Introduction to Digital Transformation (ZZ-1103)
Technology Usage

Cloud Computing
Transforming Business Through AI
Big Data

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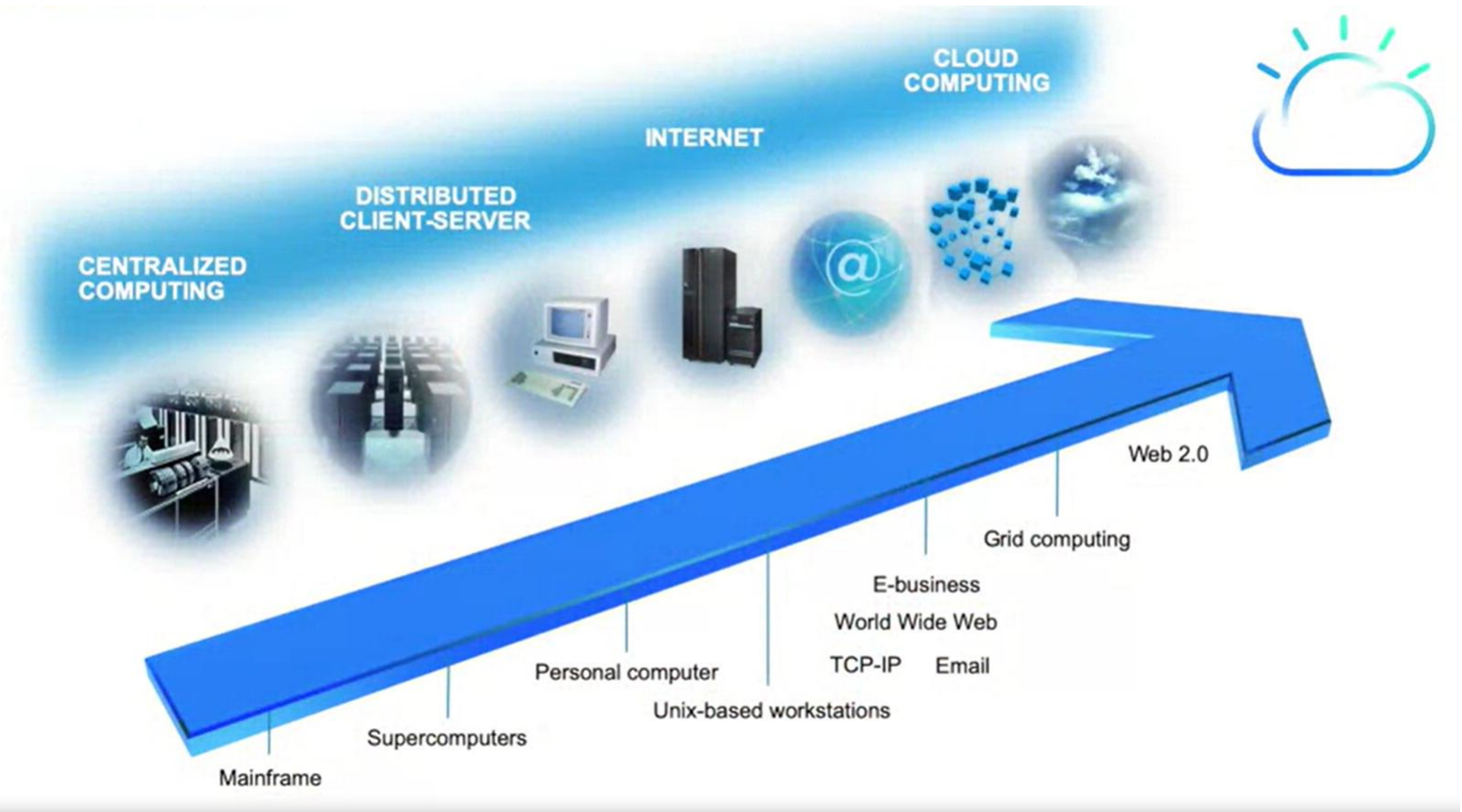School of Digital Science (SDS)
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Cloud Computing

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- **Definition of Cloud Computing according to NIST**
  - NIST (National Institute of Standards and Technology) is a U.S. federal agency that provides guidelines, standards, and best practices for various fields, including cloud computing.
  - Cloud computing is a model for enabling ubiquitous, convenient on-demand network access to a shared pool of configurable computing resources.
  - These resources include networks, servers, storage, applications, and services.
  - Cloud computing allows for rapid provisioning and release of resources with minimal management effort or service provider interaction.

- ## Scalability:
  - Cloud computing enables businesses to scale their computing resources up or down based on demand, allowing for flexibility and cost optimization.

- ## Cost Efficiency:
  - By utilizing cloud services, enterprises can avoid upfront costs associated with building and maintaining their own infrastructure.

- ## Accessibility:
  - Cloud computing provides ubiquitous access to computing resources, allowing employees to access applications and data from anywhere, anytime.

- ## Collaboration:
  - Cloud-based platforms facilitate collaboration among teams, enabling seamless sharing and real-time collaboration on projects.

- ## Innovation:
  - Cloud computing enables businesses to quickly experiment with new technologies and services, accelerating innovation and time-to-market.
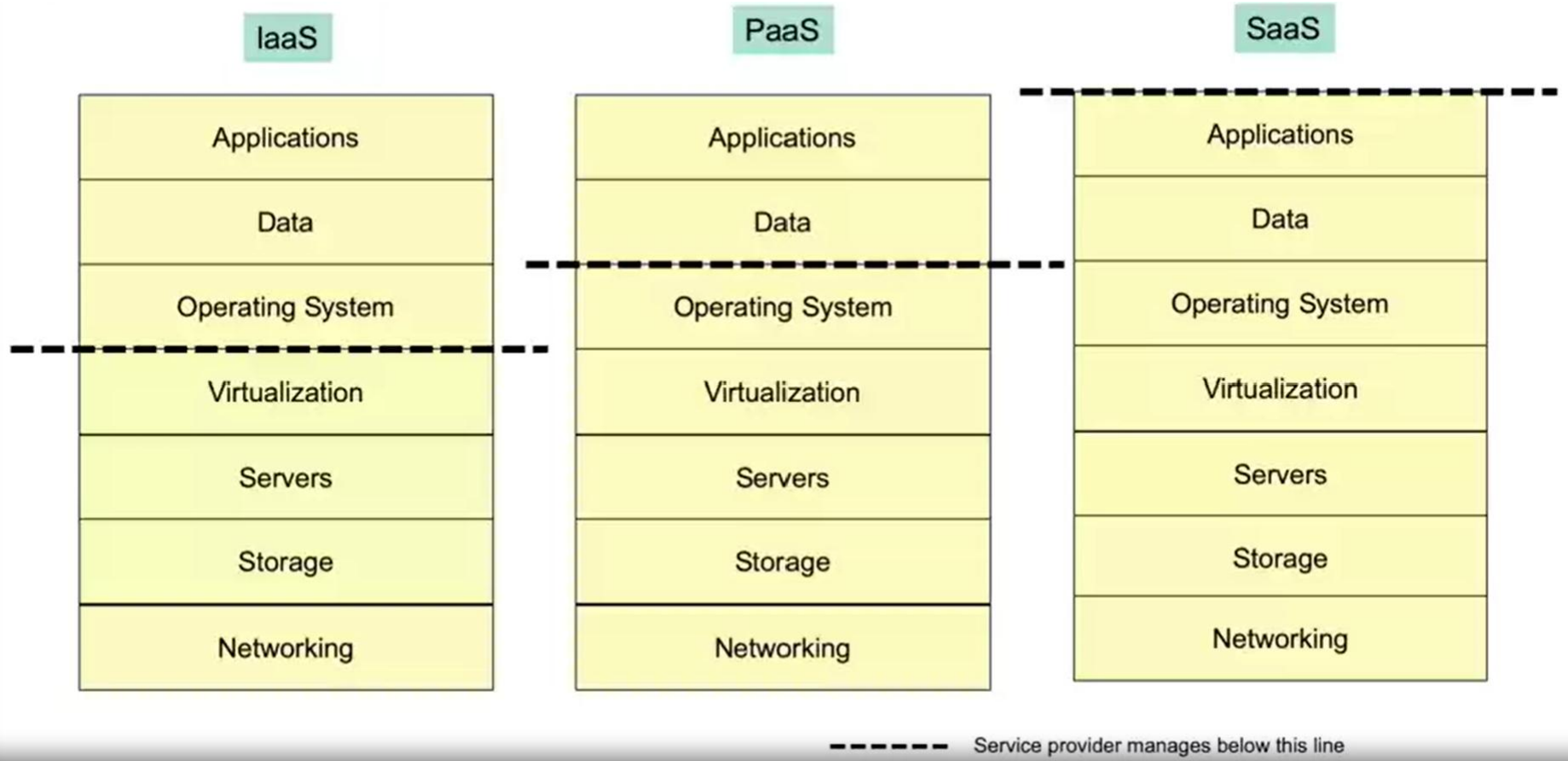
- ## Scale and Complexity:

  - Managing a large number of virtual machines can be challenging due to the sheer volume of machines that need to be configured, monitored, and maintained.

- ## Access Management:

  - Providing access to multiple users across the enterprise can be difficult, especially when different users require different levels of access and permissions.

- ## On-demand self-service:
  - Users can provision computing resources, such as servers and storage, as needed without requiring human interaction with the service provider.

- ## Broad network access:
  - Cloud services are accessible over the network and can be accessed by various devices, including mobile phones, tablets, laptops, and workstations.

- ## Resource pooling:
  - Cloud providers pool their computing resources to serve multiple consumers in a multi-tenant model. This allows for efficient resource utilization and cost optimization.

- ## Rapid elasticity:
  - Cloud platforms can rapidly scale computing resources up or down based on demand. This elasticity allows for flexibility and ensures that resources are available when needed.

- ## Measured service:
  - Cloud providers can monitor and measure resource usage, allowing for transparent and accurate billing. This characteristic enables organizations to optimize resource allocation and control costs.
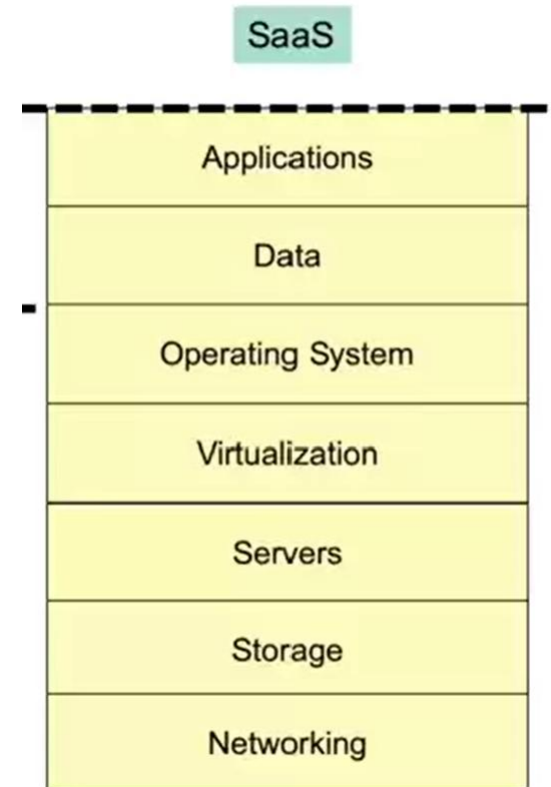
Amazon Web Services (AWS)

- ## Overview of AWS:
  - Amazon Web Services (AWS) is a cloud computing platform offered by Amazon. It provides a wide range of services and tools for managing virtual machines and running applications on the cloud.

- ## Solution for Managing Virtual Machines:
  - AWS offers a comprehensive set of services for managing virtual machines, including EC2 (Elastic Compute Cloud) for scalable computing resources and management tools like AWS Systems Manager for configuration and automation.
  - EC2 allows you to rent virtual machines (VMs) on demand, known as instances, and provides resizable compute capacity in the cloud.

- # Scalability:
  - – AWS allows businesses to easily scale their computing resources up or down based on demand, ensuring optimal performance and cost efficiency.

- # Cost Savings:
  - – By using AWS, businesses can avoid the upfront costs associated with building and maintaining their own infrastructure, as well as the ongoing costs of hardware upgrades and maintenance.

- # Reliability and Availability:
  - – AWS provides a highly reliable and available infrastructure, with built-in redundancy and data replication across multiple regions.

- # Security:
  - – AWS offers robust security features and compliance certifications, ensuring the protection of data and applications.

Cloud Service Models

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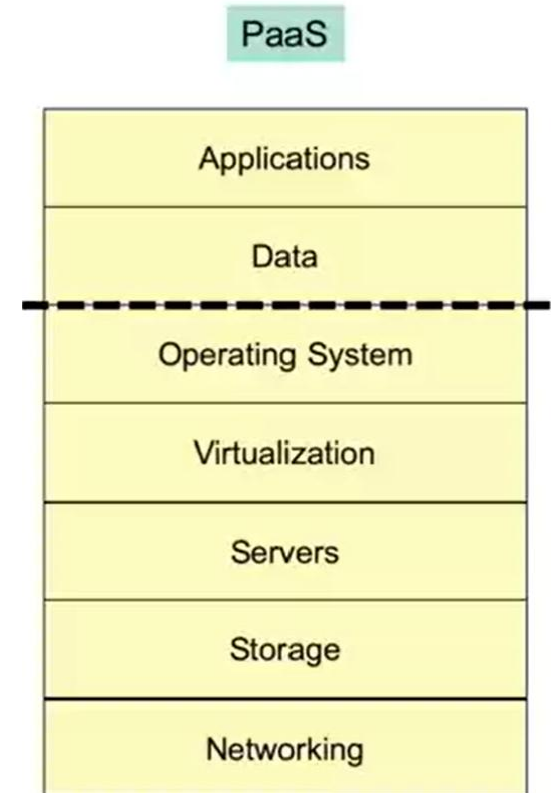
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Software as a Service (SaaS):

- End users access applications running on a cloud infrastructure through a web browser.

- Users do not manage or control the underlying infrastructure, including networks, servers, and storage.

- Examples of SaaS include Gmail and other cloud-based applications.

- Eg: GMAIL

SaaS

| Applications |
| Data |
| Operating System |
| Virtualization |
| Servers |
| Storage |
| Networking |

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Platform as a Service (PaaS):

- End users can deploy their own or other people's applications on a cloud platform.

- Users do not have to manage the underlying infrastructure but have control over the deployed applications.

- PaaS allows customization and configuration of the application hosting environment.

- Eg: IBM Cloud Service

PaaS

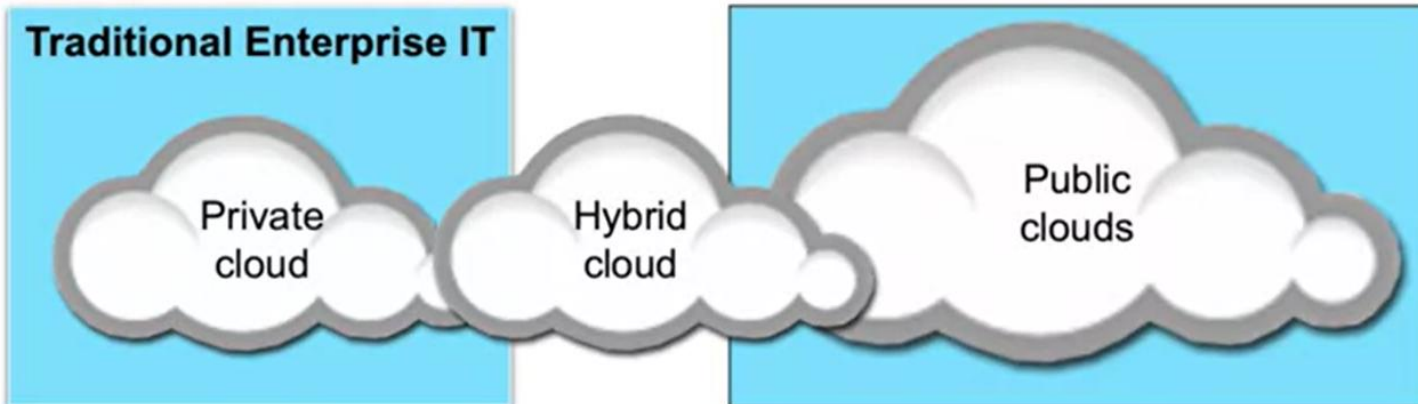| Applications |
| Data |
| Operating System |
| Virtualization |
| Servers |
| Storage |
| Networking |

Infrastructure as a Service (IaaS):

- End users have control over the underlying processing, storage, and networks.

- Users typically access resources through an operating system like Linux.

- IaaS providers offer flexibility and control over the infrastructure.

- Examples of IaaS providers are AWS, Azure, and Google

IaaS

| Applications |
| Data |
| Operating System |
| - - - - - - - - - |
| Virtualization |
| Servers |
| Storage |
| Networking |

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- IBM Cloud:
  - PaaS (Platform as a Service): IBM Cloud provides a platform for developers to build, deploy, and manage applications without having to worry about the underlying infrastructure.
  - It offers services and tools for application development, integration, and deployment.
  - Users can focus on developing their applications while IBM Cloud handles the infrastructure management.

- AWS Cloud:
  - IaaS (Infrastructure as a Service): AWS offers a comprehensive set of infrastructure services that users can utilize to build and manage their own applications and services.
  - It provides virtual servers, storage, networking, and other fundamental computing resources.
  - Users have more control over the infrastructure and can configure and manage it according to their specific needs.

Traditional Enterprise IT

Private cloud

Hybrid cloud

Public clouds

- Private cloud (on premise)
  - IT activities/functions are provided "as a service" over an intranet, within the enterprise and behind the firewall.
- Key features:
  - Scalability
  - Automatic/rapid provisioning
  - Widespread virtualization
  - Charge back

- Hybrid cloud
  - Internal and external service delivery methods are integrated, with activities/functions allocated based on security requirements, criticality, architecture, and other established policies.

- Public cloud
  - IT activities/functions are provided "as a service" over the Internet.
  - Key features:
  - Scalability
  - Automatic/rapid provisioning
  - Standardized offerings
  - Consumption-based pricing
  - Multi-tenancy

- Owned and managed by a single organization, typically an enterprise.

- Access to the cloud infrastructure and services is limited to the organization and its trusted partners.

- Provides a high level of control, privacy, and security.

- Enables customization, standardization, and best practices specific to the organization's needs.

- Can be accessed from within the organization's firewall.

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- Owned and managed by a third-party service provider, such as IBM or Google.

- Accessible to the general public or subscribers who pay for the services.

- Offers a wide range of standardized services, applications, and infrastructure on a pay-as-you-go basis.

- Provides scalability, flexibility, and cost-effectiveness.

- Usually accessible from outside the organization's firewall.

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- Combines elements of both private and public clouds.

- Allows organizations to leverage the benefits of both deployment models.

- Enables seamless integration and movement of workloads between private and public clouds.

- Offers flexibility in choosing where to deploy applications and services based on specific requirements.

- Can be used to handle peak workloads or to meet specific security or compliance needs.

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- https://www.coursera.org/learn/ubd-fd800380-5973-4628-98d0-625e0c400b34/home/module/5. (Module 5)

https://www.youtube.com/watch?v=vUXmvoZQbfw

Big Data in Digital Transformation

- https://www.coursera.org/learn/ubd-fd800380-5973-4628-98d0-625e0c400b34/home/module/6 (Module 6)