



**NANYANG
TECHNOLOGICAL
UNIVERSITY**
SINGAPORE

Introduction to IT Infrastructure

Cloud Infrastructure Engineering

**Nanyang Technological University
& Skills Union - 2022/2023**

Course Content

- Quick Check-In
- Explore concepts of IT Infrastructure
- Dive into the basics of IT Infrastructure
- Explore the motivations and goals of Cloud Migration

Self Study Check-In



Q1: Which of the following is not part of an IT Infrastructure?

- A) Servers
- B) Network
- C) Engineers
- D) Storage

Q2: Which of the following allow you to maintain your own data center / hosting environment?

- A) Private Cloud
- B) Public Cloud
- C) On-Premise
- D) Hybrid

What is IT Infrastructure?



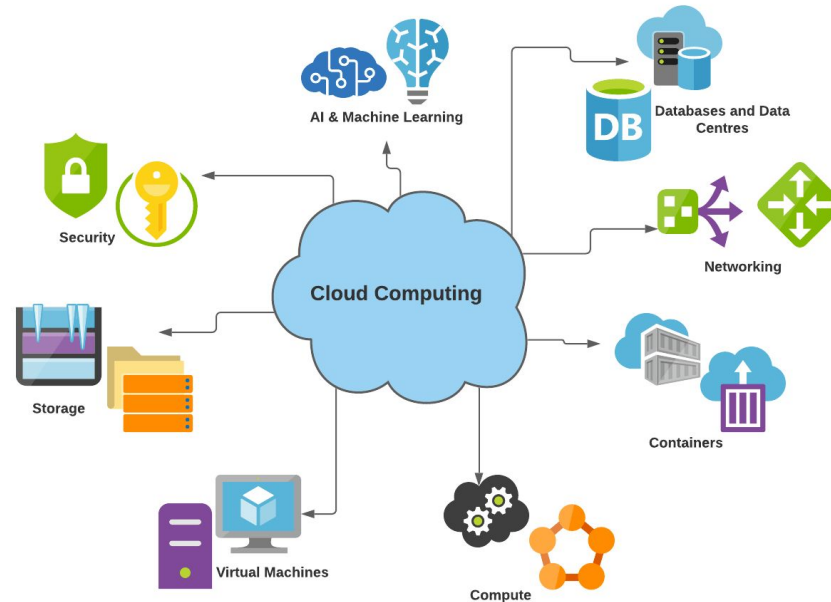
What is Traditional Computing?



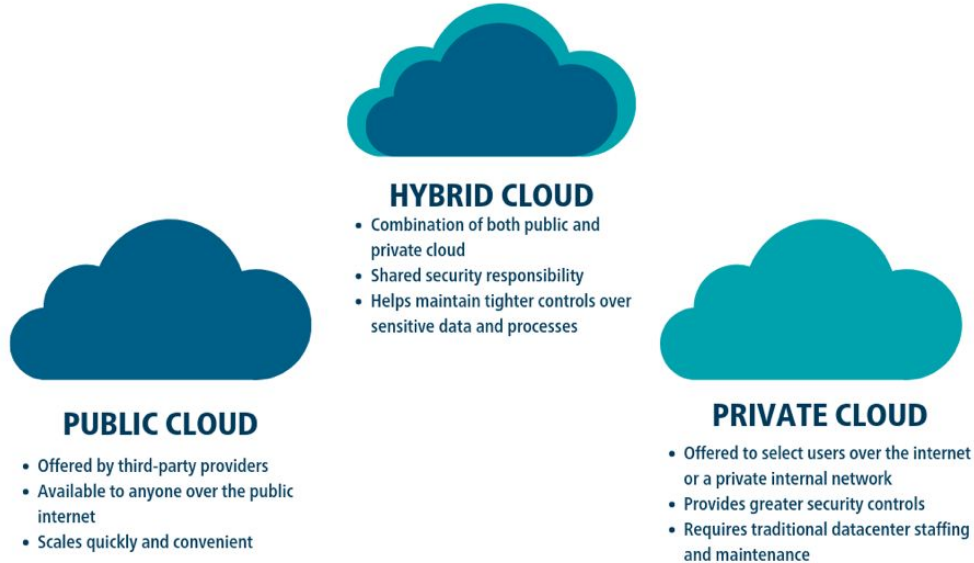
What is Cloud Computing?



What is Cloud Computing?

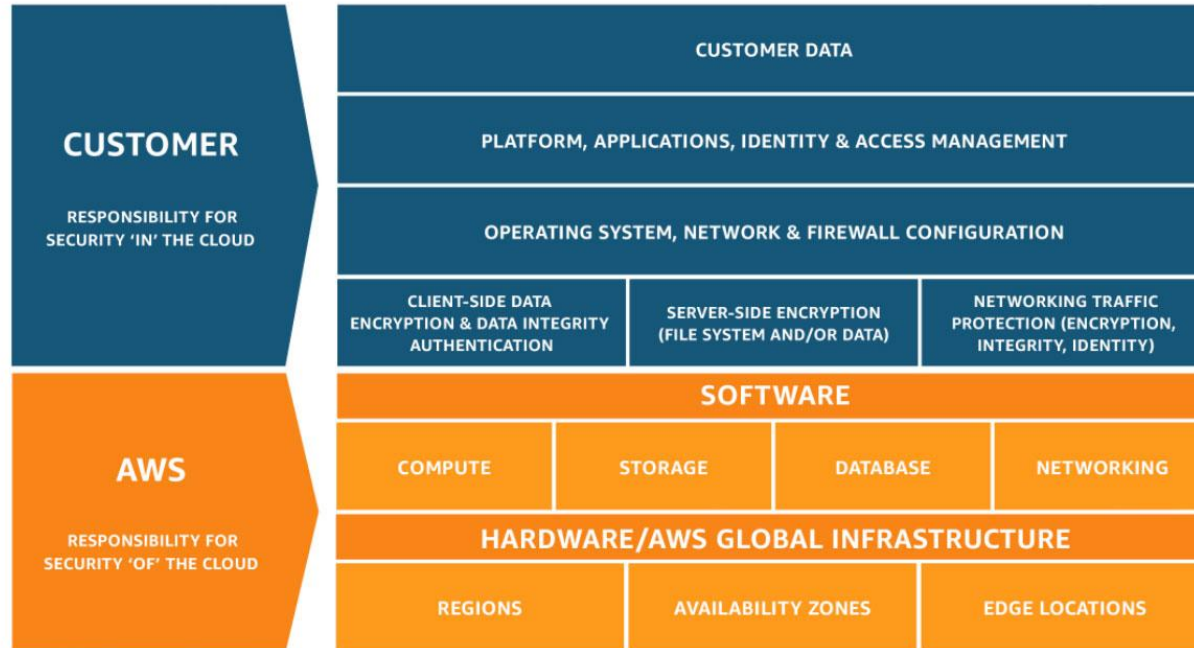


Types of Cloud



<https://www.youtube.com/watch?v=3WIJ4axzFIU>

Shared Responsibility Model



Key Components of IT Infrastructure

- Network
- Compute Servers
- Storage
- Virtualization

Network

The network layer is essential for **allowing communication** between different services to and from users, and encompasses security, availability and load-balancing.



Network

Some common networking hardware:



Router



Switch



Hub

Networking and Content Delivery on AWS

Network Foundations



Amazon VPC



AWS Transit Gateway



AWS PrivateLink

Application Networking



Elastic Load Balancing



AWS App Mesh



Amazon API Gateway



AWS Cloud Map

Edge Networking



Amazon CloudFront



Amazon Route 53



AWS Global Accelerator

Network Security



AWS Shield



AWS WAF



AWS Firewall Manager

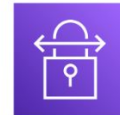
Hybrid connectivity



AWS Direct Connect



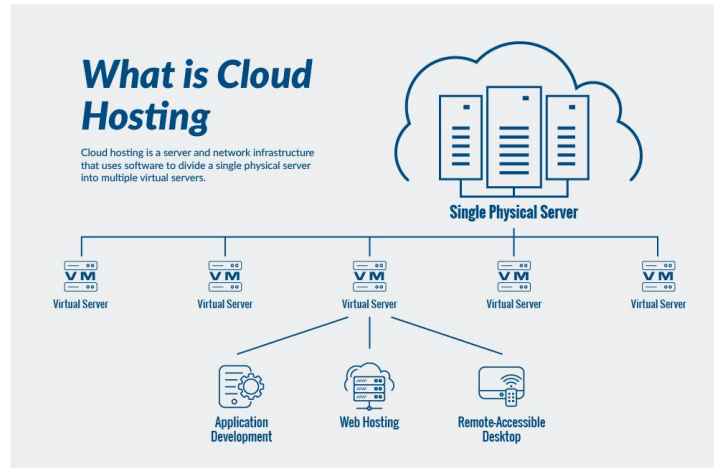
AWS VPN - Client



AWS VPN – Site to Site

Compute Servers

A centralized group of servers that is hosted and delivered over a network and accessed on demand by multiple users, delivering applications, storage capability and processing power.



Compute in AWS

A dark blue rectangular panel with a grid of AWS Compute services. Each service is represented by a small icon, a bold title, and a brief description. The services listed are AWS App Runner, Batch, EC2, EC2 Image Builder, Elastic Beanstalk, Lambda, Lightsail, AWS Outposts, Serverless Application Repository, and AWS SimSpace Weaver.

 **Compute**

AWS App Runner
Build and run production web applications at scale

Batch
Fully managed batch processing at any scale

EC2
Virtual Servers in the Cloud

EC2 Image Builder
A managed service to automate build, customize and deploy OS images

Elastic Beanstalk
Run and Manage Web Apps

Lambda
Run code without thinking about servers

Lightsail 
Launch and Manage Virtual Private Servers

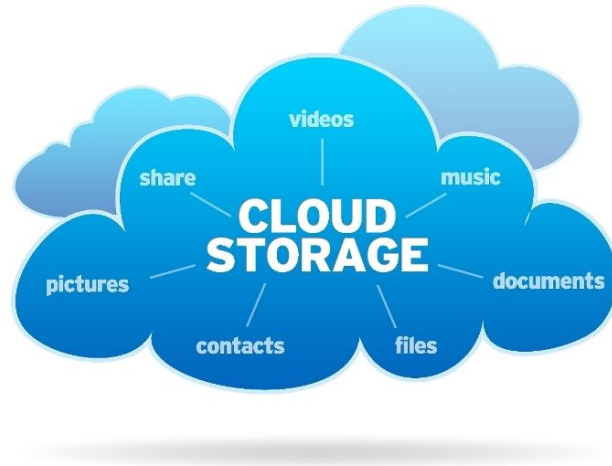
AWS Outposts
Run AWS Services On Premises

Serverless Application Repository
Assemble, deploy, and share serverless applications within teams or publicly

AWS SimSpace Weaver
Build and run large-scale spatial simulations




Storage

Cloud storage services allow organizations to store and manage data on off-site disk and file servers instead of building their own physical data centers.



Storage

Some common storage infrastructure for compute:

		
Amazon S3	Amazon EBS	Amazon EFS
Data storage for unstructured data	System storage for Amazon EC2 VMs	Scalable data storage for Amazon EC2 VMs

Storage

Some common storage infrastructure for images/ videos/ BLOB:



Amazon S3



Google Cloud Storage



Azure Files

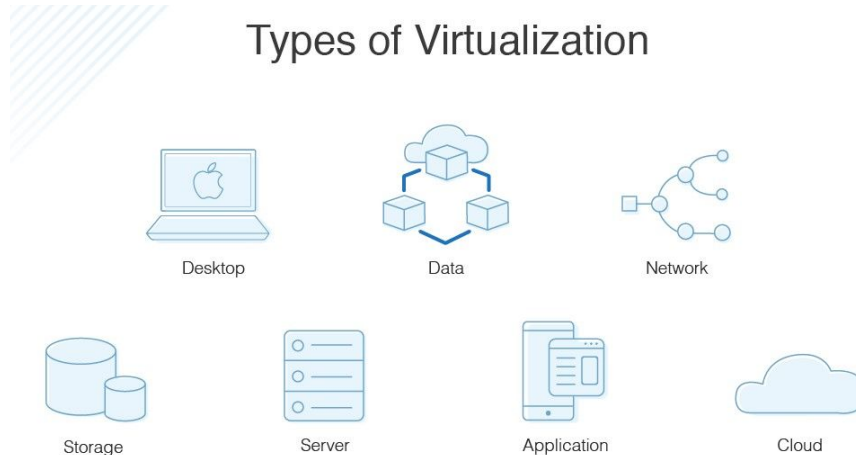
Storage



<https://aws.amazon.com/solutions/case-studies/dropbox-s3/>

Virtualization

Virtualization is a technique how to separate a service from the underlying physical delivery of that service. It is the process of creating a virtual version of something like computer hardware.



Recap: Key Components of IT Infrastructure

- Network
- Compute Servers
- Storage
- Virtualization

Cloud Migration



Cloud Migration

Cloud Migration is a process where **businesses migrate their data, softwares and processes** from local data center to a cloud platform.

Let's take some time to look at this video from IBM on the steps need to be taken to shift from on-premise to cloud.

Link:

https://www.youtube.com/watch?v=yWByEVB0VJE&ab_channel=IBMTechology

What is Cloud Migration?



Advantages of Cloud

\$ COSTS \$

The cloud **removes or greatly reduces the operating expense** of a company setting up and managing its own data center.

Taking on this process begins to add up with all the various hardware, software, servers, energy bills, IT experts, and the updates that come along with this multifaceted set-up.

With cloud infrastructure, a company simply pays for it all to be managed while paying only for as-needed services on-demand.

Advantages of Cloud

COSTS - CapEx & OpEx

CapEx is short for capital expenditure. Capital expenditure is the cost a business incurs to acquire assets that will provide benefits beyond the current year. Examples include, purchasing of data centers/servers, maintenance costs, infrastructure support costs etc.

OpEx is short for operating expenses, also known as operational expenses, and operating costs. Operating expenses refer to the money a company spends to run day-to-day operations. Examples include, Items that require a subscription fee, such as software licenses or cloud-based services such as SaaS, IaaS, PaaS etc.

Advantages of Cloud

COSTS - CapEx & OpEx

Links to refer:

- [CapEx Vs. OpEx In Cloud Computing: What's The Difference? \(cloudzero.com\)](https://cloudzero.com/blog/capex-vs-opex-in-cloud-computing-what-s-the-difference/)
- [CapEx vs OpEx Cloud: What's the Difference? | TierPoint, LLC](https://www.tierpoint.com/blog/capex-vs-opex-cloud-what-s-the-difference/)

Advantages of Cloud

Agility & Flexibility

Most cloud service infrastructures are offered as self-managed, where service changes can be made within minutes.

This **improves the uptime and efficiency of business systems** while allowing off-site coworkers and partners to access shared data on mobile devices whenever and wherever.

And with a cloud infrastructure managing processes, a company becomes more business-focused than IT-focused.

Advantages of Cloud

Scalability

Instead of being constrained by the number of physical servers, cloud services **allow you create new resources quickly and immediately.**

In some cloud platform, you can even configure auto-scaling of resources when high traffics to your application are being detected.

There are several approach to scalability and this needs to considered based on the offerings provided by the cloud service provider.






Advantages of Cloud

Security


Cloud infrastructure technologies and providers are always **improving protection against hackers, viruses, and other data breaches** with stronger firewalls, advanced encryption keys, and a hybrid approach that stores sensitive data in a private cloud and other data, even apps, in a public cloud.

Advantages of Cloud

Security

AWS security, identity, and compliance solutions				
 Identity & access management	 Detection	 Infrastructure protection	 Data protection	 Incident response
AWS Identity & Access Management (IAM) AWS Single Sign-On AWS Organizations AWS Directory Service Amazon Cognito AWS Resource Access Manager	AWS Security Hub Amazon GuardDuty Amazon Inspector Amazon CloudWatch AWS Config AWS CloudTrail VPC Flow Logs	AWS Firewall Manager AWS Shield AWS WAF – Web application firewall Amazon Virtual Private Cloud (VPC) AWS PrivateLink AWS Systems Manager	Amazon Macie AWS Key Management Service (KMS) AWS CloudHSM AWS Certificate Manager AWS Secrets Manager AWS VPN Server-Side Encryption	Amazon Detective CloudEndure DR AWS Config Rules AWS Lambda

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Disadvantages of Cloud Migration

Vendor lock-in

Vendor lock-in is another perceived disadvantage of cloud computing. Easy switching between cloud services is a service that hasn't yet completely evolved, and organizations may find it difficult to migrate their services from one vendor to another. Differences between vendor platforms may create difficulties in migrating from one cloud platform to another, which could equate to additional costs and configuration complexities.

What could we do?

Disadvantages of Cloud Migration

Cloud Infrastructure fails(Downtime)...

A cloud infrastructure is only as good as its network connection.

The cloud can't stay afloat without a dependable connection. Any glitches in an internet or intranet connection due to a technical outage or storm mean the cloud goes down along with all the data, software, and/or applications in it. A reliable network means business promises and SLAs are delivered.

What could we do?

Disadvantages of Cloud Migration

Lower Control...

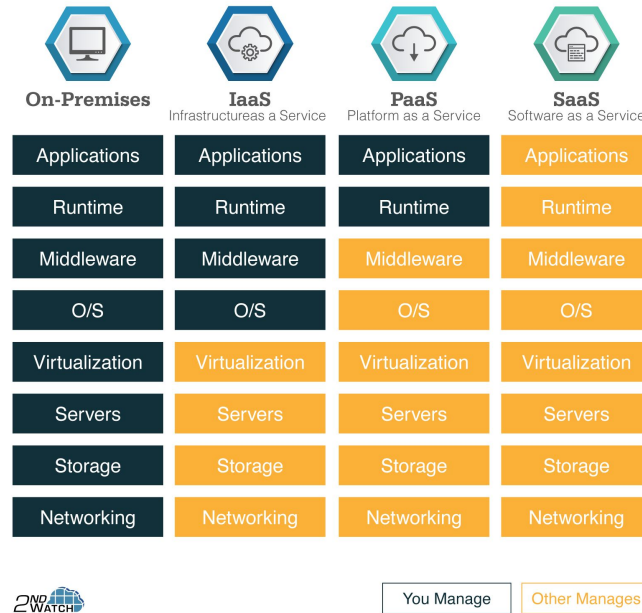
Since a company's cloud infrastructure is generally controlled by its service provider, there are times organizations have limited access to data.

And business customers have even less control than they might want, with limited access to applications, data, and tools stored on a server.

What could we do?

Disadvantages of Cloud Migration

Lower Control...



Questions

- What is Application Modernization?
- What is cloud native application?
- Does moving to cloud automatically grant a company the benefits of cloud(e.g. cost savings)?

Useful Links

<https://www.ibm.com/sg-en/topics/infrastructure>

[Customer Success Stories: Case Studies, Videos, Podcasts, Innovator stories \(amazon.com\)](#)

[Disadvantages of Cloud Computing - Cloud Academy Blog](#)

[Advantages of Cloud Computing - javatpoint](#)

[CapEx Vs. OpEx In Cloud Computing: What's The Difference? \(cloudzero.com\)](#)

[CapEx vs OpEx Cloud: What's the Difference? | TierPoint, LLC](#)

What's Next?



Activity Time

Work on one of the following based on the earlier video:

Research Problem	Answer
What is Application Modernization?	<i>Explain application modernization</i>
What does it mean to build cloud native software?	<i>Explain Cloud Native</i>

Time	What	How or Why
7:10pm - 7:30pm	Part 1 - Presentation	What is IT Infrastructure?
7:30pm - 7:45pm	Part 1 - Activity	Discuss in Breakout Rooms
7:45pm - 8:00pm	Part 1 - Activity	Class sharing
8:00pm - 8:05pm	Break	Break
8:05pm - 8:15pm	Part 2 - Presentation	Cloud Migration
8:15pm - 8:35pm	Part 2 - Activity	Discuss in Breakout Rooms
8:35pm - 8:55pm	Part 2 - Activity	Class sharing
8:55pm - 9:00pm	Break	
9:00pm - 9:50pm	Learners self attempt on assignments	
9:50pm - 10:00pm	Recap	

Disadvantages of Cloud Migration

Cloud Providers goes missing...

The cloud is still an evolving, albeit improving, technology that rapidly fluctuates. Some cloud services companies get it right and some don't. If a company goes out of business or sees a massive overhaul, that could be destructive to a business that relies on just one infrastructure for its entire database.

What could we do?