Cloud Computing Oral Exam Preparation Guide

Module 1: Introduction to Cloud Computing

Fundamental Questions:

1. **What is cloud computing in simple terms?**
    - Cloud computing is on-demand delivery of computing resources (servers, storage, databases, networking, software) over the internet with pay-as-you-go pricing.
    - **Key points**: Scalability, on-demand access, resource pooling, and measured service.
    - *Likely follow-up*: How does it differ from traditional computing?
2. **Describe the historical development of cloud computing.**
    - Started with mainframes (1950s-60s) → grid computing → utility computing → SaaS emergence → modern cloud computing formally recognized when Amazon launched AWS EC2 in 2006.
    - **Key milestone**: Salesforce.com (1999) pioneered SaaS before "cloud" became mainstream.
3. **What are the essential characteristics of cloud computing?**
    - **Remember using BROAD**: Broad network access, Resource pooling, On-demand self-service, Automatic resource optimization, and Dynamic scalability with measured service.

Application-Based Questions:

4. **How would you explain cloud computing benefits to a small business owner?**
    - Cost efficiency (capital to operational expenses)
    - Scalability without upfront investment
    - Focus on core business rather than IT infrastructure
    - Improved accessibility and collaboration
5. **Compare and contrast the major cloud computing platforms covered in your course.**
    - **Microsoft Azure**: Enterprise-focused, strong hybrid capabilities, tight Windows integration
    - **Hadoop**: Big data processing framework, not a full cloud platform but essential for data workloads
    - **Force.com/Salesforce**: PaaS specialized for business applications, rapid development
    - **Manjrasoft Aneka**: Cloud application platform for deploying apps across private/public clouds

Experiment-Related Question:

6. **Based on your experiments, what fundamental differences did you observe between cloud platforms like Azure, GCP, and AWS?**
    - Interface differences
    - Service naming conventions
    - Pricing models
    - Deployment workflows

- Integration with existing tools

Module 2: Virtualization

Conceptual Questions:

1. **Define virtualization and explain its importance in cloud computing.**
   - Virtualization creates a simulated computing environment that abstracts physical infrastructure.
   - It's the **foundation technology** enabling cloud computing by allowing multiple virtual instances on single physical hardware.
   - Enables efficient resource utilization, isolation, and provisioning.
2. **Explain the characteristics of virtualized environments.**
   - Partitioning (running multiple OS on one machine)
   - Isolation (VM failures don't affect others)
   - Encapsulation (VM state captured as files)
   - Hardware independence (run anywhere)
   - **Key term**: Hypervisor manages these environments
3. **Diagram and explain the taxonomy of virtualization techniques.**
   - Full virtualization: Complete simulation of hardware
   - Para-virtualization: Modified guest OS communicates with hypervisor
   - OS-level virtualization: Shared OS kernel with isolated user spaces

    - **Memory aid**: "FPO" - Full, Para, OS-level
4. **Compare and contrast Xen, VMware, and Microsoft Hyper-V.**
    - **Xen**: Open-source, para-virtualization, lightweight, directly communicates with hardware
    - **VMware**: Full virtualization, mature market presence, extensive feature set
    - **Hyper-V**: Microsoft's hypervisor, deep Windows integration, Type 1 hypervisor

Application-Based Questions:

5. **How would you implement live migration in a virtualized environment?**
    - Pre-copy memory pages while VM runs
    - Brief pause to copy final changed pages
    - Resume VM at new location
    - **Key concept**: Minimal downtime while maintaining running state
    - *Likely follow-up*: What challenges might occur during live migration?
6. **Explain the pros and cons of virtualization in cloud environments.**
    - **Pros**: Resource efficiency, improved disaster recovery, easier management
    - **Cons**: Potential performance overhead, security concerns (VM escape), complexity

- **Remember**: Virtualization enables cloud but introduces its own challenges

Scenario-Based Question:

7. **A company wants to migrate from physical servers to a virtualized environment. What steps and considerations would you recommend?**
   - Assessment of workloads and requirements
   - Choosing appropriate virtualization technology
   - Planning for storage and network virtualization
   - Testing and validating performance
   - Implementing security controls specific to virtual environments
   - **Key consideration**: Not all applications may be suitable for virtualization

Module 3: Cloud Infrastructure and Platforms in Industry

AWS-Focused Questions:

1. **Explain Amazon EC2 and its key features.**
   - Elastic Compute Cloud provides resizable compute capacity
   - Features: Instance types, AMIs, auto-scaling, spot instances, security groups
   - **Key term**: Instance = virtual server in AWS
   - *Likely follow-up*: How would you choose an appropriate EC2 instance type?

2. **Differentiate between Amazon S3, EBS, and Glacier storage services.**
    - **S3**: Object storage, highly scalable, web-accessible
    - **EBS**: Block storage for EC2 instances, persistent
    - **Glacier**: Long-term archival storage, low cost, slower retrieval
    - **Memory aid**: "SEG" - Speed decreases, cost decreases, retrieval time increases
3. **Describe AWS communication services and their use cases.**
    - Simple Queue Service (SQS): Message queuing
    - Simple Notification Service (SNS): Pub/sub messaging
    - Route 53: DNS service
    - **Key concept**: Decoupled architecture enables scalability
4. **Explain AWS DynamoDB and its advantages.**
    - Fully managed NoSQL database service
    - Single-digit millisecond performance
    - Seamless scalability without downtime
    - **Key point**: Serverless database option with automatic scaling

Google Cloud Platform Questions:

5. **Describe the architecture and core concepts of Google AppEngine.**

    - PaaS for building scalable web applications and mobile backends
    - Automatic scaling and load balancing
    - Language runtimes (Java, Python, Go, etc.)
    - Managed services integration
    - **Key term**: "Serverless" approach - focus on code, not infrastructure
6. **Explain the application lifecycle in Google AppEngine.**
    - Development (local SDK)
    - Deployment
    - Instance scaling
    - Monitoring/management
    - Updates and versioning
    - **Key concept**: Traffic splitting for safe deployments

Experiment-Related Questions:

7. **Based on your experience hosting a website on GCP (Experiment 4), what were the key steps and services involved?**
    - Creation of project
    - Selection of appropriate services (App Engine, Compute Engine, etc.)
    - Configuration of networking and security
    - Deployment process
    - **Key insight**: Differences from traditional hosting
8. **From your Azure experiments, explain how VM creation and management works.**

- Portal interface vs CLI/PowerShell
- Resource groups concept
- Network configuration
- Storage considerations
- Management options
- **Key difference**: Azure Resource Manager model

Module 4: Cloud Applications

Scientific Applications:

1. **Explain how ECG analysis is implemented in cloud computing.**
   - Data collection from devices
   - Secure transmission to cloud
   - Distributed processing of ECG signals
   - ML/AI analysis for anomaly detection
   - Results storage and retrieval
   - **Key benefit**: Real-time processing of large volumes of medical data
2. **How is cloud computing used for protein structure prediction?**
   - Massive parallel computing resources
   - Distributed algorithms
   - Storage of large molecular databases
   - Integration with visualization tools
   - **Key point**: Previously infeasible calculations now possible

3. **Describe satellite image processing in cloud environments.**
    - Ingestion of large image datasets
    - Parallel processing using frameworks like Hadoop
    - Specialized geospatial tools
    - Distribution and access to processed results
    - **Key advantage**: Handling petabyte-scale imagery efficiently

Business Applications:

4. **Compare and contrast CRM and ERP implementations in the cloud.**
    - **CRM**: Customer relationship focus, sales/marketing, customer service
    - **ERP**: Enterprise-wide processes, finance, HR, manufacturing, supply chain
    - Both benefit from cloud accessibility, integration capabilities
    - **Key example**: Salesforce (CRM) vs. NetSuite/SAP (ERP)
5. **How have cloud technologies transformed social networking applications?**
    - Elastic scalability for viral growth
    - Global content delivery
    - Real-time data processing
    - AI/ML integration for content recommendation

    - **Key insight**: Cloud enables experimentation and rapid feature development
6. **Explain the cloud architecture for multiplayer online gaming.**
    - Global server distribution
    - Matchmaking services
    - State synchronization
    - Scaling for usage spikes
    - Content delivery networks
    - **Key challenge**: Latency minimization while maintaining consistency

Module 5: Advanced Topics in Cloud Computing

Energy Efficiency and Management:

1. **How is energy efficiency achieved in cloud environments?**
    - Workload consolidation
    - Dynamic resource allocation
    - Temperature-aware scheduling
    - Renewable energy integration
    - **Key metric**: Power Usage Effectiveness (PUE)
2. **Explain market-based management of clouds.**
    - Supply and demand dynamics
    - Spot pricing models
    - Service level agreements
    - Resource allocation through bidding

- **Key example**: AWS Spot Instances

Multi-Cloud Concepts:

3. **Differentiate between federated clouds and interclouds.**
   - **Federated cloud**: Coalition of providers with agreements, standardized interfaces
   - **Intercloud**: Global "cloud of clouds" with universal standards and interoperability
   - **Key difference**: Federation is agreement-based; intercloud aims for universal connectivity
   - *Likely follow-up*: What challenges exist in implementing these models?
4. **Explain third-party cloud services like MetaCDN and SpotCloud.**
   - **MetaCDN**: Integrates multiple CDN providers for optimized content delivery
   - **SpotCloud**: Marketplace for buying/selling excess compute capacity
   - **Key concept**: Value-added services operating across multiple providers

Containerization:

5. **Compare and contrast virtual machines and containers.**
   - **VMs**: Full OS virtualization, hypervisor-managed, larger footprint
   - **Containers**: OS-level virtualization, shared kernel, lightweight

- **Key diagram**: Traditional VM stack vs. Docker container stack
- **Memory aid**: "VMs are houses, containers are apartments"

6. **Explain Docker architecture and its components.**
   - Docker Engine
   - Images and containers
   - Registries
   - Networking
   - **Key workflow**: Build, ship, run
7. **What are microservices and how do they relate to containers?**
   - Architectural style where applications are collections of loosely coupled services
   - Containers provide ideal deployment units for microservices
   - Each service runs in isolated container
   - **Key benefit**: Independent development, deployment, and scaling

DevOps Integration:

8. **Describe cloud automation tools and DevOps concepts.**
   - Infrastructure as Code (Terraform, CloudFormation)
   - Configuration management (Ansible, Chef, Puppet)
   - CI/CD pipelines
   - Monitoring and logging
   - **Key principle**: Automation throughout the lifecycle

Experiment-Related Questions:

9. **Based on your Docker experiment (Experiment 7), explain the process of containerizing an application.**
    - Creating a Dockerfile
    - Building the image
    - Managing dependencies
    - Running containers
    - **Key insight**: Consistency between development and production
10. **From your AWS VM creation experiment, what are the key differences compared to traditional virtualization?**
    - Deployment speed
    - Pricing model
    - Management interface
    - Integration with other services
    - **Key advantage**: Ecosystem of integrated services

Additional Practical Questions Based on Experiments

1. **In your VMware Hands-on Lab experiment, what specific VMware technologies did you work with and what were their functions?**
    - vSphere components
    - vCenter management
    - Storage and network virtualization

    - **Key takeaway**: Enterprise-grade virtualization capabilities
2. **When creating VMs on different cloud platforms (AWS, Azure, GCP), what differences did you notice in the setup process?**
    - Interface differences
    - Terminology variations
    - Default security settings
    - Network configuration approaches
    - **Key insight**: Platform-specific best practices
3. **In your containerization experiment, how did you manage application dependencies?**
    - Dockerfile specifications
    - Environment variables
    - Volume mounting
    - Docker Compose for multi-container apps
    - **Key principle**: Portability across environments