01. An Introduction of Cloud Computing

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Why Cloud, Why Now?

- Like water system in your kitchen, cloud computing services can be turned on or off quickly as needed.
- The water company, there is a team of dedicated professionals making sure the service provided is safe, secure, and available on a 24/7 basis.

Cloud computing is the result of many years of evolution

- **centralized mainframe era (before Y2K)**
  - the mainframe administrators were the powerful gatekeepers of all data and all systems
  - the biggest bottleneck
- **distributed client-server era (after Y2K)**
  - system built and deployed faster, cheaper, and richer features
  - issues of management and security

- **Internet era**
  - complexity of systems increased dramatically
  - in 2013, enterprise-class clouds were designed
  - enterprise clouds (SLAs, service level agreements)
  - commodity clouds

Commodity Cloud

- Providers: Amazon Web Services, Google, and Microsoft Azure
- being big and providing cost savings, not necessarily on being flexible, accessible,
- V.S. premium cloud service
    - Firewalls, VM monitoring, Threat signature protection

Assignment 1

- What is commodity cloud service and its benefit?

4 Different Cases of Cloud Computing

Case 1
Instagram

- October 2010, a photo-sharing application
- April 2012, bought by Facebook for an estimated $1 billion, and hit 100 million users
- Wow! Three guys on a bootstrap budget were able to build a solution entirely on a public cloud
- In a physical data center, they would never be able to buy hardware fast enough

Case 2
Netflix

- Neflix is an industry leader in streaming video content over the Internet
- Netflix technology blog on Dec. 14, 2010:
  Cloud environments are idea for horizontally scaling architectures. We don't have to guess months ahead what our hardware, storage, and networking needs are going to be. We can programmatically access more of these resources from shared pools within AWS almost instantly.

Case 3
Government - NOAA

- NOAA - National Oceanic and Atmospheric Administration moved to a cloud-based e-mail solution - Google's Gmail (2012)

- NOAA is a federal agency with over 25,000 employees whose mission is to understand and predict change in climate, weather, oceans, and coasts

Case 4
Non profit - Obama Campaign

- They very quickly had to build a suite of applications including an e-commerce fund-easing platform

Assignment 2

- What’s the common factors among these 4 cases?

Cloud Service Models

Choosing the right service model is a critical success factor for delivering cloud-based solutions

- There are three cloud service models
  - Software as a Service (SaaS) /SAAS/
  - Platform as a Service (PaaS) /PAZ/
  - Infrastructure as a Service (IaaS) /ICE/
- Each cloud service model provides a level of abstraction that reduces the efforts required by the service consumer to build and deeply systems

Cloud Stack

Service Models	Cloud Stack	Stack Components		Who Is Responsible
SAAS	User	Login		Customer
		Registration		
		Administration		
	Application	Authentication	Authorization	Customer
		User Interface	Transactions	
		Reports	Dashboard	
PAAS	Application Stack	OS	Programming Language	Vendor
		App Svr	Middleware	
		Database	Monitoring	
IAAS	Infrastructure	Data Center	Disk Storage	Vendor
		Servers	Firewall	
		Network	Load Balancer	

IaaS
(NIST defines)

- Provision processing, storage, networks, and other fundamental computing resources where the consumer is able to deploy and run arbitrary software, which can include OS and APs.

- The consumer does not manage or control the underlying cloud infrastructure but has control over OS, storage, and deployed APs and possibly limited control of select networking components (e.g., host firewalls)

IaaS vendors

- Amazon Web Services (AWS)
- AT&T, 台灣大哥大
- HP
- Rackspace
- GoGrid
- OpenStack (open source)

PaaS
(NIST defines)

- The capability provided to the consumer is to deploy onto the cloud infrastructure consumer-created or acquired applications created using programming languages, libraries, service, and tools supported by the provider

- The consumer does not manage or control the underlying cloud infrastructure, including network, servers, operating systems, or storage, but has control over the deployed applications and possibly configuration settings for the application-hosting environment

PaaS vendors

- force.com
  developers write in Apex code and the underlying infrastructure must be on force.com's data center.

- Google Apps Engine
  Python, on the Google data center.

- Microsoft Azure
  .NET, on Microsoft data center.

SaaS
(NIST defines)

- At the top of the stack, CRM, ERP, payroll, accounting

- The capability provided to the consumer is to use the provider's applications running on a cloud infrastructure. The applications are accessible from various client devices through either a thin client interface, such as a web browser, or a program interface. The consumer does not manage or control the underlying cloud infrastructure, including network, servers, OS, storage…

Laptops

Desktops

Application

Monitoring

Content

Collaboration

Communication

Finance

Platform

Object Storage

Identity

Runtime

Queue

Database

Infrastructure

Compute

Block Storage

Network

Phones

Tablets

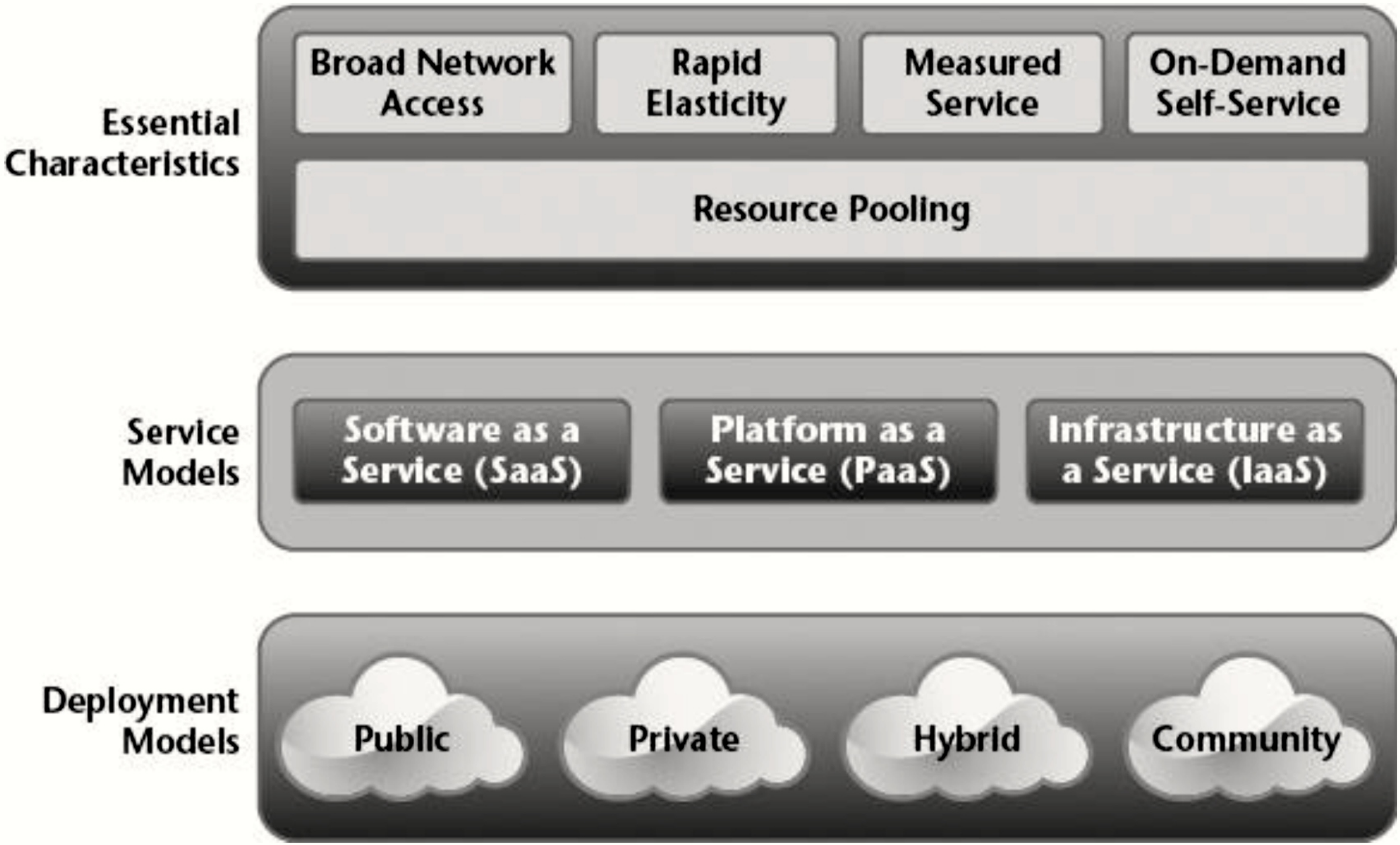
Cloud computing

Assignment 3

- Please describe the differences between 3 fundamental models of cloud computing.

Deployment Models

Visual Model of Cloud Computing (NIST)



Public cloud

- a multitenant (single instance serving multiple client-organizations) environment, the end user pays for usage of resources on a shared grid of commodity resources alongside other customers.
    - Utility pricing
    - Elasticity
    - Core competency
    - Control
    - Regulatory issues
    - Limited configurations

Private cloud

- The cloud infrastructure is provisioned for exclusive use by a single organization comprising multiple consumers. It may be owned, managed, and operated by the organization, a third party, or some combination of them, and it may exist on or off premises.

The advantage of a private cloud

- Private clouds can be on-premises or hosted in a cloud provider's data center
- Private clouds sacrifices some of the core advantages of cloud computing: rapid elasticity, resource pooling, and pay-as-you-go pricing.

Hybrid cloud

- A composition of two or more distinct cloud infrastructures (private, community, or public) that remain unique entities, but are bound together by standardize or proprietary technology that enables data and application portability

Best practice for hybrid clouds

- Use the public cloud as much as possible for rapid elasticity and resource pooling
- Leverage the private cloud where the risks in areas of data ownership and privacy are too high for the public cloud

Assignment 4

- What are the essential characteristics of Cloud computing according to the definition of NIST?

Cloud Computing Worst Practices

1. Migrating Applications to the Cloud

- A common misperception about cloud computing is the notion that migrating existing applications to the cloud is a simple solution that drives down cost.

2. Expectations

- Many organizations have a very complex enterprise consisting of numerous vendor and proprietary solutions ranging from mainframe technologies, to midsize computers, m-tier architectures…

- Starting with a blank slate with a new cloud-based architecture is not the norm for most companies.

3. Misinformed about Cloud Security

- Cloud computing is still very immature and lacking standards at this time
- Cloud vendors are a huge target
- **Recommendation**: Start by making sure the architects, the product team, and the security professionals have a broad understanding of cloud security

4. Selecting a Favorite Vendor, Not an Appropriate Vendor

- A common mistake many companies make is they don't thoroughly evaluate the cloud vendors and simply select vendors that they are familiar with

- **Recommendation**: Understand the differences between the three cloud service models: SaaS, PaaS, and IaaS

5. Outages and Out-of-Business Scenarios

- **Recommendation**: When choosing a cloud service model and cloud service providers, understand the risks and points of failure and design for failure

6. Underestimating the Impacts of Organizational Change

- The conflict is not a technology problem; it is a people problem
- Recommendations: If possible, start with smaller, lower risk initiatives as the early candidates for cloud computing projects

7. Skills Shortage

- Recommendations: Evaluate the current staff and identify skill gaps based on the project requirements. Plug those skill gaps with experienced talent, either full time or contract resources.

8. Misunderstanding Customer Requirements

- Recommendation: Understand the business requirements and customer expectations of cloud computing before selecting cloud service models and cloud types. Requirements drive the decisions; the decisions should not drive the requirements.

9. Unexpected Costs

- Companies underestimate the effort it takes to build software in the cloud
- **Recommendation**: Understand the costs of each cloud service model and establish the appropriate levels of governance and software controls to optimize and monitor costs

Assignment 5

- Propose a case suit for hybrid cloud and try to avoid one or two of the worst practices.