PROFESSIONAL CLOUD SOLUTIONS ARCHITECT

Syllabus

Syllabus for the certification course *Cloud Design, Build, Transition and Transformation* leading to the CCC Professional Cloud Solutions Architect certification

CLOUD CREDENTIAL COUNCIL

CCC Cloud Computing PROFESSIONAL CLOUD SOLUTION ARCHITECT Certified by EXIN

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Contents

1. Overall Purpose of Syllabus

The purpose of this syllabus is to provide a clear statement of the knowledge and skills required by a professional cloud solution architect. This syllabus informs both candidates and the designers and deliverers of learning materials of the objectives that must be met in order to fulfill the role of cloud architect. Furthermore, the contents of the syllabus will be used as the basis of the examination set by the Cloud Credential Council.

2. Structure of the Syllabus

The structure of this syllabus is layered as follows:

The role itself is briefly described in relation to the background context of cloud computing.

Each module has a clearly stated purpose and introductory synopsis followed by key topics and the specific learning objectives that must be met in order to achieve the required standard.

The flow of the learning modules is designed to build both understanding of the topics and practice in applying that knowledge to the architect role.

Each module also contains details of external reference materials and suggested case studies and scenarios to illustrate and enhance understanding of the topic.

Specific case studies and vendor links are provided for the complete role, testing the scope of learning objectives, issues and learning scenarios.

3. The Role of the Professional Cloud Solutions Architect

Cloud computing has been around for a few years now and continues to be built on the foundations of Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS). Public and private cloud implementations are now mainstream options that solution architects need to understand and consider in their role. There are a range of capabilities and issues that need to be successfully navigated to support the adoption, development and performance optimization of cloud solutions and services in the enterprise and the wider marketplace and IT ecosystem.

This syllabus examines these major issues and modern cloud-enabled systems and services and their impact on business models, software, hardware and devices. It looks at the following emerging new trends and leading architecture solutions:

- Tablets and other smart devices and platforms and their important role today in modern internet-based service ecosystems.
- The development of private cloud solutions and hybrid cloud solutions that are complementary and alternative to public clouds and their role in business and IT portfolio management and service hosting and delivery models.
- How social enterprise and business processes are converting into new online end user experience systems, mash-ups and services.
- Cloud computing is also creating new development, test and delivery models that are spreading across on-premise and off-premise hosting and deployment channel models.

Solution architects need to consider how existing systems and new solution practices driven by on-demand cloud computing are impacting on consumers, provider private- and public-enabled systems and the integrated hybrid categories of IT and business that are now part of today's technology landscape.

4. Learning Level of the Syllabus

The modern version of Bloom's taxonomy of learning is a widely used classification framework for course syllabi and assessments for certification. The taxonomy classifies learning into six ascending levels.

- Level 1 – the Knowing Level: Exhibit memory of previously learned materials by recalling facts, terms, basic concepts and answers.
- Level 2 – the Comprehension level: Demonstrative understanding of facts and ideas by organizing, comparing, translating, interpreting, giving descriptions, and stating main ideas.
- Level 3 – the Application level: Using new knowledge. Solve problems to new situations by applying acquired knowledge, facts, techniques and rules in a different way.
- Level 4 – the Analysis level: Examine and break information into parts by identifying motives or causes. Make inferences and find evidence to support generalizations.
- Level 5 – the Evaluate level: Present and defend opinions by making judgments about information, validity of ideas or quality of work based on a set of criteria.
- Level 6 – the Creation level: Compile information together in a different way by combining elements in a new pattern or proposing alternative solutions.

The level of this advanced course for the Professional Cloud Solution Architect role is level 3-4 (Apply, Analyze).

5. Syllabus – Core Skills

Module 1. History of Cloud Computing

Module Purpose and Overview

The aim of this module is to give the candidate an understanding of the history of the shift from computing to cloud computing so that the candidate takes into account the impact of the historical context on cloud architecture design.

The evolution of computing has undergone another quantum leap; this time into an era of cloud computing that sees the convergence of existing and new technologies in a new business and technology paradigm. This introduction establishes the context of the trends that cloud computing represents in terms of technical, business and marketplace and governmental impact and legislation.

Key Topics

- Why Cloud
- Basics of Cloud Computing
- SOA and Cloud

Learning Objectives

- (L2) Explain the history of emergence of cloud computing.
- (L3) Interpret the importance of the history of computing and the impact on cloud architecture design.
- (L4) Explain the pros and cons of utility computing, grid computing, and cloud computing.
- (L3) Relate the impact of the shift from virtualization to cloud.
- (L4) Understand the impact of factors such as the Internet, sustainability, energy awareness, and the emergence of tablets and smart devices on business.
- (L3) Interpret cloud-related service models, including Service Oriented Architecture (SOA) and enterprise architecture.

References

Links to content and books

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- http://www.forbes.com/sites/joemckendrick/2012/09/18/before-there-was-cloud-computing-there-was- soa/
- http://www.eecs.berkeley.edu/Pubs/TechRpts/2009/EECS-2009-28.pdf
- http://www.informationweek.com/cloud-computing/infrastructure/10-cloud- computing-pioneers/240142397

Module 2. Impact of Cloud Computing

Module Purpose and Overview

The aim of this module is to establish the business, social, legal and commercial impacts of cloud computing so that the candidate can apply that understanding to cloud architecture design.

Cloud computing is a business model as well as a technology model that influences the way individuals, companies, marketplaces and whole governments need to think in terms of how to address its opportunities and challenges. This situation has also seen the rise of new collaboration models such as open source and new types of emerging on-demand cloud-enabled sourcing and digital stores and on-line marketplaces. There is also a wider context to these changes including the impact on security, privacy, intellectual property, legality, marketplace access and trading relationships. This can be taken from a number of viewpoints including those of consumers, providers, intermediaries and audit and policy governance.

Key Topics

- Impact on Business and IT Models
- Impact on Change – Business, IT Transition, and Transformational Drivers
- New Business Models – Custom Versus Product
- Comparison of Make, Buy, and Rent
- Value and Monetization Impact
- Security, Risk, and Compliance Impact

Learning Objectives

- (L2) Explain how cloud computing has created new types of business and IT models through disruption and innovation.
- (L3) Relate the key risk, security, and legal issues inherent in applying cloud solutions.
- (L4) Outline the correct variant architecture solutions in case study scenarios.

References

Links to content and books

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- http://radar.oreilly.com/2008/07/open-source-and cloud- computing.html
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- http://www.computerfutures.com/page/newsfeed/cloud-computingsecurity
- https://cloudsecurityalliance.org/
- http://csrc.nist.gov/publications/nistpubs/800-144/SP800-44.pdf
- http://en.wikipedia.org/wiki/Cloud_computing_security

Module 3. Technology Engineering of Cloud Computing

Module Purpose and Overview

The aim of this module is to explain the implications of operating "as a service" so that the candidate can factor in the relevant key engineering concepts to their architectures.

The scope of technology that is involved in Cloud Computing includes devices, networks, computing, storage, databases as well as the applications, data and other components. Operating "as a service" can involve engineering management systems that enable secure federated security and identity, policy management, template configuration management, automated provisioning, tenancy and multi-tenancy management, subscription, pricing engines, metering, billing, self-service, catalog management and marketplace management, synchronization and API management and related technical standards. Understanding the technology concepts and reference component architectures in SaaS, PaaS, IaaS and the various deployment models: Private Cloud, Public Cloud, Community Cloud and Hybrid cloud is important in the design and control of effective Cloud Computing Solution Architectures.

Key Topics

- Protocols, Interfaces, and Frameworks
- Web of Devices and Web of Services
- Internet, Internetworking, and Telecommunications
- Data Centers, Facilities, and Fabric
- Cloud Technology Components

Learning Objectives

- (L2) Outline the changes in information technology that have enabled cloud computing.
- (L3) Explain the technology implications of operating "as a service".
- (L3) Identify the relevant key engineering related to cloud solutions architecture.
- (L3) Distinguish the relevant technology stack layers and their shift towards distributed network based services.
- (L3) Demonstrate an understanding of the difference between virtualization and cloud management.
- (L4) Analyze the types of cloud resources, including cloud storage, cloud database, and Operating System (OS).

References

Links to content and books

- http://computer.howstuffworks.com/cloud- computing/cloud-computing.htm

Module 4. Cloud Computing Solution Architectures

Module Purpose and Overview

The aim of this module is to discuss the consumer and provider perspectives that have undergone radical changes as a result of cloud computing so that the candidate can use new cloud-enabled business models.

Cloud computing has resulted in new and shifting non-traditional consumer and provider perspectives thanks to the "art of the possible" by which cloud technologies have enabled new business models. A big shift is in the phenomenon of interchanging roles along that consumer-provider axis. Small to medium size enterprises and start-ups have new possibilities with cloud computing. Larger enterprises are greatly impacted by migration, transition and the potential transformations that cloud computing can bring to their organization and the wider marketplaces.

Key Topics

- The Architecture Layers
- Cloud Solution Architectures: XaaS
- Cloud Reference Architecture Principles
- Consumer and Provider Reference Architecture
- Cloud Security Reference Architectures
- Industry Reference Architecture Standards

Learning Objectives

- (L2) Outline the development of architecture reference models in information technology.
- (L3) Show the impact and influence of new cloud-enabled solution reference architecture models.
- (L4) Compare the different consumer and provider perspectives of cloud computing architectures.
- (L3) Outline appropriate architecture module views and key metadata used to define a cloud solution architecture in IaaS, PaaS, and SaaS.

References

Links to content and books

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- http://www.guardian.co.uk/media-network-partner-zone- huawei/business-model-innovations-in-cloud-computing
- http://www.wired.com/insights/2012/02/multitenancy-and-cloud- problems/
- http://www.saas-showplace.com/home.php
- http://governmenttraininginc.com/GovCloud- II-Handbook.asp

Module 5. Cloud Service Life Cycle

Module Purpose and Overview

The aim of this module is to establish the relevant organizational and service paradigms so that the candidate can address situations in which the control and management of the architecture may be federated and/or involve multiple parties and technologies using new cloud-enabled business models.

Cloud computing affects software development life cycles and hardware management models. New concepts of cloud computing life cycles that involve new template-based techniques and standardization as well as rapid agile provisioning and development need to be understood to maximize elasticity, scalability, responsiveness and cost. Hardware and software component requirements and design need to consider cloud computing characteristics in XaaS design and deployment models.

Key Topics

- Key Concepts of Cloud Service Life Cycle
- Key Cloud Computing Life Cycle
- Sourcing and Provisioning Life Cycle
- Product and Custom Service Life Cycle
- Development Ops Life Cycle
- Service Management Life Cycle
- Cloud Governance Life Cycle

Learning Objectives

- (L2) Recapitulate the different control and management issues in different cloud deployment solutions.
- (L3) Identify and apply the different cloud life cycles.
- (L4) Define the key features of cloud service life cycle steps.
- (L3) Identify the key architecture features that affect cloud service selection and delivery.

References

Links to content and books

- http://searchcloudcomputing.techtarget.com/definition/XaaS-anything-as-a-service
- http://searchcloudcomputing.techtarget.com/definition/Software-as-a-Service
- http://searchcloudcomputing.techtarget.com/definition/Platform-as-a-Service-PaaS
- http://searchcloudcomputing.techtarget.com/definition/Infrastructure-as-a-Service-IaaS
- http://www.techopedia.com/definition/4544/standard- operating-environment-soe
- http://www.zdnet.com/cloud-gives-virtualized-containers-higher-relevance-2062302586/
- http://www.servernest.com/container-virtual-machine.html
- http://searchservervirtualization.techtarget.com/tip/Virtualization-performance-and-container-based-
- http://www.techdirt.com/articles/20040506/1217213.shtml
- http://www.cio.com/article/722713/Beware_the_Commoditization_of_IT_Outsourcing

Module 6. Service Transition and Service Transformation

Module Purpose and Overview

The aim of this module is to focus on the issues involved in moving from non-cloud to cloud solutions so that the candidate can effectively advise and guide a successful transition.

Much of the perceived benefit of cloud computing can be attributed to the rapid search, discovery, selection and use of services. The SLA performance and running of services have different viewpoints from the consumer and provider perspectives.

How to “run your business in the cloud” and how to “run IT as a business” are two key consequences of this. Which factors need to be addressed and what changes are involved when moving away from a traditional hosting model are addressed in this module.

Key Topics

- Benefits, Challenges, Opportunities, and Barriers
- Investors’ and Stakeholders’ Expectations
- TCO Models
- Impact of Cloud on Business Operating Models
- Impact of Cloud on Legacy IT
- Impact of Cloud on Migration and Transformation
- Cloud Transformation and Innovation

Learning Objectives

- (L2) Summarize the key features and issues of transitioning to cloud services and their impact on transforming the business.
- (L3) Identify features and issues of running IT as a business in cloud computing.

- (L3) Recognize the primary issues involved in the certification and accreditation of a cloud solution.
- (L4) Compare different strategies to maximize the enablers and minimize the barriers of adopting cloud computing as a business option.

References

Links to content and books

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- http://www.isaca.org/Knowledge-Center/Documents/Using-COBIT-to- Manage-the-Benefits-Risks-and-Security-of-Outsourcing-Cloud-Computing.pdf
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Module 7. Consumer Perspective on Setting Up Cloud Environments

Module Purpose and Overview

The aim of this module is to explore the perspective of the cloud consumer so that the candidate can take it into account when architecting a cloud environment.

This module covers the consumer side of defining a cloud environment, including the IaaS, PaaS, and SaaS models and different deployment options.

Key Topics

- Key Consumer Processes for Cloud
- Consumer Usage Models and Scenarios
- Key Consumer Solution Architecture Features

Learning Objectives

- (L2) Summarize the key business features of a consumer cloud solution architecture.
- (L3) Prepare and plans a specific consumer cloud environment for a given scenario.
- (L4) Identify the key steps in setting up a consumer cloud environment.

References

Links to content and books

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- http://www.zdnet.com/consumers-actually-really-like-cloud-storage-report-says-7000005784/
- http://www.prnewswire.com/news-releases/global-consumer-cloud-services-industry-168743426.html
- http://www.cisco.com/web/about/ac79/docs/sp/CLMW-Cloud-Demand.pdf
- http://www.gartner.com/technology/research/personal-cloud/

Module 8. Provider Perspective on Setting Up Cloud Environments

Module Purpose and Overview

The aim of this module is to explore the perspective of the cloud provider so that the candidate can take it into account when architecting a cloud environment.

This module covers the provider side of defining a cloud environment, including the IaaS, PaaS, and SaaS models and different deployment options.

Key Topics

- Cloud provider processes to set up a cloud environment
- Cloud provider usage models and scenarios
- Cloud provider solution architecture features

Learning Objectives

- (L3) Explore the perspective of a cloud provider when architecting a cloud environment.
- (L3) Summarize the key business features of a cloud solution architecture.
- (L4) Prepare and plan a specific cloud provider environment for a scenario.
- (L4) Identifies the key steps in setting up a cloud environment.

References

Links to content and books

- http://www.forbes.com/sites/ciocentral/2012/12/17/cloud-computing-four-predictions-for-the-year-ahead/
- http://www.ictknowledgebase.org.uk/cloudproviderquestions
- http://www.terremark.co.uk/services/infrastructure-cloud-services/enterprise-cloud.aspx?gclid=CJmp4KyipLQCFUrwzAodpRoAAg
- http://searchcloudcomputing.techtarget.com/photostory/2240149038/Top-10-cloud- providers-of-2012/1/Introduction
- http://www.webopedia.com/TERM/C/cloud_provider.html
- http://www.theregister.co.uk/2012/09/28/ico_cloud_provider_data_protection_guidelines/
- http://gnax.net/

Module 9. Cloud Ecosystem

Module Purpose and Overview

The aim of this module is to cover the interconnected nature of the different elements of the cloud ecosystem so that the candidate can take into account the bigger picture and consider how providers and consumers and intermediaries can play different roles in this landscape.

The Cloud Ecosystem involves many solutions and components. In addition, the choice and variety of cloud access endpoints and the diversity of marketplaces and services enable providers and consumers to offer or leverage a variety of products and services to best suit their business needs. This represents the emergent ecosystems of cloud products, services, and devices that occur inside and outside an organization.

Key Topics

- Cloud Ecosystem – Introduction
- Internet of Things
- Business and Technology Ecosystems and Drivers
- Entities and Ecosystems – Cloud Interactive Ecosystem Language

Learning Objectives

- (L2) Understand the cloud-based ecosystem.
- (L3) Identify the impact of wider concepts, such as the Internet of Things (IoT) and the Internet of Everything (IOE), on the process of architecting cloud solutions.
- (L4) Discover and prioritize the value drivers of business and technology ecosystems.
- (L2) Understand the Ecosystem Design Language.

References

Links to content and books

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- http://governmenttraininginc.com/GovCloud- II-Handbook.asp

Module 10. Types of XaaS Solutions

Module Purpose and Overview

The aim of this module is to explore both the existing and new generation of workloads that exist in today's cloud enabled digital ecosystem so that the candidate can utilize the full range of architecture and business model solutions.

The emergence of Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS) as mainstream on-demand services has led the way to the evolution of new cloud supporting services including Big Data analytics, mobility, social enterprise, embedded devices, and multi-channel stores. The services are resulting in a cultural and market shift. In addition, the issues, such as Cloud Service Broker (CSB), User Experience (UX), open source cloud, and the new integration of hybrid cloud environments, are also evolving fast as part of the range of cloud ecosystems.

Desktop as a Service (DaaS) has evolved from Virtual Desktop Integration (VDI) into a multi-channel customer UX, Bring Your Own Device (BYOD), and converged network and business services. Personal cloud and personal cloud storage and services are also evident particularly in individual and small to medium size businesses in the new cloud consumer usage models. Network as a Service (NaaS) and Embedded Cloud Services (ECS) have resulted in new cloud-enabled services. Internet of Things (IoT) that involves different types of devices is also connected. Over 7 billion devices were connected in 2008, this is predicted to pass 50 billion by 2020.

Enterprise architecture and solutions architectures have been developed to align with the new range of service types and deployment model options (collectively known as XaaS). The critical issue is the analysis of horizontal and vertical workloads' requirements that determine the criteria used to select and fit XaaS type solutions.

Key Topics

- XaaS Solutions and the Architecture Landscape
- XaaS Solution Definitions
- Make, Buy, Subscribe, and Reuse Options Analysis
- Cloud ROI and TCO Models

Learning Objectives

- (L2) Relate to the historical development of cloud computing and its future path to new cloud ecosystem solutions.
- (L3) Identify the types of Anything/Everything as a Service (XaaS) solutions and service options.
- (L3) Identify the key cloud functional and non-functional criteria.
- (L4) Define and compare the features of the different XaaS solution architecture models.
- (L3) Define a cloud solution architecture design.

References

- http://www.nist.gov/itl/cloud/upload/cloud-def-v15.pdf
- http://www.zdnet.com/blog/service-oriented/nist-definition-of-cloud-computing-doesnt-go-far-enough/8634
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- http://searchsecurity.techtarget.com/definition/Security-as-a-Service
- http://cloudsecurityalliance.org/research/secaas/

Module 11. Targeting the Right Solution Architecture

Module Purpose and Overview

The aim of this module is to consider the role of the solution architect so that the candidate can balance the perspectives of provider, consumer and intermediary.

This learning module covers the key skills in solution architecture to define specific cloud computing XaaS solutions and deployment models. The roles of architecture and solution architects are examined in the context of cloud computing and how enterprise architecture and solution architecture

may work together to define a specification.

The solution architect needs to understand the perspective of their role and how it fits with a consumer, provider or intermediary perspective. It is possible to have all these roles in one organization being both a consumer and provider through consuming cloud and providing a cloud service.

Key Topics

- Cloud Solution Requirements
- Cloud Fit Selection
- Cloud Solution Architecture Specification
- Cloud Business Case
- Cloud Implementation Roadmap

Learning Objectives

- (L3) Identify the criteria to fit the cloud solution requirements for a specific type of cloud solution.
- (L2) Define the key cloud solution architecture specifications.
- (L4) Prepare a business case for a cloud solution.
- (L2) Identify key stages and tasks for a cloud implementation roadmap.

References

Links to content and books

- http://thoughtsoncloud.com/index.php/2011/12/migration-to-cloud-it-is-all-about- workloads/
- http://www.dummies.com/how-to/content/how-to-handle- workloads-in-cloud-computing.html

6. Specific Architecture Knowledge for Cloud Architect

The aim of this chapter is to suggest a variety of vendor-based potential courses of further study for cloud architects so that the candidate can plan their on-going personal development in the role.

- Microsoft Learning - IaaS, PaaS, SaaS
- VMware vCloud: Architecting the VMware Cloud v1.0
- VMware Certified Professional (VCP), Certified Advanced Professional (VAP)
- Cisco, EMC, VMware alliance Cloud Training
- Cloud Architect EMC Education, Training and certification
- Foundations in IBM Cloud Computing Architecture IBM Training
- IBM Cloud Computing Infrastructure Architect IBM Training
- Cloud Architect, HP ASE
- AWS Training – Architect
- Google Apps Certified Deployment specialist
- Cloud Architect Red Hat
- 3Tera Cloud Computing Certifications

7. Course & Exam Details

Course Details

Suggested delivery format is instructor-led classroom-based learning.

Suggested duration: 24 learning hours.

Exam Details

Aspect	Details
Exam Type	Scenario Based, Complex Multiple Choice
Number of Questions	25
Duration	75 minutes
Provisions for additional time relating to language	15 minutes of additional time
Prerequisite	None. However, it is recommended to have passed *Cloud Essentials* or *Virtualization Essentials* certification.
Supervised (Proctored)	Yes
Open Book	No
Pass Score	65%
Delivery	Online