

Introduction to Cloud Computing

CS 7346 Cloud Computing

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Road Map

- What is Cloud Computing?
- Cloud Computing History
- Characteristics of Cloud Computing
- Cloud Deployment Models
- Cloud Delivery Models
- Ethical Issues in Cloud Computing
- Major Obstacles (Activity)

Cloud Computing



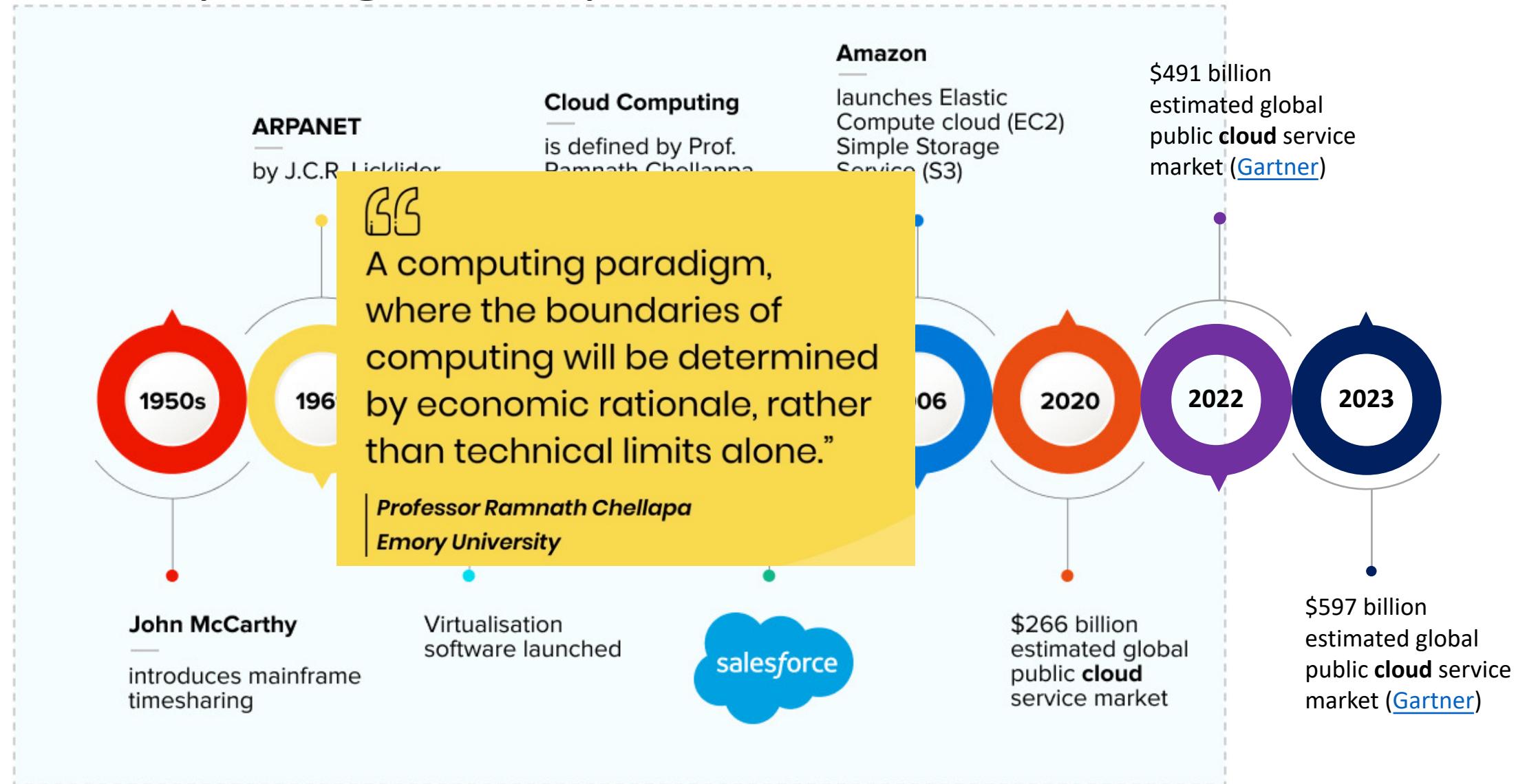
Cloud Computing

- What is a cloud?
- Minimizes cost, maximizes compute efficiency
- A game changer in business
 - Affordable; pay for what you use
 - On demand
 - Scale up and back as needed
 - An evolution of two technologies: timesharing and distributed systems

History of Cloud Computing



Cloud Computing History



Characteristics of Cloud Computing

- On-demand and self service
- Ubiquitous Access
- Resource Pooling
- Rapid Elasticity
- Metered Services

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Characteristics of Cloud Computing

- On-demand self service
 - Immediate
 - Accessible
 - Supported
 - Saves money and time
 - Scalability remains independent
- Ubiquitous access
 - Only requires Internet to access

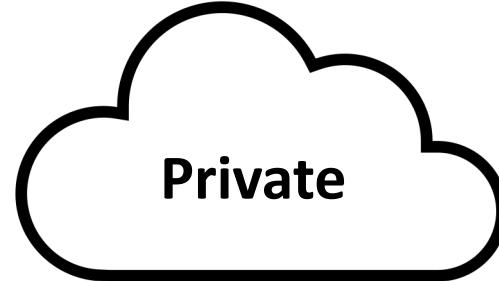
Characteristics of Cloud Computing

- Resource pooling
 - Able to access resources
 - Leverage them for a period of time
 - Return them to the resource pool for others to use
- Rapid elasticity
 - Scale up and down as needed
- Measured (metered) services
 - Only pay for the services you consume

Deployment Models

- Public
- Private
- Hybrid
- Multi-cloud
- Community

Deployment Models

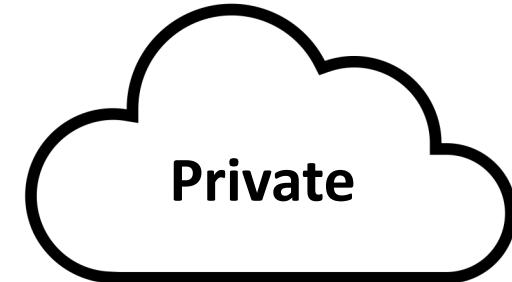


OR

Multi-cloud

Private Deployment

- Exclusive use by a single organization
- Fully customizable
- Secure
- Not Multitenant
- Complies with privacy regulation
- Disadvantages:
 - You are responsible for everything
 - Not as many high-level services
 - May not be cheap
 - You manage physical and system security / High IT Overheads



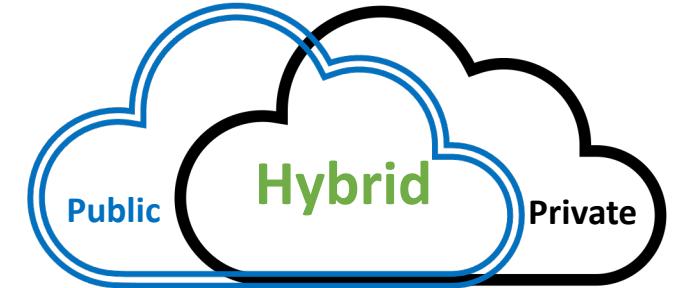
Public Deployment

- Massive scale
- Huge and growing list of services
- Infinite scalability
- Highly competitive on pricing due to economies of scale
- Security is strong / Hardware constantly upgraded / patches
- Freedom from managing and maintaining hardware
- Disadvantages:
 - Rules prohibit data moving to cloud
 - Lack of customization
 - Fear of vendor Lock-in
 - Less secure



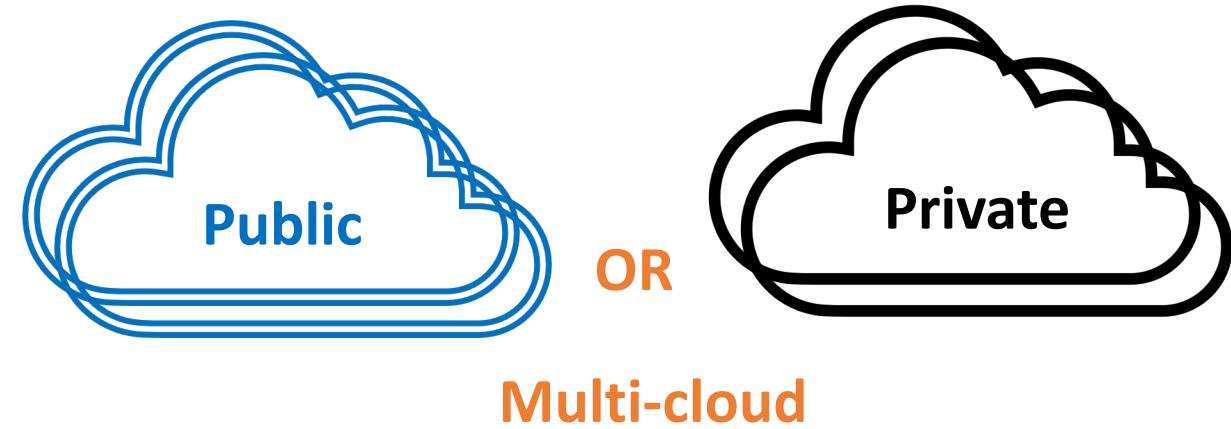
Hybrid Deployment

- Leverages strengths of both public and private clouds
- Resilience to cloud outages
- No capacity ceiling
- Mitigate vendor lock-in
- Fewer IT Overheads
- Disadvantages:
 - Costs spiraling out of control
 - Additional complexity
 - Compatibility issues
 - Compliance and legal risk



Multi-cloud Deployment

- Multiple providers
- Vendor flexibility
- Broad range of feature choices
- Cherry-pick services
- Redundancy
- Disadvantages:
 - Requires extensive planning and management
 - More complex
 - More costly solutions



Community Deployment

- Shared by more than one organization
- Customized to an industry
- Disadvantages:
 - Fixed amount of data storage and bandwidth
 - More costly than public cloud
 - Coordination among organizations



Delivery Models

- Software as a Service (SaaS)
- Infrastructure as a Service (IaaS)
- Platform as a Service (PaaS)
- Identity as a Service (IDaaS)
- Database as a Service (DBaaS)

Software as a Service (SaaS)

- A third-party provider hosts the application software on behalf of the end-user
- Replaces traditional enterprise applications
- Unlimited scalability
- Updates are continuous and automatic
- Supports both desktop and mobile computing
- Prime examples:
 - Salesforce.com
 - Google Workspace
 - Microsoft 365
- Features:
 - No need to purchase hardware and software
 - Subscription based
 - Pervasive application delivery

Infrastructure as a Service (IaaS)

- A third-party provider hosts hardware and software, servers, storage and other infrastructure components
- Used for any purpose such as hosting and application or data
- Features:
 - Compute and storage
 - Hosts applications and databases
 - Can be deployed as private, public, or hybrid clouds
- Prime Examples:
 - AWS, Azure, and Google Cloud Platform
- Value:
 - No need to purchase hardware and software
 - Only pay for use
 - Elastic scaling

Platform as a Service (PaaS)

- A third-party provider provides application development, testing, deployment, and hosting service as a service
- Features:
 - Cost-effective application development
 - Provides complete development, testing, and deployment platforms
 - Reduces complexity of application development
 - Supports most IaaS cloud providers: AWS, Google, and Microsoft Azure
- Prime Examples:
 - AWS Elastic Beanstalk
 - Microsoft Azure
 - Google App Engine
- Value:
 - Reduces development complexity
 - Only pay for use
 - Speed up development

Identity as a Service (IDaaS)

- A third-party provider provides ID management as a service
- Cloud-based solutions for identity and access management (IAM) functions
- Features:
 - Single sign-on (SSO), multi-factor authentication (MFA), federated identity management (FIDM), account provisioning and management, and so on.
- Prime Examples:
 - Okta, OneLogin, vmware, auth0, IBM, Google, AWS, and Microsoft
- Value:
 - Redundancy
 - Security
 - Faster logins
 - Reduces costs

Database as a Service (DBaaS)

- A third-party provider hosts the database on its physical infrastructure
- Features:
 - Self-service
 - Device and location-independent
 - Elasticity and scalability
 - Only pay for use
 - Agility
- Prime Examples:
 - AWS, Google, Oracle, and Microsoft (SQL, NoSQL, graph, data warehouses, etc.)
- Value:
 - Scalability
 - Performance guarantees
 - Security
 - Failover support
 - Low initial costs

Ethical Issues in Cloud Computing



Ethical Issues in Cloud Computing

- Paradigm shift with implication for computing ethics
 - Relinquishing control to third party services
 - Where's my data located?
 - Services interoperate across the network
- Concerns:
 - Governance
 - Accountability
 - Vendor lock-in
 - Who dictates pricing and policies

Major Obstacles (Activity)



Major Obstacles (Activity)

We looked at ...

- What is Cloud Computing?
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Next Stop: AWS and IAM

