Cloud Computing

CHAPTER 1

WHAT IS CLOUD COMPUTING?

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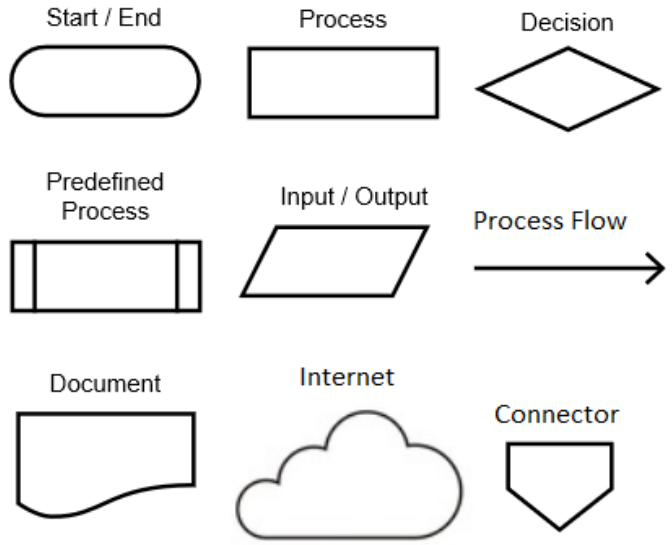
What is Cloud Computing?

Broad term that simply means delivering computing services---servers, databases, storage, networking, software, data analytics, security solutions, organizational systems, virtual computers, and much more---over the Internet.



Originates from the 'Cloud' symbol used in flow charts and diagrams to symbolize the Internet.

Why Cloud Computing?

Result of the perfect storm

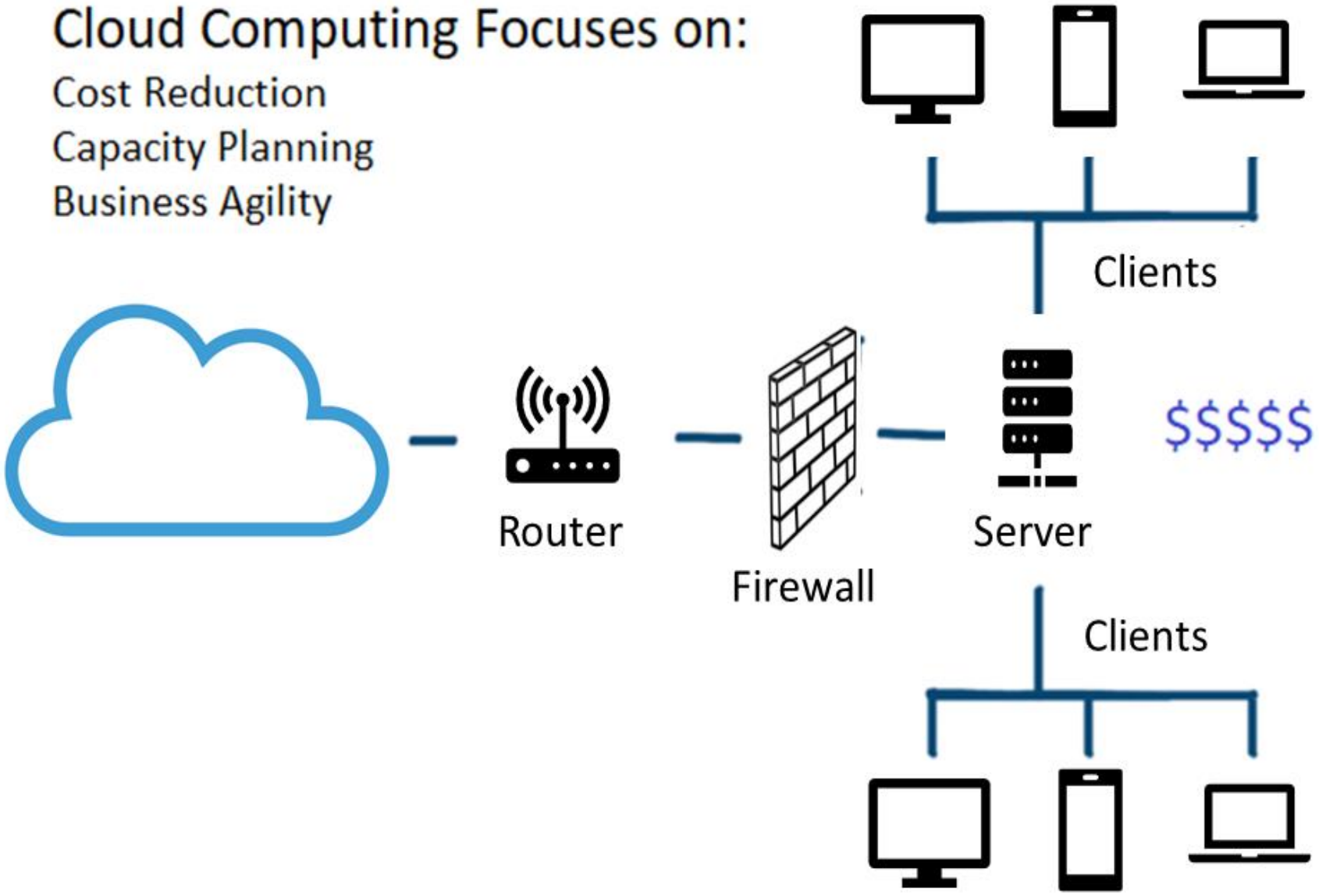
Growing number of software systems, databases, security requirements, hardware needs make it hard for IT specialists

Be an expert in too areas daunting and beyond capabilities of many Information Technology (IT) departments

Internet matured to point where high-speed connections meant increasingly complex applications worked remotely

Cloud Computing Focuses on:

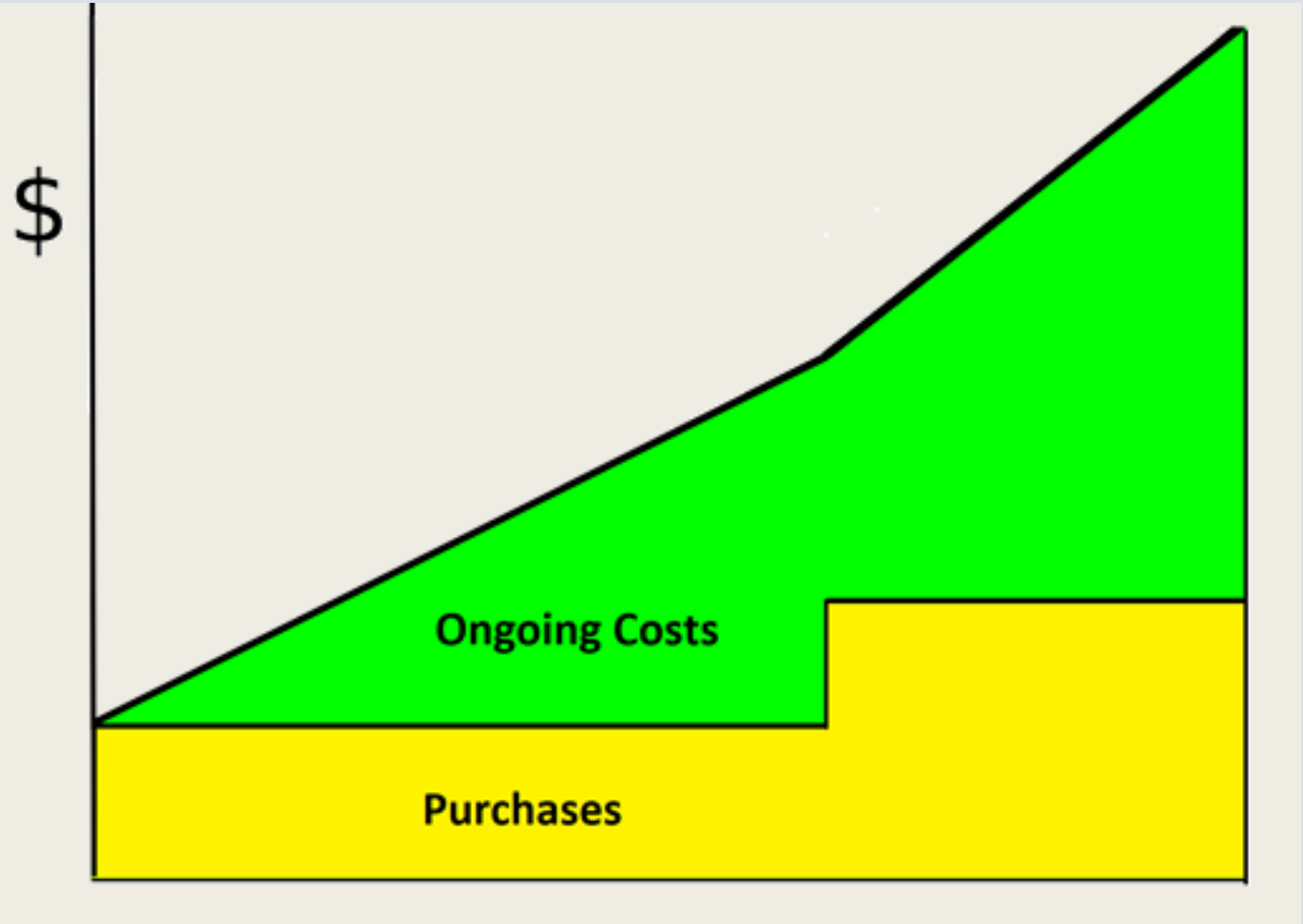
Cost Reduction
Capacity Planning
Business Agility



Cost Reduction

IT cost categories

- (1) new equipment/software (e.g. purchase costs)
- (2) ongoing costs of ownership (e.g. operational costs)



Operating Expenses

Technical personnel with high levels of skills. Regular training, certification et cetera.

Software and hardware upgrades and patches. Testing, user training, and installation time.

Software leasing costs.

Operation costs like electric utility bills and investments for cooling systems, surge protection, air filtration systems et cetera.

Security and access control measures such as software, network, and physical infrastructure components (e.g. virus protection, intrusion detection, video cameras, locks, and so forth).

Help desk, staff specialists, and administrative assistants.

Other expenses like insurance, audits, travel, staff meetings and retreats, et cetera.

Capacity Planning

Process of deciding how to prepare for the future

- *Match Strategy* - Adds IT resources in small increments to match demand as best as possible. Avoids over-provisioning but fails to take advantage of volume discounts. May result in systems unable to ramp up quick enough (e.g. adding staff, training and so forth).
- *Lead Strategy* - IT resource *ca*pacity added in anticipation of demand. Takes advantage of volume purchases but more susceptible to over-provisioning. May result in unused resources that become obsolete before needed.
- *Lag Strategy* - *A*dds IT resources only after capacity reached*. C*an suffer from under-provisioning and from being unable to rapidly react to organizational needs. Best used in situations where demand for IT resources is steady and less susceptible to unexpected changes.

Organizational Agility

Cloud computing allows businesses to easily acquire and roll out the latest technologies without as much internal expertise.

Elasticity occurs when IT departments respond to business changes by upsizing or downsizing capabilities to match the current situation.

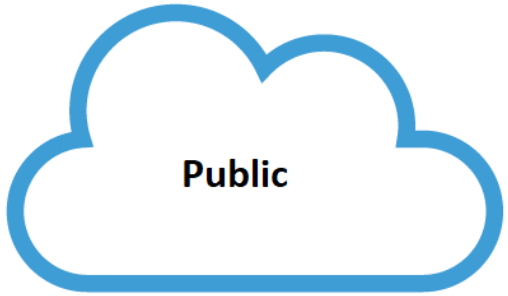
A system is scalable when it can grow without being hampered by existing structure or available resources. A scalable system can respond to higher demand with little or no changes required.

How is Cloud Computing Hosted?

Private Cloud Deployment - Hosted on hardware systems located within an organization's data center

Public Cloud Deployment - Day-to-day management of hosting done by a third-party vendor

Hybrid Cloud Deployment - Features offered by both public and private clouds



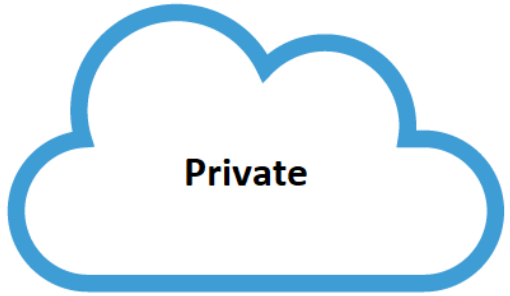
Access via Internet

Public Virtualized Resources

Supports Multiple Clients

Less Confidential Data

Shared Overhead Expenses



Access via Intranet

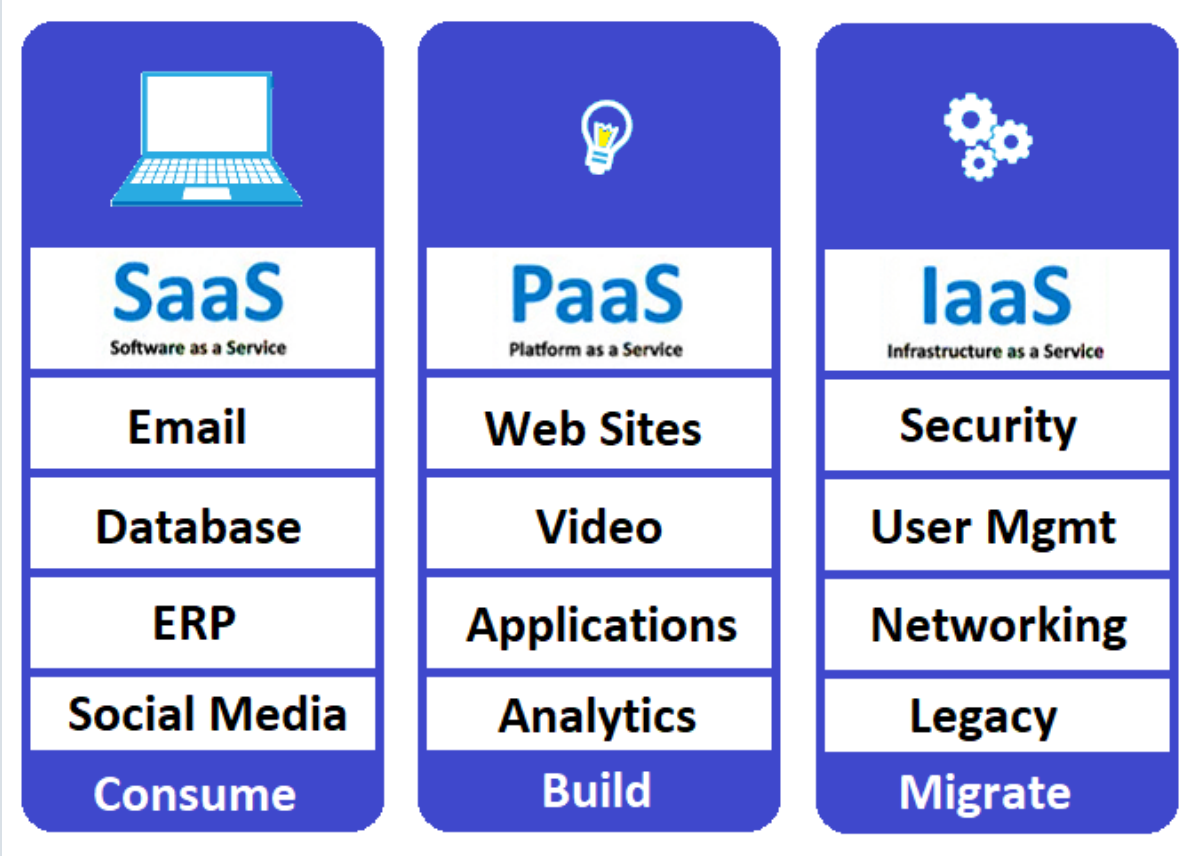
Private Virtualized Resources

Dedicated to One Organization

Preferred for Sensitive Data

Expenses Covered by One Company

What are the Different Types of Cloud Solutions?



Software as a Solution (SaaS)

Software runs on host computers accessed via Internet

- Software updates applied automatically and transparently for the end-user.
- Users pay subscription fee based on number of seats, level of service, storage requirements or other criteria.
- Only hardware required by the customer is a desktop, laptop, or mobile device capable of connecting over the Internet.

Benefits of SaaS

Flexibility: Customers quickly and seamlessly add users, capacity, or capabilities. Often automatic.

Accessibility: End-users access the software from anywhere with Internet connection.

Cost Savings: Costly infrastructure and in-house expertise costs minimized or eliminated.

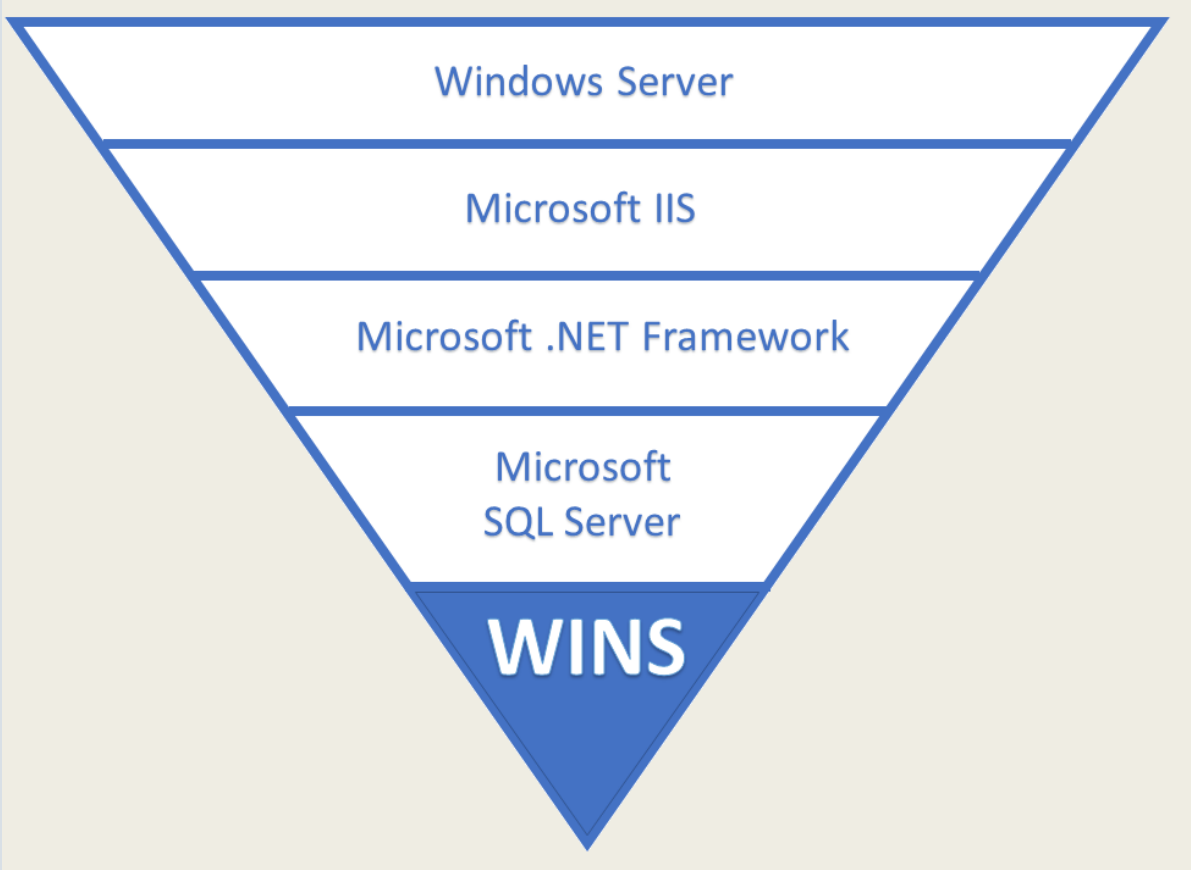
Platform as a Service (PaaS)

Used by organizations involved in custom application development.

Make it easier to develop, test, collaborate, maintain, track releases and changes, and perform other duties related to software creation.

Offers a configured sandbox for software testing, project management features, and deployment environment.

Full Stack Development Solutions: WINS



Infrastructure as a Service (IaaS)

Lowest level of cloud solution

Focuses more on system configuration issues.

Host infrastructure components traditionally managed in on-premise data centers and includes servers, data storage, networking hardware, and virtual machines.

Seeks to be a fully outsourced service that replaces a data center.

Offers pre-configured hardware (or software) through an interface.

Customers install software and services on IaaS cloud and run/manage their applications as if it were an on-premise data center.

Benefits of IaaS

Reduces capital expenditures and outlays

Can reduce overall cost of IT function

Users only pay for the services needed

Enterprise-grade IT resources and infrastructure are available even to small organizations

Scalability and elasticity are very easy

Users maintain control over their own application deployment if critical to their business model

Good Analogy

On-Premise Solutions like owning a car. You are responsible for maintenance and upkeep. Upgrading means buying a new car.

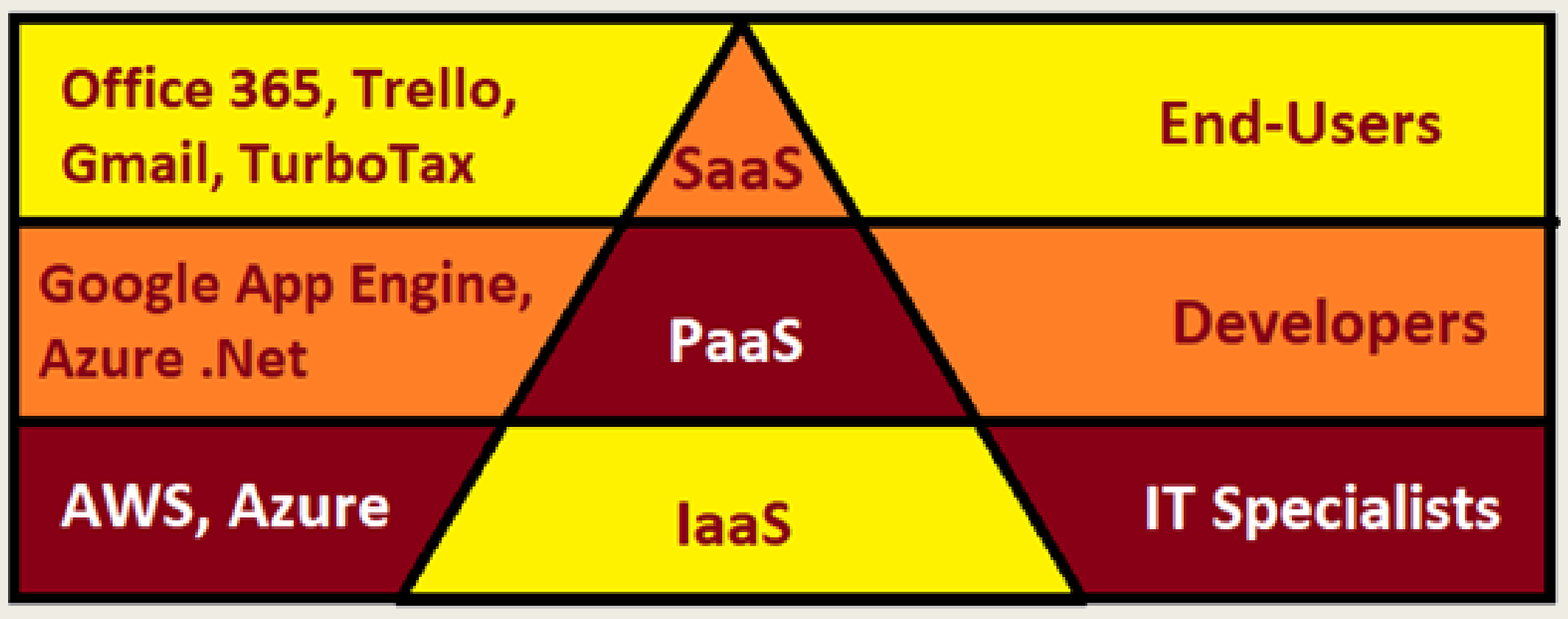
IaaS like leasing a car. You choose what you want, drive it but car belongs to lease company. If you need to upgrade, you lease a different auto.

PaaS like taking a taxi. You tell the driver where to go, and they get you there.

SaaS is like going by bus or train. A fixed route where you share ride and go with everyone else.

From: Gleb on RubyGarage.org

Cloud Computing Users



Recovery as a Service (RaaS)

Facilitates backup, archives, disaster recovery, and business continuity functions.

Ensures organization has data backed up in multiple locations and can quickly resume operations should disaster or unexpected event occur.

May protect and help recover data centers, servers, middleware, databases, web sites, and other IT resources.

Helps businesses reduce downtime and minimize negative impacts.

What are Cloud Computing Benefits?

Cloud service deployment is fast.

Cloud services accessed from nearly any device.

Cloud services accessed from nearly any geographic location.

Cloud services are elastic.

Cloud services facilitate improved efficiency and cost reductions.

Cloud services provide expertise on IT infrastructure without needing inhouse staff.

Cloud services are billed to subscribers, so they pay for what they use.

What are Cloud Computing Challenges?

Cloud servers and data storage generally require network connectivity for resource access. If a network disruption occurs, service interrupted.

Cloud security considerations.

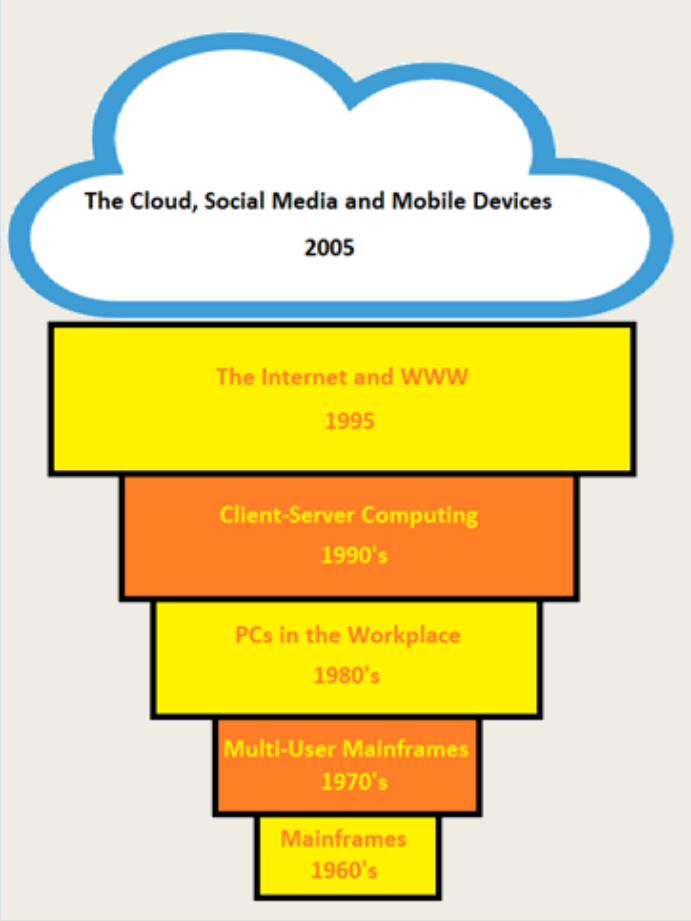
Cloud services can be costly.

Vulnerability to attacks.

Loss of control.

Technical problems. If technical problems emerge, the fix might depend on cloud service providers.

Cloud Computing History Overview



Service Oriented Architecture (SOA)

Describes philosophy behind how large development projects are organized through divide and conquer and communicate approach.

Code developed in reusable modules that can ‘talk’ to each other.

Encapsulates design decisions that may change in the future (e.g. all changes can be made in a single, known location).

Ensures code modules can be combined in different ways depending on specific software deployment needs.

Draws from fundamental, object-oriented, software design principles.

SOA in Terms of Legos

Legos are interoperable. Legos have standard bumps that can fit into any other Lego block. In SOA, the bumps are the messages that link modules together.

Legos are composable. A single Lego block may be interesting to look at, but it does not do much. Until a structure comprising multiple Legos is created, not much value exists.

Legos are reusable. A person can build a structure with Legos, then later the same blocks can be reassembled to build something different.

Legos are robust. Although breaking individual blocks is possible, the blocks remain unlikely to break when structures are reassembled.

Harriet Fryman's 7 Principles of SOA

Open and standards based.

Platform-neutral. Encapsulated so a service works identically on Linux or Windows.

Location-transparent. Should not change based on user or location in the global infrastructure.

Peer-to-peer. There should be no primary or secondary (Landau, 2020). Every service is created equal. This means services can spawn and scale out without a single point of failure.

Loosely coupled. Can enhance capability within a service without impacting another service.

Interface-based. Each service is opaque regarding other services.

Coarsely grained. Must operate at a business level, not down in the bits and bytes. That makes it more reusable.

Cloud Computing Chapter 1 Summary

3 main operational paradigms for cloud computing:

- SaaS (software-as-a-service)
- PaaS (platform-as-a-service)
- IaaS (infrastructure-as-a-service)

Chapter 1 Summary: Cloud Features

Cloud Computing Feature	Description
Pooled resources	Available to users with subscription and level of access.
Virtualization	Improved utilization of hardware assets.
Elasticity	Dynamic scaling capability (e.g. scalability) and the ability to downsize when needed.
Automation	Build, configure, and deploy without human intervention required.
Metered billing	Per-usage business model. Pay only for use.