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MCITP EXAM
70-686

Windows® 7 Enterprise Desktop Administrator

Craig Zacker
Orin Thomas

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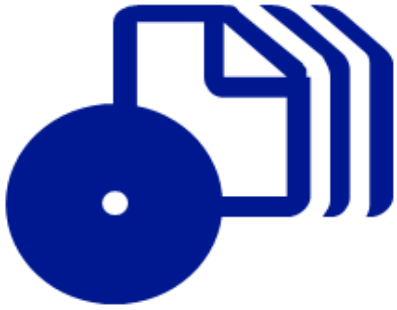

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Exam 70-686: Pro: Windows 7, Enterprise Desktop Administrator

OBJECTIVE	CHAPTER	LESSON
1. PLANNING AND MANAGING A CLIENT LIFE CYCLE STRATEGY		
1.1 Plan and manage client licensing and activation.	Chapter 2	Lesson 1
1.2 Plan and manage software updates.	Chapter 8	Lessons 1 and 2
1.3 Plan and manage a physical hardware and virtualization strategy.	Chapter 2	Lesson 2
2. DESIGNING A STANDARD IMAGE		
2.1 Design an image creation strategy.	Chapter 3	Lesson 1
2.2 Design a custom image.	Chapter 3	Lesson 2
2.3 Define an image update strategy.	Chapter 3	Lesson 2
3. DESIGNING CLIENT CONFIGURATIONS		
3.1 Design standard system settings.	Chapter 4	Lessons 1 and 2
3.2 Define client security standards.	Chapter 5	Lesson 1
3.3 Define Windows Internet Explorer settings.	Chapter 5	Lesson 2
4. DESIGNING A WINDOWS 7 CLIENT DEPLOYMENT		
4.1 Analyze the environment and choose appropriate deployment methods.	Chapter 6	Lessons 1 and 2
4.2 Design a lite-touch deployment strategy.	Chapter 7	Lesson 1
4.3 Design a zero-touch deployment strategy.	Chapter 7	Lesson 2
4.4 Design a user state migration strategy.	Chapter 2	Lesson 3
5. DESIGNING APPLICATION PACKAGES FOR DEPLOYMENT		
5.1 Design a delivery or deployment strategy.	Chapter 9 Chapter 10	Lesson 1 Lessons 1 and 2
5.2 Manage application compatibility.	Chapter 9	Lesson 2
6. IDENTIFYING AND RESOLVING DEPLOYMENT AND CLIENT CONFIGURATION ISSUES		
6.1 Identify and resolve Internet Explorer issues.	Chapter 11	Lesson 1
6.2 Identify and resolve Group Policy issues.	Chapter 11	Lesson 2
6.3 Identify and resolve networking issues.	Chapter 12	Lesson 1
6.4 Identify and resolve authentication and authorization issues.	Chapter 12	Lesson 2

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Introduction

This training kit is designed for Windows desktop administrators who want to update their current certification credentials to reflect their experience with Windows 7. As a desktop administrator, you have at least three years of experience installing, configuring, and administering clients in a medium to very large Windows network environment. You are likely responsible for deploying operating systems and applications, and should be familiar with the client administration capabilities of Windows Server 2008 R2 and the System Center suite of products. The Preparation Guide for Exam 70-686 is available at *http://www.microsoft.com/learning/en/us/exam.aspx?id=70-686*.

By using this training kit, you will learn how to do the following:

- Plan and manage a client life cycle strategy.
- Design a standard image.
- Design client configurations.
- Design a Windows 7 client deployment.
- Design application packages for deployment.
- Identify and resolve deployment and client configuration issues.

Refer to the objective mapping page in the front of this book to see where in the book each exam objective is covered.

Hardware Requirements

We recommend that you use a test workstation, test server, or staging server to complete the practice exercises in each lesson. However, it would be beneficial for you to have access to production-ready data in your organization. If you need to set up a workstation to complete the practices, the minimum system requirements follow:

- Personal computer with at least a 1-GHz 32-bit (x86) or 64-bit (x64) processor
- At least 1 GB of RAM (x86 systems) or 2 GB of RAM (x64 systems)
- At least a 40-GB hard disk
- DVD-ROM drive
- Super VGA (800 x 600) or higher resolution video adapter and monitor
- Keyboard and Microsoft mouse or compatible pointing device

For some chapters, your workstation must have access to an Active Directory Domain Services network. Chapter 10, "Using Application Deployment Tools," requires access to a computer running Windows Server 2008 R2.

Software Requirements

The practices in each chapter have various software requirements, all consisting of products available as free downloads from the Microsoft Download Center at *http://www.microsoft.com/downloads/*. The following software is required to complete the practices.

- Microsoft Assessment And Planning Toolkit
- Microsoft Windows Automated Installation Kit for Windows 7
- Microsoft Deployment Toolkit 2010
- Microsoft Internet Explorer Administration Kit
- Microsoft Baseline Security Analyzer 2.2
- Microsoft SQL Server 2008 Express
- Microsoft Application Compatibility Toolkit

Using the Companion Media

The companion media (CD/DVD) included with this training kit contains the following:

- **Practice tests** You can reinforce your understanding of how to configure Windows Vista by using electronic practice tests you customize to meet your needs from the pool of Lesson Review questions in this book, or you can practice for the 70-686 certification exam by using tests created from a pool of 200 realistic exam questions, which give you many practice exams to ensure that you are prepared.
- **An eBook** An electronic version (eBook) of this book is included for when you do not want to carry the printed book with you.

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How to Install the Practice Tests

To install the practice test software from the companion CD to your hard disk, perform the following steps:

1. Insert the companion CD into your CD drive and accept the license agreement. A CD menu appears.

> ***NOTE*** **IF THE CD MENU DOES NOT APPEAR**
>
> **If the CD menu or the license agreement does not appear, AutoRun might be disabled on your computer. Refer to the Readme.txt file on the CD for alternate installation instructions.**

2. Click Practice Tests and follow the instructions on the screen.

How to Use the Practice Tests

To start the practice test software, follow these steps:

1. Click Start, click All Programs, and then select Microsoft Press Training Kit Exam Prep. A window appears that shows all the Microsoft Press training kit exam prep suites installed on your computer.
2. Double-click the lesson review or practice test you want to use.

> ***NOTE*** **LESSON REVIEWS VS. PRACTICE TESTS**
>
> **Select the (70-686) Pro: Windows 7, Enterprise Desktop Administrator *lesson review* to use the questions from the "Lesson Review" sections of this book. Select the (70-686) Pro: Windows 7, Enterprise Desktop Administrator *practice test* to use a pool of 200 questions similar to those that appear on the 70-686 certification exam.**

Lesson Review Options

When you start a lesson review, the Custom Mode dialog box appears so that you can configure your test. You can click OK to accept the defaults, or you can customize the number of questions you want, how the practice-test software works, the exam objectives to which you want the questions to relate, and whether you want your lesson review to be timed. If you are retaking a test, you can select whether you want to see all the questions again or only the questions you missed or did not answer.

After you click OK, your lesson review starts.

- **Article I** To take the test, answer the questions and use the Next and Previous buttons to move from question to question.
- **Article II** After you answer an individual question, if you want to see which answers are correct—along with an explanation of each correct answer—click Explanation.
- **Article III** If you prefer to wait until the end of the test to see how you did, answer all the questions, and then click Score Test. You will see a summary of the exam objectives you chose and the percentage of questions you got right, both overall and per objective. You can print a copy of your test, review your answers, or retake the test.

Practice Test Options

When you start a practice test, you choose whether to take the test in Certification Mode, Study Mode, or Custom Mode:

- **Certification Mode** Closely resembles the experience of taking a certification exam. The test has a set number of questions. It is timed, and you cannot pause and restart the timer.
- **Study Mode** Creates an untimed test during which you can review the correct answers and the explanations after you answer each question.
- **Custom Mode** Gives you full control over the test options so that you can customize them as you like. In all modes, the test user interface is basically the same but with different options enabled or disabled depending on the mode. The main options are discussed in the previous section, "Lesson Review Options."

When you review your answer to an individual practice test question, you see a "References" section that lists where in the training kit you can find the information that relates to that question and provides links to other sources of information. After you click Test Results to score your entire practice test, you can click the Learning Plan tab to see a list of references for every objective.

How to Uninstall the Practice Tests

To uninstall the practice test software for a training kit, use the Program And Features option in Windows Control Panel.

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Preparing for the Exam

Microsoft certification exams are a great way to build your resume and let the world know about your level of expertise. Certification exams validate your on-the-job experience and product knowledge. Although there is no substitute for on-the-job experience, preparation through study and hands-on practice can help you prepare for the exam. We recommend that you augment your exam preparation plan by using a combination of available study materials and courses. For example, you might use the Training Kit and another study guide for your "at home" preparation, and take a Microsoft Official Curriculum course for the classroom experience. Choose the combination that you think works best for you.

CHAPTER 1

Preparing to Deploy Windows 7

The smaller the enterprise, the less formal and complex its software deployment process tends to be. It is not unusual for a single team of administrators to be responsible for the conception, planning, and execution of an entire workstation deployment in a small to medium-size company. When the team consists of individuals who work together every day, collaboration and communication are relatively simple matters; the whole group can easily gather to report their progress to their managers.

Take, for example, the process of designing image files, as covered in Chapter 3, "Creating and Managing System Images." For a small network, administrators can address easily issues such as how many images to create and of what type. Factors affecting these decisions, such as the number of client roles required, are manageable, and all of the people involved in the imaging process are likely to be available for consultation.

For a large enterprise, however, this same image creation process can be enormously complex. A company with thousands of users and dozens of offices around the world might require hundreds of image files that support a great many client roles, each in multiple languages. The team needed just to create and manage these image files could be far larger than the entire deployment team for a small company.

Lesson 1 of this chapter examines the entire Windows 7 deployment process, from planning to execution to retirement. Lesson 2 discusses how to gather the information you might need at the commencement of such a process.

Exam objectives in this chapter:

This chapter provides a high-level overview of the Windows 7 workstation life cycle and describes how to gather the information you need to deploy and support Windows 7 in an enterprise environment. You might therefore say that Chapter 1 covers all of the 70-686 exam objectives in general and none of them in particular.

Lessons in this chapter:

- Lesson 1: Understanding the Windows 7 Deployment Life Cycle **3**
- Lesson 2: Gathering Upgrade Information **23**

Before You Begin

Although this training kit is dedicated largely to the process of deploying Windows 7, most of the tools involved in the deployment process can run on other operating systems as well. To install and run Microsoft Assessment And Planning (MAP) Toolkit 5.0, described in this chapter, you must have the following:

- A computer running Windows 7, Windows Vista, Windows XP SP2, Windows Server 2008 R2, Windows Server 2008, or Windows Server 2003 R2, with all available updates installed.
- Microsoft .NET Framework 3.5 SP1.
- Microsoft Office Word 2007 or Word 2003 SP2.
- Microsoft Office Excel 2007 or Excel 2003 SP2.
- Microsoft Office PowerPoint 2007.
- Microsoft Office Primary Interop Assemblies for Word and Excel.

REAL WORLD

Craig Zacker

Mass deployments of new operating systems or applications often have repercussions that haunt you long after all of the immediate technical problems are resolved. IT people are naturally inclined to dwell on the technical aspects of the deployment process; they might have to work hard to provide adequate consideration for its other aspects, such as approval by nontechnical managers, end-user training, and budgetary issues.

A company I once worked for decided to replace its existing e-mail client with a comprehensive groupware platform that, our new IT director insisted, would revolutionize the company's workflow and increase productivity across the board. The planning for the deployment, spearheaded by the director, was rushed, but the project proceeded on time and on budget. On the appointed morning, an army of IT staffers, with temporary reinforcements, flooded into the office, displacing users from their computers so that they could install the new application.

Unfortunately, the application deployment plan had omitted the real object of the exercise: to give the application's users a better work tool. With no training, no documentation, and virtually no help, everyone in the company had to muddle their way through learning to use a new e-mail client that was utterly different from any they had used before. Rather than increase productivity, the deployment slowed the work of many users for weeks. Before any palpable improvement was realized, the company had to pay for a series of expensive visits from several per diem consultants.

The project needed a much longer planning phase and a much wider base of advisors and contributors, including end-users and their supervisors. Additional time spent planning is rarely wasted and should include input from all concerned parties.

Lesson 1: Understanding the Windows 7 Deployment Life Cycle

The bulk of this training kit is devoted to the process by which Windows 7 desktop administrators design a workstation deployment on an enterprise network. Subsequent chapters in this book discuss the processes by which administrators design and create image files, decide on a baseline client configuration, package applications, and select a deployment strategy. The primary tool for designing and implementing mass Windows 7 deployments is Microsoft Deployment Toolkit 2010. However, depending on the size and complexity of the network, the processes listed here can be but a small part of the overall deployment process.

After this lesson, you will be able to:

- Understand the phases involved in a large scale deployment of Windows 7 workstations.
- Review the life cycle of a Windows 7 workstation.

Estimated lesson time: 90 minutes

Scaling the Deployment Process

How many people do we need for the image team? Should they be centrally located or distributed around the world? Who is going to evaluate the client roles required for each branch office? Where should we create and update the image files? These are just a few of the hundreds of questions that go beyond the scope of the imaging process as described in this training kit. What's more, in a large enterprise deployment, administrators must discuss, codify, and document the answers to these questions, not just handle them informally as the project proceeds, as is often possible in a smaller enterprise.

Image design and creation is just one part of a lengthy and complicated workstation deployment process. Windows 7 desktop administrators involved in a large-scale deployment must understand that they are part of a much larger and farther-reaching process than they might imagine. The deployment process begins long before they design and create their first image file and ends long after they complete the final workstation installations.

Viewing the Highest Level

The tools and documentation included in Microsoft Deployment Toolkit (MDT) 2010 cover the basic tasks of the Windows 7 workstation deployment process. Deployment Workbench, the primary MDT 2010 tool, is shown in Figure 1-1. The deployment process includes such hands-on tasks as building a reference computer, capturing image files from it, and deploying those image files to the target workstations on the network. However, these tasks are just a subset of the entire enterprise deployment process.

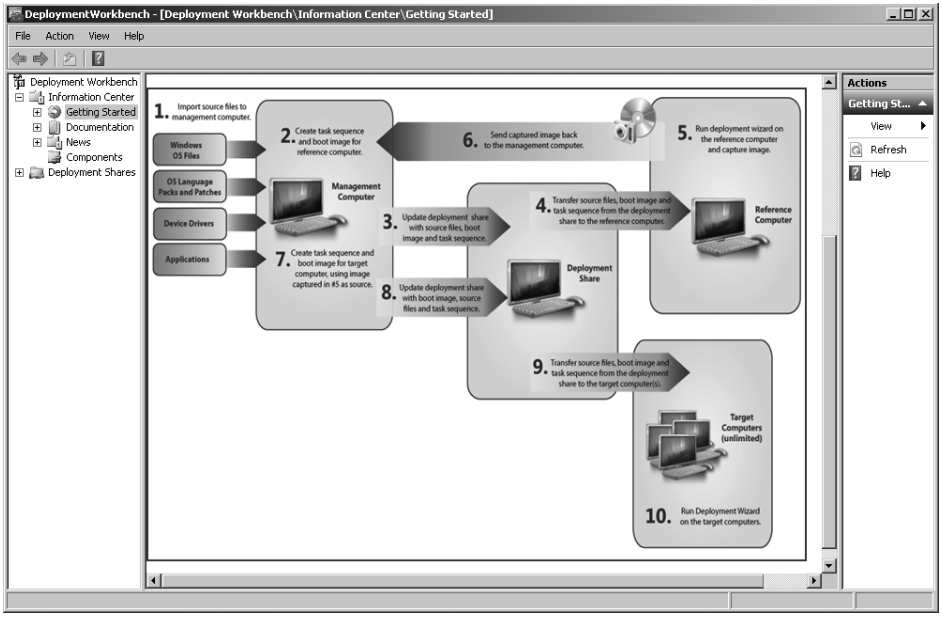


FIGURE 1-1 The Deployment Workbench tool from Microsoft Deployment Toolkit 2010

When Windows 7 desktop administrators take part in a large-scale workstation deployment, they are often required to devote themselves primarily to the technical details of the project, or possibly the details of one small part of the project. For this reason, they often lose sight of the big picture—the high-level conception, planning, and supervision that make a large IT project possible.

In previous MDT versions, including MDT 2008, the documentation supplied with the package included a "Planning Guide," a series of job aids, and other documents that defined the place of the MDT deployment process within the bigger picture of an IT service life cycle. However, beginning with MDT 2008 Update 1, Microsoft removed this high-level documentation from the MDT package, in an effort to streamline what was already a document-heavy product.

This was a reasonable decision because the inclusion of the "Planning Guide" and other documents implied that every MDT deployment required a massive organizational effort, which is simply not the case. Therefore, instead of including this documentation in MDT 2010, Microsoft refers administrators to the original source for this high-level information: the Microsoft Operations Framework (MOF), the current version of which is MOF 4.0.

MORE INFO **COMPARING MOF VERSIONS**

For those familiar with the "Planning Guide" and other MOF-derived documents provided in MDT 2008, be aware that these documents are based on Microsoft Operations Framework 3.0. Compared to MOF 3.0, version 4.0 expands the scope of its guidance beyond operations to cover the entire IT service life cycle.

There are also substantial changes in the organization and nomenclature of the framework. For example, MOF 3.0 divides the IT service life cycle into four units that it calls quadrants, while MOF 4.0 defines three elements, known as phases. The "Microsoft Operations Framework Foundations" document (version 2.5, included as part of the MOF 4.0 IT Pro Quick Start Kit) includes a detailed discussion of the differences between MOF 3.0 and MOF 4.0, as well as a table that maps the 3.0 elements onto their 4.0 counterparts.

Microsoft also documents the MDT deployment process using the Microsoft Solutions Framework (MSF), a set of documents designed to guide the software development process, but which are also applicable to other IT projects, such as large-scale workstation deployments.

MORE INFO **DOWNLOADING MOF 4.0**

The core Microsoft Operations Framework 4.0 package, plus a number of updates and ancillary documents, is available free of charge from the Microsoft Download Center at *http://www.microsoft.com/downloads/details.aspx?FamilyId=457ED61D-27B8-49D1-BACA-B175E8F54C0C&displaylang=en*.

Introducing the MOF

The goal of MOF 4.0 is to define the entire life cycle of an IT service, beginning from the initial recognition of a need, proceeding through the planning, building, and deployment processes, and culminating in operation and finally retirement. The basic structure of the life cycle, as illustrated in Figure 1-2, consists of three distinct phases: Plan, Deliver, and Operate, all of which are figuratively surrounded by—and answerable to—a Manage layer.

FIGURE 1-2 The phases of the MOF life cycle

The three phases are defined as follows:

- **Plan** The Plan phase refers not to specific IT service deployment plans but to a generalized understanding between the IT department and the business management elements of the organization. The object is for these two elements to reach an understanding about how IT services will support the business, how the reliability of IT services will be managed, ensured, and supervised, and what financial structure will support the organization's IT strategy.
- **Deliver** The Deliver phase encompasses the actual conception, planning, implementation, testing, and deployment of IT services. The MDT 2010 deployment process occurs primarily in the Deliver phase.
- **Operate** The Operate phase defines the procedures that ensure the stable operation, maintenance, and support of the deployed IT services. This phase also includes the eventual retirement of IT services at the end of their life cycles.

Using Service Management Functions

These phases are described in a series of white papers called service management functions (SMFs), each of which defines processes and activities for a specific aspect of each phase, as well as the roles of the people who perform them. Table 1-1 lays out the SMFs for the Plan phase.

TABLE 1-1 Service Management Functions for the MOF Plan Phase

SMF	PURPOSE
Business/IT Alignment	To recognize the needs of the organization and define a portfolio of IT services that address those needs
Reliability	To establish performance standards for IT services that meet the organization's requirements for service availability, continuity, capacity, and data integrity

SMF	PURPOSE
Policy	To define a set of policies for IT services that meet the organization's requirements in matters of security, privacy, and appropriate use
Financial Management	To estimate, optimize, and account for the costs involved in delivering IT services throughout their life cycles

Table 1-2 describes the SMFs for the Deliver phase.

TABLE 1-2 Service Management Functions for the MOF Deliver Phase

SMF	PURPOSE
Envision	To conceptualize a solution to a particular need of the organization in the form of an IT service and define the scope and potential risks involved in implementing the project
Project Planning	To create a project plan that specifies the design and features of an IT service that addresses the stated needs of the organization and is agreeable to all stakeholders involved in the project
Build	To implement an actual solution that meets the specifications defined in the project plan and the expectations and requirements of all the stakeholders involved in the project
Stabilize	To fully test the solution, using laboratory or pilot deployments, and resolve any issues exposed by this testing so as to create a high-quality solution that fully meets the specifications defined in the project plan
Deploy	To implement the solution in a production environment in a manner that fully meets the expectations of all stakeholders in the project, as well as to smoothly transfer responsibility for the service from the project team to the operations and support personnel

MORE INFO **MOF AND THE MICROSOFT SOLUTIONS FRAMEWORK**

The SMFs of the Deliver phase, as well as the Operations SMF from the Operate phase, are largely derived from the Microsoft Solutions Framework (MSF) process model. MSF is a collection of documents that are primarily intended to govern database and application development projects but are adaptable to other large scale IT projects as well, such as workstation deployments. Unlike MOF, the MSF documents do not attempt to cover the entire life cycle of an IT service, just the tasks involved in envisioning, planning, developing, stabilizing, and deploying the application or service. For more information on MSF and to download the component documents, see *http://www.microsoft.com/downloads/details.aspx?familyid=A71AC896-1D28-45A4-880C-8B0CC8265C63&displaylang=en*.

Table 1-3 describes the SMFs for the Operate phase.

TABLE 1-3 Service Management Functions for the MOF Operate Phase

SMF	PURPOSE
Operations	To define the procedures needed to operate IT services while minimizing down time and maximizing efficiency
Service Monitoring and Control	To observe the ongoing health of IT services, anticipate potential problems, and take proactive steps to minimize the impact of those problems should they occur
Customer Service	To provide efficient and positive assistance to users of IT services, and address all complaints and other issues raised by those users
Problem Management	To predict potential problems and devise problem resolution procedures that generate workarounds and permanent solutions

The SMFs in Table 1-2 represent a sequence of procedures for a project in the Deliver phase. In the Plan and Operate phases, however, the processes defined in the various SMFs can in many cases occur simultaneously.

The Manage layer, which applies equally to all of the MOF life cycle phases, is designed to create a decision making, risk management, and change management infrastructure that is consistent throughout the life cycle of an IT service. The Manage layer too has its own SMFs, as listed in Table 1-4.

TABLE 1-4 Service Management Functions for the MOF Manage Layer

SMF	PURPOSE
Governance, Risk, and Compliance	To establish policies that delegate authority, accountability, and responsibility for the outcome of IT projects, assess the likelihood and possible impacts of actions taken or not taken, and ensure that everyone involved in a project is aware of and adheres to the policies and regulations resulting from senior management decisions
Change and Configuration	To manage project and service changes in a predictable and repeatable manner, while minimizing the risks inherent in those changes
Team	To define the roles of all team members involved in an IT service life cycle, including their responsibilities and accountabilities, and assign those roles to specific individuals

Management Reviews

Finally, the MOF life cycle model includes milestones in the form of periodic management reviews that evaluate the current state of the project and signal its readiness to move forward. These management reviews, and the phases with which they are associated, are listed in Table 1-5.

TABLE 1-5 Management Reviews in the MOF Life Cycle

MANAGEMENT REVIEW	PHASE	PURPOSE
Service Alignment	Plan	To evaluate a recognized need as having the potential to become a new project and, if it is approved, initiate the process of gathering information from management and stakeholders
Portfolio	Plan	To evaluate the proposal for a new project and, if it is approved, form a team, draft an initial project charter, and signal the Deliver phase to commence
Project Plan Approved	Deliver	To evaluate a completed project plan and, if it is approved, signal the commencement of the Build stage
Release Readiness	Deliver	To evaluate the results of the Stabilize process, confirm the satisfactory completion of all laboratory testing and pilot deployments, verify that the team has addressed all issues arising during those processes, and signal the readiness for the Deploy process to begin
Operational Health	Operate	To evaluate the current health of projects in the Operate phase and, if necessary, modify the procedures established during that phase
Policy and Control	Manage	To evaluate the current state of a service relative to the policies established during the Governance, Risk, and Compliance process and, if necessary, initiate changes to the compliance mechanisms currently in place or to the policies themselves

The phases of the MOF life cycle, along with their component SMFs and management reviews, are shown in Figure 1-3.

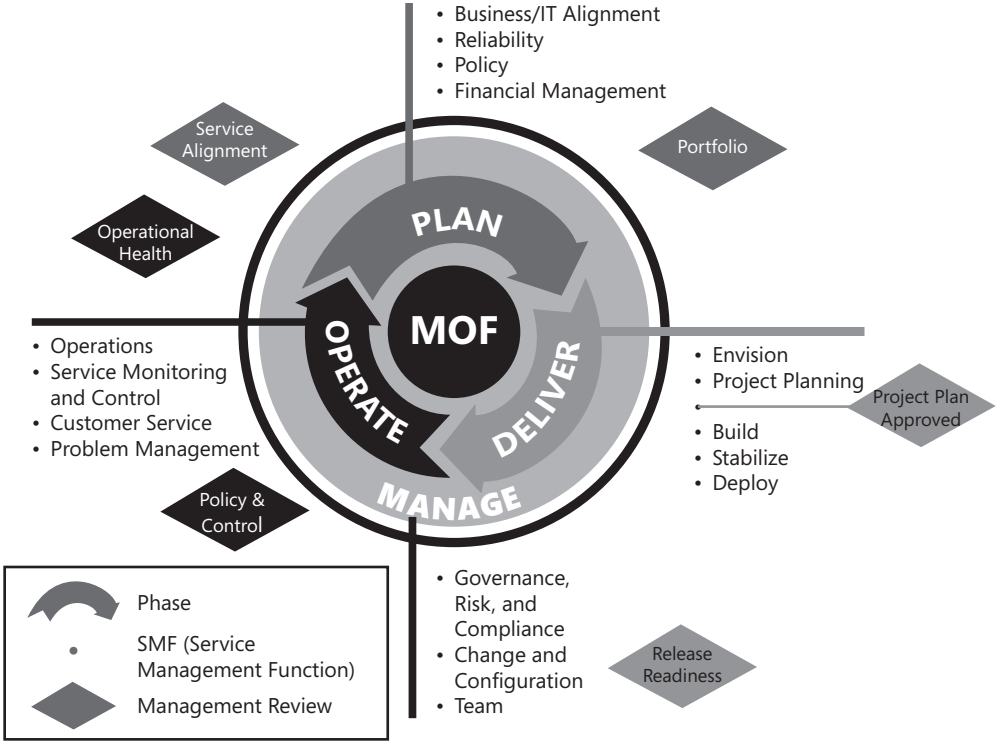


FIGURE 1-3 The phases of the MOF life cycle, with SMFs and management reviews

Placing an MDT Deployment in the MOF Life Cycle

The following scenario portrays the entire life cycle of a Windows 7 workstation deployment in terms of the SMFs in the Microsoft Operations Framework, from the realization of a need through deployment, and all the way to the ultimate retirement of the computers, sometime in the future. An organization undertaking a large-scale Windows 7 workstation deployment often has company-wide and IT-specific management policies already in place. This scenario at times assumes the existence of these policies.

> ***NOTE*** **UNDERSTAND THE SMF SEQUENCE**
>
> **As mentioned earlier, the Manage layer of the MOF life cycle applies equally to the Plan, Deliver, and Operate phases, and its SMFs can appear (and reappear) almost anywhere in the life cycle. In much the same way, the management reviews occur at various times during the three phases.**

Realizing the Need

A. Datum Corporation is opening a new Genetic Research division, for which they have leased an entire new office building. The new division must be operational by July 1 of the next year. The process of outfitting the new division with everything they need is a huge undertaking, involving virtually every one of the company's existing departments. The IT division is responsible for satisfying the highly specific and specialized computing requirements of the new personnel, one specification of which is the deployment of new workstations.

Management Review: Service Alignment

Largely a formality in this case, because the formation of the new division is already approved and the new personnel must have computers and other equipment, the company management officially recognizes the need for a workstation deployment, along with a variety of other IT projects related to the rollout of the new division. The process of gathering the information needed to begin the project from stakeholders, managers, and other personnel can begin.

The Plan Phase

The SMFs in the Plan phase, shown in Figure 1-4, encompass all of the currently operative IT services and are therefore already in use. The following sections describe how the meetings and practices generated by those SMFs apply to the workstation deployment.

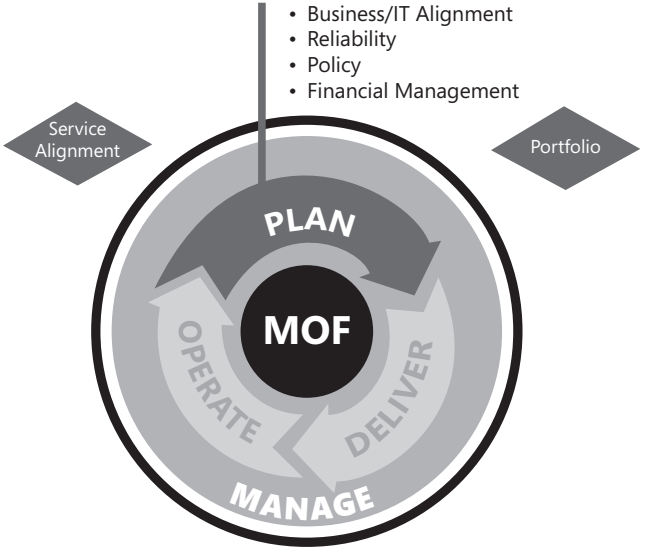


FIGURE 1-4 The Plan phase of the MOF life cycle

GOVERNANCE-RISK-COMPLIANCE

The vice president responsible for the creation of the new division meets with the new director of Genetic Research and the IT director, to discuss the extension of existing company governance, risk, and compliance (GRC) policies to encompass the new division and the upcoming IT projects needed to support that division. Eventually, as the directors fill positions and form teams in their divisions, additional managers and supervisors attend the GRC meetings as well.

During these meetings, the vice president and the directors do the following:

- Establish a chain of command and define the responsibilities and accountabilities of all personnel in supervisory positions, whether permanently or for the life of a specific project.
- Discuss the possible consequences of failure to adhere to the policies and requirements defined by management, both in terms of project failures and personal culpability, as wells as methods for minimizing the risk of such failures.
- Impress upon all supervisory personnel the need for compliance with established policies throughout the enterprise.

GRC meetings, which actually constitute part of the Manage level, as shown in Figure 1-5, continue at regular intervals throughout the life of the project.

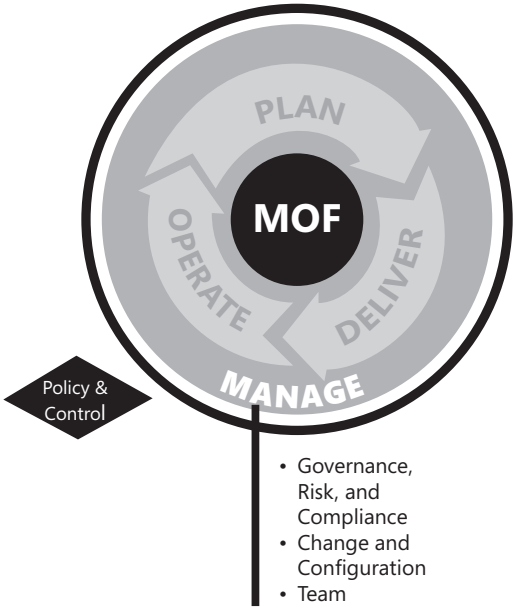


FIGURE 1-5 The Manage level of the MOF life cycle

POLICY

The company already has policies in place that govern the nondisclosure of company information, the privacy of employees' personal information, and appropriate use of company computing facilities. However, the Genetic Research division will do classified work for government agencies, which increases both the need for high security and the consequences of noncompliance.

The vice president meets with the director of security and a government security consultant to discuss the specialized policies that they need to prevent secret information from leaking, both within and outside the company. In later meetings, the IT director is involved to discuss the technical feasibility of some of the requirements. Among many other considerations, the conferees decide that the new workstations must all have encrypted local storage and biometric authentication capability.

These meetings produce a new policy addendum for the Genetic Research division and a list of technical security requirements for the IT rollout, including the encryption and authentication mechanisms for the new workstations.

RELIABILITY

The IT division already has policies and technologies in place to ensure high availability of data and services, so the IT director meets with the Genetic Research director and a government consultant to discuss whether the existing measures are sufficient for the new division. They all approve the existing high availability technologies; the conferees agree to use the same reliability plan as the rest of the enterprise.

BUSINESS/IT ALIGNMENT

The directors of Genetic Research and IT, along with various managers and representatives from both divisions, meet to discuss, among other things, the workstation requirements for the new division. The Genetic Research scientists will use many specialized software products and also require computers that can work with microscopes and other scientific hardware devices. The result is a service map that defines both the workstation requirements already established by the company managers for existing users and the new division's various types of users. The service map for the workstation deployment consists of the following sections:

- **Customers** Lists the categories of users who require workstations
- **Hardware** Lists the basic hardware requirements for the workstations
- **Applications** Lists the types of applications that will run on the workstations
- **Settings** Lists specialized configuration settings that the workstations will need
- **Services** List the internal and external services that the workstation will access

These are highly general specifications, intended to provide only the most basic estimation of the requirements.

CHANGE AND CONFIGURATION

The service map for the Genetic Research workstations is substantially different from that for the typical A. Datum user workstation. For this reason, the documents that the IT director submits to the financial and management teams include a Request For Change (RFC), which lists the reasons why these workstations differ from the company standard and why they cost more.

FINANCIAL MANAGEMENT

IT people meet with the financial team and, using a previous workstation deployment as a guide, create a budget model that reflects cost changes since the earlier project and the special requirements of the Genetic Research division users.

MANAGEMENT REVIEW: PORTFOLIO

The IT director assembles the various documents defining the criteria for the workstation deployment and into a project proposal. The management team decides that the proposed project meets the company's business and financial requirements, as well as those of the prospective customers—the Genetic Research division—and approves the proposal, allowing the project to proceed to the Deliver phase.

TEAM

The IT director, in cooperation with the rest of the management team and the Genetic Research director, creates a roster for the team that will manage the workstation deployment project. The roster defines the duties and responsibilities of the various team members. The managers then select individuals to fill the roles and hand the workstation deployment project off to the new team.

The Deliver Phase

After the project enters the Deliver phase, as shown in Figure 1-6, the tasks defined in the SMFs correspond to the basic stages of the deployment process, as defined in MDT 2010.

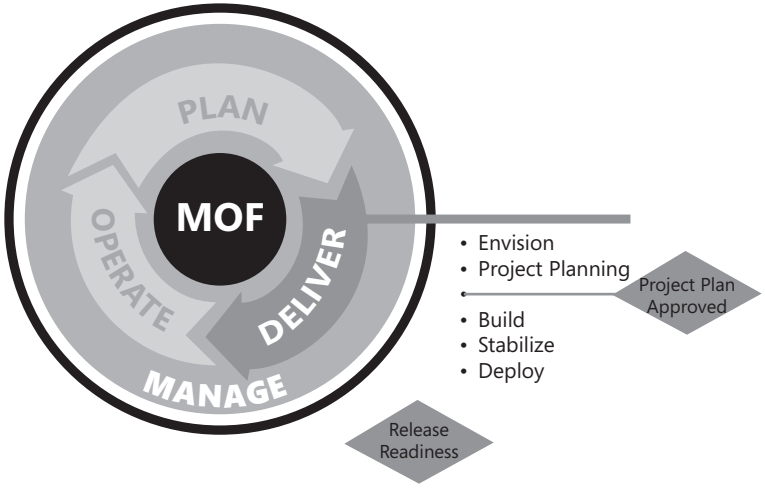


FIGURE 1-6 The Deliver phase of the MOF life cycle

ENVISIONING THE GOALS

The process of envisioning the goals of the workstation deployment project actually began during the Plan phase, with the stipulations documented during the Policy, Reliability, and Business/IT Alignment meetings. However, these stipulations were basic premises: high-level observations that enabled the management team to create a project proposal. The Envision SMF calls for a more detailed analysis of the business requirements that the new workstations for the Genetic Research division must satisfy.

For this particular workstation deployment project, the envisioning process produces a list of user types in the new division and an inventory of the tasks that users of each type are required to perform using their workstations. With this information, the IT personnel on the project team can begin to determine the exact hardware and software requirements for each workstation. This information goes into a vision/scope document that defines in detail the overall goals of the project.

During the envisioning process, the project management team begins defining the roles for the project delivery team—the individuals who will be responsible for planning, building, testing, and deploying the new workstations. Each of these tasks of the Deliver phase requires its own team; each of these is a subgroup of the overall project delivery team. Although it is not necessary to name all members of the team at this point, the project managers install the core team members. These include the individuals who will lead each of the subgroups and other people who begin to work immediately on the planning process and the construction of the test laboratory.

PROJECT PLANNING

With the vision/scope document in hand, the project delivery team can begin to plot the entire deployment process in detail. Their goals are to decide what to build, how to build it, and who will build it.

As part of their process, the team performs the following tasks:

- Evaluate hardware and software products and technologies
- Create a functional specification for the new workstations
- Define the individual processes involved in the remaining stages of the Deliver phase
- Designate subordinate groups to create individual process plans
- Create a master schedule for the remaining stages of the Deliver phase
- Combine the individual process plans into a master project plan for management review

For this deployment, many of the requirements established during the Plan phase and the Envision process are highly specific. The users in the Genetic Research division require specialized hardware and software tools, and building their workstations is primarily a matter of creating an efficient and workable environment for those tools. The product evaluation process consists largely of evaluating the system requirements for the tools that various types of users require and outfitting the workstations with appropriate components to accommodate them.

For the functional specification, the team evaluates the business requirements established during the Plan phase, as well as the requirements of the various types of users they must support. With this information, they design three separate workstation hardware/software configurations. For each configuration, the functional specification provides a complete and detailed description of the workstation's hardware, software, and configuration settings. This functional specification is the key document that guides the rest of the Deliver phase; it tells the Build team what to build, the Stabilize team what to test, and the Deploy team what to deploy.

IMPORTANT **FUNCTIONAL SPECIFICATIONS AND VERSION CONTROL**

After all of the stakeholders in the project approve the functional specification, the management accepts the document and places it under version control. The functional specification will probably require changes before the deployment is complete, but the version control mechanism tracks all of the changes made to the document and requires stakeholder approval before it allows anyone to make changes.

With the functional specification completed, the managers of the planning team assign teams to create detailed plans for the following elements of the Deliver phase:

- **Imaging** This plan specifies how many images the team will create, how they will create them, and how the operations team will manage them in the future.
- **Applications** This plan indicates the applications that the workstations will run and how to deploy them.
- **Configuration** This plan specifies the configuration settings that the team will deploy on the workstations, both for the operating system and for applications.
- **Testing** This plan sets a testing regimen for the workstations, which includes building a laboratory and executing pilot deployments.
- **Deployment** This plan describes how the team will deploy the images to the workstations and ready them for use.

After the planning subgroups complete their individual plans, the project delivery team assembles them into a single master plan and draws up a master schedule that accounts for all of the remaining tasks in the Deliver phase.

MANAGEMENT REVIEW: PROJECT PLAN APPROVED

The project delivery team submits the functional specification, the master plan, and the master schedule to the management team for review. After the management team approves these documents, the Build stage of the Deliver phase can begin.

BUILD

In the Build stage, the various delivery teams use all of the planning completed this far to realize a physical product and prepare it for final deployment. The IT management places the order for the new workstation computers immediately after the approval of the project plan.

The vendor is able to supply the computers with the exact hardware listed in the functional specification, so the build teams are responsible only for installing and configuring the operating system and the applications on each computer.

During the Build process, the teams created during the Project Planning stage might work together or separately. For example, the configuration and applications teams initially work together to create a viable workstation environment, according to the requirements stated in the master plan. This process must be near to completion before the imaging team can start creating and working with the actual images they eventually deploy. However, the imaging team members are also busy evaluating and selecting the tools they will use to create the images during the deployment, as well as the tools that the support personnel will use to maintain the workstations during the Operate phase of the life cycle.

Meanwhile, the testing team is preparing the laboratory environment that is required for the Stabilize phase. In a workstation deployment such as this, the lab computers also function as the reference computers for the creation of the actual deployment images, so the lab must duplicate the production workstation environment precisely. The testing team is also busy planning two pilot deployments, which involves the selection of appropriate users and the development of reporting and documentation procedures.

Documentation is a major concern throughout the Build stage, as it will be during the Stabilize and Deploy stages. To adequately support the workstations later, during the Operate phase, a complete documentation of the build process is required, as is a full record of the three final workstation configurations.

STABILIZE

The Build stage culminates in the creation of images that are nearly ready for deployment on the workstations, and the design of the process the team will use for the actual production deployment. But a team must first test both of these elements, in the lab and then in a pilot deployment. The testing team begins designing and constructing the laboratory during Project Planning stage, to be sure they have the necessary infrastructure to develop and create the workstation image files and to duplicate as closely as possible the actual working environment of the new workstations.

The IT division sets up a workroom that is equipped with the same network infrastructure used throughout the company, including its own servers, which they can isolate from the rest of the network for testing purposes. The testing team installs several of the new workstations intended for the Genetic Research division in this room. Because of the special requirements documented in the plan, the testers also take delivery of some of the scanning and microscopy equipment that the new users require. To help install, configure, and test the scientific equipment, the manufacturers have sent two technicians to A. Datum; the suppliers' technicians will function as adjuncts to the testing team.

The Build and the Stabilize stages of the Deliver phase are not sequential; many of their activities occur simultaneously, and it often seems that the two teams are actually functioning as one. As the builders generate interim versions of their image files, the testers deploy them in the lab and begin documenting issues for consideration in future builds.

After the two teams have generated images that are feature complete, the testing team performs pilot deployments to evaluate them further. Because the actual Genetic Research division is not operational yet, standard pilot deployments in the live environment are not possible. Therefore, the team plans two pilot deployments that they hope will simulate the live environment as closely as possible. The first uses a selected group of users in other divisions, and concentrates on testing general business requirements, such as security mechanisms. The second pilot deployment uses a group of Genetic Research division new hires, who the company is bringing in before the division launch especially for this testing. This pilot concentrates on the specialized scientific applications and hardware that require experienced users.

Both pilot deployments emulate real-world use in an attempt to expose any flaws in the plan or its implementation. The building and testing teams work together to assess, triage, and debug any problems that arise. During this stage, it might be necessary to revise the functional specification, the master plan, or the master schedule. If this is the case, all of the project's stakeholders must approve these revisions before they are adopted.

MANAGEMENT REVIEW: RELEASE READINESS

At the conclusion of the Stabilize process, the management team reviews all of the documentation generated during the testing and debugging processes. When team members conclude that the workstation environments are stable and meet all of the requirements set down in the master plan, they sign off on the build, signaling that the Deploy stage can begin.

DEPLOY

The deployment process has been carefully plotted during the Project Planning stage, and it has been tested during the Stabilize stage. Now, the live production deployment can begin with the installation of the workstations and other required hardware in the new site for the Genetic Research division. Other IT teams have already completed their own projects, to provide the division with the network infrastructure and other resources it will need to operate.

A hardware installation team first unpacks and assembles the new computers on site, testing them for basic functionality. The hardware order included spares, so the team can immediately swap out any computers that are nonfunctional on arrival.

With the hardware in place, the deployment team can begin the process of installing the completed image files on the workstations. Although the Stabilize process is formally ended, testing continues during the deployment because there are always variables that cannot be duplicated in the lab. Most of the issues that arise during the deployment likely concern the specialized scientific equipment, and it is prudent for the manufacturers to send technicians to the site. To take advantage of the technicians' presence, several of the operations team members participate in the sessions as well because they will likely have to service the equipment later.

The Deploy stage concludes with the installation of all of the planned workstations, fulfillment of all planned requirements, and the satisfaction of all stakeholders involved, including management, IT, and end users. The life cycle now proceeds from the Deliver phase to the Operate phase, with responsibility for the workstations passing to the operations teams.

The Operate Phase

The completion of the workstation deployments signals the beginning of the life cycle's Operate phase, as shown in Figure 1-7. The Operate phase is the culmination of the two phases that preceded it. The Plan phase was concerned with what workstations to build, and the Deliver phase with the process of building them. The Operate phase is all about keeping the workstations running smoothly after they are built.

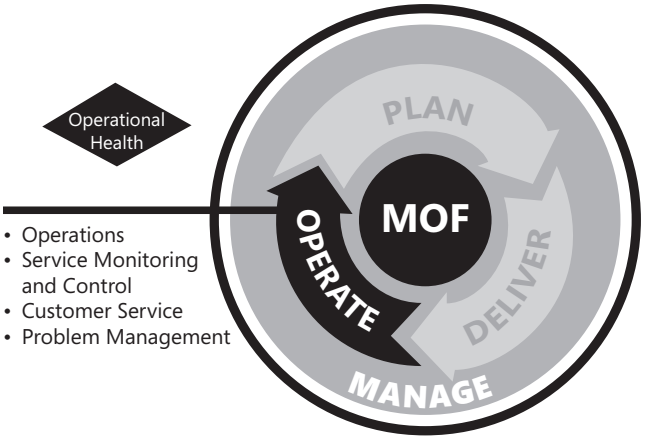


FIGURE 1-7 The Operate phase of the MOF life cycle

Responsibility for the workstations now passes to the operate teams, many members of which are individuals who participated in the Deploy phase. The SMFs for the Operate phase all occur concurrently, with each one defining tasks and services that the workstations will use at various times throughout their operational lives.

OPERATIONS

The initial part of the Operations stage is devoted to acceptance testing, the process by which the Operate team evaluates the work of the Deliver team and declares the workstations ready to pass into their care. This process is largely a formality, because many of the IT workers are members of both teams, and the two teams have already been working together in any case.

The remainder of the Operations stage is devoted to defining the regular maintenance tasks that will keep the workstations running smoothly. In many respects, the maintenance for the Genetic Research workstations is no different from that for the other computers at A. Datum, and the team was able to use the existing operational work instructions with only a few modifications.

These instructions describe the periodic maintenance tasks for the workstations, such as backups, drive defragmentations, and software updates, as well as contingency plans for unforeseen events, such as virus infections, drive failures, and other disasters.

The management team has decided that the specialized scientific equipment falls outside the purview of the IT operations team. The IT team will service issues related to the equipment interface, but the Genetic Research division will provide its own support for the devices themselves, and deal with the manufacturers directly, when necessary.

SERVICE MONITORING AND CONTROL

Service Monitoring and Control covers the process by which the IT division tracks the ongoing performance of the Genetic Research workstations and takes action when conditions warrant it. The IT staff already has performance monitoring, security auditing, and antivirus policies in place for the existing network, and they extend these policies to include the Genetic Research division as well.

Because of the classified work the new division will be performing, however, these policies will require some modifications, and the management team establishes a new operational security team specifically for this purpose. This team is responsible for extending these policies as needed and seeing to it that the government security requirements for the Genetic Research division's work—which change frequently—are always met.

MANAGEMENT REVIEW: POLICY AND CONTROL

Beginning several months after the launch of the Genetic Research division, and each quarter thereafter, the management team meets to evaluate how well the workstations are complying with the policies and requirements defined during the Plan phase. Toward this end, the IT director provides the conferees with performance summaries, auditing reports, and a list of policy violations that have occurred. The vice president of Genetic Research supplies a list of changes to the government security requirements that are due to go into effect during the next quarter.

None of the policy violations that occurred were severe, and none of the other records point to any major policy compliance problems. The IT directory takes receipt of the new security requirements and calls a meeting of the policy team to discuss modifications to the Genetic Research workstation configurations.

CUSTOMER SERVICE

In this project, the "customers" are the users of the workstations in the Genetic Research division. The Customer Service process defines the interface between these users and the IT division, which is the standard help desk provided to all of A. Datum's computer users. The process by which the help desk personnel work with the Genetic Research users will be largely the same as for the other users in the company. The operations team updates the help desk technical support database with the functional specification for the Genetic Research workstations, as well as documentation for the specialized hardware and applications they use and the troubleshooting records generated during the Stabilize phase.

PROBLEM MANAGEMENT

The Problem Management service deals with issues that are beyond the scope of the help desk resources defined in the Customer Service process. These are typically problems that go beyond user error and transient service outages, reflecting instead incidents that cause a significant reduction or interruption of workstation performance.

Although the MOF classifies Problem Management as part of the Operation phase, the skills and procedures it requires are equally applicable to the Plan and Deliver phases. In fact, at A. Datum, most of the same individuals who handled complex problems during the earlier phases are now doing so as part of the Operate team. When the help desk personnel escalate an issue, the problem management team becomes responsible for performing an independent investigation, researching the problem, and developing a workaround or a resolution—whether proactive or reactive.

As with all other stages in the life cycle, documentation is a key part of the problem management process, so that in the future, others can benefit from the team's experiences.

MANAGEMENT REVIEW: OPERATIONAL HEALTH

Every quarter, the IT director holds an operational health review with the IT division managers and the heads of the company's other divisions. The purpose of the meeting is to assess customer satisfaction with all of the services the IT division provides. It is this meeting that decides when a change to an IT service is needed, such as an upgrade to an application, modified configuration settings, or a hardware replacement.

Three years after the launch of the Genetic Research division, the director of that division expresses the dissatisfaction of her users with the performance of their workstations. Several of their applications have been upgraded several times, and their system requirements have increased. Discussion then begins regarding the possibility of retiring the existing workstations and replacing them with new, upgraded models, thus signaling the imminent end of one IT service life cycle and the beginning of another.

PRACTICE Leading a Workstation Build Team

In this practice, you take on a supervisory role in one stage of a workstation deployment project and use SMFs from Microsoft Operations Framework 4.0 to assemble your team and plan your course of action.

EXERCISE 1 Assembling a Stabilization Team

Wingtip Toys is expanding their sales operation and plans to open a new call center, which requires 100 new Windows 7 workstations. At the latest deployment project planning session, the IT director placed you in charge of the stabilization team responsible for testing the new workstations prior to their deployment on the production network. To help you organize and lead the workstation stabilization effort, the IT director suggests that you read the Stabilize SMF from Microsoft Operations Framework 4.0. This document is available online at *http://technet.microsoft.com/en-us/library/cc543320.aspx*.

The call center users have a limited set of tasks that they are required to perform, so their workstations are relatively simple. All of their database entry screens are exposed through Microsoft Internet Explorer, and the users do not require Microsoft Office or any other outside applications. To keep the users focused, the functional specification for the workstations calls for a limited interface, locking the users out of the Windows 7 features they do not need.

As the leader of the stabilization team, you function as Solution Manager and Program Manager, responsible for designing, scheduling, and overseeing the entire workstation testing process. The IT director is allowing you to recruit six additional persons for your team, who can come from the IT division or any other department in the company.

To complete this exercise, create a roster of your proposed team members by using the Stabilize SMF for guidance. Your roster should specify the departments your team members come from, the skills they need, their roles, and their responsibilities during the stabilization effort.

EXERCISE 2 Planning the Stabilization Process

The stabilization effort begins as soon as the build team delivers their first feature-complete workstation configuration. To complete this exercise, create a high-level outline listing the basic steps of your proposed testing process and the team members involved in each step, beginning with your team's receipt of the initial workstation build and culminating in the release readiness management review. The stabilization process should include both lab testing and at least one pilot deployment, as described in the Stabilize SMF.

Lesson Summary

- The goal of Microsoft Operations Framework 4.0 is to define the entire life cycle of an IT service, beginning from the initial recognition of a need, proceeding through the planning, building, and deployment processes, and culminating in operation and finally retirement.
- MOF 4.0 divides the life cycle of an IT service into three phases: Plan, Deliver, and Operate, all of which are surrounded by a Manage level.
- The MOF 4.0 phases consist of a series of white papers called service management functions (SMFs), each of which defines processes and activities for a specific aspect of each phase, and the roles of the people who perform them.
- The MOF 4.0 life cycle model includes milestones in the form of periodic management reviews that evaluate the current state of the project and signal its readiness to move forward.

Lesson Review

You can use the following questions to test your knowledge of the information in Lesson 1, "Understanding the Windows 7 Deployment Life Cycle." The questions are also available on the companion CD if you prefer to review them in electronic form.

NOTE **ANSWERS**

Answers to these questions and explanations of why each answer choice is correct or incorrect are located in the "Answers" section at the end of the book.

1. Which of the phases in the MOF 4.0 life cycle contains stages that run sequentially, and not concurrently?
   - **A.** The Plan phase
   - **B.** The Deliver phase
   - **C.** The Operate phase
   - **D.** The Manage Level
2. Which of the following SMFs is concerned primarily with security, privacy, and appropriate use?
   - **A.** Governance, Risk, and Compliance
   - **B.** Business/IT Alignment
   - **C.** Policy
   - **D.** Change and Configuration
3. The majority of the tasks involved in a Microsoft Deployment Toolkit 2010 deployment project occur during which phase of the MOF 4.0 life cycle?
   - **A.** The Plan phase
   - **B.** The Deliver phase
   - **C.** The Operate phase
   - **D.** The Manage level

Lesson 2: Gathering Upgrade Information

Deploying Windows 7 on a fleet of brand new workstations is a complex undertaking, to be sure, but the process is complicated further when you are deploying Windows 7 on an existing group of hundreds or even thousands of workstations in an enterprise network environment. Before you can even begin to plan the deployment project, you must gather information about the existing computers so that you can determine what preliminary steps are necessary before they can run Windows 7.

For such a project to be worth the investment, the benefits of the new operating system must exceed—or at least balance—the outlay. Before even beginning to study the benefits versus outlay equation, an organization must know exactly what the outlay is. Decision makers must assess what they currently have in terms of hardware, software, and performance, and compare it with what they need. Some of the questions that are likely to arise at this time include the following:

- Do the existing workstations have the hardware required to run the new operating system?
- Will the new operating system improve performance, and if so, how much?

In Lesson 1, you might have noticed that issues like these first come up in the Plan phase, quite early in the MOF 4.0 life cycle. Some of the earliest tasks for an IT department in a Windows 7 deployment are feasibility studies, as discussed in the following sections.

After this lesson, you will be able to:

- List the various tools you can use to compile a hardware inventory for your workstations.
- Create a workstation performance baseline using Performance Monitor.

Estimated lesson time: 60 minutes

Compiling a Workstation Hardware Inventory

When you consider these basic questions—what hardware does the new software require? and do our workstations meet those requirements?—you are likely to find the first question is easy because the Windows 7 system requirements are readily available on the Microsoft Web site. But the second can pose a problem.

In the IT manager's idea of a perfect world, all of the organization's workstations are identical: the same model computer with the same hardware inside, a single operating system, and application configuration throughout the enterprise. Of course, most of these managers know that this is a dream that very seldom comes true.

Companies rarely buy all of their workstations at once. They typically buy computers in lots from large vendors or manufacturers. Even if they buy from the same vendor every time, models and supply situations change so quickly that the computers they purchase today are likely to have substantially different components than those they bought only a few months ago.

IT managers also must consider the practices of maintenance and support. When a workstation hard disk fails, an IT person might replace it with a different model the team happens to have on hand. When a department adopts a new application, workstations might need installations of extra memory to support it. The designers in the Marketing department might require high-end graphics adapters in their workstations. The result is a fleet of workstations with widely varying hardware and software configurations. A dedicated and disciplined IT staff might keep careful records of these modifications, but in a busy department, the documentation often is deferred, delayed, or forgotten altogether.

REAL WORLD

Craig Zacker

Some organizations run a "tight ship," as far as IT considerations are concerned, maintaining rigorous control over workstation configurations and preventing users from installing or modifying any software or hardware themselves. Other organizations are considerably more casual. I once worked in the technical support department for a small, but rapidly growing, software company full of inveterate tinkerers.

Our computer cases were always open, and we were constantly swapping out hard drives and memory sticks, installing beta software, and reconfiguring the operating system. Any hardware or software inventory the IT department attempted to compile would be outdated only a few hours after its completion.

This experimental atmosphere fostered an excellent learning environment for the technical support staff, but it also led to chaos when the IT department wanted to deploy a database application to track technical support incidents. The IT staffers who arrived to install the application found half the workstations in various stages of disassembly, and most of the others unready in other ways to support the new software.

This fiasco forced the management team to supply the technical support staff with new production workstations that we were forbidden to modify in any way. The moral of this story is that if your organization has highly skilled computer users who take care of their own workstation support, the everyday burden on the IT staff might be reduced, but large projects such as operating system upgrades might be considerably more complicated.

Organizations considering a Windows 7 deployment might need to perform a detailed inventory of the hardware in each existing workstation. A hardware inventory should include the following information for each computer:

- Processor type and speed
- System memory
- Number and capacities of hard disks
- Amount of free hard disk space
- Graphic adapter type

The ways to discover this information are discussed in the following sections. Which one you choose depends on how many workstations you have to inventory, how much you can afford to spend, and what other uses you might make of the inventory tool.

Using the Manual Method

The simplest method for gathering workstation inventory information is, of course, to look at each computer. You can open each computer case and look inside, but even then, it can be hard to locate the information you need. Components are often not clearly marked on the outside, and many computers pack them in so tightly that you would have to disassemble them to find out, for example, the capacities of the hard disks. And even if you can determine the disk capacities in this way, you have no way of knowing how much free space there is on the disks without starting the computer and manually checking free space as well.

This method is far too complicated if you have more than two or three workstations to inventory. What you need is some sort of tool that produces a report listing the hardware inside the computer.

Using System Information

All of the Windows operating systems have an application called System Information, which can display extensive information about the hardware and software configuration of the local computer or another computer on the network. System Information can provide all of the essential inventory information listed earlier, and a great deal more. You can save the reported information to a System Information file with an .nfo extension, for later access, or to a text file.

In Windows 7, Windows Vista, and Windows XP, System Information is accessible from the Start menu, in the All Programs\Accessories\System Tools\ folder. Launching the program displays a system summary for the local computer, as shown in Figure 1-8. This page includes processor and memory information.

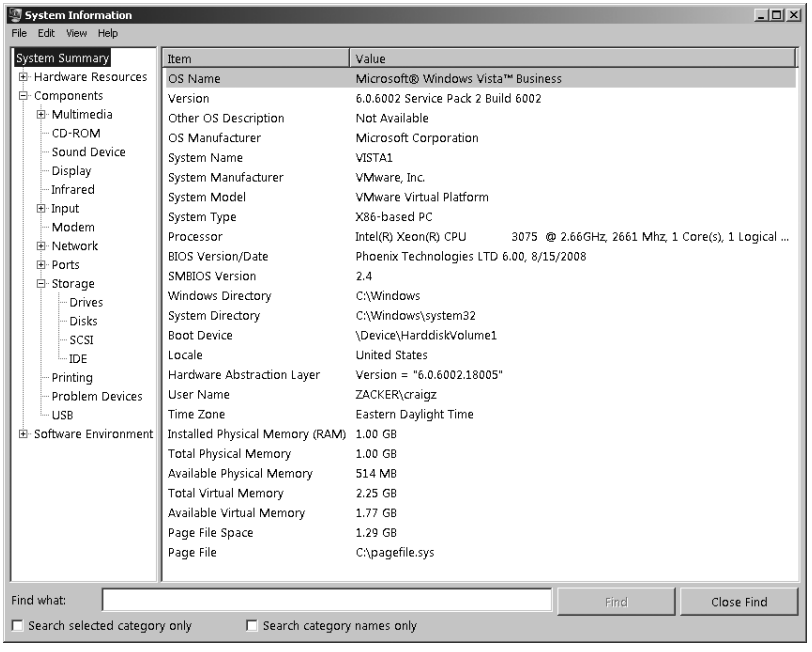


FIGURE 1-8 The System Summary page in System Information

The Components\Display\ page, shown in Figure 1-9, contains information about the graphics adapter.

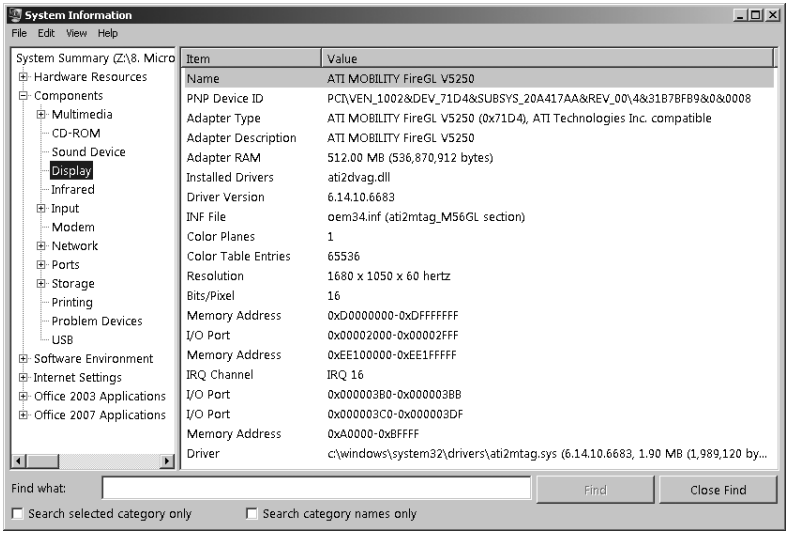


FIGURE 1-9 The Components\Display\ page in System Information

The Storage\Drives\ page, shown in Figure 1-10, lists the hard disks in the system, their capacities, and the amount of free space available. Selecting View\Remote Computer\ enables you to connect to another system on the network and view its system information as well.

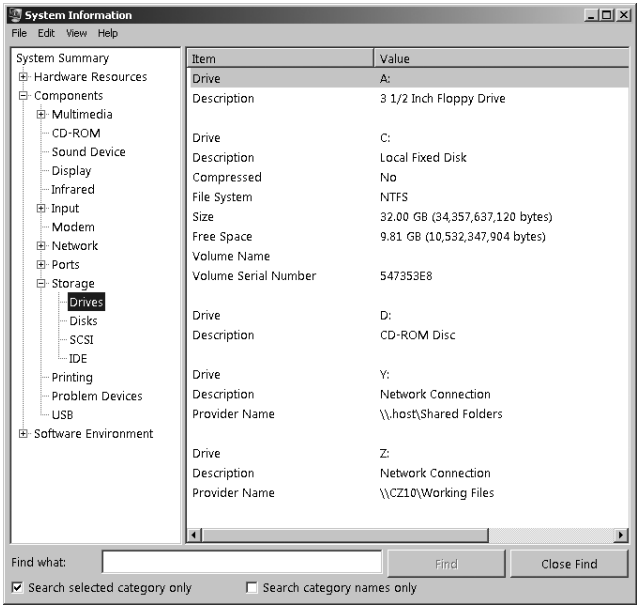


FIGURE 1-10 The Storage\Drives\ page in System Information

Although the System Information program provides the inventory information an IT technician needs to determine whether a workstation meets the system requirements for Windows 7, the process of gathering and analyzing the information is slow, and for a large network, all but unmanageable. The only way to store the workstation hardware inventory information in one central location would be to create a repository yourself, manually, using a spreadsheet or similar program. The administrators of a medium or large enterprise network need a tool that can gather hardware information from all of the computers on the network into a single interface.

Using Microsoft System Center Configuration Manager

Microsoft System Center Configuration Manager (SCCM) 2007 is a network management application that, among many other capabilities, can perform an inventory of the hardware and software in all of the computers on your network and store the information in a centralized database for later analysis. SCCM can also manage software updates, distribute software packages, remotely administrator network computers, and deploy operating systems. In fact, the Zero Touch Installation (ZTI) deployment process defined in Microsoft Deployment Toolkit 2010 requires an SCCM infrastructure. For more information on using System Center Configuration Manager 2007 to deploy Windows 7, see Chapter 6, "Designing a Windows 7 Client Deployment Strategy."

SCCM is an excellent tool for creating a hardware inventory, but it is not a product that you are likely to use solely for that purpose. First, it's an expensive product, requiring you to purchase licenses for each server and client on your network. Second, installing, configuring, and deploying SCCM requires a separate database server and the installation of client agents on each workstation.

For assessing the current hardware configuration of your workstations, with an eye toward a Windows 7 deployment, SCCM is almost overkill. The SCCM Hardware Inventory Client Agent queries Windows Management Instrumentation (WMI) on the workstation, enabling it to collect information on over 1,500 hardware properties and report it to the SCCM site server.

Assuming that you have SCCM fully installed, enabling the Hardware Inventory Client Agent on your workstations causes them to transmit inventory information to the site server at regular intervals. You can then view the information by using Resource Explorer in the SCCM 2007 Administrator Console.

Using the Microsoft Assessment And Planning Toolkit 5.0

For an enterprise that has not invested in SCCM, you can choose other, simpler, options for automating the process of compiling a hardware inventory. There are many third-party products that can compile a workstation inventory, but the Microsoft Assessment And Planning (MAP) Toolkit 5.0 is particularly well suited to this task.

> ***NOTE*** **DOWNLOADING MAP TOOLKIT 5.0**
>
> **The MAP Toolkit 5.0 is available from the Microsoft Download Center at *http://www.microsoft.com/downloads/details.aspx?familyid=67240B76-3148-4E49-943D-4D9EA7F77730*.**

One of the biggest advantages of the MAP Toolkit is that it does not require you to install an agent or other client program on the computers you want to inventory. After you install the program on a Windows server or workstation, it can scan the network and, by using Active Directory Domain Services, IP addresses, or network broadcast messages, locate other computers and query them for information about their hardware and software configurations, as shown in Figure 1-11.

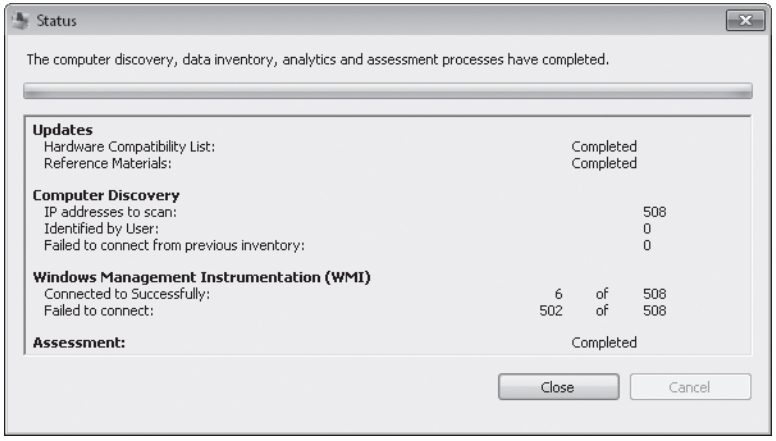


FIGURE 1-11 The Status display produced by MAP Toolkit 5.0 as it scans the network

> ***EXAM TIP***
>
> **The MAP Toolkit is not a full-featured network management tool, as SCCM 2007 is. Instead, it is specifically designed to assess the readiness of workstations and servers for the installation of Windows 7, Windows Vista, Windows Server 2008 R2, or Windows Server 2008. The program is relatively easy to install and use, and it's free.**

Like SCCM, the MAP Toolkit stores its inventory information in a Microsoft SQL Server database, but unlike SCCM, it can use the free SQL Server 2005 Express Edition, which it downloads and installs automatically during the setup process. The toolkit is scenario-based, enabling you to specify how you want to use the inventory data. After the program completes its client scan, it displays its results in the Microsoft Assessment And Planning Toolkit console, as shown in Figure 1-12.

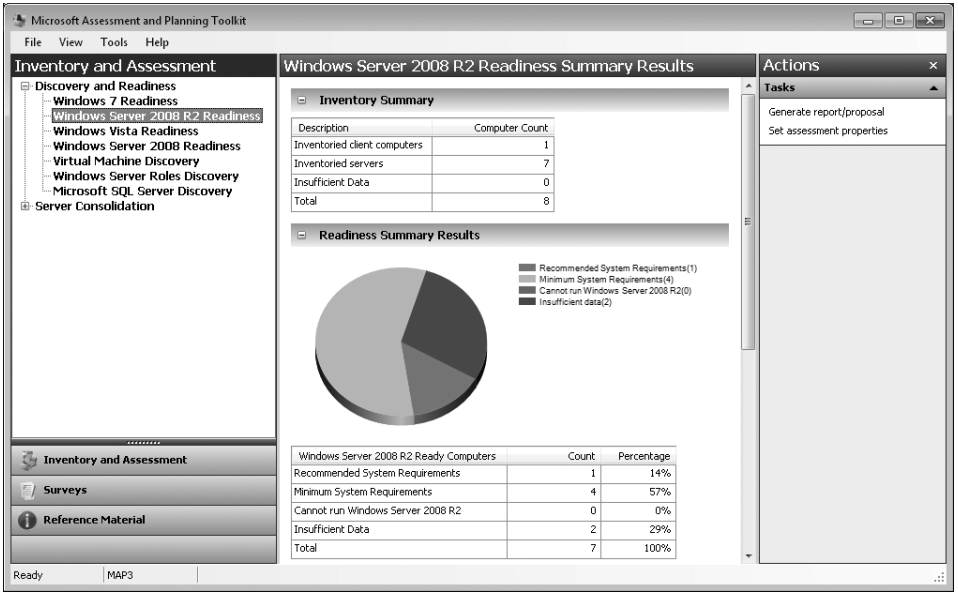
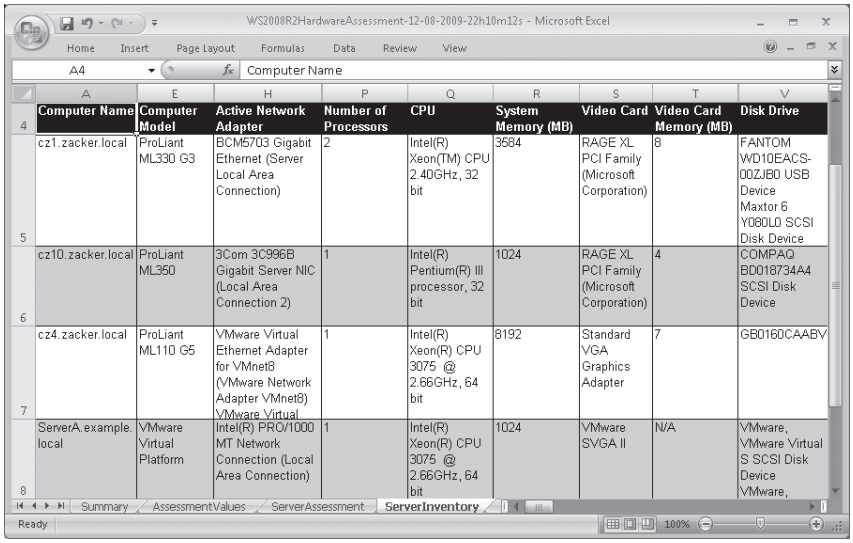


FIGURE 1-12 Readiness summary results, as displayed in the Microsoft Assessment And Planning Toolkit console

Because it is designed specifically for Windows deployment scenarios, MAP Toolkit also enables you to generate boilerplate reports and proposals, into which the program inserts the inventory information it has gathered from the clients. A hardware assessment report generated by the toolkit takes the form of an Excel spreadsheet containing the raw inventory results, as shown in Figure 1-13.



WS2008R2HardwareAssessment-12-08-2009-22h10m12s - Microsoft Excel

Home Insert Page Layout Formulas Data Review View

A4 Computer Name

	A	E	H	P	Q	R	S	T	V
4	Computer Name	Computer Model	Active Network Adapter	Number of Processors	CPU	System Memory (MB)	Video Card	Video Card Memory (MB)	Disk Drive
5	cz1.zacker.local	ProLiant ML330 G3	BCM5703 Gigabit Ethernet (Server Local Area Connection)	2	Intel(R) Xeon(TM) CPU 2.40GHz, 32 bit	3584	RAGE XL PCI Family (Microsoft Corporation)	8	FANTOM WD10EACS-00ZJB0 USB Device Maxtor 6 Y080L0 SCSI Disk Device
6	cz10.zacker.local	ProLiant ML350	3Com 3C996B Gigabit Server NIC (Local Area Connection 2)	1	Intel(R) Pentium(R) III processor, 32 bit	1024	RAGE XL PCI Family (Microsoft Corporation)	4	COMPAQ BD018734A4 SCSI Disk Device
7	cz4.zacker.local	ProLiant ML110 G5	VMware Virtual Ethernet Adapter for VMnet8 (VMware Network Adapter VMnet8) VMware Virtual	1	Intel(R) Xeon(R) CPU 3075 @ 2.66GHz, 64 bit	8192	Standard VGA Graphics Adapter	7	GB0160CAABV
8	ServerA.example.local	VMware Virtual Platform	Intel(R) PRO/1000 MT Network Connection (Local Area Connection)	1	Intel(R) Xeon(R) CPU 3075 @ 2.66GHz, 64 bit	1024	VMware SVGA II	N/A	VMware, VMware Virtual S SCSI Disk Device VMware,

Summary AssessmentValues ServerAssessment ServerInventory

Ready 100%

FIGURE 1-13 A hardware assessment report generated by the MAP Toolkit 5.0

Quick Check

- **As a tool for collecting hardware inventory information from the computers on your network, what are the two primary advantages of the MAP Toolkit 5.0?**

Quick Check Answer

- **The MAP Toolkit 5.0 requires no agents on the client computers, and it's free.**

Creating Workstation Performance Benchmarks

Workstation performance is another issue to consider when proposing a Windows 7 deployment. System administrators always hope that software upgrades result in performance improvements, but that is not always the case. For example, a computer running Windows XP might have sufficient system memory to run well, but after installing Windows 7 on that same computer, the amount of memory might be barely adequate.

Generalized performance levels can be difficult to quantify, but if you are going to perform any kind of comparison, you must establish a performance-level baseline on your workstations before you do any test or pilot deployments. There are many third-party benchmarking tools available, or you can use the Performance Monitor tool provided with all versions of Windows. For network performance benchmarking, you can use a third-party product or download the Microsoft protocol analyzer tool, Network Monitor.

NOTE **DOWNLOADING NETWORK MONITOR**

Microsoft Network Monitor is available from the Microsoft Download Center at *http://www.microsoft.com/downloads/details.aspx?displaylang=en&FamilyID=983b941d-06cb-4658-b7f6-3088333d062f*.

To establish a performance baseline for a test workstation running Windows Vista by using Reliability And Performance Monitor, you could create a data collector set that samples the following performance counters for an extended period of time, as shown in Figure 1-14:

- Processor (_Total): % Processor time
- Processor (_Total): Interrupts/sec
- System: Processor Queue Length
- Server Work Queues (0): Queue Length
- Memory: Page Faults/Sec
- Memory: Pages/Sec
- Memory: Available Bytes
- Memory: Committed Bytes
- Memory: Pool Nonpaged Bytes
- PhysicalDisk (_Total): Disk Bytes/sec
- PhysicalDisk (_Total): Avg. Disk Bytes/Transfer
- PhysicalDisk (_Total): Current Disk Queue Length
- PhysicalDisk (_Total): % Disk Time
- LogicalDisk (_Total): % Free Space
- Network Interface (All Instances): Bytes Total/sec
- Network Interface (All Instances): Output Queue Length
- Server: Bytes Total/Sec

NOTE **UNDERSTANDING PERFORMANCE COUNTER NOTATION**

For each of the performance counters listed, the first term (before the colon) is the name of the performance object in which the counter is located. The second term (after the colon) is the name of the counter itself. A value in parentheses appearing after the performance object name (immediately before the colon) is the instance of the counter.

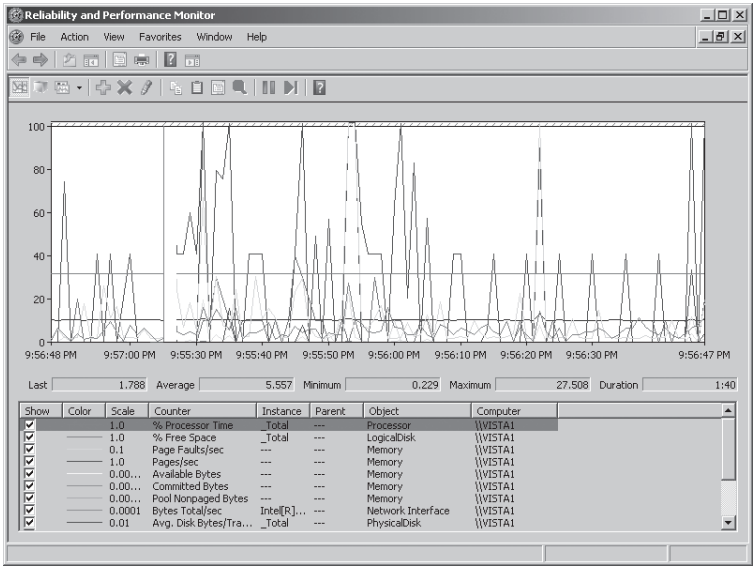


FIGURE 1-14 Baseline performance counter readings in Windows Vista

After installing Windows 7 on the workstation, you can then evaluate the computer's performance by creating the same data collector set and comparing the results with the baseline you created earlier.

Benchmarking tools do not necessarily provide absolute measurements that are verifiably accurate. However, they are usually consistent in their measurements. Whatever tools you elect to use when establishing your performance benchmarks, make sure you use the same ones in the same manner for all of your subsequent measurements.

MORE INFO **USING PERFORMANCE MONITOR**

For more detailed information on using Performance Monitor, see Chapter 13, "Monitoring and Performance," in *MCTS Self-Paced Training Kit (Exam 70-680): Configuring Windows 7* by Ian McLean and Orin Thomas (Microsoft Press, 2009).

PRACTICE Using the Microsoft Assessment And Planning Toolkit 5.0

The Microsoft Assessment And Planning Toolkit 5.0 package is a single executable that checks for a program's prerequisites before installing the software and, if necessary, downloads and installs SQL Server Express.

EXERCISE 1 Installing the MAP Toolkit

Microsoft provides the MAP Toolkit 5.0 free of charge, from the Microsoft Downloads Center.

1. Open a browser window and, in the address box, type the following URL and press Enter: ***http://www.microsoft.com/downloads/details.aspx?displaylang=en&FamilyID=67240b76-3148-4e49-943d-4d9ea7f77730***. The Microsoft Assessment And Planning Toolkit download page appears.
2. Click the Download button for the Microsoft_Assessment_and_Planning_Toolkit_Setup.exe file and save the file to a folder on your local drive.
3. Open Windows Explorer, then locate and run the file you downloaded. The Microsoft Assessment And Planning Toolkit Setup Wizard appears.
4. If any of the prerequisites that the toolkit requires are missing, a Prerequisites Not Found page appears. Click the links for the missing prerequisites for more information or to download them. The installation will not proceed until the computer meets all of the prerequisites.
5. After meeting the prerequisites, restart the installation process, and then accept the terms of the license agreement and the default installation folder location.
6. On the SQL Server Express page, specify whether you want the program to download SQL Server Express or install from previously downloaded files.
7. Accept the terms of the SQL Server Express license agreement and complete the installation.

EXERCISE 2 Compiling an Inventory

To use the MAP Toolkit 5.0, you select one of the scenarios provided with the package.

1. From the Start menu, open the Microsoft Assessment And Planning Toolkit. The Microsoft Assessment And Planning Toolkit console appears and displays a Create Or Select A Database To Use dialog box.
2. Specify a name for the database, and click OK.
3. Click the link for the Inventory And Assessment Wizard. The wizard appears, displaying the Computer Discovery Methods page.

4. Clear all of the check boxes except Scan An IP Address Range, and click Next. The Scan An IP Address Range page appears.
5. Specify the Starting Address and Ending Address values for the range of addresses you want to scan, and click Next. The WMI Credentials page appears.
6. Click New Account and, in the Inventory Account dialog box, specify the credentials for the account the wizard will use to connect to the computers on your network. Then click Save. You can create as many additional accounts as needed; the wizard will try each one in turn for each computer. Then click Next. The Summary page appears.
7. Click Finish. The Status dialog box appears, updating as the wizard connects to the computers it finds on the network.
8. Click Close, and then in the Microsoft Assessment And Planning Toolkit console, in the scope (left) pane, expand the Discover And Readiness node and select Windows 7 Readiness. The results of the inventory appear in the detail (right) pane.

Lesson Summary

- Before IT staff can begin to compare the benefits of a Windows 7 deployment with the outlay required, they must assess what they currently have, and compare it with what they need, in terms of hardware, software, and performance.
- The most basic questions regarding any software installation are these: what hardware does the new software require and do our workstations meet those requirements?
- Organizations considering a Windows 7 deployment might need to perform a detailed inventory of the hardware in each existing workstation. A hardware inventory should include, for each computer: processor type and speed, amount of system memory, number and capacities of hard disks, amount of free hard disk space, and the graphic adapter type.
- To inventory workstation hardware, you can examine each computer manually, use the System Information tool, purchase System Center Configuration Manager 2007, or download the Microsoft Assessment And Planning Toolkit 5.0.
- If you are going to perform any kind of performance comparison on your workstations, you must establish a performance-level baseline on your workstations before you do any test or pilot deployments. Many third-party benchmarking tools are available, or you can use the Performance Monitor tool provided with all versions of Windows.

Lesson Review

You can use the following questions to test your knowledge of the information in Lesson 2, "Gathering Upgrade Information." The questions are also available on the companion CD if you prefer to review them in electronic form.

NOTE **ANSWERS**

Answers to these questions and explanations of why each answer choice is correct or incorrect are located in the "Answers" section at the end of the book.

1. Which of the following hardware inventory tools is available as a free download from Microsoft?
   - **A.** Performance Monitor
   - **B.** Microsoft Assessment And Planning Toolkit
   - **C.** System Center Configuration Manager 2007
   - **D.** System Information
2. Which of the following is NOT a valid reason to use the Microsoft Assessment And Planning Toolkit to create a hardware inventory, rather than System Center Configuration Manager 2007?
   - **A.** The MAP Toolkit does not require client agents.
   - **B.** The MAP Toolkit is free.
   - **C.** The MAP Toolkit can use SQL Server 2005 Express Edition.
   - **D.** The MAP Toolkit can perform ZTI deployments.
3. Which of the following hardware specifications is necessary to determine whether a workstation is capable of running Windows? (Choose all that apply.)
   - **A.** Amount of system memory
   - **B.** Number and type of network adapters
   - **C.** Amount of free hard disk space
   - **D.** Processor type and speed

Chapter Review

To further practice and reinforce the skills you learned in this chapter, you can perform the following tasks:

- Review the chapter summary.
- Review the list of key terms introduced in this chapter.
- Complete the case scenarios. These scenarios set up real-world situations involving the topics of this chapter and ask you to create a solution.
- Complete the suggested practices.
- Take a practice test.

Chapter Summary

- The operating system deployment tasks that fall to a Windows 7 desktop administrator can actually be part of a much larger project life cycle that involves management and policy makers through the organization. The Microsoft Operations Framework 4.0 specifies the phases of this life cycle and defines each one by using a series of white papers called service management functions (SMFs).
- Deploying Windows 7 on a fleet of existing workstations is considerably more complicated than on new hardware. Before you can begin to plan the deployment project, you must gather information about the existing computers so that you can determine what preliminary steps are necessary before they can run Windows 7.

Key Terms

Do you know what these key terms mean? You can check your answers by looking up the terms in the glossary at the end of the book.

- Microsoft Assessment And Planning (MAP) Toolkit 5.0
- Microsoft Deployment Toolkit (MDT) 2010
- Microsoft Operations Framework (MOF) 4.0
- Microsoft Solutions Framework (MSF)
- Microsoft System Center Configuration Manager (SCCM) 2007
- Service management functions (SMFs)

Case Scenarios

In the following case scenarios, you will apply what you've learned about the Windows 7 deployment process. You can find answers to these questions in the "Answers" section at the end of this book.

Case Scenario 1: Making a Windows 7 Deployment Decision

Bob is the IT manager for a company with a single office and 150 workstations. Approximately 100 of the workstations are several years old and are running Windows XP. The remaining 50 were purchased less than a year ago and are running Windows Vista. With the release of Windows 7, Bob is trying to determine whether it is worthwhile to upgrade the operating system workstations. If he decides to proceed, he will have to create a project proposal and present it to the company management team.

Using the Microsoft Assessment And Planning Toolkit 5.0, Bob performs a hardware inventory of his workstations and generates a Windows 7 readiness report. The report states that all of the workstations are capable of running Windows 7. However, Bob is still concerned about performance levels after the upgrade because many of his users run resource-intensive graphics applications.

Bob is considering each of the following courses of action as the next step in his Windows 7 deployment project. For each option, specify reasons why Bob should or should not take that course of action.

1. Purchase and install Microsoft Systems Center Configuration Manager 2007 so that he can perform a more detailed hardware inventory.
2. Propose installing Windows 7 on all 150 workstations as they are currently configured.
3. Propose installing additional memory in the Windows XP workstations and then upgrading all 150 workstations to Windows 7.
4. Conduct performance baseline benchmarks on one Windows XP and one Windows Vista workstation, then upgrade both to Windows 7 and repeat the performance testing.

Case Scenario 2: Preparing for Windows 7 Deployment

Carol is the manager of the Windows 7 Deliver Team in her company's IT department, and this team is preparing to deploy Windows 7 on the company's entire fleet of 500 user workstations. Laboratory testing of the workstation builds has been completed. According to the MOF and MSF procedures they are using to guide the project, should Carol complete each of the following tasks before she begins the actual deployment on the production workstations? Why or why not?

1. Hand off control of the project to the Operate team.
2. Perform one or more pilot deployments.
3. Submit the build and testing reports for a release readiness review by the management team.

Suggested Practices

To help you successfully master the exam objectives presented in this chapter, complete the following tasks.

Using the IT Pro Quick Start Kit

The base Microsoft Operations Framework 4.0 package consists of 23 documents totaling nearly 600 pages. Although these documents contain a lot of valuable information, students' intent on preparing for the 70-686 exam can probably make better use of their time than by reading that package. Fortunately, Microsoft has also published the IT Pro Quick Start Kit, which contains a collection of presentations, graphics, podcasts, and relatively brief documents that provide a basic overview of Microsoft Operations Framework 4.0. In this practice, you download the IT Pro Quick Start Kit and examine its contents.

- **Practice 1** Download the IT Pro Quick Start Kit from the Microsoft Operations Framework page on their TechNet site at *http://technet.microsoft.com/en-us/solutionaccelerators/dd320379.aspx* and save it to a new folder on your local drive.
- **Practice 2** Extract the files from the IT Pro Quick Start Kit and double-click the START HERE.pptx file. When PowerPoint launches and loads the file, press F5 to start the presentation. View the Get Started: MOF Overview Presentation and listen to the MOF 4.0 Overview Podcast.

Benchmarking a Performance Baseline

In this practice, you create a performance-level baseline on a lab computer running Windows Vista, and then repeat the performance benchmark test after installing Windows 7 on the same computer.

- **Practice 1** On a lab computer running Windows Vista, use the Performance Monitor tool in Reliability And Performance Monitor to create a data collector set that captures a 30-minute data sample for the performance counters listed in Lesson 2. When you have captured the data sample, copy it to a removable drive or a network share on another computer.
- **Practice 2** Install Windows 7 on the same lab computer, and then use Performance Monitor to create an identical data collector set as before, using the same performance counters. Compare the results from the Windows Vista benchmark to those from the Windows 7 benchmark and decide whether the computer's hardware configuration is sufficient to support a permanent Windows 7 installation.

Take a Practice Test

The practice tests on this book's companion CD offer many options. For example, you can test yourself on just one exam objective, or you can test yourself on all the 70-686 certification exam content. You can set up the test so that it closely simulates the experience of taking a certification exam, or you can set it up in study mode so that you can look at the correct answers and explanations after you answer each question.

MORE INFO **PRACTICE TESTS**

For details about all the practice test options available, see the "How to Use the Practice Tests" section in this book's Introduction.

CHAPTER 2

Designing a Client Life Cycle

When you are designing a client life cycle, you should ensure that your plan reduces the amount of time you have to spend maintaining parts of that life cycle. Your aims can include reducing the amount of time you spend managing operating system activation, configuring the operating system so that the installation is easily transferrable to another computer, and minimizing the amount of time it takes to move data from an older computer to its replacement.

Although it is not a problem to enter a unique product key when you perform a traditional installation of Windows 7 on a small number of computers, a simple operation that takes a minute or so becomes problematic when you have to perform the same operation on several thousand. Microsoft offers enterprise customers an alternative way of ensuring that their computers are properly licensed without consuming an inordinate amount of time. The name for this method is volume activation. You will learn about volume activation in the first lesson of this chapter.

A new feature of Windows 7 is the ability to deploy the operating system directly to a VHD file and boot that VHD file on physical hardware. Installing Windows 7 on a bootable VHD allows an installation to be easily migrated to new hardware. When configured in this manner, migration to new hardware is as simple as transferring the VHD container in which Windows 7 has been installed to the new physical or virtual host.

Although the promise of VHD deployments suggest that in the future it will be relatively simple to migrate users from their old computers to their new computers, most of the users coming to a new Windows 7 installation will be coming from computers running the Windows XP or Windows Vista operating systems. The User State Migration Tool offers administrators the ability to automate the process of user data migration, vastly speeding the process of transitioning users from these older computers to new computers that run Windows 7.

Exam objectives in this chapter:

- Plan and manage client licensing and activation.
- Plan and manage a physical hardware and virtualization strategy.
- Design a user state migration strategy.

Lessons in this chapter:

- Lesson 1: Designing and Managing a Licensing Strategy **43**
- Lesson 2: Designing a Client Hardware Platform **52**
- Lesson 3: Migrating User Profiles **61**

Before You Begin

To complete the exercises in the practice sessions in this chapter, you need to have done the following:

- Installed the Windows 7 operating system on a stand-alone client PC named WKSTN1, as described in the introduction.
- Downloaded and installed the Windows Automated Installation Kit (Windows AIK).

MORE INFO **DOWNLOAD WINDOWS AIK**

You can obtain the Windows Automated Installation Kit from the following location on TechNet: *http://technet.microsoft.com/en-us/library/dd349343(WS.10).aspx*.

REAL WORLD

Orin Thomas

Enterprise desktop administrators have the same enthusiasm for operating system licensing that the average five year old has for a tetanus shot. The only thing that excites enterprise desktop administrators less than operating system licensing is the thought of going through a licensing audit to ensure that all of the client computers at your organization are properly licensed. A few years ago, I had to manage the client operating system licenses for a number of postgraduate computer labs at a local university. Each semester we would reimage the computers because the students tended to be brutal with them, and it was easier to wipe-and-replace than it was to figure out the creative ways they had managed to compromise the original installation. Keeping track of keys during this process was a nightmare, and we always feared that some of the machines would not be properly activated when it was time for the new semester's classes to start. When I first heard about Key Management Services, I thought how useful it would have been in managing those computer labs. Rather than worrying about reactivating those computers each time I did a deployment, I would have been able to sit back and let the KMS service handle it.

Lesson 1: Designing and Managing a Licensing Strategy

The licensing strategy that you choose depends on the circumstances of your Windows 7 deployment. When you are determining which strategy to pursue, you must take into account factors such as client connectivity to the Microsoft activation servers on the Internet, the number of clients that you need to activate, and the editions of Windows 7 that you have chosen to deploy. In this lesson, you learn about the licensing and activation options that are available to volume licensing customers and how these differ from the licensing and activation options available to normal retail customers.

After this lesson, you will be able to:

- Understand different Windows 7 licensing options.
- Deploy Key Management Services.
- Utilize Multiple Activation Keys.
- Describe licensing options for virtual clients.

Estimated lesson time: 40 minutes

Windows 7 Editions and Licensing

Windows 7 uses three types of license: the OEM license, the retail license, and the volume license. OEM licenses are tied to a specific hardware vendor. This license type is used with computers that are sold with Windows 7 already installed by the vendor, such as those you might purchase from your local computer retailer. The product keys associated with an OEM license do not allow you to transfer the license to a computer made by a different vendor. Computers that have OEM licenses undergo activation prior to being deployed to customers.

Retail keys are provided when you buy a retail copy of Windows 7. You can use the Home Premium, Professional, and Ultimate editions of Windows 7 with retail keys. Because a retail key is used only for a single computer, this type is not used with zero touch or lite touch automated volume deployments.

Volume License keys are made available to organizations that have a volume licensing agreement with Microsoft. Volume licenses include the Open, Select, and Enterprise agreement types. You can use volume license keys only with computers running the Windows 7 Professional and Enterprise operating systems. You can use a mixture of retail, volume license, and OEM keys in an organizational environment.

MORE INFO **VOLUME LICENSING**

To find out more about volume licensing, consult the following reference on the Microsoft Web site: *http://www.microsoft.com/licensing/default.aspx*.

Windows Product Activation

Each computer that runs the Windows 7 operating system installed in your organization must undergo Windows Product Activation (WPA). Microsoft uses WPA to ensure that it is possible to use the Windows 7 operating system on a computer only when the computer has a license. Windows 7 must undergo the WPA process within 30 days of the completed installation. You can extend this 30-day period to a total of 120 days by using the *slmgr.vbs –rearm* command. Each use of this command extends the activation period for 30 days. You can use this command to extend the activation period only three times. After the grace period expires, the WPA process must successfully occur or Windows enters reduced functionality mode.

WPA relies on two specific identifiers and a third identifier that Windows generates based on the previous two identifiers. These identifiers have the following properties:

- **Hardware ID** This identifier is generated using information about computer hardware configuration. This ID is unique and changes if the hardware configuration of the computer changes.
- **Product ID** 25-character key. This is either a retail key or a Multiple Activation Key. Unless Key Management Services is in use, this key must be input on the computer running the Windows 7 operating system. You can deploy keys through the unattended installation process. You learn about Key Management Services and deploying keys in an unattended installation later in this lesson.
- **Installation ID** Windows 7 generates this ID using the Hardware ID and Product ID. You forward the installation ID to Microsoft when you perform an activation using the telephone.

During the online WPA process, the computer forwards the Product and Hardware IDs to Microsoft activation servers. If the activation check determines that the Product ID has not exceeded its allowed number of activations, the activation servers record the Hardware ID and Product ID, the number of recorded activations for the Product ID is incremented, and the activation servers forward an activation code to the client.

Microsoft allows you to reinstall and reactivate Windows 7 on the same computer once without incrementing the number of recorded activations. Substantially altering the computer's hardware configuration also triggers reactivation. This can cause problems if a prior event has triggered a reactivation: you might need to contact Microsoft if a single computer goes through several rapid hardware configuration changes that prompt multiple reactivations.

MORE INFO **WINDOWS ACTIVATION TECHNOLOGIES**

To learn more about Windows Activation Technologies, consult the following document on TechNet: *http://technet.microsoft.com/en-us/library/dd979803.aspx*.

Volume Licensing Activation Methods

You can choose from two methods for performing volume licensing activation: Multiple Activation Keys (MAK keys) or Key Management Services. In the real world, one method is more appropriate for some situations but in other situations, the choice is a matter of personal preference. You often need to choose a volume activation method prior to deploying client computers running the Windows 7 operating system. In the next few pages, you learn about the solutions that you can implement and the types of situations in which you would choose one volume licensing activation method over another.

MORE INFO **VOLUME ACTIVATION OPERATIONS GUIDE**

For more information about the techniques that you can use to activate volume licenses, consult the Volume Activation Operations Guide at the following address: *http://technet.microsoft.com/en-us/library/dd772270.aspx*.

Multiple Activation Keys

MAK keys are special keys that allow an organization to perform multiple activations using a single key. MAK keys are similar to retail keys except that instead of allowing a single activation, they allow multiple activations from different computers to occur up to the limit defined by the particular key. The number of activations that a MAK key allows depends on the number you purchase when you obtain the key. You cannot recover an activation on a MAK key after you have consumed it. For example, if an organization uses a MAK key and replaces one computer running Windows 7 activated using a MAK key with another computer, the replacement computer consumes a new activation of the MAK key. In some scenarios, this circumstance makes KMS a preferred solution to MAK key activation.

As a single key is used, you can add MAK keys images when deploying them centrally. When using the Sysprep utility to prepare an image, you add a MAK key to an image during the Specialize configuration pass. When performing a traditional installation, you can enter MAK keys in the same way that you would enter a retail key. The main issue that requires consideration when using a MAK key is how you will perform activation.

You can activate a MAK key in one of two ways:

- **MAK Independent Activation** Similar to normal retail activation in that it requires that each computer independently activate. You can activate the key automatically over the Internet or use the telephone to call the licensing clearinghouse. MAK Independent Activation is a good option for locations in which you do not have sufficient numbers of clients to make KMS or MAK Proxy Activation viable. For example, if you plan to deploy five clients on an isolated network, it is simpler for you to perform MAK Independent Activation over the telephone than it is to configure MAK Proxy Activation for such a small number of clients.

- **MAK Proxy Activation** Allows administrators to configure activation of multiple independent clients using a single connection to Microsoft. MAK Proxy Activation is suitable for isolated networks that do not meet the KMS client threshold but have sufficient numbers of clients to make independent activation more time consuming than configuring proxy activation. For example, consider MAK Proxy Activation for an isolated network of 23 clients for the Windows 7 Enterprise operating system. Performing 23 separate telephone activations would take more time than configuring proxy activation. To use MAK Proxy Activation, you need to configure the Volume Activation Management Tool (VAMT). You learn about the VAMT in the next section.

MORE INFO **MAK KEYS AND VOLUME DEPLOYMENTS**

To learn more about entering product keys when preparing volume deployments, consult the following TechNet document: *http://technet.microsoft.com/en-us/library/dd744266(WS.10).aspx*.

Volume Activation Management Tool

The Volume Activation Management Tool (VAMT) allows you to collect activation requests from multiple computers and then forward those requests to Microsoft all at one time. After the VAMT receives the activation confirmation identifiers from Microsoft, it can distribute those IDs back to the computers that originally requested activation. The term for this process is MAK Proxy Activation, described previously.

The VAMT stores activation confirmation identifiers in a database called a collection. Because these identifiers are stored locally, you can perform operating system reactivation without being required to initiate a new connection between the computer hosting the VAMT and Microsoft. This allows organizations to reimage computers without the concern of consuming an additional activation on an existing MAK key. You can use the Volume Activation Management Tool to transition client computers between MAK and KMS volume activation if necessary.

To use MAK Proxy Activation, perform the following general steps:

1. Install the VAMT on a computer on the isolated network and the VAMT on a computer that is located on a network connected to the Internet. For the purposes of this explanation, the computer on the isolated network is VAMT-Isolated and the computer on the connected network is VAMT-Connected.
2. Create a computer group named Isolated Computers on VAMT-Isolated. Use the VAMT discovery process to discover the identity of the computers on the isolated network.

3. Add the MAK key to the VAMT on computer VAMT-Isolated. Right-click the Isolated Computers group on VAMT-Isolated and then choose the MAK Proxy Activate option. Make sure of the following:
   - The Get Confirmation ID From Microsoft check box is not enabled.
   - The Apply Confirmation ID And Activate check box is not enabled.
4. When VAMT finishes assigning the MAK keys on the isolated network, save the collection file on VAMT-Isolated, and then transfer and import the collection file to the VAMT-Connected computer. This action populates the VAMT on VAMT-Connected with the Isolated Computers group.
5. On the VAMT-Connected computer, right-click the Isolated Computers group and then choose MAK Proxy Activate. Make sure of the following:
   - The Get Confirmation ID From Microsoft check box is selected.
   - The Install MAK (Overwrite Existing) check box is not selected.
   - The Apply Confirmation ID And Activate check box is not selected.
6. VAMT on VAMT-Connected now interacts with the Microsoft servers and procures confirmation identifiers.
7. After the confirmation IDs have been obtained from the Microsoft servers, export the collection with a new name. Transfer this file to the VAMT-Isolated computer and import the file.
8. After you import the file, save the file in a secure location such as a removable flash device placed in a safe. This allows you to perform reactivation if it is necessary to reimage hosts on the isolated network.
9. On VAMT-Isolated, select the Isolated Computers group and choose MAK Proxy Activate. Make sure of the following:
   - The Apply Confirmation ID And Activate check box is selected.
   - The Get Confirmation ID From Microsoft check box is not selected.
   - The Install MAK (Overwrite Existing) check box is not selected.
10. VAMT assigns the confirmation identifiers to computers on the isolated network, activating them.

You can configure VAMT clients on an Active Directory computer account, a stand-alone workgroup membership, a fully qualified domain name, or an IP address, as shown in Figure 2-1. The tool also allows you to see the current licensing state of clients on your network, allowing you to determine whether your organization is compliant with the number of purchased licenses.

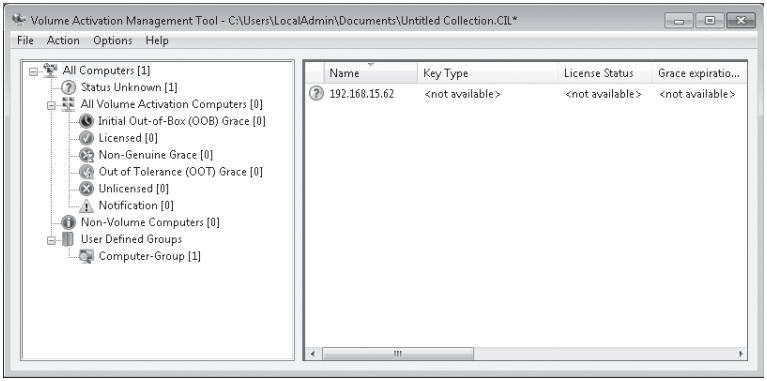


FIGURE 2-1 Volume Activation Management Tool

You can also use the VAMT to activate a large number of computers that are located on a network connected to the Internet. The name for this process is MAK Independent Activation. When you perform MAK Independent Activation, the VAMT installs the MAK key on a group of selected computers and then prompts those computers to undergo the activation process on Microsoft activation servers.

MORE INFO **MAK PROXY ACTIVATION**

To learn more about MAK Proxy Activation, consult the following TechNet document: *http://technet.microsoft.com/en-us/library/dd981010.aspx*.

Quick Check

- **What tool do you use to perform MAK Proxy Activation?**

Quick Check Answer

- **Volume Activation Management Tool**

Key Management Service

Key Management Service (KMS) allows you to place an activation server on the local area network. Rather than activate on the Microsoft activation servers on the Internet, clients activate on the KMS server on the LAN. Clients locate KMS servers using DNS. Because KMS provides activation servers, you should not expose a KMS server to hosts on the Internet by allowing direct access from the Internet. You can also configure clients to use a specific KMS server by using the VAMT. Computers running the Windows 7, Windows Vista, Windows Server 2008, Windows Server 2008 R2, and Windows Server 2003 operating system can function as KMS servers. When you configure a computer running Windows Server 2008 R2 as a KMS server,

you can activate both server and client operating systems. When you configure a computer running the Windows 7 operating system as a KMS server, it is able to activate only computers running Windows client operating systems.

A certain number of clients must contact a KMS server before the KMS activation can occur. This number is the KMS activation threshold. Clients activating on the KMS server can be running in a traditional hardware deployment or as virtual hosts. The KMS activation threshold differs between clients and servers and is as follows:

- The KMS client threshold is 25 Windows clients.
- The KMS server threshold is five servers.

When a new client or server contacts the KMS server, the server increments the activation count by one. Clients do not activate until the activation count reaches the threshold value. Clients contact the KMS server every two hours until the activation threshold is reached or the activation grace period expires. After the activation count on the KMS server exceeds 5, any servers that contact or have contacted the KMS server successfully activate. After the activation count on the KMS server exceeds a value of 25, clients that contact or have contacted the server successfully activate.

To configure a host to function as a KMS server, perform the following steps:

1. Install the KMS key on the computer that will function as the KMS server. This computer can be running the Windows 7 operating system, although this means that it is able to activate only Windows client operating systems and is unable to activate Windows server operating systems.
2. Activate the computer that you installed the KMS key on with Microsoft over the Internet or by using the telephone. After activation is complete, the computer functions as a KMS server.

Each KMS key can be installed on up to six computers that will function as KMS servers. Each KMS server can be reactivated up to nine times with Microsoft, should it be necessary. If your organization needs more than six KMS servers, you must contact a Microsoft Licensing representative to enable additional activations for the organization's KMS key. For example, if your organization has 12 separate sites covered by a single Volume Licensing agreement and a KMS server is to be placed at each site, you need to enable additional activations for the organization's KMS key.

After a KMS client has been activated, it tries to reconnect with the KMS server every 7 days but must reconnect with the KMS server at least once every 180 days. If the client is unable to reconnect with the KMS server in 180 days, it enters a reduced functionality mode. Each time a KMS client successfully connects with a KMS server, the 180-day activation countdown timer is reset.

MORE INFO **KMS ACTIVATION WEBCAST**

To learn more about KMS activation, view the following webcast on the Microsoft Web site: *http://technet.microsoft.com/en-us/library/dd936199.aspx*.

Software Licensing Management Tool

The software licensing management tool is a command-line utility that you can use to manually manage licensing. The tool uses the slmgr.vbs script. Unlike VAMT, which you must obtain and install manually, slmgr.vbs is included in a default installation of the Windows 7 operating system. The slmgr.vbs script is usually run locally from an elevated command prompt. You can also use it to manage licensing on computers configured for remote management. You can configure the slmgr.vbs command to perform the following tasks:

- Install and remove product keys from hosts.
- Display current host licensing information including current license expiration date.
- Force a host to undergo the activation process.
- Configure a client to use a KMS server and specify the address of the KMS server.
- Extend the evaluation period by 30 days up to three times.

EXAM TIP

Know which editions of Windows 7 can be used with volume licensing. Know the situations in which you can use a KMS server. Know which licensing scenarios require a host to have Internet access.

Lesson Summary

- MAK keys and KMS can be used only with editions of Windows 7 that support volume licensing. Only the Windows 7 Professional and Enterprise editions support this type of licensing.
- A KMS server requires 25 clients before it can function. A client must check in with the KMS server every 180 days.
- You can use the VAMT to perform MAK proxy activation.
- You add the MAK key to an operating system image using Sysprep during the configuration pass.

Lesson Review

You can use the following questions to test your knowledge of the information in Lesson 1, "Designing and Managing a Licensing Strategy." The questions are also available on the companion CD if you prefer to review them in electronic form.

NOTE **ANSWERS**

Answers to these questions and explanations of why each answer choice is correct or incorrect are located in the "Answers" section at the end of the book.

1. You need to deploy the Windows 7 operating system to 10 computers that are located on a network isolated from the Internet. These computers have been custom-built using hardware purchased from different vendors. These 10 computers are the only hosts on this network. These computers have the Windows 7 Enterprise operating system installed. Which of the following components should you deploy in your solution?
   - **A.** Retail key
   - **B.** MAK key
   - **C.** OEM key
   - **D.** KMS server
2. Your organization has an isolated network with one computer running the Windows Server 2008 R2 operating system. This server is configured as a KMS server and uses KMS for activation. How many clients running the Windows 7 Enterprise edition operating system must you add to this isolated network before clients can successfully activate using the KMS server?
   - **A.** 4
   - **B.** 9
   - **C.** 24
   - **D.** 29
3. Which of the following methods can you use to activate 15 clients using a MAK when they are on a network isolated from the Internet? (Choose all that apply; each answer forms a complete solution.)
   - **A.** MAK Independent Activation
   - **B.** MAK Proxy Activation
   - **C.** KMS
   - **D.** Telephone activation
4. You are using Sysprep to prepare a Windows 7 Enterprise image for deployment. During which Sysprep configuration pass do you add the MAK key?
   - **A.** auditUser
   - **B.** Generalize
   - **C.** Specialize
   - **D.** auditSystem
5. Which of the following editions of Windows 7 support volume licensing? (Choose all that apply; each answer forms a complete solution.)
   - **A.** Enterprise
   - **B.** Ultimate
   - **C.** Professional
   - **D.** Home Premium

Lesson 2: Designing a Client Hardware Platform

You must ensure that Windows 7 is deployed on hardware that meets the minimum hardware requirements. Although it is unusual today to find new hardware that would not meet the Windows 7 requirements, you might encounter problems when you attempt to install Windows 7 on older computers that had previous operating systems installed, such as Windows XP.

After this lesson, you will be able to:

- Understand hardware requirements.
- Choose an edition of Windows 7 for deployment.
- Determine when to choose physical or virtual deployments.

Estimated lesson time: 40 minutes

Windows 7 Hardware Requirements

Make sure you deploy Windows 7 only to hardware platforms that meet the minimum requirements. Windows 7 has the following minimum hardware requirements:

- 1 GHz or faster 32-bit (x86) or 64-bit (x64) processor
- 1 gigabyte (GB) of RAM (x86) or 2 GB of RAM (x64)
- 16 GB of hard disk space (x86) or 20 GB (x64)
- DirectX 9 graphics card with WDDM 1.0 or higher graphics adapter driver

The primary limitation of the x86 versions of Windows 7 is that they do not support more than 4 GB of RAM. You can install the x86 version of Windows 7 on a computer that has more than this amount of RAM, but only 4 GB is usable by the operating system. Some editions support more RAM than other editions.

The Starter edition of Windows 7 supports a maximum of 2 GB of RAM. The x64 version of Windows 7 Home Basic x64 supports a maximum of 8 GB of RAM. The x64 Home Premium edition supports a maximum of 16 GB of RAM. The x64 Professional, Enterprise, and Ultimate editions support up to 192 GB of RAM.

MORE INFO **PHYSICAL MEMORY LIMITS**

To find out more about memory limitations in Windows 7, consult the following MSDN article: *http://msdn.microsoft.com/en-us/library/aa366778(VS.85).aspx*.

Although the x86 version of Windows 7 can be installed on computers that have x64 compatible processors, you cannot install an x64 version of Windows 7 on a computer with an x86 processor. Different editions of Windows 7 support different numbers of physical processors, and x86 versions support up to 32 cores, while x64 versions support up to 256 cores per physical processor. For example, all editions of Windows 7 support quad-core CPUs. Windows 7 supports either one or two physical processors. The editions and the number of processors that they support are as follows:

- **1 Physical Processor** The Starter, Home Basic, and Home Premium editions.
- **2 Physical Processors** The Professional, Ultimate, and Enterprise editions of Windows 7 support a maximum of two physical processors.

MORE INFO **WINDOWS 7 SYSTEM REQUIREMENTS**

To learn more about the Windows 7 system requirements, consult the following document: ***http://windows.microsoft.com/systemrequirements***.

Windows 7 Editions

Because the 70-686 exam is primarily concerned with issues related to the deployment and management of Windows 7 in enterprise environments, the exam concentrates on those editions of Windows 7 that are most likely to be present in those environments. Only three editions of Windows 7 can be joined to an Active Directory Domain Services domain and are likely to be managed by enterprise administrators on an organizational network. These are the Professional, Ultimate, and Enterprise editions of Windows 7. Although these editions all share the same basic features, such as the ability to join domains and be subject to Group Policy, these editions differ from one another in the following ways:

- **Windows 7 Professional** This edition of Windows 7 supports Encrypting File System and Remote Desktop Host. You can use either a retail product key or an enterprise licensing key with this edition of Windows 7.
- **Windows 7 Ultimate** This edition of Windows 7 supports enterprise features such as Domain Join, EFS, Remote Desktop Host, AppLocker, DirectAccess, BitLocker Drive Encryption, BranchCache, and Boot from VHD. You can use Windows 7 Ultimate only with a retail product key.
- **Windows 7 Enterprise** This edition of Windows 7 has support for identical features to the Ultimate edition. The difference between Enterprise and Ultimate is that Enterprise supports only volume licensing and cannot be used with a retail key. The Enterprise edition also includes four licenses for virtualized clients.

Quick Check

- **Which edition of Windows 7 would you choose if you needed to use a retail license key and the BranchCache feature on a computer hardware platform that had 8 GB of RAM?**

Quick Check Answer

- **You would choose the x64 version of Windows 7 Ultimate. Windows 7 Ultimate supports use with a retail license key and can also access the BranchCache feature. Only x64 versions of Windows 7 support computer hardware that has more than 4 GB of RAM.**

Windows 7 Virtualization

Only certain editions of Windows 7 can be installed as virtual guests. For example, you can install the Professional, Ultimate, and Enterprise editions of Windows 7 as virtual guests on servers running Hyper-V, you cannot deploy the Starter and Home Premium editions in this manner. The x86 and x64 versions of Windows 7 can be run as virtual clients, although the x64 versions of Windows 7 can be run only as virtual clients in virtualization solutions that support this processor architecture. You learn more about virtualization solutions later in this chapter.

Running Windows 7 Professional or Ultimate virtually consumes a license activation. Windows 7 Enterprise edition works differently from the other two editions in that this edition includes four virtual licenses as a part of its licensing terms. This means that if you deploy a computer running Windows 7 Enterprise and you install virtualization software, you are licensed to run four virtual instances of Windows 7 on that computer. This can be very useful for developers whose testing practices might compromise the operating system environment in a way that requires a clean install. The extra virtual licenses included in the Enterprise edition means that you can provision a virtual machine that you run tests on without consuming an extra operating system license.

MORE INFO **SUPPORTED VIRTUAL GUESTS**

To find out more about which operating systems are supported as virtual guests on Hyper-V, consult the following TechNet document: *http://technet.microsoft.com/en-us/library/cc794868(WS.10).aspx*.

Virtualization Hosts

Microsoft ships several products that can host virtual guests running the Windows 7 operating system. Software that hosts virtual guests can run on both client and server operating systems. You can also deploy the Windows 7 operating system as a virtual client on virtualization host products that are available from third-party vendors. These are the virtualization host products available from Microsoft:

- **Virtual PC 2007** Runs on previous Windows client operating systems. Virtual PC 2007 supports only x86 versions of Windows 7.
- **Windows Virtual PC** Can be installed on Windows 7. Windows Virtual PC is limited to running x86 versions of Windows 7.
- **Virtual Server 2005 R2** Can host x86 and x64 versions of Windows 7. Virtual Server 2005 R2 can be run on Windows Server 2003, Windows Server 2008, and the Windows XP operating systems.
- **Hyper-V** A role service that you can run only on x64 versions of Windows Server 2008. Hyper-V is the platform most commonly used to host virtual machines on networks in which third-party virtualization host solutions have not been deployed.

Because Hyper-V functions only on x64 versions of Windows Server 2008 and Windows Server 2008 R2, Hyper-V can be reliably used to deploy all versions of the Windows 7 operating system. On Windows Server 2008 R2, you can install the Remote Desktop Virtualization Host role service. This service allows users to connect to a Remote Desktop Server that also holds the Hyper-V role, allowing users to connect to virtual machines hosted on the Hyper-V server.

MORE INFO **REMOTE DESKTOP VIRTUALIZATION HOST**

To learn more about Remote Desktop Virtualization Host, consult the following page on TechNet: *http://technet.microsoft.com/en-us/library/dd759170.aspx*.

Boot from VHD

The Enterprise and Ultimate editions of Windows 7, as well as all editions of Windows Server 2008 R2, can be configured to boot from a virtual hard disk file (VHD). The VHD file is stored on the hard disk as a normal file, and the deployed operating system is contained within this file. In essence, the VHD file serves as a container located on the hard disk. The benefit of deploying an operating system to a container is that the container can be moved to another platform if you need to move it. For example, to transfer a fully deployed computer from one host to another, boot using the Windows PE environment and copy the VHD file to a new location. The only step required to prepare the new location is to edit the boot configuration file to point to the operating system on the VHD. You perform the task of boot environment configuration in the practice exercise at the end of this lesson.

Another benefit of deploying to VHD rather than consuming an entire disk partition with an installation of Windows 7 is that it simplifies the process of deploying Windows 7 in a multiple operating system boot configuration. For example, you could configure two VHD files, one of which is configured and optimized to run one set of applications, and another that you have configured and optimized to run a separate set of applications.

You can create VHD files using the Diskpart.exe utility and through the Create And Attach Virtual Hard Disk dialog box available from the Disk Management Console. This dialog box is shown in Figure 2-2. When you create a VHD on a hard disk that you intend to use as the host for an operating system, you choose between dynamically expanding and fixed-size disk types. A dynamically expanding virtual hard disk increases size as needed until it consumes the volume that hosts it. Dynamically expanding virtual hard disks become increasingly fragmented over time. Fixed-size disks use a fixed amount of space and are less likely to become fragmented, which increases overall performance. The drawback to fixed-size disks is that you cannot expand them if the need arises. It is also possible to use Diskpart.exe to configure a boot from VHD on differencing disks. Differencing disks allow you to discard changes to the operating system at a later time.

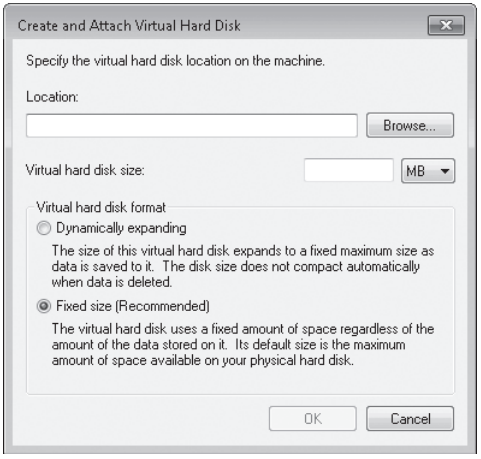


FIGURE 2-2 Creating and attaching VHD

You can deploy an operating system to an existing VHD file using the traditional installation method or by mounting the VHD file and using the ImageX.exe utility to apply an image to the VHD file. You use this second method in the practice exercise at the end of this lesson. You can also obtain a utility that converts files in Windows Imaging Format (WIM) directly to VHD files, although Microsoft does not directly support this method.

MORE INFO **WIM TO VHD CONVERTER**

To learn more about the VIM to VHD converter, consult the following page on MSDN: *http://code.msdn.microsoft.com/wim2vhd*.

You can deploy fully prepared VHD files from Windows Deployment Services running on computers with the Windows Server 2008 R2 operating system. This allows VHD files to be deployed directly to hard disk drives through a multicast transmission.

A native VHD boot has the following limitations:

- Can be used only for Enterprise and Ultimate editions of Windows 7 and Windows Server 2008 R2.
- A maximum of 512 VHD files can be attached concurrently.
- Operating system hibernation is not supported, although sleep mode is supported.
- VHD files cannot be nested.
- BitLocker cannot be used to encrypt the host volume used for native VHD boot. BitLocker cannot be used on volumes hosted inside a VHD.
- The parent volume of the VHD cannot be configured as a dynamic disk.
- The attached VHD volume cannot be configured as a dynamic disk.

MORE INFO **BOOT FROM VHD**

To learn more about configuring Windows 7 to boot from VHD, consult the following document on TechNet: *http://technet.microsoft.com/en-us/library/dd799282(WS.10).aspx*.

EXAM TIP

Remember which editions of Windows 7 can use the boot from VHD functionality. Remember which edition of Windows 7 includes four virtual licenses.

PRACTICE Preparing Boot from VHD

You can install the Windows 7 operating system so that it boots from a VHD file that is installed on physical hardware. This method has a benefit of making the operating system more portable.

EXERCISE 1 Preparing for and Installing a VHD Boot

In this exercise, you prepare a computer for a VHD installation of Windows 7. Only the Enterprise and Ultimate editions of Windows 7 allow you to perform an installation to a VHD file on physical hardware. To perform this practice, ensure that your computer running Windows 7 has at least 20 GB of free hard disk space. You need to have access to ImageX.exe, which is part of the Windows AIK tools, to complete this practice.

1. Log on to computer WKSTN1.
2. Open an elevated command prompt and copy the file Install.wim, which is located in the sources directory of the Windows 7 installation media to the directory c:\wim-store. Also, copy the ImageX.exe utility from the Windows AIK directory to the c:\wim-store folder.
3. Start diskpart by entering the command **diskpart**.

4. At the diskpart prompt, type **list disk** to list the current disks on the computer.
5. At the diskpart prompt, type **create vdisk file=c:\win7vhd.vhd maximum=20000 type=fixed**.
6. At the diskpart prompt, type **select vdisk file=c:\win7vhd.vhd**.
7. At the diskpart prompt, type **attach vdisk**, which attaches the selected disk.
8. At the diskpart prompt, type **list disk** to verify that the disk has been created. On your screen, you should see something like the text shown in Figure 2-3.

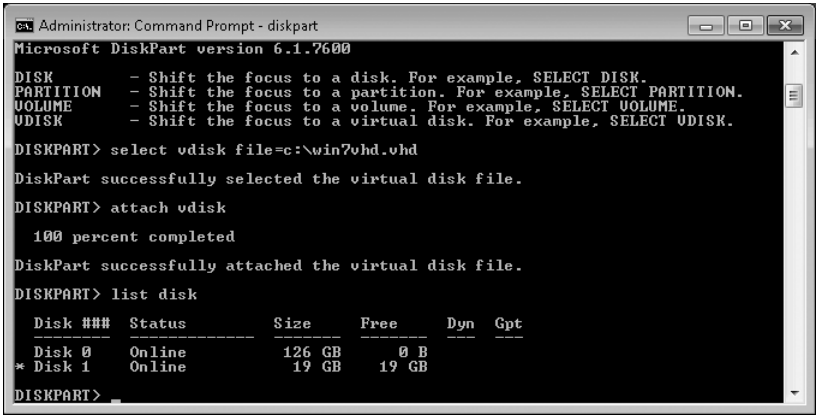


FIGURE 2-3 Verifying VHD

9. Select the disk that you created using the **select disk X** command where X is the identifier of the newly created virtual hard disk.
10. Issue the **create partition primary** command to create a partition on the selected virtual hard disk.
11. Issue the **select partition 1** command to select the partition, and then issue the **active** command to mark the partition as active.
12. Issue the command **format fs=ntfs quick**. When this command completes execution, issue the command **assign**. A pop-up window that details the drive letter assigned to the VHD file is displayed. Close this dialog box, and then in the command prompt, type **exit** to leave the diskpart utility.
13. Use the command **dism.exe /get-wiminfo /wimfile:c:\wim-store\install.wim** to determine the index assigned to the Windows 7 Ultimate or Windows 7 Enterprise operating system file image.
14. Use the command **c:\wim-store\imagex.exe /apply c:\wim-store\install.wim / check X e:** where e:\ is the volume address label that was assigned to the VHD file when you used diskpart in step 12, and X is the index number of the operating system you discovered in step 13, as shown in Figure 2-4.

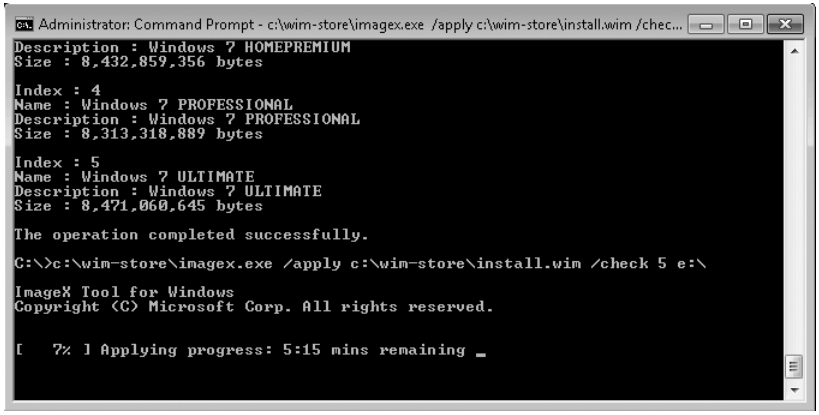


FIGURE 2-4 Applying the image to the VHD

15. Enter the command **diskpart** to start the diskpart utility.
16. Enter the command **select vdisk file=c:\win7vhd.vhd,** and when this command completes, enter the command **detach vdisk**. This detaches the virtual disk from the drive where you applied it. Type **exit** to leave the diskpart utility.
17. Create a copy of the current boot loader entry by entering the command **bcdedit /copy {current} /d "VHD Boot"**. Make a note of the GUID that is generated, as highlighted in Figure 2-5. You should use the command prompt's ability to mark and copy text to copy this to the buffer.

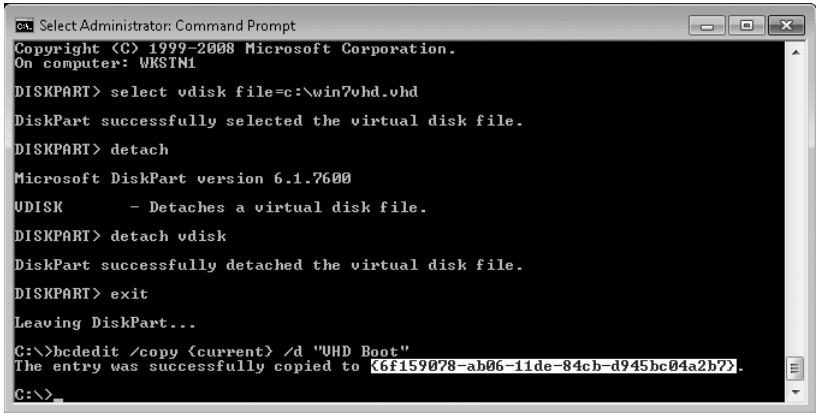


FIGURE 2-5 GUID of the new boot entry

18. Enter the command **bcdedit /set {6f159079-ab06-11de-84cb-d945bc04a2b7} device vhd=[c:]\win7vhd.vhd** where {6f159079-ab06-11de-84cb-d945bc04a2b7} is the unique GUID assigned on your computer.

19. Enter the command **bcdedit /set {6f159079-ab06-11de-84cb-d945bc04a2b7} osdevice vhd=[c:]\win7vhd.vhd** where {6f159079-ab06-11de-84cb-d945bc04a2b7} is the unique GUID assigned on your computer. This command differs from the one in step 18 in that you use the *osdevice* parameter instead of the *device* parameter.
20. Enter the command **bcdedit /set {6f159079-ab06-11de-84cb-d945bc04a2b7} detecthal on**.
21. Type **bcdedit /set {6f159079-ab06-11de-84cb-d945bc04a2b7} description "Boot from VHD"**.
22. You can now reboot into the operating system deployed to the VHD file.

Lesson Summary

- Windows 7 Professional supports domain join and volume licensing, but does not support the boot from VHD, BranchCache, AppLocker, or DirectAccess features.
- X86 versions of Windows 7 can be installed on x64 hardware, but x64 versions of Windows 7 cannot be installed on x86 hardware.
- X86 versions of Windows 7 can address a maximum of 4 GB of RAM.
- Only the Enterprise and Ultimate editions of Windows 7 support the boot from VHD.

Lesson Review

You can use the following questions to test your knowledge of the information in Lesson 2, "Designing a Client Hardware Platform." The questions are also available on the companion CD if you prefer to review them in electronic form.

> ***NOTE*** **ANSWERS**
>
> **Answers to these questions and explanations of why each answer choice is correct or incorrect are located in the "Answers" section at the end of the book.**

1. Which of the following editions allow you to use KMS activation and can be installed to a VHD file during a physical deployment?
   - **A.** Windows 7 Home Premium
   - **B.** Windows 7 Enterprise
   - **C.** Windows 7 Ultimate
   - **D.** Windows 7 Professional

2. What is the maximum number of instances of Windows 7 Enterprise that you can host virtually on a computer running Windows 7 Enterprise without having to purchase additional operating system licenses?

   A. 2

   B. 3

   C. 4

   D. 5

3. Your organization has recently purchased 15 computers that have 16 GB of RAM. You want to deploy these computers to a branch office location. Because they are located in a branch office, you want to take advantage of the DirectAccess feature. Which of the following versions and editions of Windows 7 should you acquire for these computers while also attempting to minimize licensing costs?

   A. The x64 version of Windows 7 Enterprise

   B. The x86 version of Windows 7 Enterprise

   C. The x64 version of Windows 7 Professional

   D. The x86 version of Windows 7 Professional

4. You want to allocate 8 GB of memory to a virtual instance of Windows 7 Enterprise edition. Which of the following virtualization hosts support this configuration? (Choose all that apply; each answer forms a complete solution.)

   A. Hyper-V

   B. Virtual PC 2007

   C. Virtual Server 2005 R2

   D. Windows Virtual PC

Lesson 3: Migrating User Profiles

From a user's perspective, a successful migration to Windows 7 means that all of the data that the user relied upon on her old computer is present and available on her new computer. When you have to move only a few users to new computers, you can take time and care to ensure that every bit of data and setting that was present on the previous computer is available to users on their new systems. When you need to move user profile data on several thousand computers, you do not have the time to provide this personal attention to detail. In this lesson, you learn how to automate the collection and migration of important user data. This ensures that that you can move large numbers of users to computers running the Windows 7 operating system, while ensuring that all the files and settings that the users needed from their old systems remain available.

After this lesson, you will be able to:

- Determine which data and settings to preserve.
- Choose between local and remote storage.
- Secure migrated data.
- Decide between wipe-and-load or side-by-side migration.

Estimated lesson time: 40 minutes

Understanding Migration Circumstances

Unless your organization uses roaming user profiles, the computer that a person uses probably has important data stored locally. Migrating users from the Windows XP or Windows Vista operating systems to Windows 7, or even migrating them from one computer running Windows 7 to another, means that you must get all important data from one local computer to the next. You can view user profile data by opening the System item within Control Panel and then opening the User Profiles area of the Advanced tab, as shown in Figure 2-6. You can use this tool to copy user profile data to another location, but you cannot use this tool to import user profile data.

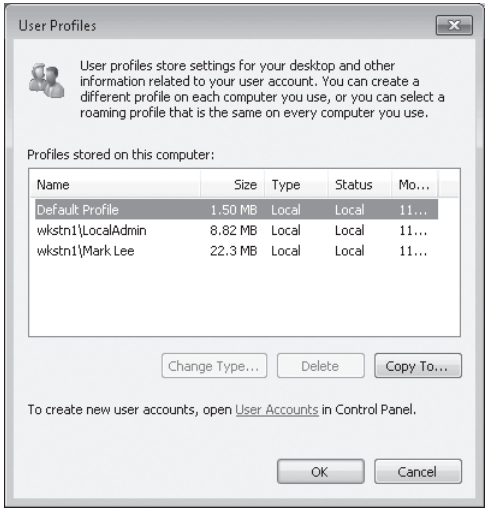


FIGURE 2-6 User profile data

MORE INFO **ROAMING USER PROFILES**

To learn more about how to implement Roaming User Profiles in your organization, consult the following TechNet reference: *http://technet.microsoft.com/en-us/library/cc784961(WS.10).aspx*.

MORE INFO **CUSTOMIZING USER PROFILES**

To learn more about customizing user profiles in Windows 7, consult the following reference on the Microsoft Web site: *http://support.microsoft.com/kb/973289*.

When you are considering the migration of a large number of users from one platform to another, you must address the following factors:

- Choosing what type of migration you will perform. Will you be migrating users to new computers, a task known as PC replacement, or will you be upgrading their current computers, a task known as a PC refresh?
- Choosing where migrated data will be stored during the migration. If you are moving a large number of users, you may need to use a network migration store. This can cause problems if you are not careful about cataloging the location of each migrated user profile store.
- Choosing an appropriate migration tool. In small migrations, you may choose to use Windows Easy Transfer, a tool built into the Windows 7 operating system. In larger migrations, you are more likely to choose the User State Migration Tool, a tool available as a free download from Microsoft.

If you are moving users of a small number of computers, you should consider using Windows Easy Transfer rather than other tools. Windows Easy Transfer is a utility built into the Windows 7 operating system that allows you to move user profile data from one location to another. The tool is wizard driven, which simplifies use and allows migration of the most common user profile components. You can use Windows Easy Transfer to migrate user profile data from computers running the Windows XP, Windows Vista, and Windows 7 operating system to computers running the Windows 7 operating system. The drawback of Windows Easy Transfer is that you cannot automate the utility, which makes migrating user profile data for a large number of computers prohibitively time consuming.

MORE INFO **WINDOWS EASY TRANSFER**

To learn more about the Windows Easy Transfer, consult the following Web page: *http://www.microsoft.com/windows/windows-vista/features/easy-transfer.aspx*.

Choosing a Migration Type

The nature of your task influences the migration type you ought to choose. Depending on whether you are migrating user profile data because you are replacing an existing computer's operating system or because you are moving a user from one computer to another, one type is more suitable than another. These are the two basic types of migration:

- **Wipe-and-load migration** This is appropriate when the current hardware can support a new operating system. Sometimes people refer to this as a PC Refresh scenario. For example, you are deploying the Windows 7 operating system to a group of users whose computers are presently running the Windows XP operating system. In most cases with a wipe-and-load migration, you move user data, format the hard disk drive, and then perform a clean installation of the new operating system, importing the new data after the clean installation completes. You can use the local hard disk as a migration store in a wipe-and-load migration. You can keep the data on the computer during the migration or use a remote store, such as a network location or a removable storage device.
- **Side-by-side migration** This is appropriate when you are replacing the user's current computer with a new computer. People also refer to this type of migration as a PC Replacement scenario. For this type, you need to use an intermediate store for the migrated data that is accessible to both the current and replacement computer. This intermediate store might be a network location or could be a removable storage device.

You can perform an upgrade only when users already have Windows Vista installed on their original computer. Upgrades are possible only across versions of the operating system that support the same processor architecture. For example, you can upgrade an x86 version of Windows Vista to an x86 version of Windows 7, but you cannot upgrade an x86 version of Windows Vista to an x64 version of Windows 7. To transition from an x86 to an x64 edition requires that you perform a migration rather than an upgrade.

MORE INFO **COMMON MIGRATION SCENARIOS**

To learn more about common migration scenarios, consult the following article on TechNet: *http://technet.microsoft.com/en-us/library/dd560802(WS.10).aspx*.

Quick Check

- **What type of migration do you perform when you are replacing people's computers running Windows Vista with computers that will run the Windows 7 operating system?**

Quick Check Answer

- **You perform a side-by-side migration when you are replacing a person's computer running Windows Vista with a computer running the Windows 7 operating system.**

User State Migration Tool

The User State Migration Tool (USMT) is a command-line utility that you can use to automate the task of migrating user profiles in wipe-and-replace and side-by-side migrations. USMT is a part of the Windows AIK and is designed to be used in highly automated migration scenarios. USMT migrations occur in two phases: in collecting profile data from the source computer using Scanstate.exe and in importing profile data to the destination computer using Loadstate.exe. In PC Refresh scenarios, the source computer and the destination computer are the same machine.

USMT allows you to capture user accounts, user files and folders (including NTFS permissions), operating system settings, and application settings. You can use USMT to migrate profile data to destination computers running Windows 7 from source computers running the Windows XP, Windows Vista, and Windows 7 operating systems. You cannot use USMT to migrate settings for mapped network drives, local printers, device drivers, local user account passwords, shared folder permissions, and Internet connection sharing settings.

MORE INFO **USER STATE MIGRATION TOOL**

To learn more about the User State Migration Tool, consult the following TechNet document: ***http://technet.microsoft.com/en-us/library/dd560801(WS.10).aspx***.

Configuring USMT Migration Settings

If you use USMT with basic options, it moves the most common application settings as well as data from folders most commonly used to store documents. Although this selection works in most cases, many organizations use unique local storage configurations and deploy unusual applications. You can configure USMT to migrate data stored from these unique locations and unusual applications by configuring an appropriate XML-formatted configuration files. Here are the XML-formatted configuration files that you can use with USMT:

- **MigUser.xml** This file contains rules about user profiles and user data. The default settings for this file move all data in My Documents, My Video, My Music, My Pictures, desktop files, Start Menu, Quick Launch settings, Favorites, Shared Documents, Shared Video, Shared Music, Shared desktop files, Shared Pictures, Shared Start menu, and Shared Favorites. This file also contains rules to ensure that all the following file types are migrated from fixed volumes: .qdf, .qsd, .qel, .qph, .doc, .dot, .rtf, .mcw, .wps, .scd, .wri, .wpd, .xl*, .csv, .iqy, .dqy, .oqy, .rqy, .wk*, .wq1, .slk, .dif, .ppt*, .pps*, .pot*, .sh3, .ch3, .pre, .ppa, .txt, .pst, .one*, .mpp, .vsd, .vl*, .or6, .accdb, .mdb, .pub, .xla, .xlb, and .xls. The asterisk (*) represents zero or more characters.
- **MigDocs.xml** This file contains information about the location of user documents. Use this file if local user documents are stored in nonstandard locations.

- **MigApp.xml** This file contains rules about migrating application settings. These include Accessibility settings, dial-up connections, Favorites, folder options, fonts, group membership, Open Database Connectivity (ODBC) settings, Microsoft Office Outlook Express mailbox files, mouse and keyboard settings, phone and modem options, Remote Access Service (RAS) connection phone book files, regional options, remote access, screen-saver settings, taskbar settings, and wallpaper settings.
- **Config.xml** This file is used to exclude features from the migration. You can create and modify Config.xml using Scanstate.exe with the /genconfig option.

In some situations, there may be files or application settings that are not migrated when you configure the XML files listed in the preceding paragraphs. In these instances, you must create a custom XML file. You can also use custom XML files to reroute folders, specific file types, or specific files. Rerouting is the process by which you move all files of one type that may have been stored in separate places on the source computer to a specific, final location on the destination computer.

MORE INFO **CREATING CUSTOM XML FILES**

To learn more about creating custom XML files, consult the following document on TechNet: *http://technet.microsoft.com/en-us/library/dd560773(WS.10).aspx*.

ScanState

Scanstate.exe runs on the source computer. If you are running Scanstate.exe from within Windows on computers that have either the Windows Vista or Windows 7 operating system, you must do so from an elevated command prompt. If you are running Scanstate.exe on a computer running the Windows XP operating system, you must be logged on with an account that is a member of the local administrators group.

You can use Scanstate.exe to perform an offline migration of data. An offline migration occurs when you run Scanstate.exe from the Windows PE environment, rather than from a client Windows operating system environment. The benefit of performing an offline migration is that it occurs more quickly than when you perform an online migration. You can configure a special bootable Windows PE image that performs an automatic offline migration. You can also deploy this image using Windows Deployment Services, which allows you to perform automatic offline migrations on a computer from a PXE boot. Although you can use Scanstate.exe in offline mode, you cannot use Loadstate.exe in this manner. You must always run Loadstate.exe from within the Windows client operating system environment.

MORE INFO **OFFLINE MIGRATIONS**

To learn more about performing offline migrations using Scanstate.exe, consult the following TechNet Web page: *http://technet.microsoft.com/en-us/library/dd560758(WS.10).aspx*.

Scanstate.exe is a command-line utility. When using Scanstate.exe, you must specify the location in which the migration store will be hosted. The following command creates an encrypted migration store named store123 on the file share named Migration on the file server named Fileserver and uses the files MigApp.xml and MigUser.xml. You encrypt the store using the key mykey:

```
Scanstate \\fileserver\Migration\store123 /i:MigApp.xml /i:MigUsr.xml /o /encrypt /
key:"mykey"
```

MORE INFO **SCANSTATE**

To learn more about how to use the Scanstate.exe command-line utility, consult the following TechNet document: *http://technet.microsoft.com/en-us/library/dd560781(WS.10).aspx*.

LoadState

You run the Loadstate.exe utility from an elevated command prompt on the destination computer. You should install all applications that were on the source computer on the destination computer prior to running Loadstate.exe. If you install applications on the destination computer after running Loadstate.exe, individual application settings might be overwritten by the new installation.

You need to use the same custom XML files when using the Loadstate.exe utility to restore data if you used custom XML files during the Scanstate.exe process. For example, to load data from the store123 store that you created in the example earlier in this chapter, you would use this command:

```
Loadstate \\fileserver\Migration\store123 /i:MigApp.xml /i:MigUsr.xml /decrypt /key:"mykey"
```

MORE INFO **LOADSTATE**

To learn more about how to use the Loadstate.exe command-line utility, consult the following TechNet document: *http://technet.microsoft.com/en-us/library/dd560804(WS.10).aspx*.

Selecting a Migration Store

When you have determined exactly what files and settings you need to migrate from the source computer to the destination computer, you need to determine which type of migration store you will use. Although you can use a removable storage device as a migration store, most administrators do not use this option when they are moving a large number of user profiles. This store type requires the technician performing the migration to attach and detach the device as a part of the migration process. This level of manual intervention can significantly lengthen the migration process when you are dealing with several thousand computers. If you choose to use

a network share as a migration store host, you need to consider the amount of storage space required and the possible impact on network bandwidth of transferring a substantial amount of user profile data to and from the network share as the migration progresses. USMT supports three general migration store types:

- **Uncompressed** This type holds data in a hierarchy of folders that mirror the user profile data that is being transferred. Uncompressed migration stores create a duplicate of the migrated data in a separate location on the original volume, on an attached volume, or on a remote location such as a network share. You can navigate the folder hierarchy using Windows Explorer or the command line. Uncompressed migration stores are not encrypted when created by the Scanstate.exe utility, and they lack the security of other migration store types. When you are moving multiple computers by using uncompressed migration stores on a shared network folder, you need to ensure that each migration store is written to a separate folder location on the store.
- **Compressed** This type writes all migration data to a single compressed file. You can encrypt this file. You can extract the data located in this file using the Loadstate.exe utility. When you move data for multiple computers by using compressed migration stores, ensure that the resulting migration store has a unique name that allows you to tie it back to the computer that you migrated from.
- **Hard-link** You can use hard-link migration stores only in wipe-and-load migrations. The hard-link migration store allows files to be stored on the local computer while the old operating system is removed entirely and a new operating system is installed. Hard-link migrations do not create a duplicate of the migrated profile data and use less space than an uncompressed or compressed migration store. You cannot use a hard-link migration store when you are using a network share as a storage location.

You should consider the security of uncompressed and compressed migration stores that are located on shared network folders. If the security of user profile data is a concern during a migration, you should use a compressed migration store with encryption. This method minimizes the risk that unauthorized third parties are able to access user profile data during the migration process. You configure an encrypted migration store in the practice exercise at the end of this lesson.

Estimating Storage Requirements

You can use Scanstate.exe to determine the amount of space required for each storage type on a computer given a specific set of migration rules. This can be useful when you are planning a migration and you do not know how much data actually has to be stored. The migration report is written in XML format. You can open the report for review using Windows Internet Explorer, as shown in Figure 2-7.

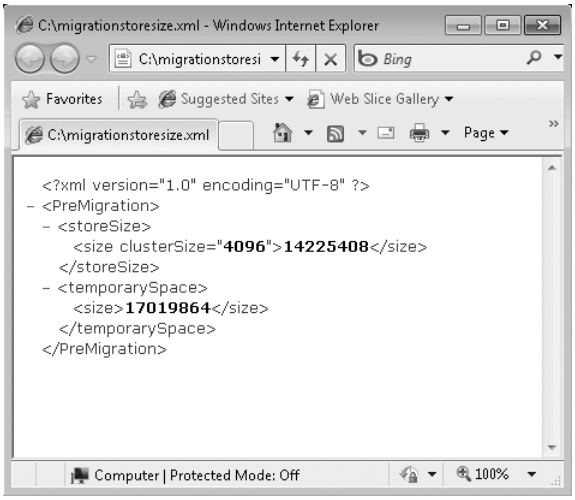


FIGURE 2-7 Migration store report

You run the following command to generate an estimate of the migration store size:

```
Scanstate.exe c:\migrationstore /o /p:"C:\migrationstoresize.xml"
```

PRACTICE Using USMT

USMT allows you to automate the process of migrating user profile data. In this set of practice exercises, you perform several steps that you would perform with USMT when preparing to migrate profile data. These include creating an estimate of the size of the migration store, creating a custom XML file that has the location of any nonstandard document directories and then creating an encrypted migration store.

EXERCISE 1 Creating an Estimate of the Migration Store Type

Prior to performing this practice exercise, ensure that the Windows Automated Installation Kit is already installed on WKSTN1. To complete this exercise, follow these steps:

1. Log on to computer wkstn1 with the Mark Lee user account.
2. Create the directories c:\mig-store, c:\mig-reports, and c:\usmt.
3. Depending on whether your Windows 7 installation is x86 or x64, copy the contents of the c:\Program Files\Windows AIK\Tools\USMT\x86 or c:\Program Files\Windows AIK\Tools\USMT\amd64 directories to the c:\usmt directory.
4. Run the following command to generate an estimate of the migration store size:

   ```
   C:\USMT\scanstate.exe c:\mig-reports /p:"c:\mig-reports\MigrationStoreSize.xml"
   ```

5. Use Internet Explorer to open the file c:\mig-reports\MigrationStoreSize.xml.
6. Run the following command to create an encrypted store:

```
C:\usmt\scanstate c:\mig-store /encrypt /key:"Pa$$w0rd"
```

7. Verify that the migration store has been created in the c:\mig-store directory.

Lesson Summary

- The User State Migration Tool can be automated to migrate profile data.
- The process of replacing the operating system on a computer is known as a PC Refresh scenario or as a wipe-and-load migration. You can use a hard-link migration store during this type of migration if you want to minimize the use of disk space.
- The process of replacing an old computer with a new computer is called a PC Replacement scenario or side-by-side migration. You cannot use a hard-link migration store for this type of migration.
- Scanstate.exe is run on the source computer. Loadstate.exe is run on the destination computer.
- USMT uses XML configuration files such as MigUser.xml, MigApp.xml, and MigDocs.xml to control which data is migrated from the source computer to the destination computer.

Lesson Review

You can use the following questions to test your knowledge of the information in Lesson 3, "Migrating User Profiles." The questions are also available on the companion CD if you prefer to review them in electronic form.

> ***NOTE*** **ANSWERS**
>
> **Answers to these questions and explanations of why each answer choice is correct or incorrect are located in the "Answers" section at the end of the book.**

1. Your organization has just purchased 400 new computers and you need to move user data from 400 existing installations in a side-by-side migration. These computers run a mix of Windows 2000 Professional, Windows XP Professional, Windows Vista, and the Windows 7 operating systems. You want to extract data from as many computers as possible by performing an offline migration with the User State Migration Tool. Which of these operating systems support this type of migration? (Choose all that apply; each answer forms a complete solution.)
   - **A.** Windows 7
   - **B.** Windows XP Professional
   - **C.** Windows Vista
   - **D.** Windows 2000 Professional

2. Which of the following XML files do you modify to specify information about a custom user documents folder when you use the User State Migration Tool?
   - **A.** MigApp.xml
   - **B.** Config.xml
   - **C.** MigUser.xml
   - **D.** MigDocs.xml
3. Which of the following migration store types support encryption when you use Scanstate.exe?
   - **A.** Hard-link migration
   - **B.** Uncompressed Remote Store
   - **C.** Compressed Remote Store
   - **D.** Uncompressed Local Store
4. Which of the following migration store types should you use when you have to perform a wipe-and-load migration on a large number of computers, you want to ensure that no data is transferred from the computers, and that a minimum amount of disk space is used?
   - **A.** Compressed remote store
   - **B.** Uncompressed local store
   - **C.** Hard-link migration store
   - **D.** Compressed local store

Chapter Review

To further practice and reinforce the skills you learned in this chapter, you can perform the following tasks:

- Review the chapter summary.
- Review the list of key terms introduced in this chapter.
- Complete the case scenarios. These scenarios set up real-world situations based on the topics of this chapter and ask you to create a solution.
- Complete the suggested practices.
- Take a practice test.

Chapter Summary

- Volume activation allows organizations with large operating system deployments to use multiple activation keys and key management services servers to simplify the process of activating computers.
- x86 versions of Windows 7 support a maximum of 4 GB of RAM.
- Windows 7 Enterprise and Ultimate editions support boot from VHD.
- You can use the User State Migration Tool to automate the user profile migration process through XML configuration files.

Key Terms

Do you know what these key terms mean? You can check your answers by looking up the terms in the glossary at the end of the book.

- Activation
- Hard-link
- KMS
- MAK

Case Scenarios

In the following case scenarios, you apply what you've learned about subjects of this chapter. You can find answers to these questions in the "Answers" section at the end of this book.

Case Scenario 1: Branch Office and Head Office Activation

Your organization has a volume license agreement with Microsoft. You will be deploying Windows 7 to 200 clients at your organization's head office. You will be deploying between 15 and 20 clients on isolated networks at 11 separate branch offices. You want to minimize the amount of administrative effort required. With these facts in mind, answer the following questions:

1. Which editions of Windows 7 can you deploy at Contoso as a part of your volume license agreement with Microsoft?
2. Which activation solution should you use at your head office site?
3. Which activation solution should you use for the clients located on isolated branch office networks?

Case Scenario 2: Migrating Users to Virtual Machines

Your organization has a large number of people using computers that have the Windows XP Professional operating system. Rather than migrate all these users to new computers running the Windows 7 Enterprise operating system, you have decided to migrate users to Windows 7 virtual machines hosted on a server running Hyper-V. During the migration, you want to ensure

that user profile data is stored on a network share as a single encrypted file. You should be able to create this file with the User State Migration Tool and not use any additional utilities. You want to apply AppLocker policies to secure application execution on the virtual machines. You also want to use KMS to activate the virtual machines. With these facts in mind, answer the following questions:

1. Which edition of Windows 7 should you choose to be hosted on the Hyper-V server?
2. What type of migration should you use to move data off computers running Windows XP Professional so that it can be imported into virtual machines running Windows 7?
3. What is the name of the command-line utility you should use to import data from the encrypted migration store to the Windows 7 virtual machines?

Suggested Practices

To help you successfully master the exam objectives presented in this chapter, complete the following tasks.

Plan and Manage Client Licensing and Activation

You should complete this practice if your computer is connected to the Internet.

- **Practice 1** Download and install the Volume Activation Management Tool.
- **Practice 2** Use the Volume Activation Management Tool to scan a group of computers by IP address range.

Plan and Manage a Physical Hardware and Virtualization Strategy

Perform this exercise if your computer is connected to the Internet and you have access to a computer running Windows 7 Enterprise or Ultimate on physical hardware.

- **Practice 1** Download and install Windows Virtual PC on a computer running Windows 7 Enterprise or Ultimate on physical hardware.
- **Practice 2** Install a virtualized copy of Windows 7 under Windows Virtual PC. Make note of which versions of Windows 7 you can install under Windows Virtual PC.

Design a User State Migration Strategy

Perform these practices if you have downloaded the Windows Automated Installation Kit and have access to a separate computer.

- **Practice 1** Use the Scanstate.exe utility to create a custom XML file that includes documents located in nonstandard directories.
- **Practice 2** Use the Loadstate.exe utility to import migration data generated in the practice exercise at the end of Lesson 3 on to a second computer running the Windows 7 operating system.

Take a Practice Test

The practice tests on this book's companion CD offer many options. For example, you can test yourself on just one exam objective, or you can test yourself on all the 70-686 certification exam content. You can set up the test so that it closely simulates the experience of taking a certification exam, or you can set it up in study mode so that you can look at the correct answers and explanations after you answer each question.

MORE INFO **PRACTICE TESTS**

For details about all the practice test options available, see the "How to Use the Practice Tests" section in this book's Introduction.

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