

## Cloud Computing

### 1. Determine if cloud solution is appropriate

#### 1.1 Explain advantages provided by cloud to stakeholders

- Describe cloud infrastructure
- Distinguish between IaaS, PaaS, and SaaS
- Show how cloud allows building applications cheaper than with traditional models
- Show how cloud allows building applications faster than with traditional models

#### 1.2 Explain cost to stakeholders

- Identify the use case (new development or transition of existing product or service)
- Identify the resources that will be required to construct the service or product using cloud-hosted components (include compute, data, and network costs)
- Identify support plan that will be required to meet performance, availability, scalability, and reliability (PASR) criteria
- Consider factors that go into return on investment

#### 1.3 Explain performance to stakeholders

- Identify performance criteria
- Consider what solutions meet the criteria
- Assess cost and availability of technical expertise

#### 1.4 Explain reliability to stakeholders

- Identify reliability criteria, including network speeds
- Consider what solutions meet the criteria
- Understand service-level agreement (SLA) with cloud provider
- Consider disaster-recovery and backup plans (including backup redundancy or replication factor)

#### 1.5 Explain availability to stakeholders

- Identify the use case (new development or transition of existing product or service)
- Identify any upstream or downstream SLAs that will govern availability requirements
- Establish availability metrics
- Assess the SLA offered by the cloud-hosted solution

#### 1.6 Explain scalability to stakeholders

- Identify the use case (new development or transition of existing product or service)
- Understand that rules can be set to adjust resources based on need

#### 1.7 Recommend off-the-shelf (OTS) or custom solutions as needed

- Identify the use case (new development or transition of existing product or service)
- Evaluate if existing OTS offering meets performance, availability, scalability, and reliability needs



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- Evaluate technical effort needed for custom solution
- Evaluate if custom solution can exceed OTS on PASR criteria

## 2. Developing cloud architecture

### 2.1 Choose between public, private, and hybrid cloud implementations

- Identify the security and privacy requirements for the solution (focusing on networking options that each provides)
- Consider limits imposed by tenancy in various cloud implementations

### 2.2 Draw an architectural diagram (show data flows)

- Break down the proposed solution into compute, data, and networking components
- Produce logical groupings for the components
- Mark data flows between components (including the protocol)
- Identify system and component boundaries (including responsibility model)

### 2.3 Define requirements

- Decide whether to virtualize server, network, storage, and desktop
- Be aware of design patterns like microservices and serverless
- Consider networking infrastructure, storage devices, memory, and end-user devices required

### 2.4 Identify how services communicate through application programming interfaces (APIs)

- Identifying services with which the application needs to integrate
- Interact using an API

### 2.5 Create virtual machines

- Determine the operating system for the virtual machines
- Choose the appropriate size for the virtual machines
- Decide on geographic setting for the virtual machines (latency, legal requirements)
- Configure options (e.g., time limitations, scaling, backups) for the virtual machines

### 2.6 Identify data storage requirements

- Distinguish between structured and unstructured data
- Determine amount of storage needed
- Consider location of storage
- Consider storage security

## 3. Implementing the cloud development life cycle

### 3.1 Create content in virtual environments

- Understand that a source-code management system needs to be set up
- Install and configure the prerequisite packages in the virtual environment
- Save changes and keep track of the codes in a source code management system (such as Github)



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## 3.2 Perform testing

- Provide different test cases, test scenarios, and test scripts
- Run the tests and report the bugs iteratively

## 3.3 Structure the overall cloud-based solution

- Integrate systems and applications within the selected environment
- Integrate systems and applications with legacy systems
- Integrate systems and applications with third-party applications
- Distinguish between containers and virtual machines
- Know when to choose containers over virtual machines

## 3.4 Deploy application on server

- Decide on the strategy to deploy a new application, replacing a previous one
- Understand version control
- Identify cloud-hosted solutions to create code and data pipelines (e.g., cloud-native CI/CD offerings and workflow automation like GitHub Actions)
- Identify existing CI/CD practices

## 4. Managing cloud operations

### 4.1 Manage operational costs

- Understand usage-based pricing
- Scale up and scale down to meet demand cost-effectively

### 4.2 Develop business continuity and disaster recovery policy

- Identify potential risks and disaster scenarios
- Establish on-premise vs offsite backup strategy

### 4.3 Provide support to users

- Identify protection and security policies for external and internal users
- Provide application and hardware support for internal users
- Provide training tools for internal and external users

### 4.4 Monitoring cloud systems

- Log events
- Monitor hardware and software (e.g., interpret graphs and dashboards)
- Understand notifications or alerts for provisioning backup

## 5. Understanding cloud governance

### 5.1 Comply with privacy and regulatory requirements

- Identify relevant privacy requirements based on geographical and domain constraints (e.g. BIPA, HIPAA, PDP, FERPA, COPPA, GDPR, CCPA, etc.) as well as organization-specific policies
- Identify cloud-provider compliance for these privacy regulations
- Assess types of data managed within the environment
- Assess location and storage of data
- Be aware of NIST and ISO frameworks and standards



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## 5.2 Comply with ethical guidelines

- Consider the impact of bias, lack of transparency, and lack of accountability
- Explain potential bias and transparency challenges with prebuilt services

## 5.3 Managing cloud security

- Understand options and concepts for identity verification and authentication, including digital identity and multifactor authentication
- Understand access policies and authorizations (e.g., options for access, vendor-provided roles vs. custom roles and permissions, and access hygiene, including least privilege access, removal of access when not needed, disabling accounts)
- Understand the importance of data security and encryption
- Understand options to protect against unauthorized access in cloud environments (including intrusion detection and prevention, firewalls)



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