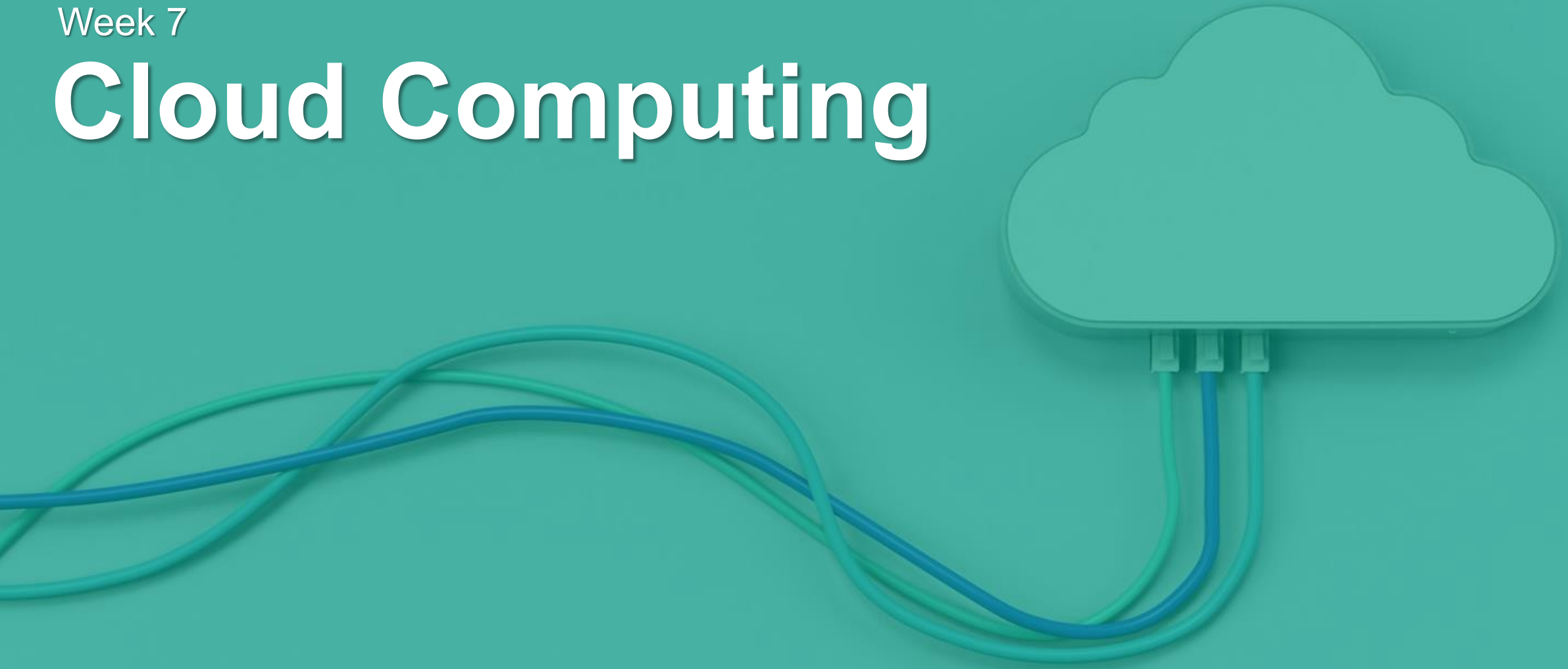
Week 7

Cloud Computing



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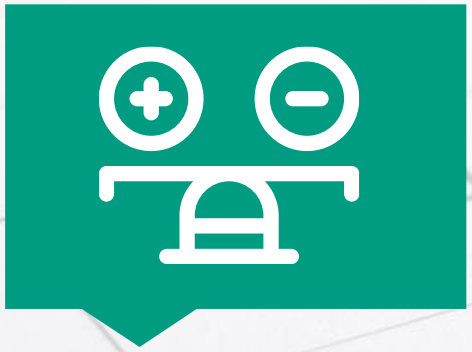
Agenda

What is Cloud Computing?



The advantages and disadvantages

The main Cloud Providers

Working in Azure

What is Cloud Computing?

Definition

"Cloud computing is the on-demand delivery of IT resources over the Internet with a pay-as-you-go pricing. ”

Instead of buying, owning and maintaining physical data centres and servers, access is provided to technological services such as processing power, storage and databases from a cloud provider.

A cloud consists of:

- 5 essential characteristics
- 3 service models
- 4 implementation models

Five essential characteristics

1. **On-demand self-service**
   Self-assignment of services from the cloud by the user(s) to be available **when needed**.

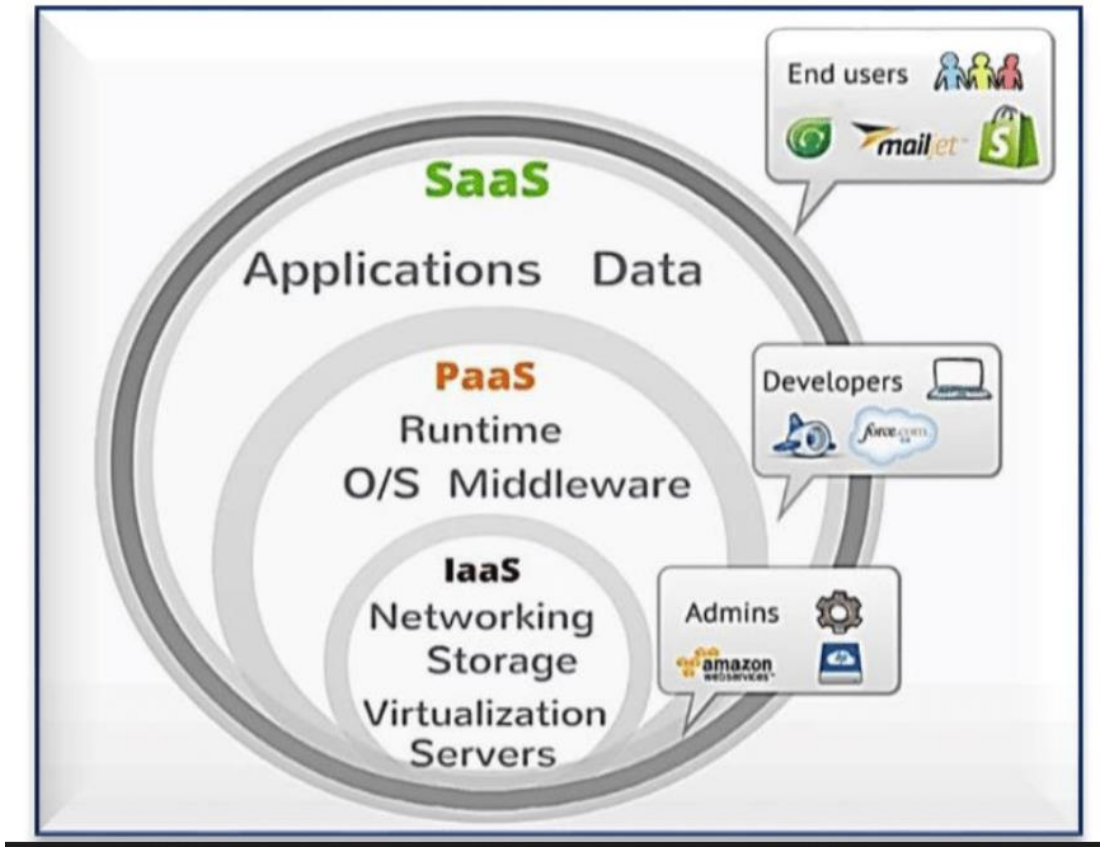
2. **Wide network access**
   Services from the cloud are accessible via the network using **standard mechanisms**.

3. **Resource pooling**
   Resources such as processing power, network or storage are **shared between different projects and clients**.

4. **Fast elasticity**
   Virtual assets **scale quickly** and from a user perspective **almost indefinitely** and can also be automatically adjusted to load changes.

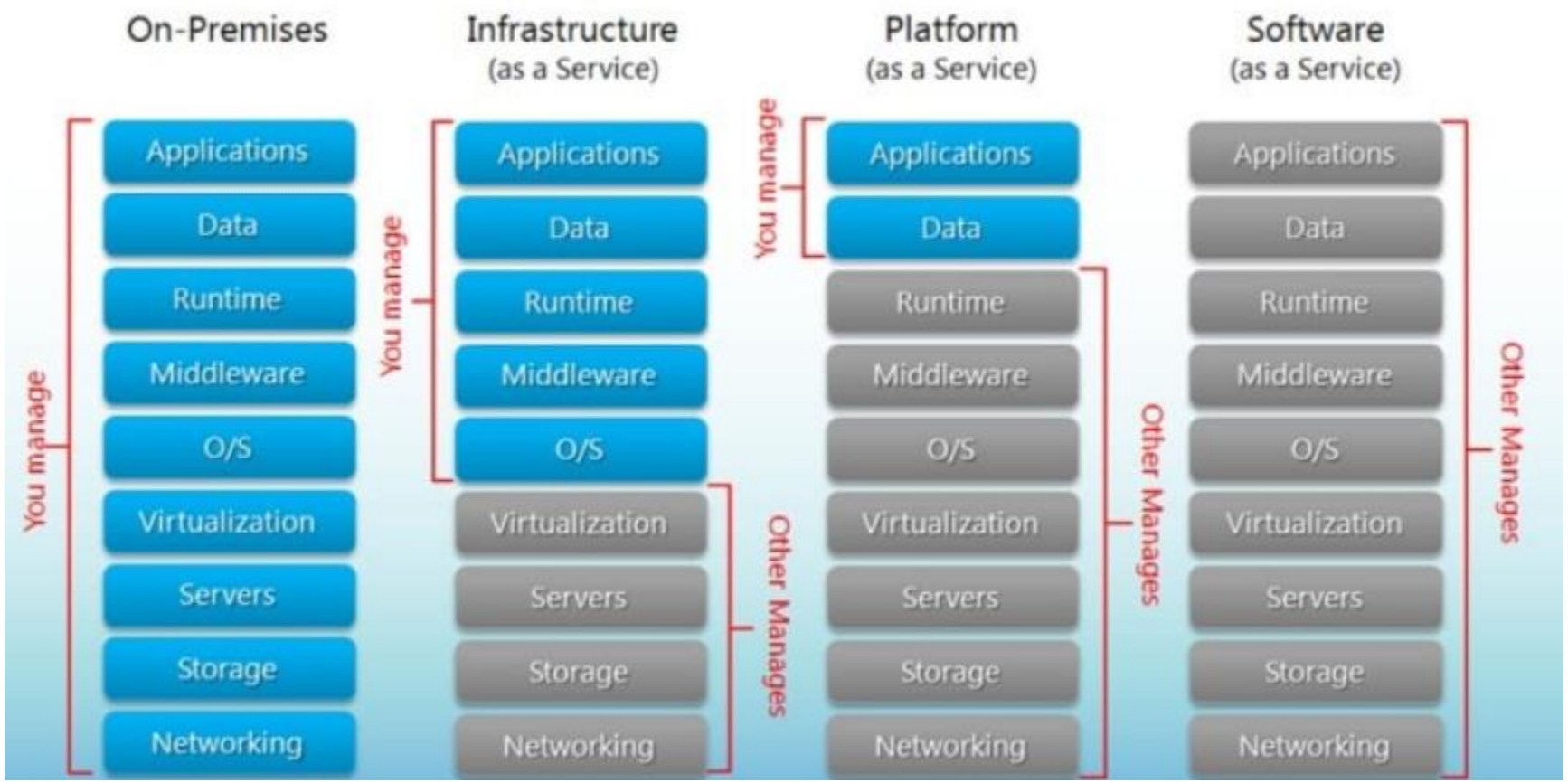
5. **Measured service**
   Resource usage can be **measured** and **monitored**. For example for billing or automatic scaling.

Three service models

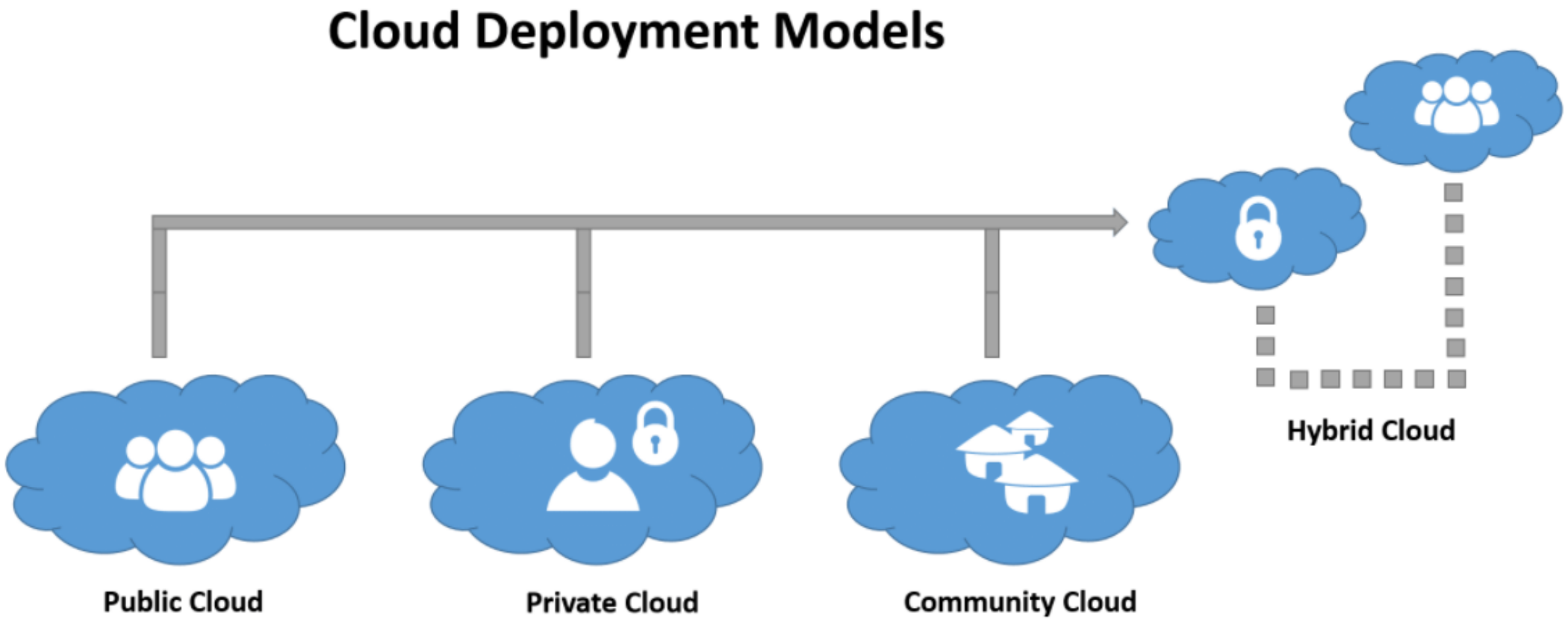


- **SAAS**: Software as a Service
  - Applications such as email, CRM, ERP.
- **PAAS**: Platform as a Service
  - Operating system with applications such as IDE or database.
- **IAAS**: Infrastructure as a Service
  - Virtual machines with networking and data storage.

Three service models: Who is responsible for what?



Four deployment models



Four deployment models

- **Public Cloud:**
  Cloud services are provided over a public use network (physical resources may be shared with others).

- **Private Cloud:**
  A cloud infrastructure used only by 1 organization.

- **Hybrid Cloud:**
  A combination of a public and private cloud .

- **Community Cloud:**
  A cloud infrastructure used only by the organizations belonging to the community.

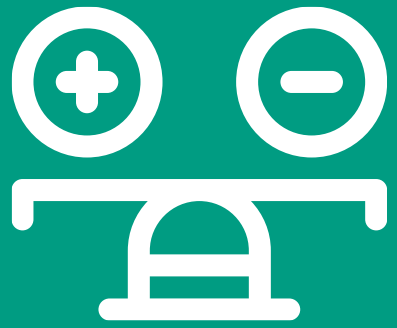
Housing: is this Cloud Computing?

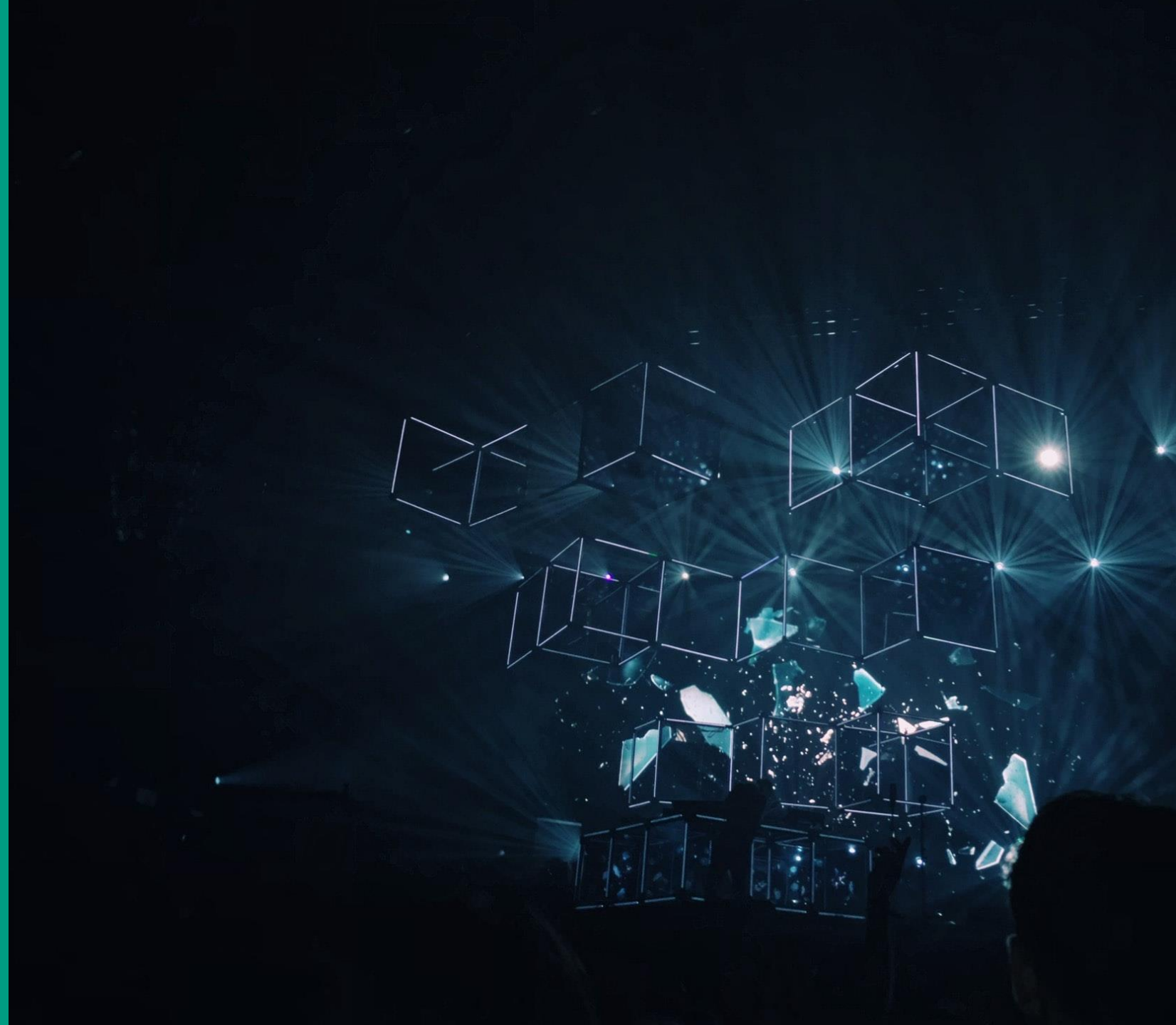
- **Housing** (or colocation):
  Having the servers placed in an external datacentre where they do the management of the hardware, networks, etc.

Activity

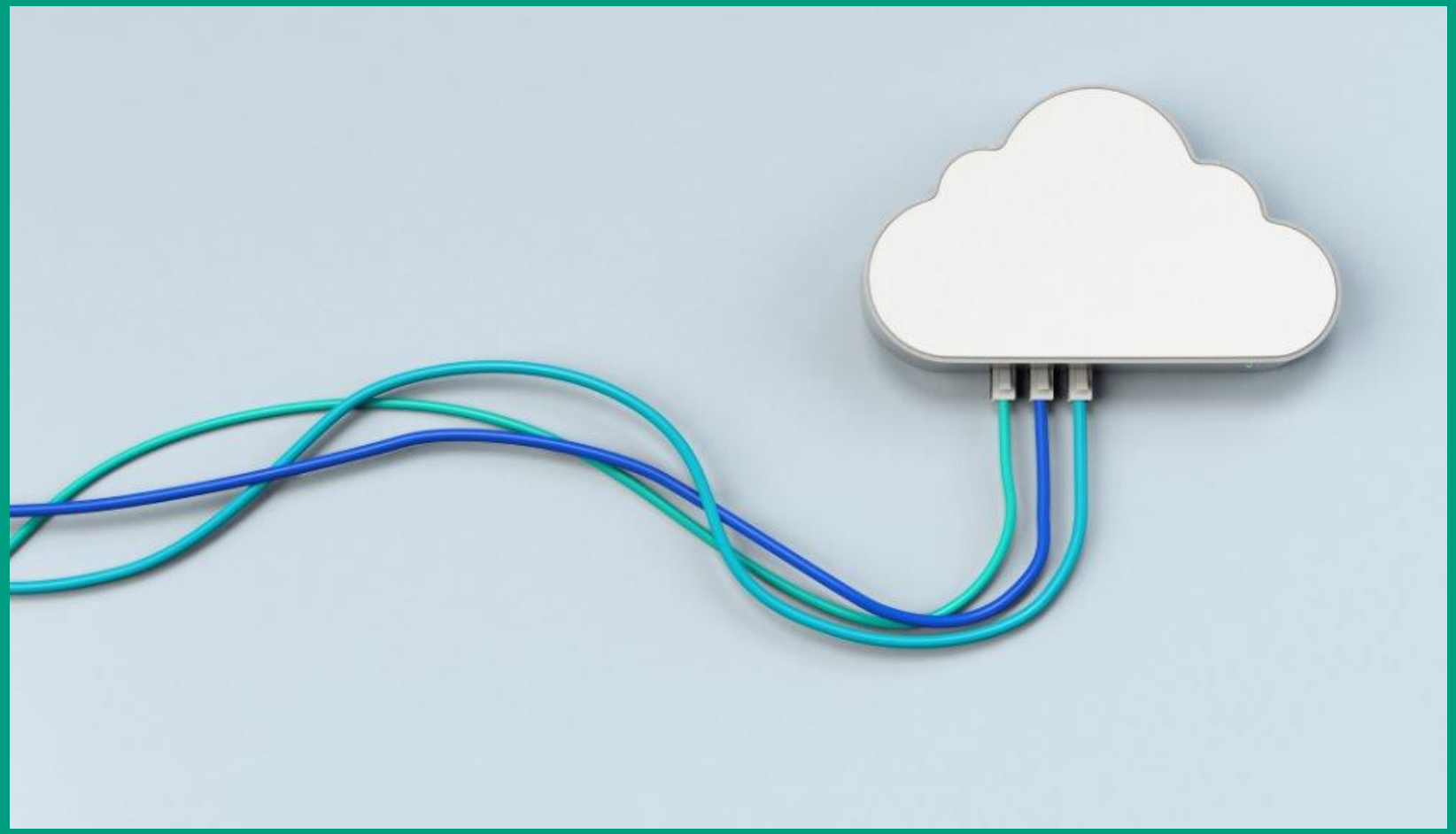
- Make an inventory of the services
  you use in the cloud.
- For each service, indicate whether it is
  SAAS, PAAS or IAAS.
- Which implementation model is applicable?
- Make an inventory of which of Saxion systems you would move to the cloud.

Advantages and disadvantages





Advantages of Cloud Computing



Benefits

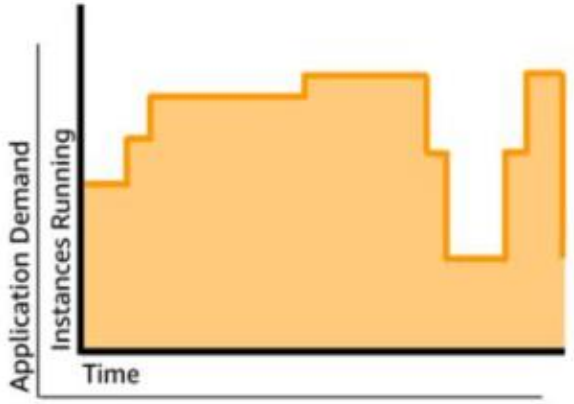
- **No investment needed.** Pay for use.
- Shift from **Capital Expense** (CapEx) to **Operational Expense** (OpEx).

Benefits

- **Scalable** with unlimited capacity.
  - Useful for e.g. web shops in busy periods.

Overestimated server capacity

Underestimated server capacity



Scaling on demand

Benefits

- Increase **speed** and **flexibility**

Traditional:

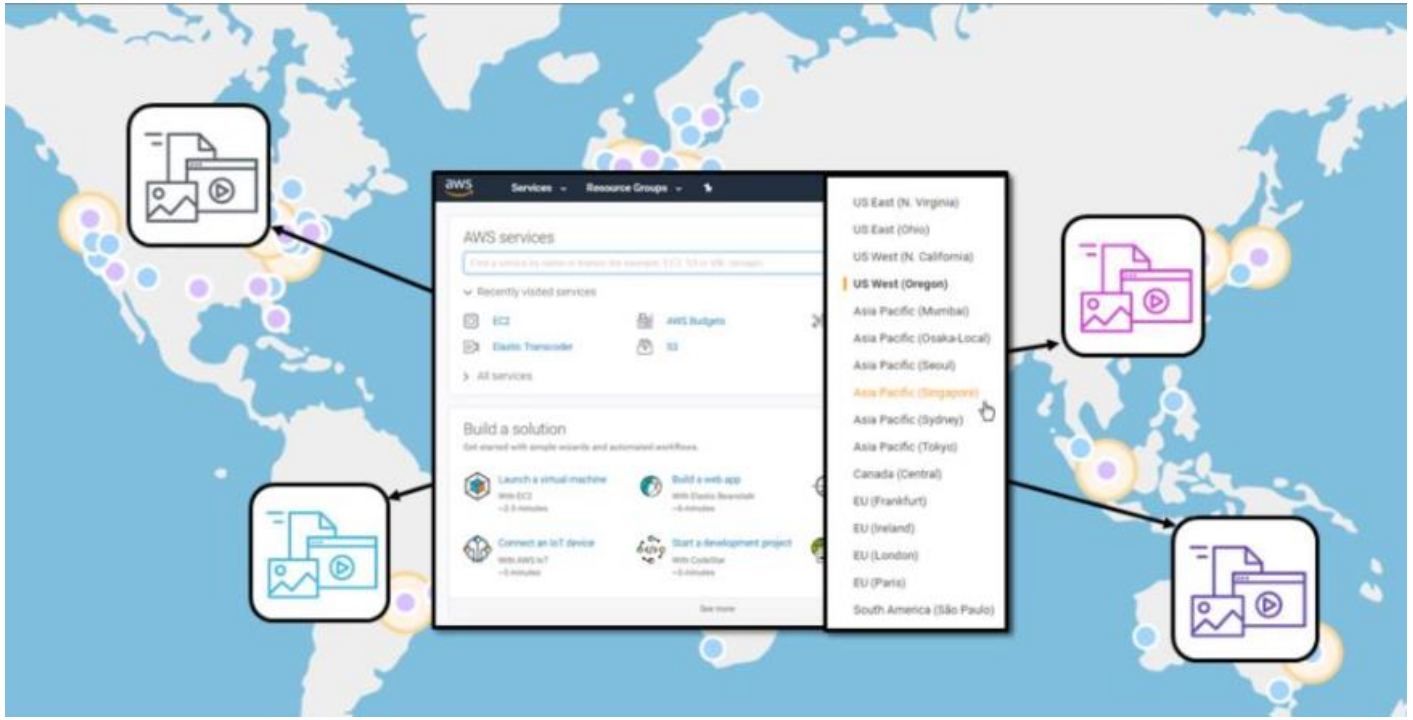
- Adding new functionality
  Takes weeks to months

Cloud:

- Adding new functionality
  can be done in minutes

Benefits

- **Global coverage** with **low latency** in minutes.
  - Data centers in multiple regions.

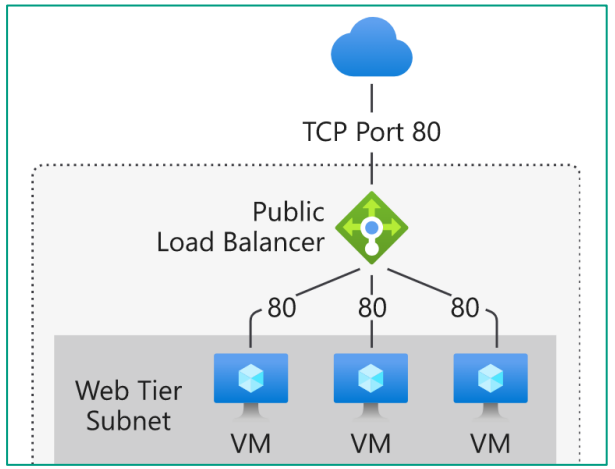


Benefits

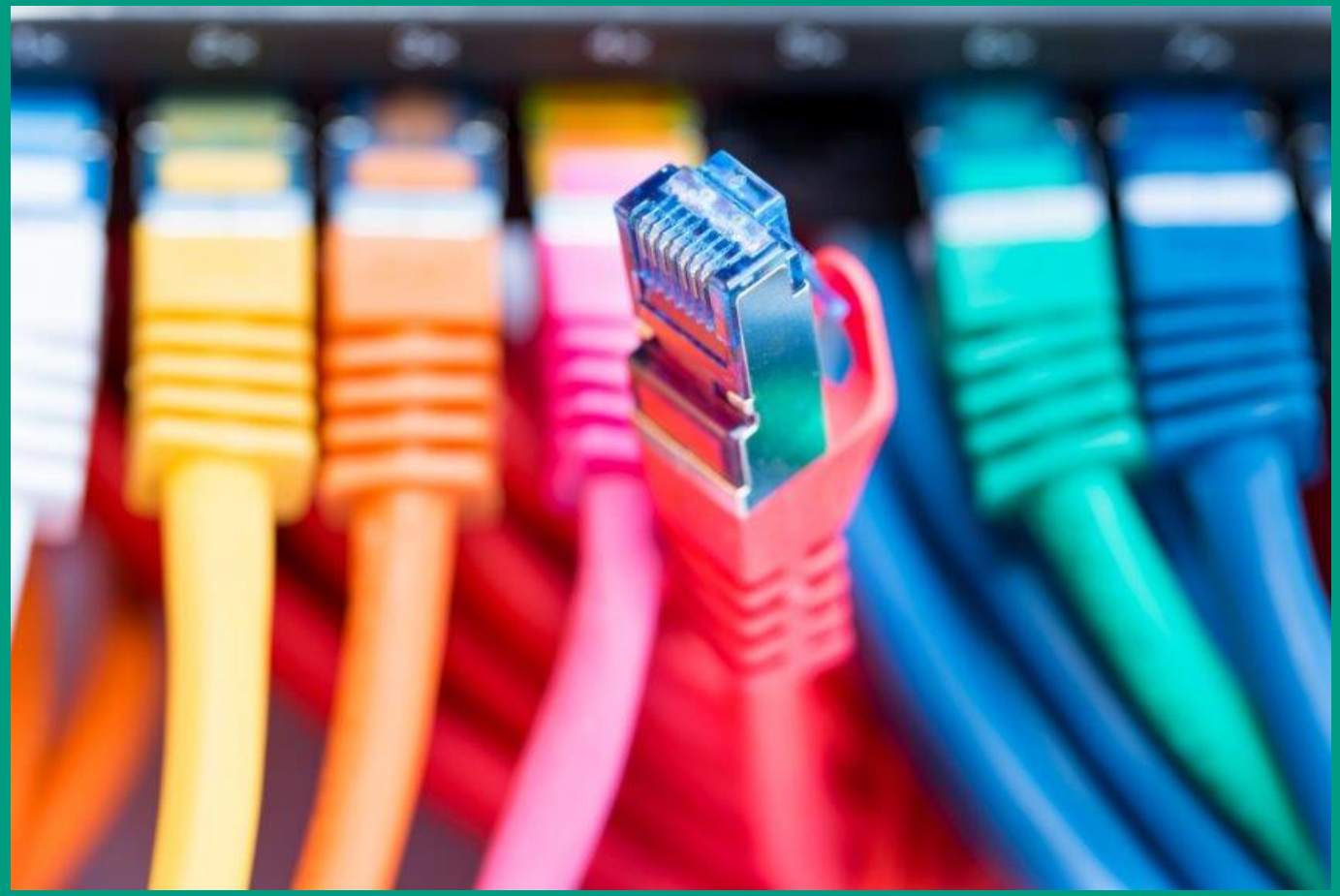
- Many services so that frequently requested functionality is easy to deploy.

- **For example:**
  - Database
  - Load balancer/ autoscaling
  - Firewall
  - Network
  - Monitoring
  - Kubernetes/docker cluster
  - Bigdata solutions

Azure firewall



Disadvantages of Cloud Computing



Cons

- **High cost** (Depending on the situation).

- Cloud provider adjusts functionality and price without consultation.
  - Vendor lock-in is a danger
  - This is why some companies choose Multicloud

- **Security**: where is the data and who is the owner?
  - Therefore, many companies also have on-premises environment.
  - Hybrid environment is most common these days.

Multicloud

The main Cloud Providers

The most important (largest) public cloud providers

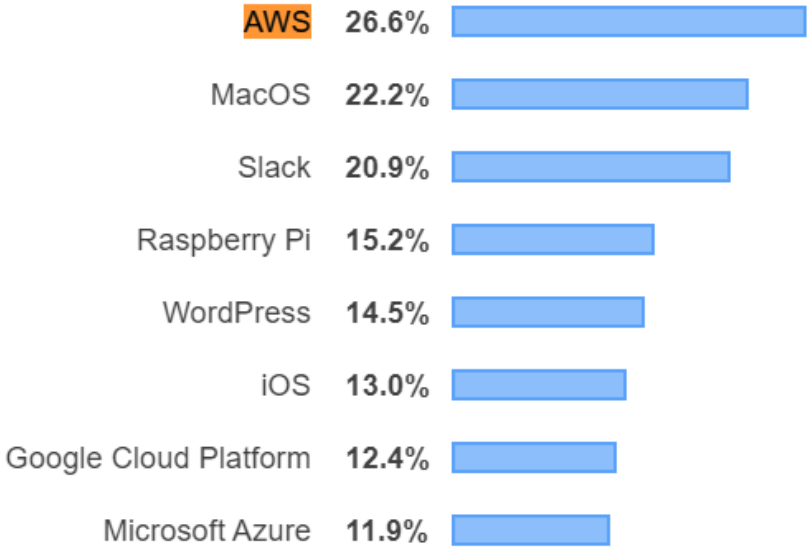
Company	Product(s)
Amazon	AWS (Amazon Web Services)
Microsoft	Azure and Microsoft 365
Google	GCP (Google Cloud Platform)

Key use cases in the cloud

- **Website support**
  - E.g. Bol.com, Dropbox, YouTube, Facebook
  - Is well supported by all providers

- **Support office worker**
  - Microsoft365 is often chosen in combination with Azure.
  - Microsoft has good functionality for this, such as:
    - Microsoft End Point Management
    - Microsoft Virtual Desktop
    - Office applications, such as exchange, sharepoint and teams
  - Google is also used here (e.g. schools, chromebook and gmail)

- **Software development support**
  - E.g. development platform with development tools, such as Docker and Kubern
  - Often choice for AWS (26.6%), also Google (12.4%), Azure (11.9%)



Choice of cloud provider

Companies choose cloud providers based on such factors as:

- Appropriate functionality
- Price
- Knowledge
- Compliancy and location data

Activity

1) Which companies use AWS, Google, Azure?

- Search:
  - whos-using-aws
  - whos-using-google-cloud-platform
  - whos-using-azure

2) Which provider do you think is most suitable for Saxion?

3) What does a VM or a database in Azure cost per month?

  - https://azure.microsoft.com/en-us/pricing/calculator/

Working in Azure

Azure infrastructure: 60+ regions by 2021

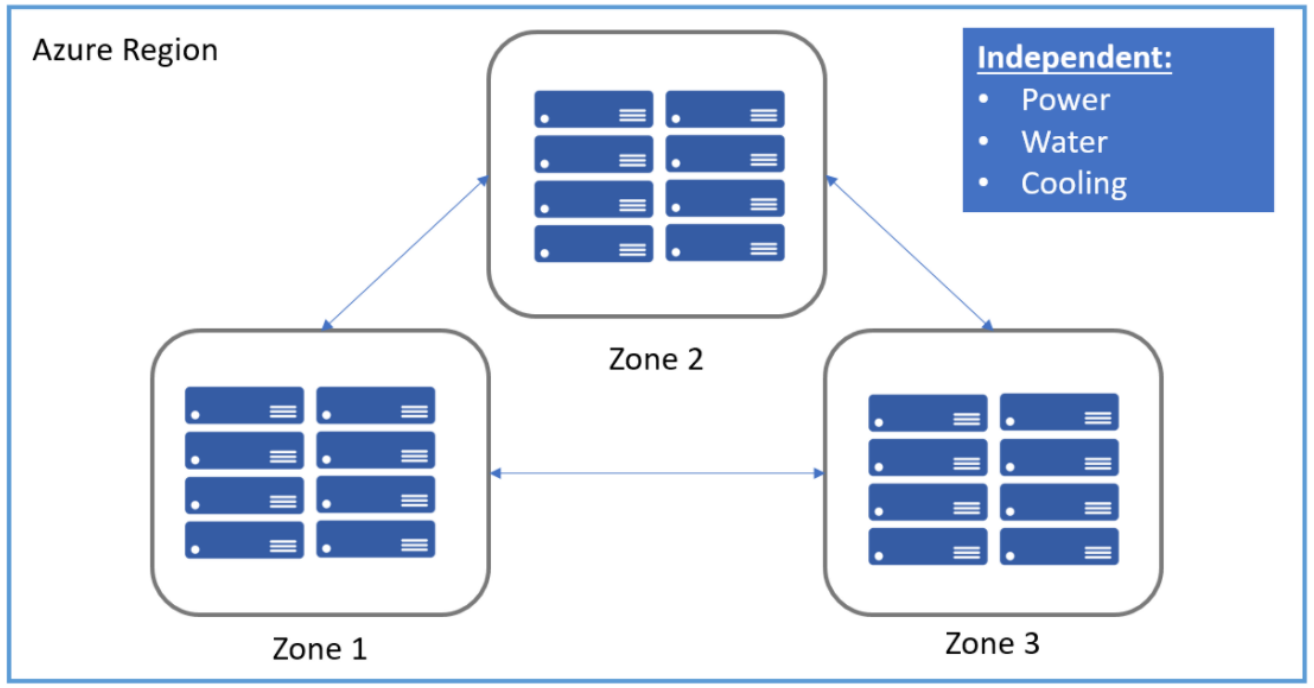
Europe

REGION	LOCATION
West Europe	Netherlands
North Europe	Ireland
France South	Marseille
France Central	Paris
UK West	Cardiff
UK South	London
Germany Central (Sovereign)	Frankfurt
Germany Northeast (Sovereign)	Magdeburg
Germany West Central (Public)	Frankfurt
Germany North (Public)	Berlin
Switzerland West	Geneva
Switzerland North	Zurich
Norway West	Stavanger
Norway East	Oslo

Important concepts

Region	Location in the world where Azure has data centers. Divided into Availability Zones
Availability zone	Zone consists of a or more data centers with independent power, cooling and networking.
Datacenter	Secure building with many servers

Region and availability zone



SLA Azure:

- Data center (or server) can and may fail.
- User is responsible for for redundantly placing servers in multiple AZs.

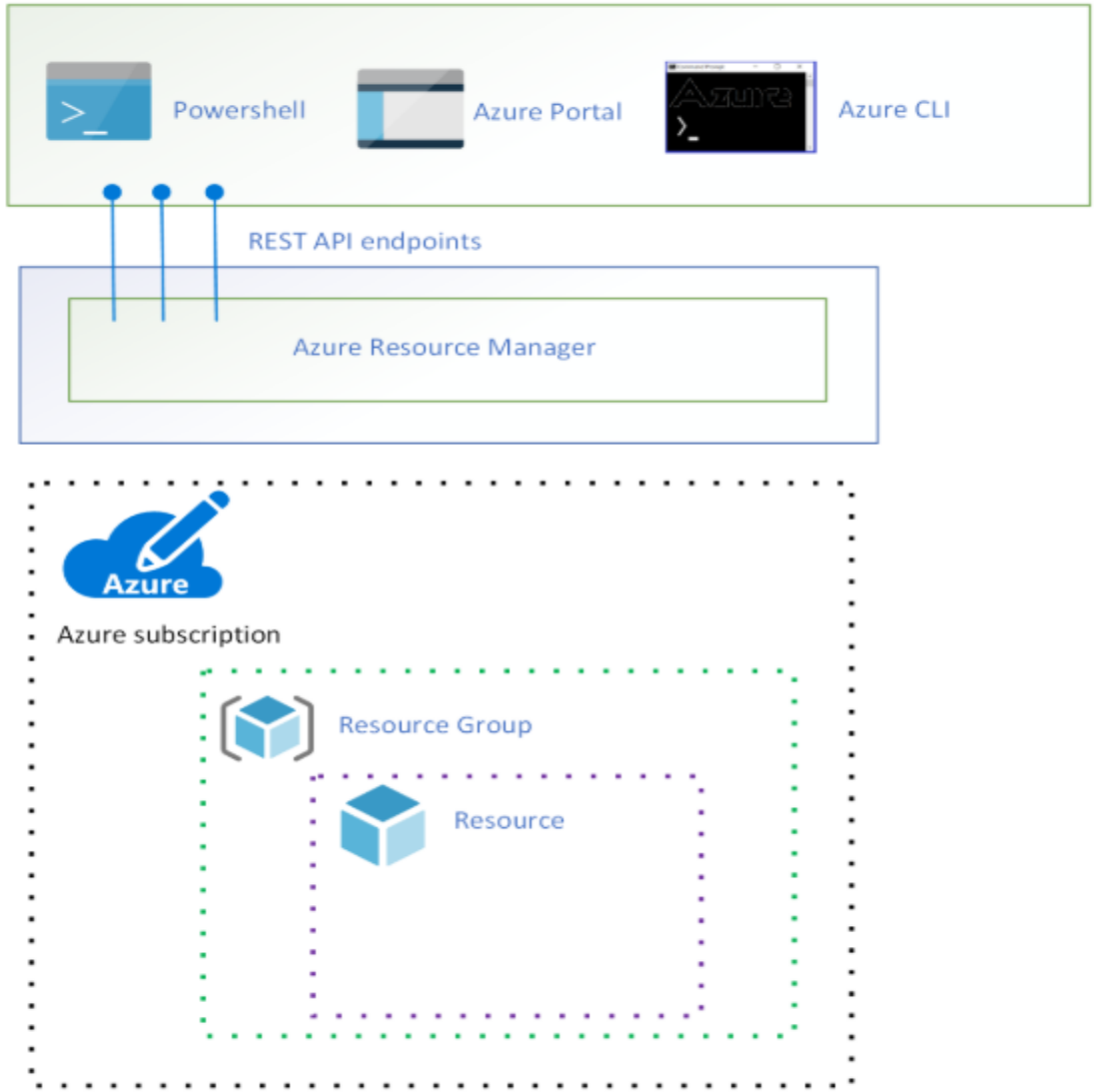
Other important concepts

Portal	Azure Management Portal: portal.azure.com
Subscription	Subscription Determines payment model and available services (e.g. Azure for Students)
Resource Group	Group of resources with the same lifecycle (are created together and later removed together)
Resource	Object in Azure e.g. VM, database, firewall etc.

Azure structure

- Access to Azure:
  - Powershell
  - Portal
  - Azure CLI

- Resources belong to a subscription

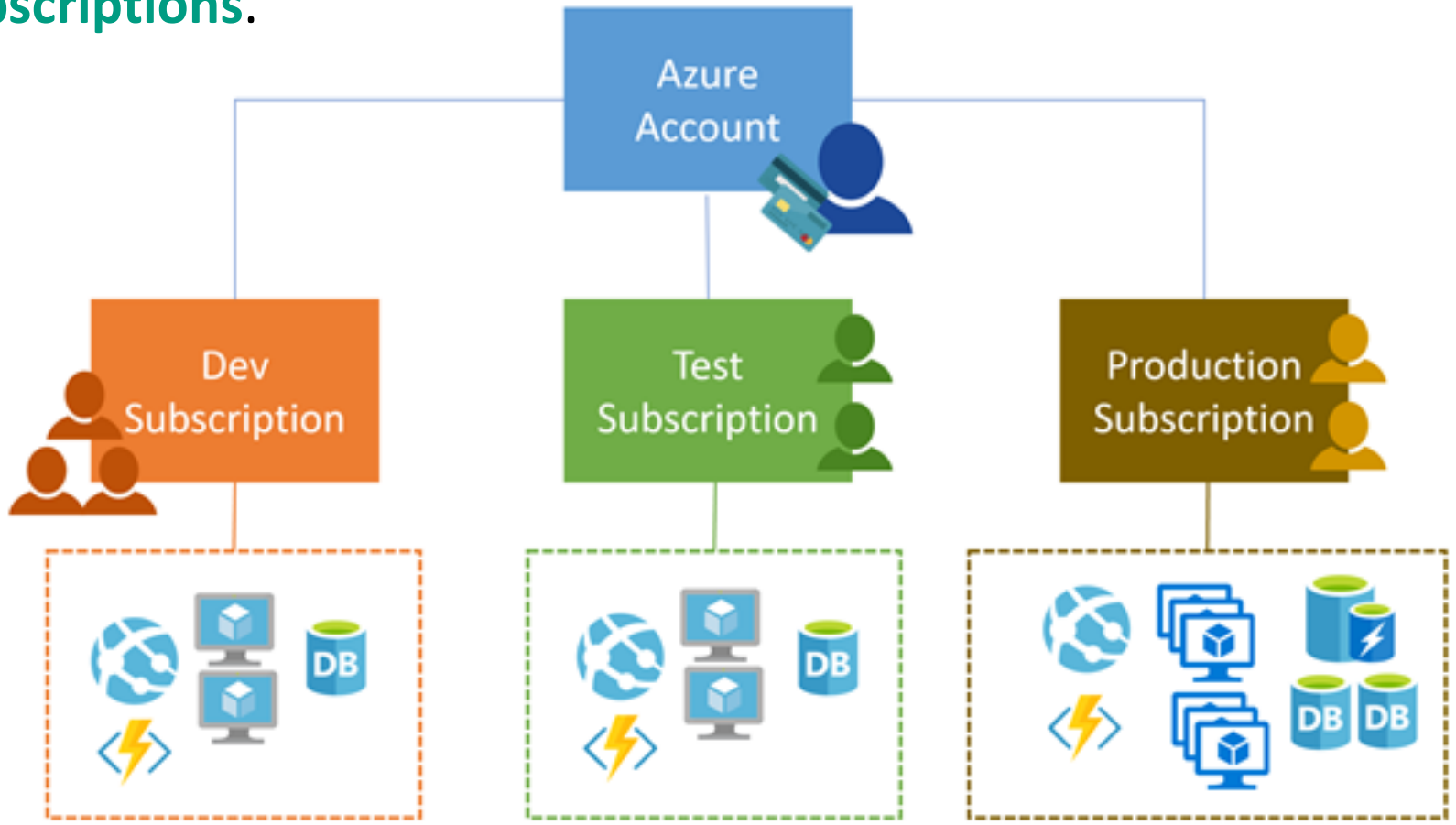


Azure structure

- There can be **multiple subscriptions**.

For example:

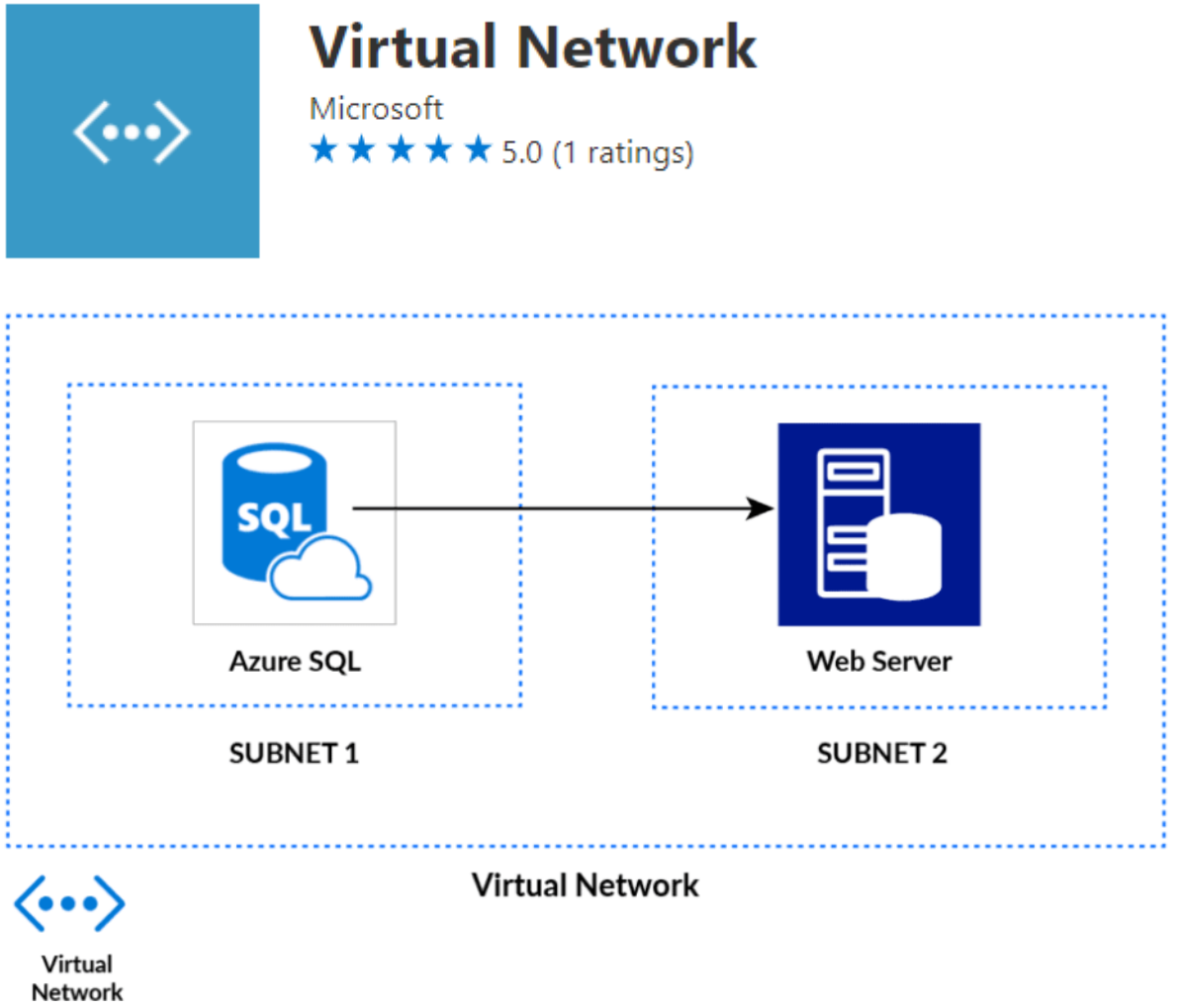
- Pay as you go
- Azure for Students



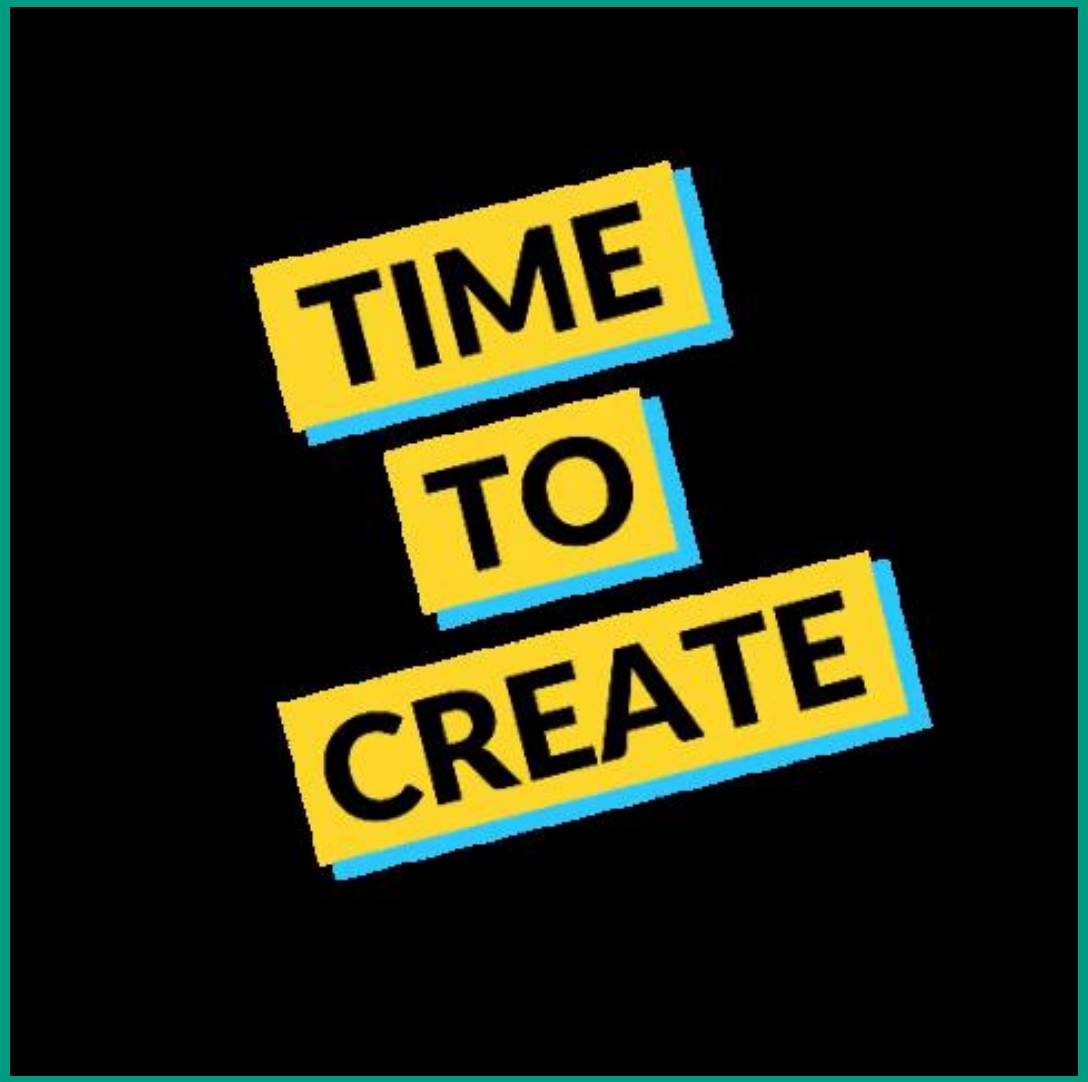
Networking in Azure

- **Virtual Network**

- VMs can be placed in it.
- Network for which should be:
  - Subscription and resource group to be used
  - Name
  - Region
  - IP address range (e.g. 10.0.0.0/16)
  - Subnet range 1st subnet (e.g. 10.0.0.0/24)
  - Possibly additional subnets (e.g. 10.0.1.0/24)

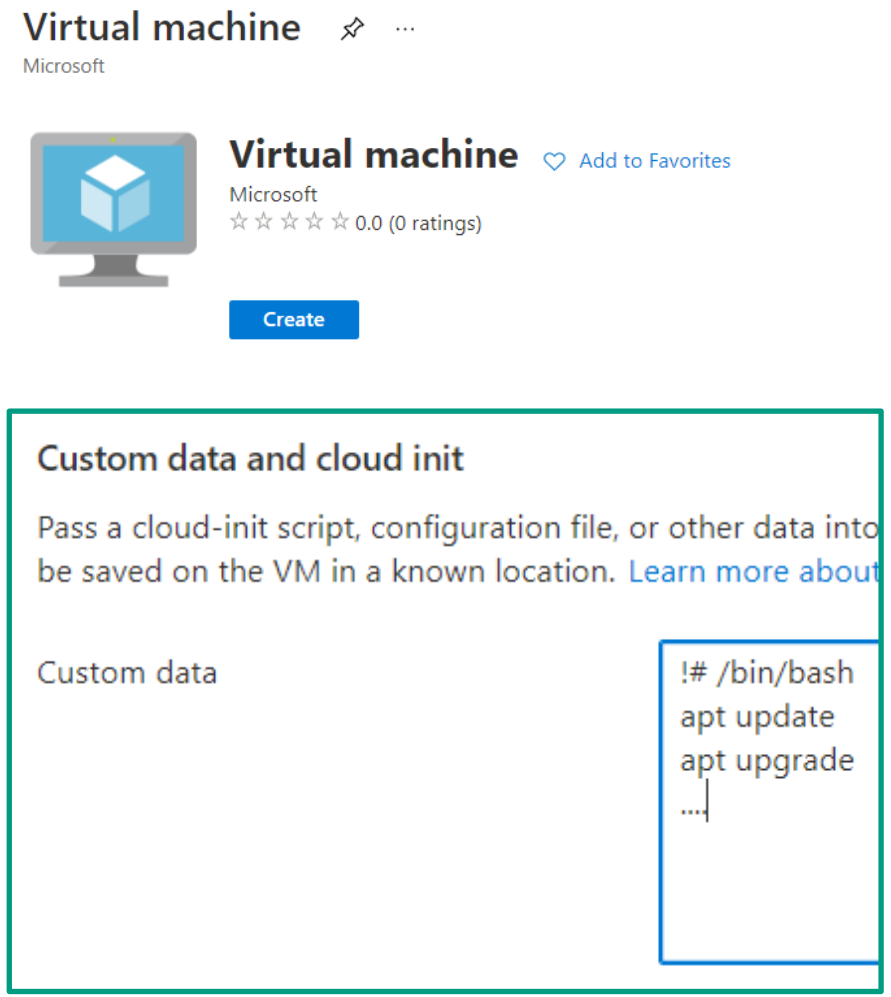


Creating Virtual Machine in Azure



Creating Virtual Machine in Azure

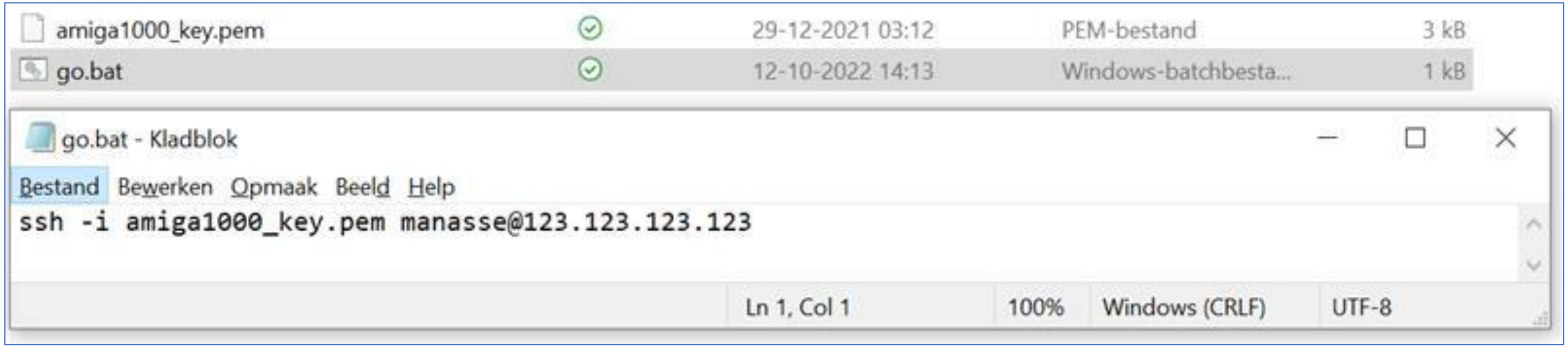
- **Signing up**:
  - Subscription and resource group
  - Name
  - Region
  - Availability options (e.g. AZ)
  - Image
  - Size (# CPUs and momorysize)
  - Username and (password or generate key pair)
  - Inbound ports allowed (e.g. ssh and/or https)
  - Disk's and disk size
  - Virtual Network and Subnet
  - Custom data: Possible script for installing VM
  - Optional Tag: key value pair
    (meta data) such as:
    Name Ubuntu20.04



Connecting to VM

- **Connecting via SSH**

- **No password set but key:**
  - Use the downloaded key with the ssh command in the terminal:
  - ssh -i <keyname.pem> <user>@<ip address>
  - **Optional**: make a bash/bat script to login to your azure vm



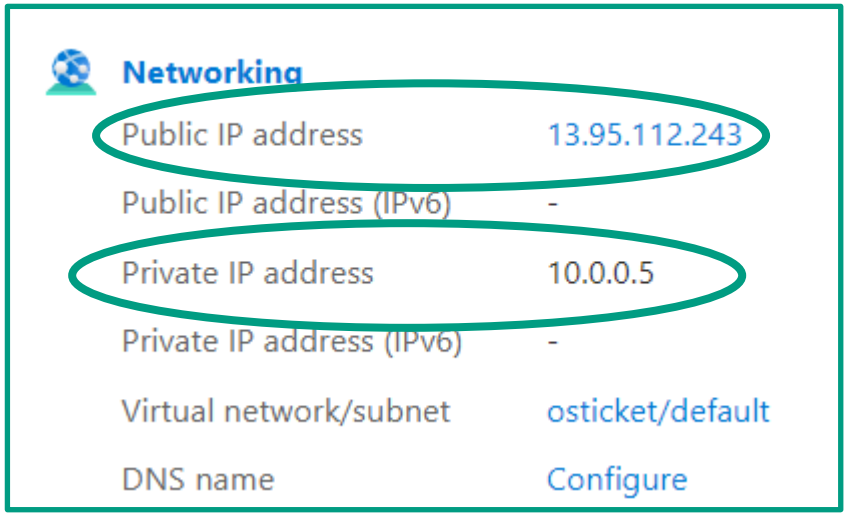
Connecting to web server

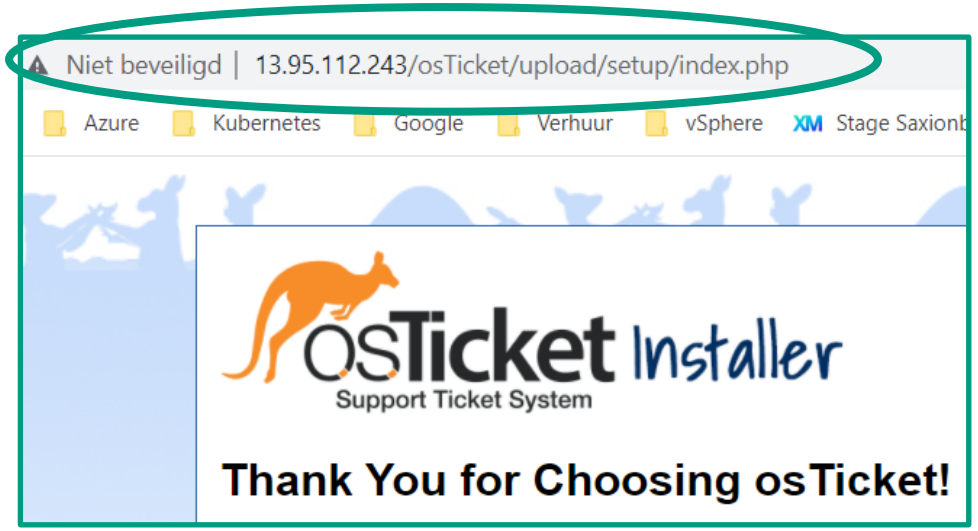
- Each instance gets **external IP** address and **internal IP** address.
- Is VM configured as web server (e.g. using custom data)
- And correct ports open (80, 443)
- Then reachable via browser on PC via **public IP** instance.

Within a virtual network, VMs communicate

by means of an internal IP.

OSticket web server





Working on the case

Case

- Do the assignments of week 6

Please consult the assignments document and the template report for more details.


Introduction to infrastructures
Submit your report

Any questions?