

Cloud Computing IaaS Infrastructure as a Service Specialist Level Complete Certification Kit - Infrastructure as a Service Study Guide Book and Online Course leading to Cloud Computing Certification

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Foreword As an education and training organization within the IT Service Management (ITSM) industry, we have watched with enthusiasm as cloud computing and Infrastructure as a Service (IaaS) has evolved over the years. The opportunities provided through IaaS has allowed for significant growth within an industry that continues to mature and develop at a rapid pace. Our primary goal is to provide the quality education and support materials needed to enable the understanding and application of IaaS in a wide range of contexts. This comprehensive book is designed to complement the eLearn IaaS Specialist program provided by The Art of Service. The interactive eLearning program uses a combination of narrated PowerPoint presentations with flat text supplements and multiple choice assessments which will ultimately prepare you for the IaaS Specialist Level certification exam. We hope you find this book to be a useful tool in your educational library and wish you well in your IT Service Management career! The Art of Service © The Art of Service Pty Ltd 'All of the information in this document is subject to copyright. No part of this document may in any form or by any means (whether electronic or mechanical or otherwise) be copied, reproduced, stored in a retrieval system, transmitted or provided to any other person without the prior written permission of The Art of Service Pty Ltd, who owns the copyright.' ITIL® is a Registered Community Trade Mark of OGC (Office of Government Commerce, London, UK) and is Registered in the U.S. Patent and Trademark Office. **Notice of Rights** All rights reserved. No part of this book may be reproduced or transmitted in any form by any means, electronic, mechanical, photocopying, recording, or otherwise without the prior written permission of the publisher. **Notice of Liability** The information in this book is distributed on an "As Is" basis without warranty. While every precaution has been taken in the preparation of the book, neither the author nor the publisher shall have any liability to any person or entity with respect to any loss or damage caused or alleged to be caused directly or indirectly by the instructions contained in this book or by the products described in it. **Trademarks** Many of the designations used by manufacturers and sellers to distinguish their products are claimed as trademarks. Where those designations appear in this book, and the publisher was aware of a trademark claim, the designations appear as requested by the owner of the trademark. All other product names and services identified throughout this book are used in editorial fashion only and for the benefit of such companies with no intention of infringement of the trademark. No such use, or the use of any trade name, is intended to convey endorsement or other affiliation with this book. **Write a review to receive any free eBook from our Catalog** €\$99 Value! If you recently bought this book, we would love to hear from you! Benefit from receiving a free eBook from our catalog at <http://www.emereo.org/> if you write a review on Amazon (or the online store where you purchased this book) about your last purchase! As part of our continual service improvement process, we love to hear real student experiences

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The certification kits are in line with the Cloud Computing Certification Scheme. After you've read this book, studied the eLearning materials, and successfully passed your exam, you will achieve your Cloud Computing IaaS Certification. In addition to the certification kits, The Art of Service has developed a series of books on the subject of Cloud Computing. All books are available as e-books, PDF downloads, and paperbacks. **eLearning Component** This certification kit comes with COMPLIMENTARY access to the eLearning program. The following page explains how to access the program materials online. **The Cloud Computing IaaS Exam** Chapter 7 of this book provides more detail about the certification exam and what the requirements are to pass. The PaaS certificate is a prerequisite for all other programs in the certification scheme. **Exam Details** • 40 multiple-choice questions • The correct answer is only one of the four • 60 minutes duration • 32 out of 40 is a pass (80%) • Closed book • No notes **How to access the associated eLearning Program** 1. Direct your browser to: www.theartofservice.org 2. Click 'Login' (found at the top right of the page) 3. Click 'Create New Account'. If you already have an existing account, please move to step 5. 4. Follow the instructions to create a new account. You will need a valid email address to confirm your account creation. If you do not receive the confirmation email, check that it has not been automatically moved to a Junk Mail or Spam folder. 5. Once your account has been confirmed, email your User-ID for your new account to iaas@theartofservice.com 6. We will add your account to the Cloud Computing IaaS eLearning Program and let you know how you can access the program. 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If you are behind a firewall and are facing problems in accessing the course or the learning portal, please contact your network administrator for help. **If you are experiencing difficulties with the Flash Presentations within the eLearning Programs please make sure that:** 1) You have the latest version of Flash Player installed by visiting the Adobe Flash Player site 2) You check that your security settings in your web browser (or corporate firewall) do not prevent these flash modules from playing 3) For users of Internet Explorer 7, a solution involves DESELECTING 'Allow active content to run files on my computer' in Internet Explorer -->Tools, Options, Advanced, Security settings 4) We generally recommend the use of Mozilla Firefox 3.5 or later, as it will generally provide the best performance when browsing the site or when playing presentations **Contents** **1 Introduction to Infrastructure as a Service 13** **1.1 Defining Cloud Computing 14** **1.2 Components of a Web Service 19** **1.2.1 Infrastructure as a Service (IaaS) 21** **1.2.2 Platform as a Service (PaaS) 22** **1.2.3 Software as a Service (SaaS) 24** **2 Technologies of IaaS 26** **2.1 Virtualization 26** **2.1.1 What is Virtualization? 27** **2.1.2 Hypervisors 29** **2.1.3 Understanding Infrastructure Virtualization 32** **2.1.4 Virtual Machines, Scale Units, and Instances 35** **2.1.5 Scaling in the Cloud 39** **2.1.6 Fabric Management 40** **2.2 Security in a Virtualized Environment 41** **2.3 Federated Cloud Computing 43** **2.3.1 Types of Clouds 43** **2.3.2 Using Public Clouds 46** **2.3.3 Using Private Clouds 49** **2.3.4 Roles in Federated Cloud Computing 51** **2.3.5 Connecting Clouds 53** **2.3.6 Using Federated Clouds 55** **2.4 Automation 56** **2.4.1 Benefits of Automation 57** **2.4.2 Determining Where Automation Exists 58** **2.4.3 Applying Automation 60** **2.4.4 Self-Service 61** **3 Storage Management 64** **3.1 Uses for Storage 65** **3.2 Techniques Used in Storage Solutions 67** **3.3 Storage**

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Service Whenever the term “infrastructure” is used, the resulting images will involve some set of physical devices. In IT, the infrastructure comprises all the physical computing devices required to enable an enterprise or individual to produce some result supporting the goals of the business. The role of the infrastructure is to make the achievement of the result easier and to increase its value to the business. The ways in which the infrastructure can do this is too numerous to account for here. Infrastructure is: “The basic physical and organizational structures and facilities (e.g. buildings, roads, power suppliers) needed for the operation of a society or enterprise.” -Oxford English Dictionary “The underlying foundation or basic framework (as of a system or organization)” -Merriam-Webster Dictionary Infrastructure as a Service is another method for managing and delivering the framework required to operate the business. At its core, Infrastructure as a Service (IaaS) must be discussed on two fronts: its construction and its presentation. The construction of an IaaS comprises the physical hardware and software used to provide the foundation for supporting the business. In a traditional IT solution, this foundation included servers, routers and bridges, and, in many cases, the technologies and solutions used to create the infrastructure were highly standardized. For IaaS, the physical infrastructure still remains, but how it is presented to the customer is radically different. The presentation of IaaS is an abstraction of the physical infrastructure. One might think of this abstraction as a software-based representation of the physical infrastructure and that perspective would not be without merit. For a business, an IaaS has a radical impact on how IT is delivered and managed because it is possible to purchase the right to use the abstraction of an infrastructure without purchasing and managing the physical infrastructure. IaaS is a service model for cloud computing, as well as the foundation for all other service models of cloud computing. What it provides for the enterprise and individual is a way to obtain the power of computing without having to invest heavily into IT solutions. **13 1.1 Defining Cloud Computing** In 1961, John McCarthy, a computer scientist at the Massachusetts Institute of Technology (MIT) suggested that technology would one day see a future where computing power and applications could be sold as a utility business model. McCarthy was the first to publicly announce the concept that would later become known as cloud computing, and was the first to coin the term “artificial intelligence”. He is also credited for developing ‘timesharing’ in computers, which is now the basis for cloud computing. Timesharing is a method of sharing a computing resource among many users through multiprogramming or multi-tasking. Since multiple people can simultaneously interact with a single computer, the cost of providing computing capability is significantly lower. Timesharing is a key element in the success of cloud computing. Unfortunately, the technology to support this form of utility required by clouds could not be found in the hardware, the software, or the telecommunications of the age. In 1966, a strong comparison was first introduced by Douglas Parkhill between utility service for electricity and future innovations in computing, which mentions many of the characteristics of modern-day cloud computing. He explored this comparison fully in his book, *The Challenge of the Computer Utility*. The first attempts at cloud computing were simply to apply the economies of scale found in the telecommunications industry to IT infrastructures. The term ‘cloud’ was already in commercial use in the early 1990s, but it was not until 1997 that the term “cloud computing” was used

academically in a lecture by Ramnath Chellappa. By the 21st century, Cloud Computing solutions have appeared in the market. In 2002, a major move was made to offer utility-based computing. The effort came from Amazon.com when they launched their Web Services line of products. Several companies followed suit, with the leading service focused on software deployment, or software-as-a-service (SaaS) offerings. 2007 brought cloud computing to a whole new level, especially with a joint research effort between IBM and Google, offering computer science students in major universities an opportunity to obtain real experience with their studies. The framework for this effort was cloud computing. However, like any new technology concept, the definition of cloud computing went unclear. It was not until September 2011 that a formal definition for cloud computing was published by the National Institute of Standards and Technology (NIST). The definition recognizes three types of service models:

- **Infrastructure as a Service:** The customer is provided the processing, storage, network, and fundamental resources capable to enable the deployment and operation of arbitrary software, including operating systems and applications. The underlying infrastructure is managed and controlled by the service provider, while the customer has control of everything running on top of the infrastructure.
- **Platform as a Service:** The customer is provided the capabilities to deploy customer-created or acquired applications into the cloud infrastructure using provider-supported programming languages, libraries, services, and tools. The underlying infrastructure is managed and controlled by the service provider, but the customer has control over the deployed applications and limited control over application-hosting configurations.
- **Software as a Service:** The customer is provided the use of the application running on the cloud infrastructure. The application is accessible through a thin client, such as a web browser or a program interface. The underlying infrastructure and applications are managed and controlled by the provider. The customer may have limited control over user-specific application configuration settings.

The characteristics of a service model are quite simple. The NIST definition lists only five items specific to cloud computing, though some service models may be distinguished by more. The five essential characteristics of cloud computing are:

- **On-demand self-service:** The customer is able to obtain and expand computing capabilities automatically without any interaction with the service provider.
- **Broad network access:** All service capabilities are available over the network and accessible through standard mechanisms using thin or thick client platforms, including workstations, laptops, tablets, and mobile phones.
- **Resource pooling:** Physical and virtual resources are pooled to serve multiple consumers within a multi-tenant model and are dynamically assigned according to customer demand. The customer will generally have no control or knowledge over the exact location of the resources provided, though a location may be specified at a higher level of abstraction, such as country or state.
- **Rapid elasticity:** Capabilities are provided and released elastically, sometimes through automation, to scale according to demand. The customer perception of service may be such that capabilities are unlimited and appropriate in any quantity at any time.
- **Measured service:** Resource usage is automatically and transparently monitored, controlled, reported on, and optimized through a metering capability at a level of abstraction appropriate to the service type.

The NIST definition continues by establishing four models for deploying clouds:

- **Public clouds** are designed for open use by the general public. The public cloud exists on the premises of a business, academic, or government organization who owns, manages, and operates the offering.
- **Community clouds** are designed for exclusive use by a specific community of users from organizations with shared missions or concerns. One or more of the organizations may own, manage, and operate the offering or it may be provided by a third party provider or a combination of the two. The solution may exist on or off the premises.
- **Private clouds** are designed for exclusive use by a single organization comprised of multiple consumers. The offering may be owned, managed, or operated by the organization, a third party, or a combination of the two. The solution may be found on or off premise.
- **Hybrid clouds** are a combination of public, community, and private clouds, bound together using standardized or proprietary technology for data and application portability. A hybrid cloud must be a single entity that remains unique.

The NIST Definition for Cloud Computing is not the first attempt to define cloud computing, but its publication provides a framework from a recognized agency and can be

used to ensure future discussions in cloud computing. While the NIST Definition of Cloud Computing provides a high level perspective of the basic tenets of clouds, it does not provide enough details about how to deliver or exploit cloud resources within a business context. To understand this more clearly, a different model is required. 17 The Jericho Forum, a subset of the Open Group, has an expanded model of cloud deployments as part of their current focus, "Securely Collaborating in Clouds". From an infrastructure perspective, the easiest way to view a cloud deployment is by its physical datacenter, where a single datacenter supports a single cloud. The cloud model provides four dimensions to distinguish how clouds are formed and what their manner for provisioning services is. The four dimensions are:

- **Internal/External:** Defines the physical location of the data, either within an organization's boundaries or outside the organization's boundaries (on or off premise). The purpose of this dimension is to establish the distance between the cloud and the data used by the cloud. For instance, it is possible for the business to use computing resources of a public cloud while maintaining the data within its own boundaries, creating a cloud that is internal but deperimeterized. The distance between cloud and data cannot be defined and may cause some performance issues.
- **Proprietary/Open:** Defines the state of ownership of the technology used and determines whether the means for provisioning cloud services are owned and controlled by the service provider or not. This dimension affects the portability of solution (the more proprietary the provision is, the harder it will be to move from one cloud solution to another). The proprietary/open condition of the cloud will also have an impact on the enterprise's ability to federate its use of multiple clouds.

- **Perimeterized/De-perimeterized Architectures:** Defines whether the cloud operates within the traditional IT security perimeter or outside that perimeter. Many large enterprises utilize a defense-in-depth security architecture to provide a perimeter. This dimension addresses how deep the cloud infrastructure is within the perimeter and whether remote access or access from outside the perimeter is allowed, as well as how this remote access works.
- **Insourced/Outsourced:** The cloud service is provided by an organization's IT department exclusively or by a third party. This dimension defines whether the design and ownership belongs to the organization or not, creating the line of demarcation between the customer and the provider. (Cloud Cube Model ver 1.0, Jericho Forum: April 2009) The Cloud Cube Model is very important in the provisioning of cloud infrastructure, as it relates to the enterprise. An insourced cloud is an internal, proprietary, and perimeterized solution that represents the majority of private clouds. An outsourced cloud is an external, open, deperimeterized solution that clearly represents an NIST-defined public cloud.

While many exceptions to these configurations can be found, a generic rule relating to clouds can arise. **1.2 Components of a Web Service** Cloud services are technology solutions which are accessible from an Internet connection over the network. Networking is all about communication, specifically requests and responses. Because of this, the basic unit of measure for a cloud service is the request, particularly a request made by the end user for a specific response from the cloud service. Different components of the cloud service will relate and manage the request differently. Understanding this will allow a deeper understanding of what a cloud service is and how it works.

Infrastructure Storage Platform Application Functionality User Interface As stated, what users require to access a cloud service is Internet connection, but they also need an interface. While a web browser can facilitate in providing an interface, it is not the interface. However, a web browser will place conditions and restrictions on what the interface can and cannot do. An interface for a cloud service through a web browser cannot do more than what the web browser is designed to do on its own or with custom add-ons. Some cloud service providers may decide to create a custom Internet-based interface that allows greater functionality than a web browser. Through the user interface, the end-user will make a request of the service or the interface will make a request based on what the end user is doing at the time. This request serves a function, such as "retrieve data", but the request will span to a number of other hidden requests for other functions, such as "authenticate user" and "locate data". The number of actual functions initiated by a single user request is unlimited and each function is initiated by a distinct request for that function. Generally, the functions will process the request and provide a result that is provided to a "controller", which consolidates all the results into a single response to the end user. 19 The

application acts as the controller. The application ensures that the end-user provides the response desired. It manages how the services, their capabilities and functions, work together to provide a quality result. The optimization of the application is based on the actual developed code used to construct the application. The application provides functionality, security, and basic load handling to the end user. In a traditional IT infrastructure, the application will sit on a service and will be accessed by the user. In cloud computing, the application sits on a platform, which defines the environment for the application. The definition will be a set of programming languages that are supported. Most programming languages can be launched in a platform intended for a different programming language but the optimal situation is an application being launched on a platform explicitly supporting the programming language used to create the application. The programming language is used to develop the actual code of the application. The programming language serves to interpret the request and, depending on the compatibility of the application and the platform, it may require appropriate “translators” for the request. Every application requires storage, whether temporary or permanent. Storage is used to hold results from function until they can be compiled as a response to the user. It is also used to house the coding, services, and functions of the application, as well as the data used in processing requests. Storage can even be used to store frequently used functions in an easily accessible part of the application. This type of storage is distinctly different from possible storage requirements of the end user for created data, such as a document. How the application accesses and uses storage is an extremely critical component on how the application performs. Most security controls focus on how to protect data that is stored or in transit on the network. Each request will have different requirements on storage. The application manages these requirements appropriately. The power of cloud computing actually comes from the infrastructure. The infrastructure is what allows every function, service, or storage requirement to perform optimally. From the end user request perspective, the infrastructure is responsible for handling an ever changing number of requests. Depending on the demand (number of users, number of different application, number of shared services, size of the infrastructure), the number of requests could easily reach into millions per second. Each component can be optimized to provide the end user the best experience possible. **1.2.1**

Infrastructure as a Service (IaaS) Infrastructure as a Service offers organizations the option to outsource the equipment needed to support their business operations. This can include storage equipment, hardware, servers, and networking components. The organization pays the service provider for the use of the equipment, and the service provider maintains ownership of and responsibility for the equipment. This means that the service provider houses, runs, and maintains the equipment. Traditionally, businesses would lower capital spending by leasing equipment and they could use and manage the equipment as they desire. IaaS is not a leasing agreement in the traditional sense because it is not only outsourcing the equipment, but also the management and optimization of the equipment. **Infrastructure Storage Platform Application Functionality**

User Interface Cloud API In this service model, the request from the customer is for a computing infrastructure with associated storage, but the customer will provide the platform and applications. The customer is responsible for everything running on top of the infrastructure. However, keep in mind that applications require storage to function optimally. To facilitate the interchange between the customer’s applications and platforms and the service provider’s infrastructure, the cloud provider will provide a “Cloud API”. Consider two IaaS providers who are using the same types and numbers of servers, storage devices, and network components. The same customer is running the exact same configuration of applications and platforms at the similar levels of demand. Instinctively, one might assume that the performance of each environment would be the same, but this is not necessarily true. The interface and the Cloud API between the customer and the service provider can be distinct enough that the actual performance for the customer is affected. The Cloud API provided by different service providers are not the same. It is the responsibility of the customer to ensure that the products and services they place on the infrastructure can communicate appropriately with the Cloud API. ²¹ Storage as a Service is a special type of IaaS with a strong emphasis on permanent storage. Often times, they are marketed as IaaS solutions. In pure storage as a service solutions, the customer can allow data transfers but

cannot host any platforms or applications in the environment. Storage-as-a-service solutions provide capacity to customers for a variety of uses, mainly: • Backups • Backups for potential disaster recovery • Archiving • Raw data for online databases of analytics • Online collaboration

The most prominent drivers for online storage are individual backups, backups for potential disaster recovery, archiving, raw data for online databases of analytics, and online collaboration efforts. The focus of storage-as-a-service is the physical storage infrastructure with numerous layers of virtualization. From a provider perspective, the provision of storage means supplying the necessary capacity required by the customer, ensuring that the data is always available to the customer, and that transfer rates are outstanding for the customer. In most cases, data from multiple customers will be found on a single storage device with the appropriate volume separation to ensure that the data is kept secure and uncorrupted. From a customer perspective, they have a place to store their data without having to heavily invest in the necessary hardware and software to save this data. They have continuous access to this data at any time from any location. The solution is scalable to handle any growth in the business.

1.2.2 Platform as a Service (PaaS)

IaaS solutions are used to support PaaS solutions and, in doing so, must be adaptable to meet the varying requirements of the PaaS provider and software developers. As developers and businesses look into cloud solutions with more vigor and greater attention, there are an increased number of gaps being identified. Pay-as-you-use services for software, storage, computing, and even CRM (Customer Relations Management) are having greater success as time goes on. However, these services still only represent pieces of a larger solution.

Platform-as-a-service has the ability to encompass all of these services and more. A cloud platform includes all the systems required to manage the entire life cycle of a web application. Bungee Labs have identified these six key elements of such platform for the most inclusive Platform-as-a-Service (PaaS) offering possible today:

Integrated environment

The first element of a fully functional platform is the ability to develop, test, deploy, host, and maintain the application in a single environment. This places a considerable amount of burden on the developer in terms of hardware, maintenance, and configuring to ensure that application moves through its life cycle.

User experience

The experience that the developer has using the platform is critical to the success of the PaaS service. Most developers move from one project to the next, so repeat business is a considerable factor. However, from the developer perspective, having the tools and capabilities available to move the application through its life cycle is extremely important. It is like using DOS and Windows. DOS allowed a computer user to perform most functions required at that time, but the introduction of the Windows operating system made those functions easier to perform and with a more pleasant experience.

Built-In Management Features

Developers and businesses have to deal with a number of different variables throughout the life cycle of the application, which requires considerable attention to factors that can adversely affect the function of the application. Of these, scalability is a major factor, as well as reliability and security. These factors should be built into the platform without any need to develop, configure, or, in any way, spend any time, cost, or effort away from the application itself.

Built-In Integration

Very few applications are developed in complete isolation. The need to connect to external sources for dynamic data, updates, even third party web services is very much a required consideration. Specifically for applications depending on real time data, the platform needs to allow direct and continuous connection to external sources.

Support Collaboration

In the same way applications are not developed in isolation, developers do not work in isolation. Most software development projects are a collaboration of several individuals throughout the entire life cycle of the application. This collaboration is a mixture of formal and on-demand occurrences that require the ability to communicate effectively while maintaining the security and performance of the application code.

Deep Application Instrumentation

Software development no longer ends upon the deployment of the application. As much as a developer or business would like to think that they have introduced a perfect application into the marketplace, this is rarely true. How the application is used, its performance, and reliability issues are all concerns that software manufacture would like to monitor. A platform-as-a-service would have a complete set of instrumentation in place to handle this monitoring for improvements.

1.2.3 Software as a Service (SaaS)

IaaS solutions also

support SaaS. Software as a Service (SaaS) is a software deployment opportunity where an application is hosted into the Internet environment. Once there, the application is available to users throughout the Internet without any need for the user to install or run the application on their own computer. As a result, the user does not have to be concerned with software maintenance, operations, or support. SaaS is a pay-as-you-use service, which means that initial purchase of software and its license is not required. Instead, the charge is continuous, usually monthly, to use the application without any contract. For software vendors, SaaS is an attractive solution because it promises stronger protection of online intellectual property and an ongoing revenue stream. They can host the application on their own web server or allow the application to be handled by a third party application service provider (ASP). As a result, the term “software-as-a-service” is sometimes diluted, as it has two meanings. It can speak to the application itself and the environment hosting the application. The second situation is also referred to as a platform and is sometimes interchanged with platform-as-a-service. To settle this problem, some have started using the terms “SaaS” and “SaaS platform” to distinguish the two situations.

Cloud computing has dramatically changed how business applications are built and run. At its core, cloud computing eliminates the costs and complexity of evaluating, buying, configuring, and managing all the hardware and software needed for enterprise applications. Instead, these applications are delivered as a service over the Internet.

Whenever the term infrastructure is used, the resulting images will involve some set of physical devices. In IT, the infrastructure comprises all the physical computing devices required to enable an enterprise or individual to produce some result supporting the goals of the business. The role of the infrastructure is to make the achievement of the result easier and to increase its value to the business.

Infrastructure as a Service is another method for managing and delivering the framework required to operate the business. At its core, Infrastructure as a Service (IaaS) must be discussed on two fronts: its construction and its presentation. The construction of an IaaS comprises the physical hardware and software used to provide the foundation for supporting the business. In a traditional IT solution, this foundation included servers, routers and bridges, and, in many cases, the technologies and solutions used to create the infrastructure were highly standardized.

For IaaS, the physical infrastructure still remains, but how it is presented to the customer is radically different. The presentation of IaaS is an abstraction of the physical infrastructure. One might think of this abstraction as a software-based representation of the physical infrastructure and that perspective would not be without merit. For a business, an IaaS has a radical impact on how IT is delivered and managed because it is possible to purchase the right to use the abstraction of an infrastructure without purchasing and managing the physical infrastructure.

New to IaaS? Welcome! If you're just starting to explore the concept of IaaS, this is the place to find out what IaaS can do for you, understand different types of IaaS solutions, and learn more about developing IaaS.

The Infrastructure as a Service Specialist level certification kit explores the concepts of Infrastructure as a Service (IaaS) and where they apply in the current technological

world.

Using this book and the accompanying elearning materials, you will gain an understanding of the goals, objectives, benefits and challenges of the different types of IaaS and how they support the relevant IT Service Management processes. This certification kit will prepare you for the Infrastructure as a Service (IaaS) Specialist Level Exam.

The pre-requisite for this program is the completion of the Cloud Computing Foundation Program.

This Kit contains the book and online course access that provides everything you need to prepare for the IaaS Specialist Certification Exam, including in-depth coverage of all exam objectives, scenarios to easily demonstrate the processes in action, and practice exam questions for that last minute test preparation.

This Study Guide and Online Course access provides complete, in-depth coverage of all exam objectives for the IaaS Specialist exam in a systematic approach, so you can be confident you're getting the instruction you need.

- * Real-world scenarios put what you've learned in the context of service solutions.
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