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# VCAP5-DCD

## VMware® Certified Advanced Professional in Datacenter Design

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# VCAP5-DCD
# Official Cert Guide

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# VCAP5-DCD Official Cert Guide

Paul McSharry

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## VCAP5-DCD Official Cert Guide



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# About the Author

**Paul McSharry** is an independent virtualization consultant and instructor based in the UK. He has been an IT professional for 15 years and now specializes in virtualization technologies and web hosting solutions, working with large retail and financial enterprises.

When not working in the field, he is often instructing the VMware-authorized classes for various VMware VATCs.

Paul holds a variety of vendor-based IT certifications, such as MCSE, MCITP, VCP, and VCAP, and he is also a qualified IT instructor, holding VMware Certified Instructor (VCI), CompTIA CTT+, and Microsoft MCT credentials.

His recent consultancy projects include the following:

- Producing a large-scale hybrid cloud platform to deploy and enable secure e-discovery web-based applications for data review
- Several large datacenter migrations using various vSphere platforms
- Multiple public and private vCloud director platform designs and implementations
- Several enterprise-wide VMware view-based VDI deployments

Paul is an active blogger (http://www.elasticsky.co.uk) and Twitter user (@pmcsharry). He has also been awarded the vExpert designation for his work in the VMware community for two years running (2012–2013).

# Dedication

*For my family—Carolyn, Harrison, and Sadie*
*xxx*

# Acknowledgments

The past 18 months or so have been a very busy time; my son, Harrison, made the transition from being a toddler to being a little boy, and my baby daughter, Sadie, arrived. Soon after, my wife and I moved and settled in a different part of the UK. As these life-changing events occurred, I continued to consult and teach using VMware technology.

Writing this book was challenging, not only given my already busy life, but because effectively writing a guide on how to design rather than simply providing information on how a specific product works or creating lab exercises was a bit of a change from anything I have ever tried to do before.

I would like to first thank my children, who had to play without their dad while he was writing this guide.

I would also like to thank the team at Pearson, who were very helpful and patient, to say the least. I'm sure I asked a lot of silly questions.

Thanks also to the team at VMware Education for providing such great reference content in the VCI channel.

Finally, I would like to thank my wife, Carolyn, for all her help and suggestions, and for living with this project. I would not have finished it without her.

# About the Reviewers

**Manish Patel** has more than 14 years of experience as an IT professional, and is currently working at VMware Canada as a senior TSE. He also possesses various industry certifications, including VCP3,4,5-DV/DT/Cloud, VCAP4/5-DCA, VTSP 5, MCSA/E, SCNA, SCSA, CCNA, CNE, CNA, and Compaq ASE. Manish was recently named a vExpert 2013 for his contributions to the VMware community. Readers can visit Manish on LinkedIn at http://ca.linkedin.com/pub/manish-patel/5/249/12b/, where he maintains several groups, including VCAP-DCD, vCloud, View, and VMware Orchestrator, as well as on Twitter (@mandivs).

**Tom Ralph** is an early adopter and firm believer in VMware technologies, with more than eight years of experience in architecture, optimization, and troubleshooting of complex virtual environments dating back to ESX 2.5. He is an expert in VMware Cloud, network security solutions, and architecture. In addition to holding VCDX (3, 4, and 5) certification, Tom holds VCP (3, 4, and 5), VCAP-DCD 4 and 5, and VCAP-DCA 4. In his current role as an architect with the Cloud Tenant Operational group, he focuses on the creation of service definitions, the consumption of cloud resources, and the definition of consumption methods for cloud infrastructures. In his spare time, he can be found authoring the *Official VCP-Cloud Certification Guide* for VMware Press.

**Gabrie van Zanten** is a virtualization specialist working for Open Line in the Netherlands. As a consultant, he designs and implements virtual infrastructures for customers. Besides being a consultant, Gabrie runs one of the top-ranked blogs on VMware at www.GabesVirtualWorld.com. He writes about VMware and helps his readers get in-depth understanding on how VMware products work. His blogging activities, the presentations he gives, and the effort he puts into helping members of the VMware community earned him the VMware vExpert award 2009 through 2012.

## We Want to Hear from You!

As the reader of this book, *you* are our most important critic and commentator. We value your opinion and want to know what we're doing right, what we could do better, what areas you'd like to see us publish in, and any other words of wisdom you're willing to pass our way.

We welcome your comments. You can email or write us directly to let us know what you did or didn't like about this book—as well as what we can do to make our books better.

*Please note that we cannot help you with technical problems related to the topic of this book.*

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# Introduction

Welcome to *VCAP5-DCD Official Cert Guide*. I am extremely honored to be able to present this guide to you in conjunction with VMware Press.

As a full-time consultant working with virtualization every day, I found the writing process challenging. It was extremely useful for me to question not only how to best create a guide to pass the advanced VMware certification but also how to provide you, the reader, some takeaway aspects that could be put into use in the field—which, after all, is the main reason to complete the certification in the first place.

I have worked in the IT industry for 15 years, in both training and consultancy roles. I have tried to add value from my experience, using various real-life examples in the explanations.

This book is designed to help you study for the VCAP5-DCD exam. It is not a definitive guide to designing VMware technology, nor is it a complete reference book for all material in the exam. I have intentionally decided not to try to reinvent or rewrite content already available in the VMware community but to concentrate on the thought processes that an architect should use in design work.

This guide is not only based on real-world projects but also on my experience of passing the VCAP4-DCD and VCAP5-DCD exams while teaching the vSphere design workshops.

I have purposely stripped the content right down to the processes that the VCAP5-DCD blueprint concentrates on and the specific knowledge required by a professional VMware architect. Knowledge of a product is one thing; how to use that information to create a good design is something else entirely.

## Who Should Read This Book

This guide is aimed at anyone looking to pass the VCAP5-DCD exam, but also at existing vSphere engineers looking to make the transition from supporting systems to designing platforms. There is a change in skill set in the role transition, and it is often hard to find study material—you are more likely to learn from experience. I have tried to bridge this gap throughout the guide.

## Goals and Methods

My number one goal of this book is simple: to help you pass the VCAP5-DCD certification test and obtain the status of VMware Certified Advanced Professional – Data Center Design.

To aid you in gaining the knowledge and understanding of key topics, I use the following methods:

- **Opening topics list:** This list defines the topics to be covered in the chapter. Each chapter is a part of the exam blueprint and the chapters and topics are written in blueprint order.
- **"Do I Know This Already?" quizzes:** At the beginning of each chapter is a quiz. The quizzes, and answers/explanations (found in Appendix A), are meant to gauge your knowledge of the subjects. If the answers to the questions do not come readily to you, be sure to read the entire chapter.
- **Key topics:** The key topics indicate important figures, tables, and lists of information that you should know for the exam. They are interspersed throughout the chapter and are listed in table format at the end of the chapter.
- **Review questions:** All chapters conclude with a set of review questions to help you assess whether you have learned the key material in the chapter.
- **Exam-type questions:** Exam questions are included with the printed and digital editions of this book. They are written to be as close to the type of questions that appear on the VCAP5-DCD exam.

## How to Use This Book

The VCAP5-DCD is an advanced-level certification; it requires you to have attained a VCP-level certification and relevant professional real-world experience using the technologies. It is a very different exam from the VCP5-DCV and VCAP5-DCA exams. The VCAP5-DCD exam is based on making informed and pragmatic design choices using VMware platforms.

A designer requires a broad knowledge of all linking technologies and must do extensive reading around the subject. Unfortunately, there are no shortcuts around this!

Due to the amount of material available for VMware technologies, preparing for the VCAP5-DCD exam can be very daunting, and many professionals I have spoken to during courses I have led or in various contract roles have said that they find all the following difficult:

- Understanding where to start with correct platform design
- Knowing what aspects of the technology to cover and to what level of detail
- Knowing when to take the exam

This guide was created with these uncertainties in mind.

I recommend that you use this book as a guide to help you study other material. For each objective in the blueprint I do the following:

- Discuss the important concepts needed for the exam
- Relate real-life examples to the content
- Set tasks that can be used to prepare for the exam
- Recommend further reading to add to your growing knowledgebase

Once you have read all the chapters in this book and have completed the exam preparation tasks, you should have the basis of a real-life designer's toolkit.

This set of documentation and processes can be used for real designs in the field and to study for the VCAP5-DCD exam.

The core chapters of this book, Chapters 1–7, cover the following topics:

- **Chapter 1, "Introduction to Technical Design":** This chapter focuses on the design process and associated terminology.
- **Chapter 2, "Creating a Design":** This chapter focuses on information gathering and logical design presentation.
- **Chapter 3, "Thoughts on Good Choices for Virtualization and Design":** This chapter focuses on the impact of specified and sometimes assumed business expectations on platform design.
- **Chapter 4, "Developing a Design on Paper and Delivering It Physically":** This chapter focuses on creating logical designs and the process to develop them into a physical design.
- **Chapter 5, "Virtual Machine Design":** This chapter focuses on the thoughts and options that can be used to ensure that an appropriate virtual guest is produced for an application workload.
- **Chapter 6, "Project Execution":** This chapter focuses on the order of delivery, task validation, and project documentation.
- **Chapter 7, "Tips for Passing the Exam":** This chapter focuses on final exam tips and strategies, as well as a review of the VCAP5-DCD exam experience.

## The Designer's Toolkit

All engineers have a folder or USB stick with a collection of their favorite tools, scripts, and tricks. The purpose of this book is to help you create your own folder for design work.

Your folder should include the following:

- A well-understood design process
- A checklist and process for good design questions
- A high-level design template
- Worked examples of the following:
  - Entity relationship diagrams
  - Logical design diagrams
  - Physical design diagrams
  - A milestone project implementation plan
  - Walkthrough documentation
  - A high-level disaster recovery plan document
  - A virtual machine/workload/vApp design template
- A test/validation plan
- An implementation plan

The VCAP5-DCD certification exam will be updated as the certification is updated. As VMware develops more exciting functionality, the blueprint will also change with respect to technology, but the overall theme of and feeling behind this certification should not. After all, platform design processes and thoughts do not change; the technologies do.

Passing the VCAP5-DCD certification exam will validate your skills in design and translating business requirements into technical requirements and creating suitable technical documentation. These skills are very important, regardless of what technology is used. Therefore, in my opinion, VCAP5-DCD has been the most useful non-defense-based IT certification I have ever completed. I hope you enjoy the study!

## The VCAP5-DCD Certification Exam and This Book

Table I-1 maps the VCAP5-DCD exam topics to the chapters of this book that cover them.

**Table I-1** VCAP5-DCD Exam Topics and Chapter References

| Exam Section/Objective | Chapter Where Covered |
|---|---|
| **Section 1: Plan, Install, Configure, and Upgrade vCenter Server and VMware ESXi** | |
| Objective 1.1 – Install and Configure vCenter Server | Chapter 1 |
| Objective 1.2 – Install and Configure VMware ESXi | Chapter 1 |
| Objective 1.3 – Plan and Perform Upgrades of vCenter Server and VMware ESXi | Chapter 1 |
| Objective 1.4 – Secure vCenter Server and ESXi | Chapter 1 |
| Objective 1.5 – Identify vSphere Architecture and Solutions | Chapter 1 |
| **Section 2 – Plan and Configure vSphere Networking** | |
| Objective 2.1 – Configure vNetwork Standard Switches | Chapter 2 |
| Objective 2.2 – Configure vNetwork Distributed Switches | Chapter 2 |
| Objective 2.3 – Configure vSS and vDS Policies | Chapter 2 |
| **Section 3 – Plan and Configure vSphere Storage** | |
| Objective 3.1 – Configure Shared Storage for vSphere | Chapter 3 |
| Objective 3.2 – Configure the Storage Virtual Appliance for vSphere | Chapter 3 |
| Objective 3.3 – Create and Configure VMFS and NFS Datastores | Chapter 3 |
| **Section 4 – Deploy and Administer Virtual Machines and vApps** | |
| Objective 4.1 – Create and Deploy Virtual Machines | Chapter 4 |
| Objective 4.2 – Create and Deploy vApps | Chapter 4 |
| Objective 4.3 – Manage Virtual Machine Clones and Templates | Chapter 4 |
| Objective 4.4 – Administer Virtual Machines and vApps | Chapter 4 |
| **Section 5 – Establish and Maintain Service Levels** | |
| Objective 5.1 – Create and Configure VMware Clusters | Chapter 5 |
| Objective 5.2 – Plan and Implement VMware Fault Tolerance | Chapter 5 |
| Objective 5.3 – Create and Administer Resource Pools | Chapter 5 |
| Objective 5.4 – Migrate Virtual Machines | Chapter 5 |

| Exam Section/Objective | Chapter Where Covered |
|---|---|
| Objective 5.5 – Backup and Restore Virtual Machines | Chapter 5 |
| Objective 5.6 – Patch and Update ESXi and Virtual Machines | Chapter 5 |
| **Section 6 – Perform Basic Troubleshooting** | |
| Objective 6.1 – Perform Basic Troubleshooting for ESXi Hosts | Chapter 6 |
| Objective 6.2 – Perform Basic vSphere Network Troubleshooting | Chapter 6 |
| Objective 6.3 – Perform Basic vSphere Storage Troubleshooting | Chapter 6 |
| Objective 6.4 – Perform Basic Troubleshooting for HA/DRS Clusters and vMotion/Storage vMotion | Chapter 6 |
| **Section 7 – Monitor a vSphere Implementation and Manage vCenter Server Alarms** | |
| Objective 7.1 – Monitor ESXi, vCenter Server and Virtual Machines | Chapter 7 |
| Objective 7.2 – Create and Administer vCenter Server Alarms | Chapter 7 |

## Book Content Updates

Because VMware occasionally updates exam topics without notice, VMware Press might post additional preparatory content on the web page associated with this book, at http://www.pearsonitcertification.com/title/9780789750181. It is a good idea to check the website a couple weeks before taking your exam to review any updated content that might be posted online. We also recommend that you periodically check back to this page on the Pearson IT Certification website to view any errata or supporting book files that may be available.

## Pearson IT Certification Practice Test Engine and Questions on the DVD

The DVD in the back of this book includes the Pearson IT Certification Practice Test engine—software that displays and grades a set of exam-realistic multiple-choice questions. Using the Pearson IT Certification Practice Test engine, you can either study by going through the questions in Study Mode or take a simulated exam that mimics real exam conditions.

The installation process requires two major steps: installing the software and then activating the exam. The DVD in the back of this book has a recent copy of the Pearson IT Certification Practice Test engine. The practice exam—the database of exam questions—is not on the DVD.

**NOTE** The cardboard DVD case in the back of this book includes the DVD and a piece of paper. The paper lists the activation code for the practice exam associated with this book. *Do not lose the activation code.* On the opposite side of the paper from the activation code is a unique, one-time-use coupon code for the purchase of the Premium Edition eBook and Practice Test.

## Install the Software from the DVD

The Pearson IT Certification Practice Test is a Windows-only desktop application. You can run it on a Mac using a Windows virtual machine, but it was built specifically for the PC platform. The minimum system requirements are as follows:

- Windows XP (SP3), Windows Vista (SP2), or Windows 7
- Microsoft .NET Framework 4.0 Client
- Microsoft SQL Server Compact 4.0
- Pentium-class 1GHz processor (or equivalent)
- 512 MB RAM
- 650 MB disc space plus 50 MB for each downloaded practice exam

The software installation process is pretty routine as compared with other software installation processes. You will need access to the Internet. If you have already installed the Pearson IT Certification Practice Test software from another Pearson product, there is no need for you to reinstall the software. Just launch the software on your desktop and proceed to activate the practice exam from this book by using the activation code included in the DVD sleeve.

The following steps outline the installation process:

1. Insert the DVD into your PC.
2. The software that automatically runs is the Pearson software to access and use all DVD-based features, including the exam engine and the DVD-only appendixes. In the main menu, click the Install the Exam Engine option.
3. Respond to window prompts, as with any typical software installation process.

The installation process gives you the option to activate your exam with the activation code supplied on the paper in the DVD sleeve. This process requires that you establish a Pearson website login. You need this login to activate the exam, so please register when prompted. If you already have a Pearson website login, there is no need to register again. Just use your existing login.

## Activate and Download the Practice Exam

After installing the exam engine, you should then activate the exam associated with this book (if you did not do so during the installation process) as follows:

1. Start the Pearson IT Certification Practice Test software from the Windows Start menu or from your desktop shortcut icon.
2. To activate and download the exam associated with this book, in the My Products or Tools tab, click the Activate button.
3. At the next screen, enter the activation key from the paper inside the cardboard DVD sleeve in the back of the book. Then click the Activate button.
4. The activation process downloads the practice exam. Click Next and then click Finish.

When the activation process completes, the My Products tab should list your new exam. If you do not see the exam, make sure you have opened the My Products tab on the menu. At this point, the software and practice exam are ready to use. Simply select the exam and click the Open Exam button.

To update a particular exam you have already activated and downloaded, open the Tools tab and click the Update Products button. Updating your exams will ensure you have the latest changes and updates to the exam data.

If you want to check for updates to the Pearson Cert Practice Test exam engine software, open the Tools tab and click the Update Application button. This will ensure you are running the latest version of the software engine.

## Activating Other Exams

The exam software installation process, like the registration process, has to happen only once. Then, for each new exam, only a few steps are required. For instance, if you buy another new Pearson IT Certification Guide or VMware Press Official Certification Guide, extract the activation code from the DVD sleeve in the back of that book; you do not even need the DVD at that point. From there, all you have to do is start the exam engine (if it is not already up and running) and perform steps 2 through 4 from the previous list.

## Premium Edition

In addition to the free practice exam provided on the DVD, you can purchase two additional exams with expanded functionality directly from Pearson IT Certification. The Premium Edition eBook and Practice Test for this title contains an additional full practice exam and an eBook (in both PDF and ePub format). In addition, the Premium Edition title also has remediation for each question to the specific part of the eBook that relates to that question.

If you have purchased the print version of this title, you can purchase the Premium Edition at a deep discount. A coupon code in the DVD sleeve contains a one-time-use code and instructions for where you can purchase the Premium Edition.

To view the Premium Edition product page, go to http://www.pearsonitcertification.com/title/9780133125351.

**This chapter covers the following subjects:**

- **What Is a Technical Design?** This section explains what a technical design is and why it is important to the end solution.
- **The Technical Design Process:** This section demonstrates what happens at each stage of the technical design process.
- **Project Deliverables:** This section covers what should be produced as part of a technical design, such as the documents, sample contents, and so on.

This chapter covers the following portion of the VCAP5-DCD 5 blueprint:

Section 1, "Create a vSphere conceptual design."

# Introduction to Technical Design

Technical design requires completely different skills from the troubleshooting and maintenance tasks commonly carried out by experienced IT professionals. The role of a technical designer or architect involves communication skills, technical knowledge, and a certain amount of artistic flare. This chapter will take you through the terminology and process of technical design. The concepts discussed here can be applied to any project, not just a VMware-related solution. By understanding and working with a design process, an engineer can integrate with other business and technical professionals and provide valued input to a business project.

## "Do I Know This Already?" Quiz

The "Do I Know This Already?" quiz allows you to assess whether you should read this entire chapter or simply jump to the "Exam Preparation Tasks" section for review. If you are in doubt, read the entire chapter. Table 1-1 outlines the major headings in this chapter and the corresponding "Do I Know This Already?" quiz questions. You can find the answers in Appendix A, "Answers to the 'Do I Know Already?' Quizzes and 'Q&A' Chapter Review Questions."

**Table 1-1** "Do I Know This Already?" Foundation Topics Section-to-Question Mapping

| Foundations Topics Section | Questions Covered in This Section |
|---|---|
| What Is a Technical Design? | 1, 7, 9, 12 |
| The Technical Design Process | 2–4, 6, 10 |
| Project Deliverables | 5, 8, 11, 13 |

1. Which of the following is a design methodology?
   a. A set of best practices for the technology
   b. An iterative process used to produce a technical solution
   c. A project proposal that shows the advantages of new technology or the latest upgrade

2. Which of the following is a project risk?
   a. The technology is over three years old.
   b. The technology is cutting edge.
   c. Both a and b.

3. Who sets the vision?
   a. The board and business professionals
   b. IT staff
   c. A proposed vendor

4. Who generally sets the scope?
   a. Business staff
   b. IT staff and business staff working together
   c. The proposed vendor

5. Which of the following is true of a project requirement?
   a. It must be satisfied.
   b. It is for advice and observation only.
   c. Both a and b

6. You are working on a project team tasked to migrate a platform between two datacenters. Which of the following describes a design methodology?
   a. A set of best practices for the technology
   b. An iterative process used to produce a technical solution
   c. A project proposal that shows the advantages of new technology or latest upgrade

7. Which of the following describes a best practice?
   a. Dictated by the vendor as the way to do something
   b. Continuously evolving
   c. Static

8. If changed, which of the following may affect the logical design?
   a. The server vendor
   b. The type of replication from synchronous to asynchronous
   c. The IP addresses of the servers

9. A project vision may be a long-term goal, and it may be achieved after several iterations of a project life cycle.
   a. True
   b. False

10. Which of the following is a constraint on design?
    a. The VDI platform is dependent on a stable network, which is not managed by the internal network team.
    b. The VDI project has a small budget.
    c. During a migration project, the destination datacenter has not been completely finished. It is currently three months behind schedule.

11. The number of disks used in a storage array is detailed in the physical design.
    a. True
    b. False

12. You are the technical lead in a vSphere 4 to vSphere 5 project. The platform is currently using a supported NFS storage device. There are no plans to upgrade or change this device within two years. Which of the following is correct?
    a. This is a risk to the project.
    b. This is a design constraint.
    c. This is a design assumption.

13. Best practices can be used as guidance in a design, assuming that the requirements are satisfied.
    a. True
    b. False

# Foundation Topics

## What Is a Technical Design?

A technical design is a way of communicating an end product or solution. By creating a technical design, a group of people can work together to create a final solution.

A design methodology is a multiphase process used to direct a technical design process. A design process is:

- Iterative
- Involves other people
- Helpful and necessary to the success of a project

### Where Do We Start? What Are We Doing?

These questions are asked not only in the classroom but also during real projects. Skilled engineers are accustomed to some form of guidance, such as a vendor best practice or a design document from an experienced consultant or architect. How are technical designs constructed? How does an engineer bridge the gap between engineer and architect/designer?

### What Makes a Good Designer?

I have asked this question in a number of training courses. The following are some examples of responses:

- Expertise—in-depth technical knowledge
- Experience—someone who has implemented the technology previously
- Good communication—a technical expert who can talk to nontechnical people

From my own commercial experience, I know that a good designer is someone who can:

- Accept advice from other members of the team and other stakeholders
- Be flexible to change and understand that the end result is the required aim
- Acquire new skills rapidly

Most importantly, however, a good designer questions everything!

For example, say that a technical designer working on an application migration project interviews a senior user who spends 40 hours per week operating a data processing application. The user has data delivered to him weekly as a zip file. He unzips the file, counts the number of uncompressed files, and takes a copy for an archive and uploads it into the system. He stores the zip file in one folder (original) and keeps a copy of the unzipped files in another (imported data).

The designer establishes that this method is viewed as the accepted process—the company best practice, which has been developed over time by an experienced member of staff.

A technical designer would probe this process from various angles, asking questions such as: When is the data required? Can the zip file be stored and unzipped when required? Is it possible to work backward from the result of the data processing?" The zip file is a smaller copy of the processed data after all, and even a designer with no experience with the software at the user level could save the company time and money by taking a step back and questioning the process—even if it is an accepted one.

### A Familiar Scenario...?

Suppose that a company's CTO calls his team into a meeting. The CTO looks enthusiastic and says, "I've just had a meeting with the board. Our competitors are gaining on us. We need to deploy our services more rapidly, without lowering the quality our customers expect. The web applications are needed now rather than next quarter."

The CTO continues, "I need the platform guys to continue to support the production system but work smarter, so you can spend more time with the development team and investigating new technology. Developers, I am depending on you to produce our new software on time. Automate it all. You are the top team! If you make this work, there will be no more late nights in the office! And one more thing: Nobody mention a budget!"

The CTO leaves the room, the dust settles, and the project team looks at each other. Now what?

## The Technical Design Process


Try typing "design methodology" into a web search engine. You will be presented with numerous versions and definitions. Some of these definitions are standard, but some are company specific. VMware, for example, has developed its own methodology, called VIM, for Virtual Infrastructure Methodology.

Each methodology has various pros and cons, but all have similar phases:

- Information gathering—This is where a problem, vision, or goal is described; requirements are detailed; users are interviewed; and factors affecting the project, such as risks, constraints, compliancy, and cost are highlighted. Analysis of the current state of play is carried out.
- Solution development—This phase uses the information gathered from the previous phase to produce a detailed solution.
- Implementation and delivery—This stage utilizes the detailed plans from the solution development phase, and the solution is produced.
- Review and manage—During this frequently forgotten part of the technical design process, the project and solution are discussed to ensure quality and continuous improvement. Issues such as ongoing maintenance and operational management can be addressed here.

The basic components of a good design are:

- Vision
- Scope
- Requirements
- Constraints
- Assumptions
- Risks

### Vision

The vision component represents the actual idea—the light bulb over the cartoon character—and is the whole reason for a project. The vision must, therefore, be kept at the forefront throughout the project.

The vision may be ambitious, such as "Automate everything."

The project team might never actually achieve the original vision; costs, risks, and constraints could prevent it. The vision is the end goal; however, without a vision, a project may evolve into something else entirely.

The vision is normally set or controlled at the upper management level, and it is, consequently, a business-driven attribute rather than one driven by technology.

### Scope

The scope is a quantitative statement of what is included in a project, or, more pertinently, what is not included in a project.

While virtualization consolidation projects may have several phases, instead of trying to virtualize every machine in the company in one go, the scope would specify quick wins or good, critical, or high-priority candidates, allowing for progress on the project while establishing implementation methods.

The project requester normally creates the project scope, but he or she further develops it by working with other members of the project team, such as IT management.

### Requirements

A requirement is an attribute that must be achieved; for example, the solution must comply with the company's security policy, the current security policy specifies that any web-facing application servers must be separate from internal application servers.

Requirements affect design choice substantially.

### Constraints

A constraint is an attribute that may limit a design choice, and it could be technical or business driven. For example, in a datacenter migration project, the storage vendor has already been decided due to existing company vendor relationships. This choice means that data de-duplication technology cannot be used, as it is not available from the preferred vendor. A greater amount of network bandwidth would be required to synchronize data between the two sites.

Consider the applications running on the new virtual platform; a requirement states that these applications must remain supported by the application vendor. If the vendor does not support applications running in VMware platforms, the application may have to remain running on physical machines.

### Assumptions

An assumption is something that has been decided to be true for the project design but that has not been tested nor verified.

Say that a company requires a new remote working solution. It creates a project and assembles a team. The current solution, a VPN, is provided by an outsourcing company. This service was already in place before a firm-wide agreement of

telecommuting was in place. The contracts in place prevent renegotiation of service until next year. There is, however, no reason to expect an issue as the availability and performance of the VPN have been acceptable. Therefore, a suitable assumption could be "Sufficient network bandwidth to support 500 concurrent VDI users is available via the existing VPN solution." It could be difficult to accurately predict the amount of network bandwidth required and the work patterns of the proposed service once in use.

### Risks

A risk is an attribute that could prevent the completion of a project or change the project design considerably.

Risks can be pretty easy to spot. For example, say that in a datacenter migration project, one datacenter is being demolished, and another one is being constructed. The company has to move in any case, and it is starting the application migration project before the destination datacenter is available. If the availability of the second site is delayed, the project will be affected substantially. This is a risk.

A less obvious risk would be using cutting-edge technology. Has this been done by someone else, on this scale? If not, it may not be the best solution.

## Project Deliverables

Depending on the size and type of project or the organization where the project is being carried out, the items that are delivered from the project process will vary. They could include the following:

- A high-level design document (HLD)
- A quick one-pager
- A proof-of-concept solution
- An implementation or configuration document
- A test or verification document
- Support documentation

At a minimum, it is useful to always have a short HLD that explains the approach. In addition, a quick one-pager or a data flow diagram is an invaluable reference during project meetings and defenses. A good example of such a diagram is an exit plan affixed near the elevator in case of fire or other emergency.

Talking through a design with a CTO is a completely different task than talking through a system with another designer or a technical resource. The technical details of the design have to be pitched correctly; you must present useful information with sufficient detail to ensure comfort in the project or confidence in the design.

If a suitable level of communication is not achieved and maintained, there is a danger of confusion, scope creep, and an unsuccessful project.

### Building a Realistic and Executable Plan of Approach


Following the information gathering phase, you can devise a realistic time frame and approach for the project. A key question to address is whether the project will be delivered in one big bang or in smaller, more manageable phases.

For example, in a recent vCloud project, I was required to deploy a secure and scalable hybrid cloud platform to release various e-discovery applications. It was possible, of course, to plan to make all applications available to users simultaneously, releasing nothing until all the project requirements were met. This approach requires a huge investment in terms of technical hours, and if the finished application does not meet user expectations, you have to start over.

A less risky approach is to separate the requirements into phases, with each phase working toward the vision. In the vCloud project I worked on, we used the following phases:

1. **Vendor selection—**In selecting the VMware datacenter hosting provider, we considered the requirements detailed in the information gathering phase.
2. **Proof of concept application—**We produced a proof of concept based on the solution design. The application the users were most familiar with was selected as the first candidate, and it was used to establish the process for verification and validation of the design.
3. **Production deployment of application—**Based on the lessons learned from the proof of concept, we released a single production application.
4. **Integration and management—**We implemented the support and operational management requirements.

Once phase 3 was complete, additional applications were deployed, using the processes developed from the first live deployment. Gradually we released all applications and created a full production platform with associated management and integration tools.

This phased release approach gave comfort to the business sponsor, who was able to witness regular application releases on a tight schedule. This staggered approach provided the opportunity for continuous platform improvements from one release to the next.

Key Topic

### General Guidelines for a Good Technical Design

Although every project is different and depends on several factors, a good technical design should:

- Be simple and easy to reproduce
- Be scalable
- Be cost efficient
- Be fault tolerant
- Have a total cost of ownership that the business can achieve
- Be supportable

One useful addition to every technical design is a section that justifies the design choices and references the original requirements, constraints, risks, and so on. This extra information demonstrates to the business project sponsor that all the requirements have been seriously considered, and it also assists the designer in validating his or her thought process at the next project iteration.

### Learning from Experience

How do you know if a project has been successful?

Early in my career as a Windows engineer, I worked on many Microsoft Exchange projects. Microsoft Exchange can be deployed in various ways, and it does have some great functionality. For instance, I remember well the excitement surrounding the release of Outlook Anywhere, and the massive impact it had. Users were suddenly able to double-click on an icon and check email without a VPN! The underlying system, however, was not completely fault tolerant, and the single points of failure were unlikely to satisfy uptime requirements if they failed.

This is an example of a project evolving from "Building a highly available messaging solution for the company based on a standard supportable platform" to "Enabling users to access email from any location without the use of a VPN."

As you work on a project, ensure that at every stage of the project, the vision and requirements remain in clear view. It is easy to lose sight of the vision or goal and fall prey to scope creep. Both the vision and requirements should be clearly defined and not open to interpretation.

### Measuring Project Success

"That will do." This everyday saying makes many people shudder; however, it can be very true with technical design.

A company needs a sensible design to be delivered on time and within budget, and it needs the design to meet requirements while observing risks and assumptions and operating around constraints.

*"True perfection has to be imperfect; I know that sounds foolish, but it's true."*

*—Noel Gallagher*

Your project may be far from perfect, but if it meets its vision while respecting all requirements, then it can be regarded as a success. Any imperfections can be fixed either as a business-as-usual exercise or during a period of stabilization.

## Exam Preparation Tasks

## Review All Key Topics

Review the most important topics in the chapter, noted with the key topics icon in the outer margin of the page. Table 1-2 lists these key topics and the page number on which each is found.

**Table 1-2** Key Topics

| Key Topic Element | Description | Page |
|---|---|---|
| Paragraph | The Technical Design Process | 7 |
| Paragraph | Building a Realistic and Executable Plan of Approach | 11 |
| List | General Guidelines for a Good Technical Design | 12 |

## Design Scenarios

Create your own standard templates for a high-level design process:

- Write down the components of a design process as headings in a document.
- Think of a project you have worked on as an engineer. Fill in each component area with bullet points to consider. This is the start of your HLD.
- Start to flesh out the HLD. Add more detail, such as what your company's security policy specifies with regard to encryption, uptime, and so on.
- Use the HLD to create a one-page summary of the project. Construct a diagram of the solution. (Logical and physical designs are discussed in Chapter 4, "Developing a Design on Paper and Delivering It Physically")
- The skills needed for these tasks are assumed in the VCAP5-DCD exam.

## Definitions of Key Terms

Define the following key terms from this chapter and check your answers in the glossary.

Vision, Requirement, Constraint, Risk, Assumption

## Read the Technical Material with a Designer's Hat On

- No specifically defined or examined design process exists for the VCAP5-DCD; you must adapt a suitable one with which to work throughout your exam preparation.
- Study the recommended reading on the VCAP5-DCD blueprint, ensuring that you work to the latest exam version; slight changes in documentation or content often appear without warning.
- Although the VCAP5-DCD exam is a highly technical one, try to look past the technical facts and consider the impact of the settings or functionalities. For example, do not simply memorize the requirements for vMotion but consider the effect of guest virtual machines not meeting those vMotion requirements. Will the cluster become imbalanced? What is the importance of initial guest placement? What affect will DRS have?
- Know the VMware design terminology. Technical knowledge is great, but this exam also requires you to understand business requirements. If you don't have experience with design work, remember to ask questions such as, "Is this the best way? Is it still simple? Is it required? Does its meet the requirements?"

## Review Questions

The answers to these review questions are in Appendix A.

1. You are working on a hybrid cloud project, where production applications (yet to be fully developed) are to be deployed. Which of the following is a project requirement?
   a. The production data must be in the UK at all times.
   b. The hosting partner provides sufficient resources, without overcommitting, to support application load.
   c. The hosting provider meets uptime expectations.
   d. The development team provides the software on time.

2. In the project life cycle, who defines the vision?
   a. The IT architect
   b. The software vendor
   c. The business

3. Which of the following describes an item that is taken to be true at the design phase but has not been tested prior to execution?
   a. Requirement
   b. Constraint
   c. Assumption
   d. Risk

4. You are a virtualization consultant working on a disaster recovery project. You have proposed a solution that uses SAN technology to replicate production virtual machine files. This meets a cold standby requirement. During a design workshop meeting several points are raised. Which of the following could be a design constraint?
   a. The hardware currently being used in the datacenter is no longer supported.
   b. The company is undecided about the choice of centralized storage to be used in the enterprise.
   c. The company is at the end of year one of a three-year contract for the point-to-point link between site A and site B. This link is currently 10MB.

5. You are a technical consultant designing a solution for a web retail company. The project vision is to deploy a hybrid cloud, where the internal team develops the website on internal infrastructure and migrates production-ready applications to a hosting provider. The project is expected to ease deployment and require less infrastructure capital expenditure without lowering application quality. Which of the following is a risk associated with the project?
   a. The solution must adhere to ISO27001.
   b. Change control of the hosting vCloud platform is not under full control of the internal business.
   c. The hosting provider outsources the platform support to the platform vendor.
   d. The applications to be deployed are not fully developed, although a beta exists.

6. A project vision in some cases may not be achieved due to constraints, risks, and other project factors. However, a vision is required to guide the project throughout the life cycle.
   a. True
   b. False

7. When should a software vendor's best practice be adhered to? (Choose all that apply.)
   a. Whenever possible, respecting other project requirements
   b. At all times because the vendor wrote and designed the software
   c. When there are no other requirements, as a guide to configuration

8. The following diagrams may be included in project documentation. Which of them shows a system's components and how they could affect each other?
   a. Logical
   b. Entity relationship diagram
   c. Physical diagram

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**This chapter covers the following subjects:**

- **Gathering Information and Spotting the Gaps:** This section explains how to start a project from a technical design perspective.
- **Presenting the Data Gathered:** This section covers what should be produced as part of the information gathering and logical design phase.
- **Real-Life Tips:** This section explains the processes to follow when gathering information and the types of information to collect.

This chapter covers the following objectives of the VCAP5-DCD blueprint:

Objective 1.2, "Gather and analyze application requirements"

Objective 2.1, "Map business requirements to the logical design"

Objective 2.2, "Map service dependencies"

Objective 2.5, "Build performance requirements into the logical design"

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