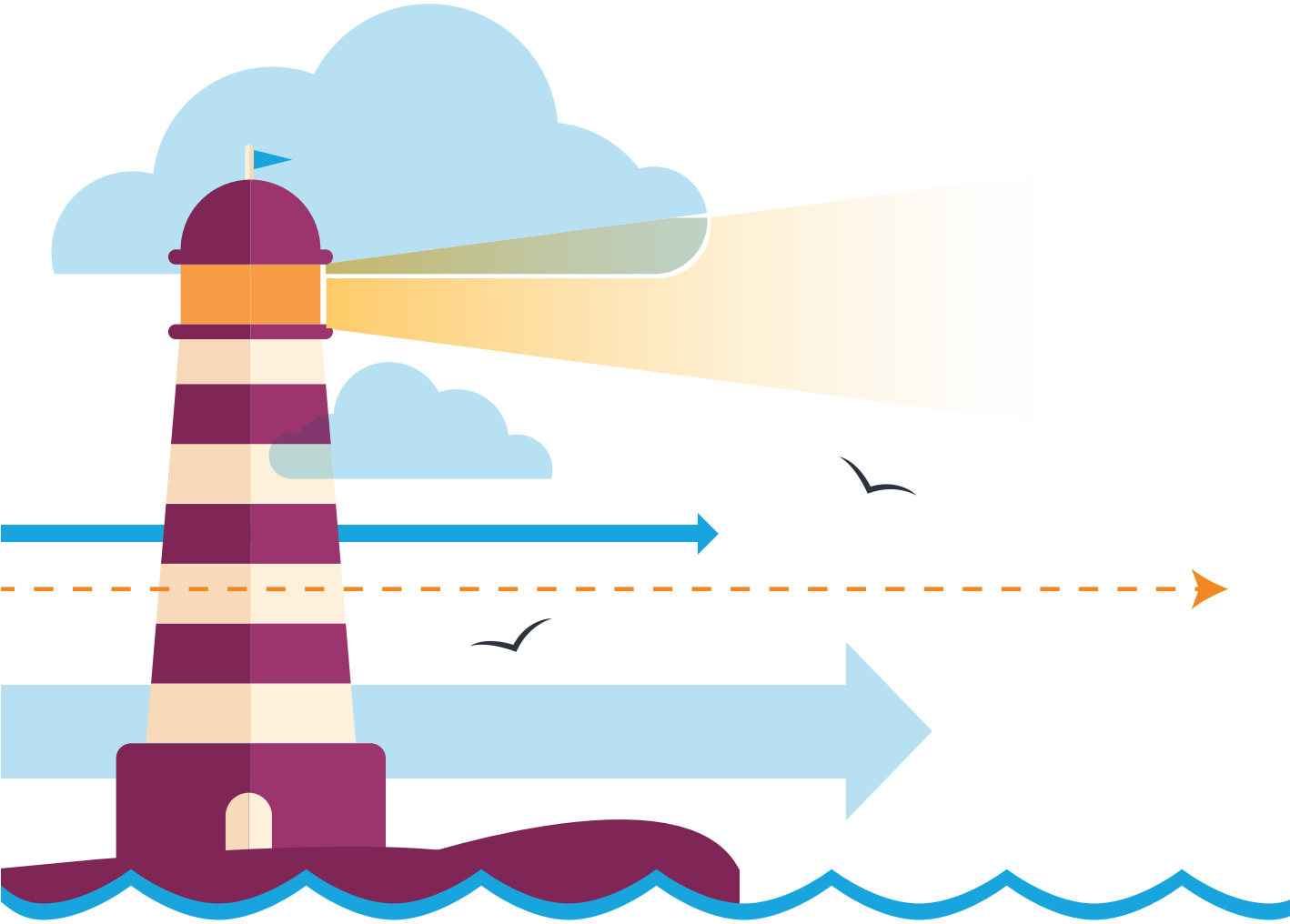

WINDOWS® OPERATING SYSTEM FUNDAMENTALS

Crystal Panek

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Windows

Operating System Fundamentals

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This book is dedicated to my loving husband, William Panek, and to my two wonderful daughters, Alexandria and Paige. Thank you all for your love and support. I love you all more than anything!

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I would like to thank my husband and best friend, Will, because without him I would not be where I am today - Thank you! I would also like to express my love to my two daughters, Alexandria and Paige, who have always shown nothing but love and support. Thank you all!

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Crystal Panek holds the following certifications: MCP, MCP+I, MCSA, MCSA+ Security and Messaging, MCSE-NT (3.51 & 4.0), MCSE 2000, 2003, 2012/2012 R2, 2016, MCSE+Security and Messaging, MCDBA, MCTS, MCITP.

For many years she trained as a contract instructor teaching at such places as MicroC, Stellacon Corporation and the University of New Hampshire. She then became the vice-president for a large IT training company and for 15 years she developed training materials and courseware to help 1000's of students get through their certification exams. She currently works on a contract basis creating courseware for several large IT training facilities.

She currently resides in New Hampshire with her husband and two daughters. In her spare time, she likes to camp, hike, shoot trap and skeet, golf, bowl, and snowmobile.

Contents

Introduction *xix*

Lesson 1 Installing and Upgrading Client Systems 1

Understanding Windows Systems 3
- Understanding User Interfaces 4
- Determining Appropriate Editions Per Device Type 5
- Understanding Processor and Memory Architecture 10
- Understanding Drivers 12
- Understanding Windows 10 System Requirements 13

Understanding Installation Types 17
- Installing Windows 10 18
- Performing a Clean Install of Windows 10 20
- Upgrading to Windows 10 23
- Migrating to Windows 10 from Previous Versions of Windows 26

Skill Summary 31

Knowledge Assessment 32
- Multiple Choice 32
- Fill in the Blank 34
- True/False 34

Case Scenarios 34
- Scenario 1-1: Troubleshooting a Compatibility Problem 35
- Scenario 1-2: Converting a Small Office to Windows 10 35
- Scenario 1-3: Selecting the Right Computer and Operating System 35
- Scenario 1-4: Installing Windows 10 35

Lesson 2 Understanding Operating System Configurations 37

Understanding User Accounts 39
- Create a User Account 40

Configuring and Optimizing User Account Control (UAC) 42
- Review UAC Settings 44

Configuring Windows 10 45
- Introducing Windows 10 Settings 47
- Using Control Panel 50
- Configuring System Options 53
- Changing the Date and Time 56
- Configuring the Desktop and Taskbar Settings 56

Configuring the Start Menu 60
Configuring File Explorer Settings 60
Configuring User Profiles 62
Configuring Folder Locations 63
Configuring Libraries 65
Configuring Display Settings 67
Configuring Power Settings 70
Configuring Accessibility Options 74
Creating and Managing Shortcuts 78
Configuring Hyper-V 80
Enable the Hyper-V Feature 80
Creating and Configuring Virtual Machines 82
Creating and Managing Virtual Switches 87
Creating and Managing Virtual Disks 90
Creating and Managing Checkpoints 91
Skill Summary 92
Knowledge Assessment 94
Multiple Choice 94
Fill in the Blank 95
True/False 96
Case Scenarios 96
Scenario 2-1: Getting Administrative-Level Privileges 96
Scenario 2-2: Configuring Accessibility Features 96
Scenario 2-3: Running a Legacy Application 96
Scenario 2-4: Creating a Better User Experience 96

Lesson 3 Understanding Native Applications, Tools, Mobility, and Remote Management and Assistance 97

Configuring Internet Explorer 99
Managing Cookies and Privacy Settings 99
Configuring Security Zones 104
Using Dynamic Security and Protected Mode 106
Configuring the SmartScreen Filter and Phishing 108
Managing Add-Ons 109
Configuring Compatibility Mode 111
Configuring Secure Sockets Layer (SSL) and Certificates 112
Managing Favorites 113
Managing LAN Settings 114
Configuring Microsoft Edge 116
Configuring Cortana 118
Introducing Accessory Programs 119
Using Snip & Sketch 120
Using Windows Media Player 12 125

Supporting Mobile Access and Data Synchronization 130
Synchronizing Your PC Settings 130
Configuring Offline Files 132
Using Windows Mobility Center 136
Change Mobility Center Settings 138
Accessing a Computer Remotely 138
Configuring Remote Desktop 139
Configuring Remote Assistance 144
Configuring Remote Management Settings 148
Using the Microsoft Management Console to Manage Systems Remotely 149
Using Windows Remote Management 153
Using WinRS.exe 155
Introducing Windows PowerShell 155
Using Remote Windows PowerShell 160
Skill Summary 162
Knowledge Assessment 163
Multiple Choice 163
Fill in the Blank 164
True/False 165
Case Scenarios 165
Scenario 3-1: Securing Internet Explorer 11 165
Scenario 3-2: Offering Remote Assistance 165
Scenario 3-3: Viewing Logs Remotely 166
Scenario 3-4: Creating a Playlist 166

Lesson 4 Managing Applications, Services, and Disks 167

Configuring Applications 169
Configuring Desktop Apps 169
Configuring Windows Features 171
Supporting Desktop Application Co-Existence 172
Troubleshooting Program Compatibility 172
Configuring Startup Options 174
Managing Windows Store Apps 176
Configuring the Windows Store 176
Implementing Windows Store Apps 178
Understanding Group Policy and Network Application Installation 180
Understanding Services 181
Understanding Service Startup Types 183
Using MSConfig (System Configuration Utility) 189
Change System Configuration Settings 193
Managing Processes and Applications with Task Manager 194

Understanding Storage 198
Understanding Storage Device Types 198
Understanding Disk and Drive Types 201
Understanding File Systems 203
Using Disk Management to Configure Disks, Volumes, and File Systems 205
Encrypting and Compressing Files and Folders 212
Understanding Encrypting File System (EFS) 213
Understanding BitLocker 217
Skill Summary 220
Knowledge Assessment 222
Multiple Choice 222
Fill in the Blank 223
True/False 224
Case Scenarios 224
Scenario 4-1: Providing Redundancy on a Client Computer 224
Scenario 4-2: Protecting Laptop Computers 225
Scenario 4-3: Uninstalling Local Software 225
Scenario 4-4: Running a Windows 7 Application on Windows 10 225

Lesson 5 Managing Devices 227

Understanding Cloud Storage 228
Using OneDrive to Manage Files and Folders 229
Understanding Printing Devices 232
Understanding Local Printers 232
Understanding Network Printers 236
Printing a Document 237
Understanding Print Queues 239
Understanding Internet Printing 241
Understanding System Devices and Device Drivers 242
Managing Devices 243
Using the Devices and Printers Folder 245
Using Device Manager 247
Troubleshooting Problem Devices 252
Skill Summary 255
Knowledge Assessment 256
Multiple Choice 256
Fill in the Blank 257
True/False 258

Case Scenarios 258
Scenario 5-1: Troubleshooting Print Jobs 258
Scenario 5-2: Troubleshooting a Printer Driver 258
Scenario 5-3: Changing Print Drivers 259
Scenario 5-4: Using Cloud Services 259

Lesson 6 Understanding File and Print Sharing 261

Understanding File and Printer Sharing Basics 263
Configuring HomeGroup Connections 266
Creating Shares 271
Configuring Public Folders 271
Configuring File Sharing 272
Configuring File System Permissions 276
Understanding Effective NTFS Permissions 279
Viewing Effective Permissions on a Resource 283
Combining NTFS and Share Permissions 285
Mapping Drives 285
Configuring Printer Sharing 288
Skill Summary 290
Knowledge Assessment 291
Multiple Choice 291
Fill in the Blank 292
True/False 293
Case Scenarios 293
Scenario 6-1: Picking an Appropriate File Sharing Method 293
Scenario 6-2: Creating and Configuring a Homegroup 294
Scenario 6-3: Restricting Permissions 294
Scenario 6-4: Mapping a Network Drive 294

Lesson 7 Maintaining, Updating, and Protecting Windows 10 295

Exploring Built-in Maintenance Tools 297
Using Disk Defragmenter 297
Using Disk Cleanup 300
Using Task Scheduler 301
Using Security and Maintenance (formerly called Action Center) 308
Using System Information 310
Maintaining the Windows Registry 312
Browse and Back Up the Windows Registry 314

Configuring and Managing Updates 315
Configuring Windows Update Options 316
Managing Update History and Rolling Back Updates 319
Implementing Insider Preview 320
Implementing Semi-Annual Channel, Semi-Annual Channel (Targeted), & Long-Term Servicing Branch (LTSB) Scenarios 320
Defending Your System from Malicious Software 322
Understanding Windows Firewall 324
Managing Client Security Using Windows Defender 326
Skill Summary 331
Knowledge Assessment 332
Multiple Choice 332
Fill in the Blank 333
True/False 334
Case Scenarios 334
Scenario 7-1: Automating Computer Maintenance and Program Launching 334
Scenario 7-2: Removing Viruses Safely 334
Scenario 7-3: Gathering System Information 335
Scenario 7-4: Distributing Windows Updates Across a Network 335

Lesson 8 Understanding Backup and Recovery Methods 337

Understanding Local, Network, and Automated Backup Methods 338
Restoring Previous Versions of Files and Folders 339
Schedule a Windows 10 Backup to Include a System Image 340
Restore a File from a Windows 10 Backup 342
Configuring System Recovery 343
Configuring a System Restore 343
Configuring a Windows 10 File Recovery Drive 346
Configuring File History 347
Performing Recovery Operations Using Windows Recovery 351
Skill Summary 358
Knowledge Assessment 360
Multiple Choice 360
Fill in the Blank 361
True/False 362
Case Scenarios 362
Scenario 8-1: Scheduling File Backups 362
Scenario 8-2: Installing from an Image 363

Scenario 8-3: Creating a System Repair Disc 363
Scenario 8-4: Resolving a Driver Problem Using Recovery Boot Options 363

Appendix Answer Key 365

Lesson 1: Installing and Upgrading Client Systems 366
Answers to Knowledge Assessment 366
Answers to Business Case Scenarios 367
Lesson 2: Understanding Operating System Configurations 367
Answers to Knowledge Assessment 367
Answers to Business Case Scenarios 368
Lesson 3: Understanding Native Applications, Tools, Mobility, and Remote Management and Assistance 369
Answers to Knowledge Assessment 369
Answers to Business Case Scenarios 370
Lesson 4: Managing Applications, Services, Folders, and Libraries 371
Answers to Knowledge Assessment 371
Answers to Business Case Scenarios 372
Lesson 5: Managing Devices 372
Answers to Knowledge Assessment 372
Answers to Business Case Scenarios 373
Lesson 6: Understanding File and Print Sharing 374
Answers to Knowledge Assessment 374
Answers to Business Case Scenarios 375
Lesson 7: Maintaining, Updating, and Protecting Windows 10 376
Answers to Knowledge Assessment 376
Answers to Business Case Scenarios 377
Lesson 8: Understanding Backup and Recovery Methods 378
Answers to Knowledge Assessment 378
Answers to Business Case Scenarios 379

Index *381*

Introduction

What Does This Book Cover?

Chapter 1: Installing and Upgrading Client Systems This chapter covers identifying Windows operating system editions, identifying hardware and compatibility requirements, determine the appropriate editions per device type. Covers identifying different upgrade paths, how to identify upgrade paths from previous Windows versions and application compatibility. This chapter also covers understanding installation types, how to perform a clean install, upgrade using Windows Update, migrate from previous Windows versions, perform removable media installation and how to perform network installation. As well as, understanding operating system architecture, understanding the kernel mode and user mode; understand memory, IRQs, drivers, CPUs, and UI; and understanding 32-bit versus 64-bit architecture.

Chapter 2: Understanding Operating System Configurations This chapter covers how to configure user account control (UAC), understanding standard user versus administrative user, understand types of UAC prompts and levels. Also covers how to configure Control Panel options, configure administrative tools, configure accessibility options, configure power settings, as well as how to configure File Explorer settings. This chapter delves into how to configure desktop settings, profiles, display settings, and shortcuts. How to configure and customize the Start Menu; configure Task Bar settings and configuring toolbars. You will also learn about libraries, how to configure libraries, add multiple local locations to a library, and adding networked locations.

Chapter 3: Understanding Native Applications, Tools, Mobility, and Remote Management and Assistance Designing for Technical Requirements This chapter covers how to configure Windows SmartScree as well as how to configure Microsoft Edge, configure Cortana, and configure computer management. You will learn how to configure mobility settings, configure Sync Center, Windows Mobility Center, and Remote Desktop. This chapter also discusses how to configure and use management tools, configure MMC, configure the Windows PowerShell console and Windows PowerShell ISE. You will also learn about offline files.

Chapter 4: Managing Applications, Services, and Disks This chapter covers configuring applications, understand local versus network applications, configure desktop applications, configure app startup options, configure Windows features, configure application removal, and how to configure Windows Store apps. You will also learn about services, understand service start-up types, service accounts, and service dependencies. You will learn to configure settings using MSCONFIG, configure processes and applications using Task Manager. This chapter also discusses understanding storage, different disk types, security (encryption), storage device types (eSATA, USB, IEEE 1394, iSCSI, InfiniBand), and storage drive

types (basic, primary, extended, logical, dynamic disk, VHDs). This chapter delves into understanding file systems, FAT32, NTFS, and ReFS as well as, understanding encryption using BitLocker and Encrypting File Systems (EFS).

Chapter 5: Managing Devices This chapter covers connecting devices, how to connect, enable, and disable plug-and-play and Bluetooth devices, connect and disconnect printers, install third-party software for devices and install device drivers. This chapter also discusses cloud storage options. You will learn about printing devices, understanding local printers, network printers, print queues, print-to-file, and Internet printing. This chapter will also delve into system devices, understanding video, audio, and infrared input devices and discussing Device Manager.

Chapter 6: Understanding File and Print Sharing This chapter covers file and print sharing, how to configure File System permissions, configure Share Permissions, configure HomeGroup settings, configure print drivers, configure effective permissions, create shares, and create mapped drives.

Chapter 7: Maintaining, Updating, and Protecting Windows 10 This chapter covers using maintenance tools, such as Disk Defragmenter, Disk Cleanup, Task Scheduler, and System Information. You will learn how to configure updates, configure Windows Update options, implement Insider Preview, Current Branch, and Current Branch for Business scenarios as well as manage update history and utilize roll back updates. This chapter also discusses how to optimize drives. You will learn how to also configure antivirus settings, how to set up Windows Defender and the Malicious Software Removal tool. This chapter will also teach you how to configure notifications.

Chapter 8: Understanding Backup and Recovery Methods This chapter covers backup and recovery methods, such as configuring System Restore, configure a recovery drive, configure recovery boot options, and various Safe Mode options and how to recover files from OneDrive.

Interactive Online Learning Tools

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Lesson

1

Installing and Upgrading Client Systems

Objective Domain Matrix

Technology Skill	Objective Domain Description	Objective Domain Number
Understanding Windows Systems	Identify Windows operating system editions	2.1
	Understand operating system architecture	2.4
Understanding Installation Types	Understand installation types	2.3
	Identify upgrade paths	2.2

Key Terms

AppLocker
Assigned Access 8.1
BitLocker
BranchCache
Business Store
clean installation
Client Hyper-V
cloud
command-line interface (CLI)
Continuum
Cortana
Credential Guard
Current Branch for Business
desktop PC
device driver
Device Guard
DirectAccess
Encrypting File System (EFS)
Enterprise Mode Internet Explorer (EMIE)
graphical user interface (GUI)
Group Policy management
hardware interrupts (IRQ)
High Touch Installation (HTI)
hybrid computer
joining to a domain
kernel mode
laptop
Lite Touch Installation (LTI)
LoadState.exe
Long-Term Servicing Branch
Private catalog
Remote Desktop
RemoteApp
ScanState.exe
smartphone
tablet
text user interface (TUI)
upgrade installation
User Experience control and lockdown
user interface (UI)
user mode
User State Migration Tool (USMT)
UsmtUtils.exe
virtual desktops
Windows 10
Windows 10 Education
Windows 10 Enterprise
Windows 10 Home
Windows 10 Media Creation tool
Windows 10 Pro
Windows Deployment Services

Windows Hello	Windows Update for Business
Windows Spotlight	x64
Windows To Go	x86
Windows Update	Zero Touch Installation (ZTI)

Real World Scenario

Lesson 1 Case

You work as an IT technician for Interstate Snacks, Inc., a mid-market food service and vending company. Management has decided to standardize on Windows 10 Pro and has asked your IT group to evaluate all existing computers to determine if they can support the operating system. Any newly acquired computers should have Windows 10 Pro installed. You need to learn as much as possible about Windows 10 system requirements, types of installations, and upgrade paths.

Understanding Windows Systems

The client version of Windows is the version that is purchased and installed on personal computers such as desktop computers, laptops, workstations, and tablets. Windows Server operating systems are purchased and installed on stand-alone physical servers, blade servers, and virtual machines.

Windows XP merged the consumer-oriented Windows 9x series with Windows NT/2000, while introducing a redesigned user interface that included the Start menu, Internet Explorer 6, and Remote Assistance functionality. As a result, Windows XP became one of the most popular client operating systems in history.

Microsoft attempted to replace Windows XP with Windows Vista, which had an updated graphical user interface and improved security. Unfortunately, Windows Vista was not well received, and it failed to overtake Windows XP. To overcome the shortcomings of Windows Vista, Microsoft released Windows 7, which offered increased performance, a more intuitive interface, and fewer User Account Control pop-ups. Windows 7 included some terrific new features as well, such as large and animated task thumbnails, HomeGroups, Jump Lists, libraries, and Windows XP Mode.

The next version of Windows introduced was Windows 8, which was upgraded to support desktop computers, mobile computers, and tablets, while optimized for touch screens. Windows 8 replaced the Start button and menu with the Start screen, a new platform for developing apps, and the Windows Store. Unfortunately, the new interface made it confusing and difficult to learn. To address some of these concerns, Microsoft released Windows 8.1, which improved the Start screen.

There are some common threads throughout all editions of Windows. For example, every edition contains the same integrated applications, such as Network and Sharing Center, Control Panel, and Windows Media Player. The different editions also include many of the same multimedia features. All Windows editions support 32-bit systems, and all editions except Windows 7 Starter support 64-bit systems.

Windows 10 is the newest client operating system. After the failure of Windows 8, Microsoft listened to customer complaints to develop Windows 10. To distance the new version of Windows from Windows 8/8.1, Microsoft skipped Windows 9 and went to Windows 10. Unlike previous versions of Windows, Windows 10 is released as an "operating system as a service," which means that it will receive ongoing updates to its features and functionality.

As client operating systems are developed and released, Microsoft also develops and releases server operating systems, as shown in Table 1.1. Until Windows 10, the client operating system and server operating system were introduced together. While both client and server operating systems can provide and request services, server operating systems can provide additional services and can service many more clients simultaneously.

TABLE 1.1 Client and Server Operating Systems

Client Operating Systems	Server Operating Systems	Version Number
Windows 10	Windows Server 2016	10.0
Windows 8.1	Windows Server 2012 R2	6.3
Windows 8	Windows Server 2012	6.2
Windows 7	Windows Server 2008 R2	6.1
Windows Vista	Windows Server 2008	6.0
Windows XP	Windows Server 2003/Windows Server 2003 R2	5.1/5.2
Windows 2000 Professional	Windows 2000 Server	5.0
Windows NT 4.0 Workstation	Windows NT 4.0 Server	4.0

Understanding User Interfaces

A *user interface (UI)* is the part of the operating system, program, or device that users use to input and receive data, and to tell the computer what to do. For example, to play a video, navigate to the folder where the video file is located, and double-click the file. Windows typically identifies the program, opens a video player, and plays the file.

User interfaces are organized into two types:

- *Graphical user interface (GUI)*: Performs functions by clicking and moving buttons, icons, and menus with a pointing device, such as a mouse or track pad.
- *Text user interface (TUI)/command-line interface (CLI)*: Performs functions by using a keyboard to type commands.

Most operating systems have a GUI, as do Windows 10 and Windows Server 2016. These operating systems include a Start menu with program groups, a taskbar showing the programs currently in use, a desktop, and various icons and quick-launch icons.

Early operating systems, such as UNIX and Microsoft DOS, were text user interface operating systems, in which you would type commands to perform tasks. However, even GUI operating systems include a text user interface that you can access to perform functions that may or may not also be available with the GUI. For example, when using Windows 10, you can use the command prompt (which allows you to type commands similar to Microsoft DOS) or Windows PowerShell. Use the command prompt or Windows PowerShell to create scripts, which can be used for repetitive tasks or for automation.

Determining Appropriate Editions Per Device Type

Like previous client version operating systems, Windows 10 offers multiple editions. The barest version is Windows 10 Home, which has the fewest number of features. Windows 10 Pro includes more features, and Windows 10 Enterprise and Windows 10 Education have the most features. Of course, Windows 10 Home is the least expensive edition, whereas Windows 10 Enterprise is the most expensive edition.

Before installing Windows, you should do a little bit of planning and ask the following questions:

1. What will the computer be used for?
2. What type of environment will the computer run in?
3. Does the computer need to be portable?

Determining what the computer will be used for will help you determine what hardware you need. For example, for a computer-aided design (CAD) system, you need a fast processor, lots of memory, and a fast video card. In addition, a CAD system would greatly benefit from a solid-state drive.

Examining the computer's environment will help you determine if you need special equipment to keep the computer clean. If the computer is in a dusty environment, dust will accumulate, which can cause systems to overheat.

Today, being mobile brings its own challenges. You want a system that can give you long battery life as well as sufficient power to perform the necessary tasks. In addition, your requirements will help determine what portable hardware you might need. For example, does the system need external or high-quality loud speakers, or do you need to work with a large screen? In some situations, you might only need a smaller computer (such as a small laptop or notepad) that enables you to check emails, take notes, write reports, and construct spreadsheets.

Now that you understand how the computer will be used, you can determine its form factor, which specifies the size, configuration, and physical arrangement of a computing device. Common form factors include:

- ***Desktop PC*** A desktop PC is the traditional PC that comes in a box and either lies down (desktop) or stands upright (tower). Desktops can be inexpensive systems that handle basic office tasks, or they can be very expensive systems that provide maximum performance for uses such as CAD or video editing. Because desktop PCs tend to be large, they are not very portable.
- ***Laptop*** A laptop is a portable computer that provides mobility for traveling users or users who might work from home. Although laptops tend not to be as powerful as desktop PCs, today's laptops can provide superior performance. Laptops can be enhanced with docking stations, external keyboards, mice, and monitors. Recently, laptop sales have surpassed desktop PC sales.
- ***Tablet*** A tablet is a smaller version of the laptop, with a screen that makes up the body of the computer. Tablets can be used for reading emails, doing presentations, creating reports, taking notes, and so forth.
- ***Hybrid Computer*** A hybrid computer is a laptop that can convert to a tablet. These devices typically offer better performance than tablets and include a keyboard for faster typing.
- ***Smartphone*** A smartphone is a small device with a screen that can be used to read email, keep track of tasks, access calendar information, manage address books, and run a wide range of applications.

Another device worth mentioning is a gaming console, such as Xbox. Although this system is designed to run games, it might also have additional applications and features.

Windows 10 has multiple editions and versions. The desktop editions of Windows 10 include:

- ***Windows 10 Home*** The Home edition is designed for consumer-based personal computers and tablets.
- ***Windows 10 Mobile*** Windows 10 Mobile is designed to deliver user experience on smaller, mobile, touch-centric devices like smartphones and tablets. It offers the same Windows apps that are included in Windows 10 Home, as well as a version of Office.
- ***Windows 10 Pro*** The Pro edition is designed for personal computers and tablets for small and medium-sized businesses, and for advanced users. It is similar to Windows 10 Home, but has extra features to meet the needs of small businesses. It includes BitLocker Drive Encryption, Encrypting File System (EFS), domain join, and Group Policy Management.
- ***Windows 10 Enterprise*** The Enterprise edition is designed for personal computers and tablets for large enterprises. It builds on Windows 10 Pro by adding advanced features designed to meet the demands of medium- and large-sized organizations. It includes AppLocker, BranchCache, and DirectAccess. Windows 10 Enterprise is only available to Volume Licensing customers.

- ***Windows 10 Education*** The Education edition is designed for personal computers and tablets aimed at schools (including staff, administrators, teachers, and students). Windows 10 Education has the same features as Windows 10 Enterprise. Windows 10 Education is only available through academic Volume Licensing.
- ***Windows 10 Mobile Enterprise*** Windows 10 Mobile Enterprise is designed to deliver an outstanding experience to business customers using smartphones and tablets. It is available to Volume Licensing customers.

Some of the features that are available in Windows 10 include:

- ***AppLocker*** A feature that allows you to specify which groups or users can run, or not run, a particular application in your organization
- ***Assigned Access 8.1*** A setting that lets you restrict a specific standard account to using only one Windows Store app, for use as a kiosk station
- ***BitLocker*** A feature that encrypts a volume to protect a system from being accessed if the system is lost or stolen
- ***BranchCache*** A wide area network bandwidth optimization technology that allows the local caching of shared folders and websites so that you don't always have to access data over a slower WAN link
- ***Business Store*** A feature that allows administrators to find, acquire, manage, and distribute apps to Windows 10 devices
- ***Client Hyper-V*** Virtualization technology that allows you to run virtual machines so that you can run older applications on older operating systems or run a different operating system on the same machine as Windows 10
- ***Continuum*** A feature that allows you to turn your phone into a big-screen projector or attach a keyboard or mouse to your phone
- ***Cortana*** A voice-activated personal assistant
- ***Credential Guard*** A feature that stores credentials, such as NTLM hashes and Kerberos tickets, and provides them to the necessary applications; the credentials are stored in a secured isolated container, which uses Hyper-V and virtualization-based security (VBS).
- ***Current Branch for Business*** A feature that allows you to delay upgrades (new versions) and updates, so that you can perform pilot testing before deploying updates
- ***Device Guard*** A feature that helps protect a system by locking a device so that it can only run trusted applications
- ***DirectAccess*** An advanced VPN technology that allows remote users to securely access internal network file shares while connected to the Internet
- ***Encrypting File System (EFS)*** A feature that provides transparent file-level encryption
- ***Enterprise Mode Internet Explorer (EMIE)*** A compatibility mode that runs Internet Explorer 11 or higher and lets websites render using a modified browser configuration

that's designed to emulate either Windows Internet Explorer 7 or 8, avoiding the common compatibility problems associated with Web Apps written and tested on older versions of Internet Explorer

- ***Group Policy Management*** An infrastructure that allows you to centrally manage computer settings and configuration
- ***Joining to a Domain*** A feature that allows you to join an Active Directory domain
- ***Long-Term Servicing Branch*** An option for organizations that only want to receive features updates every two to three years, so that the current systems can be stable
- ***Private Catalog*** A feature that provides a list of applications that users within the organization can download apps from
- ***Remote Desktop*** A program or feature that allows you to connect to a remote computer and access the desktop and applications as if you were accessing the machine directly
- ***RemoteApp*** A feature that enables you to run a program remotely through Remote Desktop Services, although the application appears to be running on your local machine
- ***User Experience Control and Lockdown*** A feature that allows you to customize and lock down the Windows 10 user interface
- ***Virtual Desktops*** A feature that allows you to run and switch between multiple desktops
- ***Windows Hello*** A credential technology that provides multi-factor authentication, including a personal identification number (PIN) or biometrics (face, iris, or fingerprint)
- ***Windows Spotlight*** An option that displays a new image on the lock screen each day
- ***Windows To Go*** A feature that allows you to boot and run Windows from USB mass storage devices such as USB flash drives and external hard disk drives
- ***Windows Update for Business*** A free service for Windows 10 Pro, Enterprise, and Education editions that can provide updates to your users based on distribution rings

Table 1.2 shows some of the common features available for the various editions of Windows 10.

TABLE 1.2 Features Based on Windows 10 Editions

Feature	Windows 10 Home	Windows 10 Pro	Windows 10 Enterprise	Windows 10 Education
AppLocker	No	No	Yes	Yes
Assigned Access 8.1	No	Yes	Yes	Yes
BitLocker	No	Yes	Yes	Yes
BranchCache	No	No	Yes	Yes
Business Store	No	Yes	Yes	Yes