
Cloud Computing

By

Asst.

Prof.

Ghassan A.

OasMarrogy

Cloud Computing

- Cloud Introduction
- Cloud Service Model
- Big Data
- Hadoop
- MapReduce
- HDFS (Hadoop Distributed File System)

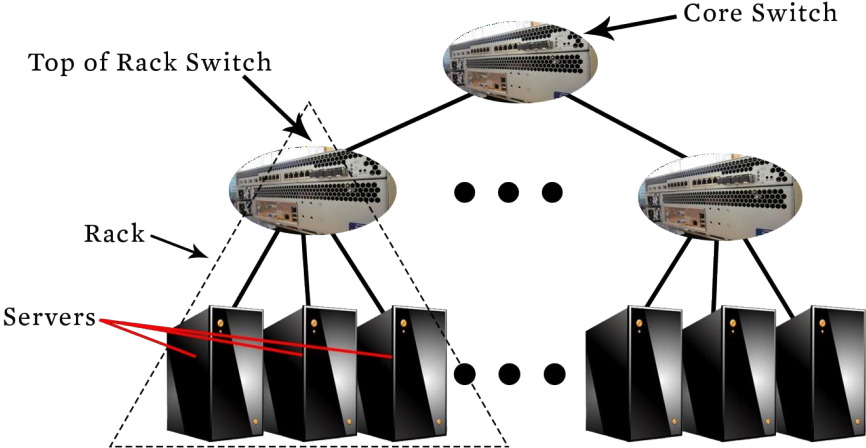
Cloud Introduction

Cloud Computing



- ▶ **What does Cloud Computing do?**
 - Provides online **data storage**
 - Enables **configuration** and **accessing** of online applications
 - Provides a variety of **software** usage
 - Provides **computing platform** and **computing infrastructure**

A Sample Cloud Topology



Cloud Computing



▶ Application Example

- Using **Gmail** on my **smartphone** to check **e-mails**
- Receive an e-mail with a **MS Power Point** attachment file
- However, **MS Power Point** and **Windows OS** is not installed on my smartphone!
- Google Drive service's **Google Docs, Sheets, and Slides** can be used to open the file



What is Cloud Computing?

- **Cloud Computing** is a general term used to describe a new class of network based computing that takes place over the Internet,
 - basically a step on from Utility Computing
 - a collection/group of integrated and networked hardware, software and Internet infrastructure (called a platform).
 - Using the Internet for communication and transport provides hardware, software and networking services to clients
- These platforms hide the complexity and details of the underlying infrastructure from users and applications by providing very simple graphical interface or API (Applications Programming Interface).

What is Cloud Computing?

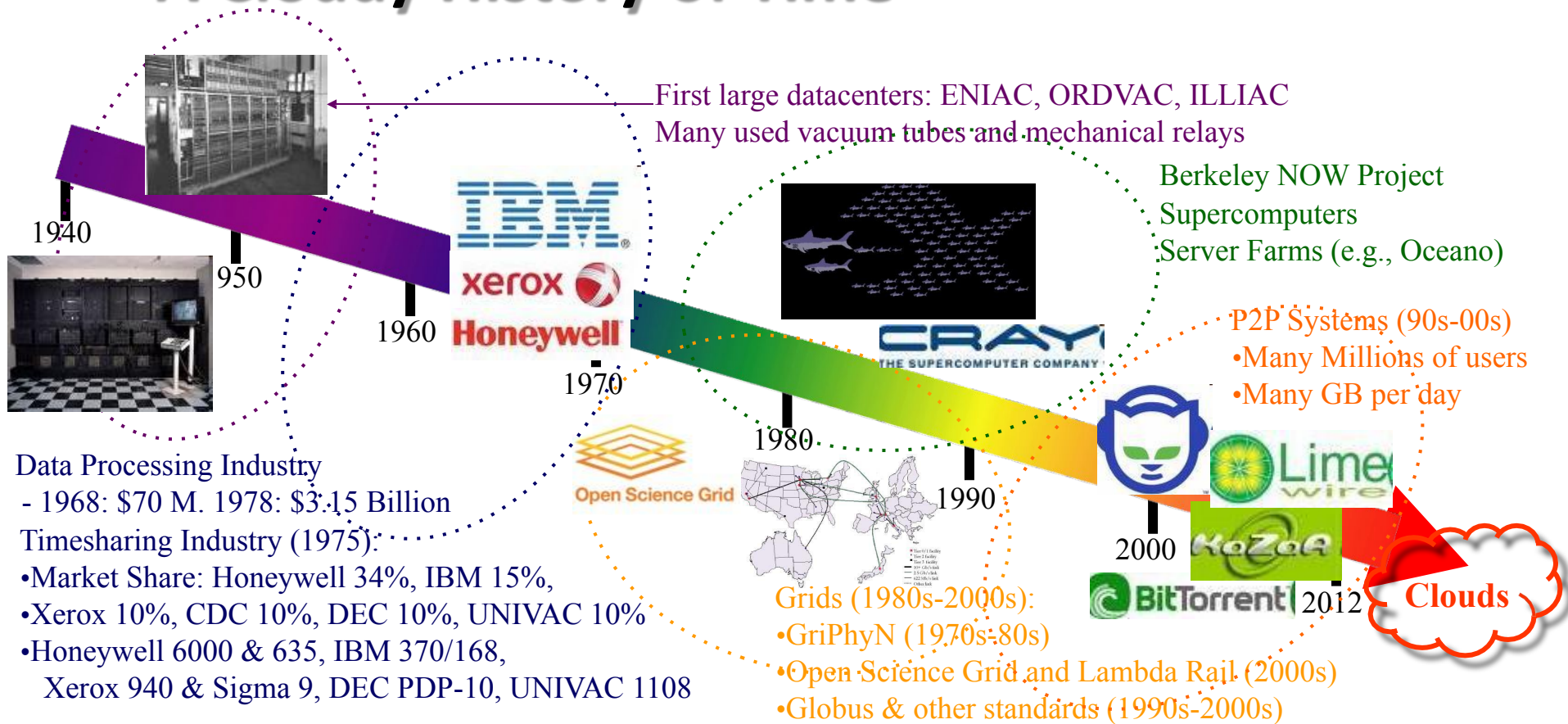
- In addition, the platform provides on demand services, that are always on, anywhere, anytime and any place.
- Pay for use and as needed, elastic
 - scale up and down in capacity and functionalities
- The hardware and software services are available to
 - general public, enterprises, corporations and businesses markets

Cloud Computing



- **What is a Cloud?**
 - **Cloud** can provide services through a **public** or **private Network** or the **Internet**, where the service hosting system is at a **remote location**
 - **Cloud** can support various applications
 - **E-mail, Web Conferencing, Games, Database Management, CRM (Customer Relationship Management), etc.**

“A Cloudy History of Time”



Massive Scale

- Facebook [GigaOm, 2012]
 - 30K in 2009 -> 60K in 2010 -> 180K in 2012
- Microsoft [NYTimes, 2008]
 - 150K machines
 - Growth rate of 10K per month
 - 80K total running Bing
- Yahoo! [2009]:
 - 100K
 - Split into clusters of 4000
- AWS EC2 [Randy Bias, 2009]
 - 40K machines
 - 8 cores/machine
- eBay [2012]: 50K machines
- HP [2012]: 380K in 180 DCs

What does a datacenter look like from inside?

- Servers
- Pcs
- Storage
s
- Cables
- Racks
- Monitors

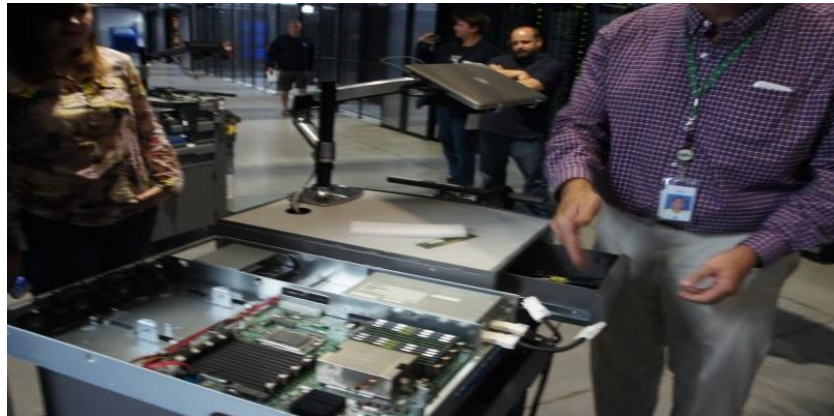
Servers



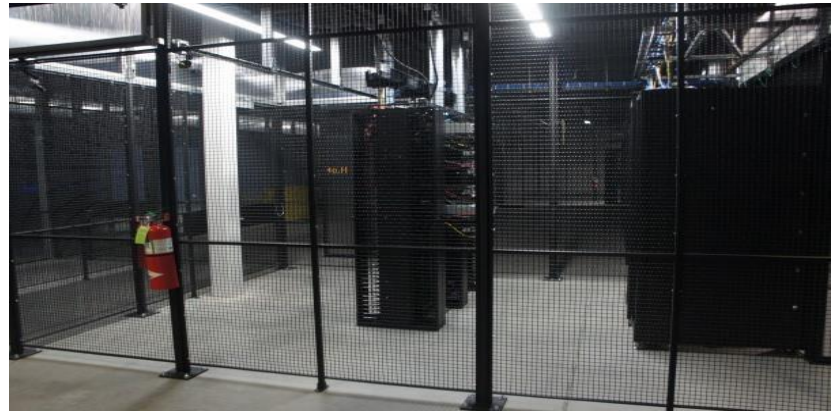
Front



Back



In



Some highly secure (e.g., financial info)

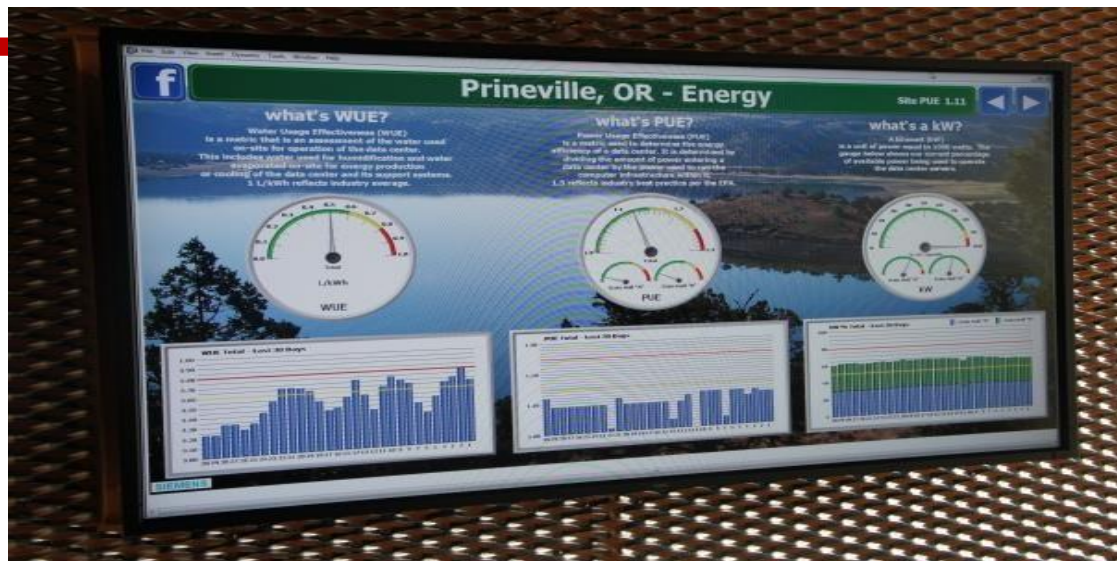
Power



Off-site

On-site

- $WUE = \text{Annual Water Usage} / \text{IT Equipment Energy (L/kWh)}$ – low is good
- $PUE = \text{Total facility Power} / \text{IT Equipment Power}$ – low is good
(e.g., Google~1.11)



Cooling



Air sucked in from top (also, Bugzappers)



Water purified



Water sprayed into air



15 motors per server bank