Las Positas College
3000 Campus Hill Drive
Livermore, CA 94551-7650
(925) 424-1000
(925) 443-0742 (Fax)

Course Outline for CNT 7285

CLOUD INFRASTRUCTURE: COMPTIA CLOUD+ CERTIFICATION

Effective: Fall 2019

I. CATALOG DESCRIPTION:
CNT 7285 — CLOUD INFRASTRUCTURE: COMPTIA CLOUD+ CERTIFICATION — 3.00 units

IT professionals need to understand the concepts and principles required to build cloud infrastructure. This course covers the objectives of the CompTIA Cloud+ and Dell/EMC Cloud Infrastructure and Services (CIS) certification exams. Topics include: Cloud Computing Concepts; Models; Disk Storage Systems; Storage Networking; Network Infrastructure; Virtualization Components; Virtualization and the Cloud; Network Management; Performance Tuning; Systems Management; Security in the Cloud and Best Practices; Business Continuity and Disaster Recovery; Testing; Automation; and Changes. The EMC cloud computing reference model includes five fundamental layers (physical, virtual, control, orchestration, and service) and three cross-layer functions (business continuity, security, and service management). Technologies, components, processes, and mechanisms for each layer and cross-layer function will be covered. The course follows the U.S. National Institute of Standards and Technology as a guide for all definitions of cloud computing. Upon completing this course, participants will have the knowledge to make informed decisions on technologies, processes, and mechanisms required to build cloud infrastructure. CompTIA certification is normally valid for three years.

2.50 Units Lecture 0.50 Units Lab

Strongly Recommended
CNT 8001 - Introduction to Networks (CCNA1)
with a minimum grade of C

Grading Methods:
Letter or P/NP

Discipline:
- Computer Information Systems or
- Computer Service Technology

	MIN
Lecture Hours:	45.00
Expected Outside of Class Hours:	90.00
Lab Hours:	27.00
Total Hours:	162.00

II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: 1

III. PREREQUISITE AND/OR ADVISORY SKILLS:

Before entering this course, it is strongly recommended that the student should be able to:

A. CNT8001
1. describe and differentiate the devices and services used to support communications in data networks and the Internet;
2. describe the role of protocol layers in data networks;
3. evaluate the importance of addressing and naming schemes at various layers of data networks in IPv4 and IPv6 environments;
4. design, calculate, and apply subnet masks and addresses to fulfill given requirements in IPv4 and IPv6 networks;
5. explain fundamental Ethernet concepts such as media, services, and operations;
6. build a simple Ethernet network using routers and switches;
7. compose Cisco command-line interface (CLI) commands to perform basic router and switch configurations;
8. experiment with common network utilities to verify small network operations and analyze data traffic.

IV. MEASURABLE OBJECTIVES:

Upon completion of this course, the student should be able to:

A. Explain the importance and benefits of cloud computing and the need for its rapid adoption
B. Explain roadmap for transformation from classic to cloud environment
C. Identify and differentiate various infrastructure components of classic and virtualized data center

D. Explain virtualization requirements and available tools at each layer of IT infrastructure
E. Explain business continuity options in a virtualized environment
F. Discuss effective cloud computing deployment models for businesses /IT organizations
G. Perform detailed exploration of cloud products and services
H. Describe infrastructure framework and service management activities in cloud computing
I. Address security concerns commonly found in cloud computing environments
J. Formulate high-level cloud migration strategy and best practices

V. CONTENT:

A. Cloud Computing Concepts, Models, and Terminology
    1. Cloud Service Models
        a. Infrastructure as a Service (IaaS)
        b. Platform as a Service (PaaS)
        c. Software as a Service (SaaS)
        d. Database as a Service (DBaaS)
        e. Communications as a Service (CaaS)
        f. Business Process as a Service (BPaaS)
        g. Anything as a Service (XaaS)
        h. Accountability and Responsibility by Service Model
    2. Cloud Deployment Models and Services
        a. Private Cloud
        b. Public Cloud
        c. Hybrid Cloud
        d. Community Cloud
        e. On-Premises vs. Off-Premises Hosting
        f. Orchestration Platforms
    3. Cloud Characteristics and Terms
        a. Elasticity
        b. Demand-Driven Service
        c. Pay-as-You-Grow
        d. Chargeback
        e. Ubiquitous Access
        f. Metering
        g. Multitenancy
        h. Cloud Bursting
        i. Baselines
        j. Source and Target Hosts
        k. Existing Systems
        l. Cloud Elements
    4. Object Storage Concepts
        a. Object ID
        b. Metadata
        c. Data BLOB
        d. Policies
        e. Replicas
B. Disk Storage Systems
    1. Disk Types and Configurations
        a. Rotational Media
        b. Solid State Drive (SSD)
        c. USB Drive
        d. Tape
        e. Interface Types
        f. Access Speed
        g. Redundant Array of Independent Disks (RAID)
    2. Tiering
        a. Performance Levels of Each Tier
        b. Policies
    3. File System Types
        a. Unix File System
        b. Extended File System
        c. File Allocation Table File System
        d. New Technology File System
        e. Resilient File System
        f. Virtual Machine File System
        g. Z File System
C. Storage Networking
    1. Storage Types and Technologies
        a. Direct Attached Storage (DAS)
        b. Storage Area Network (SAN)
        c. Network Attached Storage (NAS)
        d. Object Storage
        e. Deduplication Technologies
        f. Compression Technologies
    2. Storage Access Protocols
        a. Fibre Channel (FC)
        b. Fibre Channel Protocol
        c. Fibre Channel over Ethernet (FCoE)
        d. Ethernet
        e. TCP/IP
        f. Internet Fibre Channel Protocol
        g. Internet Small Computer System Interface (iSCSI)
    3. Storage Provisioning
        a. Performance
        b. Logical Unit Numbers (LUNs)
        c. Network Shares
        d. Zoning and LUN Masking
        e. Multipathing
        f. Provisioning Model
        g. Encryption Requirements

        h. Tokenization
    4. Storage Protection
        a. High Availability
        b. Storage Replication
D. Network Infrastructure
    1. Network Types
        a. Intranet
        b. Internet
        c. Extranet
    2. Network Optimization
        a. Network Scope
        b. Network Topologies
        c. Bandwidth and Latency
        d. Load Balancing
    3. Routing and Switching
        a. Network Address Translation (NAT)
        b. Port Address Translation (PAT)
        c. Subnetting and Supernetting
        d. Network Segmentation and Micro-Segmentation
        e. Virtual Local Area Network (VLAN)
        f. Virtual Extensible LAN (VXLAN)
        g. Routing Tables
    4. Network Ports and Protocols
        a. Hypertext Transfer Protocol (HTTP)
        b. Hypertext Transfer Protocol Secure (HTTPS)
        c. File Transfer Protocol (FTP)
        d. FTP over SSL (FTPS)
        e. Secure Shell File Transfer Protocol (SFTP)
        f. Domain Name System (DNS)
        g. Dynamic Host Configuration Protocol (DHCP)
        h. Simple Mail Transfer Protocol (SMTP)
        i. Well-Known Ports
E. Virtualization Components
    1. Hypervisor
        a. Type
        b. Proprietary
        c. Open Source
        d. Consumer vs. Enterprise
    2. Virtualization Host
        a. Hardware-Assisted Virtualization
        b. BIOS
        c. UEFI
        d. Firmware Configurations
        e. CPU and Cores
        f. Memory Capacity and Configurations
        g. NIC
    3. Virtual Machine
        a. Virtual Disks
        b. vNIC
        c. Virtual Switches
        d. Memory
        e. Storage Virtualization
        f. Guest Tools
    4. Virtualized Infrastructure Service Elements
        a. Certificate Services
        b. DNS
        c. DHCP
        d. Local Agents
        e. Antivirus
        f. Load Balancing
        g. Multifactor Authentication
        h. Firewall
        i. IDS/IPS
F. Virtualization and the Cloud
    1. Benefits of Virtualization in a Cloud Environment
        a. Shared Resources
        b. Elasticity
        c. Network and Application Isolation
        d. Infrastructure Consolidation
        e. Virtual Data Center Creation
    2. Virtual Resource Migrations
        a. Virtual Machine Templates
        b. Physical to Virtual (PV)
        c. Virtual to Virtual (VV)
        d. Virtual to Physical (VP)
        e. Virtual Machine Cloning
        f. Virtual Machine Snapshots
        g. Clones vs. Snapshots
        h. Storage Migration
        i. Host Clustering and HA/DR
        j. Cloud Provider Migrations
    3. Migration Considerations
        a. Requirements Gathering
        b. Migration Scheduling
        c. Upgrading
        d. Testing
G. DevOps
    1. Resource Monitoring Techniques
        a. Protocols and Methods
        b. Baselines and Thresholds

c. Automated Event Responses
2. Remote-Access Tools
a. Remote Hypervisor Access
b. RDP
c. Console Port
d. SSH
e. HTTP
3. Life Cycle Management
a. Application Life Cycle
b. ITIL
c. Application Replacement
d. Application Retirement
e. Application Migration
f. Application Feature Use (Increase/Decrease)
g. Business Needs Change

H. Performance Tuning
1. Host and Guest Resource Allocation
a. Host Resource Allocation
b. Guest Resource Allocation
2. Optimizing Performance
a. Configuration Best Practices
b. Common Issues
c. Scalability
d. Performance Concepts
e. Performance Automation

I. Systems Management
1. Policies and Procedures
a. Standard Operating Procedures
b. Workflow
c. Capacity Management
2. Systems Management Best Practices
a. Documentation
b. Standardization
c. Metrics
d. Planning
3. Systems Maintenance
a. Code Updates
b. Patch Management
c. Maintenance Automation

J. Security in the Cloud
1. Data Security
a. Public Key Infrastructure
b. Encryption Protocols
c. Tunneling Protocols
d. Ciphers
e. Storage Security
f. Protected Backups
2. Network Security
a. Security Systems
b. Security Applications
c. Impact of Security Tools to Systems and Services
3. Access Control
a. Identification
b. Authentication
c. Authorization
d. Federation
e. Access Control Methodologies
f. Multifactor Authentication
g. Single Sign-On

K. Security Best Practices
1. Cloud Security Engineering
a. Host and Guest Computer Hardening
b. Implementing Layered Security
c. Protecting Against Availability Attacks
d. Least Privilege
e. Separation of Duties
f. Security Automation
2. Security Governance and Strategy
a. Developing Company Security Policies
b. Account Management Policies
c. Documenting Security Procedures
d. Assessment and Auditing
e. Leveraging Established Industry Standards and Regulations
f. Applying Platform-Specific Security Standards
g. Data Classification
h. Keeping Employees and Tools Up to Date
i. Roles and Responsibilities
3. Vulnerability Management
a. Testing Methods
b. Vulnerability Scanning
c. Penetration Testing
d. Roles and Responsibilities

L. Business Continuity and Disaster Recovery
1. Business Continuity Methods
a. Business Continuity Plan
b. Contingency
c. Resiliency
d. High Availability
e. Service Level Agreements for BCP and HA
2. Disaster Recovery Methods

a. Corporate Guidelines
b. Replication
c. File Transfer
d. Service Level Agreements for DR

3. Backup and Recovery
a. Backup Types
b. Backup Target
c. Other Backup Considerations
d. Archiving

M. Testing, Automation, and Changes
1. Testing Techniques
a. Baseline Comparisons
b. Performance Testing
c. Configuration Testing
d. Testing in the Cloud Landscape
e. Validating Proper Functionality
f. SLA Comparisons
g. Testing Sizing Changes
h. Testing High Availability
i. Testing Connectivity
j. Verifying Data Integrity
k. Evaluating Replication
l. Testing Load Balancing

2. Automation and Orchestration
a. Event Orchestration
b. Scripting
c. Custom Programming
d. Runbook Management for Single Nodes
e. Orchestration for Multiple Nodes and Runbooks
f. Automation Activities

3. Change and Configuration Management
a. Change Management
b. Configuration Management

N. Troubleshooting
1. Troubleshooting Tools
a. Connectivity Tools
b. Configuration Tools
c. Query Tools
d. Remote Administration Tools

2. Documentation and Analysis
a. Documentation
b. Log Files

3. Troubleshooting Methodology
a. Deployment Issues
b. Capacity Issues
c. Connectivity Issues
d. Automation/Orchestration Issues
e. Security Issues

VI. METHODS OF INSTRUCTION:
A. **Demonstration** -
B. **Lecture** -
C. **Lab** -
D. **Directed Study** -

VII. TYPICAL ASSIGNMENTS:
A. Read the textbook chapter on Virtualized Data Center-Compute. Compare and contrast the hardware resources required to host multiple web sites, including load balancing and redundancy.
B. Log on to the NETLAB+ virtual laboratory. Create and configure a virtual data center using vSphere and vCenter applications.

VIII. EVALUATION:
Methods/Frequency

A. Exams/Tests
Weekly, one mid-term and one final exam.
B. Quizzes
Weekly
C. Home Work
Read the chapter assignments. Weekly.
D. Lab Activities
Do remote labs on a virtual network of computers, routers and switches. Weekly.

IX. TYPICAL TEXTS:
1. Wilson , Scott , and Eric Vanderburg . *CompTIA Cloud+ Certification Study Guide.* 2 ed., McGraw-Hill Education, 2018.
2. Montgomery , Todd , and Stephen Olson . *CompTIA Cloud+ Study Guide Exam CV0-002* . 2 ed., Sybex/Wiley, 2018.
3. Anthony , Albert . *Mastering AWS Security: Create and Maintain a Secure Cloud Ecosystem.* 1 ed., Packt Publishing, 2018.

X. OTHER MATERIALS REQUIRED OF STUDENTS:
A. Association of Computing Machinery ACM.org student membership
B. Access to Internet for remote labs.