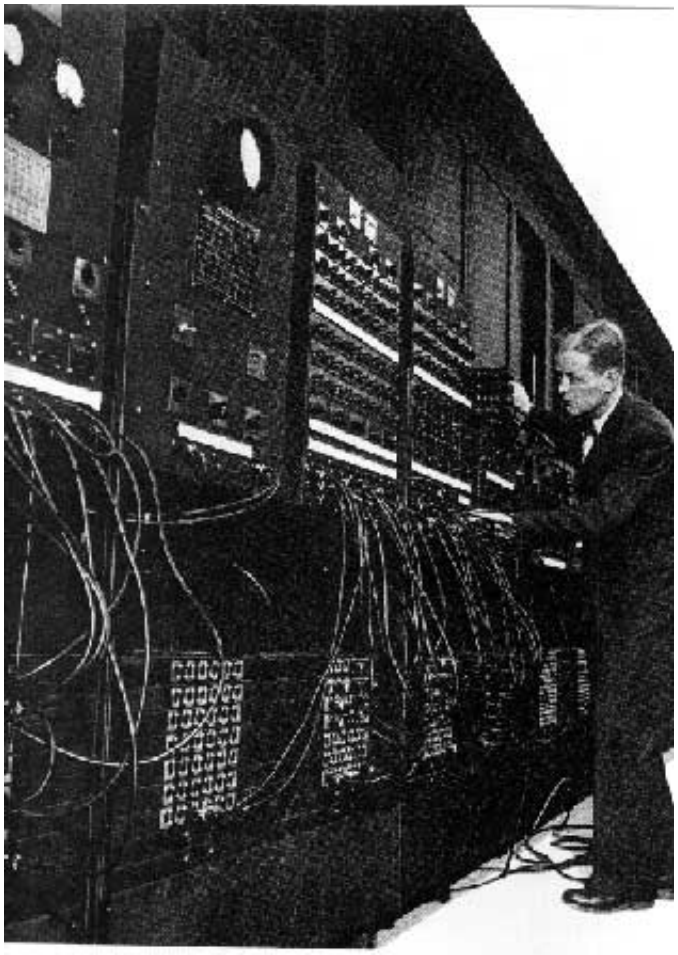
Datacenter Management

GIRS 2011

Historical Retrospective

- Prior to 1960 (1945), the US-Army developed a huge machine called ENIAC
  - Weighed 30 tons
  - Took up 1,800 sq ft of floor space
  - Required 6 full-time technicians to keep it running
  - Did 5000 operations per second
- Up until the early 1960s, computers were primarily used by government agencies. They were large mainframes stored in rooms– what we call a "datacenter" today.



The 1st age of the mainframe

- By the mid 1960s, computer use developed commercially and was shared by multiple parties.

- American Airlines and IBM teamed up to develop a reservation program termed the Sabre® system. It was installed on 2 IBM 7090 computers, located in a specially designed computer center in Briarcliff Manor, New York. The system processed 84,000 telephone calls per day.

The PC era

- In 1971, Intel released the world's first commercial microprocessor: the 4004.
- In 1977, the world's first commercially available local area network, ARCnet was first put into service at Chase Manhattan Bank, New York, as a beta-site. It was the simplest, and least expensive type of local area network using token-ring architecture, supporting data rates of 2.5 Mbps, and connecting up to 255 computers.
- Mainframes required special cooling and in the late 1970s, air-cooled computers moved into offices. Consequently, datacenters died.

The 2nd coming of the Data Center

- In 1988, IBM introduces the IBM Application System/400 (AS/400), and quickly becomes one of the world's most popular business computing systems.
- As information technology operations started to grow in complexity, companies grew aware of the need to control IT resources.
- Microcomputers (now called "servers") started to find their places in the old computer rooms and were being called "data centers."
- Companies were putting up server rooms inside their company walls with the availability of inexpensive networking equipment.

The dot-com bubble

- In the late 90's early 2000's the Internet gains immense popularity, internet based companies are launched almost everyday
  - Companies needed fast Internet connectivity and nonstop operation to deploy systems and establish a presence on the Internet.
- Many companies started building very large facilities to provide businesses with a range of solutions for systems deployment and operation.

Consolidation of Resources

- Organizations' unavoidable need to consolidate and refresh their data center estates, or even create next-generation data centers, requires a significant investment of capital and other resources.
- Rising cost have lead companies to look for alternatives such as colocation/hosting, data center outsourcing (DCO) or cloud computing approaches.

So what have we got today?

- IDC Data from 2008 for the USA
  - 38 million server
    - +700% increase in 15 years
  - $140b of unused installed capacity
  - 50% of costs related to energy
  - Average cost of a datacenter
    - $1000 / sq ft
    - $2400 / servidor
    - $40.000 / armário
  - 20-30 : 1 – server/sysadmin racio
- DataCenters are not green!!!
  - 1 rack cabinet filled with blade servers = 20-25kW = power consumption of 30 households in peek hours!!

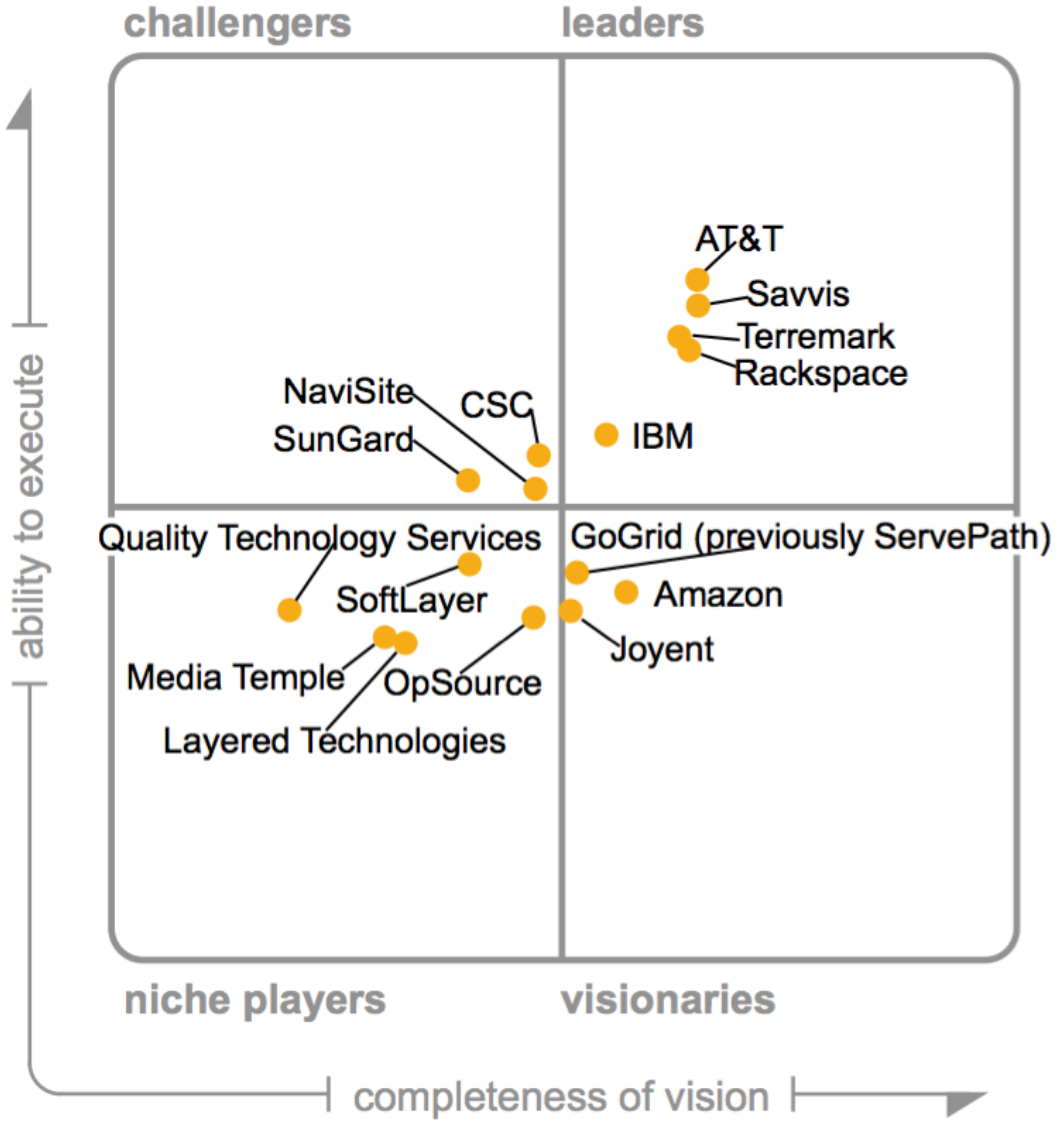
Yes… but that is in the states…

- 80% of European companies have outsourcing contracts
  - 50% of those have resorted to virtualization
- 15% of European companies are using Infrastructure as a Service (IaaS) – we will talk about this next
- Energy issues are the top concern amongst clients
  - As of 2007, the average datacenter consumes as much energy as 25,000 homes.
  - Data centers account for 1.5% of US energy consumption and demand is growing 10% per year.

Source: Gartner 2011

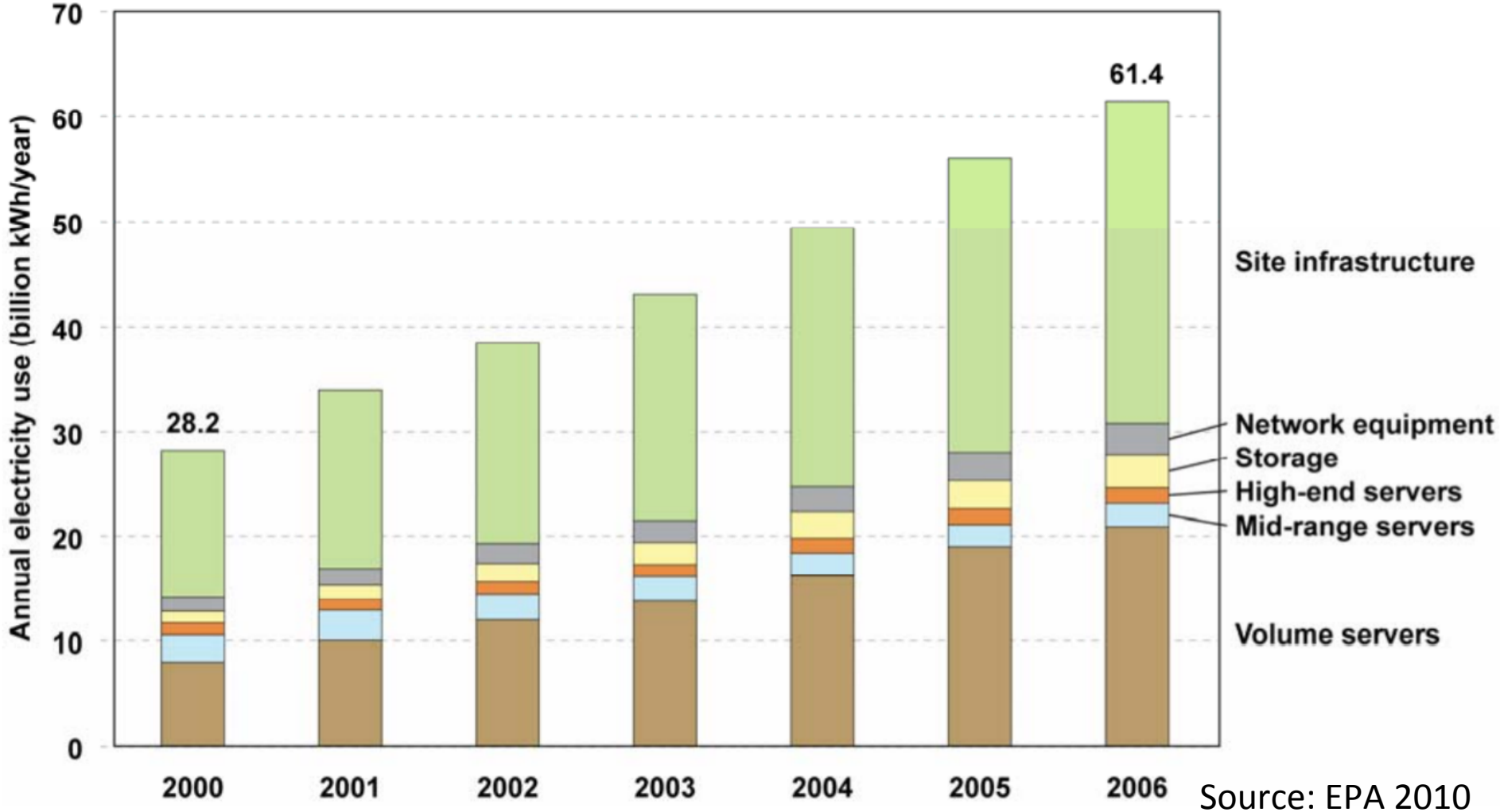
And who is playing this game?

Magic Quadrant for Data Center Outsourcing and Infrastructure Utility Services



Source: Gartner (June 2009)

Electricity Use by End-Use Component, 2000 to 2006



Source: EPA 2010

Market Segmentation

- **Colocation** includes Internet data center facilities, plus options such as remote hands and network bandwidth.
- **Dedicated hosting** includes facilities and network, plus dedicated server hardware. Managed and professional services may be optionally included.
- **Utility hosting** includes facilities, network and storage, plus a utility computing platform. This must be a shared environment using hypervisor-based virtualization, offering on-demand, flexible capacity. This may be offered in conjunction with dedicated infrastructure. Managed and professional services may be optionally included.
- **VDC (Virtual Data Center) hosting** is an outsourced "semi-private cloud" service, including facilities, network, storage and a multitenant utility computing platform that provides graphical user interface (GUI)- based self-administration.
- **Cloud hosting** includes facilities, network, storage and on-demand, multitenant elastic computing capacity, which can be either dedicated or virtualized. "Elastic" means that customers must be able to scale both up and down on demand, without a contractual commitment to capacity. Managed and professional services may be optionally included

Source: Gartner 2009

What goes in to a Data Center?

- Data Centers are valuable resources as they get close to capacity those resources must be carefully managed
- Infrastructure includes
  - Racks
  - Switches and switch ports
  - VLANs
  - Patch panels and cables (of all types)
  - Power utilization and monitoring
  - Generators
  - High voltage power components
  - HVAC components
- But that is not all!
  - Security
  - Protection against natural disasters (fires, earthquakes, floods)
  - Location (near internet junctions, power generation utilities)

Management Stack

How Are Most Data Centers Managed?

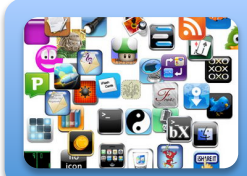
- Informal / formal processes
- Site survey, pre-installation checks, audits
- Ownership is often assigned locally
- Create knowledge sets as individuals or within teams – MS Office - Excel, Visio, Word, Notes, Sharepoint, Access
- Or give the problem to someone else
- Host, outsource, out task.

Business Processes

- Department, Company

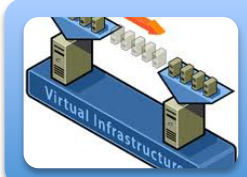
Services

- End user, Infrastructure, Supplier



Applications

- PC, server, mainframe, SOA

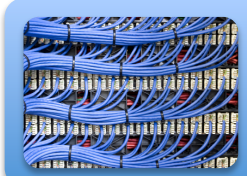


Virtual Infrastructure

- Network, Servers, Storage, DBMS

Hardware Infrastructure

- Network, Servers, UPS, Storage



Fixed Infrastructure

- Cables, Power, Cabinets, Buldings

Data Center Planning

1. How you decide where to put equipment
2. When to say no(or yes)
   - Exceed technical design or operational limits
   - Doesn't conform to the capacity management plan – Not optimal use of available resource
3. Establishing authority and ownership
   - Allocation of resources and funding
   - Decommissioning and moving
4. Confidence in service provision
   - Everything is working within design limits
   - Failover or resilience will work as required
5. Who owns the problem of creating and maintaining an end to end data centre capacity management system?
   - Facilities?
   - IT Datacenter teams?
   - Platform teams?
   - Service Management?
   - Development teams?
6. Several stake holders:
   - People
   - Processes
   - Toolsets

TIA - 942

- Proposed by Telcordia
- Published in 2005
- Details from Site Layout to Cooling
  - Distribution of functional areas
  - Cabling
  - Tiered reliability
  - Environmental Conditions
  - Power
  - HVAC

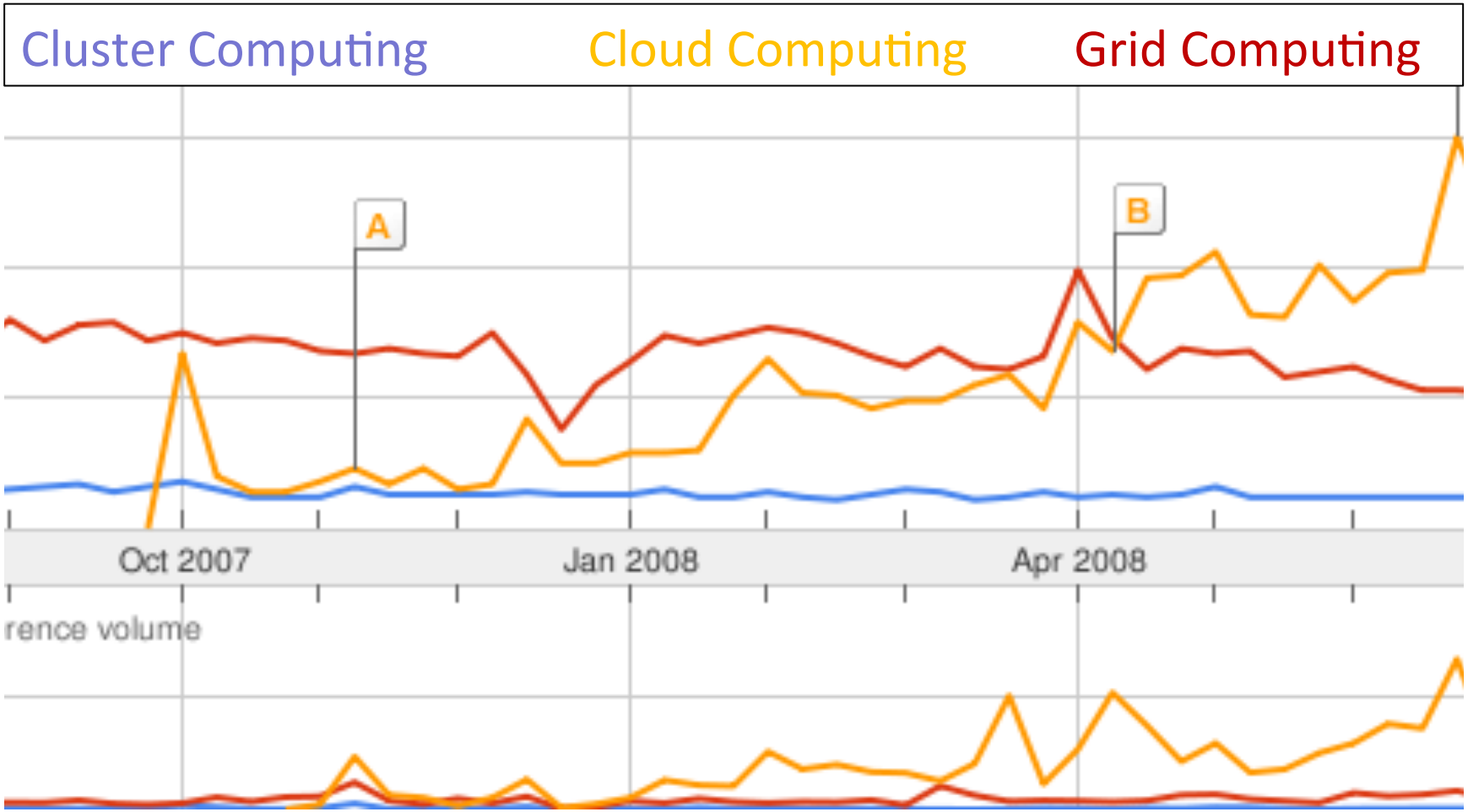
Cloud Computing

- Running a DataCenter is expensive.
  - Costs to much to built (CapEx)
  - Costs to much to run (OpEx)

  "Need milk? Don't buy the cow… buy the milk"

- Rent what you need instead of buying and running everything!
- Cloud Computing advantages:
  - Pay per use
  - Instant Scalability
  - Security
  - Reliability
  - APIs

The hype


Cluster Computing
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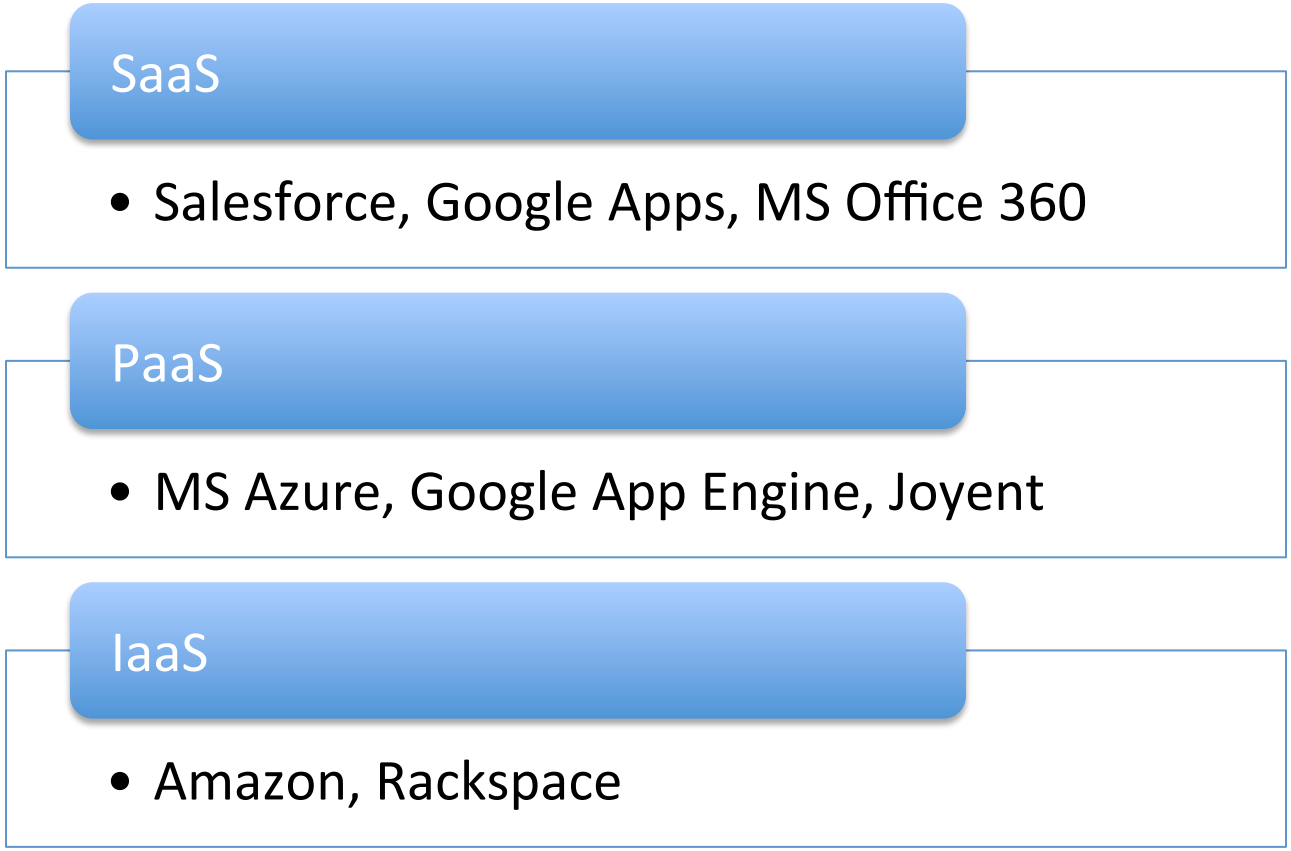
SaaS
• Salesforce, Google Apps, MS Office 360
PaaS
• MS Azure, Google App Engine, Joyent
IaaS
• Amazon, Rackspace

IaaS – Infrastructure as a Service

- Infrastructure as a Service : Grids of virtualized servers, storage & networks
  - E.g. Amazon (EC2, S3, EBS), Rackspace
- Access to infrastructure stack:
  - Full OS access
  - Firewalls
  - Routers
  - Load balancing
- Advantages
  - Pay per use
  - Instant Scalability
  - Security
  - Reliability
  - APIs
- Examples

PaaS – Platform as a Service

- The abstraction of applications from traditional limits of hardware allowing developers to focus on application development and not worry about operating systems, infrastructure scaling, load balancing and so on.
  - Examples include Google App Engine (Java, Python), MS Azure (.net), Heroku (RoR)
- Platform delivery model
  - Platforms are built upon Infrastructure, which is expensive
  - Estimating demand is not a science!
  - Platform management is not fun!
- Advantages
  - Pay per use
  - Instant Scalability
  - No sysadmin tasks
  - Better Security

SaaS – Software as a Service

- Software-as-a-Service: Applications with a Web-based interface accessed via Web Services and Web 2.0.
  - E.g. Google Apps, SalesForce.com and social network applications such as FaceBook
- Software delivery model
  - Increasingly popular with SMEs
  - No hardware or software to manage
  - Service delivered through a browser
- Advantages
  - No Installation Required
  - Not platform specific
  - Automatic Upgrades
  - Access your data anywhere

Cloud Computing

- Lower cost of ownership
- Reduce infrastructure management responsibility
- Allows for unexpected resource loads
- Faster application rollout
- How does cloud economy work ?
  - Multi-tenent
  - Virtualization lowers costs by increasing utilization
  - Economies of scale afforded by technology
  - Automated update policy
- Risks
  - Security
  - Downtime
  - Access
  - Dependency
  - Interoperability

Cloud Business Models

	Suitable Apps	Maintenance (HW, SW, Support)	Quick Starts	Efficiency	Cash Flow	Management and Compliance
Public	Limited	Excellent	Excellent	Excellent	Excellent	Newer Issues Up Front
Hybrid	Broad	Good+	Good	Good+	Good	Fewer Issues
Private	Almost All	Primarily HW Benefits	Reduces HW Setup	Good+	Good	Few New Issues