Microsoft
Technology Associate

MICROSOFT TECHNOLOGY ASSOCIATE

Student Study Guide

EXAM 98-362
Windows Development Fundamentals

Microsoft

Preparing for MTA Certification

MICROSOFT TECHNOLOGY ASSOCIATE (MTA)
STUDENT STUDY GUIDE FOR DEVELOPERS

98-362 Windows Development Fundamentals

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Introduction

MTA validates building-block technology concepts and helps students explore, discover and pursue successful careers in Information Technology (IT) in an exciting and rewarding way! As the first step in the Microsoft Technology Certification Series, this new, entry-level certification provides students with confidence, credibility, and differentiation.

Explore IT career options without committing a lot of time and resources MTA exams validate the core technology knowledge that is in demand today by businesses around the world. Whether you want to explore becoming a network administrator, software engineer, web developer, or database analyst, MTA gets you started on the right path.

Prepare to compete A little investment in IT can go a long way in today's job market. Becoming MTA certified helps you build a solid foundation to prepare for intermediate technology studies and for Microsoft Certified Technology Specialist (MCTS) certifications. It can also help you compete on college admissions and jumpstart your IT career planning!

Empower yourself As the first step toward becoming an MCTS, MTA shows your commitment to technology while connecting you with a community of more than five million Microsoft Certified Professionals. Learn from them and show them what you know by becoming MTA certified!

This MTA Student Study Guide serves as a study tool to help students prepare for their MTA certification exam. Students are challenged with real-life situations for each of the major topics covered in the exam. Although successful completion of the study guide exercises does not guarantee that you will pass your MTA exam, it is an excellent way to gauge your readiness to take the exam and build confidence that you know your stuff on exam day.

I wish you all the best as you prepare for a successful career in technology!

Victoria Pohto

Victoria Pohto
MTA Product Marketing Manager

Career Planning

Most IT solutions or infrastructure built on Microsoft technologies require proficiency with one or all of the following products, often referred to as "The Microsoft Stack."

- Microsoft Windows® Server® as the data center or development platform
- Microsoft SQL Server® as the data and business intelligence (BI) platform
- Microsoft Visual Studio® as the suite of application life-cycle management tools

MTA is the starting point of Microsoft technology certifications, providing aspiring technologists with the fundamental knowledge essential to succeed with continued studies and a successful career with technology.

Preparing for and becoming MTA certified helps you explore a variety of career paths in technology without investing a lot of time and money in a specialized career path. When you find a path that is right for you, Microsoft learning products and certification can help you prepare and guide your longer-term career planning.

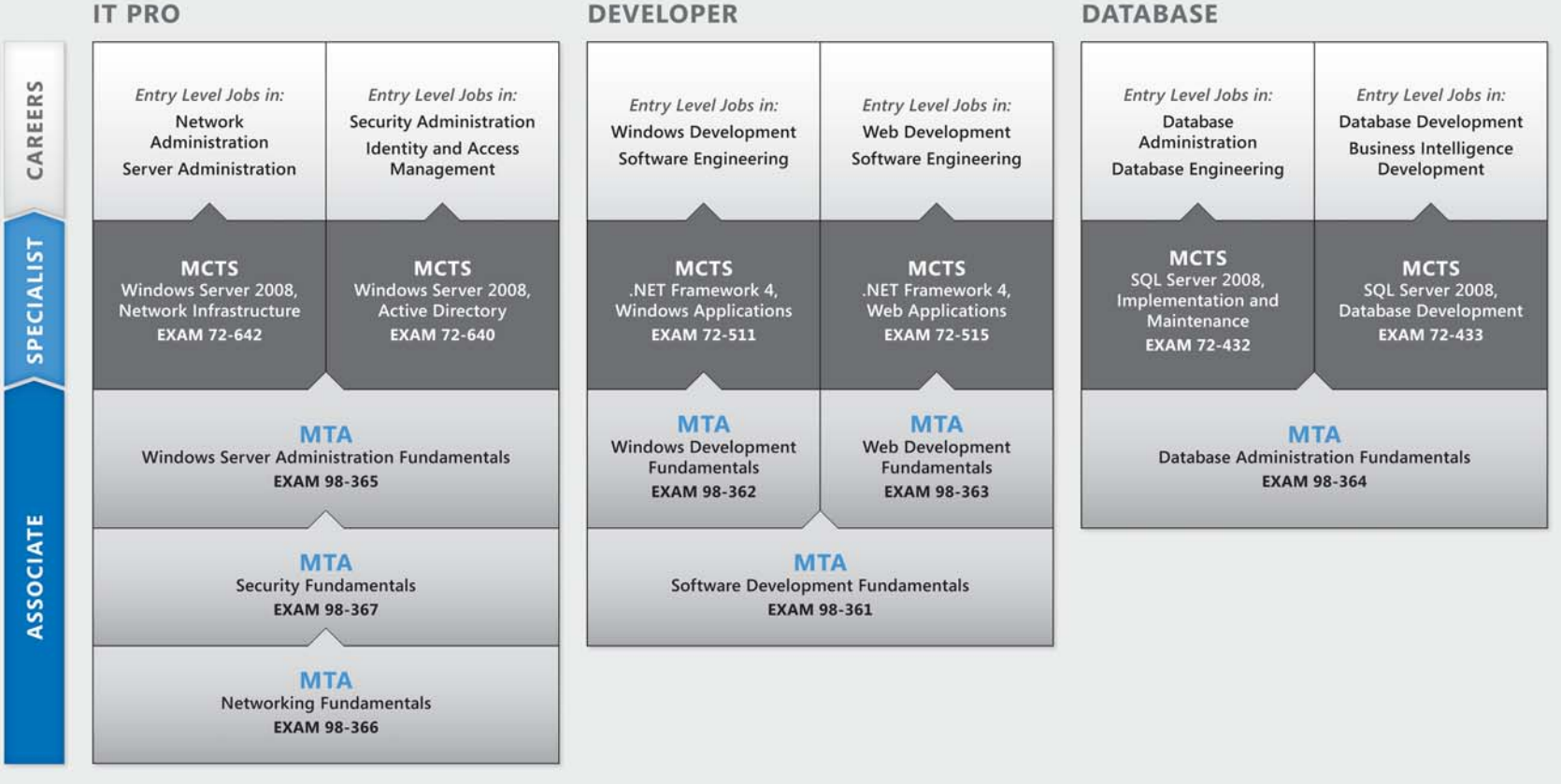
If you already know that you want to start building a career in technology, MTA preparation and certification is the recommended entry point. Becoming MTA certified shows that you have a firm working knowledge of the fundamental IT concepts critical for success with intermediate learning and certifications such as Microsoft Certified Technology Specialist (MCTS). Moreover, Microsoft certifications demonstrate an individual's commitment of self-investment and confidence to take his or her knowledge and skills to the next level with an industry-recognized credential.

MTA is not a "career certification," meaning that employers recognize you as "job ready," but it is the first step toward that career goal and can help differentiate you for an internship or to college admissions committees. As you prepare for your first job focusing on technology, be sure that you are equipped with an MCTS credential—the intermediate level certification that validates Microsoft product and technology skills.

The MTA Certification path on the next page shows you the MTA exams that are recommended prior to taking on some of Microsoft's intermediate technology certification, MCTS.

Microsoft Technology Associate Certification Paths

MTA is the recommended first step in the Microsoft IT Certification Program, and does not require pre-requisite exams. MTA certifications are not a pre-requisite for MCTS exams. *One MTA exam = One certification.*



For full Microsoft Certification roadmaps, visit **http://www.microsoft.com/learning/certification**

Exploring Job Roles

Choosing a career path is a big decision and it's not always easy, but you're not alone! Microsoft created a career site to help students understand the options and possibilities of pursuing a career in IT. The site also connects you with learning resources, student techie communities, and much more to help you prepare for a career in technology.

To chart your career with Microsoft technology, visit *www.microsoft.com/learning/career/en/us/career-org-charts.aspx*.

Database Administrator

As a database administrator, you are in charge of important databases that span multiple platforms and environments. You are a strong team player who thrives in a fast-paced environment. You build complex, highly scalable databases that meet business needs and security requirements. You are an expert in optimizing, maintaining, and troubleshooting databases, but also in designing archival, data distribution, and high-availability solutions.

Server Administrator

As a server administrator, you are in charge of implementing and managing some of the most important technology in your organization—the servers. You use extensive monitoring and profiling tools to manage the network and tune systems so they perform at optimal levels. You are an expert in Active Directory®, and you have an in-depth understanding of network protocols, and file and directory security.

Computer Support Technician

Consider starting your IT career by becoming a consumer support technician. You don't need any formal work experience, but a company might require that you know how to install, administer, and troubleshoot operating systems in a home network environment that has desktop computers, laptops, and printers. As a consumer support technician, you'll also handle network, virus, malicious software, and hardware support issues. You'll typically find this position in small to medium-sized organizations.

Exploring Job Roles

Web Developer

As a web developer, you are an expert in using the dynamic programming tools and languages that fuel the web. You might work independently or be part of a team that builds and integrates interactive web sites, applications, and services for both internal and public sites. Your role is to make it work, which means developing web applications and testing them on various browsers, enhancing and modifying them as necessary to ensure the best experience for the user. As a web developer, you might also architect websites, design data-driven applications, and find efficient client-server solutions. You must have an in-depth understanding of the software development life cycle and be able to communicate project status, issues, and resolutions.

Windows Developer

As a Windows client developer, knowing how to optimize Windows code and track bugs is a given. But you also know how to use Microsoft Visual Studio® and the Microsoft .NET framework to design, develop, test, and deploy Windows-based applications that run on both corporate servers and desktop computers. Your key talents include understanding multiple Windows application models and n-tier applications, and knowing how to work with object-oriented programming, algorithms, data structures, and multithreading. Windows Developers have an in-depth understanding of software engineering principles, software life cycles, and security principles.

Additional Online Resources for New Developers:

http://msdn.microsoft.com/beginner

http://msdn.microsoft.com/rampup

Imagine Cup

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Value of Certification

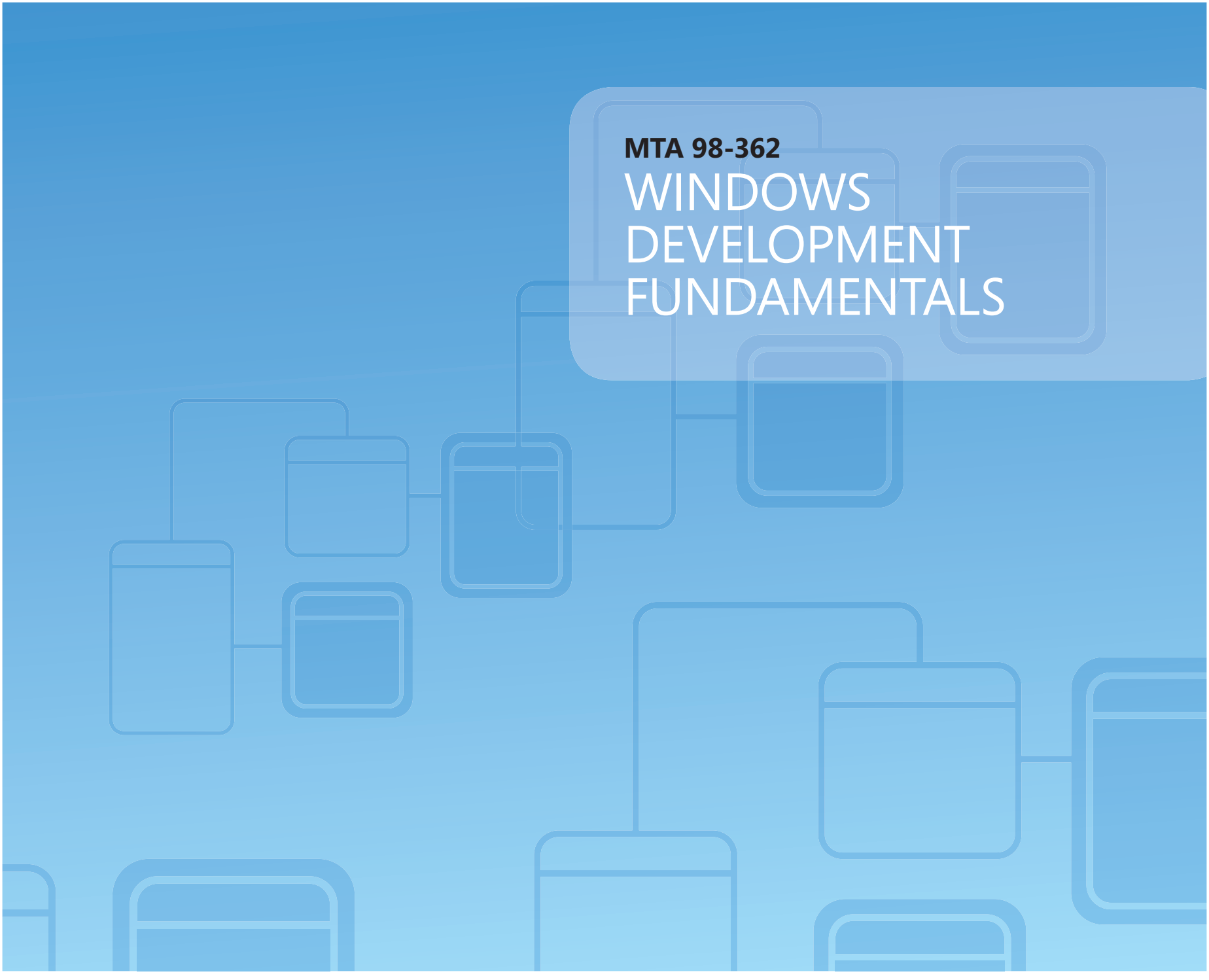
Technology plays a role in virtually everything we do. In the 20-plus years since Microsoft has been certifying people on its products and technologies, millions of people have gained the knowledge, expertise, and credentials to enhance their careers, optimize business solutions, and create innovation within just about every business and social sector imaginable. Today's Information Technology (IT) hiring managers are more often using professional credentials, such as Microsoft certification, to identify properly skilled IT candidates. Certification becomes a way to easily differentiate qualified candidates in a sea of resumes.

The job outlook for IT professionals, as reported in a study prepared by the U.S. Department of Labor's Bureau of Labor Statistics (BLS), is positive! The BLS indicates an increase that will be "faster than the average for all occupations through 2014" for Computer Support Specialists, Systems Engineers, Database Administrators, and Computer Software Engineers. One significant message resulting from this study is that information and communications technology (ICT) skills are the entry ticket to the job market, regardless of the country, industry, or job function. Information Technology is clearly an area worth investing time, resources, and education in – and technology certification is a key part of the education process, validating product and technology expertise as a result of their learning experiences.

Microsoft IT Certifications provide objective validation of the ability to perform critical IT functions successfully for worldwide IT professionals, developers, and information workers. Microsoft certifications represent a rich and varied spectrum of knowledge, job roles, and responsibilities. Further, earning a specific certification provides objective validation of the candidate's ability to perform critical IT functions successfully. Embraced by industry professionals worldwide, Microsoft certification remains one of the most effective ways to help reach long-term career goals.

MTA 98-362

WINDOWS DEVELOPMENT FUNDAMENTALS



1

Understanding Windows Programming Basics

IN THIS CHAPTER

- 1.1 Identify Windows application types
- 1.2 Implement user interface design
- 1.3 Create Windows-based applications by using Visual Studio®

Identify Windows application types

SCENARIO: Matthias and his classmates enjoy making videos with their pocket-size camcorders and sharing them with each other. One of the students has made a simple website for posting the files, and Matthias likes to watch their creations on his laptop. The problem is that Matthias is often away from home and unable to find a Wi-Fi connection—which means he can't watch his friends' videos.

He has an idea for a set of applications that would automate the process of checking the website for new videos and downloading the most recent additions to his laptop so he can watch them whenever he wants. He envisions two separate programs. The first is an application that will monitor his network connectivity. When he has an active Wi-Fi connection, it will download new content to his laptop. The second is a multimedia player that will let him browse and play all of the downloaded videos.

1. **The program to monitor connectivity and download new content should load automatically and run without user interaction. Which application type would be a good choice?**
   - **a.** Windows Forms application
   - **b.** WPF application
   - **c.** Windows Services application
2. **Matthias wants to develop a media player with a rich, animated UI capable of playing a variety of media files; which application type would work well for this application?**
   - **a.** Windows Forms application
   - **b.** WPF application
   - **c.** Windows Services application
3. **If Matthias chooses to develop his media player in C++, which library can him implement standard Windows GUI elements, such as menus and buttons?**
   - **a.** Swing
   - **b.** Win32
   - **c.** XNA Framework

hint

Windows Presentation Foundation (WPF) is a framework for creating Windows applications with media-intensive user interfaces.

Answers

1. The application type well-suited to the needs of the content download application is:
   c. **Windows Services application**
2. A good choice for the media player application is:
   b. **WPF application.** Although a Windows Forms application could work, WPF is intended to make multimedia applications easier to develop.
3. The library that helps C/C++ developers create applications with standard Windows GUI elements is:
   b. **Win32.** Also known as the Windows API, this library is often used by developers who aren't using the .NET Framework.

Essential details

- **Windows Forms** applications use Forms as the foundation of a user interface.
- **Windows Presentation Foundation** (WPF) simplifies the creation of "rich" user interfaces with such features as audio/video and 3D elements.
- WPF uses Extensible Application Markup Language (XAML) to implement a user interface.
- **Windows Services** applications, such as antivirus applications, run "in the background" with little or no user interaction.
- Win32 is a library often used by developers of C/C++ programs who are not utilizing the .NET Framework.
- Win32 applications generally use *native code*, which is faster than the *managed code* used by .NET applications. For most applications, the difference in speed is negligible; however, graphics-intensive games and other high-performance applications may benefit from this speed.

FAST TRACK HELP

- **http://msdn.microsoft.com/en-us/library/5b13a7k4.aspx**
- **http://msdn.microsoft.com/en-us/library/bb514232.aspx**

Implement user interface design

SCENARIO: As part of her internship at Litware, Inc., Pilar needs to update one of the company's oldest applications. It is a "time sheet" application that allows users to track their hours at work and transfers that data to the company's payroll department. The application functionality does not need to be changed.

However, it was originally created as a "console application," relying on text information and keyboard input to communicate with users. The company would like Pilar to give the application a user-friendly graphical user interface (GUI); they have directed her to keep the interface simple, but consistent with the Windows environment. They want Pilar to take advantage of menus and buttons, and they also want a comprehensive Help system to assist employees.

1. **Pilar decides to use a toolbar of buttons at the top of the screen. What functions should be accessible via the toolbar?**
   - **a.** every function available in the application
   - **b.** only file-management functions (*new, open, save, and so on*) and printing functions
   - **c.** only functions that are used frequently
2. **Components that make up the GUI, such as buttons, text boxes, check boxes, and radio buttons, are often referred to as:**
   - **a.** event handlers
   - **b.** icons
   - **c.** controls
3. **Litware wants the application to have context-sensitive help. Which of follow- is a common feature of a good context-sensitive help system?**
   - **a.** extensive and consistent use of tooltips
   - **b.** pressing F1 to bring up a table of contents for the complete help system
   - **c.** a Bing search available in the top-right corner of the window

hint

Tooltips provide information when the user hovers over an element on the screen, usually in a small "pop-up."

Answers

1. The functions or features on a toolbar should include:
   c. **only functions that are frequently used.** A toolbar should be simple and clean—don't try to include every feature the program has to offer!
2. GUI elements are also called:
   c. **controls**
3. Context-sensitive help features:
   a. **extensive and consistent use of tooltips**. Many good help systems allow the user to access a table of contents for help, but a table of contents is not context-sensitive.

Essential details

- The **user interface** (UI) is how a user communicates with an application.
- A **graphical user interface** (GUI) is a UI in which a user communicates with the application through graphical elements such as images, icons, and buttons, rather than just typing.
  - The components that make up a GUI are generally referred to as **controls**.
- A GUI in a Windows application is generally expected to follow some common conventions:
  - Any menu should be placed at the top of the screen and should conform to established standards; controls should be labeled with text or recognizable icons; visual elements should be consistent.
- A **context-sensitive** help system tailors help content to the user's current state or point in the application.

FAST TRACK HELP

- **http://msdn.microsoft.com/en-us/beginner/bb308740.aspx**
- **http://msdn.microsoft.com/en-us/library/aa733613**
- **http://msdn.microsoft.com/en-us/library/aa468595.aspx**

Create Windows-based applications by using Visual Studio

SCENARIO: Tom, a recent technical school graduate, is excited for his first job; he has just been hired to work with the development team at Fabrikam, Inc. Although Tom learned how to develop programs in school, he is now working in a new environment. Fabrikam develops applications with Visual Studio, which Tom has not worked with very often. To help familiarize Tom with the integrated development environment or IDE, his manager asks him to reorganize a few of the company's Visual Studio® projects. This will give Tom a chance to learn more about the company's work as well as become reacquainted with Visual Studio.

1. **If Tom has an existing application and he wants to add a related application that will use many of the same classes, what should he do?**
   - **a.** add a new solution to same project
   - **b.** add a new project to same solution
   - **c.** create a new solution
2. **Tom learns that Visual Studio creates two different files to maintain data about a solution. What extensions do they have?**
   - **a.** .sln and .suo
   - **b.** .prj and .sln
   - **c.** .prj and .suo
3. **What tool can Tom use to manage the various settings and properties for a project?**
   - **a.** Project Designer
   - **b.** Start Page
   - **c.** Toolbox

hint

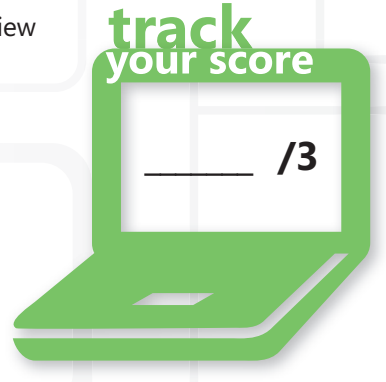
Visual Studio is an IDE that provides an editor for entering code as well a variety of tools for debug-ging applications.

Answers

1. To add a second, related application, Tom should:
   b. add a new project to the same solution. A solution is like a container that can hold multiple projects.
2. The two file extensions used by Visual Studio for files that maintain solution information are:
   a. .sln and .suo
3. The tool that Visual Studio provides for managing project settings and properties is:
   a. Project Designer

Essential details

- Visual Studio uses two different "containers" to manage applications:
  - A **solution** includes one or more related projects and their settings.
  - A **project** represents one particular part of a solution; it includes source files and metadata related to that project.
- In general, each project represents one application. If one application is closely related to another, they should both go in the same solution.
- The **Project Designer** is a window in Visual Studio that allows a developer to manage properties, settings, and resources for a project.
- The **Solution Explorer** is a window in Visual Studio that provides an organized view of a solution and all of its projects and files.



FAST TRACK HELP

- **http://msdn.microsoft.com/en-us/beginner/bb308731.aspx**
- **http://msdn.microsoft.com/en-us/library/b142f8e7.aspx**
- **http://msdn.microsoft.com/en-us/library/zfzh36t7.aspx**

2

Creating Windows Forms Applications

IN THIS CHAPTER

- 2.1A Create and handle events
- 2.1B Create and handle events
- 2.2 Understand Windows Forms inheritance
- 2.3A Understand how to create new controls and extend existing controls
- 2.3B Understand how to create new controls and extend existing controls
- 2.4A Validate and implement user input
- 2.4B Validate and implement user input
- 2.5A Debug a Windows-based application
- 2.5B Debug a Windows-based application

Create and handle events

SCENARIO: Pilar has been hard at work adding a friendly GUI to the old time-sheet application at Litware, Inc. She's designed a nice, user-friendly form that will be the main part of the interface. For the functionality of the application itself (allowing employees to clock in and out, transferring that data to the payroll department, and so on), she's able to use pre-existing code. So most of what is left is "wiring up" the application to her new interface, which consists of a menu, a toolbar for commonly used functions, and some input controls for users to enter their employee ID numbers.

1. **Which of the following best describes what happens when a user clicks a button to "clock in?"**
   - **a.** The Button event is raised and the code to save the correct data is executed
   - **b.** A Click event is raised and the code to save the correct data is executed
   - **c.** A ClockIn event is raised and the code to save the correct data is executed
2. **Pilar will be using pre-existing code to save the data when a user clocks in. Where will she put this code?**
   - **a.** In the button's constructor
   - **b.** In a property
   - **c.** In an event handler
3. **When an event is raised, what two parameters are sent to the method that is triggered?**
   - **a.** `e` and `control`
   - **b.** `e` and `sender`
   - **c.** `control` and `sender`

hint

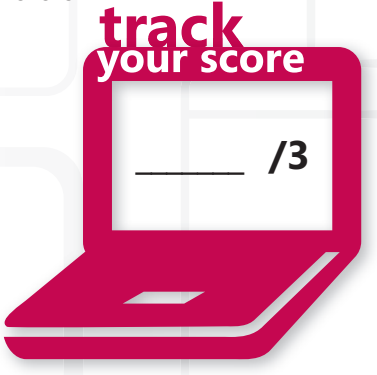
Events are often user actions such as clicking a button. Events can be responded to within the code.

Answers

1. When a user clicks a button to "clock in:"
   b. A Click event is raised and an event handler is executed.
2. Pilar will put the code to save the clock-in data:
   c. In an event handler
3. The following parameters are sent to the event handler:
   b. `e` and `sender`. `sender` is a reference to the object (often a control) that raised the event; `e` is an object specific to the event, such as the location of the mouse pointer when a `MouseDown` event is raised.

Essential details

- An **event** is an action that you can respond to in your code.
  - Sometimes the event is triggered by the user's interaction, such as clicking a button or selecting an item from the menu.
  - Other times, the event is generated by the system. For example, a `Timer` object raises a `Tick` event.
- An **event handler** is a block of code (a method or procedure) that executes when an event is raised.
- Each control type has an event handler that is created when the developer double-clicks the control in the Form Designer; this is called the **default event handler.**



FAST TRACK HELP

- **http://msdn.microsoft.com/en-us/beginner/bb308743.aspx (Visual Basic)**
- **http://msdn.microsoft.com/en-us/beginner/bb308738.aspx (C#)**
- **http://msdn.microsoft.com/en-us/library/1h12f09z.aspx**

Create and handle events

SCENARIO: The Coho Winery uses an application to prepare and track shipments to retail stores around the world. The application lists the available inventory and allows an employee to click a button to create a shipping label and packing manifest. François would like to modify the application so that employees cannot accidentally print documentation to ship products that are not currently in stock. He's already modified the application to examine the inventory, and it only creates buttons next to products with a quantity greater than zero. However, he can't create event handlers using the Form Designer like he's used to doing.

1. **Why can't François create event handlers for the different products in the Form Designer?**
   a. Event handlers can only be added in a Form's constructor.
   b. The Form has no connection to the database server.
   c. The buttons do not exist yet—they are created when the application runs.
2. **What is the correct C# syntax for adding an event handler at run time?**
   a. `newButton.add(button _ Click);`
   b. `newButton.Click += new EventHandler(button _ Click);`
   c. `EventHandler Click = new EventHandler(button _ Click);`
3. **What is the correct Visual Basic syntax for adding an event handler at run time?**
   a. `AddHandler newButton.Click, AddressOf button _ Click`
   b. `AddHandler newButton.Click(buttonClick)`
   c. `newButton.Click = New Click AddressOf button _ Click`

hint

An event handler added at run time is called a dynamically added handler.

Answers

1. Event handlers could not be added at design time in this example because:
   c. the buttons did not exist yet—they are created when the application runs.
2. The syntax for adding an event handler with C# is:
   a. `newButton.Click += new EventHandler(button_Click);`
3. The syntax for adding an event handler with Visual Basic is:
   b. AddHandler `newButton.Click, AddressOf button_Click`

Essential details

- In some cases, controls may be added while the application is running (at *run time*), so they do not appear in the Form Designer.
  - If a control doesn't exist at *design time* (when you are working in the Form Designer), you cannot add an event handler for any events related to that control.
- In that case, the developer must write the code for the event handler and connect it to the event while the application is running, using code.
  - This also allows the developer to control when the event handler is connected to the event.

FAST TRACK HELP

- **http://msdn.microsoft.com/en-us/library/dfty2w4e.aspx**
- **http://support.microsoft.com/kb/319266 (C#)**
- **http://support.microsoft.com/kb/308433 (Visual Basic)**

Understand Windows Forms inheritance

SCENARIO: Woodgrove Bank needs a new application that will allow tellers to retrieve account information for customers. Cassie is working on the user interface for the application while the rest of the development team creates the code to access the bank's records.

The project manager has requested three forms: one with general account information, one with transaction details, and one with customer contact information. All three should have a consistent appearance and should have the same set of information displayed at the top, including the account number, the customer's name, and the current balance. She will use *forms inheritance* to create the forms.

1. **Cassie has created one form that will have the basic UI controls and the account number, customer name, and current balance; the rest of the form is empty. What is the role of this form?**
   - **a.** base form
   - **b.** derived form
   - **c.** template form
2. **Each of the three forms that inherit from Cassie's first form is called a:**
   - **a.** base form
   - **b.** derived form
   - **c.** template form
3. **Which of the following is an advantage of using forms inheritance?**
   - **a.** If a change to the layout is required, it only needs to be done on one form
   - **b.** Forms only need to be compiled once, regardless of the number of changes
   - **c.** The load on the database server is decreased when the application is running

hint

Forms inheritance allows forms to share common elements/ functionality. It is analogous to object inheritance in OOP.

Answers

1. The role of Cassie's first form is:
   a. **base form.** This is also referred to as a *parent form*.
2. Forms that inherit from that form are called:
   b. **derived forms.** They are also called *child forms*.
3. An advantage of forms inheritance is:
   a. **if a change to the layout is required, it only needs to be done on one form.** If a base form is changed, derived forms automatically inherit the changes.

Essential details

- **Forms inheritance** (or **visual inheritance**) is a feature that allows forms to share common elements and functionality. Advantages of using forms inheritance include:
  - Consistency: Like a template, the base form ensures that all derived forms will have the same basic layout.
  - Maintainability: If you change the design of the base form, the derived forms inherit the changes, which means that you don't have to go into each individual form to make the same changes over and over.
  - Decreased design time: Design work can be done once and then shared with other forms, rather than designing each form individually.

FAST TRACK HELP

- **http://msdn.microsoft.com/en-us/library/aa983613**
- **http://msdn.microsoft.com/en-us/library/aa984465**

Understand how to create new controls and extend existing controls

SCENARIO: Jenny has just started an internship at A. Datum Corporation. Although she programmed with Visual Basic and Visual C# in school, Jenny's manager at A. Datum wants to see some of her work before she joins the development team. Jenny's first project will be creating some new GUI controls for the application the developers are planning. They need the following controls:

- A Text Box that converts inputted text to an integer
- A "clock" control that displays the current time
- A Button shaped like an octagon

1. **Jenny realizes the clock can be made by simply combining a Label with a Timer control. What is the name of this type of combined control?**
   - **a.** combo control
   - **b.** inherited control
   - **c.** user control
2. **If Jenny wishes to make a new control by modifying an existing control—she will likely modify a Button to create an octagonal button—what type of control should she create?**
   - **a.** combo control
   - **b.** inherited control
   - **c.** user control
3. **Which of the following would be an ideal situation for creating a user control?**
   - **a.** you only want to change the GUI of an existing control
   - **b.** the desired functionality is similar to an existing control
   - **c.** you wish to combine the functionality of two or more existing controls

hint

The term "custom control" is used to refer to both inherited controls and user controls.

Answers

1. The name of a control made by combining existing controls is:
   c. user control. Also referred to as a *composite control*.
2. The type of control Jenny should make if she wishes to modify an existing control is an:
   b. inherited control. Also referred to as a *derived control*.
3. An ideal situation for creating a user control is when:
   c. you wish to combine the functionality of two or more existing controls

Essential details

- There are several different approaches to creating a new control:
  - A **user control** or **composite control** simply combines existing controls into one new control.
  - An **inherited control** or **derived control** extends or modifies an existing control, adding new functionality or changing the GUI.
- Usually, one of these approaches is ideal for the desired result:
  - To combine functionality without changing the GUI or adding any new features, create a user control.
  - To create a control similar to an existing control with slightly different GUI or functionality, create an inherited control.
  - To create a control with completely new functionality, such as a control to display a rotating 3D model, you'll probably need to inherit from the Control class.

FAST TRACK HELP

- **http://msdn.microsoft.com/en-us/library/ms171725.aspx**
- **http://msdn.microsoft.com/en-us/library/yah0tcw1.aspx**

Understand how to create new controls and extend existing controls

SCENARIO: Now that Jenny understands how to create the three controls her manager at A. Datum Corporation wants, she's ready to begin. First she creates a user control that she calls ClockLabel. It combines a Timer and a Label, and the Timer's Tick event triggers code to update the Text property of the Label. Jenny is satisfied with the way it works, but she feels that she can't utilize user controls for the other two: an OctagonButton and an IntegerTextBox. Instead, she'll need to create inherited controls.

1. **What class should Jenny's IntegerTextBox extend?**
   - **a.** Integer
   - **b.** TextBox
   - **c.** Control
2. **What template should Jenny select when creating her project to create this IntegerTextBox?**
   - **a.** Empty Project
   - **b.** Windows Forms Application
   - **c.** Windows Forms Control Library
3. **After her controls are complete, how can Jenny add them to a new project for testing?**
   - **a.** by copying and pasting her controls
   - **b.** by adding a reference to her controls
   - **c.** by importing her controls to the Toolbox

hint

Inherited controls are also called derived controls, because they originate from a control that already exists.

Answers

1. The class that the IntegerTextBox should extend is:
   b. TextBox. The functionality of the new control is very similar to that of a TextBox.
2. The template Jenny should use to create an IntegerTextBox is:
   c. Windows Forms Control Library
3. Jenny add controls to a new project for testing by:
   b. adding a reference to her controls

Essential details

- To create a control that you can use in other projects, use the Windows Forms Control Library template in Visual Studio.
- Because a Control Library does not create an executable application, it cannot be tested independently. Create a new project and add a reference to the Control Library you have created.
  - Be sure to "Build" the library before creating the new project!

FAST TRACK HELP

- **http://msdn.microsoft.com/en-us/library/5h0k2e6x.aspx (C#)**
- **http://msdn.microsoft.com/en-us/library/w2a8y03d.aspx (Visual Basic)**

Validate and implement user input

SCENARIO: Jenny's manager at A. Datum Corporation is very pleased with Jenny's work on the custom controls, and the development team plans to use them on their current application. As a reward, Jenny has the opportunity to do a little work on the application that the team is currently developing. Before giving her a more advanced assignment, the manager has assigned Jenny to go through the team's progress so far and to add input validation to some of the forms.

First, Jenny needs to understand the process by which Forms applications handle user input.

1. **What event is raised one time when the user first presses a key on the keyboard?**
   - **a.** KeyDown
   - **b.** KeyEvent
   - **c.** KeyPress
2. **Which event is NOT raised when the user clicks a button?**
   - **a.** Click
   - **b.** MouseDown
   - **c.** MousePress
3. **What mechanism is used in Windows to notify an application that user input has occurred?**
   - **a.** Windows Alarms
   - **b.** Windows Messages
   - **c.** Windows Notifications

hint

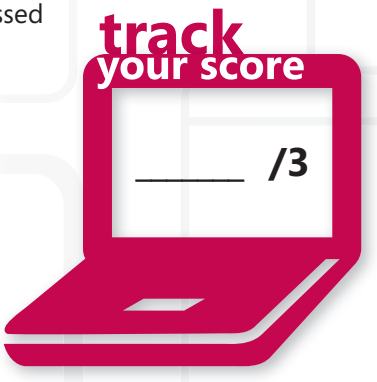
Input validation means checking data entered to make sure it is valid. Example: there should be no letters in a Text Box requesting a number.

Answers

1. When the user presses a key, the event that is raised one time is:
   a. **KeyDown.** KeyPress is raised continuously as long as the key is held.
2. The event not raised in a Button click is:
   c. **MouseClick**
3. An application is notified of a user input action through:
   b. **Windows Messages**

Essential details

- Windows Messages are sent to an application in response to user input.
- Windows Forms processes these signals and raises events.
  - Applications then use event handlers to process the user's input.
- Three events are typically associated with keyboard input (in this order):
  1. *KeyDown* is raised once when a key is pressed.
  2. *KeyPress* is raised continuously as the key is held down.
  3. *KeyUp* is raised once when a key is released.
- The event handler receives an object with information about which keys were pressed
- In a standard mouse click, the following events are triggered (in this order): *MouseDown; Click; MouseClick; MouseUp.*



FAST TRACK HELP

- **http://msdn.microsoft.com/en-us/library/ms171532.aspx**
- **http://msdn.microsoft.com/en-us/library/ms171536.aspx**
- **http://msdn.microsoft.com/en-us/library/ms171540.aspx**

Validate and implement user input

SCENARIO: Jenny is proving herself to be a valuable member of the development team at A. Datum! Her manager has given her the specifics for the input validation she needs to add to the forms in A. Datum's new application. The two most important involve checking to make sure that customer contact information is entered correctly.

- Telephone numbers: Each telephone number should be entered in a standard U.S. number format—exactly ten digits, with a hyphen after the first three digits and another after the second three. For example: 800-555-1212.
- Email addresses: An email address should have a user name, the at character (@), and a valid domain. Although Jenny's validation does not need to verify the exact address, it will need to use the World Wide Web to verify that the domain exists.

1. **Jenny can use a MaskedTextBox for telephone numbers. Which of the following is a valid mask for a U.S. telephone number?**
   - **a.** *###-###-####*
   - **b.** 000-000-0000
   - **c.** 999-999-9999
2. **Jenny will use the Validating event to check email addresses. When is this event raised?**
   - **a.** when the control loses focus
   - **b.** when the user presses Enter or Tab
   - **c.** each time a character is added to the control
3. **What property should Jenny's code set to *true* if the email address is not valid?**
   - **a.** `e.Invalid`
   - **b.** `e.Cancel`
   - **c.** `e.Error`

hint

A mask is a string that specifies what characters the user can input at any given position in a MaskedTextBox.

Answers

1. A valid mask for a U.S. telephone number is:
   b. 000-000-0000
2. The Validating event is raised:
   a. when the control loses focus.
3. The property that gets set to *true* if the input validation fails is:
   b. `e.Cancel`

Essential details

- A **MaskedTextBox** provides an easy way to perform input validation; it is also the most common way to enforce input restrictions.
- The **Mask** property accepts a string that indicates the requirements of user input.
- If your input requires more comprehensive validation, such as Jenny's email address validation, you can handle the **Validating** event, which is raised whenever a control loses focus. In an event handler, write code to perform all necessary validation.
  - If the input is valid, the handler can simply finish execution and the user can continue.
  - If the input is invalid, set the `e.Cancel` property to *true*. The user will not receive any notification, but he or she will not be able to move on to any other control.

FAST TRACK HELP

- **http://msdn.microsoft.com/en-us/library/ms229603.aspx**
- **http://msdn.microsoft.com/en-us/library/system.windows.forms.maskedtextbox.aspx**
- **http://msdn.microsoft.com/en-us/library/system.windows.forms.control.validating.aspx**

Debug a Windows-based application

SCENARIO: Lisa is an intern at Woodgrove Bank, helping with small projects related to a new application the company is developing. However, a software engineer, Miklós, had to leave town unexpectedly for a family emergency, and the project manager has asked Lisa to debug the code Miklós was testing. Lisa opens the project and sees that there are no build errors, but when she runs it she finds that several calculations are incorrect, and she sometimes gets a `StackOverflowException`. Because she is not very familiar with the code, Lisa is not sure what is causing the problems. The project manager suggests using the Visual Studio Debugger to track down the errors.

1. **What feature will allow Lisa to suspend execution of the application at specified points so that she can examine what is happening?**
   - **a.** breakpoint
   - **b.** stop point
   - **c.** watch point
2. **After suspending execution, Lisa would like to monitor data as the application executes code one line at a time. Which feature will also go through any functions or methods that are invoked?**
   - **a.** Step Into
   - **b.** Step Over
   - **c.** Step Out
3. **Lisa wants a simple way to output some data while the application executes, but she doesn't want any output to execute in the version of the program. Which method should she use?**
   - **a.** `Console.WriteLine`
   - **b.** `Debug.WriteLine`
   - **c.** `System.Out.PrintLn`

hint

"Build" errors are problems that keep the program from compiling; "logic" errors are problems that show up when the application executes.

Answers

1. The feature that suspends ("pauses") execution at specified points is a:
   a. **breakpoint**
2. The feature that will step through any functions or methods is called:
   a. **Step Into**
3. The method that will output text only when the application executes in Debug mode is:
   b. **Debug.WriteLine.** `Console.WriteLine` will also output text to the console, but the output will still execute if the application is run in Release mode (rather than Debug mode).

Essential details

- The **Visual Studio Debugger** is a tool that helps find logic errors (or **run-time errors**) by letting the developer observe how the application behaves as it is executing.
- A **breakpoint** is a marker that tells the debugger to suspend execution of a program temporarily at a designated point; this allows the developer to examine a variety of data related to the program. There are three ways to step through the execution of the code:
  - Step Into, Step Over, and Step Out
- The **Debug** class provides methods/properties to help debug code. One commonly used method is `Debug.WriteLine`, which outputs to the console like `Console.WriteLine`. However, if the application is run in Release mode, `Debug.WriteLine` will not execute.

FAST TRACK HELP

- **http://msdn.microsoft.com/en-us/library/awtaffxb.aspx**
- **http://msdn.microsoft.com/en-us/library/kya29xtx.aspx**

Debug a Windows-based application

SCENARIO: Nupur is an intern at Litware, Inc. The company computers each use a custom antivirus application created by the company's development team. Since a recent software upgrade, the application has been crashing. The development team is busy on a different project and cannot take the time to fix this annoying but non-critical problem. Nupur wants to see if she can identify the issue using the Visual Studio Debugger. The application is a Windows Services application, not a Windows Forms application like she is used to debugging.

1. **What will Nupur need to do so that she can set breakpoints in this Services application?**
   - **a.** add a try-catch block to intercept the error that causes it to crash
   - **b.** attach a debugger to the service while it is running
   - **c.** use the Windows Services Control Manager to pause the application
2. **Nupur discovers that the error may be occurring in the application's *OnStart* method, preventing the service from starting. How can she debug this type of problem?**
   - **a.** rebuild the application as a console application
   - **b.** set a breakpoint at the beginning of the `OnStart` method
   - **c.** write code to create a simulated service to see how `OnStart` behaves
3. **How can Nupur access the list of currently running processes?**
   - **a.** processes are listed in the Output window
   - **b.** from the Debug menu by selecting Processes
   - **c.** processes can *only* be viewed from Windows Task Manager

hint

Windows Services applications run as processes, so they can't be debugged like Windows Forms applications.

Answers

1. To add breakpoints to a Services application, Nupur must:
   b. attach a debugger to the service while it is running
2. Nupur can debug the *OnStart* method by*:*
   c. writing code to create a simulated service to see how *OnStart* behaves
3. Nupur can see a list of processes:
   b. from the *Debug* menu, by selecting *Processes*

Essential details

- Windows Services applications are run using the **Windows Service Control Manager.** Because of this, you cannot simply set breakpoints and debug as you can with a Forms or WPF application.
  - To debug a Services application, you have to start the service, then attach a debugger to the associated process, and then use all of the standard Visual Studio Debugger tools.
- One implication of this debugging approach is that the service must successfully start to be debugged.
  - To debug the *OnStart* method, add code that creates a simulated service—this will show you how the *OnStart* method is executing.

FAST TRACK HELP

- **http://msdn.microsoft.com/en-us/library/aa984342**
- **http://msdn.microsoft.com/en-us/library/7a50syb3.aspx**
- **http://msdn.microsoft.com/en-us/library/cktt23yw.aspx**

3

Creating Windows Services Applications

IN THIS CHAPTER

Create a Windows Services application

SCENARIO: Anna is developing an application for Contoso, Ltd., that she hopes will help prevent repetitive motion injuries and eyestrain among employees who work at their computers for extended periods of time. Her application will run as a Windows Service and will track the typing activities of the current user. If the user types more than 2,000 words in a 30-minute span, Anna's application will display a notification reminding the user to take a short break before continuing. This is Anna's first attempt at creating a Services application, so she's a little unsure about how to begin.

1. **What class will Anna need to extend in order to create this Services application?**
   - **a.** Service
   - **b.** ServiceBase
   - **c.** WindowsService
2. **Identify the three basic states of a Windows Services application.**
   - **a.** installed, running, paused
   - **b.** running, paused, stopped
   - **c.** running, stopped, terminated
3. **What method is Anna *required* to override when creating her application?**
   - **a.** OnStart
   - **b.** OnStop
   - **c.** OnShutdown

hint

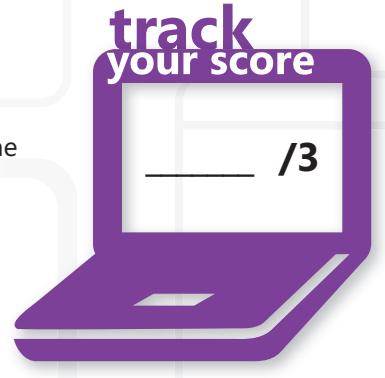
Services applications typically run "in the background" for a long period of time.

Answers

1. The main class that must be inherited when developing a Services application is:
   b. ServiceBase
2. The lifetime states of a Services application are:
   b. running, paused, stopped
3. The method that Anna must override is:
   a. OnStart

Essential details

- A Windows Services application has several different life-cycle states; the most important are:
  - Running (or started), Paused, and Stopped
- To create a Windows Services application, you must extend the *ServiceBase* class.
  - This class provides methods for reacting to changes from one life-cycle state to another: *OnStart, OnPause, OnStop, OnContinue, OnShutdown*
  - You also must override the *OnStart* method, and most Services applications also override the *OnStop* method.
  - Another important method in the *ServiceBase* class is *Run*, which registers the service with the Services Control Manager. It should be invoked from the application's *Main* method.
- The *ServiceBase* class also provides a variety of properties related to your service, such as *ServiceName*, which specifies how the service is identified within the Services Control Manager.



FAST TRACK HELP

- **http://msdn.microsoft.com/en-us/library/d56de412.aspx**
- **http://msdn.microsoft.com/en-us/library/y817hyb6.aspx**

Install a Windows Services application

SCENARIO: Anna is very proud of the Services application she has developed for Contoso, Ltd. She has successfully debugged her code, and the application does a great job of monitoring users' typing practices and reminding them to take breaks when they have been typing for extended periods of time. The application will reduce the stress experienced by employees and that will make for a healthier and happier workplace.

After demonstrating the application for her manager, she has approval to deploy her project. She knows the process is a little different than installing a Windows Forms application and is eager to complete this important work.

1. **What does Anna need to add to her project to be able to install her application?**
   - **a.** a custom .msi file
   - **b.** an installer class
   - **c.** setup.exe
2. **Which class is included in her project so it can be registered with the Services Control Manager?**
   - **a.** ClickOnce
   - **b.** OnStart
   - **c.** ServiceInstaller
3. **How can Anna create distributable files for installing her application on target computers?**
   - **a.** add a setup project to her solution
   - **b.** press F5 to build the application
   - **c.** run the ClickOnce application

hint

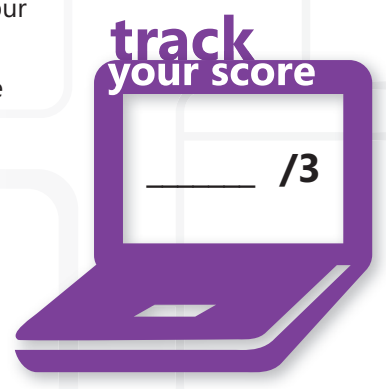
Installing a service application refers to registering the service with Services Control Manager—not setting the application up on a target computer.

Answers

1. To install the application, Anna should add:
   b. an installer class
2. The class that is added to Anna's project to interact with the Services Control Manager is:
   c. ServiceInstaller
3. To create distributable setup files for her application, Anna must:
   a. add a setup project to her solution

Essential details

- Windows Services applications can be installed (or registered with the operating system) in two different ways:
  - manually, with a command-line utility known as the Installer Tool (installutil.exe)
  - by adding installers to the project
- **Installer classes** (or simply **installers**) perform specified actions when a project is installed.
  - Installers are added to a project via the Component Designer tool in Visual Studio.
  - Installers use two classes (ServiceInstaller and ServiceProcessInstaller) that allow you to set properties related to your service application. For example, StartType designates how your service will start: manual, automatic, or disabled.
- To make the setup files necessary to distribute an application, you'll need to create a **Setup Project.**



FAST TRACK HELP

- **http://msdn.microsoft.com/en-us/library/sd8zc8ha.aspx**
- **http://msdn.microsoft.com/en-us/library/ddhy0byf.aspx**

4

Accessing Data in a Windows Forms Application

IN THIS CHAPTER

- 4.1 Understand data access methods for a Windows Application
- 4.2A Understand databound controls (Databinding)
- 4.2B Understand databound controls (Validating databound items)

Understand data access methods for a Windows Application

SCENARIO: Jesper has been designing an application for the vintage record shop where he works. It's a database application that will track the store's current inventory and allow Jesper to help customers quickly find out if an album they want is in stock. He also wants to print reports to help the store's owner see what albums they need to order.

Jesper has already designed and implemented the database in Microsoft® SQL Server®, so he's ready to develop the application itself, using a disconnected data access model. This model is similar to how web browsers work: connect to a web server and download the necessary information, then disconnect and allow the user to view the data. Whenever the page needs to be refreshed, the browser connects again and re-downloads the information.

1. **In Jesper's application, what is the in-memory cache of the database contents called?**
   - **a.** a connection string
   - **b.** a dataset
   - **c.** a datatable
2. **What library of classes can Jesper use to access his database?**
   - **a.** ADO.NET
   - **b.** AJAX
   - **c.** XAML
3. **What Visual Studio tool can you use to add a database connection to your project?**
   - **a.** Connection Explorer
   - **b.** Server Explorer
   - **c.** Solution Explorer

hint

In a disconnected data access model, an application uses a copy of the data in memory and only connects to the data source when the data is updated.

Answers

1. The in-memory representation (or copy) of data is called:
   b. a dataset
2. The classes that provide data access functionality for .NET developers is:
   a. ADO.NET
3. The tool that allows a connection to be added to a Visual Studio project is:
   b. Server Explorer

Essential details

- In a "disconnected" access model, the application connects to a data source and retrieves (or updates) whatever it needs, and then it disconnects.
- **ADO.NET** is a library of classes that assist .NET developers with database applications. It allows developers to use a variety of data sources (SQL Server databases, XML files, application data, and so on).
  - ADO.NET is sometimes referred to as the System.Data Namespace and handles many of the details of data source interactions so that developers can focus on how they wish to use the data.
- You can add a connection to a Visual Studio project using the **Server Explorer**. In Visual Studio Express Editions, this tool is called the **Database Explorer**.

FAST TRACK HELP

- **http://msdn.microsoft.com/en-us/beginner/bb308806.aspx (Lessons 8 & 9)**
- **http://msdn.microsoft.com/en-us/library/0wxwcakt.aspx**

Understand databound controls (Databinding)

SCENARIO: Jesper's record store application is progressing nicely. He has completely implemented his database, and he's designed and implemented all of the Forms that will comprise his user interface. His last step is to bind each control to the database so that the application is functional.

The most important forms in his application include an "artist overview" form and an "album details" form. The *artist overview* presents information about one artist, including a list of all that artist's albums. The *album details* Form displays extensive information about a specific album, such as the year it was released, the titles of all of the tracks, the price, and the number of copies in stock.

1. **The *artist overview* uses TextBoxes to display (and edit) information such as the artist's name, nationality, and genre, with each TextBox bound to a single dataset field. What is this type of binding called?**
   - **a.** complex binding
   - **b.** simple binding
   - **c.** unique binding
2. **Which of the following manages the connection to the dataset, allowing the user to navigate to different records?**
   - **a.** BindingSource
   - **b.** Database Explorer
   - **c.** DataGridView
3. **Jesper wants to include a list of albums on his *artist overview* Form. What Forms control provides a customizable table for this type of display?**
   - **a.** BindingSource
   - **b.** DataGridView
   - **c.** TableAdapter

hint

Binding the controls means connecting them to the dataset so that they can display and edit information in the database.

Answers

1. The term for binding a control to a single element or field in a dataset is:
   b. simple binding
2. Communication between bound controls and the dataset is handled by:
   a. BindingSource
3. The control used to display dataset information in a customizable grid is:
   b. DataGridView

Essential details

- **Data binding** is the process of connecting controls to information in a data source so that it can be displayed or changed by a user. Generally, controls can utilize simple binding or complex binding.
- **Simple binding** is intended to display and edit a single data element. It is usually used for controls such as Labels, TextBoxes, and (in WPF) TextBlocks.
- **Complex binding** is capable of displaying and editing multiple data elements. It is commonly used with controls designed to display multiple items, such as ComboBoxes.
  - The DataGridView control is an example of a control that utilizes complex binding.
- To change which record is displayed on a Form using simple binding, use a BindingSource.
  - A **BindingSource** is an intermediary between the controls on a form and the data source.
  - You can also use a **BindingNavigator** that provides a user interface for navigating with databound controls.

FAST TRACK HELP

- **http://msdn.microsoft.com/en-us/beginner/bb308829.aspx (Visual Basic)**
- **http://msdn.microsoft.com/en-us/beginner/bb308827.aspx (Visual C#)**
- **http://msdn.microsoft.com/en-us/library/ef2xyb33.aspx**

Understand databound controls (Validating databound items)

SCENARIO: Jesper's inventory application has been a huge success at the vintage record shop. Jesper's job is much easier, and customers are grateful that he can look up information so quickly. Even Oleg, the owner of the store, is excited about the application and has started using it himself.

Unfortunately, Oleg is not always careful about what he types into the fields. For example, sometimes he accidentally puts an artist's *genre* in the *release year* TextBox, causing problems with the database. Inaccurate data will result in plenty of confusion and wasted time for everyone involved, so Jesper plans to modify the program to check what the user enters before putting it into the dataset.

1. **Verifying data before adding it to the dataset or database is called:**
   - **a.** type casting
   - **b.** data validation
   - **c.** autoboxing
2. **Which event is useful for checking user input before allowing the user to continue?**
   - **a.** Casting
   - **b.** LosingFocus
   - **c.** Validating
3. **The DataGridView control provides its own event for examining user input. What is it called?**
   - **a.** e.Cancel
   - **b.** CellCasting
   - **c.** CellValidating

hint

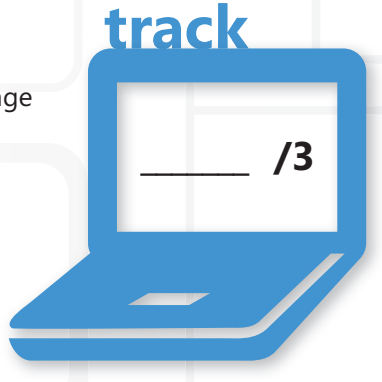
Checking data for accuracy is very similar to verifying user input in other applications.

Answers

1. Checking data before changing the data source is called:
   b. data validation
2. The event that can be used to examine user input is called:
   c. Validating
3. The DataGridView event used to check user input is:
   c. CellValidating

Essential details

- **Data validation** means verifying that values being added to a data source database are consistent with the design of the database and the requirements of the application.
  - For example, Oleg shouldn't be able to enter a negative number in the *release year* field, or enter more characters than the database can accommodate.
  - Validation isn't just limited to user input—when calculating a value, you may want to make sure it's valid before adding it to the database.
- Most of the techniques for validating input are useful in database applications, including MaskedTextBoxes.
- The DataGridView control is frequently used in data-driven applications. It provides the *CellValidating* event for checking data.
  - As with the *Validating* event, simply set e. *Cancel* to true if there's a problem.
  - You can also use the *DataGridViewRow*. *ErrorText* property to display a message to the user in the event of a problem.



FAST TRACK HELP

- **http://msdn.microsoft.com/en-us/library/kx9x2fsb.aspx**
- **http://msdn.microsoft.com/en-us/library/ykdxa0bc.aspx**

5

Deploying a Windows Application

IN THIS CHAPTER

- 5.1A Understand Windows application deployment methods
- 5.1B Understand Windows application deployment methods
- 5.2 Create Windows setup and deployment projects

Understand Windows application deployment methods

SCENARIO: Stepan spends much of his free time in the outdoors, camping, hiking, and canoeing. Whenever school is not is session, he tries to take at least one trip. He has developed two applications to help him enjoy his hobbies. The first application helps him log his activities, downloads data from his GPS unit, and automatically posts updates to his favorite social media websites. The second is a relatively simple application for planning trips; it helps him organize his maps, plan the supplies he'll need, and keep track of weather reports in the days before he leaves. Both programs are Windows Forms applications.

He has always run the applications from his own computer, but now that his friends have seen how well they work, he would like to distribute copies for others to enjoy.

1. **The planning application is newer and Stepan is still making frequent changes. Which deployment option checks for updates before installing the application?**
   - **a.** ClickOnce
   - **b.** Windows Installer
   - **c.** Both deployment options automatically check for updates.
2. **The log application interfaces with a GPS and must install a device driver upon deployment. Which option is best suited for this application?**
   - **a.** ClickOnce
   - **b.** Windows Installer
   - **c.** Neither deployment option can install a device driver.
3. **Which option will allow Stepan to distribute his applications via USB drives?**
   - **a.** ClickOnce
   - **b.** Windows Installer
   - **c.** Both deployment options can be distributed via USB drive.

hint

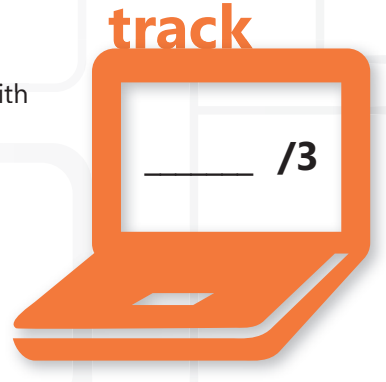
Deployment refers to packaging and distributing an application so that it can be installed on target computers.

Answers

1. If Stepan wants the installer to check for updates, the deployment method he should use is:
   a. **ClickOnce**
2. If he wants to install a device driver he should use:
   b. **Windows Installer**
3. Stepan's applications can be distributed via USB drives because:
   c. **both deployment options can be distributed via USB drive**

Essential details

- The .NET Framework provides two primary technologies for deploying applications: **ClickOnce** and **Windows Installer.**
- Both technologies:
  - provide a user interface to guide users through the installation process.
  - allow for the creation of Start Menu and desktop shortcuts.
  - can be distributed by a website or by removable media.
- The advantages and features of ClickOnce include:
  - There is minimal user interaction during the installation process.
  - The technology automatically checks for updates.
  - Updates do not require complete reinstallation of application.
- Features of Windows Installer include the use of a "wizard" that assists the user with installation and the flexibility to handle a variety of installation situations.
- Windows Installer provides more control over the installation process and is flexible enough to handle unusual or complicated setup requirements.



FAST TRACK HELP

- **http://msdn.microsoft.com/en-us/library/y18k4htb.aspx**
- **http://msdn.microsoft.com/en-us/library/e2444w33.aspx**
- **http://msdn.microsoft.com/en-us/library/6hbb4k3e**

Understand Windows application deployment methods

SCENARIO: Stepan has decided to deploy his trip planning application using ClickOnce. This is a fairly small application with simple but important installation needs: installation and removal are both user-friendly, it provides an easy way for users to check for updates, and there is minimal impact on the target computer. He wants to give the application to friends using USB drives, but he also has a website he will use to host the installation files.

1. **In addition to installing from removable media or a website, what other deployment option does ClickOnce offer?**
   - **a.** running the application itself from the Web or a network share
   - **b.** integrated peer-to-peer (p2p) distribution
   - **c.** deployment from Microsoft Messenger
2. **Which of the following installation options will *not* be available with ClickOnce?**
   - **a.** associating the .log file extension with the application
   - **b.** allowing installation for multiple user accounts on the target computer
   - **c.** installation by a user without Administrator privileges
3. **What is required when a user wishes to update to a new version of Stepan's ClickOnce application?**
   - **a.** use ClickOnce to uninstall previous version before updating
   - **b.** select which portions of the application to update
   - **c.** allow ClickOnce to update the parts of the application that have changed

hint

Applications that use ClickOnce technology are sometimes referred to as ClickOnce applications.

Answers

1. Other deployment option available with ClickOnce technology include:
   a. **running the application from the web or a network share**
2. The following is not an option when using ClickOnce deployment:
   b. **allowing installation for multiple user accounts on the target computer**
3. To update a ClickOnce application it is necessary to:
   c. **allow ClickOnce to update the parts of the application that have changed**

Essential details

- **ClickOnce** is a deployment technology used to distribute self-updating applications that require minimal user interaction during installation.
- End-user installation of a ClickOnce application is very simple, does not require Administrator rights, and has no impact on other installed applications.
- ClickOnce offers three choices for deploying an application:
  - Installation from the Web or a network share
  - Installation from removable media
  - Running the application from the Web or a network share
- The user can choose to have a ClickOnce application check a website for updates when the program is launched, in the background while the user uses the application, or through the program's user interface.
- The user can specify other update-related settings, such as how frequently the application checks for updates, or forcing the user to install new releases before being able to use the application.

FAST TRACK HELP

- **http://msdn.microsoft.com/en-us/library/142dbbz4.aspx**
- **http://msdn.microsoft.com/en-us/library/31kztyey.aspx**

Create Windows setup and deployment projects

SCENARIO: Stepan's trip planning application was a hit with his friends; they are all eagerly awaiting his next creative application.

Stepan chose to use ClickOnce technology for his trip planner application, but his trip log program requires a device driver and a couple other custom installation features that require a bit more detail. He wants to display a "readme" file with information about using a GPS, and he would like to include a user manual in Microsoft Word document format. He will use Windows Installer to deploy this application.

1. **How does Stepan create the deployment files necessary for his application?**
   - **a.** by adding a setup project to his solution
   - **b.** by running the Setup And Deployment Wizard
   - **c.** by using the Installer Tool (installutil.exe)
2. **What feature will allow Stepan to install his device driver and display his "readme" file?**
   - **a.** custom actions
   - **b.** deployment settings
   - **c.** installation options
3. **What Visual Studio tool can Stepan use to add his Microsoft Word document to the deployment files?**
   - **a.** File System Editor
   - **b.** Server Explorer
   - **c.** Toolbox

hint

Unlike a Windows Services application, Forms and WPF applications often do not require the use of installer classes.

Answers

1. Stepan can create deployment files for distribution:
   a. **by adding a setup project to his solution**
2. Stepan can add his device driver installation and user manual with:
   a. **custom actions**
3. The Visual Studio tool that allows you to add files to the deployment project is:
   a. **File System Editor**

Essential details

- To use Windows Installer technology, add a setup project to your solution. Building a setup project creates setup (or installation) files to distribute your application.
- Custom actions (using **installer classes**) allow you to perform additional actions on the target computer at the end of the installation process, such as Stepan's device driver installation and "readme" file display.
- Visual Studio's File System Editor gives the developer control over where the application is installed, the addition of shortcuts, and the inclusion of additional files.
  - The File System Editor can be accessed by clicking View in the Solution Explorer and then clicking File System Editor.

FAST TRACK HELP

- **http://msdn.microsoft.com/en-us/library/wx3b589t.aspx**
- **http://msdn.microsoft.com/en-us/library/996a3fxs.aspx**
- **http://msdn.microsoft.com/en-us/library/fyh6k4k4.aspx**