Cloud Computing and Azure Foundation

Module 1, Lesson 1:
Cloud Computing Overview

Topics

What is Cloud Computing?
Cloud Service Models
Cloud Deployment Models
Why Cloud Computing?
Cloud Vendors

Objectives

By the end of this lesson you should be able to:

- Define cloud computing and review types of service offered and deployment models available
- Explain cloud computing evolution and development of enabling technologies
- Understand how cloud computing is utilized and why it is gaining popularity and momentum
- Compare and summarize the major cloud computing vendors

What is Cloud Computing?

"The practice of using a network of remote servers hosted on the Internet to store, manage, and process data, rather than a local server or a personal computer."

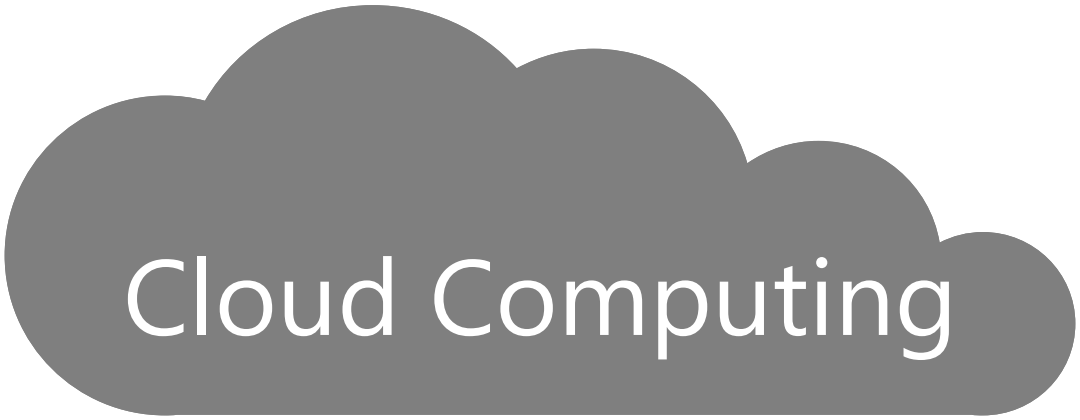
Oxford Dictionary

What is Cloud Computing?

"The practice of storing regularly used computer data on multiple servers that can be accessed through the Internet."

Webster Dictionary

What do you think Cloud Computing is?



Cloud Computing Perspectives

Perspectives highly influenced by roles and responsibilities within an organization

- End-User
- Application Developer
- IT Infrastructure Manager
- CIO
- CFO
- Service Provider

What is Cloud Computing? – Take 2

Further perspectives include:

- "An approach to computing that's about Internet scale and connecting to a variety of devices and endpoints."
- "Treating hardware and software resources as a utility."
- "A way to save a ton of money by only paying for what you need."
- "A way to scale huge when you need something done fast."

Cloud Computing NIST Definition

Cloud computing is a model for enabling ubiquitous, 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. This cloud model is composed of five essential characteristics, three service models, and four deployment models.

National Institute of Standards and Technology

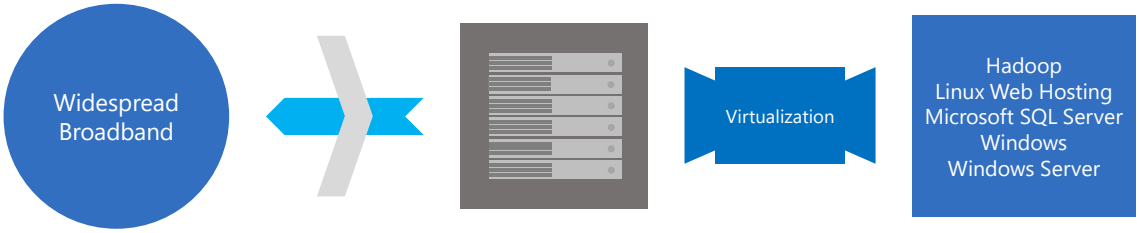
Evolution of Cloud Computing

Order of Evolution

Stage	Characteristics
Grid Computing	Solving large problems with parallel computing Made mainstream by Global Alliance
Utility Computing	Computing resources offered as a metered service Late 1990s
Software as a Service	Subscription-based software accessed over the Internet Gained momentum after 2001
Cloud Computing	Next-generation datacenters with virtualization technology Full stack of service - IasS, PaaS, & SaaS

Key Enabling Technologies

- Ubiquitous fast wide-area networks
- Powerful and inexpensive servers
- High-performance virtualization technology



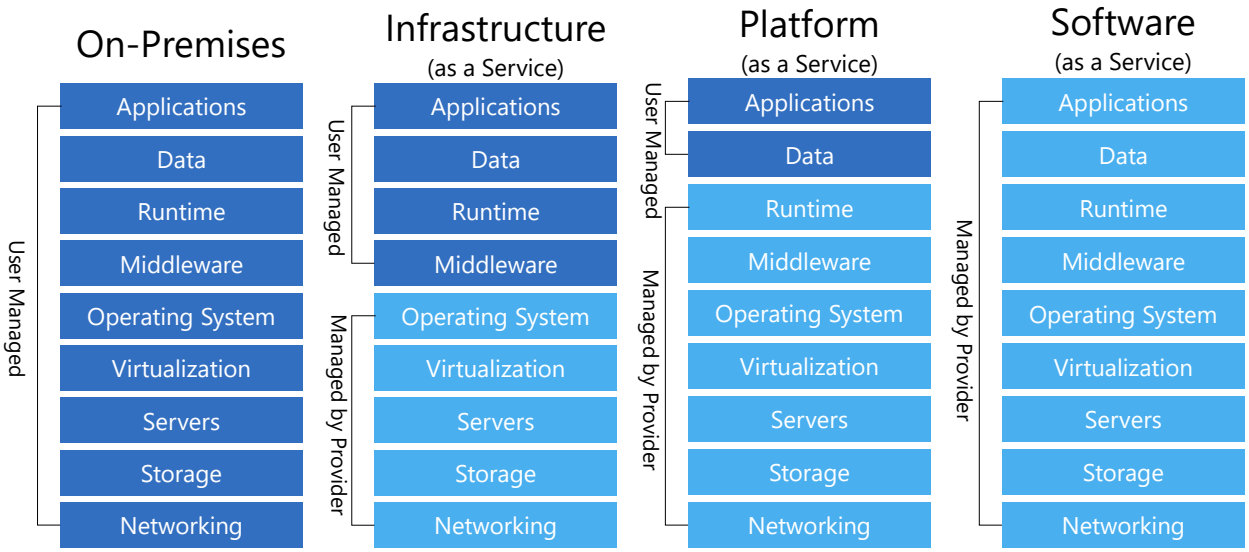
Five Key Cloud Characteristics

- On-demand self-service
- Ubiquitous network access
- Location-independent resource pooling
- Rapid elasticity
- Pay for what you use

Cloud Computing Service Models

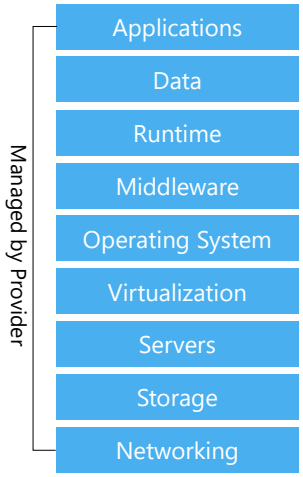
Model	Description
Software as a Service (SaaS)	Consume it End-User Applications delivered as a service, rather than by on-premises software
Platform as a Service (PaaS)	Build on it Application platform or middleware provided as a service on which developers can build and deploy custom applications
Infrastructure as a Service (IaaS)	Migrate to it Computing, storage, or other IT infrastructure provided as a service, rather than as a dedicated capability

Service Model Division of Responsibility



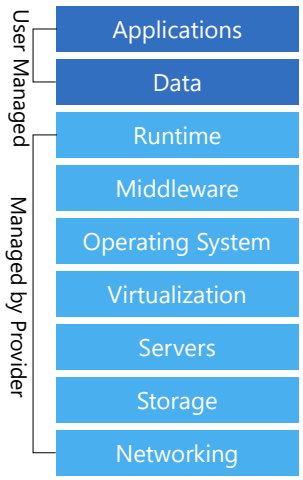
Software as a Service (SaaS)

- Internet hosted software
- Full vendor maintenance
- No upfront cost
- Pay for services as they are consumed



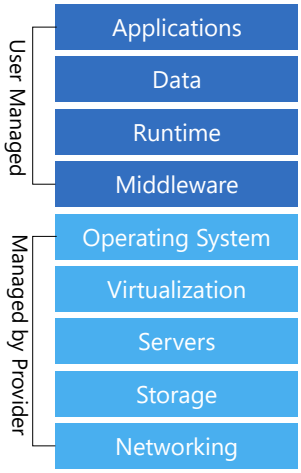
Platform as a Service (PaaS)

- Delivers and manages various development environments
- Environment and tools can be easily provisioned and torn down

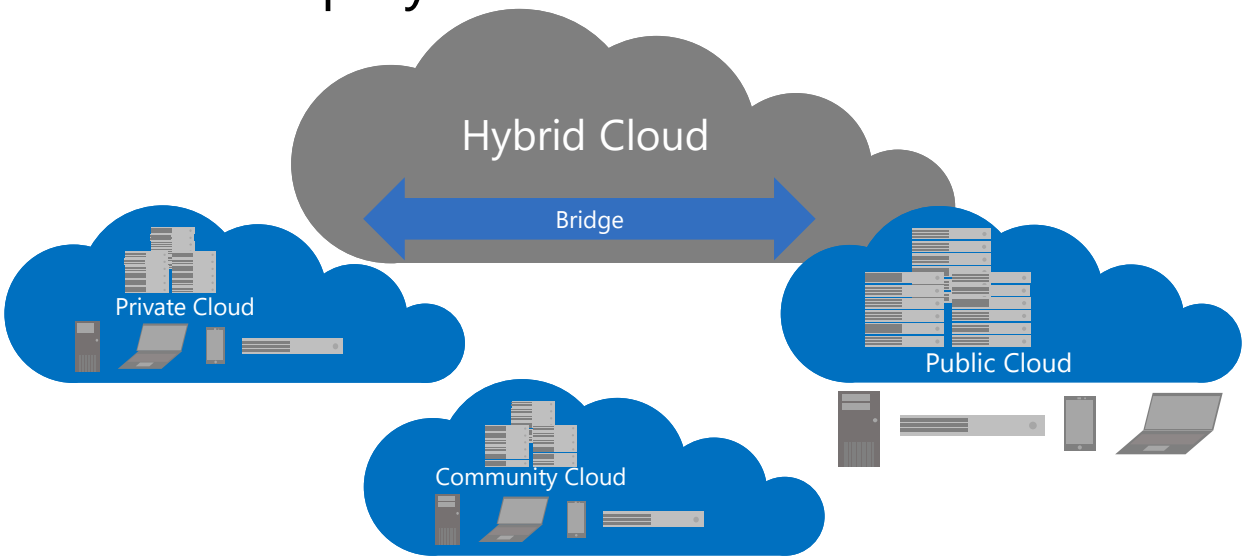


Infrastructure as a Service (IaaS)

- Dedicated virtual machines (VMs)
- Users configure server type, operating system, storage, network, etc.
- Scale up and down



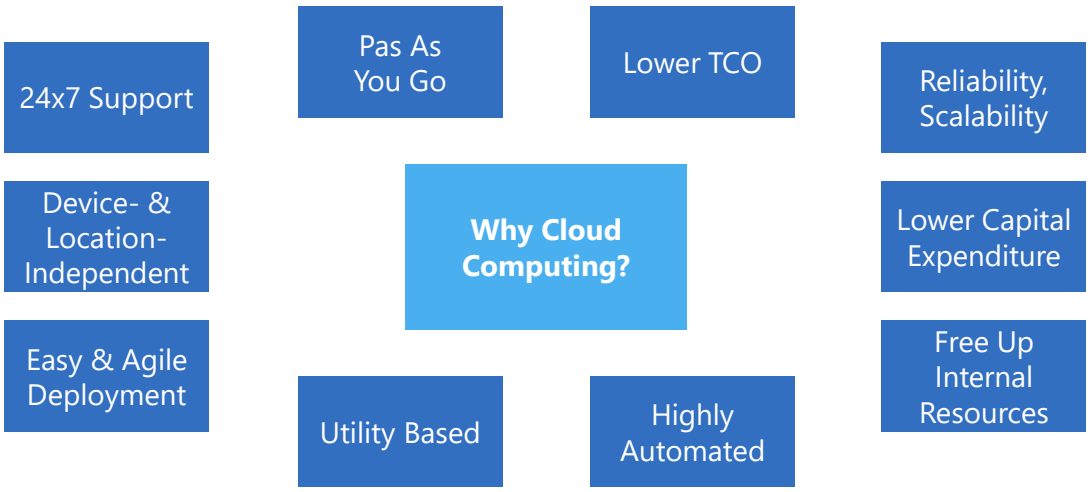
Cloud Deployment Model



Cloud Deployment Models – Advantages & Characteristics

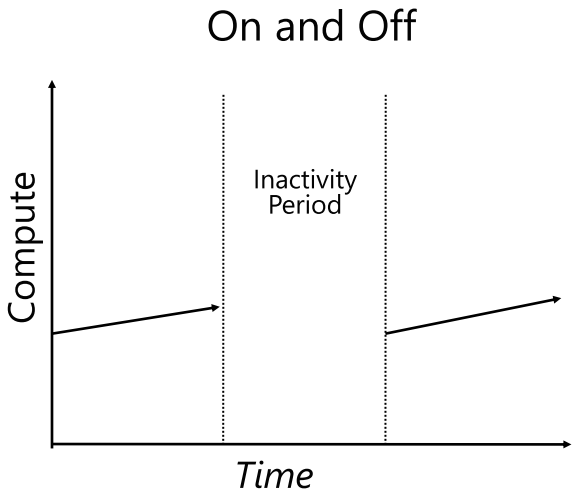
Model	Advantages and Characteristics
Public	Shifts capital expense to operating expense Offers pay-as-you-go pricing Supports multiple tenants
Private	Leverages existing capital expense Can help reduce operating costs Intended for a single tenant
Hybrid	Bridges one or more community, private, or public clouds Allows manipulation of CapEx and OpEx to optimize cost Supports resource portability
Community	Allows sharing of CapEx and OpEx to reduce costs Brings together groups with a common interest Supports resource portability

Why Cloud Computing?



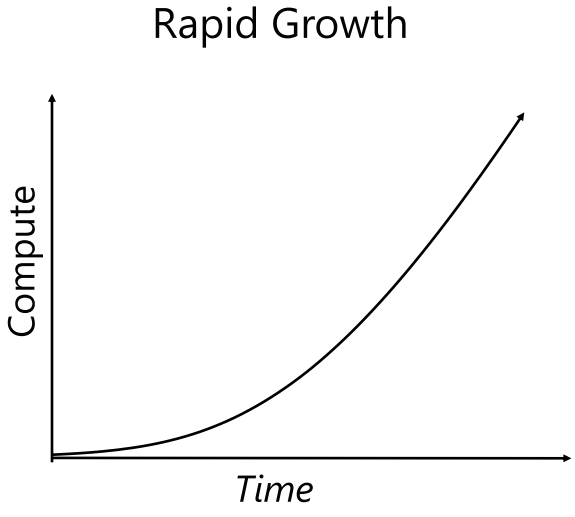
Typical Computing Pattern

- On & off workloads
  - Batch jobs
- Wasted Capacity
- Time to market can be cumbersome



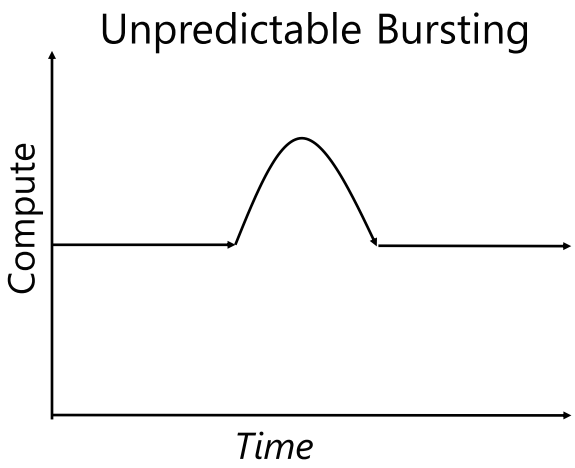
Typical Computing Pattern

- Rapidly growing company
- Major challenge for IT dept. to keep up with growth
- Potential loss of business opportunity
- Potential customer service problems



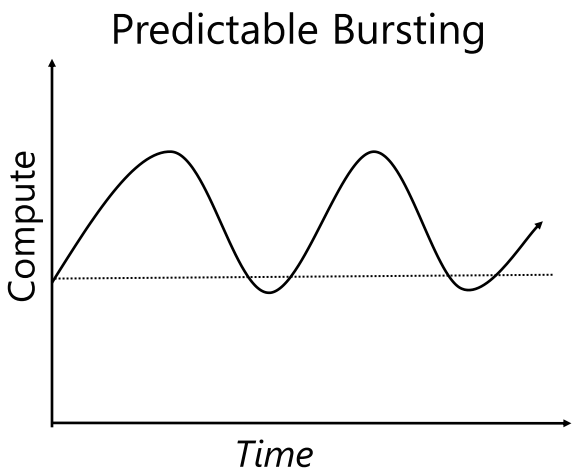
Typical Computing Pattern

- Unexpected peak in demand
- Loss of business opportunity
- Wasted capacity if demand wanes

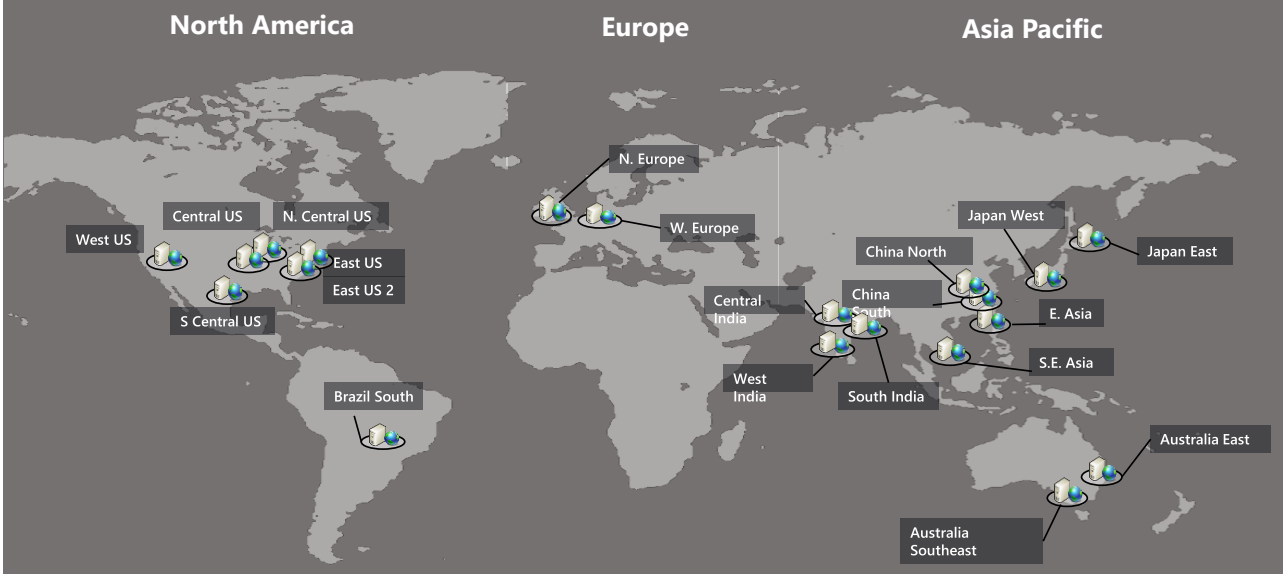


Typical Computing Pattern

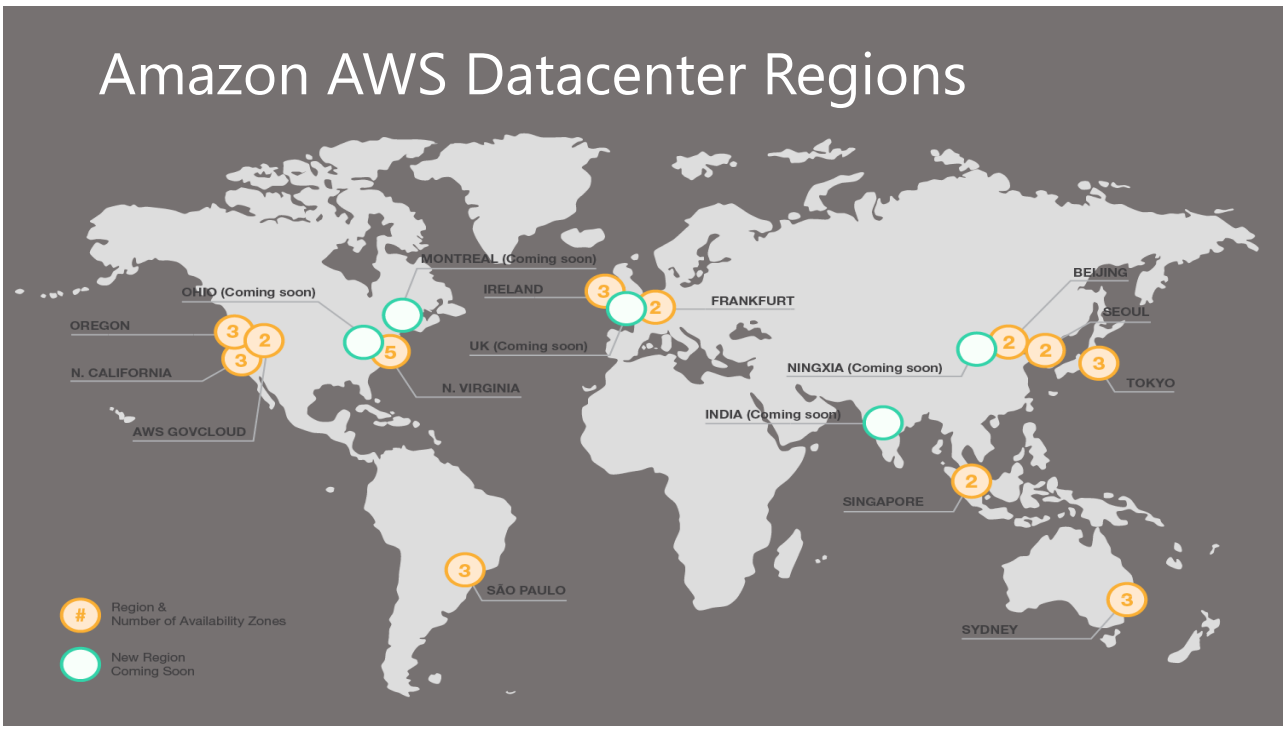
- Seasonal peaks and troughs
- Provisioning dilemma
  - Wasted capacity or
  - Loss of business



Azure Datacenter Regions



Amazon AWS Datacenter Regions

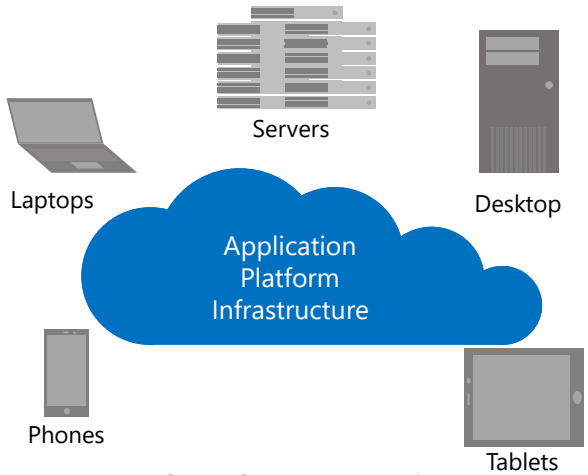


Cloud Computing Examples

- A large enterprise quickly & economically deploys new internal applications to its distributed workforce.
- An e-commerce website accommodates sudden demand for a "hot" product caused by a viral buzz.
- A pharmaceutical research firm executes large-scale simulations using computing power provided by cloud vendors.
- A media company serves unlimited video, music, and other media to their worldwide customer base.

Cloud Computing Nutshell

- End-users connect over the Internet to the cloud from their own personal computers or portable devices in order to access services.
- To the end-user, the underlying infrastructure such as the hardware, operating system, etc., is invisible



Cloud Computing

Cloud Vendor - Azure & AWS

Microsoft Azure and Amazon Web Services (AWS) offer broad and deep capabilities with global coverage

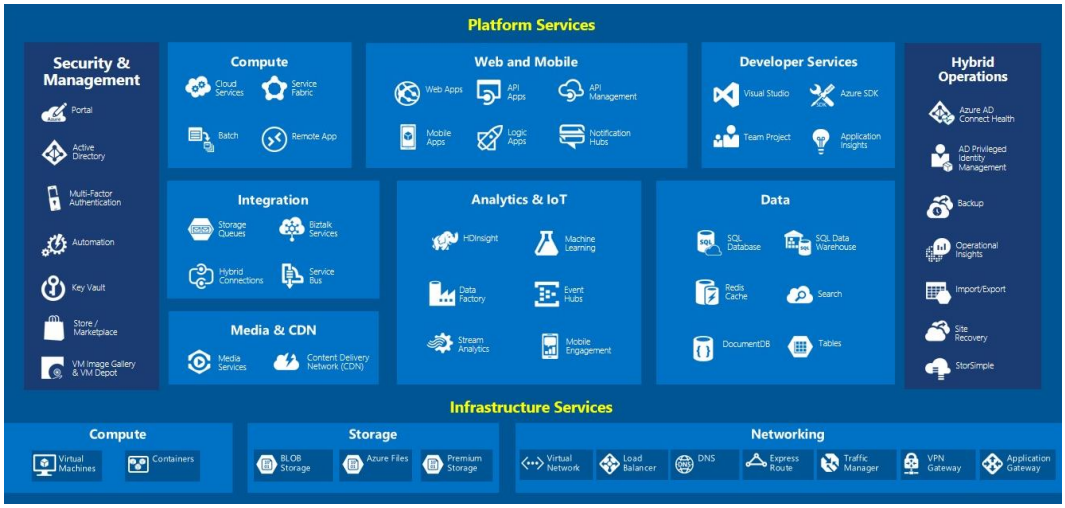
Category	Azure Service	AWS Service
Computing infrastructure	Virtual Machines	EC2
Object storage infrastructure	Blob Storage	S3
Networking	Virtual Network	Virtual Private Cloud
Relational database-as-a-service	SQL Database	RDS
NoSQL document database	DocumentDB	DynamoDB
Big data processing	HDInsight	Elastic MapReduce (EMR)
Visualization	Power BI	QuickSight

Cloud Vendor - Bluemix & Google

IBM Bluemix and Google Cloud each offer and deploy applications on highly-scalable and reliable infrastructure

Category	Bluemix	Google Service
Computing infrastructure	Virtual Server, Containers	Compute Engine
Object storage infrastructure	Object, Block Storage	Cloud Storage
Networking	Virtual Private Network	Cloud Virtual Network
Relational database-as-a-service	SQL Database	Cloud SQL
NoSQL document database	MongoDB	Cloud Datastore, Bigtable
Big data processing	Analytics for Apache Hadoop	BigQuery, Cloud Dataproc
Visualization		

Azure Services



Azure Usage

- Azure Active Directory Users
  - More than 500 Million
- Storage transactions per day
  - More than 777 Trillion
- Messages processed by Azure IoT per month
  - More than 1.5 Trillion
- Active Websites
  - More than 250,000
- Percentage of Fortune 500 Companies using Azure
  - More than 80%
- Authentications per week
  - More than 13 Billion
- SQL Databases in Azure
  - More than 1.5 Million
- Developers registered with Visual Studio Online
  - More than 1 million

Vendor Lock-In

Companies that adopt cloud computing must be wary of potential vendor lock-in issues

- Company's entire data is stored with a single vendor's cloud storage
- Company relies on a single vendor for all of its computations
- Changing vendors can be very costly

Summary

In this lesson, you have learned:

- Cloud Computing
  - Ubiquitous via network access
  - Location-independent shared pool of computing resources
  - On-demand rapid provisioning and tear down
  - Pay only for current client requirements
- Service Models
  - IaaS, PaaS, SaaS
- Deployment Models
  - Public, Private, Community, and Hybrid

Cloud Computing and Azure Foundation

Module 1, Lesson 2: Cloud Computing Services

Topics

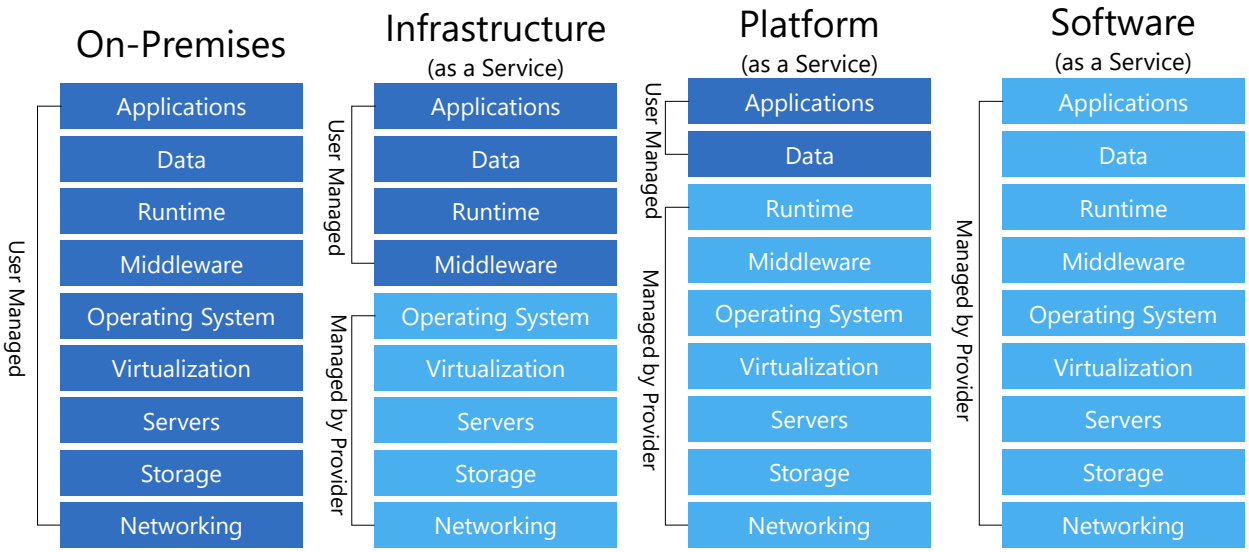
Software (as a service) Cloud Service
Platform (as a service) Cloud Service
Infrastructure (as a service) Cloud Service
Other Types of Cloud Services

Objectives

By the end of this lesson you should be able to:

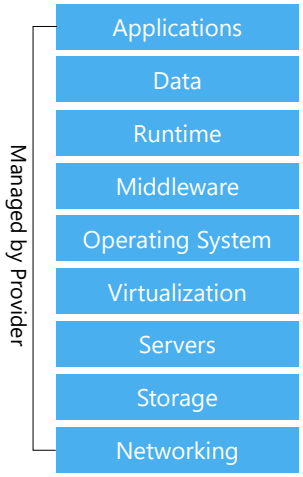
- Explain cloud service models and the underlying division of responsibility that distinguishes them
- Understand current SaaS, PaaS, and IaaS services
- Discuss other types of services and the overall direction towards XaaS (Everything as a Service)

Service Model Division of Responsibility



Software as a Service (SaaS)

- Cloud service vendor is responsible for software, hardware, and infrastructure
- Customers can reduce their upfront and ongoing maintenance costs and instead pay for services like a utility
- Customers do not have as much freedom to customize the service and can only change parameter settings as provided by the cloud vendor



Salesforce.com as an SaaS

Online salesforce automation and CRM

The following are sales points advertised by Salesforce:

- No vendor lock-in
- No large up-front investment
- No maintenance headaches
- No steep learning curve
- No outdated solutions

Microsoft Office 365

Microsoft Office Suite on the Web

Flexible environment to collaborate and work together

- Multiple environments
  - Desktop, tablet and mobile phones
- Work anywhere, anytime, any device
- Concurrent edits

GoToMeeting, WebEx, Skype

Most SaaSs have their roots on the desktop

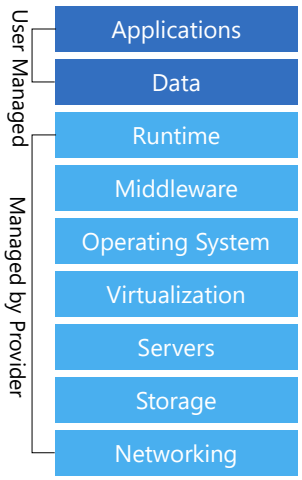
- Modern versions of old utilities
  - Think old TelCos
  - Services charged like utilities

Storage – SaaS or IaaS?

- Backup storage services such as Google Drive, Box, and OneDrive should be considered SaaS; user is not responsible for the backup software
- Storage services such as Azure Blobs and Amazon S3 are considered IaaS

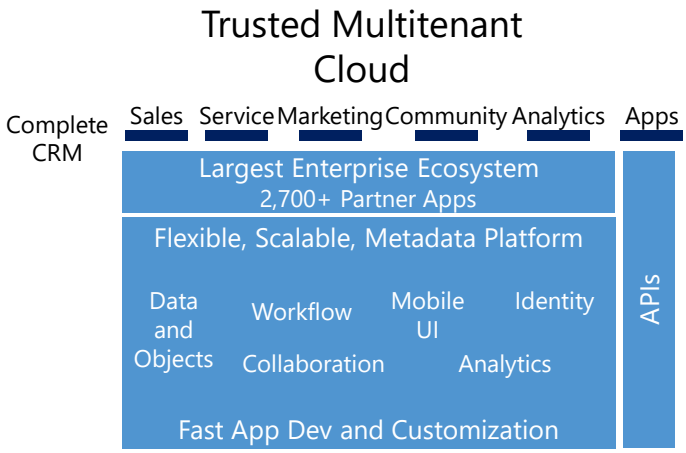
Platform as a Service (PaaS)

- Cloud vendor responsible for everything necessary to deliver a platform
- End-user responsible for maintaining the solutions and data created
- End-user NOT responsible for maintaining and updating platform
- PaaS end-users are often SaaS vendors

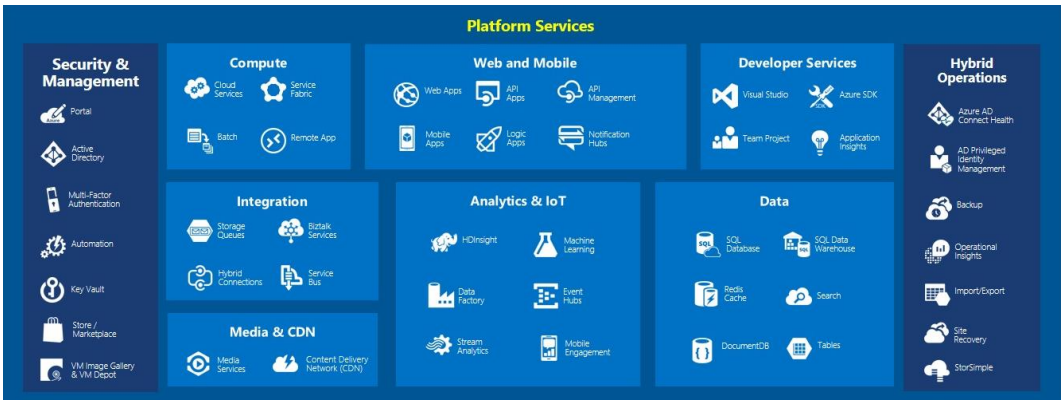


Salesforce.com as a PaaS (?)

- Multi-tenant cloud
  - Multiple user have shared resources as well as dedicated resources
- Metadata-driven architecture
  - All customizations (code, configuration, apps) are specified and saved as metadata
- API-to-CRM engine

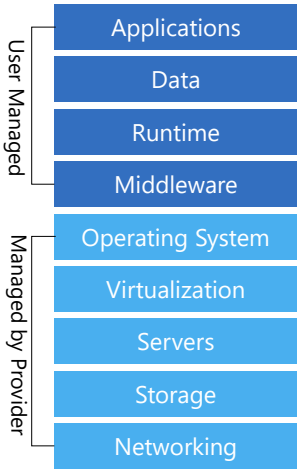


Azure Platform Services



Infrastructure as a Service (IaaS)

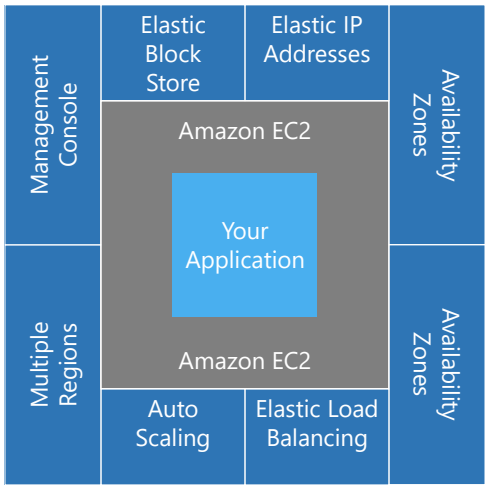
- Cloud vendor responsible for underlying hardware and operating system
- Provides user with the most flexibility
- User can customize underlying hardware and operating system
- Can be susceptible to vendor failure
  - AWS glitch in Sept. of 2015 brought down major services such as Netflix



Azure Infrastructure Services

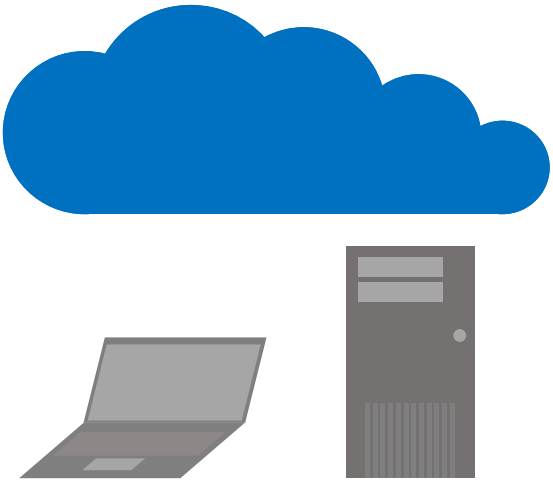
AWS EC2 and S3

- Amazon Elastic Cloud Computing
  - Resizable and elastic compute capacity in the cloud
  - Abundant community images
- Amazon Simple Storage Service
  - Online file storage web service
  - Accessible through REST, SOAP. and BitTorrent
- Elastic load balancing
- Automatic scaling



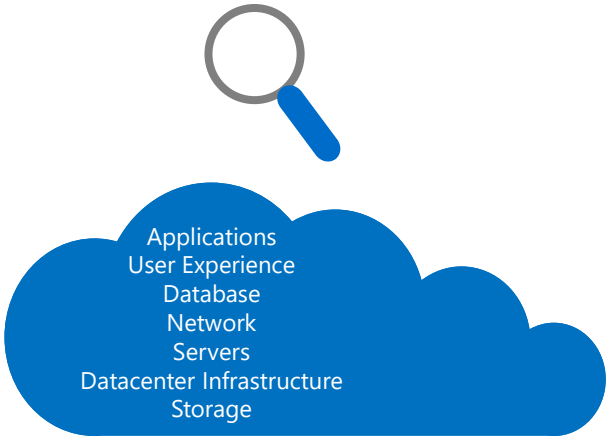
Desktop (as a service) Cloud Service

- Provides and manages a virtual desktops
- Allows smaller companies who find Virtual Desktop Infrastructure (VDI) to be cost prohibitive to deliver similar services
- Quickly deploy new solutions across the entire enterprise located in multiple regions



Monitoring (as a service) Cloud Service

- Consists of tools and applications meant to monitor certain aspects of an application, server, system, or any other IT component
- State monitoring is the most common service
  - The state of a component is constantly evaluated and results are displayed in real time



Metal (as a service) Cloud Service

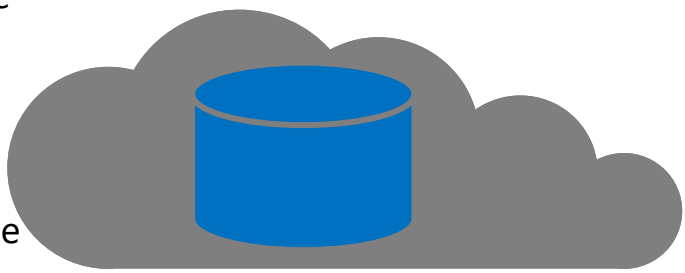
- A bare metal provisioning system to rapidly deploy physical servers
- *Flexibility* of cloud computing with *power* of actual physical servers
- Serves as a layer underneath IaaS

Communication (as a service) Cloud Service

- Includes enterprise communication solutions such as VoIP (Voice over IP), instant messaging (IM), and video conferencing that can be leased
- Vendor is responsible for all hardware and software and offers guaranteed Quality of Service

Database (as a service) Cloud Service

- Cloud-based approach to the storage and management of structured and unstructured data
- Rather than offering raw storage platforms, this service offers functionality of database platforms such as SQL Server, MySQL, Oracle, and NoSQL



Summary

In this lesson, you have learned:

- Service Models
  - IaaS, PaaS, SaaS
- Move towards XaaS (Everything as a Service)
  - Database
  - Desktop
  - Communications
  - Metal
  - Monitoring

Cloud Computing and Azure Foundation

Module 1, Lesson 4:
How to start Azure

Topics

What is a Virtual Machine?
Using Azure to Create and Deploy Virtual Machines
How to use Azure for Data Analysis

Objectives

By the end of this lesson you should be able to:

- Explain what a virtual machine is
- Use Azure to create a Windows or Linux virtual machine
- What is Big Data?
- Understand how to use Azure for data analysis

What is a Virtual Machine?

- A software implementation of a physical computer
- An emulation of a particular computer configuration
- An IaaS system that runs an operating system and applications
- One of several types of on-demand, scalable computing resources in cloud computing.

Why Virtual Machines?

- Easy to stop and start
- Disaster recovery
- Pay only for what you use
- Scalability

Some Providers for Virtual Machines

Service Provider	Virtual Machine Options
Amazon	Elastic Cloud Compute (Amazon EC2)
Google	Compute Engine
IBM	Bluemix Virtual Servers
Microsoft	Azure Virtual Machine

Benefits of Azure

- Launch websites quickly
- Visual Studio development
- Ability to use familiar Microsoft tools
- Leverage Windows Azure Virtual Machines
- Keep data storage simple
- Provides big data insights (HDInsight service)

Virtual-Machine Sizes

Azure offers a variety of VM sizes and attributes

Series	Sizes	Attributes
A-Series	A0, A1, A2, A3, A5, A6, A7, A8, A9, A10, A11	Up to 112 GB RAM and 16 cores Up to 16 Data Disks (1 TB each)
D/DS/Dv2-Series	D1, D2, D3, D4, D11, D12, D14, D5v2	Up to 100% faster than A-Series Up to 112 GB RAM and 16 Cores Up to 32 data disks (1 TB each) Solid-state drives
G/GS-Series	G1, G2, G3, G4, G5	35% faster than D-Series Up to 448 GB RAM and 32 cores Up to 64 data disks (1 TB each) Solid-state drives

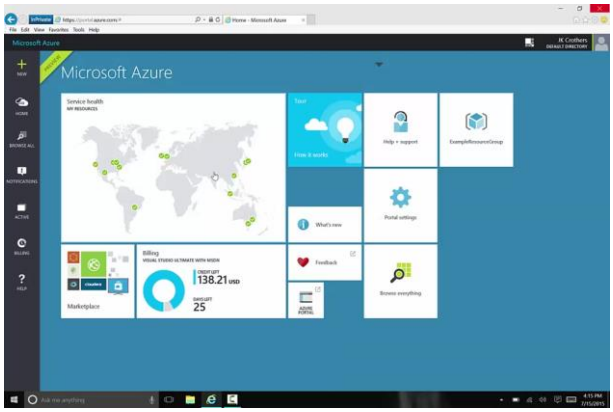
Power vs. Cost

Three kinds of comparisons in Azure VM sizes

Size	Power	Cost
A8	8 Cores 56 GB RAM 32 Gbit/sec InfiniBand with RDMA	Windows: $1.47/hr. or $1,091/mo. Linux: $0.98/hr. or $725/mo.
D1	1 Core 3.5 GB RAM 50 GB SSD drives	Windows: $0.14/hr. or $104/mo. Linux: $0.077/hr. or $57/mo.
G5	32 Cores 448 GB RAM 6,144 GB SSD drives Latest Xeon E5 v3 processors	Windows: $9.65/hr. or $7,180/mo. Linux: $8.69/hr. or $6,465/mo.

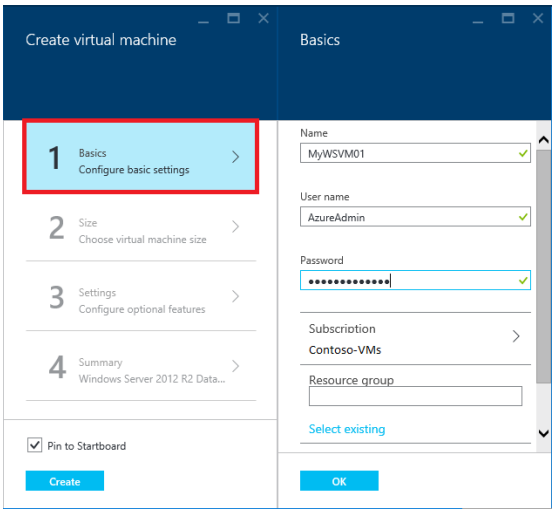
Azure Resource Manager

- Resources can be collated into resource groups
  - Deploy, manage, monitor, and delete all resources at once
- Complex deployments can be performed declaratively via deployment templates
  - Templates specify all the resources — VMs, switches, storage accounts, etc. — to be provisioned



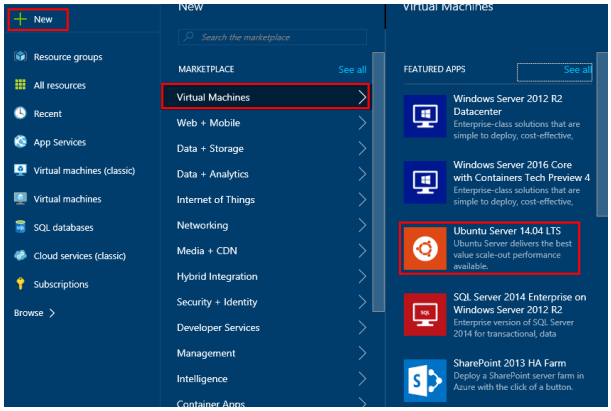
How to create a Windows VM

1. Sign in to the Azure portal
2. On the Hub menu, click ***New*** > ***Virtual Machines*** > ***Windows Server 2012 R2 Data center***
3. Select a deployment model, select ***Resource Manager***. Click ***Create***.
4. On the Create virtual machine blade section, click ***Basics***, ***Size***, ***Settings***, ***Summary***
5. Enter a value you want for the virtual machine in each phase.



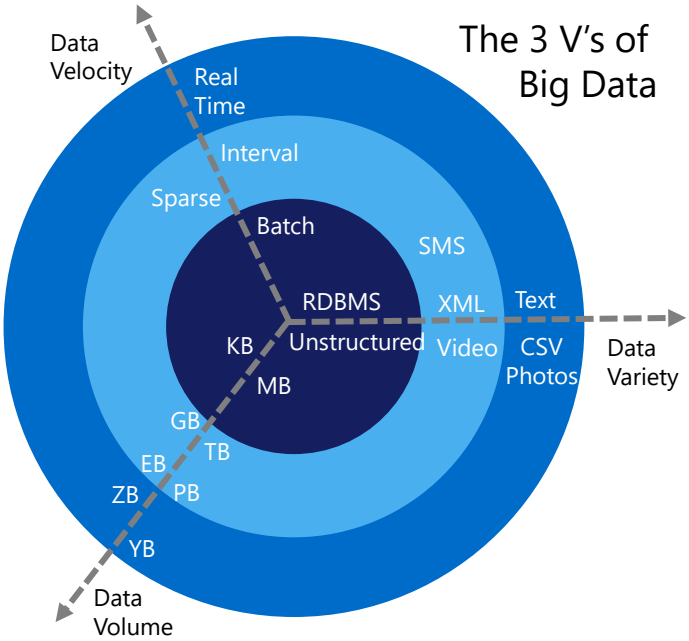
How to create a Linux VM

1. On the Hub menu, click ***New*** > ***Virtual Machines*** > ***Ubntu Server 14.04 LTS***
2. Select a deployment model, select ***Resource Manager***. Click ***Create***.
3. On the Create virtual machine blade section, click ***Basics***, ***Size***, ***Settings***, ***Summary*** .
4. Enter a value you want for the virtual machine in each phase.



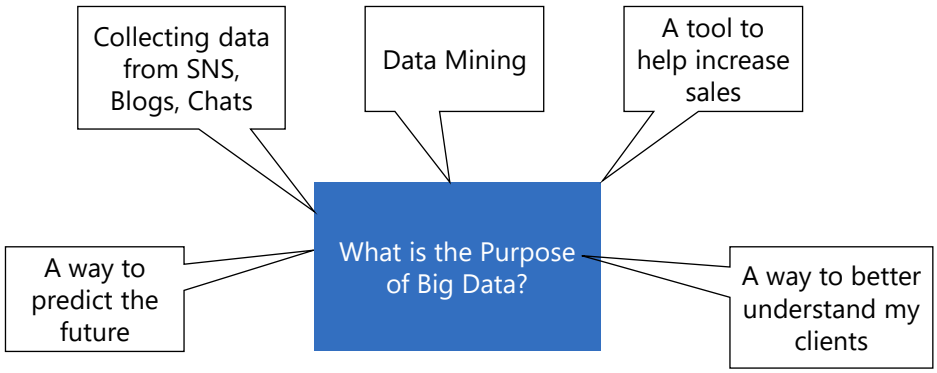
What Is Big Data?

- Computing Today:
  - Variety
  - Velocity
  - Volume



The Purpose of Big Data

Motivation for Big Data: changing nature of data



Hadoop Distributions

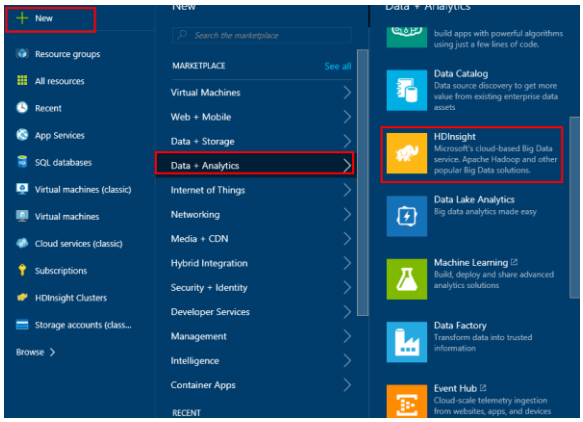
- HDInsight
  - Cloud-based big data service
- Data Lake Analytics, Data Factory
- Cloudera enterprise Data Hub
- Hortonworks Sandbox with HDP 2.4
  - Hortonworks Data Platform (HDP)

What is Azure HDInsight & HDP?

- HDInsight
  - Run Apache Hadoop, Spark, HBase and Storm technologies without managing deployment or configuration.
- HDP is a Hortonworks specific platform of Hadoop
  - Crunch all data – structured, semi-structured, unstructured
  - Develop in several languages including c#, Java, Python and .NET.
  - Use Excel or your favorite BI tool to visualize data
  - Use NoSQL transactional capabilities
  - Provide real-time stream processing

How to Create an HDInsight Instance

1. On the Hub menu, click ***New*** > ***Data + Analytics*** > ***HDInsight***
3. Select a deployment model, select ***Resource Manager***. Click ***Create***.
4. On the Create virtual machine blade section, click ***Basics***, ***Size***, ***Settings***, ***Summary*** .
5. Enter a value you want for the virtual machine in each phase.



Summary

In this lesson, you have learned:

- What is Virtual Machine in Azure?
- How to use Azure to create both Windows and Linux VM
- What is the purpose of Big Data?
- Understand how to use Azure for data analysis