THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

COMPX527-25B

Lecture 1.2 Introduction to Cloud Computing

Announcements

- **Quiz 1:**
  - Open: 10th July-12:30 pm
  - Close: 17th July-12:30 pm

- **Group Project Proposal:**
  - Deadline: 28th July – 8:00 am

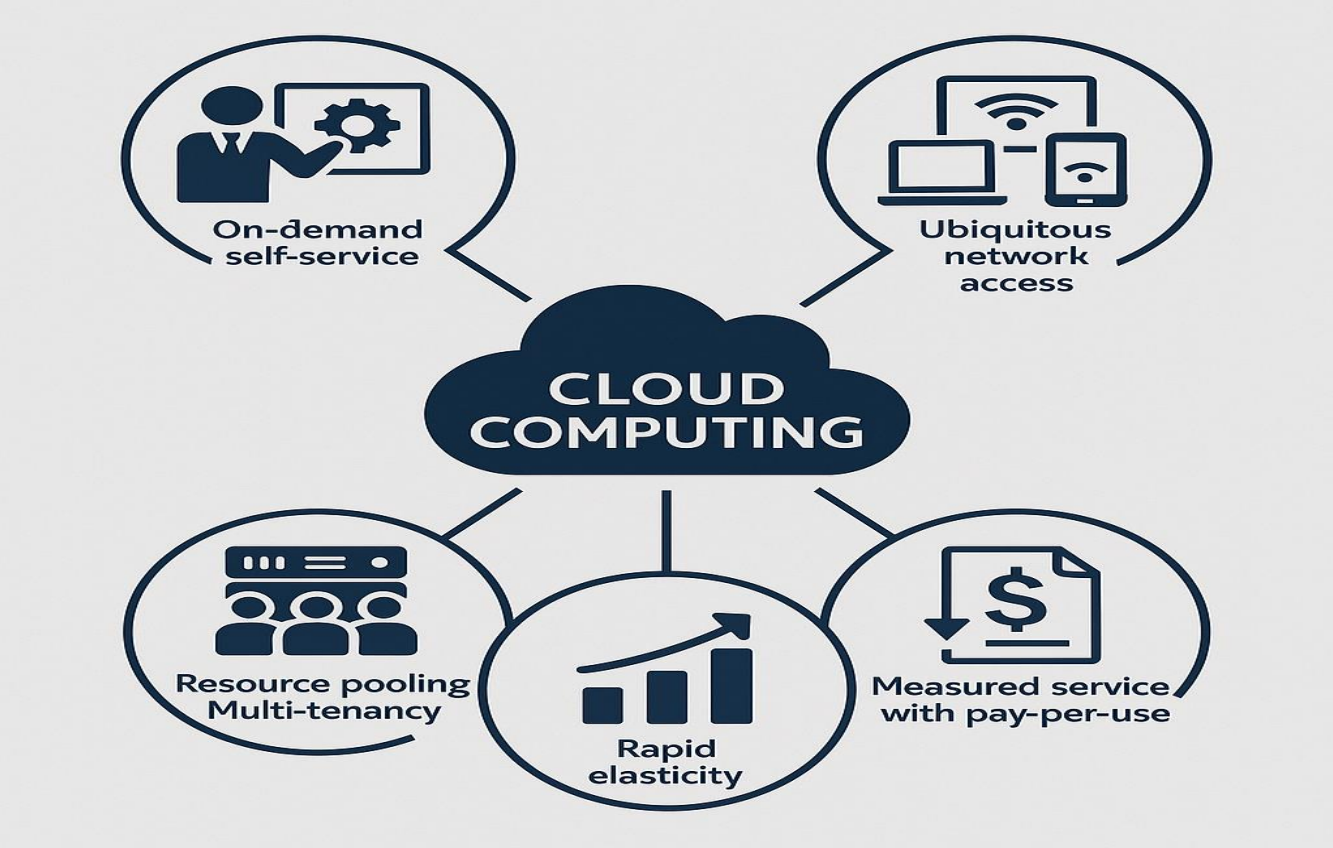
WHAT IS CLOUD COMPUTING?

Computing as a service

NIST Definition

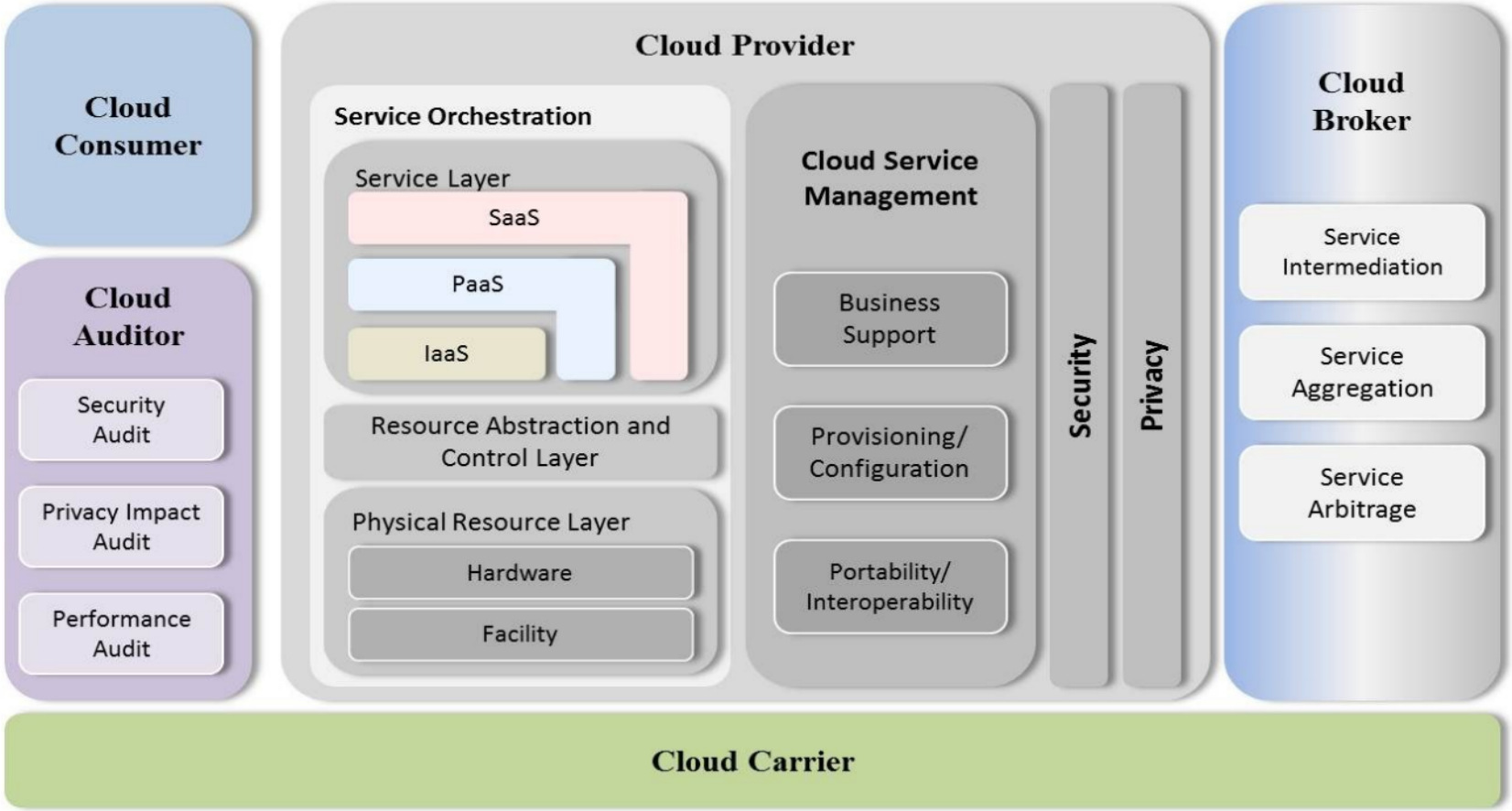
- The National Institute of Standards and Technology (NIST) defines cloud computing as "a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction."

Essential Characteristics



Src: NIST SP 800-145, The NIST Definition of Cloud Computing

NIST Cloud Computing Reference Architecture



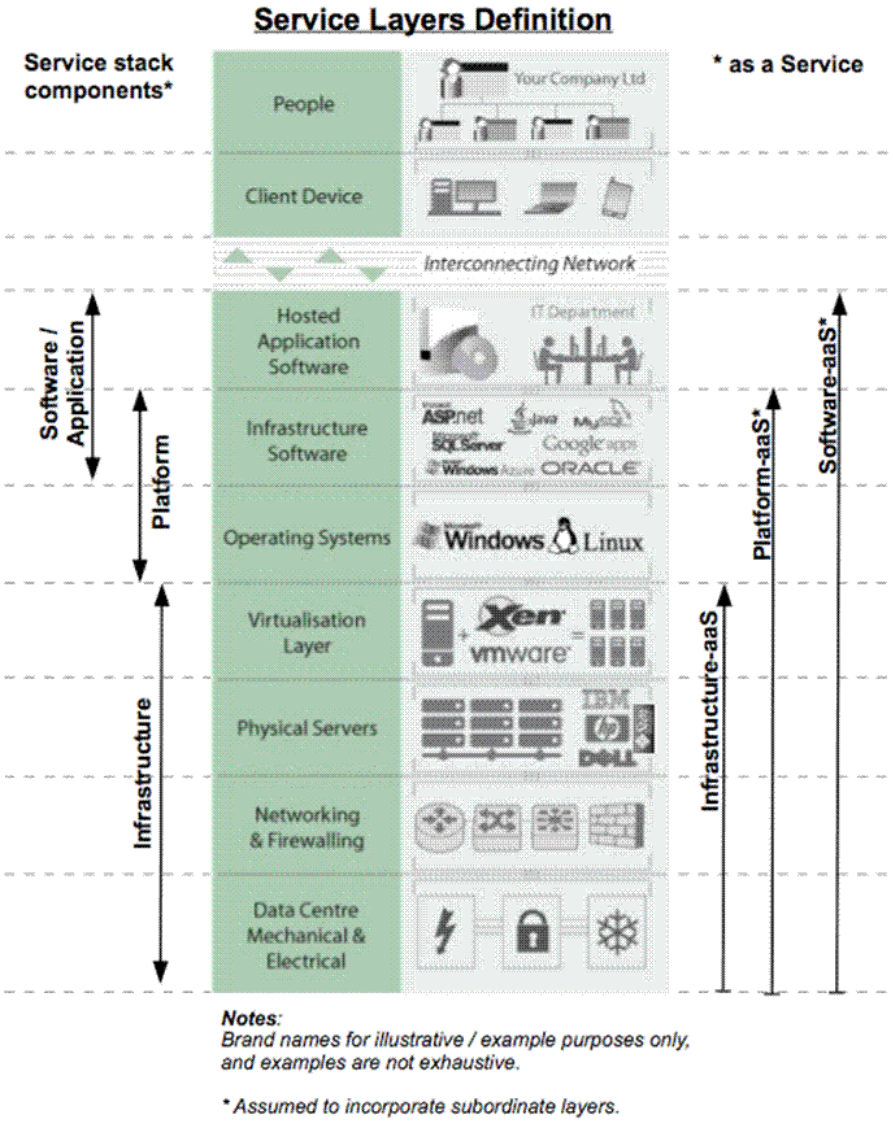
src: http://www.nist.gov/itl/cloud/upload/SP_500_293_volumeII.pdf

NIST Cloud Computing Reference Architecture

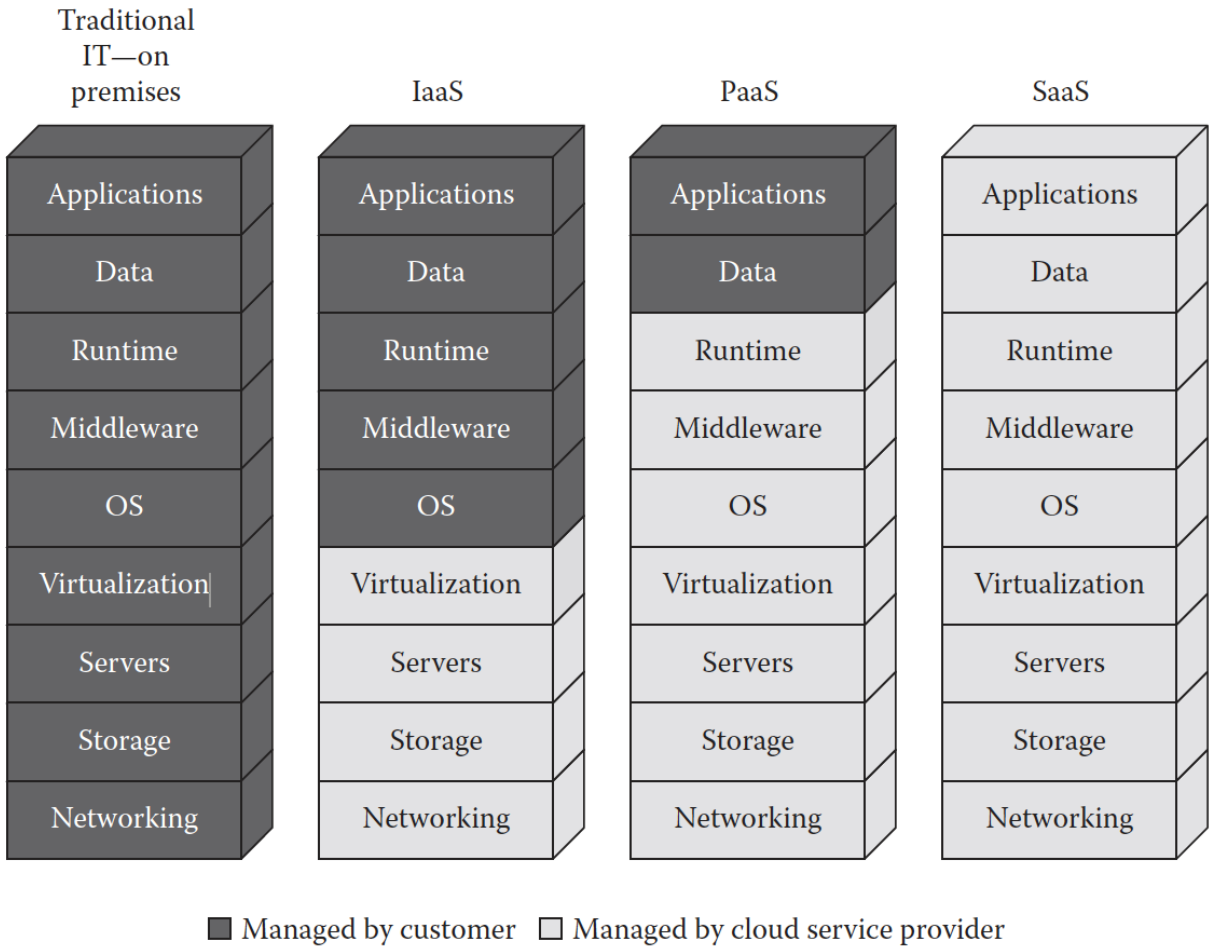
- The reference architecture describes a conceptual model comprising abstract architectural elements and their relations or interactions, such as
  - Cloud computing actors and how they interact with each other in their activities;
  - System components and how these components are orchestrated to deliver the computing services;
  - Management functionalities that are required to support the life cycle of operations; and
  - Other cross-cutting aspects such as security and privacy associated with these elements

Cloud Service/Delivery Models

- Infrastructure as a Service
- Platform as a Service
- Software as a Service



Separation of Responsibilities



Saas from the end users' view

Paid Examples:

- Salesforce.com
- Xero
- Apple iCloud

'Free' Examples:

- TVNZ OnDemand
- Facebook
- Gmail

Paas From the End-Users' View

Examples:

- Microsoft Azure – Operating System, Database Server, etc.. , IBM Bluemix, …

Iaas From the the End-Users' View

Examples from Amazon

- EC2 (Elastic Compute Cloud) - Compute
- S3 (Simple Storage Service) - Storage

Xaas - Everything as a Service

Examples:

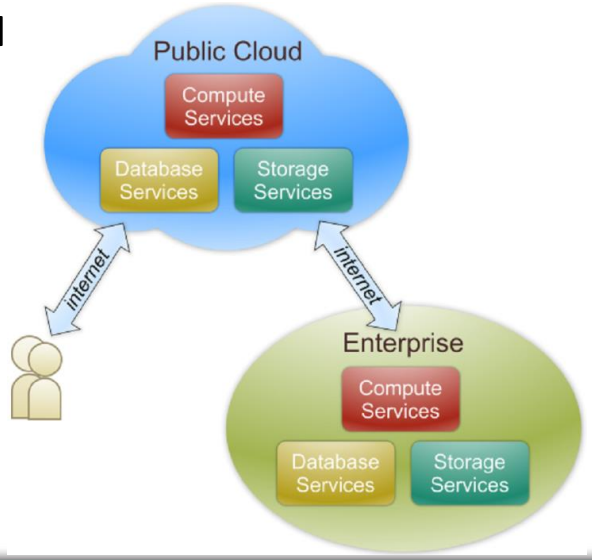
- Network-as-a-Service
- Database-as-a-Service
- Functions-as-a-Service
- Security-as-a-Service

Cloud Deployment Models

- Public Cloud
- Private Cloud
- Hybrid Cloud
- Community Cloud

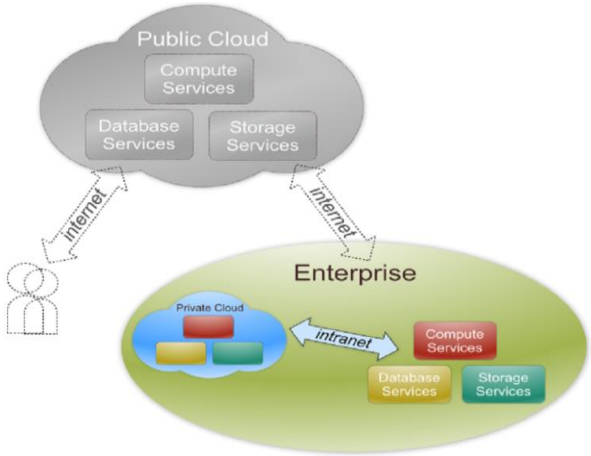
Public Cloud

- The cloud infrastructure is made available to **general end-users** and is owned by an organization selling cloud services.
- Also known as external cloud or multi-tenant cloud, this model essentially represents a cloud environment that is openly accessible.
- Basic characteristics :
  - No wasted resources-pay as you
  - Open to the public
  - Common policies
  - Leased or rented infrastructure
  - Easy and inexpensive setup



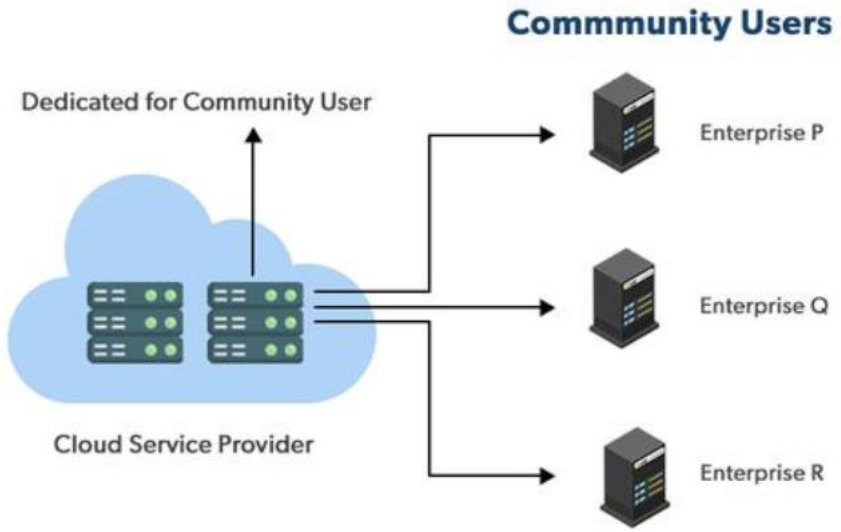
Private Cloud

- The cloud infrastructure is operated **solely** for an organization.
- Also referred to as internal cloud or on-premise cloud- limits access to its resources to service consumers that belong to the same organization that owns the cloud.
- Basic characteristics :
  - Increased control over data, and system
  - Customized and tailored policies
  - Dedicated resources



Community Cloud

- The cloud infrastructure is shared by **several** organizations and supports a specific community that has shared concerns (e.g., mission, security requirements, policy, and compliance considerations).



https://www.geeksforgeeks.org/types-of-cloud/

Hybrid Cloud (Federated Cloud)

- The cloud infrastructure is a **composition** of two or more clouds (private, community, or public).
- Unique entities are bound together by standardized or proprietary technology that enables data and application portability

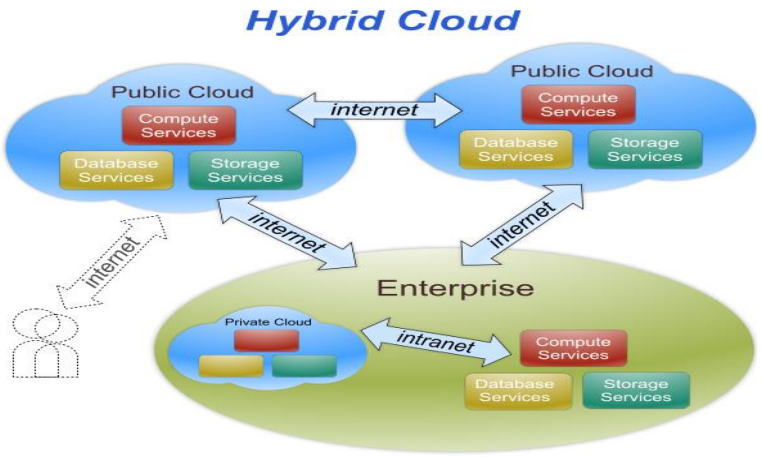


TABLE 2.2 Comparison of Cloud Deployment Models

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

For End-Users: Compute

	Traditional	With Cloud Computing
Hardware Requirement	*User needs to buy powerful hardware*	*Only basic hardware to connect to internet*
Software Requirement	*Install application in local computer*	*No local installation required*
Portability	*Hard to be portable*	*Natively portable*

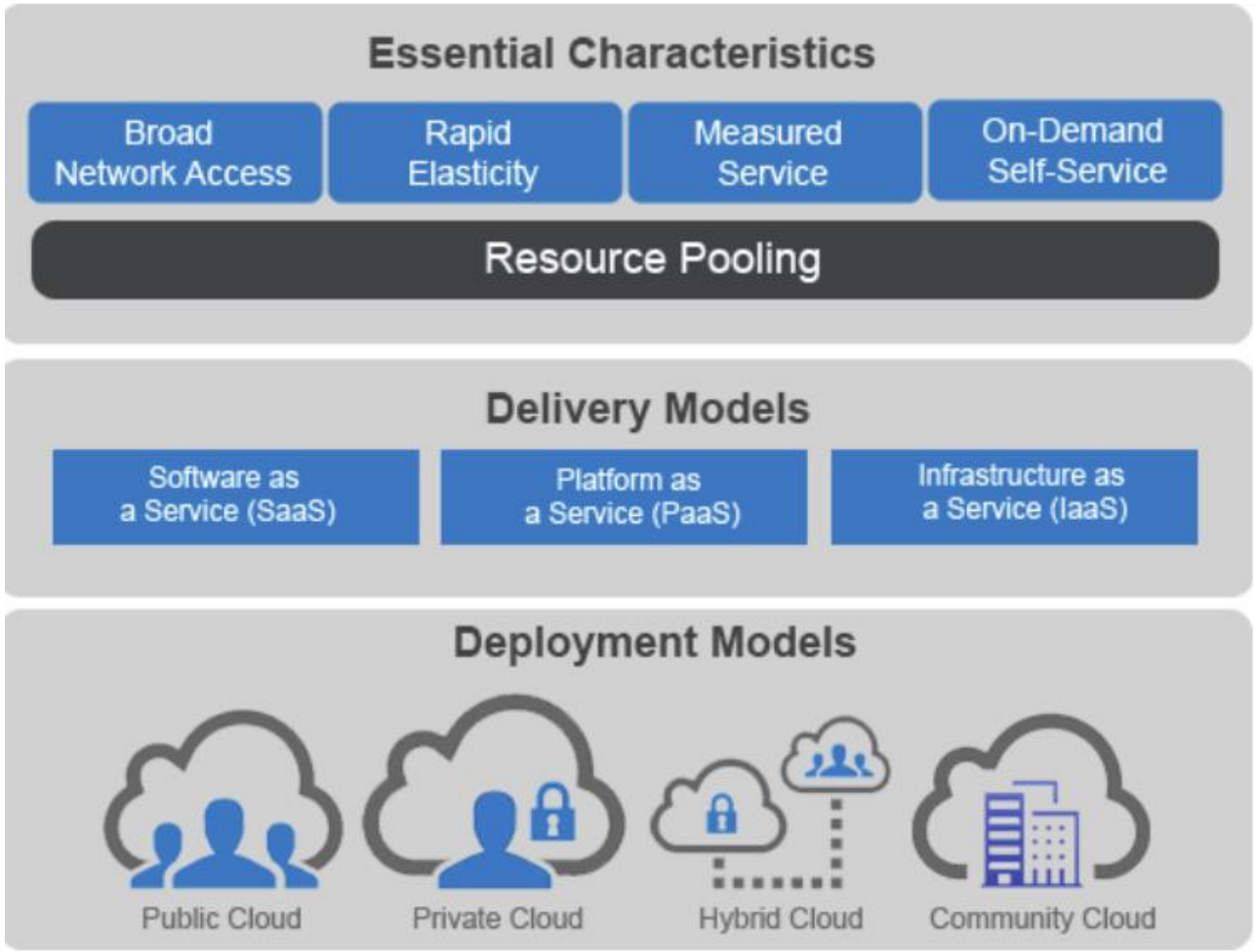
For End-Users: Storage

	Traditional	With Cloud Computing
Storage Space	*Limited to local disk, may be under utilized*	*Dynamically allocated on demand*
Storage Data Consistency	*Difficult to maintain data consistency*	*Data consistency maintained by cloud*
Availability	*Regular user backup*	*Cloud service guarantee*

For End-Users: Devices

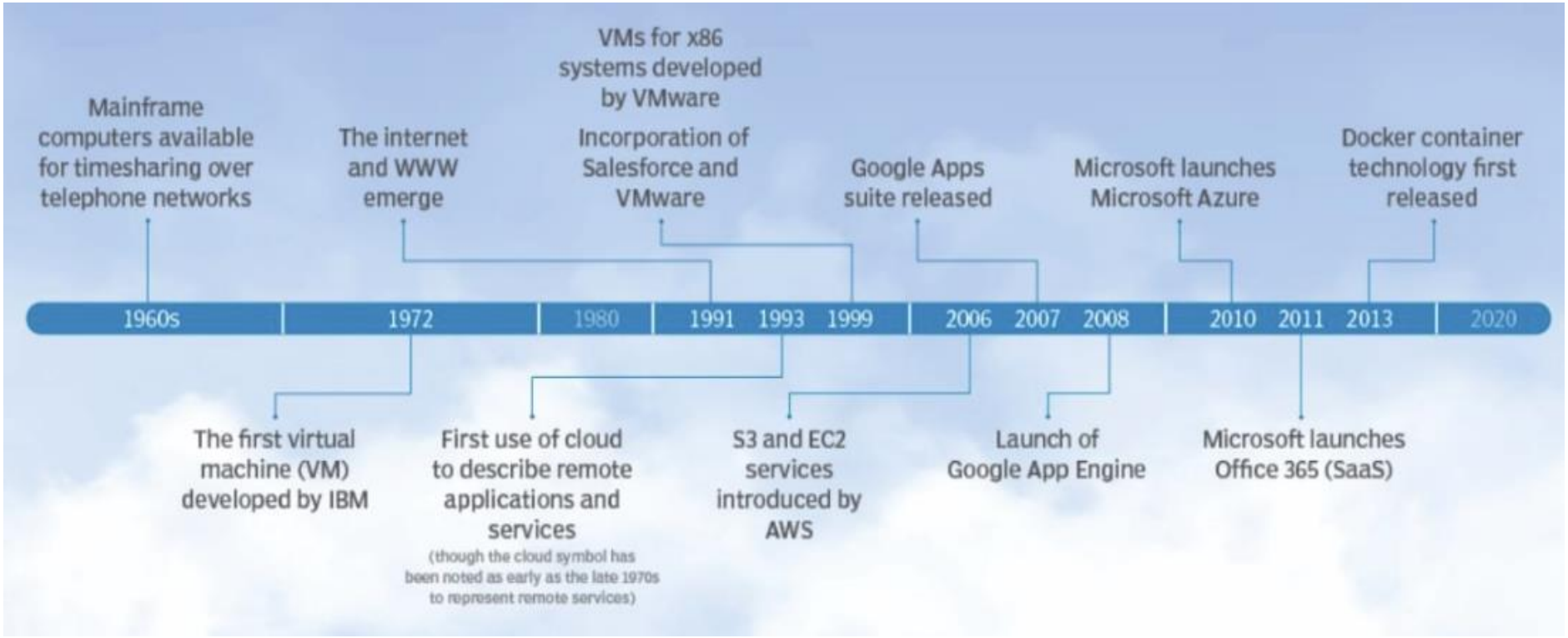
	Traditional	With Cloud Computing
Computing Power	*Only accessed through desktop computer*	*Accessed through small smart devices*
Small Device Intelligence	*Functionalities was limited due to their power consumption*	*Shift computing incentive jobs into cloud, and then wait for results*

Conclusions



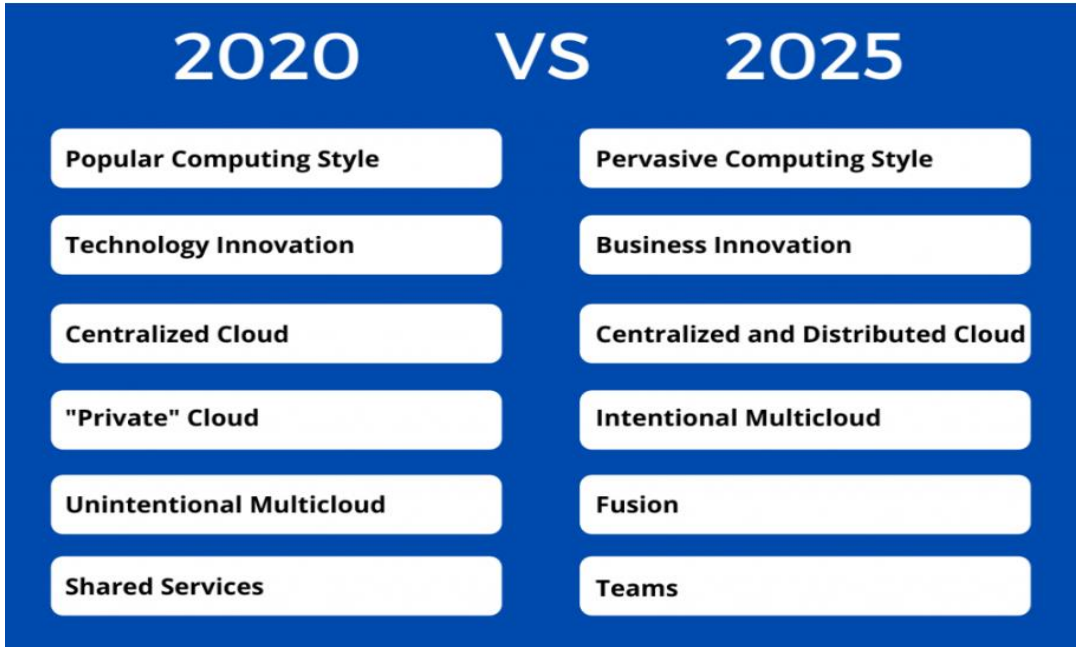
https://www.kreyonsystems.com/cloudcomputing.aspx

History



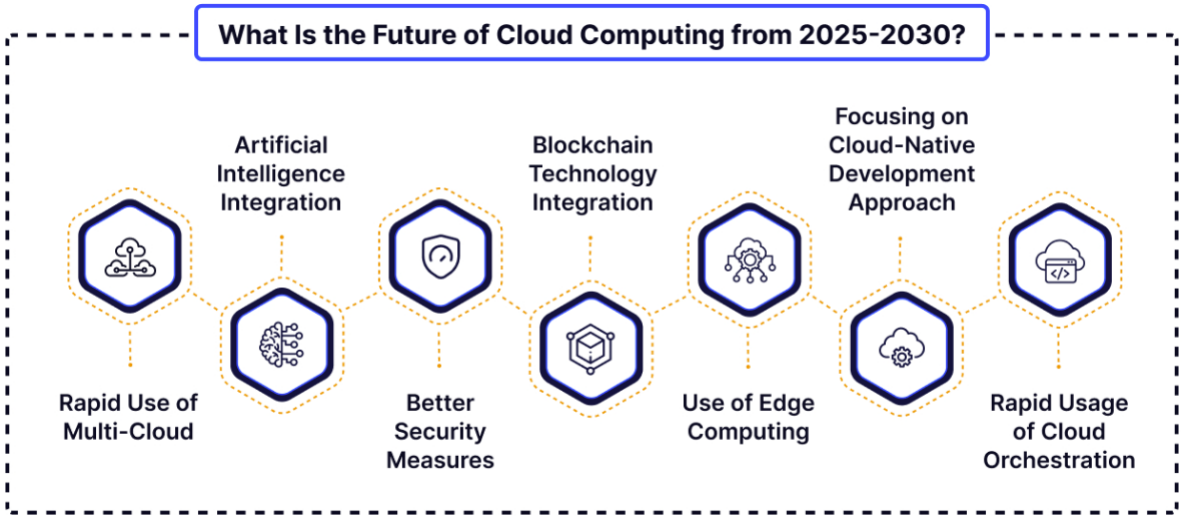
https://www.igmguru.com/blog/best-cloud-computing-services

Cloud shifts from 2020 - 2025



https://www.seasiainfotech.com/blog/history-and-evolution-cloud-computing/

Future of Cloud Computing



https://www.clouddefense.ai/future-of-cloud-computing/

References

- Alex Kilpatrick and Mary Haskett “Cloud 101: Basics of Using and Controlling Cloud Based Applications”

- Anonymous authors, “Introduction to Cloud Computing”

- William Stallings, “Overview of Cloud Computing”