Introduction to the Cloud

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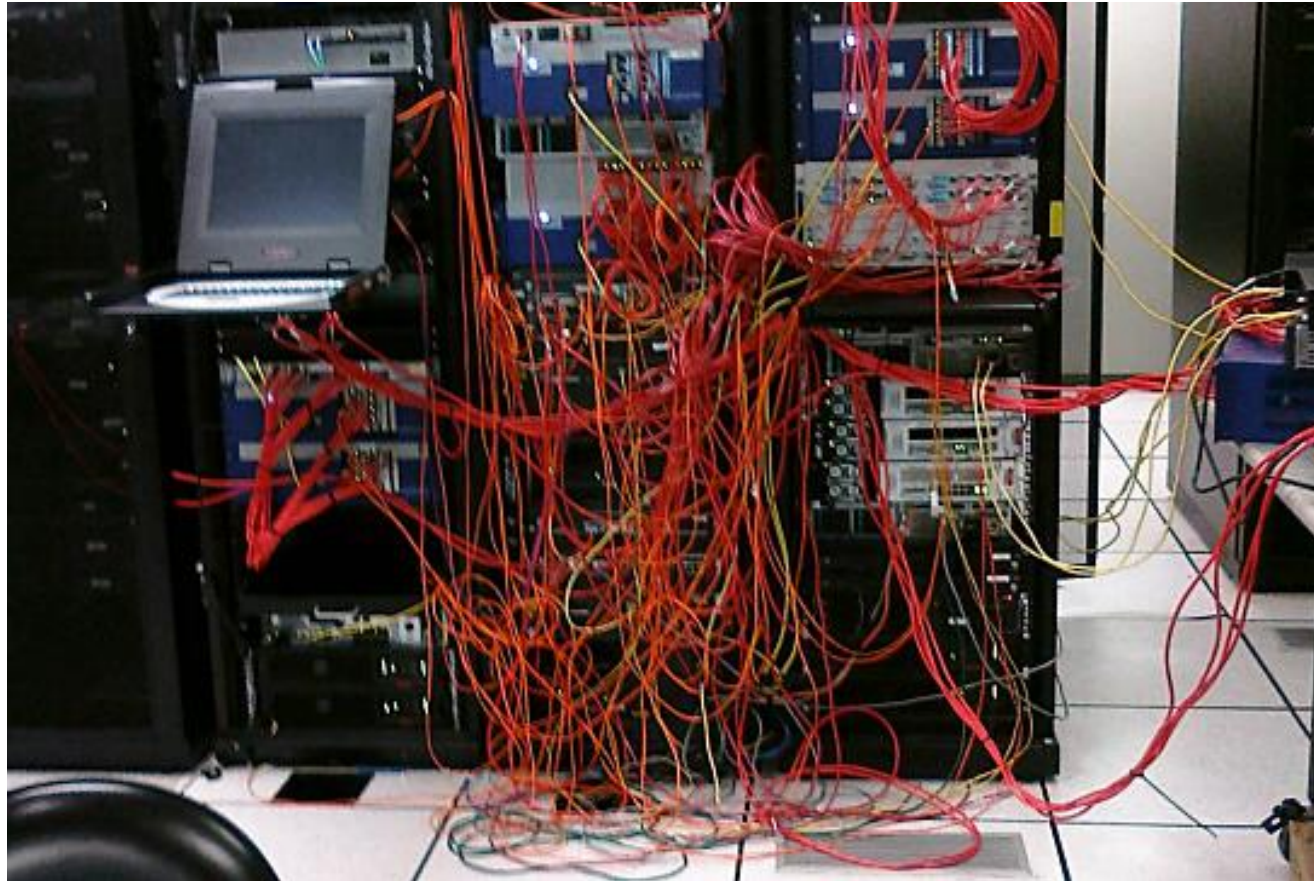
Before the cloud…

- 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…

- The same goes with:

  - Networking

  - Databases

  - User Management

  - And more…

Before the cloud…

- But there's more…

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

BLACK FRIDAY

60% CPU

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

120% CPU

BLACK FRIDAY

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

20% CPU

BLACK FRIDAY

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

90% CPU

Before the cloud…

- 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

- 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

~100Ks physical servers / datacenter

Microsoft Azure Datacenter in The Netherlands

Cloud Services

- Clouds are huge and the competition is fierce

- Offer a lot of additional services:

  - AI

  - IOT

  - Kubernetes

  - And lots more…

In the cloud era…

- 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

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

- 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

- There's also OpEx involved:

  - Electricity

  - Salaries

  - Maintenance

  - And more...

BLACK FRIDAY

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov

CapEx

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

IaaS

PaaS

SaaS

IaaS

- 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

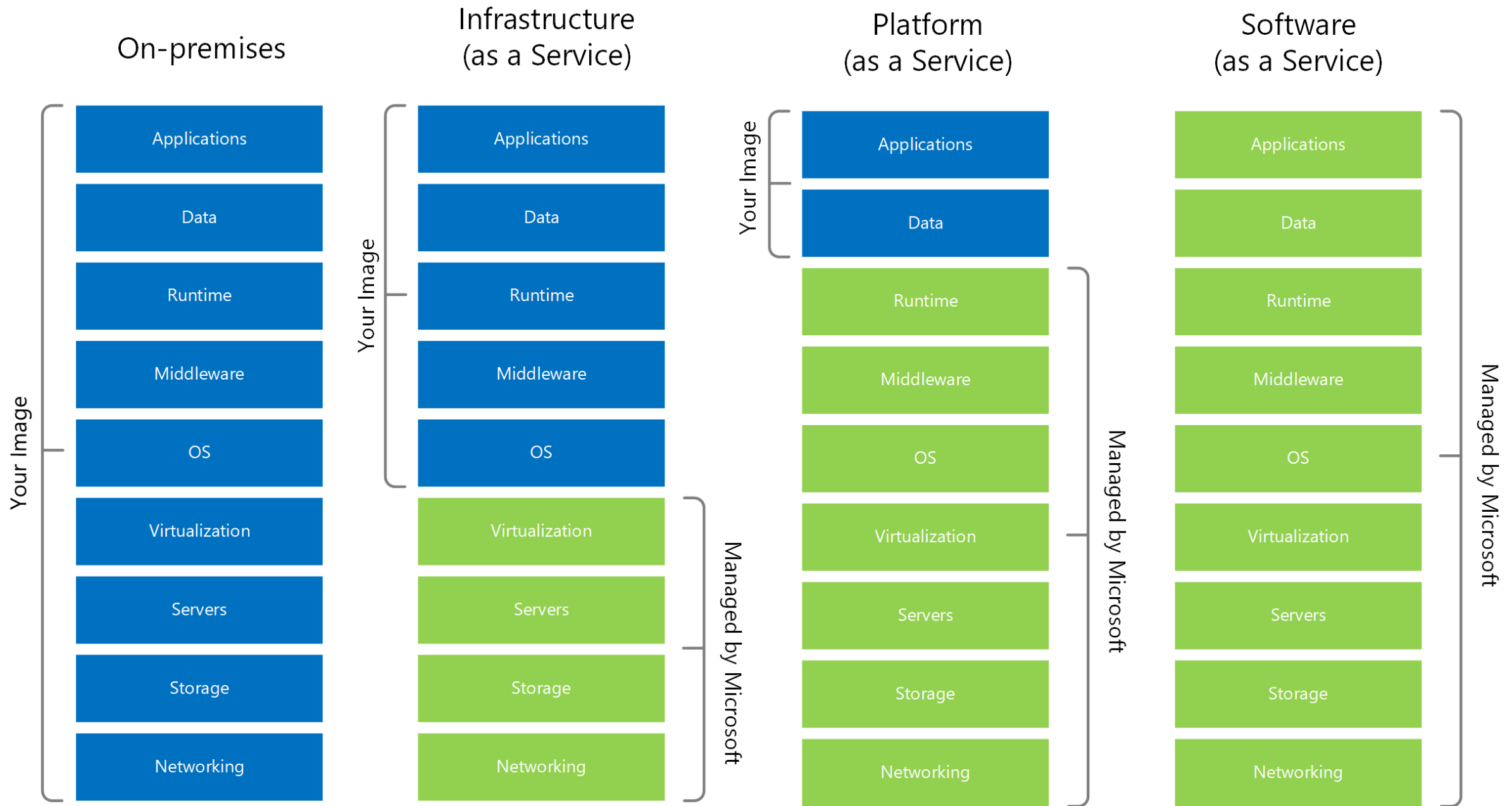- The client has no access to the underlying virtual machines

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:

On-premises

Applications
Data
Runtime
Middleware
OS
Virtualization
Servers
Storage
Networking

Your Image

Infrastructure (as a Service)

Applications
Data
Runtime
Middleware
OS
Virtualization
Servers
Storage
Networking

Your Image

Managed by Microsoft

Platform (as a Service)

Applications
Data
Runtime
Middleware
OS
Virtualization
Servers
Storage
Networking

Your Image

Managed by Microsoft

Software (as a Service)

Applications
Data
Runtime
Middleware
OS
Virtualization
Servers
Storage
Networking

Managed by Microsoft

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

Additional Service Types

- FaaS – Functions as a Service

- DBaaS – Database as a Service

- DaaS – Desktop as a Service

- IOTaaS – IOT as a Service

- AIaaS – AI as a Service

Types of Clouds

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
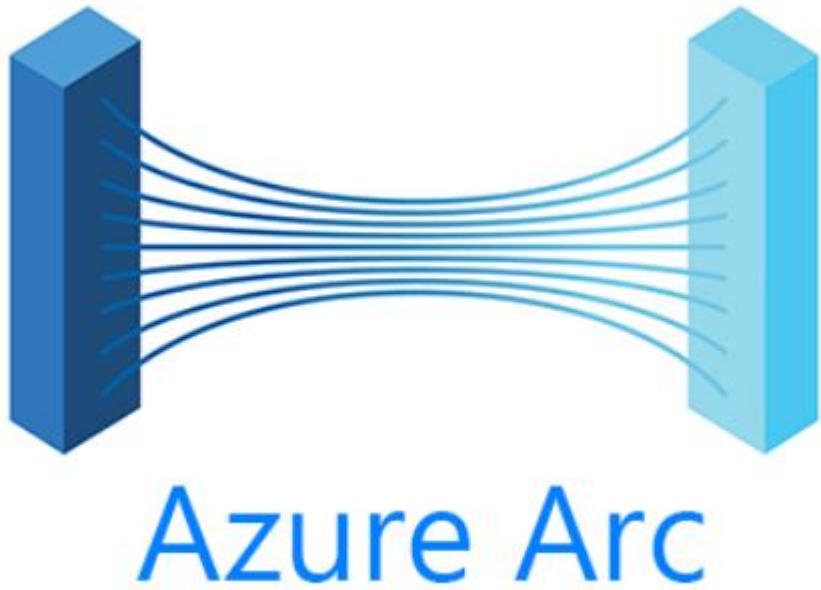
Hybrid Cloud

- 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

Azure Arc

AWS Outposts

We're going to talk about…

Public

Private

Hybrid

Cloud Providers

- 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

Google Cloud Platform Growth

Q1 2023:

22%