
# 14-848 Cloud Infrastructure

## INTRODUCTION TO THE CLOUD

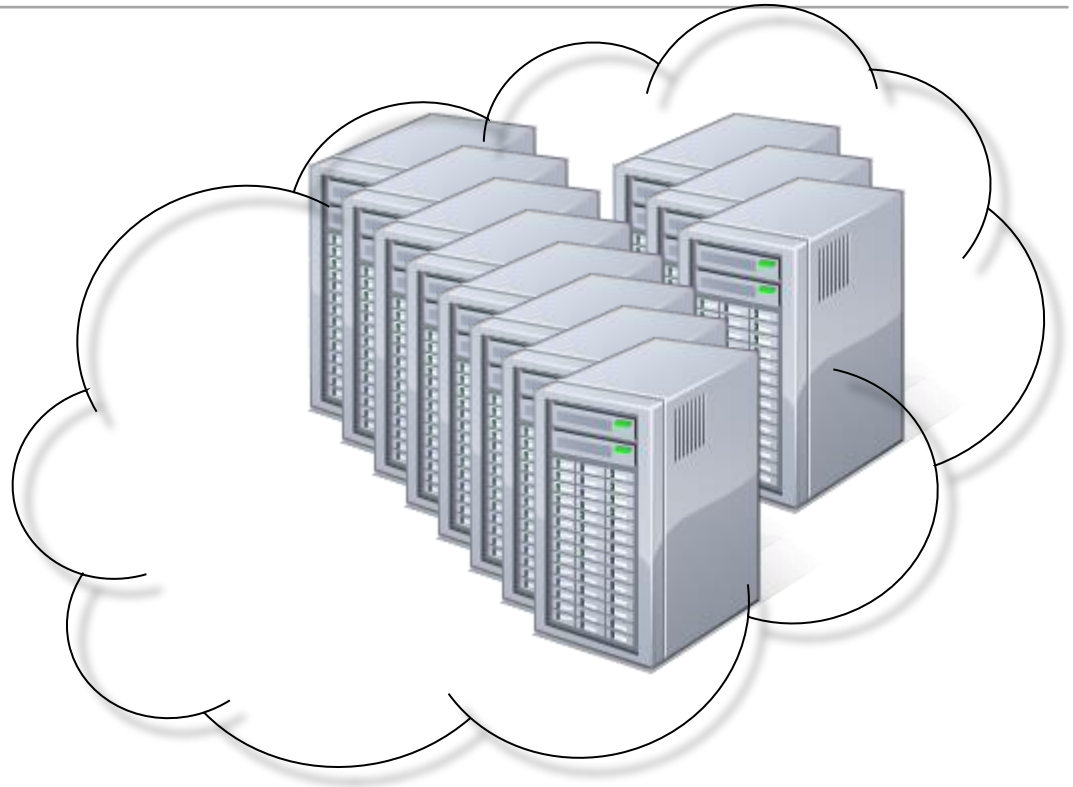
# Agenda

- Cloud Computing Introduction
  - What is Cloud Computing?
  - What are the Cloud Characteristics?
- Cloud vs Conventional Computing
- Cloud Benefits
- Cloud Computing Enablers
- Cloud Computing Service Model

# What is the Cloud?

- It's a cluster!
- It's a supercomputer!
- It's a datastore!
- It's superman!

- None of the above?
- All of the above?

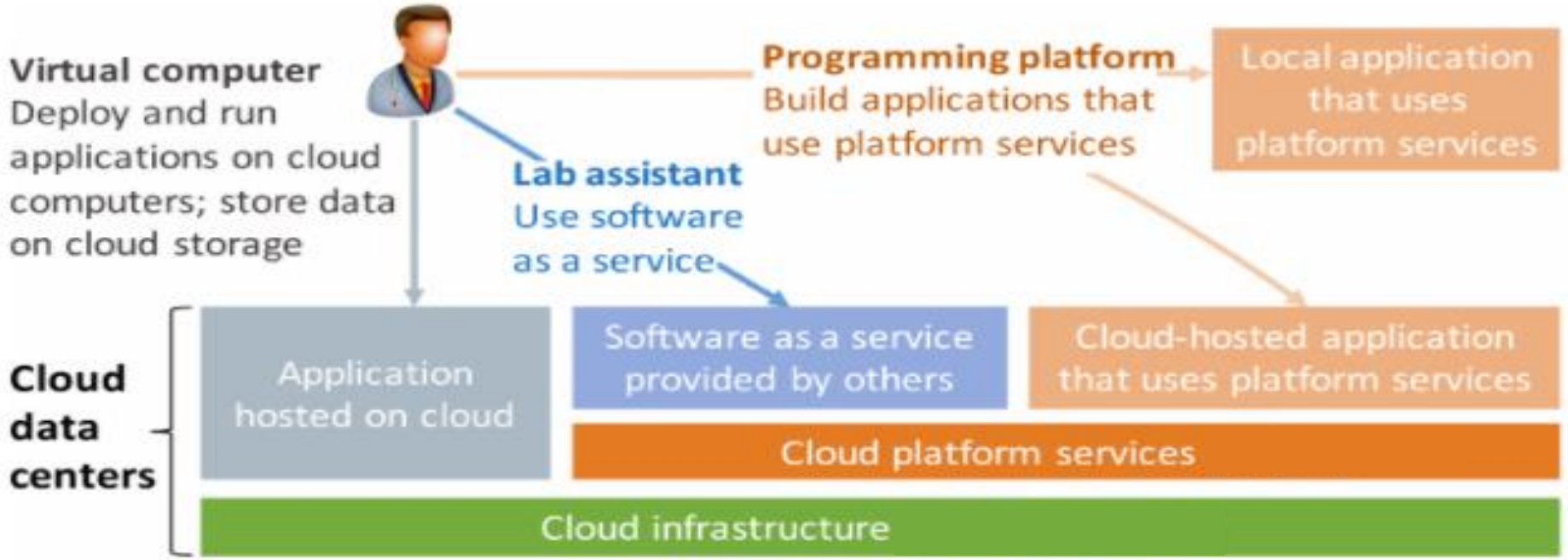


- In simple words:
  - Cloud = Lots of storage + compute cycles nearby + network bandwidth

# Cloud Computing – NIST Definition

A *model* for enabling convenient, on-demand network access to a *shared* pool of *configurable computing* **(e.g., servers, storage, applications, and services)** and networking resources that can be *rapidly provisioned* and *released* with *minimal management* effort or service provider interaction

# Cloud Use




From Cloud Computing for Science and Engineering by Gropp and Lusk

Scientists can use clouds in three distinct ways:

- As a source of on-demand computing and storage on which to run their own software (left);
- As a source of software that can be run over the network (center)
- As a source of new platform capabilities that can allow development of new types of software (right)

# What is Cloud Computing in the REAL WORLD?

"Cloud" refers to large Internet services running on 10,000s of machines (Amazon, Google, Microsoft, etc)

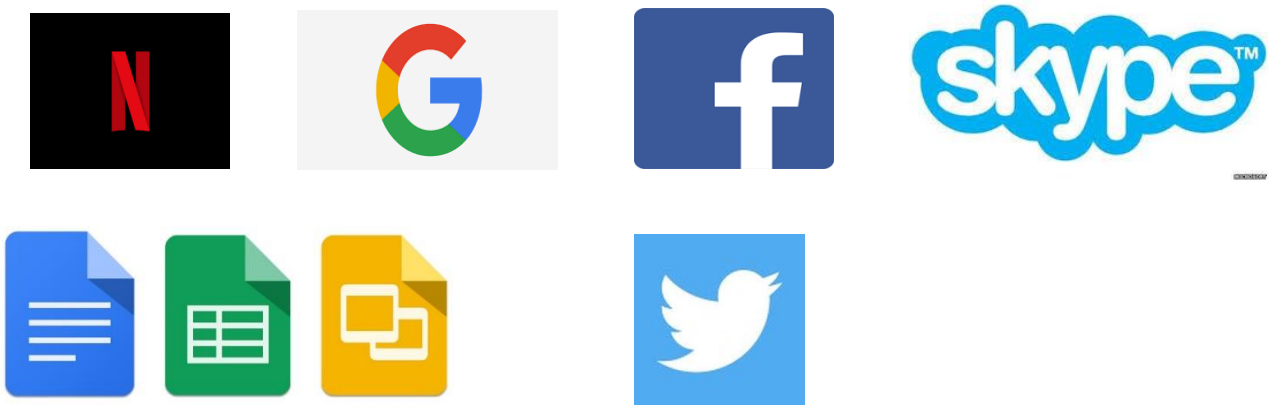
"Cloud computing" refers to services by these companies that let external customers rent cycles and storage

- Amazon EC2: virtual machines at 8.5¢/hour
- Amazon S3: storage at 21¢/GB/month
- Google Cloud AppEngine
- Windows Azure

# Why Do We Care about Cloud Computing?

- Dropbox
- Google Drive
- Microsoft OneDrive
- Apple iCloud

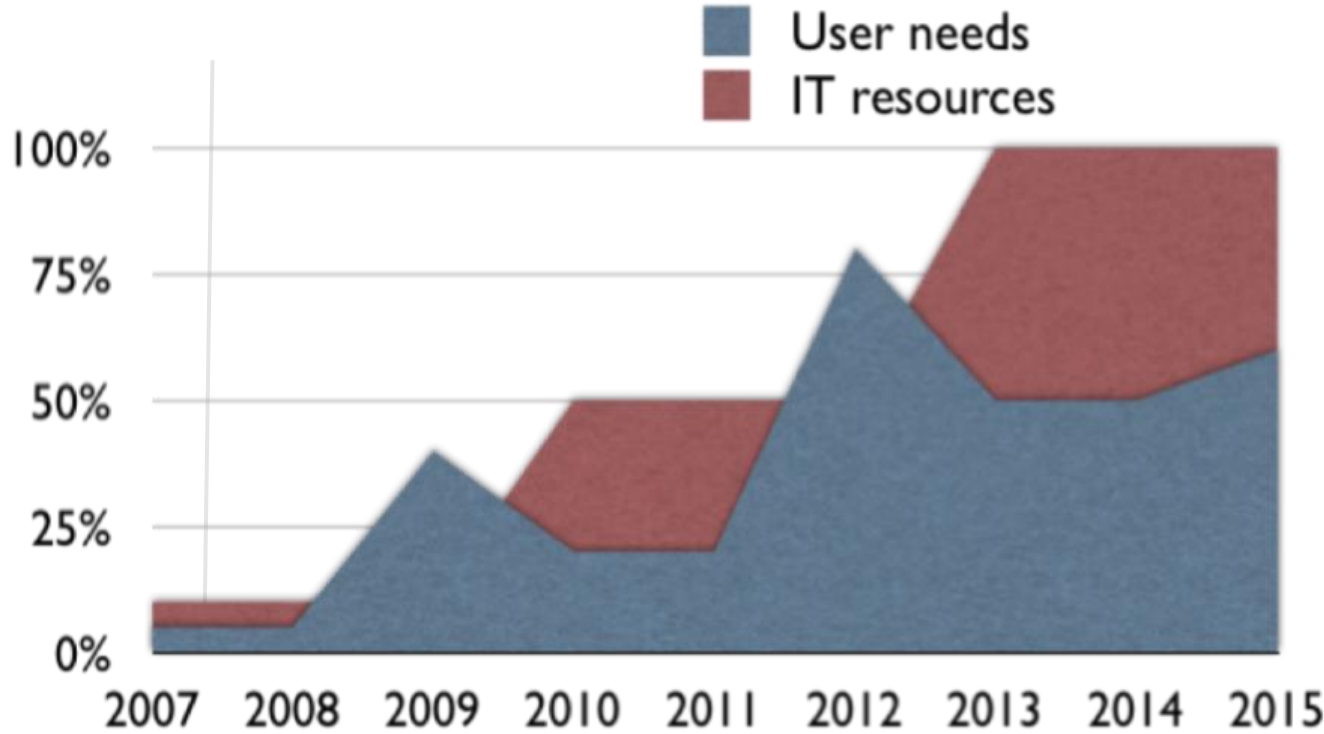

- Netflix - hosted on AWS
- Google search – Google Cloud
- Google Docs, Sheets, and Slides
- Facebook
- Skype
- Twitter



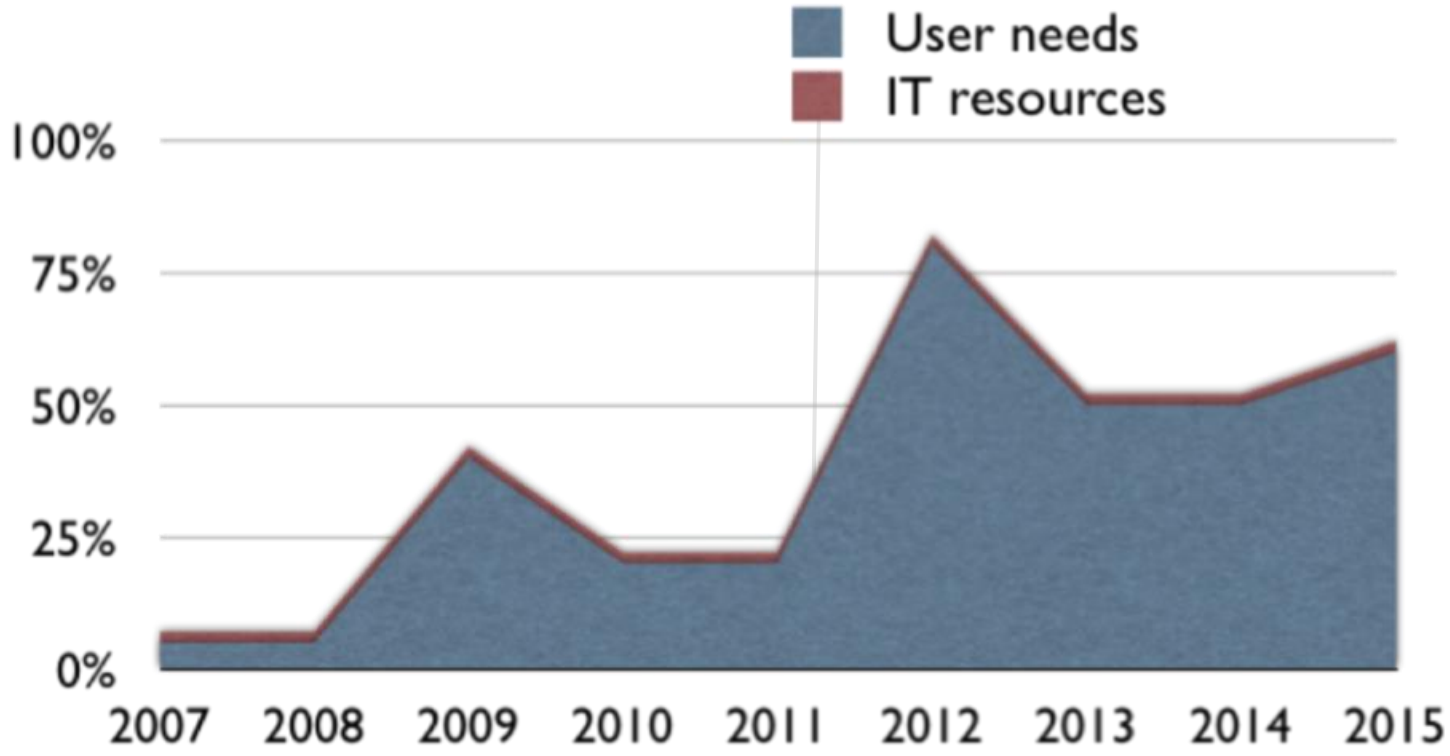
# Conventional Computing Infrastructure - Needs vs IT RESOURCES

Moore's law

- Storage Doubling Period: 12 months
- Bandwidth Doubling Period: 9 months
- CPU Computing Doubling Period: 18 months



# Cloud Computing Infrastructure - Needs vs IT RESOURCES

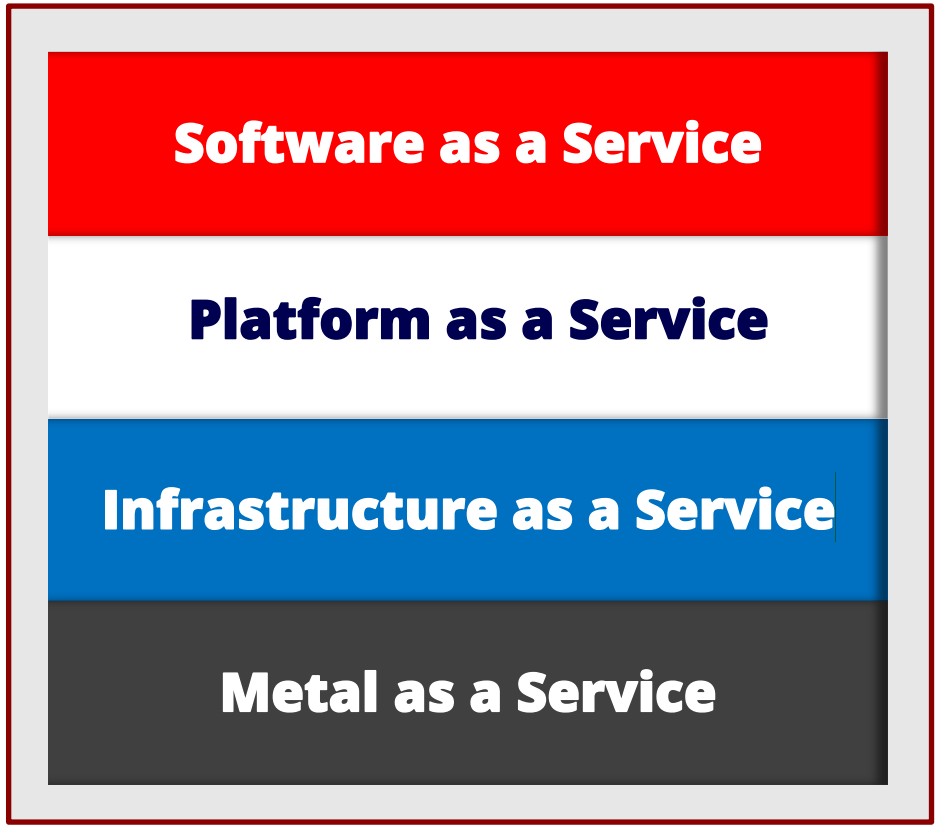


# Conventional Computing Infrastructure vs Cloud Computing Infrastructure

| Conventional | Cloud |
| --- | --- |
| Manually Provisioned | Self-provisioned |
| Dedicated Hardware | Shared Hardware |
| Fixed Capacity | Elastic Capacity |
| Pay for Capacity | Pay per Use |
| Capital & Operational Expenses | Operational Expenses |
| Managed via System administrators | Managed via APIs |

# Cloud Benefits

# Cloud Computing Service Model




Put the software on the cloud to allow other users to use it

Put the platform on the cloud so others can develop their software on the platform

Give a virtual machine that you can install OS and put all platforms/softwares on it

文本

# SaaS: Software as a Service

- Provided with access to application software in the cloud
  - On-demand software
- Most applications can be run directly from web browser
- Largest cloud market
- Examples: Google Apps, Microsoft Office 365, Oracle's Netsuite, SAP's Concur, Cisco WebEx, GoToMeeting

# PaaS: Platform as a Service

- Provides computing platforms which typically includes operating system, programming language, execution environment, database, web server, etc. to build cloud applications.
- Applications using PaaS inherit cloud characteristic such as scalability, high-availability, multi-tenancy, SaaS enablement, and more.

- Examples: Google App Engine, AWS Elastic Beanstalk, Salesforce.com, Amazon EMR, MS Azure HDInsight, GCP Dataproc

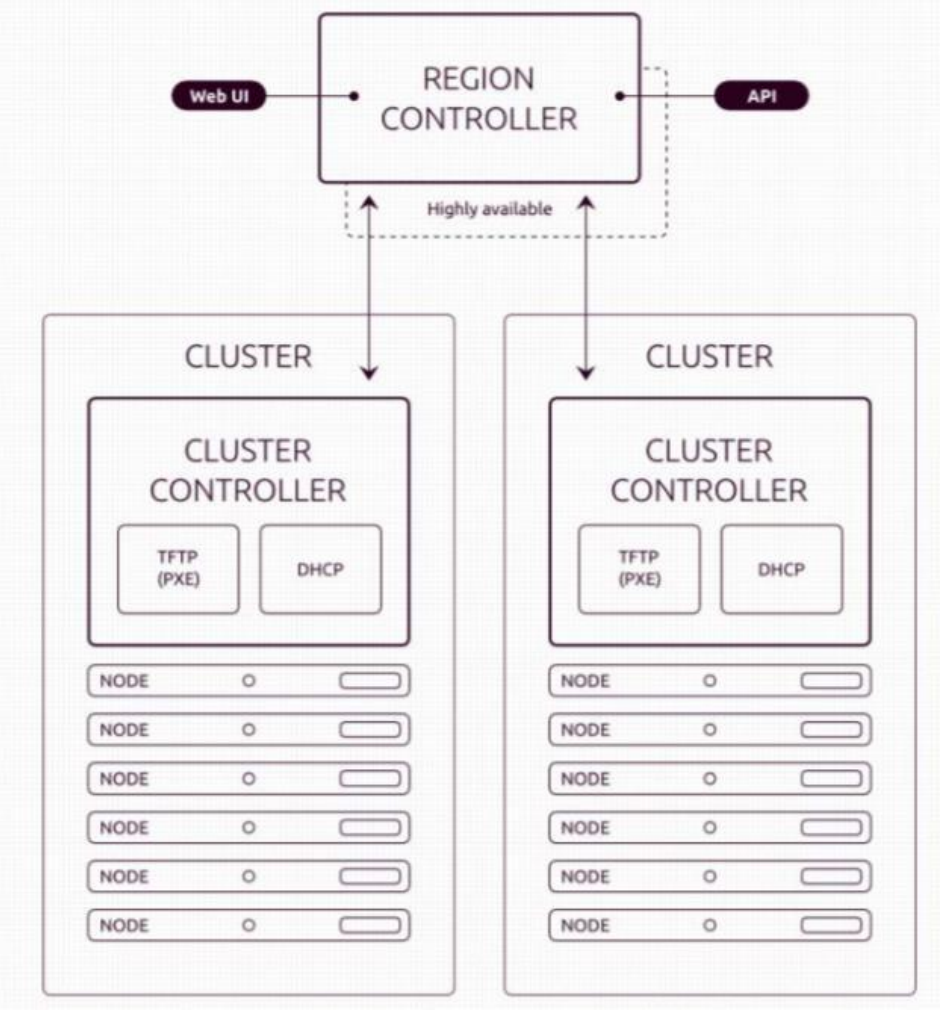
# IaaS: Infrastructure as a Service

- Offers storage and computing resources that developers and IT organization use to deliver custom business solutions
- Examples: Amazon EC2, VMWare vCloud, GCP Compute Engine

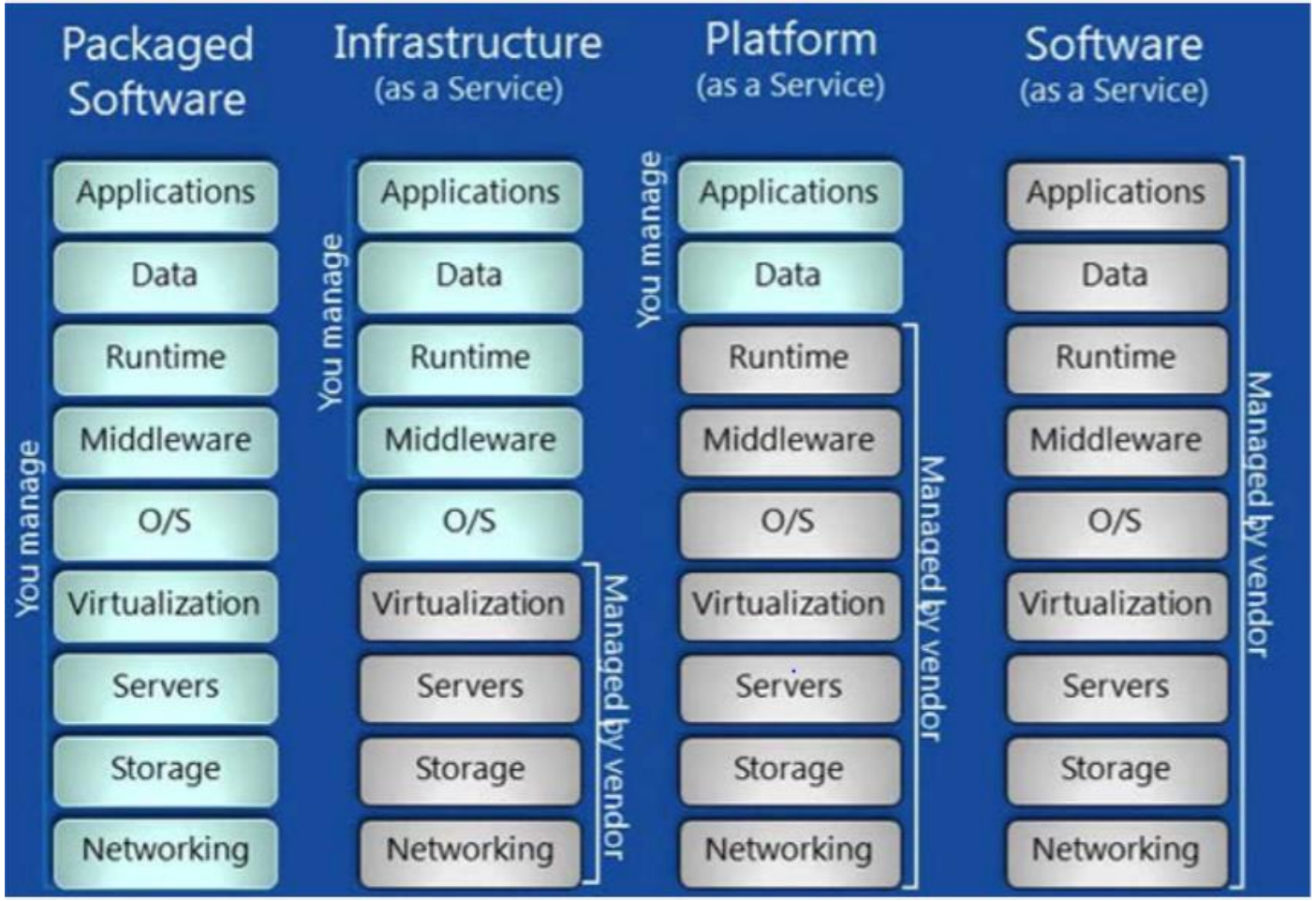
# MaaS: Metal as a Service

- Combines the flexibility and scalability of the cloud with the ability to harness the power of physical servers.
- Examples: Juju

- For more information, watch this video (optional): https://www.youtube.com/watch?time_continue=280&v=FBCKCO45xIw



# Cloud Computing Service Model




In MAAS

- You will have the option to control everything!

# PaaS or IaaS?

**Vendor Lock-in**: the ability to use “what you manage” in cloud environment with different cloud provider.

- PaaS may lock-in applications by requiring users to develop apps based on their specific APIs.
- If you are using PaaS, it might be difficult to switch to different vendor.

**Development Tools**

- PaaS providers usually allow a set of development tools for their users to shorten development time.
- Another trick for vendor lock-in!

# Cloud Computing Enablers

## Data Center + Virtualization

# Next Steps

- Take the Quiz: quiz access code is released in the lecture.
- Submit the first homework
  - HW-1 is released today at 6pm ET/3pm PT.
  - Submit HW-1 by Thursday 1/26 11:59PM ET, 8:59PM PT