Carnegie Mellon University

14-848 Cloud Infrastructure

SPRING 2026

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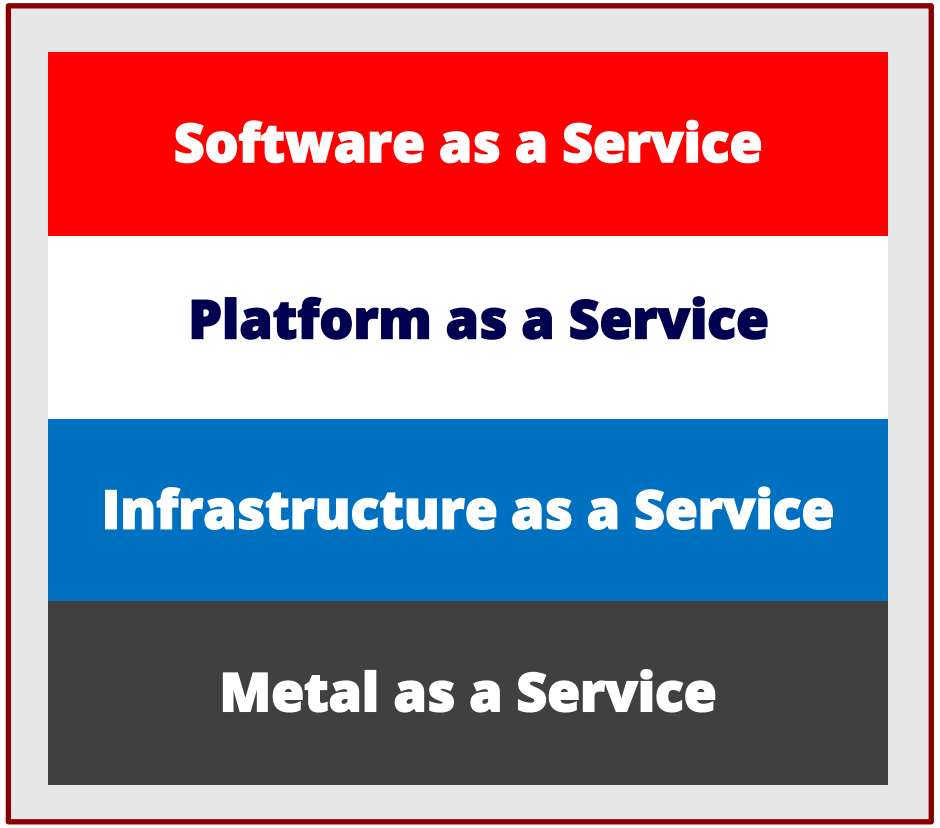
AGAI
Applied
Generative AI

Agenda

- Cloud Computing Service Models
- Cloud Types

Cloud Computing Service Models



When it comes to cloud services, we should think up of how much/ to what extent we can manage the services (users); on the other hand, how much of them is managed by the cloud provider (e.g. AWS Google Cloud).

SaaS: Software as a Service

- Provided with access to application software in the cloud
  - On-demand software
- Most applications can be run directly from web browser
- Largest cloud market
- **Examples:** Google Apps, Microsoft Office 365, Oracle's Netsuite, SAP's Concur, Cisco WebEx, GoToMeeting

You manage:
1. Configuration
2. Your data
3. User access

Provider manages:
Everything else (app, platform, infrastructure)

PaaS: Platform as a Service

Fast but difficult when doing migration (compared with SaaS)

- Provides computing platforms which typically includes operating system, programming language, execution environment, database, web server, etc. to build cloud applications.
- Applications using PaaS inherit cloud characteristic such as scalability, high-availability, multi-tenancy, SaaS enablement, and more.

- **Examples:** Google App Engine, AWS Elastic Beanstalk, Salesforce.com, Amazon EMR, MS Azure HDInsight, GCP Dataproc.

IaaS: Infrastructure as a Service

- Offers storage and computing resources that developers and IT organization use to deliver custom business solutions

- **Examples:** Amazon EC2, VMWare vCloud, GCP Compute Engine

Pros: The cost of migration is pretty low.
Cons: We have to desgin and upgrade eveything on our own.

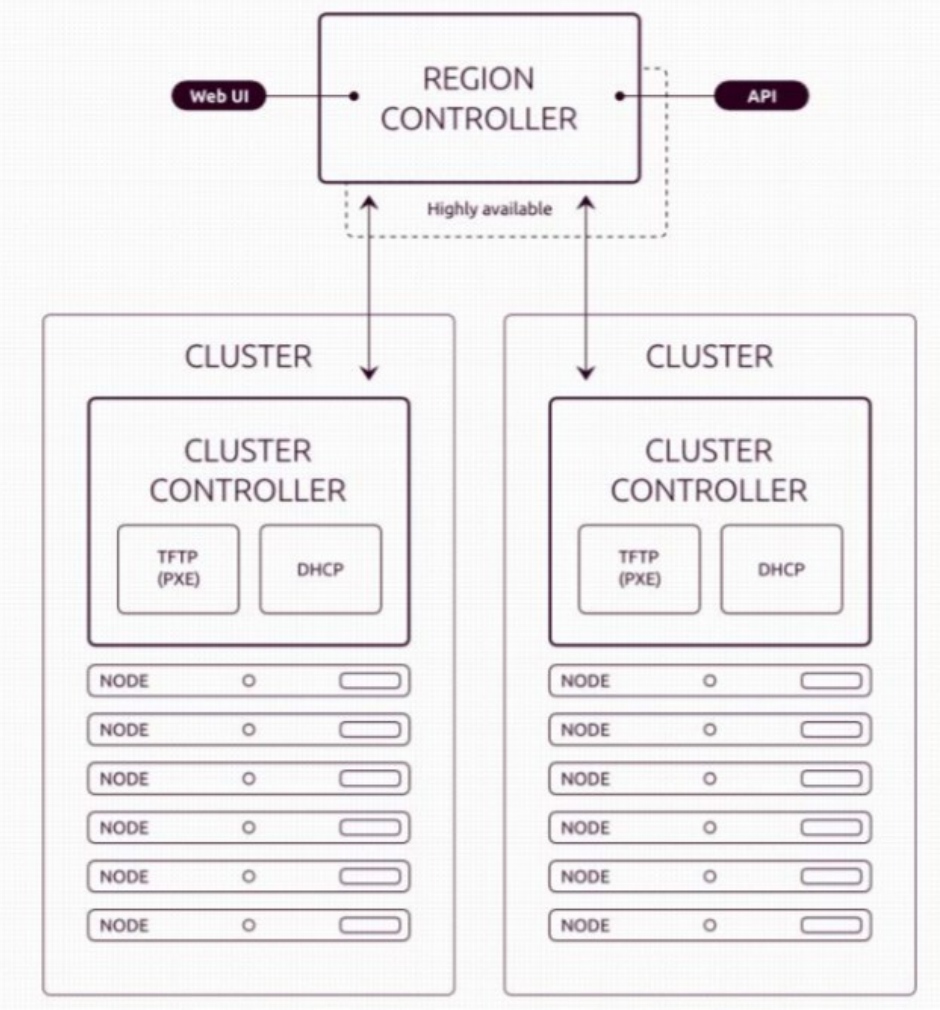
It may encounter some security issues.

MaaS: Metal as a Service

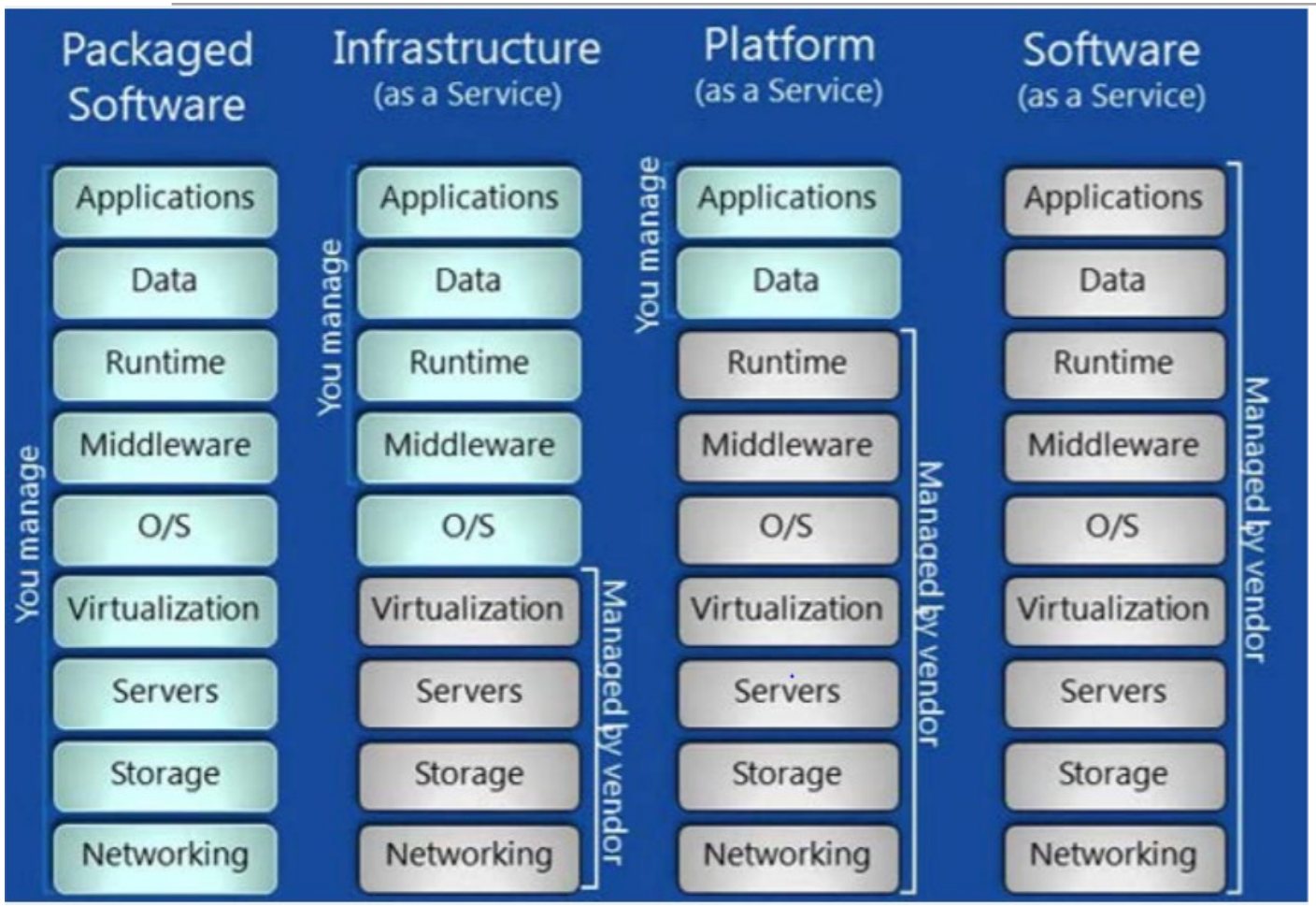
- Combines the flexibility and scalability of the cloud with the ability to harness the power of physical servers.
- **Example:** Juju

You have full access to hardwares.
- you're renting a machine

- For more information, watch this video (optional): https://www.youtube.com/watch?time_continue=280&v=FBCKCO45xIw



Cloud Computing Service Models



In MAAS

- You will have the option to control everything!

PaaS or IaaS?

Vendor Lock-in = 你在某個雲端環境中「管理的東西」，能不能容易搬到另一家雲端。

Vendor Lock-in: the ability to use “what you manage” in cloud environment with different cloud provider.

- PaaS may lock-in applications by requiring users to develop apps based on their specific APIs.
- If you are using PaaS, it might be difficult to switch to different vendor.

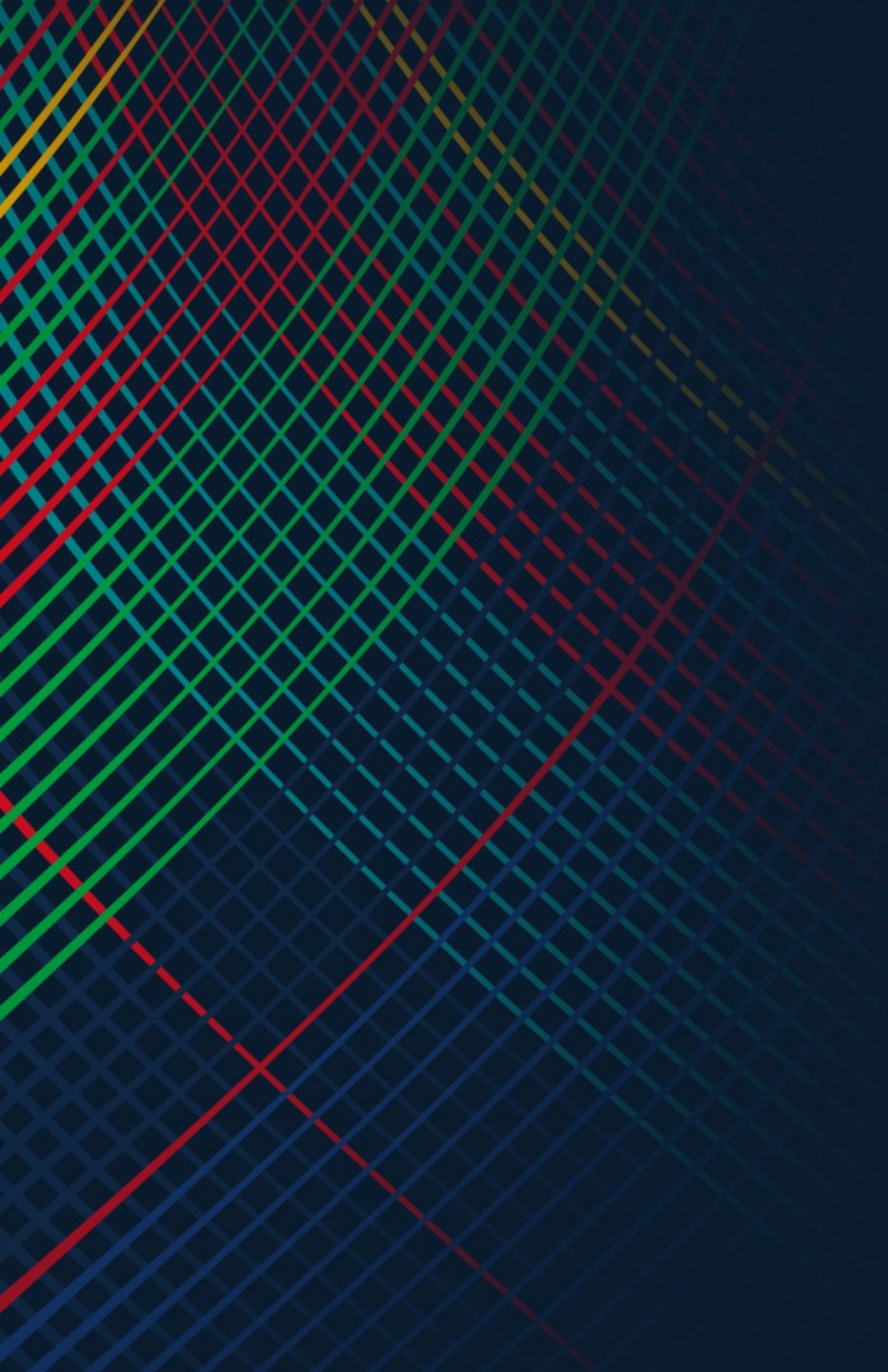
Development Tools

- PaaS providers usually allow a set of development tools for their users to shorten development time.
- Another trick for vendor lock-in!

Cloud Infrastructure Enablers

Data Center + Virtualization

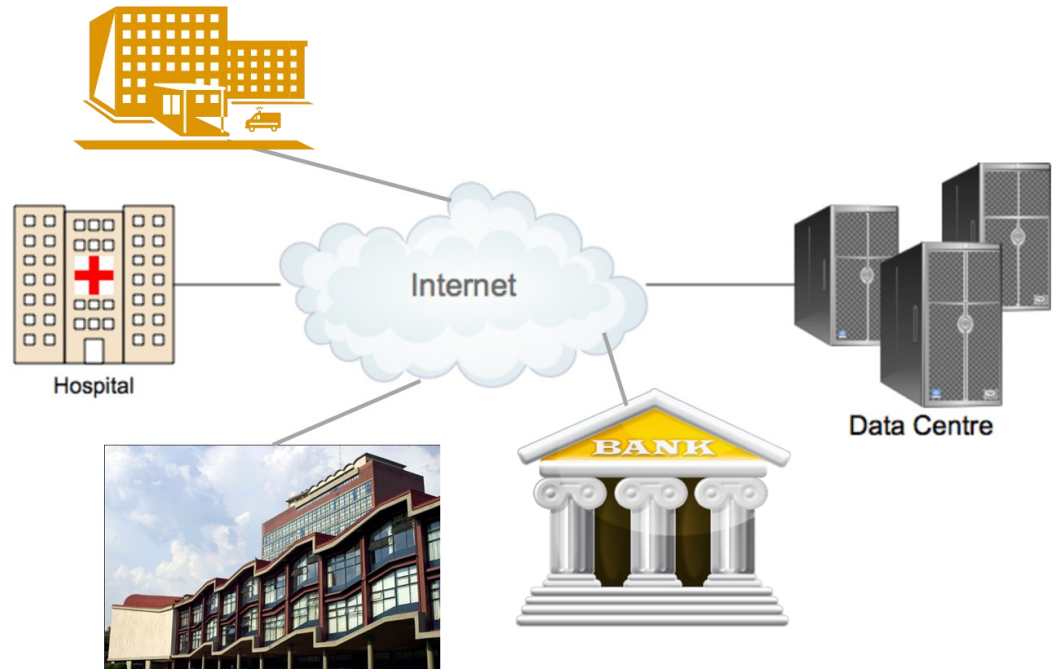
(Hardware) (Software)



Cloud Types

Public Cloud

- Public cloud services are made available to the public.
- Typically, public clouds are owned by an organization selling cloud services.
- Public clouds exist on the premise of the cloud service provider.



Public Cloud – Cont'd

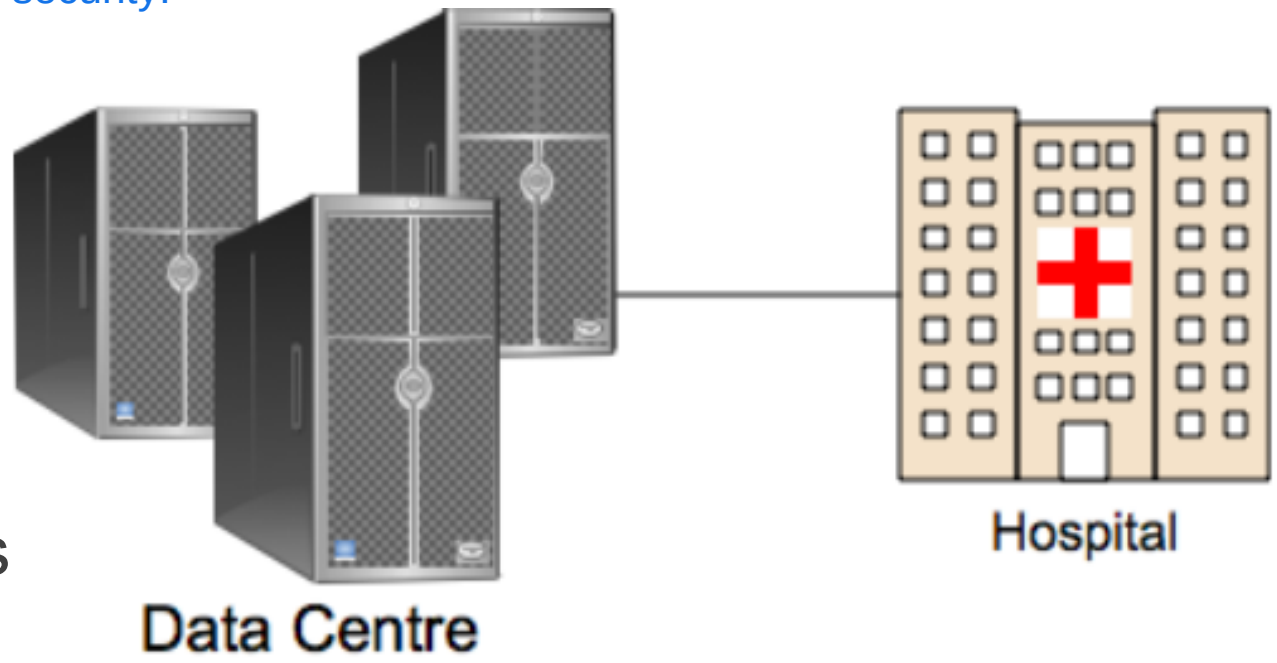
- The major advantage of the public cloud is **cost**.
- A subscribing member or organization only pays for the services and resources that are needed.
- The main concern with public cloud is **security**. However, there are some public cloud providers that have demonstrated strong security controls.

I cannot even see where my data is stored.....

Private Cloud

- Private clouds are implemented within the internal IT environment of the company.
- Private clouds are typically managed by the company or a third-party vendor.
- In private clouds, the servers and storage devices may exist on premise or off premise.

I own the data center.
Though it's connected to hospitals, I have full control over the data security.



Private Cloud - Cont'd

- Private clouds can deliver IaaS internally to employees or business units through an intranet or the Internet via a virtual private network (VPN), as well as software (applications) or storage as services to its branch offices.
- Examples of services delivered through the private cloud include database on demand, email on demand, and storage on demand.
- A key motivation for opting-in for a private cloud is **security**. A private cloud infrastructure offers tighter controls over the geographic location of data storage and other aspects of security. Other benefits include **easy resource sharing and rapid deployment to organizational entities.** But more expensive vs. Public Cloud

Do you remember?! Cost Savings in Cloud

Consider the following scenarios for resource deployment:

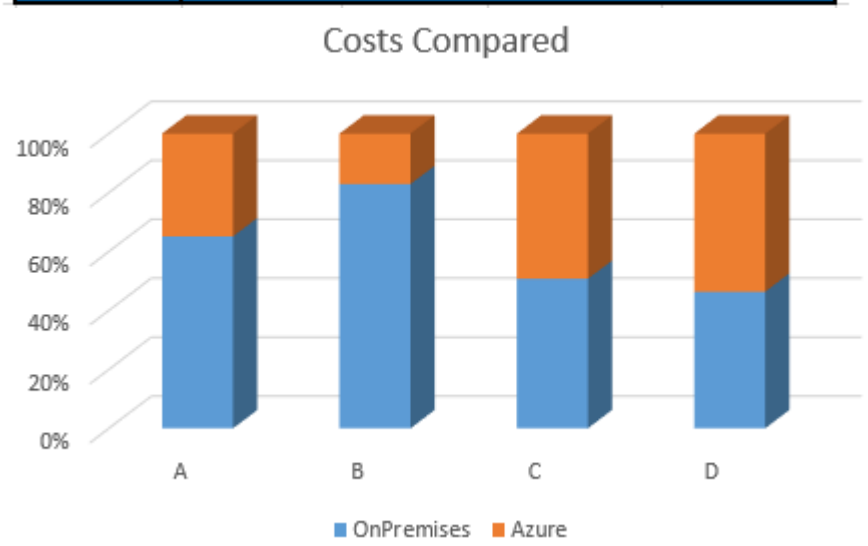
A. Modest Deployment

B. Tiny Deployment

C. Enterprise

D. Very Large Enterprise

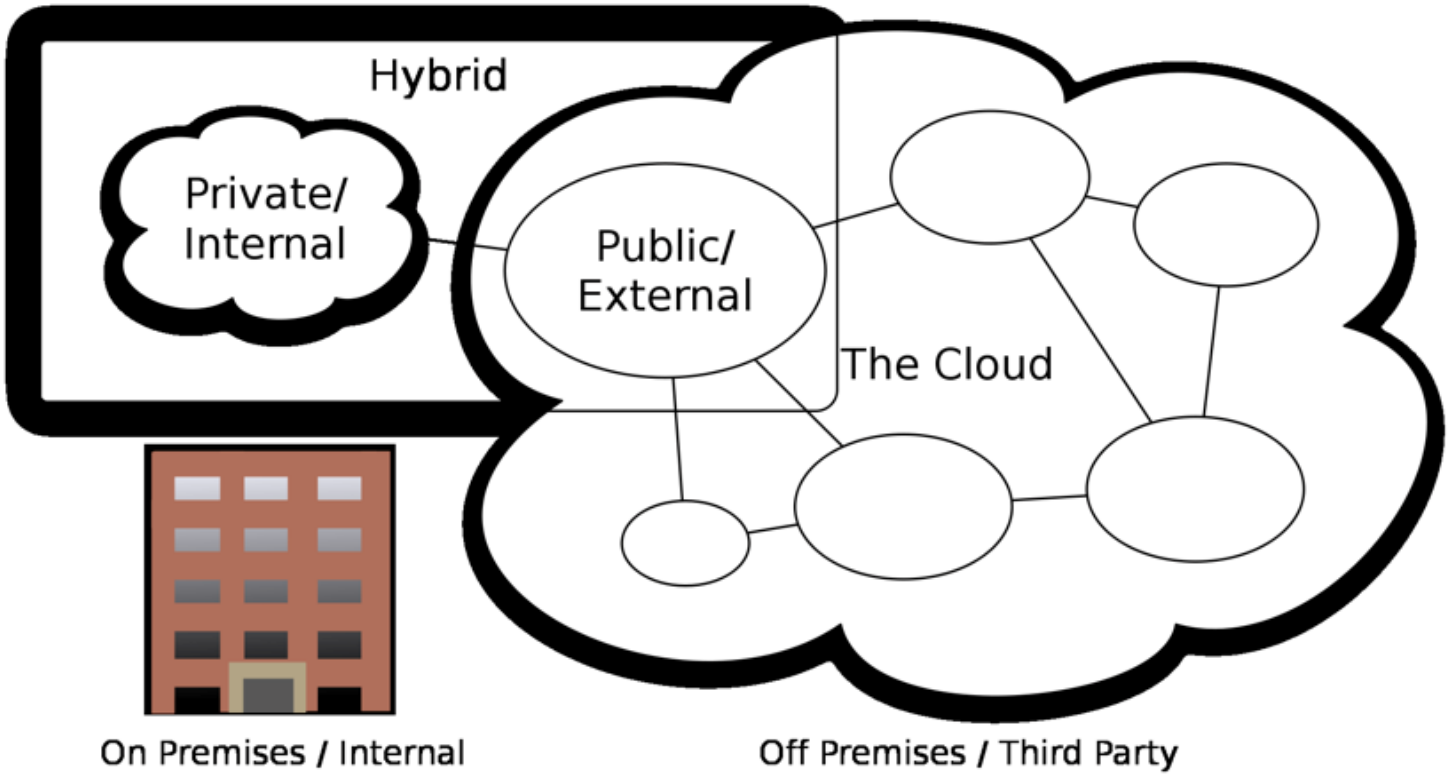
Scenario	A	B	C	D
Small VM	20	4	200	500
Medium VM	40	10	750	1750
Large VM	10	2	150	750
Storage (TB)	10.9	2.5	171.9	468.8



Full analysis could be found here:
https://kvaes.wordpress.com/2017/02/22/comparing-costs-is-cloud-more-expensive-than-an-on-premises-setup/

Hybrid Cloud

The hybrid cloud infrastructure is a composition of a public and a private cloud



Hybrid Cloud – Cont'd

- In Hybrid Cloud, constituting private and public clouds are bound together by standardized technology that enables data and application portability (e.g., cloud bursting for load balancing between clouds).
- With a hybrid cloud solution, sensitive information can be placed in a private area of the cloud, and less sensitive data can take advantage of the benefits of the public cloud.
- Using a hybrid cloud requires proper management of data transfers and replication between public and private clouds.

Comparison of Cloud Types

	Private	Public	Hybrid
Scalability	Limited	Very high	high
Security	Most secure option	Moderately secure	Very secure
Performance	Very good	Low to medium	Good
Reliability	Very high	Medium	Medium to high
Cost	High	Low	Medium

Q. Cloud Service Model and Cloud Type Exercise

Consider the following scenario:

- You're developing a product that handles patients' medical appointments, not including their sensitive data. Since the product is still in its early stages, your budget is limited, but you’re looking for the fastest possible time-to-market by leveraging existing developer tools and frameworks, while giving you control over the data storage mechanisms.
- Which cloud service model and cloud type option would be most appropriate for your company to use under these circumstances?

Waitlisted Students

- All materials for first two weeks will be uploaded here