Cloud Computing

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Before the Cloud

“Traditional” setup is on-premise infrastructure

On-site infrastructure means a server, host computer with OS all exist on the premises of the operation. Server only connects to on-site machines.

For example, a company needs a login system. Another company comes and installs a server to store all the data and to process requests from company computers connected to this server on-site.

Initially thought to be most secure way of storing Data.

Drawbacks to on-site infrastructure

Cost: unexpected maintenance, breakdowns, etc. Typically need a designated employee to manage on-site servers.

Flexibility: difficult to scale up or for a company to pivot directions with installed hardware. (Physically and Technologically)

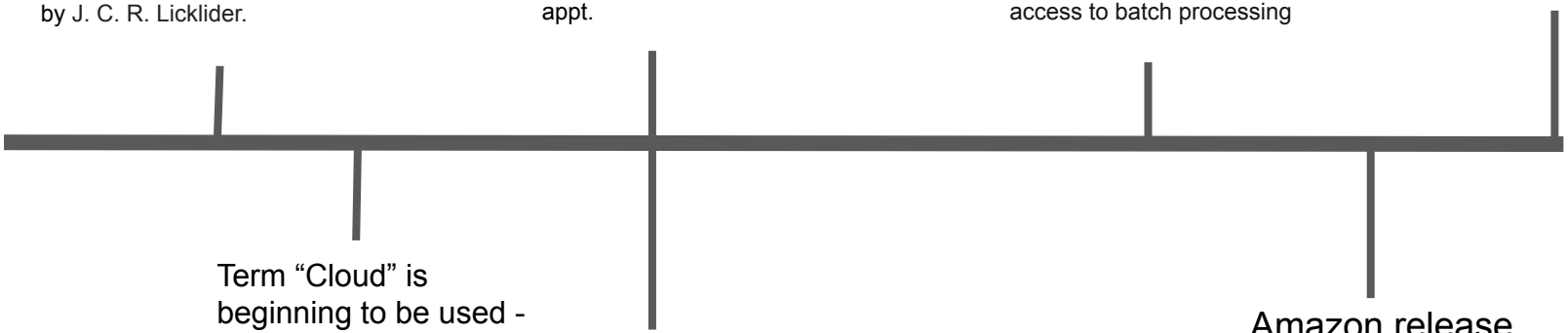
Security: while it can be more secure, the responsibility to security lies with you. So, more employees needed for security specifically.

These things make it hard for smaller and more agile companies to break in to the competitive world.

Servers Before Cloud Computing

- Prior to Cloud Computing, everyone had to store all their data in hard drives and private servers.
- High amount of network would crash servers causing problems for company.(Ex. Lots of orders on a product)
- Improving servers was very expensive to do as they are very expensive.
- Servers prior to cloud were much harder to secure in comparison
- Many businesses would not be able to function without cloud computing(EX, Social media or streaming movies)

Timeline of Cloud Computing



Cloud Computing invented - 1960s

Cloud presumed to be invented by J. C. R. Licklider.

Term “Cloud” is beginning to be used - 1996

Cloud is used to reference the network that can be accessed from different devices through the internet

Salesforce- 1999

One of the first Software as a service(SaaS). Made in a one room appt.

VMware -1999

VMware introduced the first x86 virtualization product for the Intel IA-32 architecture

VM more widely adopted- early 2000s

VMs enabled virtualization which gave multiple users access to batch processing

Amazon release AWS - 2006

Amazon popularize cloud computing with the release of Amazon web service.

Google Cloud service - 2008

What is Cloud Computing

- Cloud computing is access to computing resources, on demand via the internet.
- Can do anything from data storage, to development tools, to physical and virtual servers.
- Hosted at a remote data center managed by a cloud services provider

Examples of Cloud Computing

Cloud computing is everywhere nowadays, but some of the biggest examples would be

- MongoDB
- Gmail
- Facebook
- Netflix
- Google docs

At the end of the day, almost everything nowadays uses Cloud computing on some level.

Types of Cloud Computing

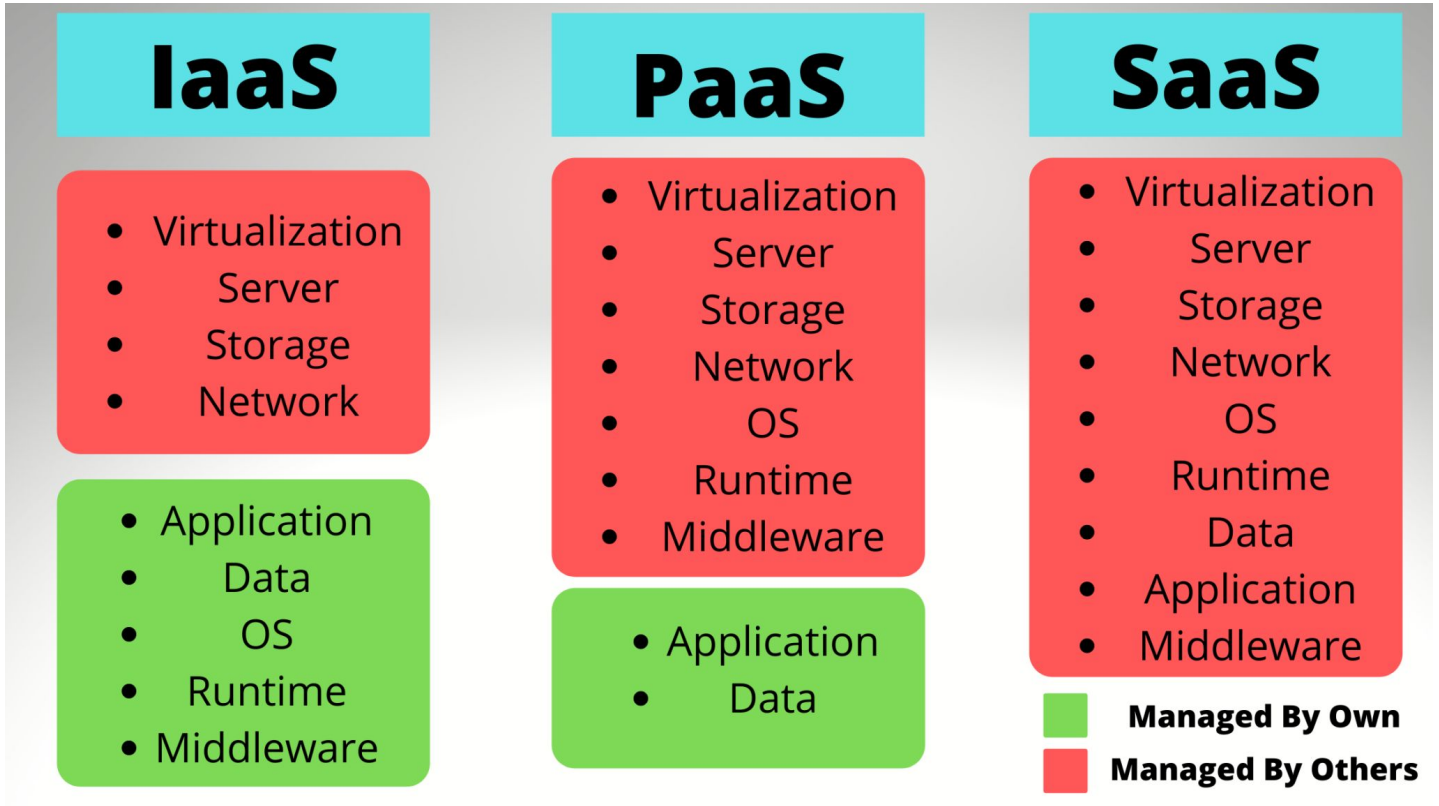
Public: Service over the internet, price based on operation (day->day use), can have multiple tenants shared (like storage unit), focused on utilities

Private: Service over internet, price based on flat rate, uses CapEx (large upfront purchase), one tenant, grid computing (functions spread across networked pcs)

Hybrid: Combo of Public/Private, suited to meet specific needs, get to pick and choose things you need from private or public

Multi: Companies infrastructure managed by multiple sources, maybe one aspect is private, another public, and another is hybrid

Cloud Service Models



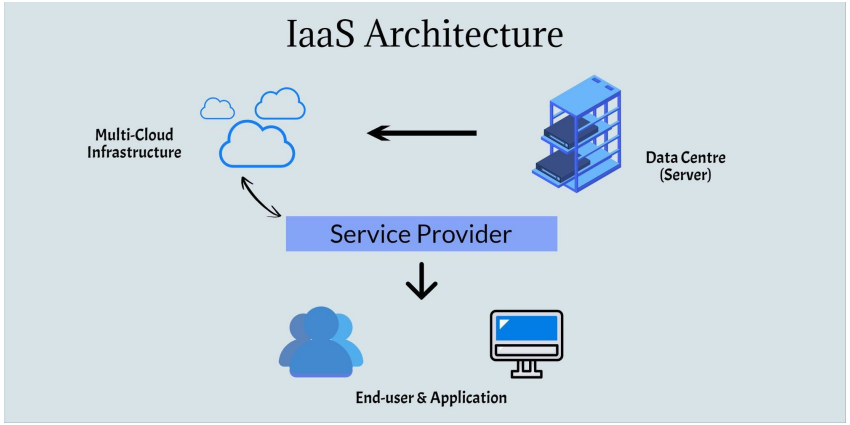
IaaS: Infrastructure as a Service

Service Provider hosts and maintains backend infrastructure. Things like compute storage, networking and virtualization.

You’re responsible for Operating System, Middleware, Data, and Applications

Examples:

- Cloud Storage
- Compute Engine



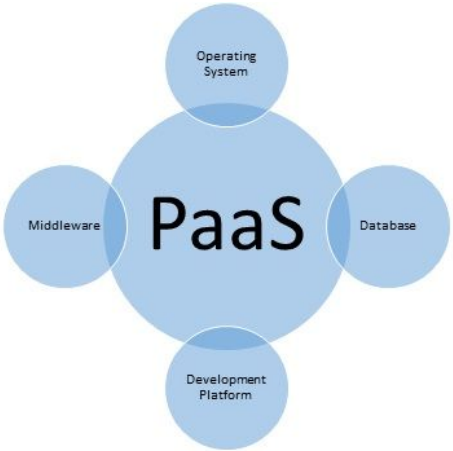
PaaS: Platform as a Service

Service Provider manages everything backend, but also provide software features/tools needed for development (like an IDE)

You’re still responsible for writing code and managing Apps and Data

Examples

- Cloud Run
- App Engine



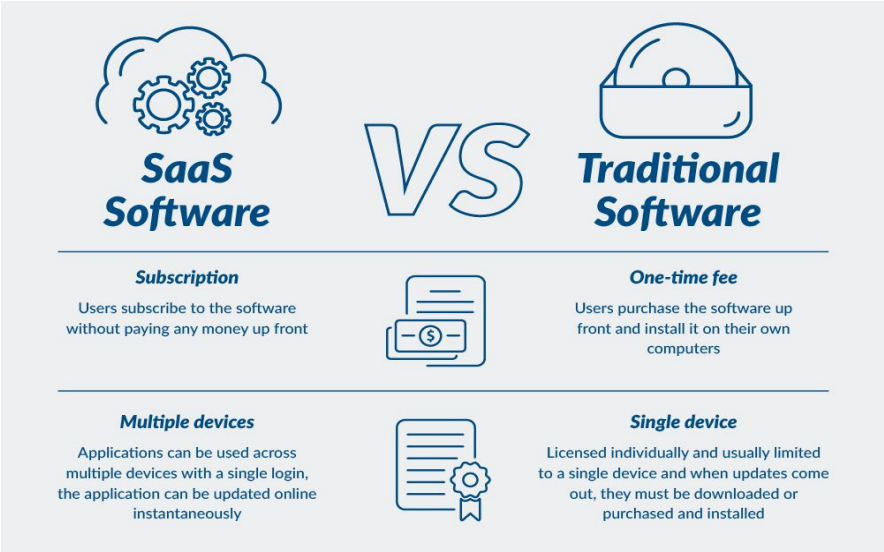
SaaS: Software as a Service

Service Provider manages your whole application stack a complete application stack, and all infrastructure needed

You’re responsible to just connect to the internet and use the service

Examples

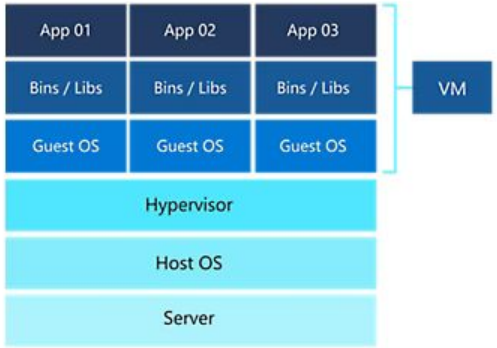
- Google Workspace

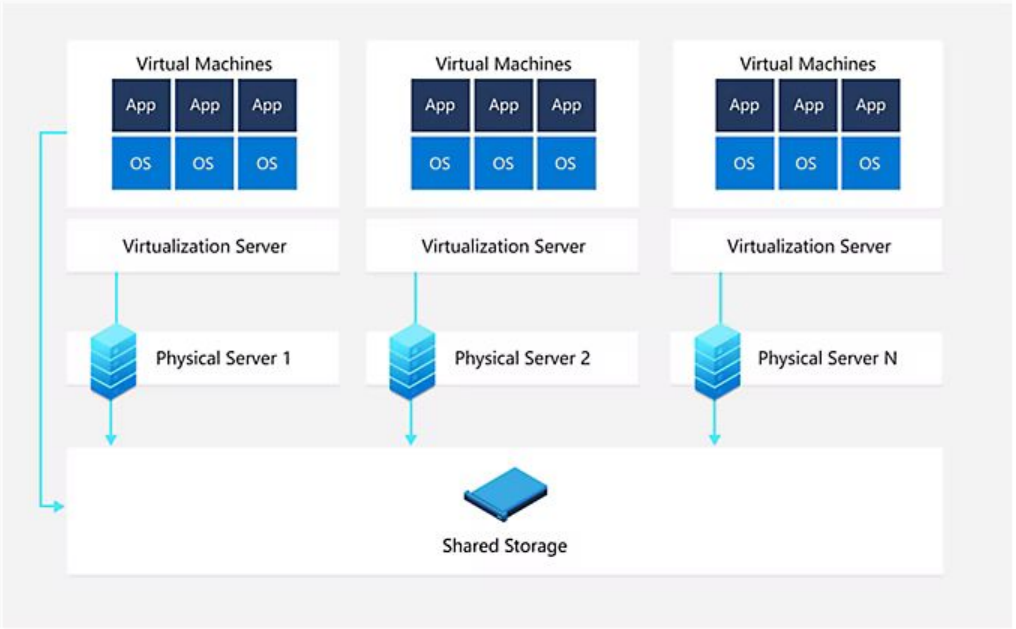


Faas: functions as a service

- AWS lambda first Faas offered by big cooperation, followed by google cloud functions and microsoft azure functions.
- Faas are usually for on demand functions.
- Pay as you use, and also don't have to pay for idle time, thus leading to lower costs

Virtual Machines





Virtual Machines

- A virtual machine is a software-defined computer
- Has CPU, memory, disks, and internet connection just like a regular computer
  - Hardware is virtualized
- Physical computer: these parts are hardware
- Virtual machine: these parts are defined in software
- These resources are “borrowed” from the physical computer

Virtual Machines (continued)

- Can be located anywhere
  - Local computer
  - Remote server in the cloud
- VM has its own operating system running
- VM’s operating system cannot interfere with the host computer

Virtual Machine Uses

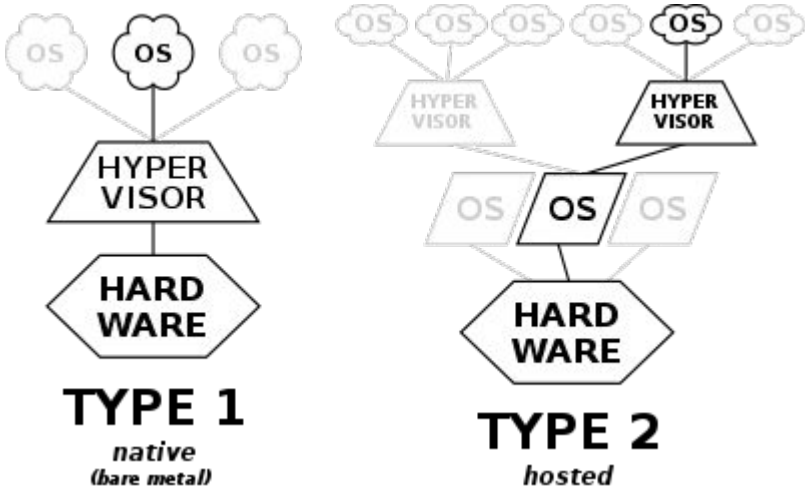
- Running different operating systems quickly and easily
- Deploying apps to the cloud
- Spinning up a predefined environment for development
- Safely observe viruses or malware without infecting host computer
- Portable - can be moved to a different physical machine

Hypervisor

- Software used for running virtual machines
  - Host: computer running hypervisor
  - Guest: virtualized operating system
- Manages the execution of guest operating system
- Most instructions executed on native hardware, unlike an emulator
- Examples: Xen hypervisor, Hyper-V, VirtualBox, QEMU

Hypervisor Types

- Type 1: Native hypervisors
  - Runs on native hardware, bare metal
  - Intermediary between operating systems and hardware
- Type 2: Hosted hypervisors
  - Runs on a conventional operating system like any other program
  - Abstract guest operating system from host operating system



Containers

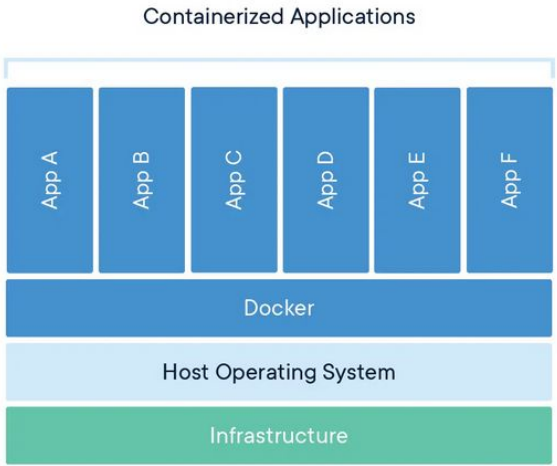
- Package of software containing all necessary elements to run in any environment
- Virtualize the operating system, not the hardware
- Useful for deploying applications to the cloud

Containers vs Virtual Machines: Similarities

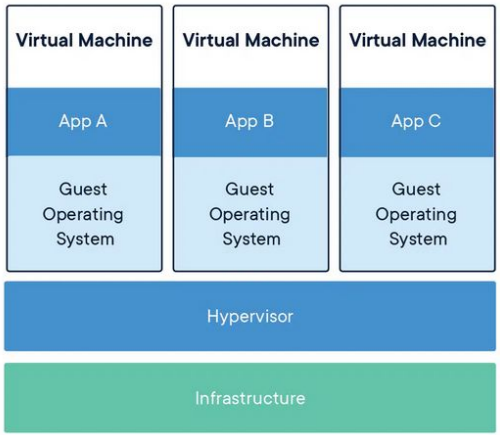
- Provide isolated environments for applications
- Abstracted away from the physical hardware
- Portable
- Run on variety of hardware

Containers vs Virtual Machines: Differences

- Virtualize OS
- Share OS kernel
- Lightweight, less resources
- Much less memory



- Virtualize hardware
- Separate OS kernel
- Requires more resources
- More memory required



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