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

Software as a Service

Platform as a Service

Infrastructure as a Service

Metal as a Service
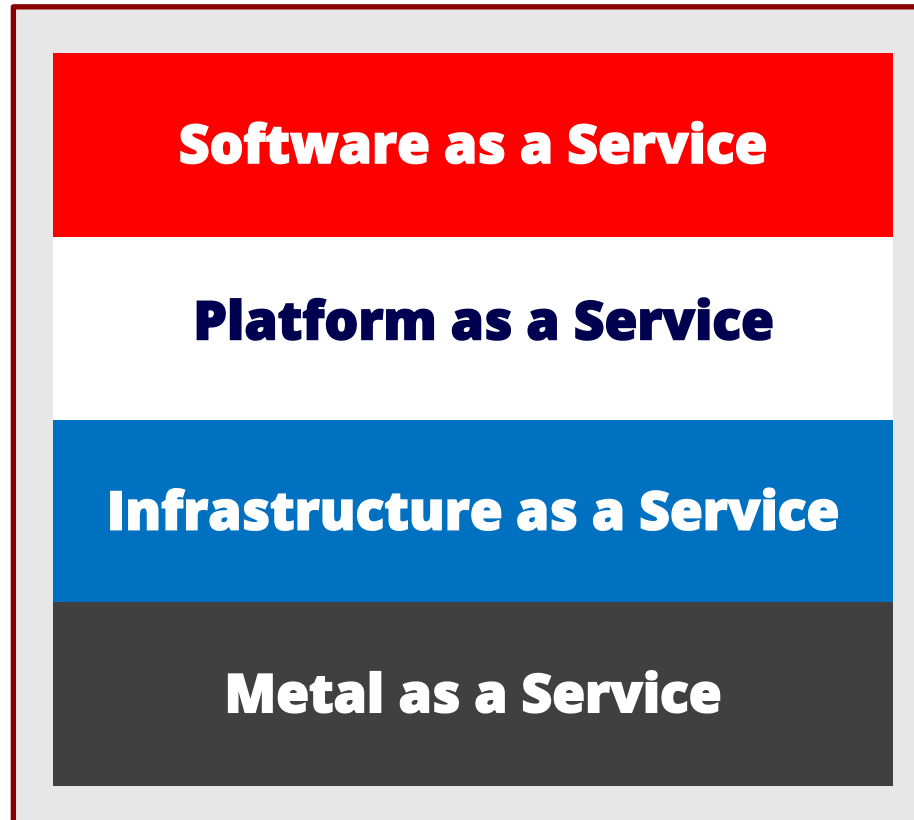
SaaS: cloud
enguploaded some
documents, use
application to store
data

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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

Cloud engineer uploads some documents, use application to store data, give documents to users

Software
(as a Service)

| Applications |
| Data |
| Runtime |
| Middleware |
| O/S |
| Virtualization |
| Servers |
| Storage |
| Networking |

Managed by vendor

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PaaS: Platform as a Service

- 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.

Platform
(as a Service)

You manage

- Applications
- Data

Managed by vendor

- Runtime
- Middleware
- O/S
- Virtualization
- Servers
- Storage
- Networking

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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

```
Cloud engineer gets an machine(virtualization), install OS and applications, provide
application to users.
pros: easy to transfer to other provider
cons: you need handle a lot of things yourself

data breach may happen
```

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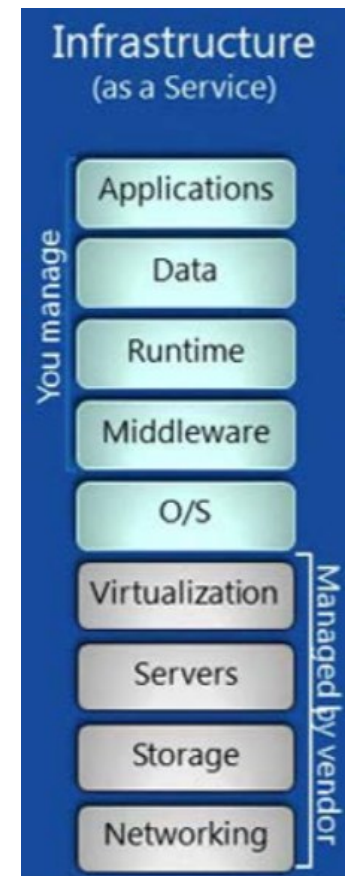
MaaS: Metal as a Service

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

- **Example:** Juju

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

  I will know the exact physical location of the machine. Have full access to hardware.
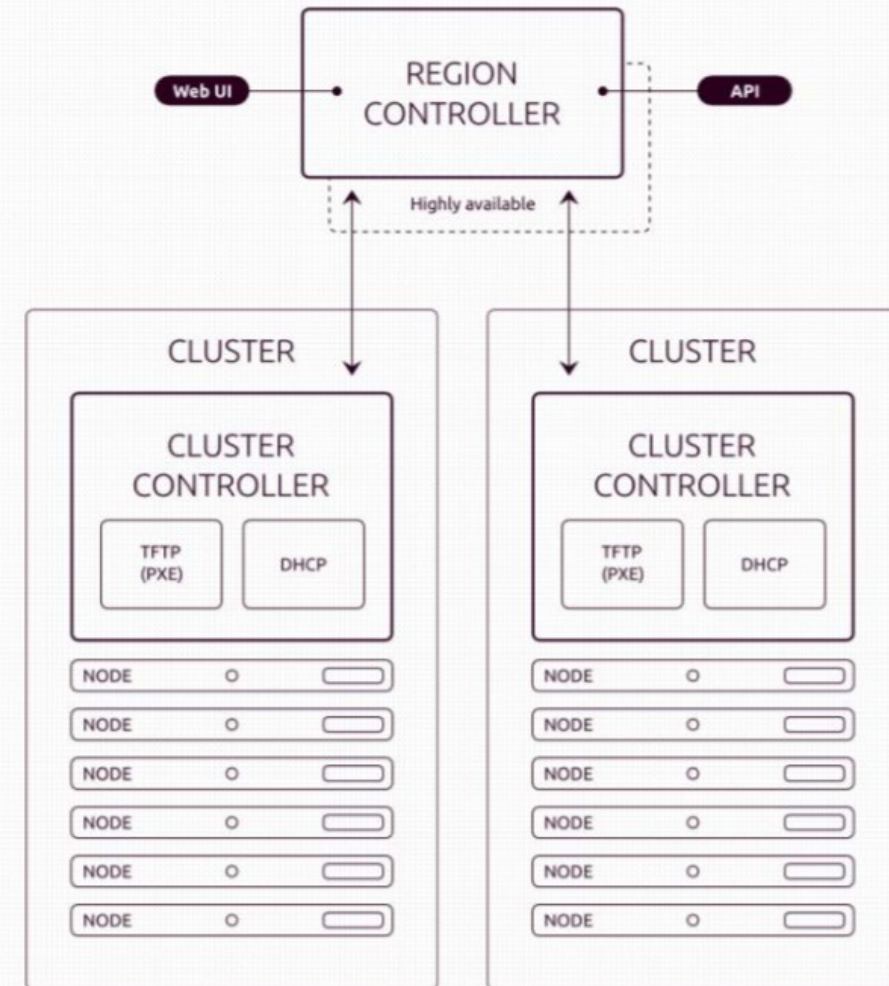
Cloud Computing Service Models
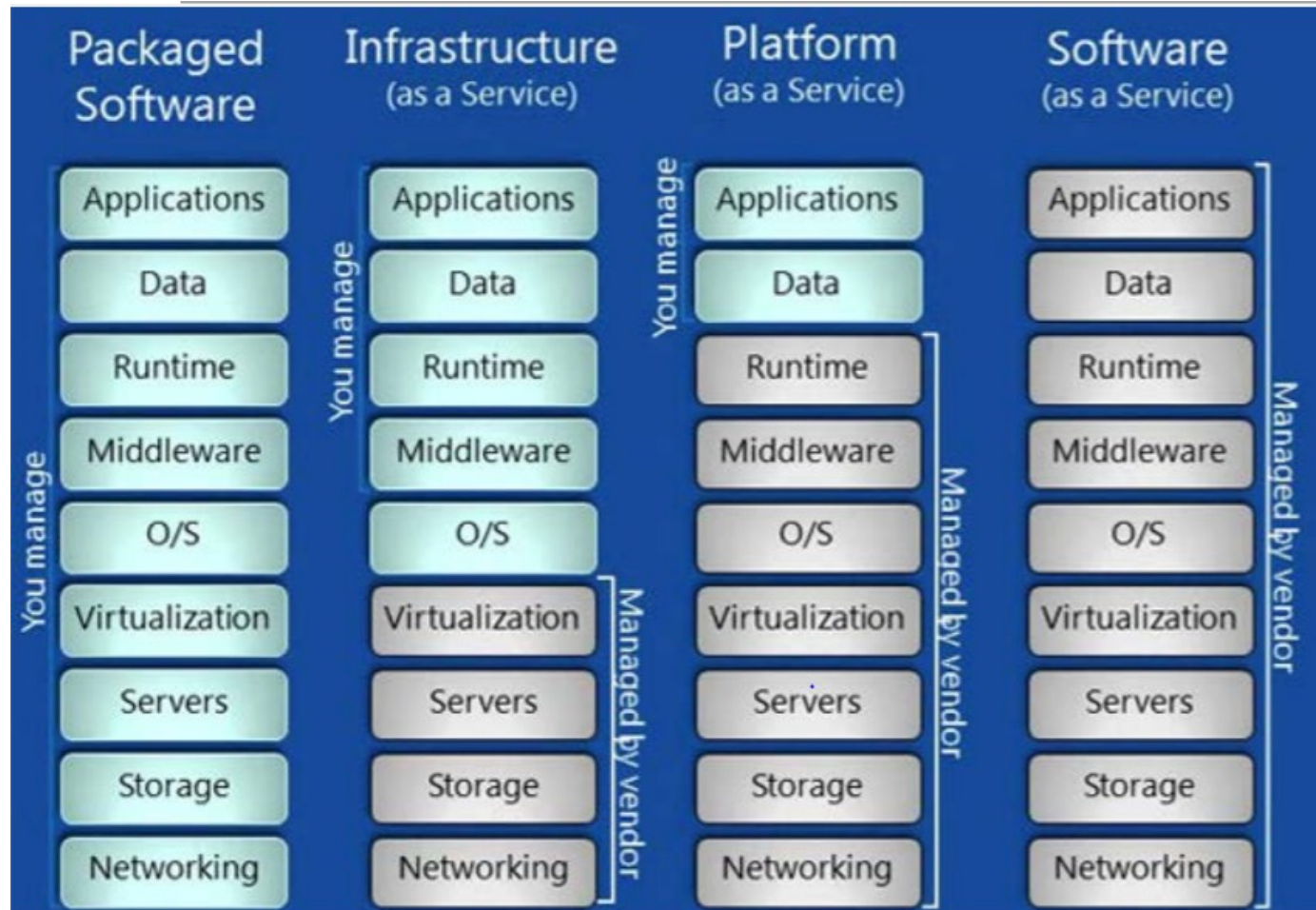
In MAAS
- You will have the option to control everything!

PaaS can manage Data:
control data model/
pattern
not physical storage

PaaS or IaaS?

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!

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Cloud Infrastructure Enablers

Data Center + Virtualization

(Hardware)   (Software)

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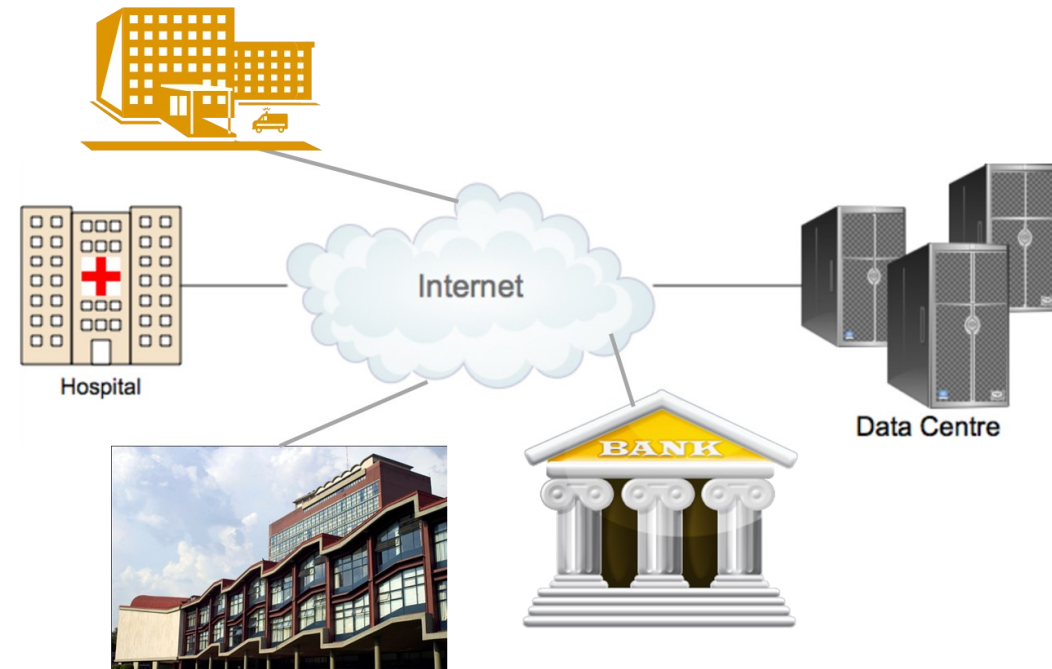
Cloud Types

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.

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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.

`multi tenacy: share machine with other users`

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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.

Data Centre

Hospital
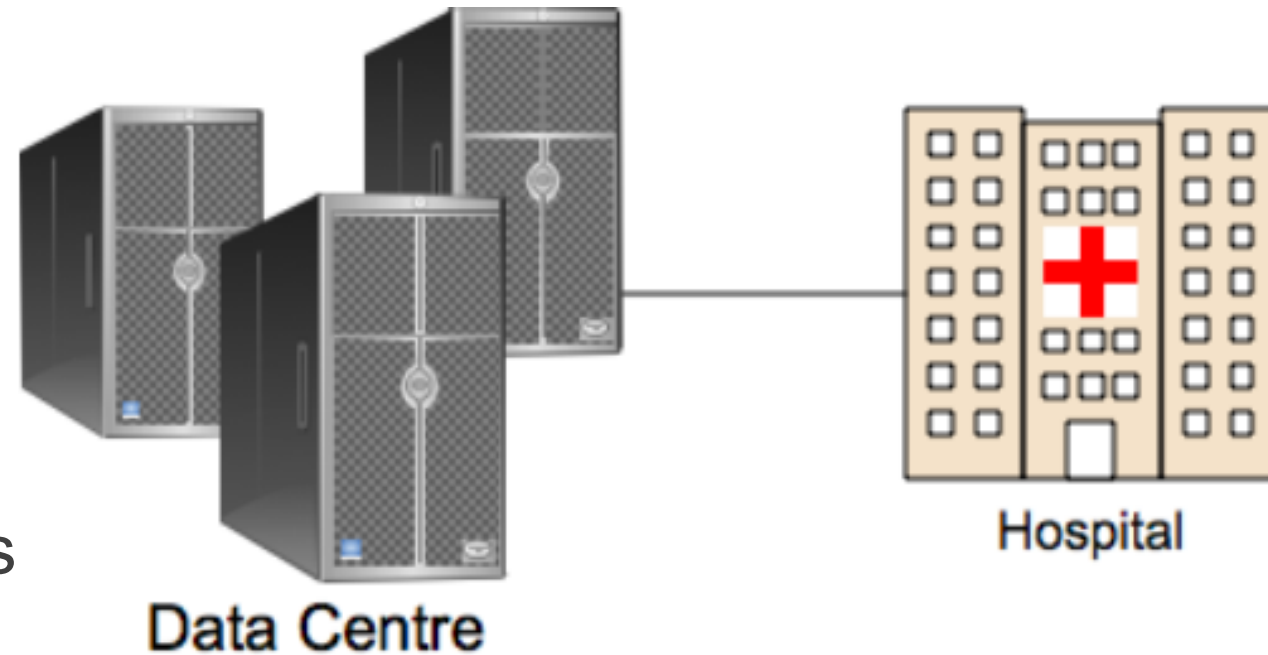
Private Cloud - Cont'd

- 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.**
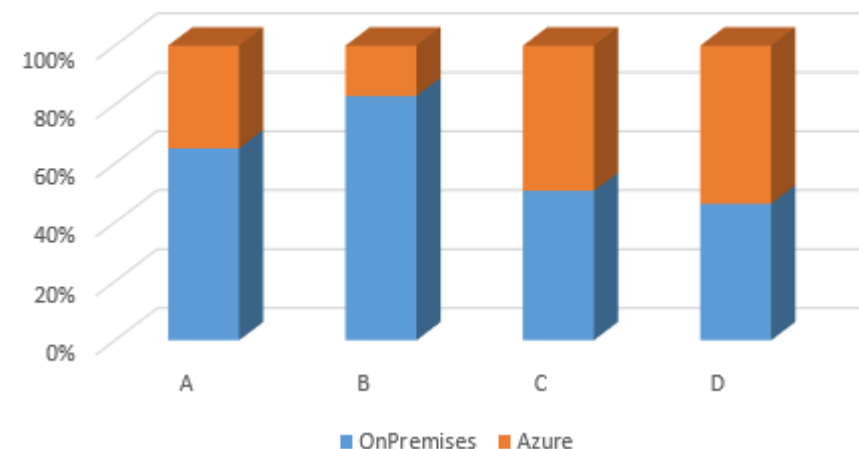
Do you remember?! Cost Savings in Cloud

Consider the following scenarios for resource deployment:

A. Modest Deployment

B. Tiny Deployment

C. Enterprise

D. Very Large Enterprise

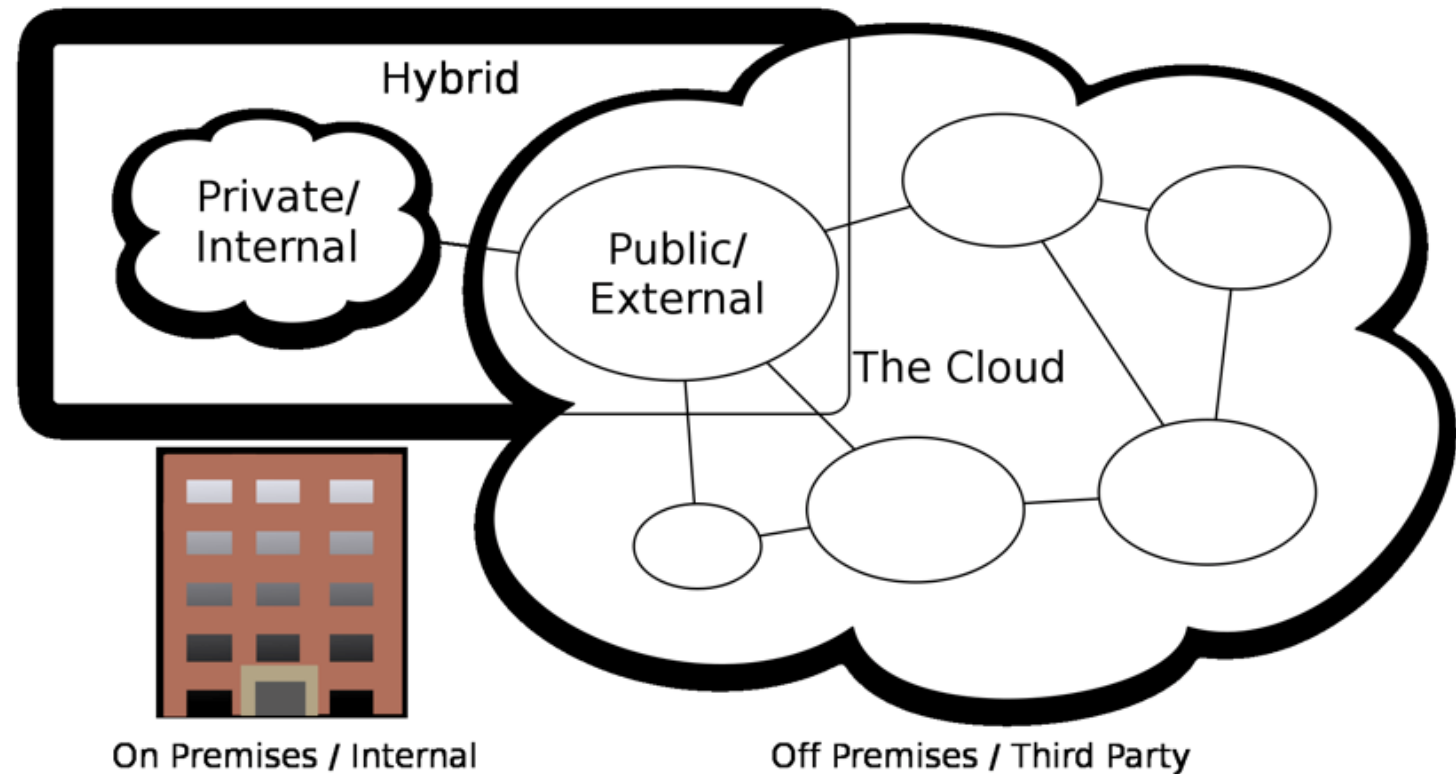| Scenario	A	B	C	D
Small VM	20	4	200	500
Medium VM	40	10	750	1750
Large VM	10	2	150	750
Storage (TB)	10.9	2.5	171.9	468.8

Costs Compared

■ OnPremises ■ Azure

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

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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? PaaS, public cloud

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Waitlisted Students

- All materials for first two weeks will be uploaded here