Introduction to Cloud Computing

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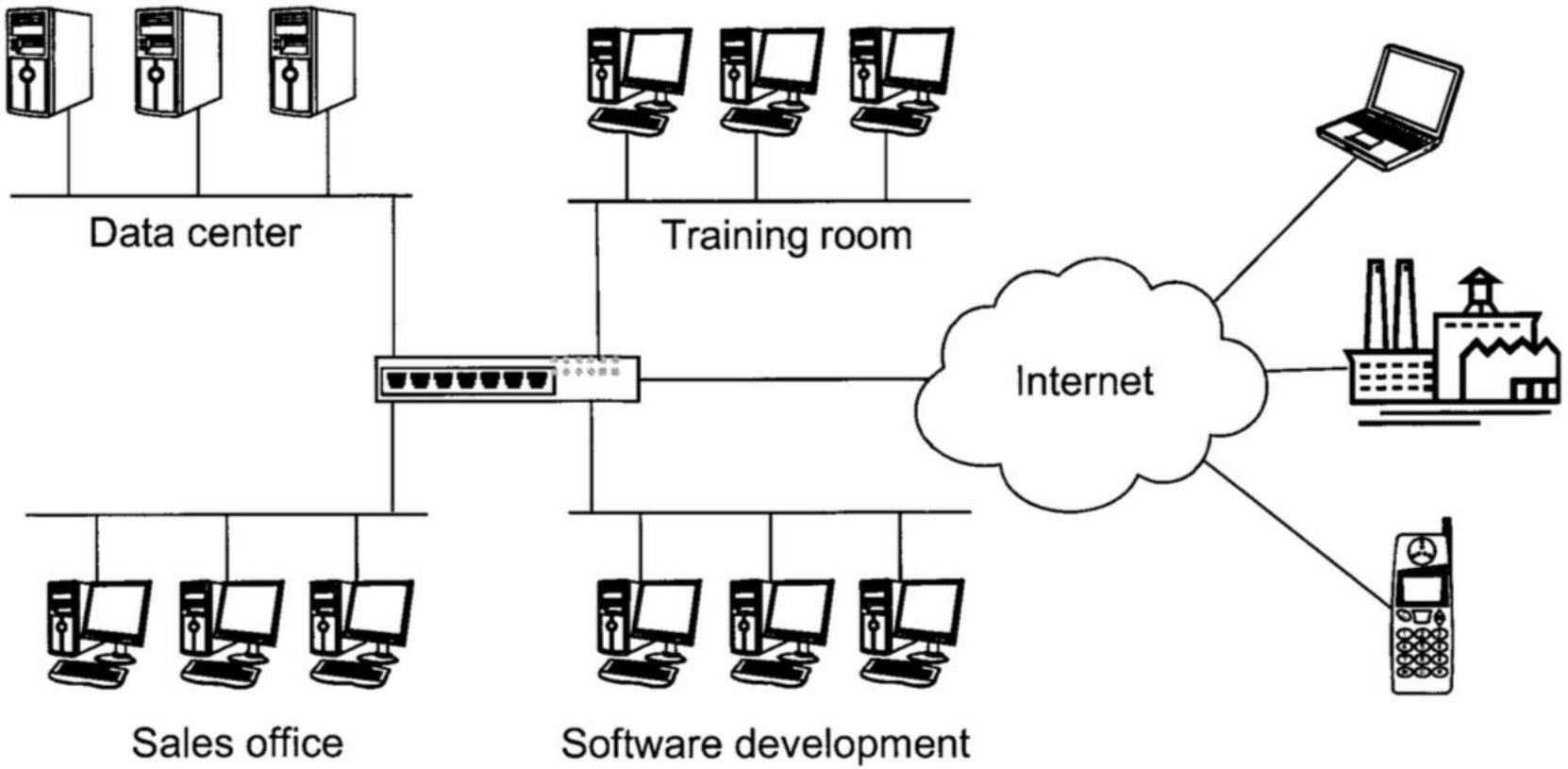
Overview

- Demystifying the “cloud”
  - What is it?
  - Where is it?
- What makes the cloud work?
- What can you do with the cloud?
  - Types of services typically offered by cloud service providers
  - Paas, Saas etc.
- Cloud Deployment Methods
  - Public, Private, Community, Hybrid

Typical/Traditional Business IT Infrastructure



Typical/Traditional Business IT Infrastructure

- **Typical organisation computing infrastructure consists of:**
  - **Application servers**
    - Host variety of business applications
  - **Database servers**
    - Persist organisational data
  - **Networks**
    - Interconnect systems
  - **Internet access**
    - For email, internet etc.
  - **Desktop**
    - Client to server hosted applications
    - Host productivity tools e.g. Word Proc, Spreadsheet etc
  - **Mobile**
    - Remote access to company infrastructure

Maintaining a Business Computer Infrastructure

Maintaining the infrastructure raises questions:

- How are new applications purchased?
- How are new applications installed for users?
- How are existing applications updated?
- How are new server machines procured and installed?
- How is server and network capacity planned?
- What utilisation does the training room facility get?
- Who is responsible for system and application security?

These questions are asked and solved over and over again as technology advances and old software/hardware becomes obsolete.

What are your choices?

- Do you leave the IT infrastructure as is and risk loosing the competitive advantage as a business?
- Do you cyclically reinvest vast amounts of company capital to maintain an up to date IT infrastructure?

There must be a better way to maintain the IT infrastructure of a business?

Why not utilise the Cloud?

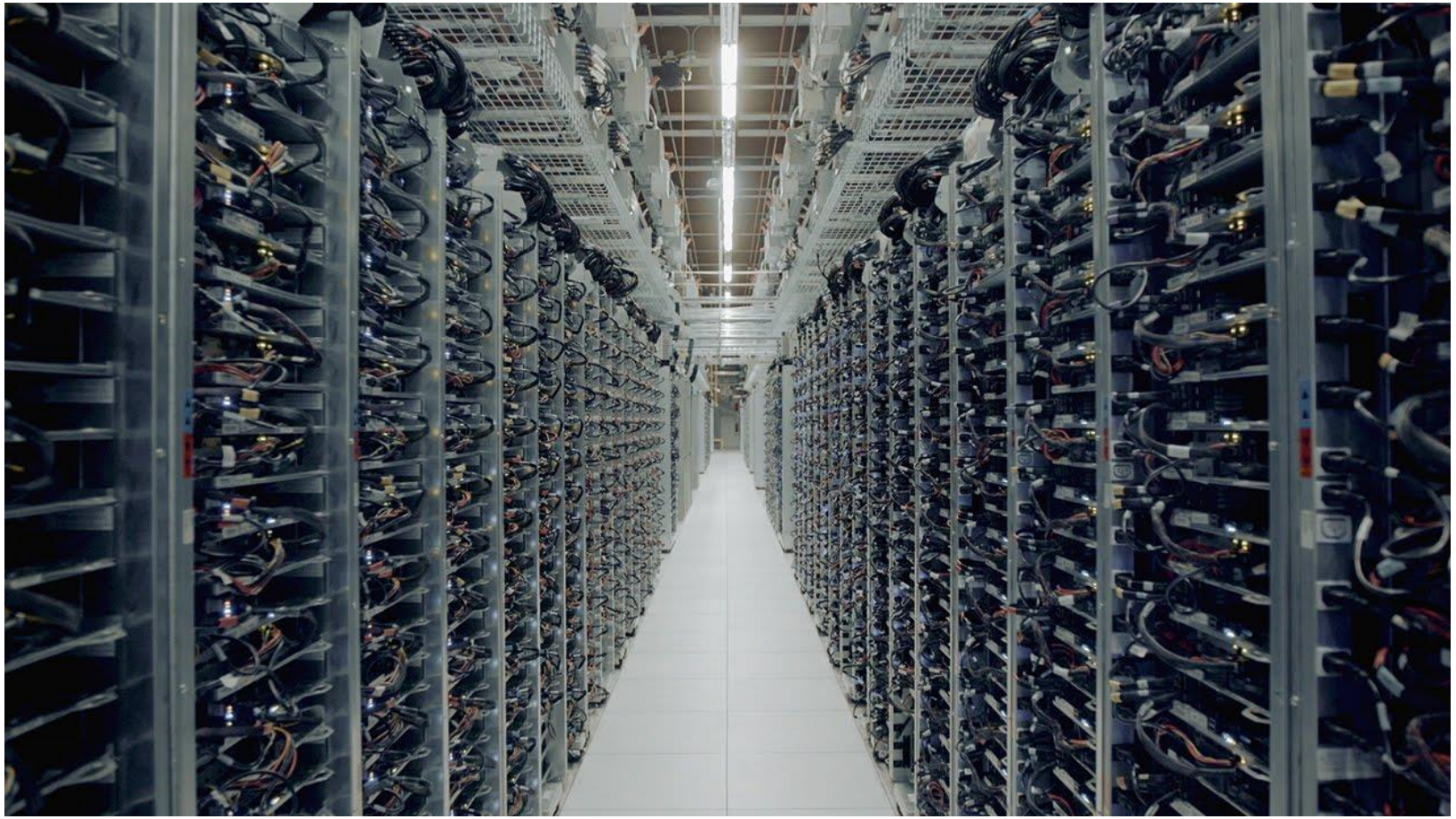
So What exactly is the Cloud?

“Simply put, cloud computing is the delivery of computing services – including **servers, storage, databases, networking, software, analytics and intelligence** – **over the Internet** (“the cloud”) to offer faster innovation, flexible resources and economies of scale. Typically, **you only pay for cloud services you use**, helping you **lower your operating costs**, run your infrastructure more efficiently and **scale** as your business needs change.”

– Microsoft (2019)

https://azure.microsoft.com/en-gb/overview/what-is-cloud-computing/

I Present to you the “**Cloud**”

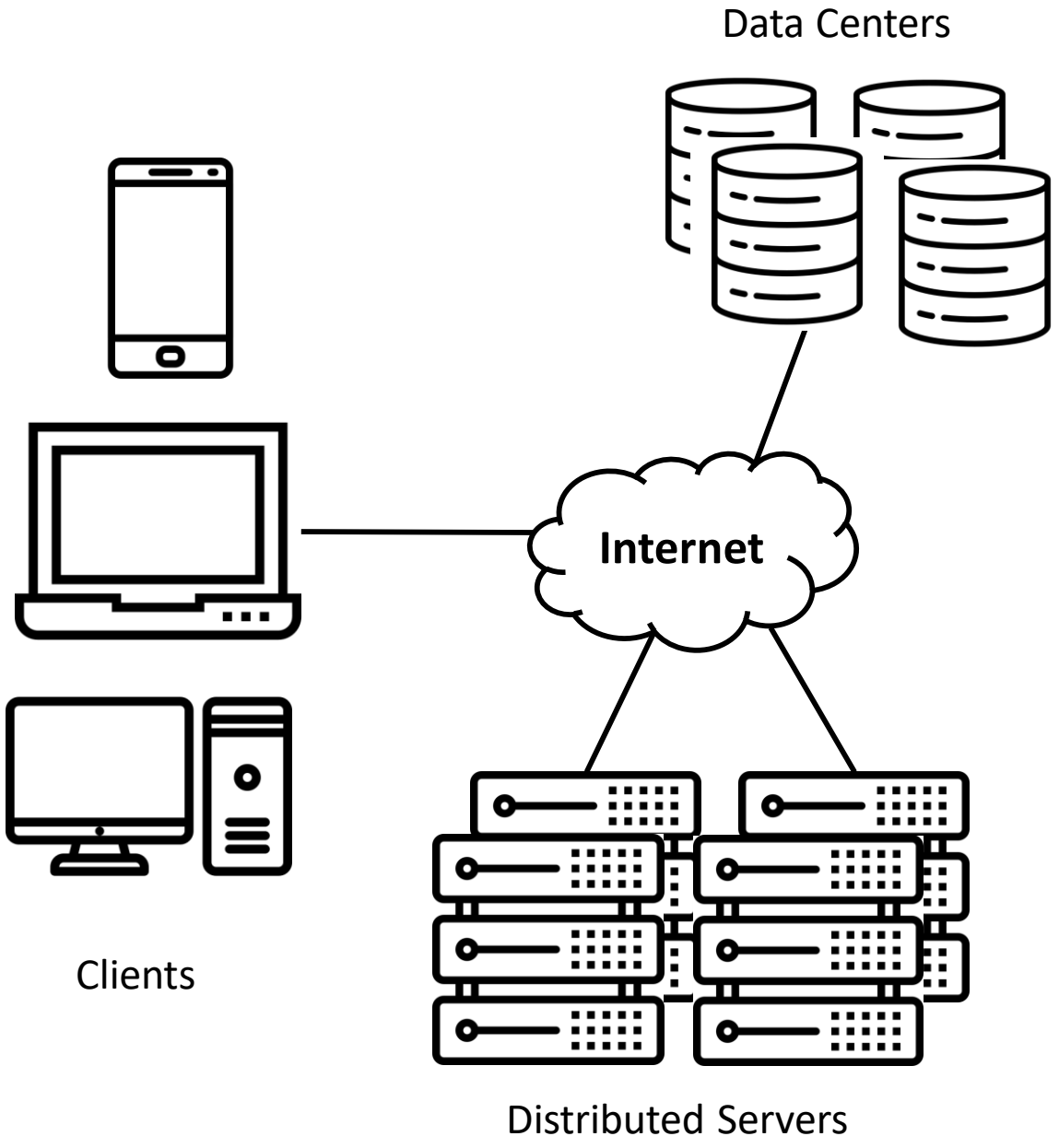


Definition of Cloud Computing

- IT resources
  - Hardware servers, storage capacity, networks, routers, load balancers
  - Software applications, database servers, application servers, development software
- Transparently scalable
  - Can handle large variations in workload transparently
  - Extra hardware is added and removed without human intervention
- Seemingly infinite pool of resources
  - Based on virtualisation technology
    - Allows multiple virtual machines to run on a single physical machine
  - Share resources and improve utilisation
- Self-service
  - New resources can be added or removed as required immediately
  - No management intervention required

Cloud Architecture

- The cloud is made up of three main components:
  - Clients
  - Distributed Servers
  - Data Centers



Components of the Cloud

1 Clients

- Devices that end users interact with, in order to access applications and manage information
  - Thick clients
    - Regular computer accessing applications via a custom proprietary vendor application
  - Thin clients
    - Often access applications via a browser – nothing to install
    - Can also be computers with no hard drive, used for display only
  - Mobile clients
    - Mobile Devices and smart phones such as iPhone, Android, Blackberry

2. Distributed servers

- Different geographic location from data centre servers
- Used for archiving, reliability/backups, overflows in load from main data centre

3 Data centre

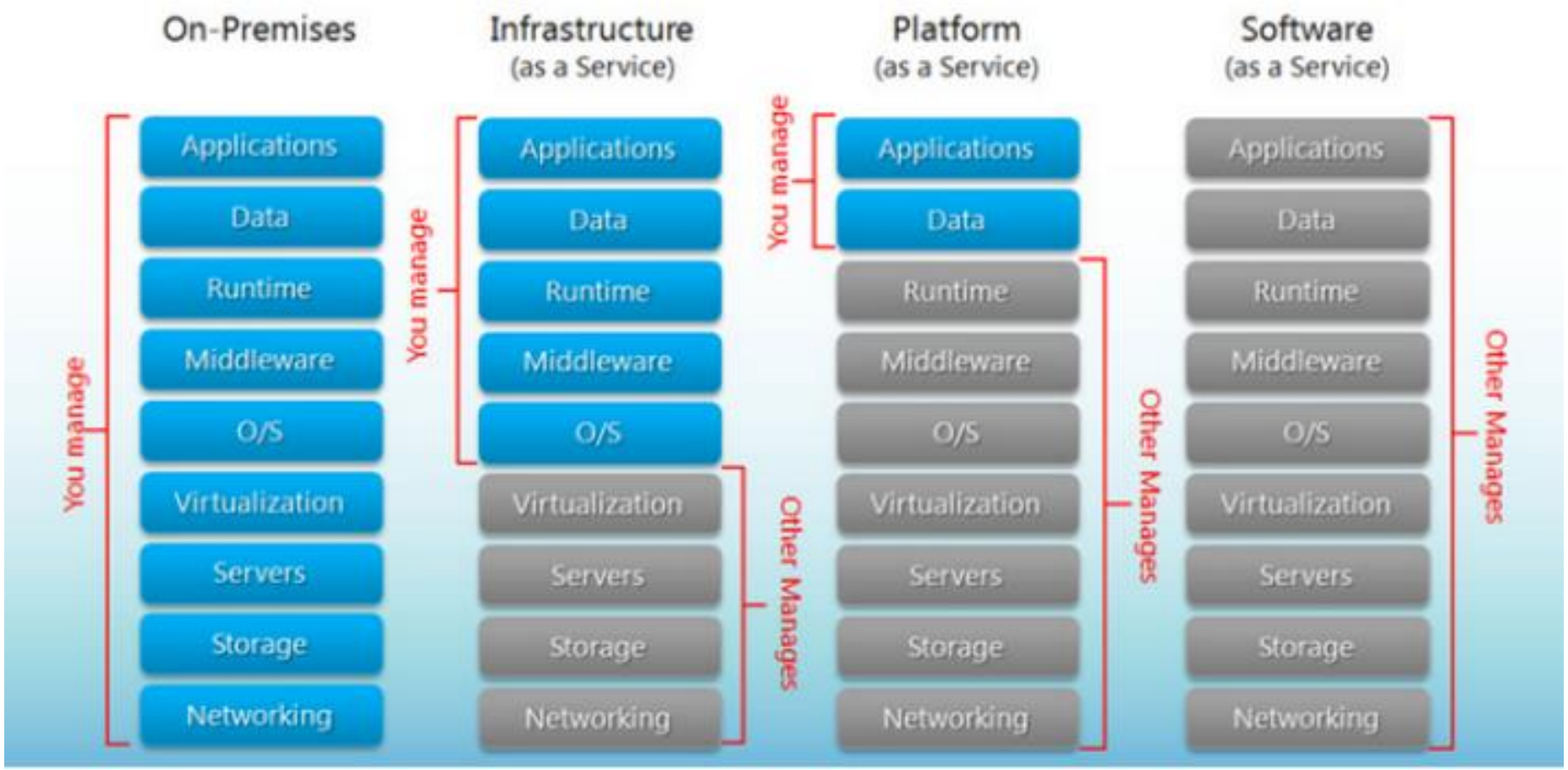
- Collection of servers hosting applications and databases

Cloud Services Delivery Model

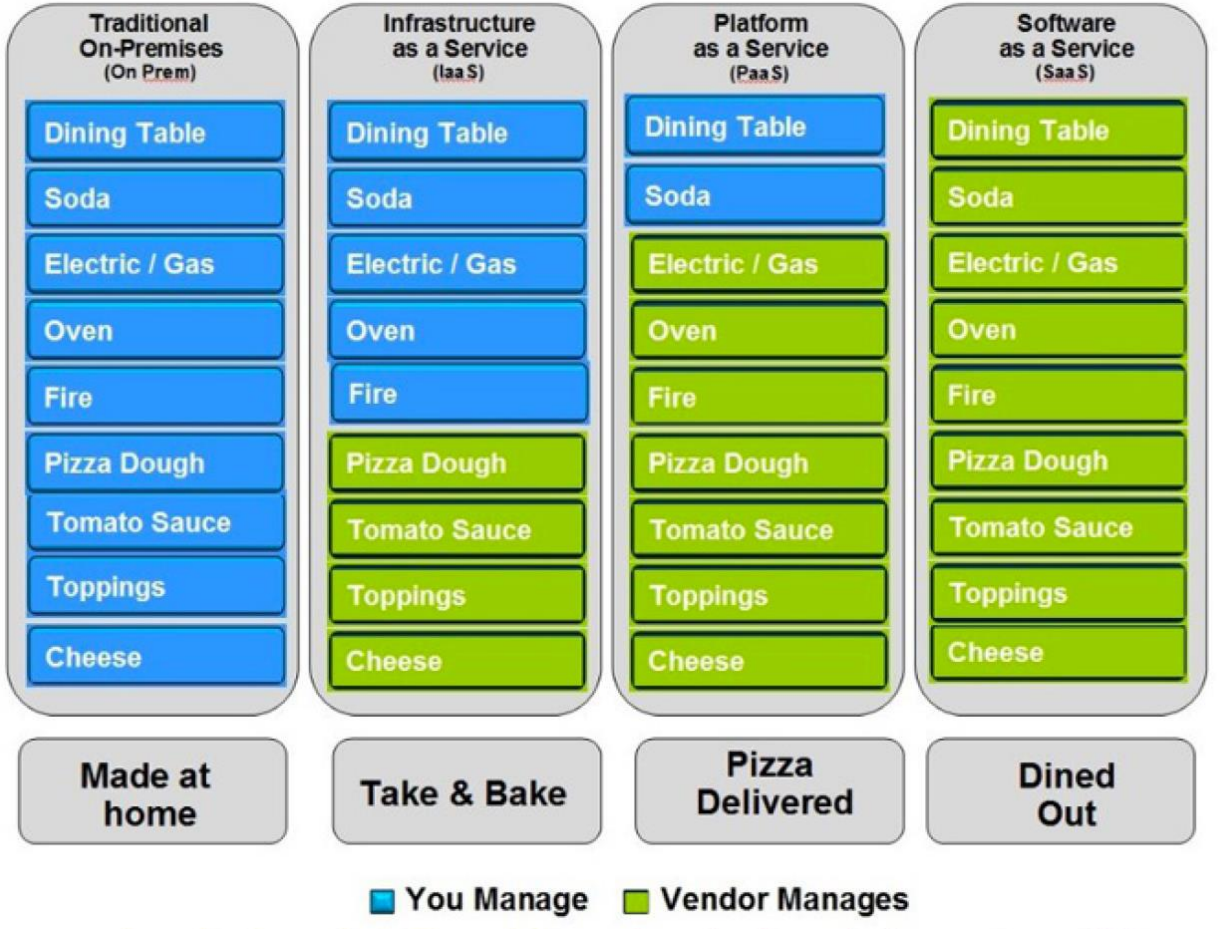
Classification scheme to categorise cloud computing services

- Known as the SPI model which is an acronym for the three major services provided by the cloud
  - **S**oftware as a Service - SaaS
  - **P**latform as a Service - PaaS
  - **I**nfrastructure as a Service – IaaS
- Each major service can be divided further
- For example IaaS can include facilities, hardware, connectivity etc.

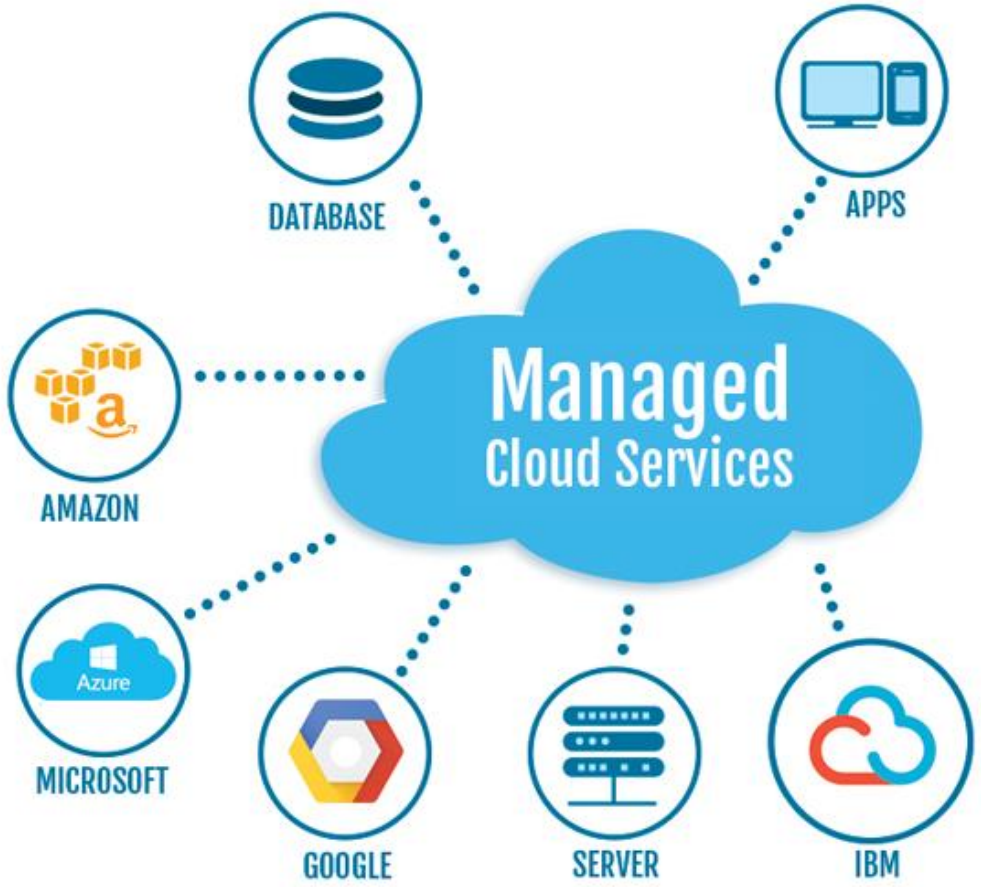
Difference in Local, IAAS, PaaS and SaaS



Analogy – Pizza as a Service



Cloud Services – The Big Players



Software as a Service

- Business applications hosted by a provider and delivered as a service
  - No need to install software on the client computer
  - Often accessed via a Web browser
- Delivery model provides a number of advantages
  - Pay per use, no up-front purchase costs
  - Receive latest updates transparently (do we need the latest version?)
  - No in-house administration/installation costs
  - Many vendors now offering traditional software as SaaS
  - Popular SaaS example is Salesforce.com
    - Customer relationship management software
  - Office suites from Microsoft and Google (Google Docs, Office 365)
    - Email
    - Word processors
    - Spreadsheets
    - Etc.

Software Plus Services

- Mixed mode of operation
  - Local software mixed with cloud services
  - The locally installed app acts as a frontend/UI to cloud based applications
- Based on Service-Oriented Architecture (SOA)
  - Integrate services from a number of providers/vendors
- Services accessed using well-defined standards
  - JSON/SOAP/XML-based
- Many services available, covering a wide range of functionality
  - Storage
  - Credit card payments
  - Maps
  - Address finder
  - Etc

Platform as a Service (PaaS)

- Computing platform that includes software for
  - Development
  - Middleware; eg Web servers, messaging systems
  - Deployment
- Enables organisations to concentrate on application development
  - No need to buy or maintain resources required to execute the software
  - During entire development cycle from testing to production
- Major benefits include
  - Easy to use
  - Automatic seamless scalability
  - Reliability, performance, and security of major providers
  - Google, Microsoft, Amazon, Alibaba etc.
  - Cost-efficient
  - Free trial periods

Paas Examples

- Google App Engine
  - Provides tools and development stack for Python, PHP and Java
  - Development tools support
  - Data storage services available
  - Application automatically scaled
  - Free for XXX Gb storage and XXX hours CPU time per day – keep checking!
    - These free limits occasionally increased
    - https://cloud.google.com/appengine/quotas
- Microsoft Azure - https://azure.microsoft.com/en-gb/get-started/
  - Provides Windows Azure operating system
  - Development tool support
  - Data storage services, plus much more
  - Runs on a virtual machine
- Force.com
  - Salesforce.com's PaaS for building applications
  - Provides custom application development platform
  - Applications rapidly built using Force.com tools
- Heroku
  - https://www.heroku.com/platform

Infrastructure as a Service (IaaS)

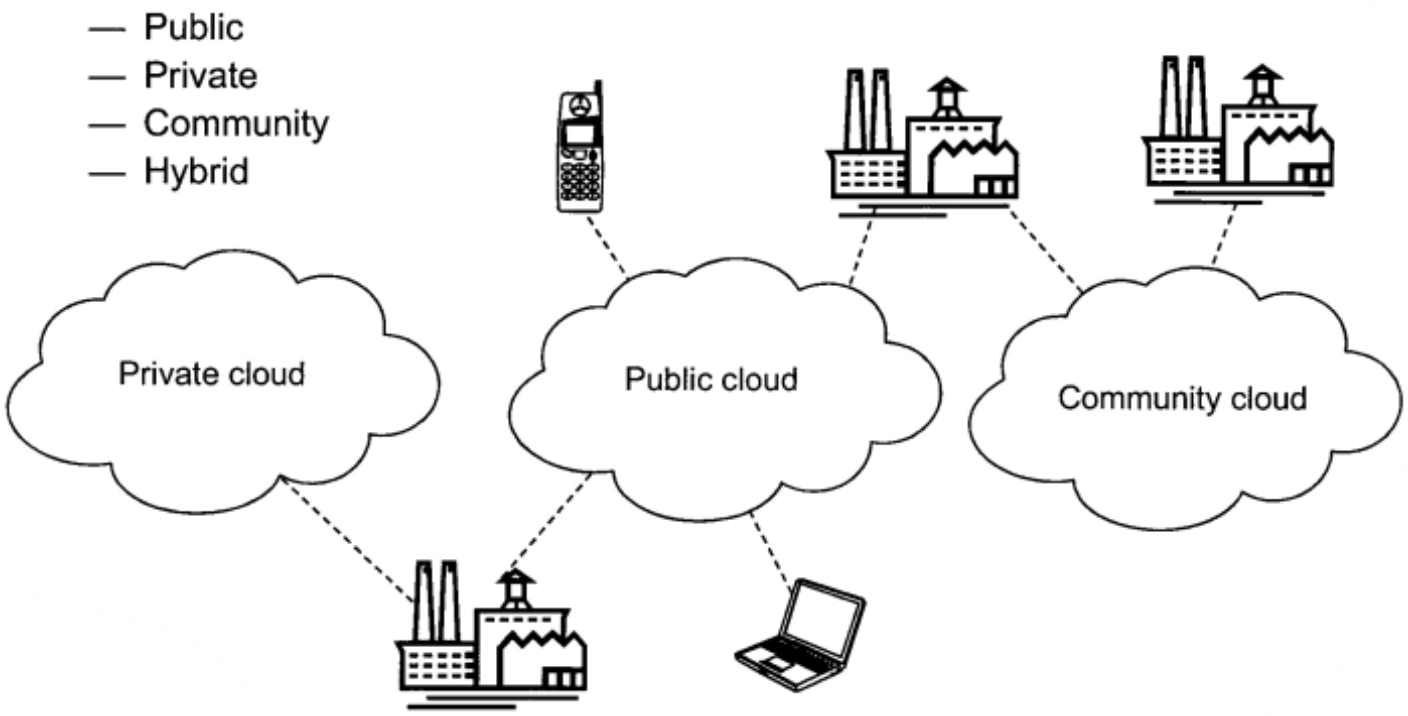
- Resources are delivered as a service
  - Including servers, networks, memory, CPU etc
- Based on virtualisation of machines
- Many vendor offerings
  - Amazon Elastic Compute Cloud (EC2)
  - Google, Microsoft
  - Eucalyptus – open source cloud platform
    - Used for private clouds
  - Rackspace
- Key feature of IaaS is instant provisioning
  - New resources available on demand within minutes
  - Accessed on virtual networks

Iaas Examples

- Amazon EC2
  - Amazon supplies a set of machine images
  - Supports various operating systems
    - Windows, UNIX, Linux (Not Mac….)
  - Allows provisioning of high-memory or high-CPU image instances
  - Multiple software options available on pre-packaged machine images
    - Various application servers: Jboss, WebLogic, WebSphere
    - Various databases: MySQL, SQL Server, DB2
  - Software developer tools available
- Google Cloud Platform (GCP) offers similar services
- Various other services available
  - Storage service
  - Message service
  - MapReduce
  - Etc.

Cloud Deployment Methods

- Cloud computing offers four deployment methods :



Public Clouds

- Infrastructure and services offered to many customers
  - Often made available to the general public (AWS, GCP)
- Managed by a third party vendor
  - Host operate and manage services
  - Security management provided
- Benefits
  - Resources dynamically provisioned on a self-service, pay as you use basis
  - Minimise costs due to optimised resource usage, for example
    - One computer could host virtual machines for multiple organisations
    - Known as multiple-tenancy
  - Enable trials and evaluations of software that was previously not available
- Disadvantages
  - Do not have total control of security, governance, reliability
    - Must trust the provider
  - May have to compromise to meet needs

Private Clouds

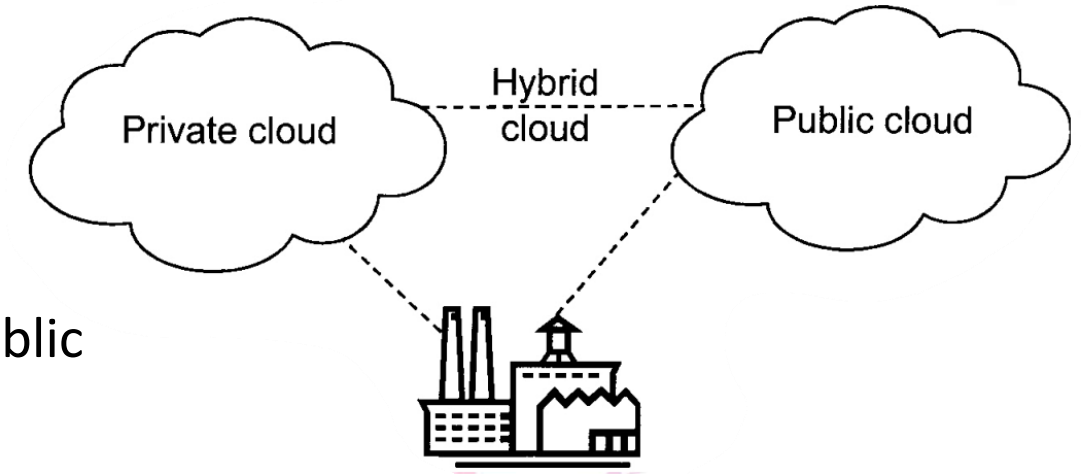
- Infrastructure and services dedicated to a single organisation
  - Emulate public cloud on private networks
  - Not shared with other organisations like a public cloud
- Managed by the organisation or outsourced to a third party
  - May exist on-premise or off-premise
- Benefits
  - Minimise potential pitfalls of public cloud
    - Data security
    - Corporate governance
    - Reliability
  - Easier to comply with corporate security standards, policies and regulatory compliance
- Disadvantages
  - Requires expertise to configure, maintain or administer the cloud
  - Some or all of this could be outsourced

Community Clouds

- Infrastructure and services shared by several organisations
  - Multiple organisations that have similar needs
  - Often for organisations in a specific business sector
    - Government agencies, travel agencies, health-care professionals
- Managed by the organisations or a third party
- Benefits
  - Leverage resources and services needed by similar businesses
  - Cost savings due to sharing infrastructure and services
    - Alternative is that each organisation repeats the infrastructure internally
  - Easier to implement standards across organisations and business sectors
    - Provides central point for updates

Hybrid Clouds

- Mixture of two or more models (public, private or community)
  - Bind clouds together
  - Private cloud to host core applications and sensitive data in-house
  - Utilise non-core applications hosted in a public cloud
- Benefits
  - Exploit features of different clouds to easily achieve desired business needs
  - Use public cloud to handle overspill in demand from private cloud
    - Known as cloud bursting



Cloud Advantages

- Cost Savings
- Reliability (SLA's that guarantee 99.9% uptime)
- Manageability
- Strategic/Competitive Edge
- Better Performance to everyday business computing
- Lower Software Costs (SaaS apps can replace desktop apps (Google docs))
- Instant software updates
- Increased Data Reliability
- Universal Data Access
  - Data is always up to date (versions of documents)
- Easier working in teams (facilitates collaborative working)
- Device/Platform Independence

Cloud Disadvantages

- Downtime
- Security
- Vendor Lock-in
- Limited Control
- Requires a constant reliable internet connection
- Features can be limited (depending on the application and use case)
- Data Security
- Data Loss (local backups?)
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Summary

- Demystified the “cloud”
  - Its essentially just somebody else’s computer/hardware
- Popular cloud services models
  - Paas, Saas, Iaas etc.
- Cloud Architecture/Components