cloud's backbone decides which physical resource to allocate for a customer's virtual services
- Some advanced cloud services allow for physical resource separation

## Rapid Elasticity

- Resources can be scaled up and down as needed, automatically
- No need to purchase resources for a one-time peak scenario

## Measured Service

- Payment is done only for resources actually used
- Server time / DB storage / Function calls etc.
- Measurement usually done in high-resolution
  - Server time by the second
- No need to invest money in non-used resources



## CapEx

### Capital Expense

Making upfront  
investment for future  
use / profit

## OpEx

### Operating Expense

Pay for what you  
actually use

# Traditional IT – CapEx Oriented

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- Major investment for:
  - Building data center
  - Purchasing servers
  - Purchasing air conditioning
  - Purchasing network devices
  - Purchasing software licenses (DB etc.)

...And only then –  
it can be used...

# Traditional IT – CapEx Oriented

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- There's also OpEx involved:
  - Electricity
  - Salaries
  - Maintenance
  - And more...



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FRIDAY**

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**Nov**

CapEx





**BLACK  
FRIDAY**

OpEx:

Jan

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Oct

Nov



## CapEx

### Capital Expense

Making upfront  
investment for future  
use / profit

- Non optimal
- Not flexible

*This is what you get with  
the cloud*



## OpEx

### Operating Expense

Pay for what you  
actually use

- Extremely flexible
- Most optimal



# Types of Cloud Services

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IaaS

PaaS

SaaS

# laaS

- Infrastructure as a Service
- The cloud provides the underlying platform
  - Compute
  - Networking
  - Storage
- The client handles, and is responsible for all the rest

# IaaS

- Most common example:
  - Virtual Machines
- The cloud provides the host machine, networking and disks
- The client creates the virtual (guest) machine, installs software on it, patches it, maintains it etc.



# PaaS

- Platform as a Service
- The cloud provides platform for running apps
- Including: Compute, networking, storage, runtime environment, scaling, redundancy, security, updates, patching, maintenance etc.
- The client just needs to bring the code to run

# PaaS

- Most common example:
  - Web Apps
- The cloud provides the runtime for running web apps
- The client uploads the code, and it just runs
- The client has no access to the underlying virtual machines

# SaaS

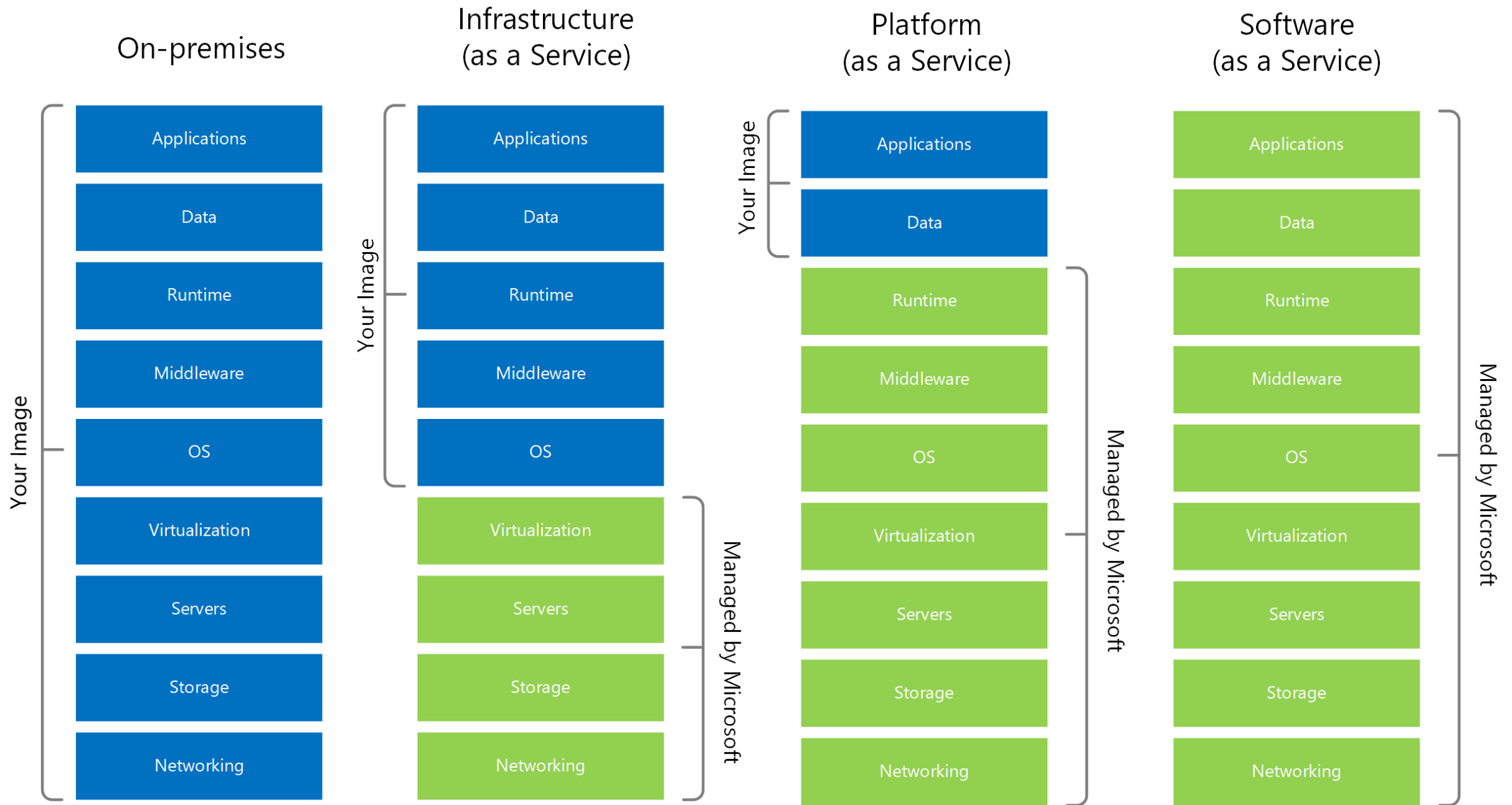
- Software as a Service
- A software running completely in the cloud
- The user doesn't need to install anything on-premises or on his machine
- The provider of the software takes care of updates, patches, redundancy, scalability etc.

# SaaS

- Common examples:







Source: <https://docs.microsoft.com/en-us/azure/cloud-adoption-framework/strategy/monitoring-strategy>

# Additional Service Types

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- FaaS – Functions as a Service
- DBaaS – Database as a Service
- DaaS – Desktop as a Service
- IOTaaS – IOT as a Service
- AlaaS – AI as a Service

# Types of Clouds

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Public

Private

Hybrid

# Public Cloud

- The cloud is set up in the public network
- Managed by large companies
- Accessible through the internet
- Available to all clients and users
- Clients have no access to underlying infrastructure



## Public Cloud



## Private Cloud

- A cloud set up in an organization's premises
- Managed by the organization's IT team
- Accessible only in the organization's network
- Available to users from the organizations
- Uses private cloud infrastructure and engines
- Contains a subset of the public cloud's capabilities

## Private Cloud

vmware® CLOUD™



**RED HAT®**  
**OPENSIFT**  
Container Platform



Azure Stack

# Hybrid Cloud

- A cloud set up in an organization's premises...
- ...but also connected to the public cloud
- Workload can be separated between the two clouds
- ie. Sensitive data in the organization's premises, public data in the public cloud
- Usually managed by the public cloud, but not always



# Hybrid Cloud



**AWS**  
**Outposts**

# We're going to talk about...

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Public

Private

Hybrid

# Cloud Providers

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- Companies which build datacenters and provide public cloud services
  - IaaS, PaaS, SaaS
  - Other services

# Main Cloud Providers

## Magic Quadrant

Figure 1: Magic Quadrant for Cloud Infrastructure and Platform Services



# Cloud Providers Growth

Q3 2023:

Cloud	% Growth
AWS	12%
Azure	29%
Google	24%

*Azure is the fastest  
growing public cloud,  
for years*