ATOM LOGIC

ENGINEERING THE DIGITAL WORLD

Is nuclear power ready to move to the Cloud?

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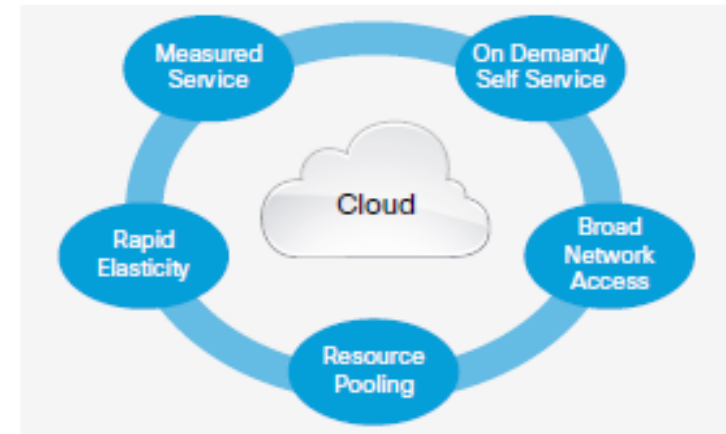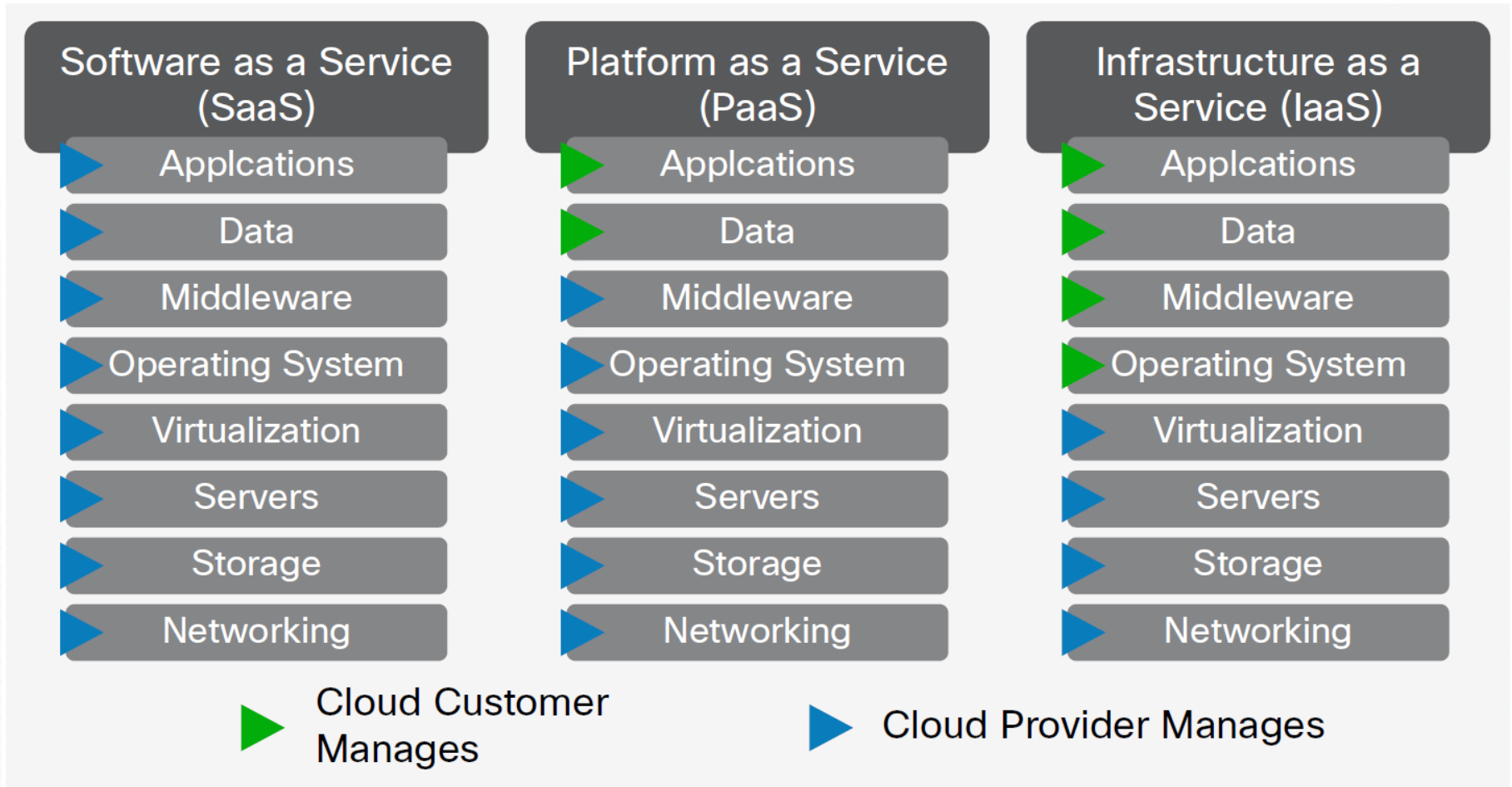
Define Cloud Computing

- Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources that can be rapidly provisioned and released with minimal management effort or service provider interaction.

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Essential Characteristics

- On-demand self-service
  - once services are established, the customer should be able to provision new users, services, virtual machines, etc. without involving the cloud service provider
- Broad network access
  - cloud services are typically accessed over the Internet, as opposed to being on an internal network accessible only over private connections
- Resource pooling
  - there is some degree of shared resources from which services draw as needed
- Rapid elasticity
  - customers' needs may expand or contract, and the service will expand or contract with those needs
- Measured service
  - customers are billed based on some measured consumption. That could be licenses, or CPU cycles, or Gigabytes of storage consumed, or number of mailboxes; whatever the thing measured, that is how customers are billed. You pay for what you use

Service Models

Software as a Service (SaaS)	Platform as a Service (PaaS)	Infrastructure as a Service (IaaS)
Applcations	Applcations	Applcations
Data	Data	Data
Middleware	Middleware	Middleware
Operating System	Operating System	Operating System
Virtualization	Virtualization	Virtualization
Servers	Servers	Servers
Storage	Storage	Storage
Networking	Networking	Networking

▶ Cloud Customer Manages   ▶ Cloud Provider Manages

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Deployment Models

	Type	Properties
1.	**Private cloud**	• Outsource or own • Lease or buy • Separate or virtual data center
2.	**Community cloud**	• Private cloud for a set of users with specific demands • Several stakeholders
3.	**Public cloud**	• Mega scaleable infrastructure • Available for all
4.	**Hybrid cloud**	• Combination of two clouds • Usually private for sensitive data and strategic applications

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Intelligence Community

Twenty-Fifth Air Force, Intelligence and Security Command, Central Intelligence Agency, Coast Guard Intelligence, Defense Intelligence Agency, Office of Intelligence and Counterintelligence, Office of Intelligence and Analysis, Bureau of Intelligence and Research, Office of Terrorism and Financial Intelligence, Drug Enforcement Administration, Federal Bureau of Investigation, Marine Corps Intelligence, National Geospatial-Intelligence Agency, National Reconnaissance Office, National Security Agency, Office of Naval Intelligence

- "CIA Cloud" built specifically for the Intelligence Community
  - $600 Million Amazon
  - Separate from the rest of the business and unconnected to the Internet.
  - Access via terminal on the Joint Worldwide Intelligence Communication System (JWICS)
  - Only found in a Sensitive Compartmented Information Facility (SCIF). SCIFs are rooms, or even whole buildings, that are built to be impervious to outside signals intelligence collection. SCIFs add a layer of physical security from external threats and even a bit of protection for internal attacks, since they are in secure locations under surveillance.
  - AWS encrypts all customer data
  - Administrative access to CIA Cloud requires two employees, jointly. The number of administrators with access is in the "tens."

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FedRAMP

- The Federal Risk and Authorization Management Program (FedRAMP), is a government-wide program that provides a standardized approach to security assessment, authorization, and continuous monitoring for cloud products and services.
- This approach uses a "do once, use many times" framework that saves an estimated 30-40% of government costs, as well as both time and staff required to conduct redundant agency security assessments.
- FedRAMP is the result of collaboration with cybersecurity and cloud experts from
  - General Services Administration (GSA)
  - National Institute of Standards and Technology (NIST)
  - Department of Homeland Security (DHS)
  - Department of Defense (DOD)
  - National Security Agency (NSA)
  - Office of Management and Budget (OMB)
  - Federal Chief Information Officer (CIO) Council

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DOD – Classification Levels

- **Level 1 & 2: Non-Controlled Unclassified Information.**
  - All data cleared for public release, as well as some DoD private unclassified information not designated as CUI or critical mission data, but the information requires some minimal level of access control.

- **Level 3 & 4: Controlled Unclassified Information**
  - Unclassified information requires protection from unauthorized disclosure
    - Export Control
    - Privacy Information- personally identifiable information (PII)
    - Protected Health Information (PHI)
    - Other (i.e., For Official Use Only, Official Use Only, Law Enforcement Sensitive, Critical Infrastructure Information, and Sensitive Security Information).

- **Level 5: Controlled Unclassified Information**
  - Higher level of protection as deemed necessary by the information owner.
  - Supports unclassified National Security Systems (NSSs)

- **Level 6: Classified Information up to SECRET**
  - Classified national security information or the Atomic Energy Act of 1954, as amended, to be Restricted Data (RD).
  - Only information classified as SECRET.
  - Higher classification levels (compartmented information) are governed by other policies

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Who offers Cloud Services to FedRAMP?

- Level 4 – 73 vendors
- Level 5

  – Microsoft's Azure GovCloud

  – Amazon Web Services GovCloud

  – CSRA's Autonomic Resources Cloud Platform

- 53 vendors are awaiting approval

DOD – Looking Forward

- John Hale, DISA's chief of enterprise applications, said the Pentagon is taking an all-of-the-above approach to cloud by pursuing hybrid, public and private offerings. "There's no one size that fits all from the department's perspective,"

- Hale foresees a day when nuclear command and control information could be stored in a commercial cloud.

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Private Cloud

- Private cloud provides the basic benefits of public cloud
    - self-service and scalability
    - multi-tenancy
    - ability to provision machines
    - changing computing resources on-demand
    - creating multiple machines for complex computing jobs
    - chargeback tools track computing usage, and business units pay only for the resources they use
- Private cloud offers hosted services to a limited number of people behind a firewall or data diode, so it minimizes the security concerns some organizations have around cloud.
- Private cloud gives companies direct control over their data.
- Private clouds disadvantages
    - On-premises IT -- rather than a third-party cloud provider -- is responsible for managing the private cloud.
    - Private cloud deployments carry the same staffing, management, maintenance and capital expenses as traditional data center ownership
    - Additional expenses include virtualization, cloud software and cloud management tools.
- To reduce on-premises IT, cloud providers, such as Rackspace with OpenStack or VMware, can deploy private cloud infrastructures.

Cloud Disadvantages

- Platform lock-in
  - cloud services tend to be built on one of several possible virtualization platforms, for example VMWare or Xen. Migrating from a cloud provider using one platform to a cloud provider using a different platform could be very complicated.
- Data lock-in
  - since the cloud is still new, standards of ownership, i.e. who actually owns the data once it lives on a cloud platform, are not yet developed, which could make it complicated if cloud computing users ever decide to move data off of a cloud vendor's platform.
- Tools lock-in
  - if tools built to manage a cloud environment are not compatible with different kinds of both virtual and physical infrastructure, those tools will only be able to manage data or apps that live in the vendor's particular cloud environment.

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Conclusions

- Cloud computing enables IT systems to be scalable and elastic.

- End users do not need to determine their exact computing resource requirements upfront. Instead, they provision computing resources as required, on-demand.

- Using cloud computing services, a customer does not need to own data center infrastructure to launch a capability that serves millions of users.

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Mike's Vision

- Everyday another "computer" based system is being added to our plants
- "Computer Rooms" are transitioned into "Data Centers"
- New systems are virtualized and provisioned in the existing infrastructure
- Management and Maintenance can be in- or out- sourced
- For functionality based in software, Nuclear vendors will (need to) stop supplying their hardware. Instead supply requirements for a Virtual Machine environment.
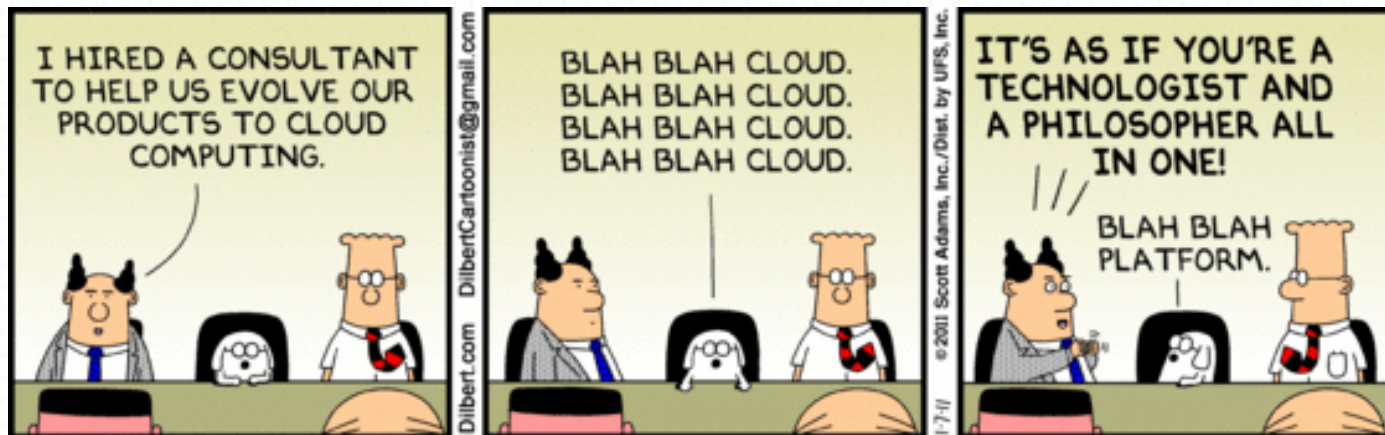
Interesting Cloud Statistics

- Q. How much data is produced every day?
- A. *The amount of data is growing exponentially. Today, our best estimates suggest that at least 2.5 quintillion bytes of data is produced every day (that's 2.5 followed by a staggering 18 zeros!).*

- Q. Which is the largest 'big data' company in the world?
- A. *Google*
  - *Google processes 3.5 billion requests per day*
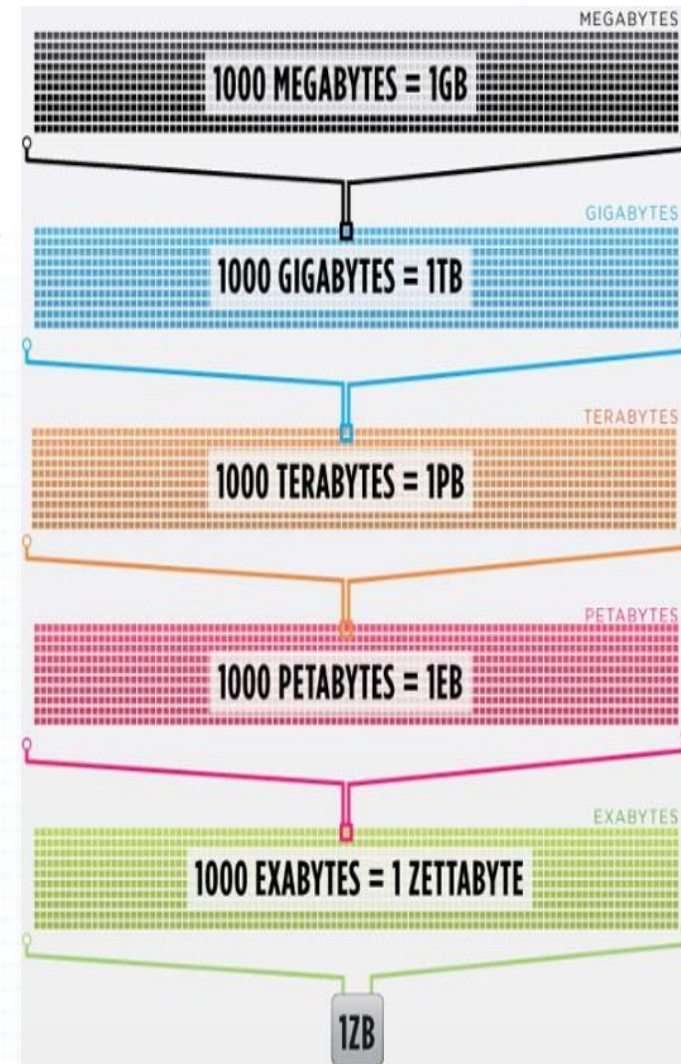 - *Google stores 10 exabytes of data (10 billion gigabytes!)*

- Q. Which company has the most servers?
- A. *Amazon. They host their estimate 1,000,000,000 gigabytes of data across more than 1,400,000 servers. Google and Microsoft are both presumed to have about 1,000,000 servers, but neither will release exact figures.*

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Interesting Cloud Statistics (continued)

- Q. What percentage of data is in digital format?
- *A. Every book in every library, school, home, and company in the entire world combine make-up a maximum of 6 percent of the sum total of all human data.*
  - *In 2007 it was estimated that a mammoth 94 percent of all data was stored in a digital format.*
  - *A phenomenal 90 percent of all data ever produced by humans has been made in the last two years.*

- Q. What does the future hold?
- A. Looking forward, experts now predict that 40 zettabytes of data will be in existence by 2020
  - In 2012 the entire World Wide Web was estimated to contain approximately 500 exabytes – which is 5 billion gigabytes, but only half of one zettabyte! 40 zettabytes is, therefore, 400 billion gigabytes!

Source: CloudTweaks 3/17/2015
http://cloudtweaks.com/2015/03/surprising-facts-and-stats-about-the-big-data-industry/

MEGABYTES
1000 MEGABYTES = 1GB
GIGABYTES
1000 GIGABYTES = 1TB
TERABYTES
1000 TERABYTES = 1PB
PETABYTES
1000 PETABYTES = 1EB
EXABYTES
1000 EXABYTES = 1 ZETTABYTE
1ZB

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ATOM LOGIC delivers the highest quality digital Instrumentation & Controls engineering and consulting services in the Nuclear Power industry.

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