

Cloud Computing

CSC 375, Fall 2016

“When you move to the cloud, companies don’t expect a multi-hundred-million-dollar project to make their CRM from Salesforce work with ERP from Oracle. We have to make that implementation work out of the box.”

-Larry Ellison, CEO, Oracle



Why Cloud Computing?

- In a recent survey, just 22% of Americans understood the concept of “the cloud”
- There is still a wide gap between the perceptions and realities of cloud computing



Outline

THE WHAT: Understanding
Cloud Computing

THE WHY: Appreciating
Cloud Computing

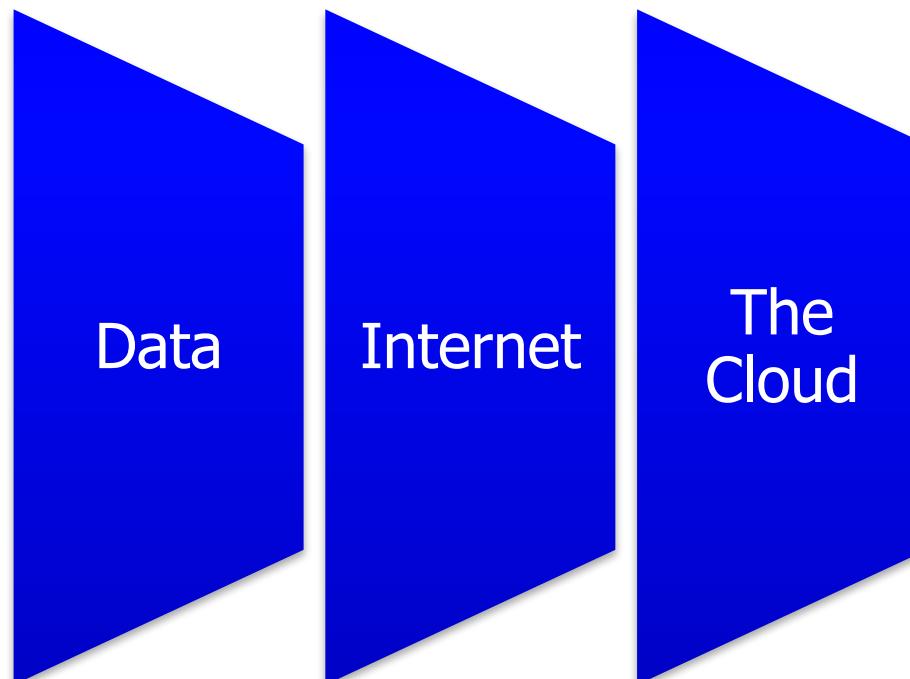
THE HOW: Applying
Cloud Computing

Cloud Computing: Definition

- “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”

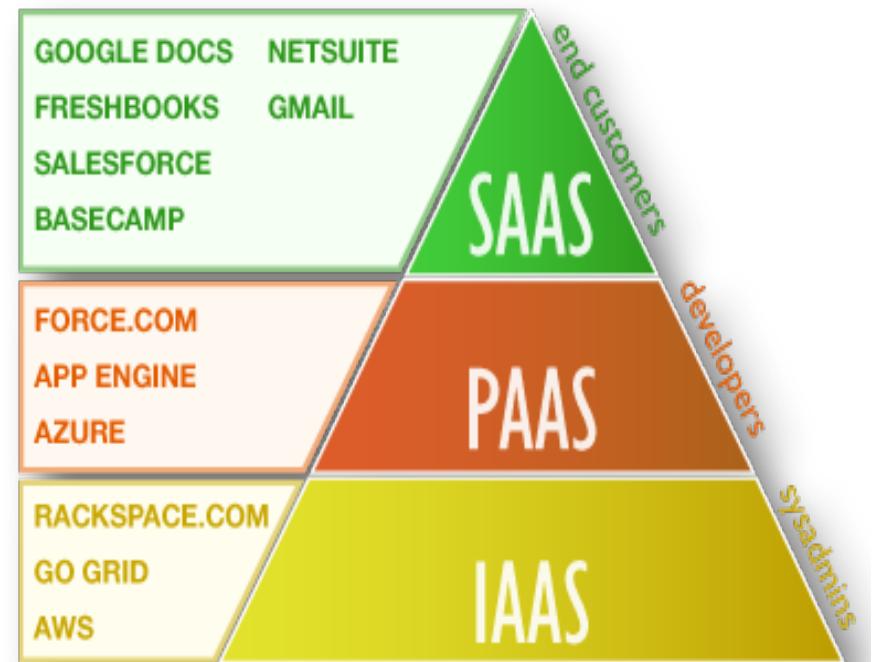
Data, Internet, and the Cloud

- Instead of storing data on individual physical machines, data is stored on the Internet
- Cloud can be Public, Private, Community, or Hybrid



Types of Cloud Computing

- Software as a Service (SaaS)
 - Access to resources and applications
- Platform as a Service (PaaS)
 - Access to development and operational components
- Infrastructure as a Service (IaaS)
 - Completely outsources needed storage and resources



The WHY: Why are so many companies moving to the cloud?



Benefits of Cloud Computing

Availability

- Access data anywhere, anytime through standard internet connection

Cost reductions

- Pay as you go model
- Savings on maintenance, repairs, and upgrades

Mobility

- Can access data and application from various devices
- Connecting employees, partners, and suppliers globally

Scalability

- Users have access to resources that scale quickly based on their demand

Putting the Cloud to Work: FAA



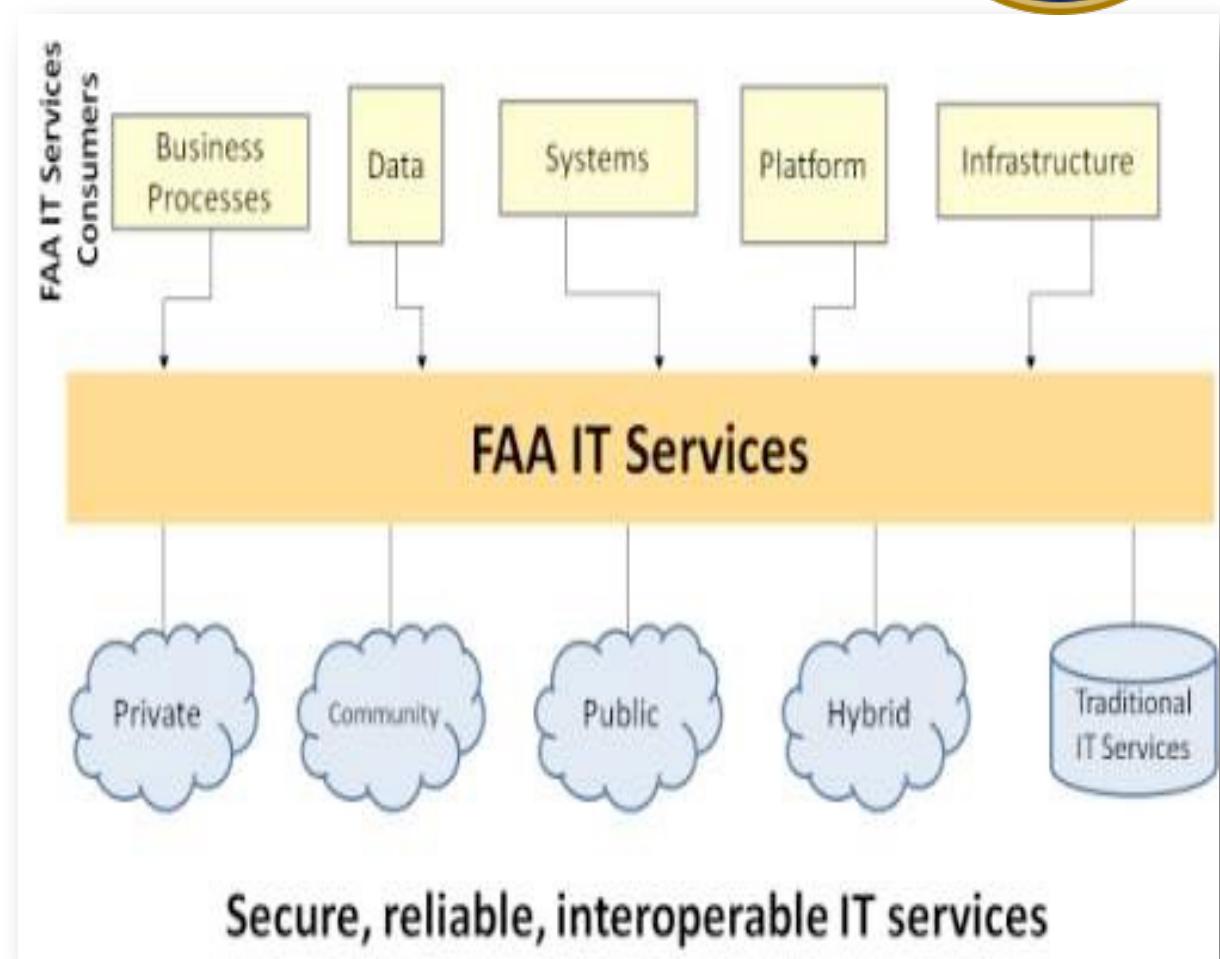
Increased cost efficiency



Provisioning speed



Scalability



Putting the Cloud to Work:



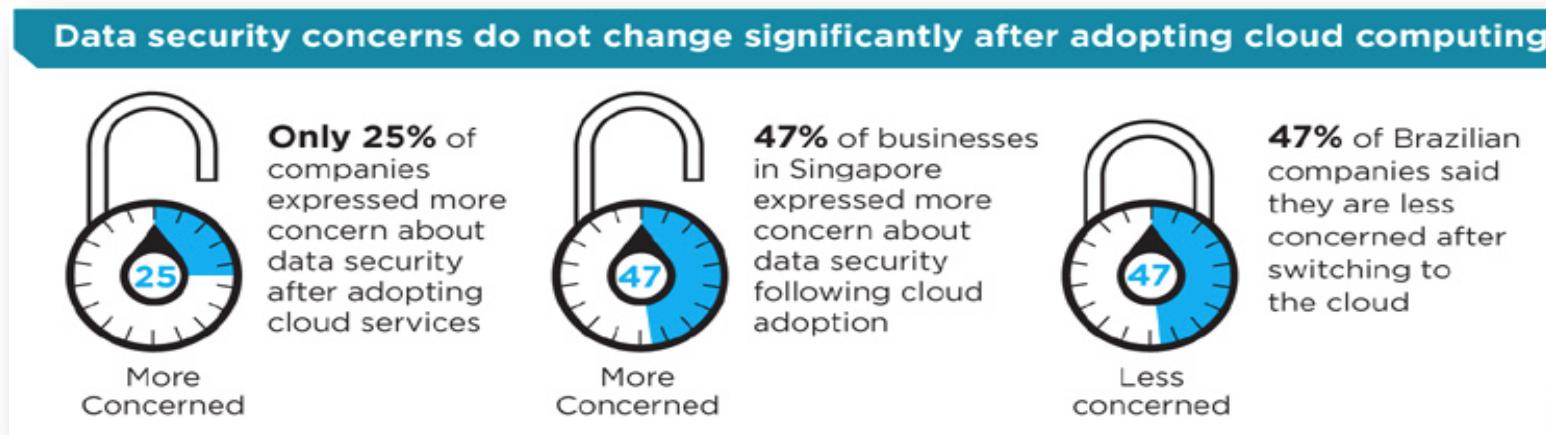
- IHG: 9 hotel brands, 660,000 rooms, 153 Million guests a year
- Believer in major cloud vendors:
 - Amazon Web Services
 - Salesforce CRM
- Operating their own private cloud:
 - “Camelot” supported by cloud services from HP & Verizon
 - Runs IHG's: Revenue Mgmt System, Loyalty program, promotions
- Continuing to Reach for the Cloud

The How: Addressing Risks and Implementing a Strategy



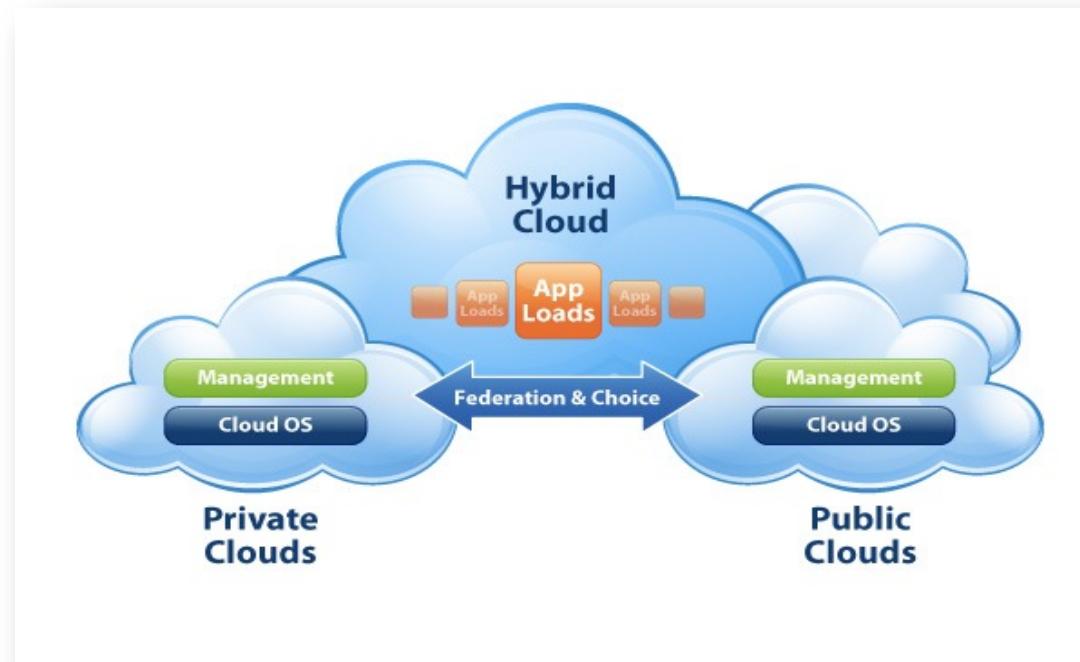
Issues with Cloud Computing: Security and Privacy

- Does the cloud back up your data?
- Is your data always safe?
- Can you conduct business abroad?
- Who is given access to your data?
- Who else is on your server?



Issues with Cloud Computing: Security and Privacy Solutions

- Triage, Secure, and Back Up
- Authentication & Authorization
- “Private Cloud” vs. “Public Cloud”
- Hybrid Approach



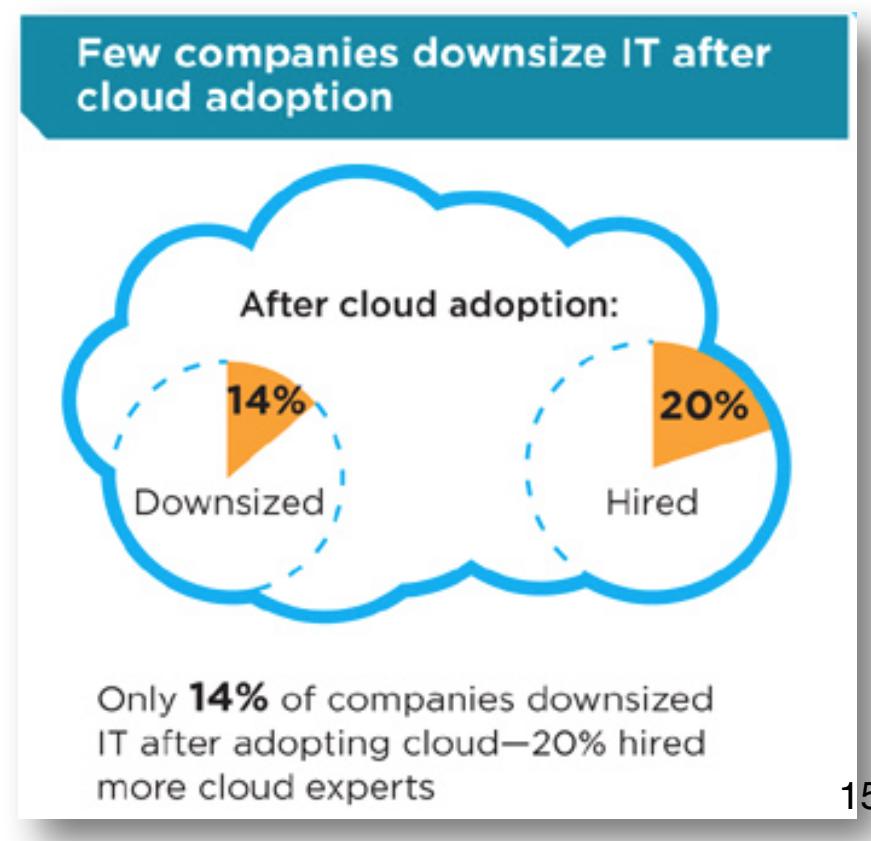
Issues with Cloud Computing: Reliability

- Past Outages
 - Amazon's "Simple Storage Service" & "Elastic Computing Cloud"
 - Microsoft & Google
- Prevention & Strategic
 - Choice of server
 - Think ahead
 - Hybrid Approach



Issues with Cloud Computing: Downsizing Workforces?

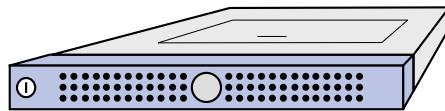
- Increasing need for cloud experts and third-party companies
- Increase in workforce leads to increase in efficiency



Appendix

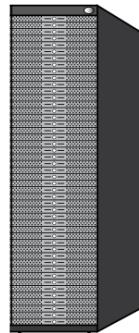
Data Centers

Datacenter Organization



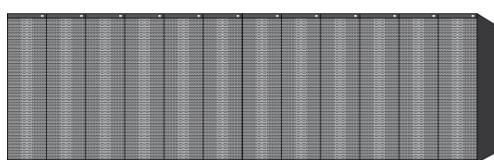
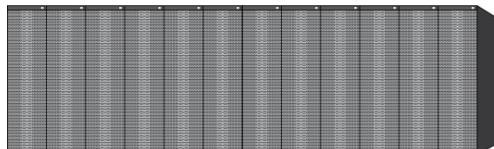
Single server:

- 8-24 cores
- DRAM: 16-64GB @ 100ns
- Disk: 2 TB @10ms



Rack:

- 50 machines
- DRAM: 800-3200GB @ 300 μ s
- Disk: 100TB @ 10ms



Row/cluster:

- **30+ racks**
- **DRAM: 24-96TB @ 500 μ s**
- **Disk: 3 PB @ 10ms**

Sun Containers



Sun Containers, cont'd



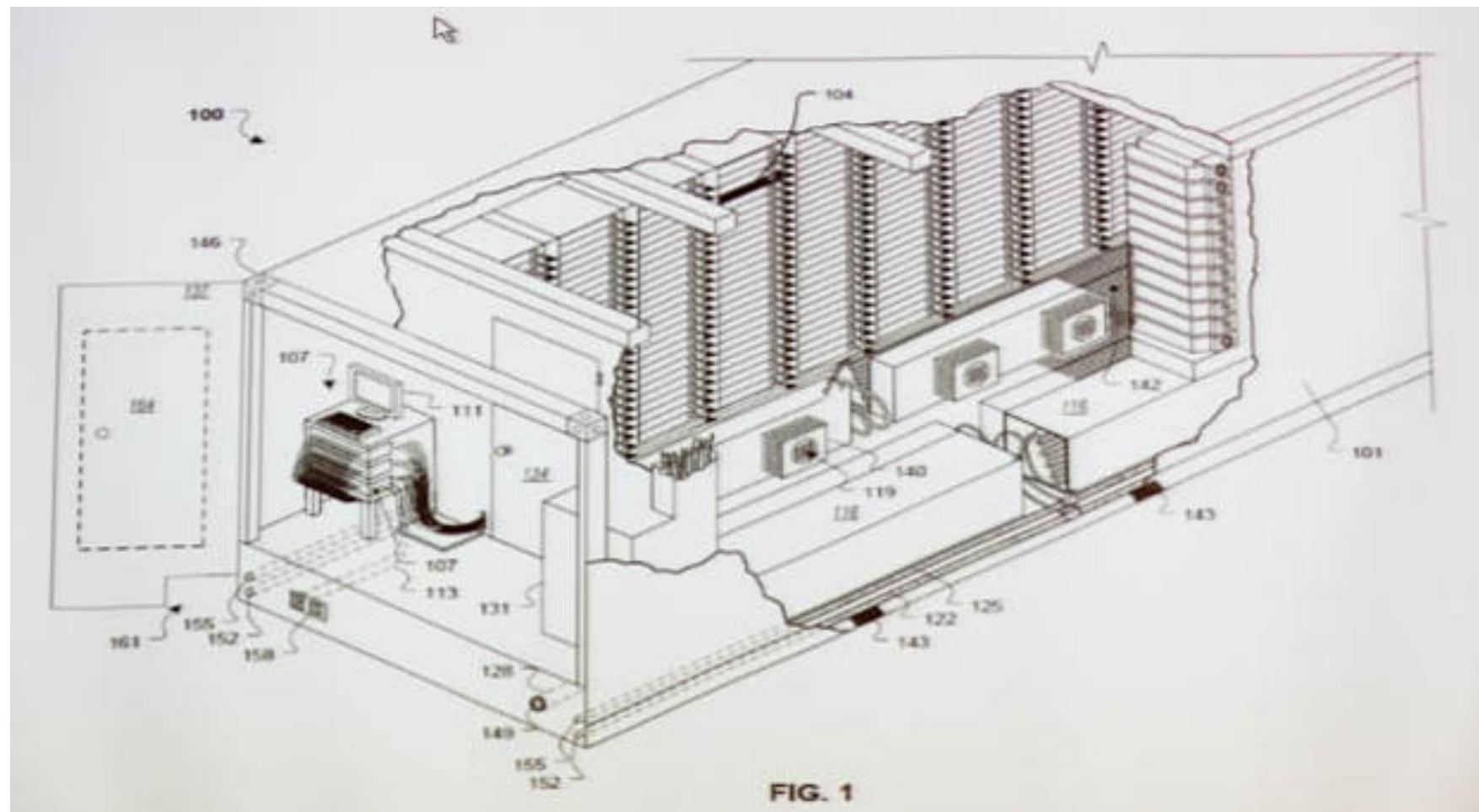
Google Data Center



Google Modular Data Center

- In 2009, Google revealed the hardware at the core of its operation
 - each server has its own 12-volt battery
 - Data centers are composed of standard shipping containers--each with 1,160 servers and a power consumption that can reach 250 kilowatts.

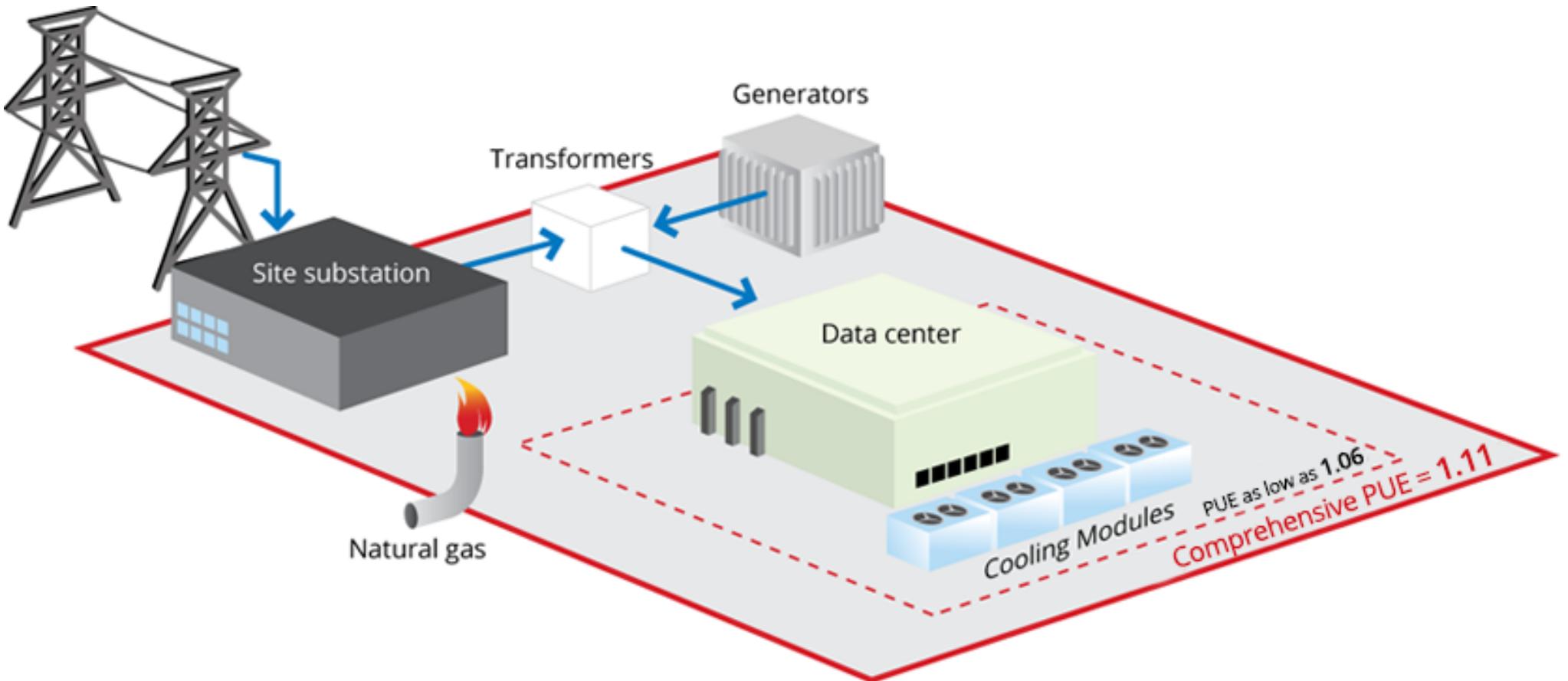
Google Modular Data Center



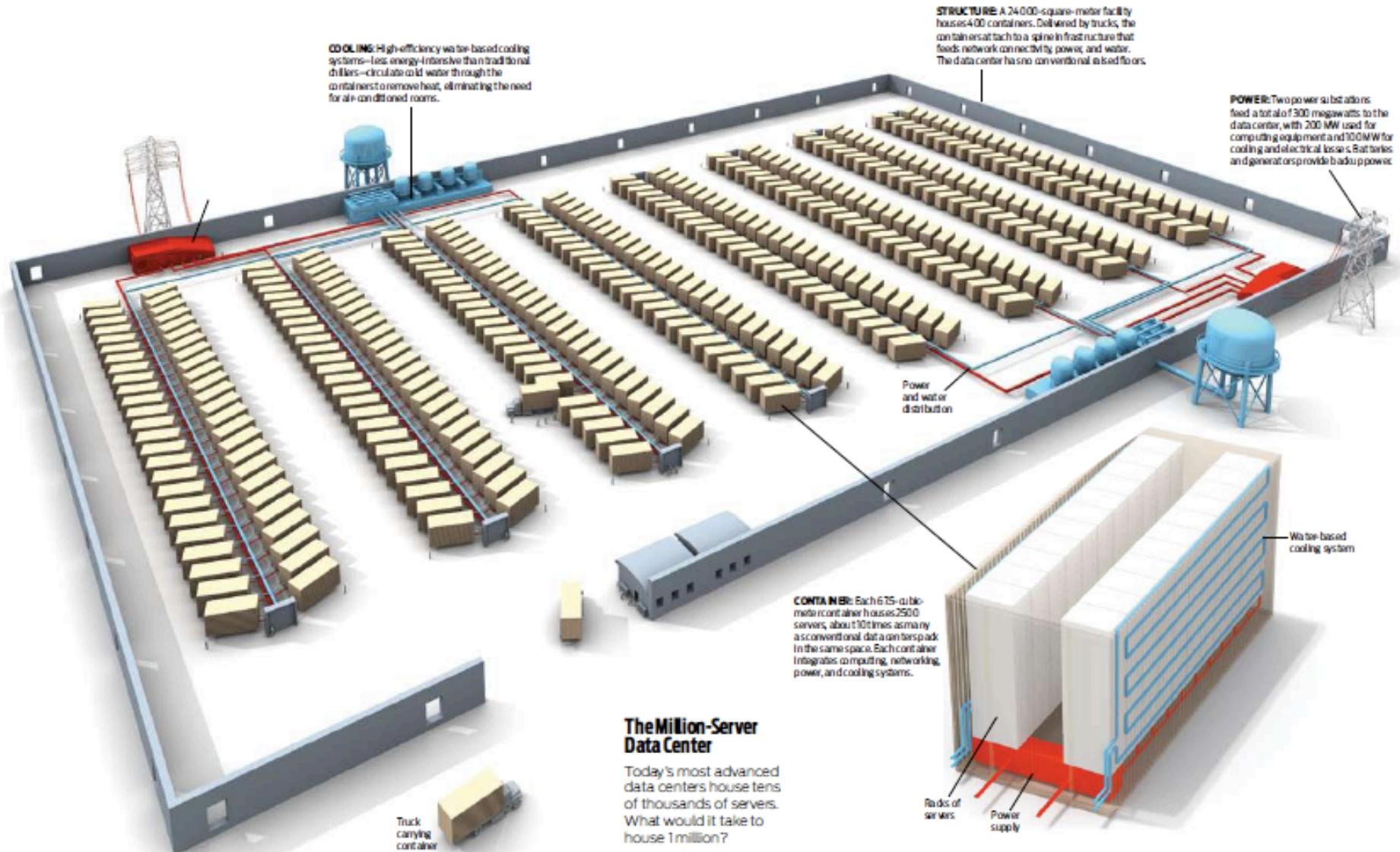
Google Containers



Google Server Room



Microsoft Containers



Microsoft Containers, cont'd



Apple Data Center



Failures are Frequent

Typical first year for a new cluster (Jeff Dean, Google):

- ~0.5 overheating (power down most machines in <5 mins, ~1-2 days to recover)
- ~1 PDU failure (~500-1000 machines suddenly disappear, ~6 hours to come back)
- ~1 rack-move (plenty of warning, ~500-1000 machines powered down, ~6 hours)
- ~1 network rewiring (rolling ~5% of machines down over 2-day span)
- ~20 rack failures (40-80 machines instantly disappear, 1-6 hours to get back)
- ~5 racks go wonky (40-80 machines see 50% packet loss)
- ~8 network maintenances (4 might cause ~30-minute random connectivity losses)
- ~12 router reloads (takes out DNS and external vips for a couple minutes)
- ~3 router failures (have to immediately pull traffic for an hour)
- ~dozens of minor 30-second blips for DNS
- ~1,000 individual machine failures
12/13/16
 - ~thousands of hard drive failures

How Many Datacenters?

- 1-10 datacenter servers/human?
- 100,000 servers/datacenter

	U.S.	World
Servers	0.3-3B	7-70B
Datacenters	3000-30,000	70,000-700,000

- 80-90% of general-purpose computing will soon be in datacenters?

Part II: Virtualization

What is virtualization?

- Virtualization allows one computer to do the job of multiple computers.
- Virtual environments let one computer host multiple operating systems at the same time

Oracle SQL

Application
Servers

Email

File

Print



Power multiple
“virtual machines”
on one server with
VMWare



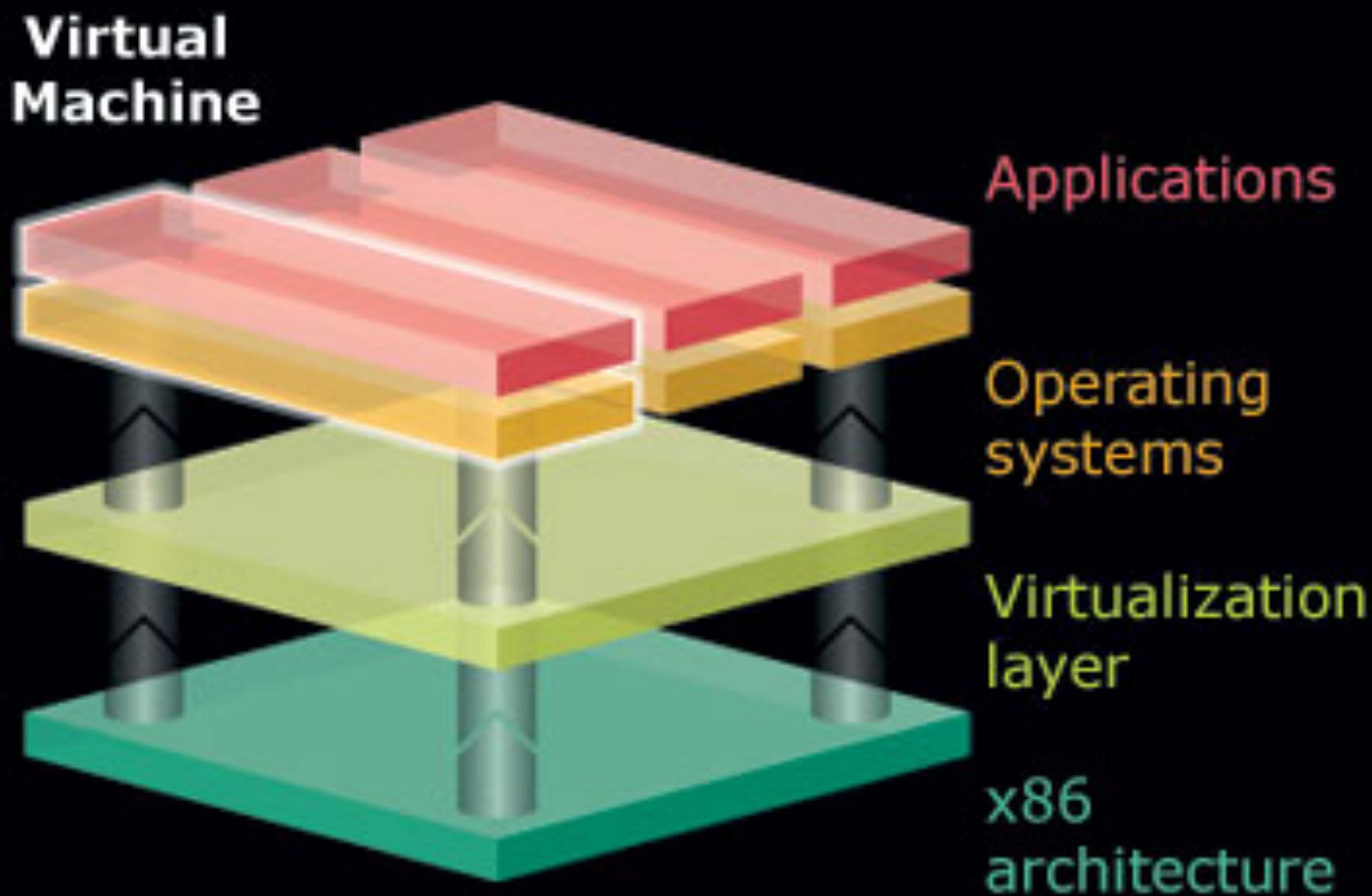
How does it work?

- Virtualization transforms hardware into software.
- It is the creation of a fully functional virtual computer that can run its own applications and operating system.
- Creates virtual elements of the CPU, RAM, and hard disk.

Background and Evolution

- Virtualization arose from a need in the 1960's to partition large mainframe hardware.
- Improved in the 1990s to allow mainframes to multitask.
- First implemented by IBM more than 30 years ago.

x86 Virtualization



Microsoft Virtualization: Key Components

DYNAMIC IT

Lower
TCO

Increase
Availability

Improve
Business Agility

Management

Unify Physical Virtual and Applications



Datacenter

Dynamic
Foundation



Windows Server 2008 R2

Cloud

On-Demand
Infrastructure



Windows Server 2008 R2



Microsoft System Center

Microsoft Dynamic Data Center Toolkit
For Enterprises

Client

Optimized
Desktops

Microsoft Desktop Optimization Pack
for Software Assurance



Pros

- Benefits include freedom in choice of operating system.
- It saves time and money.
- Consolidates server and infrastructure.
- Makes it easier to manage and secure desktop environments.

Cons

- Only powerful computers can successfully create virtual environment.
- Requires training to operate.

Conclusion

- “Companies that don’t understand the risk just shouldn’t use cloud computing, the potential for a security breach or a compliance violation can be high” –IDC Analyst Phil Hochmuth
- Understanding cloud computing will allow you to understand both the risks and the rewards
- Virtualization is a cost-effective way to run multiple operating systems and software.
- It allows for greater access to basic system resources.
- It is safer and easier to manage than physical hardware.