

# Course: Cloud Computing- Week 10 Migrating to the Cloud

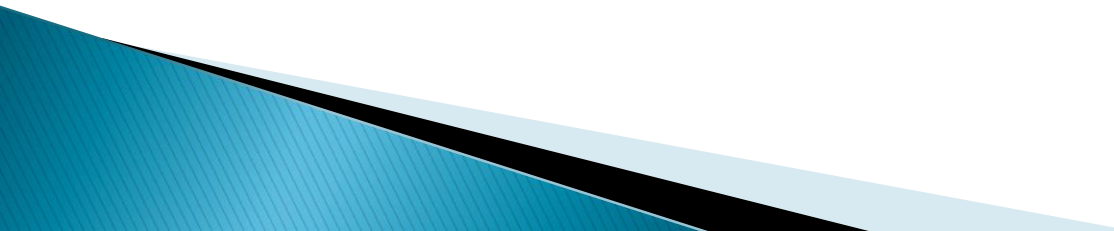
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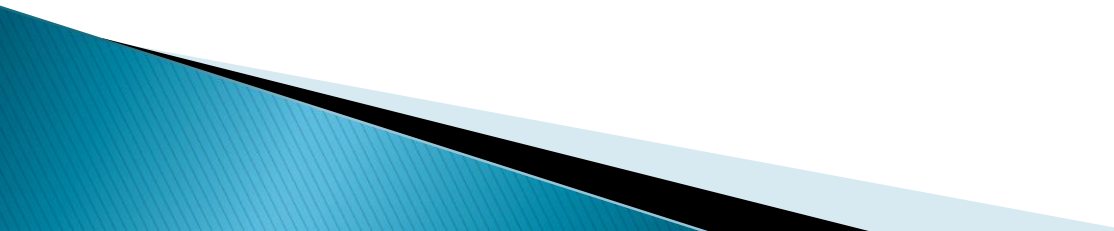
PHD in IT (Candidate)

## Lecture Learning Outcome:

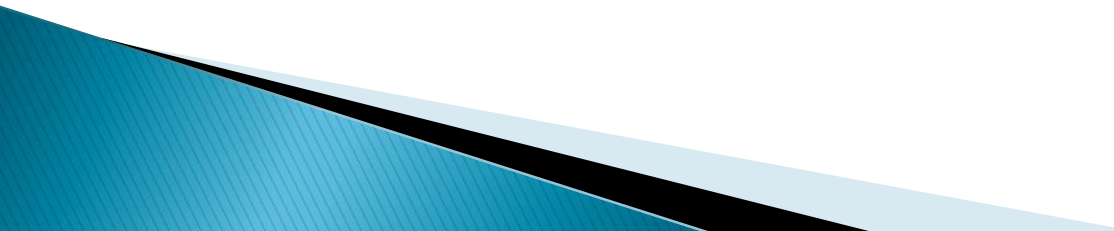
At the end of this lesson you will be able to;

- ▶ Understand the concept of Migrating to the cloud.
  - ▶ Understand the Motivation for Enterprises to Migration into the Cloud
  - ▶ Understand the Phases of Cloud Migration
  - ▶ Understand the Approaches/Strategies for cloud migration
  - ▶ Understand Cloud Migration Best Practices
  - ▶ Understand the Challenges in Cloud Migration
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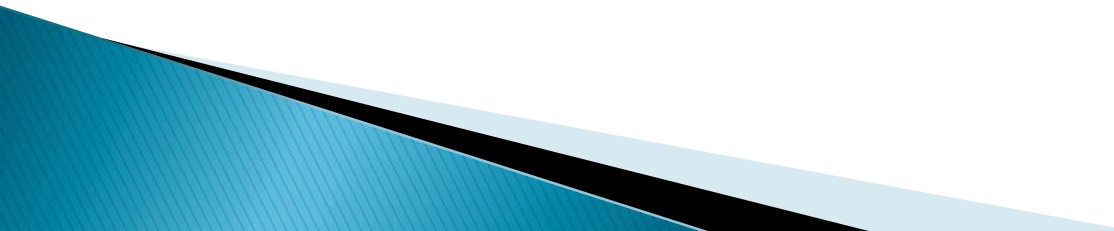
# Migrating to Cloud

- ▶ Cloud migration involves shifting enterprise applications and their IT infrastructure from the traditional hosting type to the cloud environment either public, private, or hybrid.
  - ▶ Cloud migration presents an opportunity to significantly reduce costs incurred on applications. This activity comprises, of different phases like evaluation, migration strategy, prototyping, provisioning, and testing.
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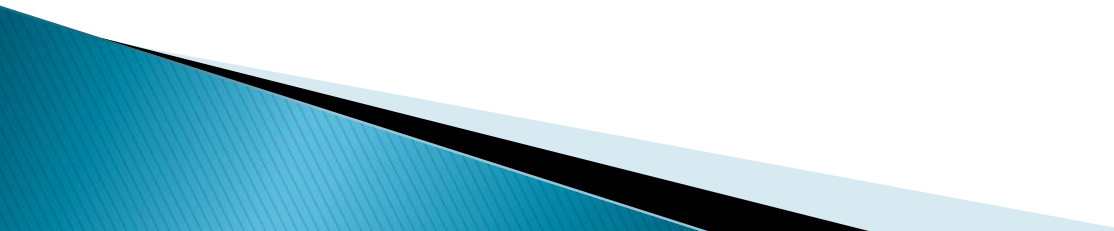
# Motivation for Enterprises to Migration into the Cloud

1. **Standardization:** Standardization means simplifying the system by dealing with less number of configurations, easily facilitated automation and much simpler support, flexible allowing easy provisioning. Also it is very user friendly.
  2. **Self Service:** With self-service, the user has the control and more cost and usage choices, along with increased visibility.
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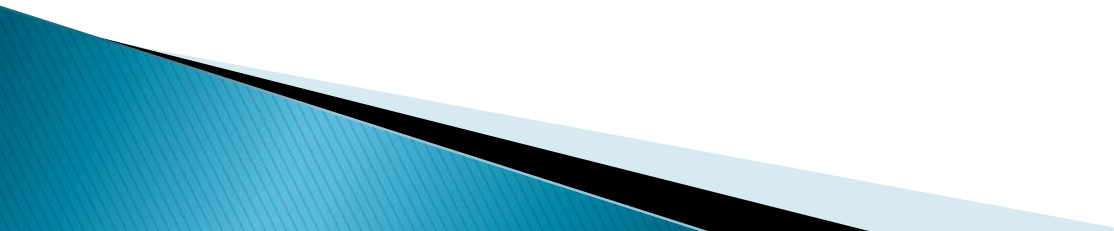
# Motivation for Enterprises to Migration into the Cloud

3. Virtualization: Virtualization ensures flexibility, increasing resource utilization thus being energy efficient.
  4. Automation: Automation means low human involvement and swift deployment. It also ensures repeatable configuration thus improving compliance.
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## Motivation for Enterprises to Migration into the Cloud

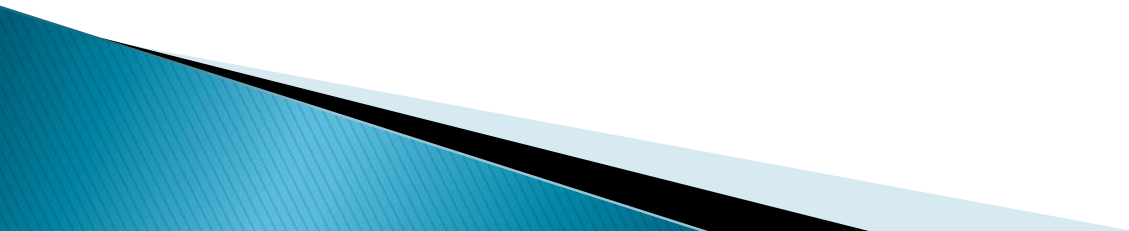
5. Cost Savings: Using cloud, capital expenditure can be decreased by not having to buy and maintain costly hardware. A cloud service provider can deploy the data to their high performance systems, with no need to maintain and upgrade expensive software and systems; instead the employees can be used to do some productive work for the organization.
  6. Better Collaboration: with cloud migration, collaboration is possible and this accelerates business growth.
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# Motivation for Enterprises to Migration into the Cloud

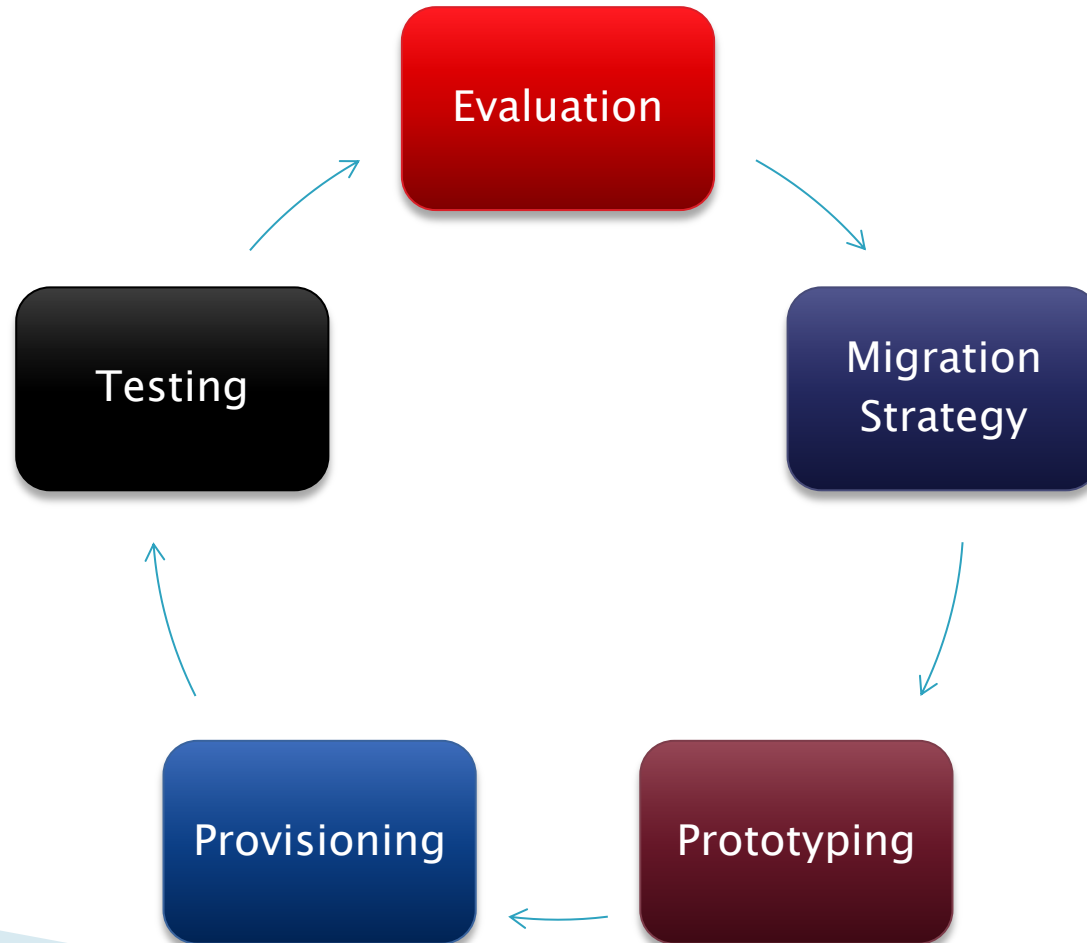
- ▶ 7. Improved Network Performance: work load for the on- premise networks is greatly reduced thus improving performance of functions using the on premise internal network.
  - ▶ 8. Improved Integration and Compatibility: Massive organizational data requires easy accessibility and analyses for data stored across various platforms. Consequently, this requires close integration and compatibility between them. With cloud migration the problems of compatibility and integration is reduced.
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# Motivation for Enterprises to Migration into the Cloud

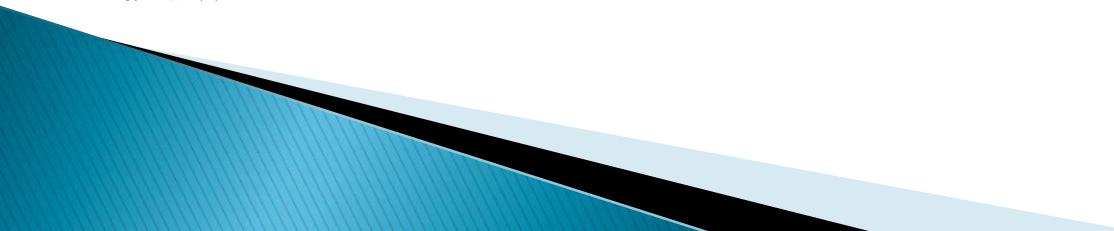
9. Reliability and Security: Reliable cloud service providers can shield the company from numerous security concerns by investing multiple security mechanisms that could have costed the company a lot of money.



# Phases of Cloud Migration



# Phases of Cloud Migration

1. Evaluation: Evaluation is carried out for all the components like current infrastructure and application architecture, environment in terms of compute, storage, monitoring, and management, SLAs, operational processes, financial considerations, risk, security, compliance, and licensing needs are identified to build a business case for moving to the cloud.
  2. Migration strategy: Based on the evaluation, a migration strategy is drawn—
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# Phases of Cloud Migration

3. Prototyping: Migration activity is preceded by a prototyping activity to validate and ensure that a small portion of the applications are tested on the cloud environment with test data setup.

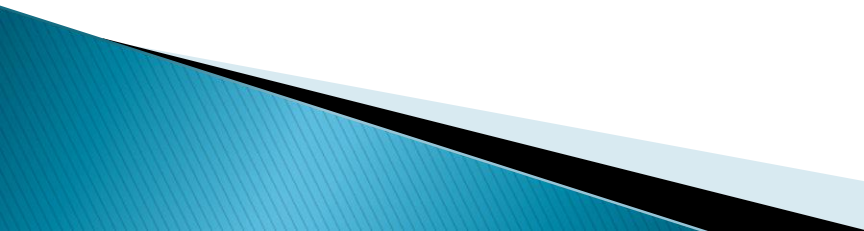
4. Provisioning: Pre-migration optimizations identified are implemented. Cloud servers are provisioned for all the identified environments, necessary platform software and applications are deployed, configurations are tuned to match the new environment sizing, and databases and files are replicated.

# Phases of Cloud Migration

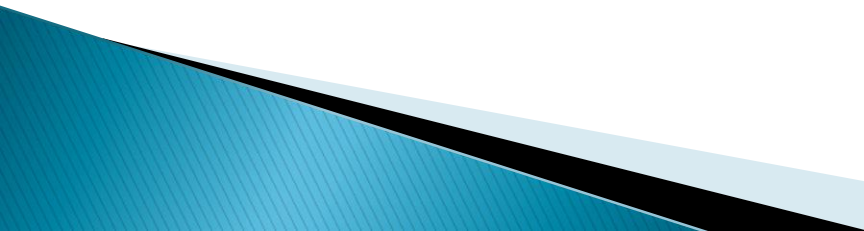
All internal and external integration points are properly configured. Web services, batch jobs, and operation and management software are set up in the new environments.

5. Testing: Post migration tests are conducted to ensure that migration has been successful. Performance and load testing, failure and recovery testing, and scale-out testing are conducted against the expected traffic load and resource utilization levels.

## Approaches/ Strategies for Cloud Migration

- ▶ Identify the intended use and requirements, the broad strategy, and the architectural concepts for how cloud services will be delivered:
  - ▶ Identify what cloud services (SaaS, PaaS, and/or IaaS) and data will be provided.
  - ▶ Establish from where the services will be provided.
  - ▶ In-house data center (on premise) – organically owned and operated by the organization.
  - ▶ In-house data center (on premise) – owned and operated by a third party (contractor).
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# Approaches/ Strategies for Cloud Migration

- ▶ External data center (off premise) – outsourced to a federal cloud provider.
  - ▶ External data center (off premise) – outsourced to a commercial cloud provider.
  - ▶ Define what cloud deployment model will be used:
    - ▶ Public cloud
    - ▶ Community cloud
    - ▶ Private cloud
    - ▶ Hybrid cloud
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# The Strategy

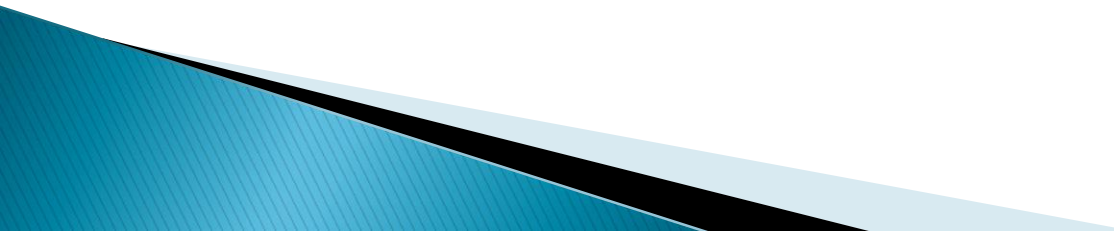
1. Lift-and-Shift Migration: The lift-and-shift migration strategy involves moving applications and workloads to the cloud with minimal changes to the existing architecture.

- ▶ In this approach, organizations lift their applications from on-premises environments and shift them to the cloud infrastructure as-is. While this strategy is relatively quick and straightforward, it may not fully leverage the benefits of cloud-native services and could result in suboptimal performance (khan, 2023) .

# The Strategy

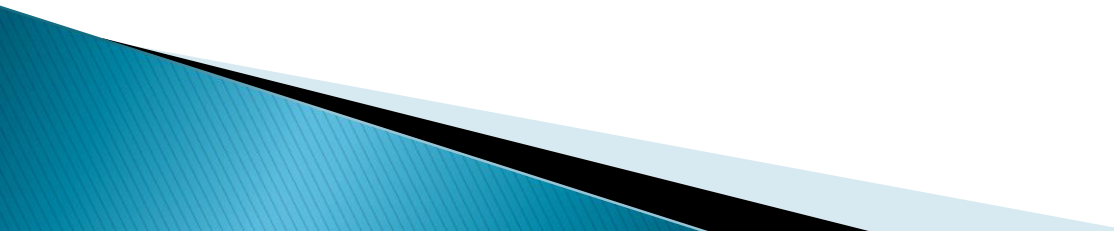
2. Re-platforming Migration: The re-platforming migration strategy entails making some adjustments to applications and workloads to take advantage of cloud-native features and services. This approach strikes a balance between quick migration and optimization.

Organizations may refactor or repackage applications to align with the cloud environment, enabling improved performance and cost-efficiency while minimizing disruption.

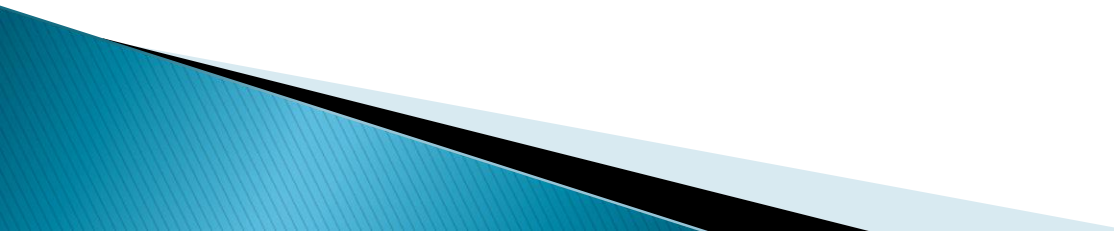


# The Strategy

3. Application Rewrite Migration: The application rewrite migration strategy involves fully redesigning and rebuilding applications for cloud-native environments. While this approach requires significant effort and resources, it offers the most potential for optimization and scalability. By rewriting applications using cloud-native architectures, organizations can fully exploit cloud services and achieve maximum performance and flexibility.

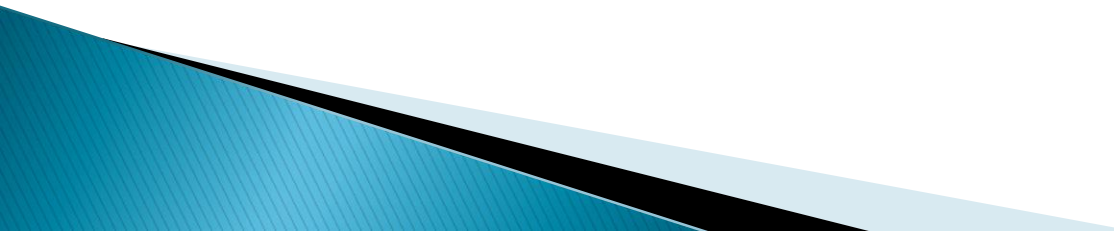


## Cloud Migration Best Practices:

- ▶ Effective planning and assessment are critical to selecting the most suitable migration strategy based on organizational goals and existing infrastructure. Proper data migration planning ensures the secure and seamless transfer of data to the cloud environment, minimizing the risk of data loss or corruption.
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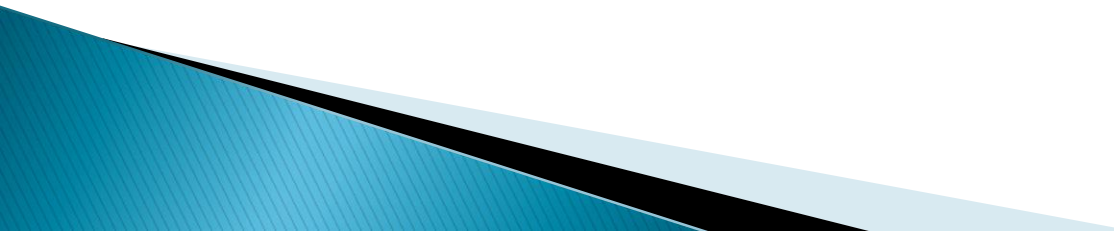
# Effective planning and assessment

## Measures used ensure proper planning

- ▶ **Adopting a framework**
  - ▶ The Main reason for using a framework is to ensure a thorough, well-thought-out, and manageable approach for planning and executing a migration project, as well as sustaining the capability once it goes operational.
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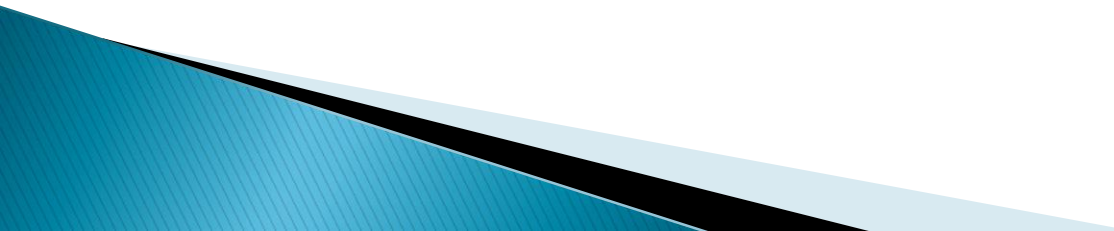
There are four major frameworks:

**There are four major frameworks:**

- ▶ Work Breakdown Structure (WBS) framework.
  - ▶ The WBS provides a logical approach and framework to identify and manage all necessary activities across the planning, development, and implementation phases of a project.
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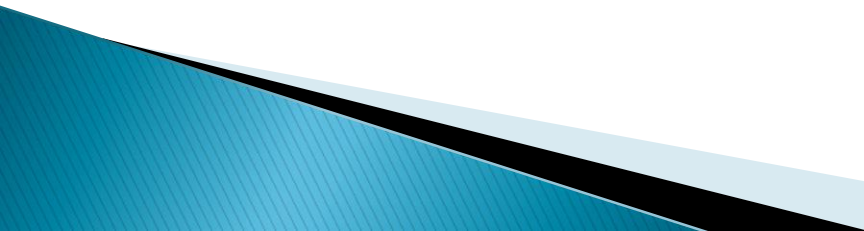
# Effective planning and assessment

## Adopting a framework

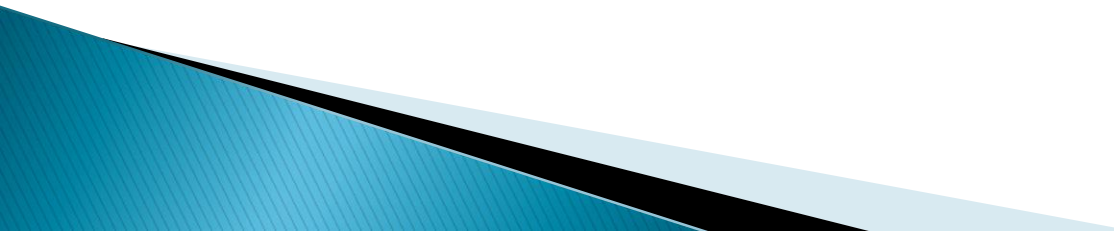
- ▶ **IT Infrastructure Library (ITIL).**
  - ▶ TIL provides guidance on, and a framework for, implementing “best” business practices for IT Service Management (ITSM) and service delivery.
  - ▶ Department of Defense Enterprise Service Management Framework (DESMF).
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# Effective planning and assessment

## Adopting a framework

- ▶ The intent of this framework is to enhance the ability of DOD organizations to implement, monitor, and improve IT service management and delivery. It leverages best practices from multiple frameworks, but is heavily ITIL-influenced.
  - ▶ **Portfolio, Program, and Project Management Maturity Model (P3M3).**
  - ▶ This framework looks at process maturity across and within Portfolios, Programs, and Projects (P3), the competencies of the personnel who apply the processes, the supporting tools, and the information necessary to manage the processes.
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# Gap/Redundancy Analysis

- ▶ A gap/redundancy analysis provides a good approach to help ensure migration plans are thorough (no gaps or shortfalls) and optimal (no redundancies or duplications). Gaps and redundancies may cause implementation or operational problems, increase costs, delay implementation, or generally result in a sub-optimal or non-responsive solution.
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# Effective planning and assessment

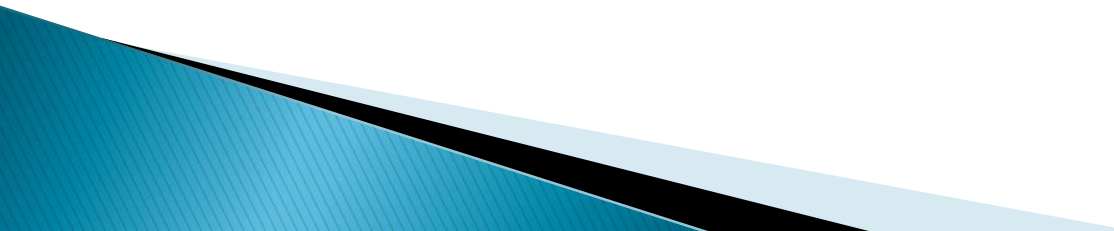
## Measures used ensure proper planning

- ▶ Analysis of Alternatives (AoA)

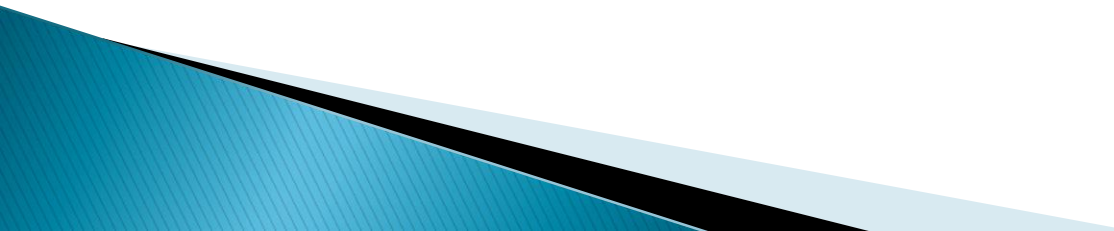
Throughout the lifecycle of a given project, leadership will make key decisions related to requirements (e.g., user and technical performance requirements) and solutions (e.g., cloud deployment model options such as public, private, or hybrid clouds)

# Effective planning and assessment

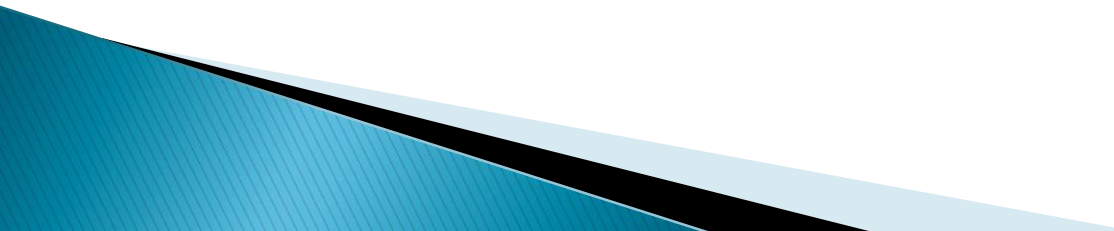
## Measures used ensure proper planning

- ▶ **Selecting a cloud provider:** it is critical to select providers that have a service model that meets the needs of the organization, in the selection process it is not enough to consider only technical issues it is critical to assess the capacity and reliability of the provider that the organization intends to hire.
  - ▶ Microsoft suggests that organizations evaluate four key areas for selecting a cloud computing provider:
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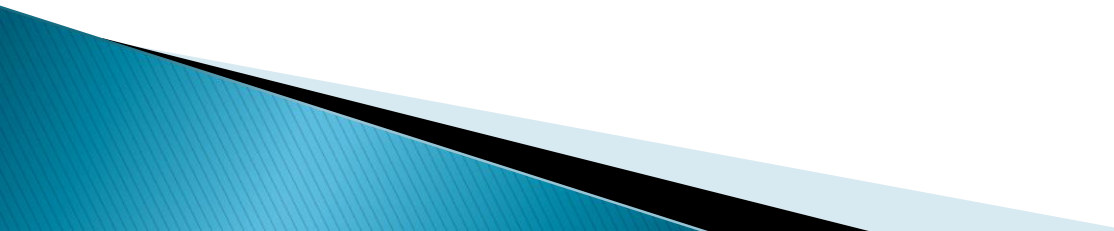
# Cloud Migration Best Practices:

- ▶ Business Processes and Integrity
    - Administration Support
    - Technical Features and Processes
    - Safety Practices
  - ▶ Security and Compliance Considerations: Security and compliance are fundamental aspects of cloud migration. There is a need for robust security measures and encryption during data migration and while applications operate in the cloud.
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# Cloud Migration Best Practices:


- ▶ Ensuring compliance with industry regulations and data protection laws is essential to maintain data confidentiality and privacy in the cloud environment.
  - ▶ Acquisition: Involve acquisition experts and contract officers early to help define the contract and acquisition strategy. Factors for consideration include the following.
    - ▶ For work that will be contracted out:
    - ▶ Define the type of contract that will be used for contractor-provided support (e.g. cost plus, firm fixed price, time and materials, performance based, etc.).
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# Cloud Migration Best Practices:

- ▶ Determine the type of contract documents and requirement specifications needed such as Statement of Work (SOW), Statement of Objectives (SOO), or Project
  - ▶ Work Statement (PWS), as well as associated strategic plans and requirements documents.
  - ▶ Consider using existing Government contracts
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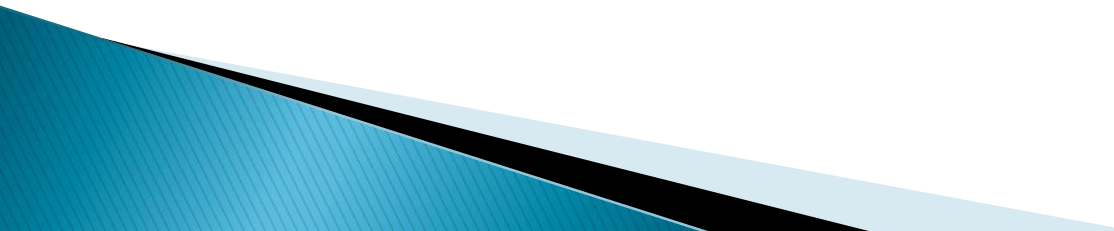
# Cloud Migration Best Practices:

## Performance

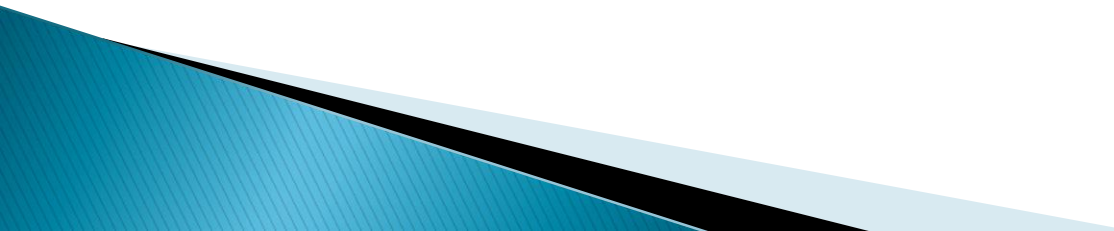
- ▶ Establish an approach to performance management/measurement.
  - ▶ Define the expected/required Quality of Service (QoS) metrics in the form of: SLAs describing the expectations for how services will be delivered to the customer (e.g., reliability, availability, and maintainability requirements; incident response times; etc.).
  - ▶ Operating Level Agreements (OLAs) describing the expectations for how the service delivery organization will work with supporting organizations
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# Cloud Migration Best Practices:

## Resources


- ▶ Plan for and acquire the necessary financial and staffing resources to cover the initial acquisition and implementations costs as well as life cycle sustainment costs.
  - ▶ Identified estimated funding required to cover: Acquisition costs.  
Data center hardware (infrastructure, storage, services, etc.). Software (applications, licensing, etc.). Networking hardware (routers, switches, etc.).
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# Resources

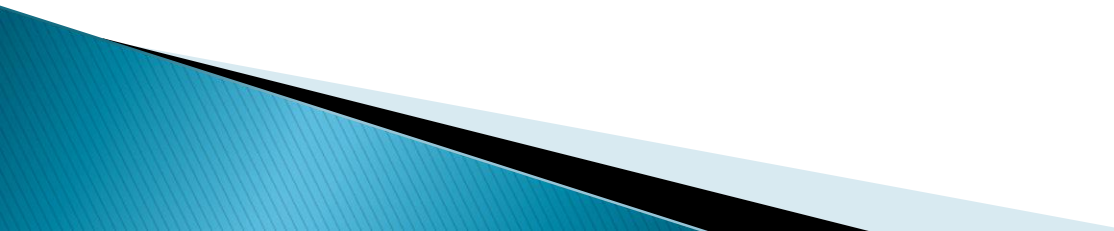
- ▶ Transport costs.
  - ▶ Support costs (logistics, training, manpower/personnel).
  - ▶ Contract costs.
  - ▶ Life cycle operations and sustainment costs.
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# Cloud Migration Best Practices:

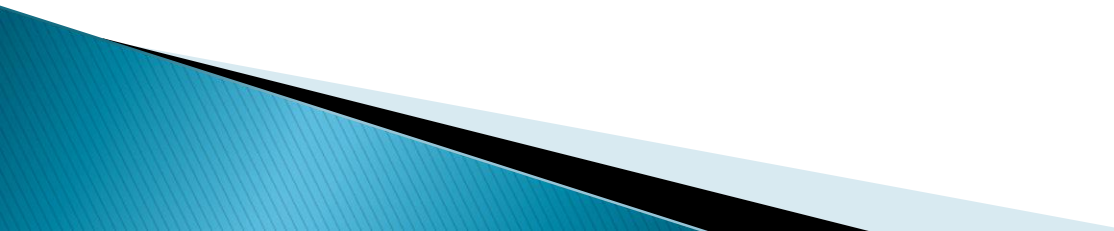
## **Risk management/mitigation.**

- ▶ Identify actual and possible implementation risks that may adversely impact (or are impacting) implementation, and lay out a mitigation strategy for them.
  - ▶ Consider risks at the cloud provider's and cloud customer's locations as well as the transport (communications) network connecting them.
  - ▶ Risk Mitigation.
  - ▶ Develop risk mitigation strategies for both implementation and operational risks.
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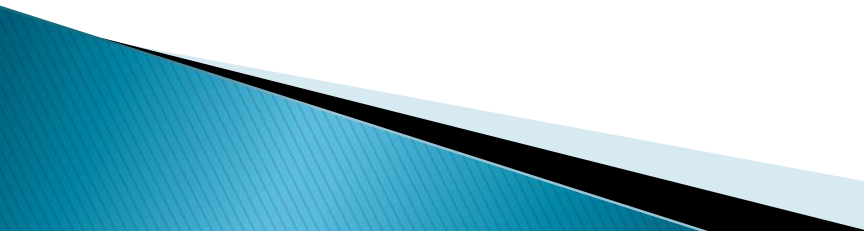
# Cloud Migration Best Practices:

- ▶ **Post-Migration Optimization:** Post-migration optimization is highlighted as an ongoing process that organizations should undertake to continuously improve the performance, security, and cost-efficiency of cloud-based applications and workloads. Regular monitoring, resource allocation adjustments, and cloud cost management are essential components of post-migration optimization efforts.
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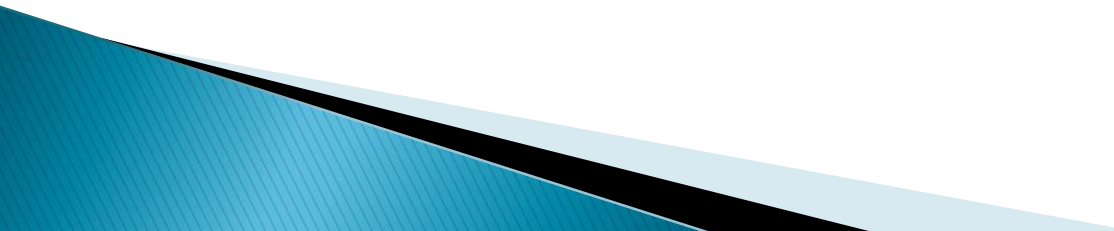
# Organizational Impacts

- ▶ Shift to the cloud will greatly impact the structure, roles and responsibilities of the IT organization and its staff
  - ▶ Key Considerations in changing organizational structure and staffing to align with the new mission/environment and changed roles and responsibilities include:
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# Organizational Impacts

- ▶ Mission: align the organization to the mission, not the systems.
  - ▶ Strategy: ensure the stakeholders (and especially the internal staff) understand the purpose and direction of the change, and how/why it is affecting the organizational structure,
  - ▶ Structure: arrange functions and staff into specific areas of responsibility  
Authority: provide the necessary authority to link responsibility with accountability.
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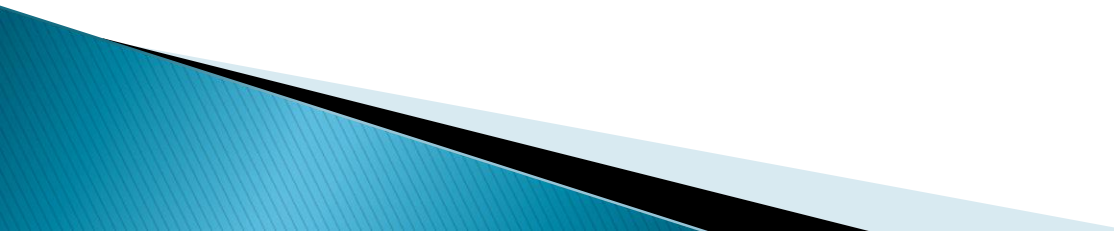
## Organizational Impacts

- ▶ Relationships: Identify and describe relationships across the organization. Apply the A RACI model (Responsible, Accountable, Coordinated, Informed)
  - ▶ Tasks and Individual Skills: ensure the stakeholders and staffs have the necessary skills, ability, and knowledge to perform in the new environment. Provide adequate training.
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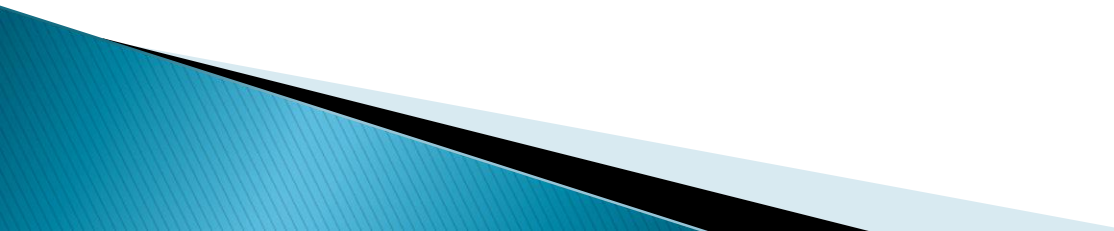
# Challenges in cloud migration

- ▶ **Sensitive Data**-All organizations whether small, medium or big run their operations at the cost of the data they store or share with their respective clients or authorized third parties. During the migration process Data may leak causing a lot of damage to the company

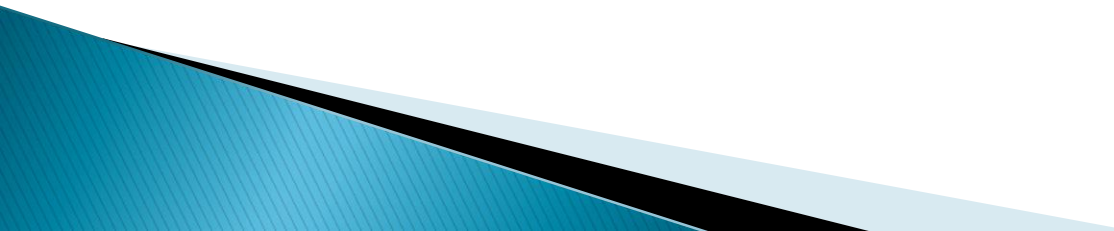
## Challenges in cloud migration

- ▶ **Cloud Security:** The biggest issue in the current IT industry is the security of the internet
  - ▶ **Interoperability-**One of the most pressing issues with respect to cloud computing is the current difference between the individual vendor approaches, and the implicit lack of interoperability. For instance limited ability to write code that works with more than one cloud provider simultaneously,
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## Challenges in cloud migration

- ▶ **Portability**-Portability is the ability to run components or systems written for one environment in another environment. So in cloud environment the software that you want to move should be portable with other cloud environment.
  - ▶ **Adapting** to cloud computing-An organization adopting cloud computing will encounter changes to the mission, authority, funding and staffing of various departments within the organization.
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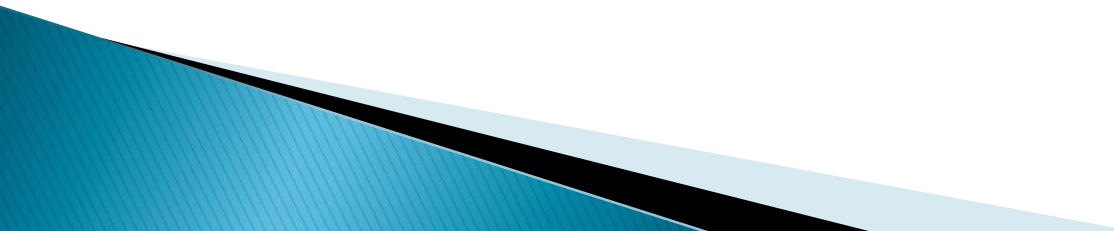
## Challenges in cloud migration

- ▶ **Cost and time** it takes to move- It may turn out to be costly to migrate to the cloud,
  - ▶ Specific things to think about here are the bandwidth, cost of moving significant amounts of data to the Cloud and the time taken to transfer data in the migration process.
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## Challenges in cloud migration

- ▶ **Service Level Agreements (SLAs)**- An SLA defines the interaction between a cloud service provider and a cloud service consumer. An SLA is the foundation of the consumer's trust in the provider. An SLA contains
  - ▶ 1. A set of services the provider will deliver, along with a complete, specific definition of each
  - ▶ 2. The responsibilities of the provider and the consumer A set of metrics to determine whether the provider is delivering the service as promised (Bhopale, 2012).

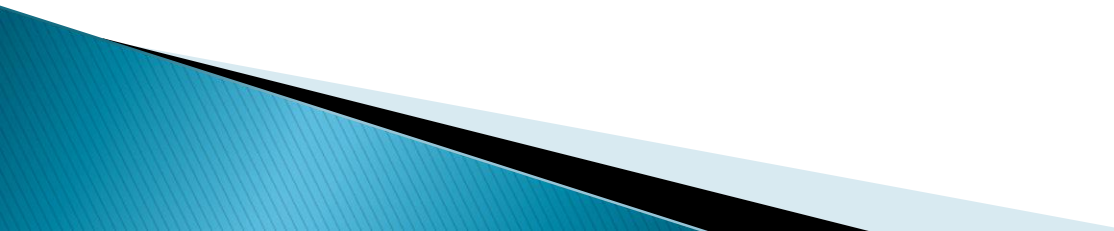
## Possible solutions to the challenges

- ▶ Applying Cloud migration best practices will greatly mitigate some of the limitations to cloud migration.
  - ▶ Use encrypted file systems- Encryption technology uses algorithms to hide data, whenever data is migrated from one server to the cloud server; it is done in an encrypted file format so that even if it is stolen, it will not be understood by any third parties. Various well-established and easy-to-implement technologies exist to do this, such as the HTTPS protocol for encrypting websites.
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## Possible solutions to the challenges

- ▶ Backups where necessary-Keep offsite backups in-house or at an alternate cloud provider so that data will be available after crash. Various companies are providing storage as a service so you can make use of it to maintain backup of your migrated data. ■

## Possible solutions to the challenges

- ▶ Hiring skilled and experienced team of cloud professionals -Foremost thing that should be taken care of is to hire a skilled and experienced team of cloud professionals. This is required because sound knowledge about cloud know-how will help these professionals manage every bit of it efficiently.
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## Possible solutions to the challenges

- ▶ Take the service from Security service providers- Various cloud providers are available in cloud environment. As they are providing security as a service, you can get service from these service providers to secure your data and information that you have migrated to cloud

## Discussion Questions

**QN1.** Discuss the factors motivating Different Enterprises to migrate to the Cloud.

**QN2.** Discuss some of the Key considerations you need to be mindful of while planning to Migrate to the Cloud.

**QN3.** Discuss some of the Challenges involved in the process of cloud Migration. Explain how your enterprise can mitigate some of those challenges.

# Next Lesson

- ▶ **Mobile Cloud Computing**

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