

Enterprise Application Development Using Windows Azure and Web Services

Enterprise Application Development Using Windows Azure and Web Services Trainer's Guide

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APTECH LIMITED

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Edition 1 - 2014



Dear Learner,

We congratulate you on your decision to pursue an Aptech course.

Aptech Ltd. designs its courses using a sound instructional design model – from conceptualization to execution, incorporating the following key aspects:

- Scanning the user system and needs assessment

Needs assessment is carried out to find the educational and training needs of the learner

Technology trends are regularly scanned and tracked by core teams at Aptech Ltd. TAG* analyzes these on a monthly basis to understand the emerging technology training needs for the Industry.

An annual Industry Recruitment Profile Survey is conducted during August - October to understand the technologies that Industries would be adapting in the next 2 to 3 years. An analysis of these trends & recruitment needs is then carried out to understand the skill requirements for different roles & career opportunities.

The skill requirements are then mapped with the learner profile (user system) to derive the Learning objectives for the different roles.

- Needs analysis and design of curriculum

The Learning objectives are then analyzed and translated into learning tasks. Each learning task or activity is analyzed in terms of knowledge, skills and attitudes that are required to perform that task. Teachers and domain experts do this jointly. These are then grouped in clusters to form the subjects to be covered by the curriculum.

In addition, the society, the teachers, and the industry expect certain knowledge and skills that are related to abilities such as *learning-to-learn, thinking, adaptability, problem solving, positive attitude etc.* These competencies would cover both cognitive and affective domains.

A precedence diagram for the subjects is drawn where the prerequisites for each subject are graphically illustrated. The number of levels in this diagram is determined by the duration of the course in terms of number of semesters etc. Using the precedence diagram and the time duration for each subject, the curriculum is organized.

- Design & development of instructional materials

The content outlines are developed by including additional topics that are required for the completion of the domain and for the logical development of the competencies identified. Evaluation strategy and scheme is developed for the subject. The topics are arranged/organized in a meaningful sequence.

The detailed instructional material – Training aids, Learner material, reference material, project guidelines, etc.- are then developed. Rigorous quality checks are conducted at every stage.

➤ Strategies for delivery of instruction

Careful consideration is given for the integral development of abilities like thinking, problem solving, learning-to-learn etc. by selecting appropriate instructional strategies (training methodology), instructional activities and instructional materials.

The area of IT is fast changing and nebulous. Hence considerable flexibility is provided in the instructional process by specially including creative activities with group interaction between the students and the trainer. The positive aspects of Web based learning –acquiring information, organizing information and acting on the basis of insufficient information are some of the aspects, which are incorporated, in the instructional process.

➤ Assessment of learning

The learning is assessed through different modes – tests, assignments & projects. The assessment system is designed to evaluate the level of knowledge & skills as defined by the learning objectives.

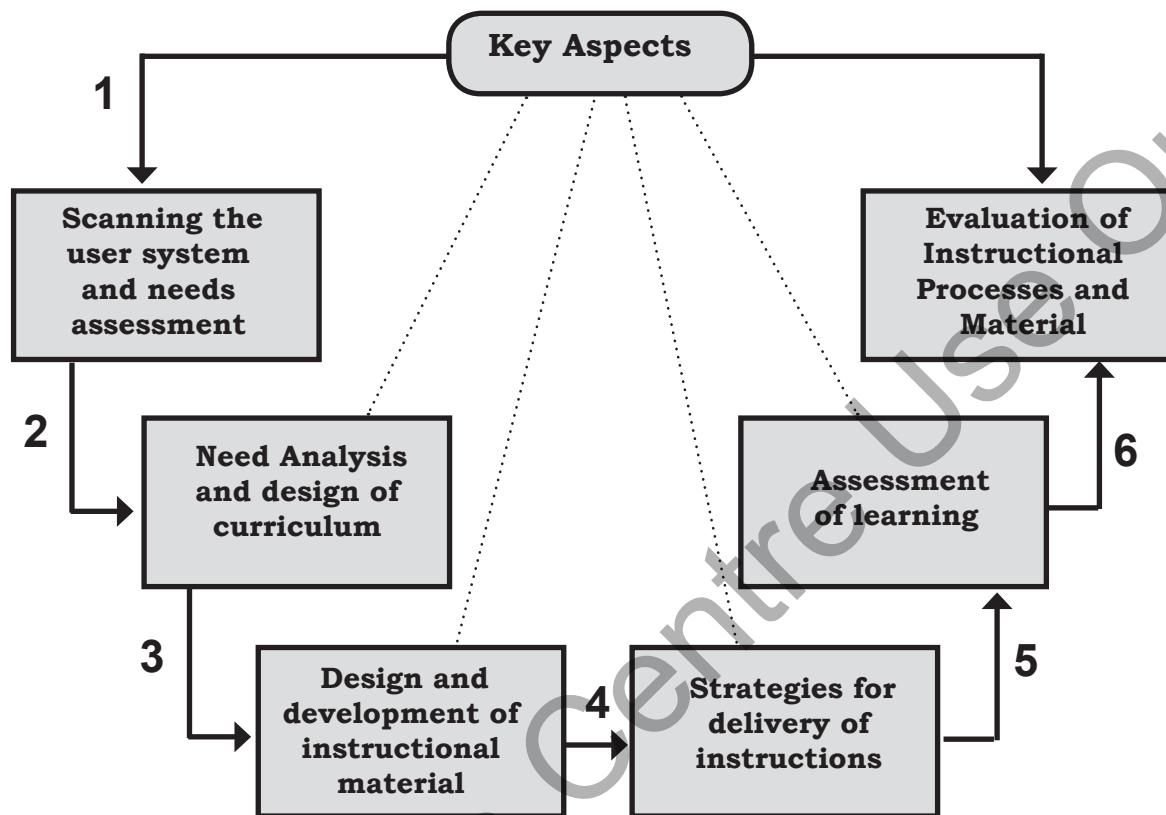
➤ Evaluation of instructional process and instructional materials

The instructional process is backed by an elaborate monitoring system to evaluate - on-time delivery, understanding of a subject module, ability of the instructor to impart learning. As an integral part of this process, we request you to kindly send us your feedback in the reply pre-paid form appended at the end of each module.

*TAG – Technology & Academics Group comprises of members from Aptech Ltd., professors from reputed Academic Institutions, Senior Managers from Industry, Technical gurus from Software Majors & representatives from regulatory organizations/forums.

Technology heads of Aptech Ltd. meet on a monthly basis to share and evaluate the technology trends. The group interfaces with the representatives of the TAG thrice a year to review and validate the technology and academic directions and endeavors of Aptech Ltd.

Aptech New Products Design Model



“ Any expansion is life
all contraction is death ”

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Preface

The Trainer's Guide for **Enterprise Application Development Using Windows Azure and Web Services** aims to teach enterprise application development using Windows Azure platform and Web services.

The faculty/trainer should teach the concepts in the theory class using the slides. This Trainer's Guide will provide guidance on the flow of the session and also provide tips and additional examples wherever necessary. The trainer can ask questions to make the session interactive and also to test the understanding of the students.

This book is the result of a concentrated effort of the Design Team, which is continuously striving to bring you the best and the latest in Information Technology. The process of design has been a part of the ISO 9001 certification for Aptech-IT Division, Education Support Services. As part of Aptech's quality drive, this team does intensive research and curriculum enrichment to keep it in line with industry trends.

We will be glad to receive your suggestions.

Design Team

**Learning how to learn is
life's most important skill**

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9. WCF Services
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12. Advanced Concepts of SQL Database
13. Application Lifecycle Management
14. Deploying Web Application and Services
15. Continuous Deployment

Knowing is not enough

we must apply;

Willing is not enough,

we must do

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Session 1 – Introduction to Windows Azure

1.1 Pre-Class Activities

Before you commence the session, you should familiarize yourself with the topics of this session in-depth. Prepare a question or two, which will be a key point to relate the current session objectives.

1.1.1 Objectives

By the end of this session, the learners will be able to:

- Define and describe cloud computing
- Describe cloud computing delivery models
- Define and describe the Windows Azure platform
- Differentiate between Windows Azure platform and Windows Azure Operating System (OS)
- Define and describe Web Services
- Describe the Windows Azure Portal
- Explain the process to create, deploy, and test a cloud service using the portal

1.1.2 Teaching Skills

To teach this session successfully, you should be aware of the concepts of cloud computing. Also, familiarize yourself with the features of Windows Azure platform, Windows Azure Operating System (OS), Web services, Windows Azure portal, and the process to create, deploy, and test a cloud service using the portal.

For teaching in the class, you are expected to use slides and LCD projectors.

Tips:

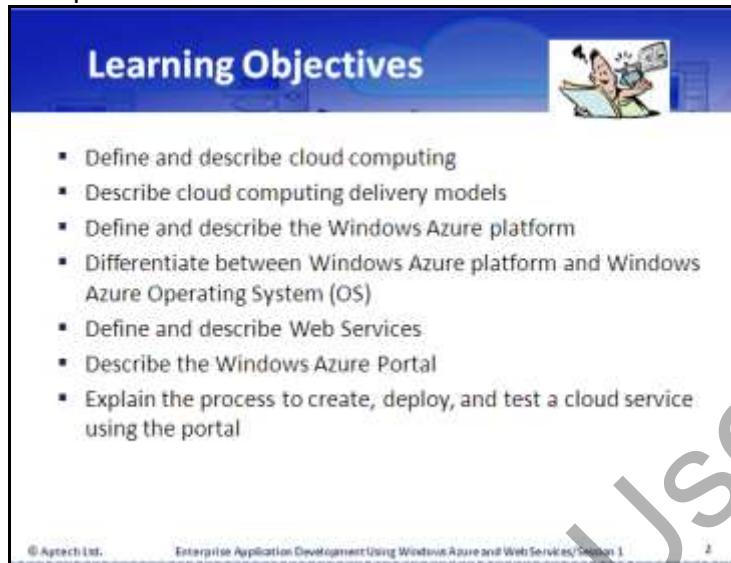
It is recommended that you test the understanding of the students by asking questions in between the class.

In-Class Activities:

Follow the order given here during In-Class activities.

Overview of the Session

Give the students a brief overview of the current session in the form of session objectives. Show the students slide 2 of the presentation.



The slide has a blue header bar with the text "Learning Objectives". Below the header is a cartoon illustration of a person sitting at a desk with a computer monitor, looking surprised or confused. The main content area contains a bulleted list of learning objectives:

- Define and describe cloud computing
- Describe cloud computing delivery models
- Define and describe the Windows Azure platform
- Differentiate between Windows Azure platform and Windows Azure Operating System (OS)
- Define and describe Web Services
- Describe the Windows Azure Portal
- Explain the process to create, deploy, and test a cloud service using the portal

At the bottom left is the copyright notice "© Aptech Ltd." and at the bottom right is the slide number "2".

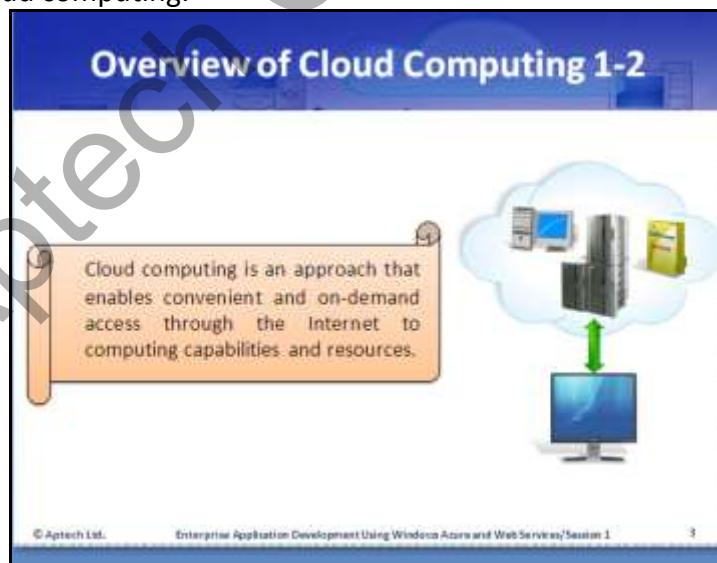
Give the students a brief overview of the current session in the form of session objectives.

Show the students slide 2 of the presentation.

1.2 In-Class Explanations

Slides 3 and 4

Let us understand cloud computing.



The slide has a blue header bar with the text "Overview of Cloud Computing 1-2". The main content area features a callout box with the following text:
Cloud computing is an approach that enables convenient and on-demand access through the Internet to computing capabilities and resources.
To the right of the text is a diagram showing a computer monitor connected by a green arrow to a cloud icon containing server racks and a database icon.

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Overview of Cloud Computing 2-2

The slide has a blue header with the title 'Overview of Cloud Computing 2-2'. Below the title are three colored boxes with text and corresponding icons:

- Red box:** 'Data resides on servers hosted across different datacenters spread over geographical locations.' with a globe icon.
- Yellow box:** 'Consumers of applications and services use the data over the Internet from a service provider.' with an icon of a person at a computer.
- Green box:** 'Datacenter: A dedicated storage space to store computers and various related components.' with an icon of a server rack.

At the bottom left is the copyright notice '© Aptech Ltd.', and at the bottom center is 'Enterprise Application Development Using Windows Azure and Web Services/Session 1'.

Using slide 3, introduce the concept of cloud computing. You can begin this slide by asking students if they are familiar with Gmail. Most of them would be familiar. Ask them if they needed to install anything apart from a browser to access Gmail. Tell them that Gmail requires only the Internet and can be accessed from anywhere anytime. It is an example of a software product that is served or delivered through the Internet. It is also an example of cloud computing, where software is served as a service.

Then, go on to define what is cloud computing as given on slide 3. Tell the students that cloud computing is an approach that enables convenient and on-demand access through the Internet to compute capabilities and resources.

Using slide 4, explain some of the three important features of cloud computing. Tell them that the data for the applications that are served over the Internet reside on the servers hosted across different datacenters, which are spread over multiple geographical locations.

Explain to them that the consumer of the applications and services do not host them locally, but uses them over the Internet from a service provider.

Mention that a datacenter is a dedicated storage space that is used to store computers and various related components. Give an analogy of a large warehouse of high-end servers and say that a datacenter is similar to such a warehouse.

Slides 5 and 6

Let us understand the definition of cloud computing.

Definition of Cloud Computing 1-2

Cloud computing approach:

- Helps small, medium, and big enterprises.
- Helps them to build, deploy, and manage any kind of services from creating a small and simple Website to working with large server workloads.



The key advantages of cloud computing:

- In the IT department, the application performance does not affect as there are no hardware limitations.

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Definition of Cloud Computing 2-2

An example of a commonly used cloud computing application:

 Twitter

The application is run from the servers hosted on the cloud and the data is also maintained on the cloud servers.

Other such applications are:

 Facebook  Gmail  Flickr  DropBox

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Using slide 5, explain that the cloud computing approach helps all kinds of enterprises to build, deploy, and manage services that range from creating a small and simple Web site to work with large server workloads.

Then, mention that one most important advantage of cloud computing is that there are no hardware limitations. For many organizations and enterprises, especially small ones, this advantage is huge because they cannot afford to frequently purchase new equipment.

In slide 6, tell that one of the most commonly used cloud computing application is Twitter, which is a social networking application that is run from the servers hosted on the cloud and the data is also maintained on the cloud servers.

Mention that there are many other cloud-based applications such as Facebook, Gmail, Flickr, DropBox, and so on.

Slides 7 to 9

Let us understand the use of cloud.

Why Use Cloud? 1-3

- ❑ The word 'cloud':
 - Is used as a representation of the Internet, because a pictorial representation of the Internet has always been the cloud.
 - Refers to cloud computing in the programming world, which is derived from the concept of utility computing.
- ❑ Utility Computing:
 - Is a concept that allows you to use-and-pay computing resources.
 - Is a concept of using and paying resources on a metered basis that gave birth to the concept of cloud computing over the last few decades.

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Why Use Cloud? 2-3

- ❑ Three core reasons that have driven the organizations to use cloud computing are:
 - Economical** 
 - Scalability** 
 - Deployment** 

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Why Use Cloud? 3-3

- Economical**
 - Cloud computing is more economical and cheaper than hosting applications on local infrastructure in an organization.
 - It does not require purchase of any hardware.
 - It is managed by the service providers, such as Amazon and Microsoft.
- Scalability**
 - Cloud computing offers unlimited scalability.
 - The IT department of an organization can scale hardware such as storage within a few minutes, if needed.
 - The hardware can be scaled without impacting the application or causing the down time.
- Deployment**
 - Cloud computing offers quick deployment.
 - It allows the developers to use similar hardware resources so that deployment does not fail.

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Using slide 7, explain that the word ‘cloud’ represents Internet. A cloud is a pictorial representation of the Internet. Tell them that cloud computing is derived from the concept of utility computing. Mention that the concept of utility computing allows to use-and-pay computing resources on a metered basis.

Using slide 8, explain the three core reasons for any organization to use cloud computing.

Using slide 9, explain how cloud computing can be economical. Tell that using cloud computing is more economical and cheaper than hosting applications on local infrastructure in an organization. To host an application, an organization’s IT department procures hardware that is available at a reasonable cost. Since the hardware becomes obsolete after some years, the organization needs to purchase new hardware. Using cloud computing does not require purchase of any hardware. There are many service providers that manage cloud computing including Amazon and Microsoft.

Then, explain scalability. Whenever an organization gets more customers, or its application gets more users, there may arise a need to scale it to cater to the growing demand. Usually scalability is tough, expensive, and time consuming to achieve.

Tell students that cloud computing offers unlimited scalability. If a cloud-hosted application needs more hardware, such as storage, it can be scaled within a few minutes. Explain to the students that hardware can also be scaled down without affecting the application or causing downtime, which will not be the case in the local hosted applications.

Next, explain deployment. Tell the students that cloud computing offers quick deployment. Tell them that in the local environment, when an application is developed, it needs to be tested and then deployed. If there are any differences in the testing and production environments in terms of hardware and resources, it can cause application deployment failure in the production environment. Mention that cloud computing allows the developers to use similar hardware resources to avoid deployment failure.

Slide 10

Let us understand the cloud services models.

Cloud Services Models 1-5

- ❑ Cloud computing platforms provide different kinds of services, depending on the delivery model that they use to deploy.
- ❑ The commonly available cloud service models are:
 - Infrastructure-as-a-Service (IaaS)
 - Platform-as-a-Service (PaaS)
 - Software-as-a-Service (SaaS)

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Using slide 10, explain to the students that the different kinds of services provided by cloud computing depend on the delivery model deployed.

Mention that the commonly available cloud service models are Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS), and Software-as-a-Service (SaaS).

Slides 11 to 14

Let us understand the Infrastructure-as-a-Service (IaaS).

Cloud Services Models 2-5

Infrastructure-as-a-Service (IaaS)

- In this cloud service model, the lower level services such as hardware and infrastructure are provided.
- Examples:
 - Network attached storage
 - Virtual machines
 - Load-balancer settings
- Amazon is a popular IaaS provider with services such as Elastic Cloud 2 (EC2) and S3.

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Cloud Services Models 3-5

Platform-as-a-Service (PaaS)

- In this cloud service model, the platform is provided over the Internet wherein developers can write their required code.
- The application runs on a specialized environment.
- Examples:

Windows Azure



- It is a cloud offering by Microsoft and is used for building, deploying, and managing services and applications.

Google App Engine (GAE)



- In this engine, developers can write code in a subset of Python.
- This code is then executed inside a custom hosting environment.
- Google is providing the platform for writing the code along with storage and servers.

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Cloud Services Models 4-5

Platform-as-a-Service (PaaS)

- The following figure describes the working of GAE:



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Cloud Services Models 5-5

Software-as-a-Service (SaaS)

- In this type of model, the software subscription is leased to the consumer.
- For example:
 - Microsoft provides Office 365 as a SaaS model.
 - A popular SaaS service is that of Gmail where an e-mail client is offered as an Internet service without requiring any local installation.
 - Anyone, anywhere, can use Gmail, provided he/she has an account.

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Using slide 11, explain to the students about IaaS. Tell them that IaaS provides lower level services such as hardware and infrastructure.

Tell them that using IaaS, the consumer can rent computing power, storage, networks, and other computing resources. The consumer can control the hardware, software, or operating system being used. Examples include network-attached storage, virtual machines, and load-balancer settings. Mention that Amazon is a popular IaaS provider. It provides services such as Elastic Cloud 2 (EC2) and S3.

Using slide 12, explain to the students about PaaS. Tell them that this kind of service is provided over the Internet that enables the developers to write their required code. The application runs on a specialized environment.

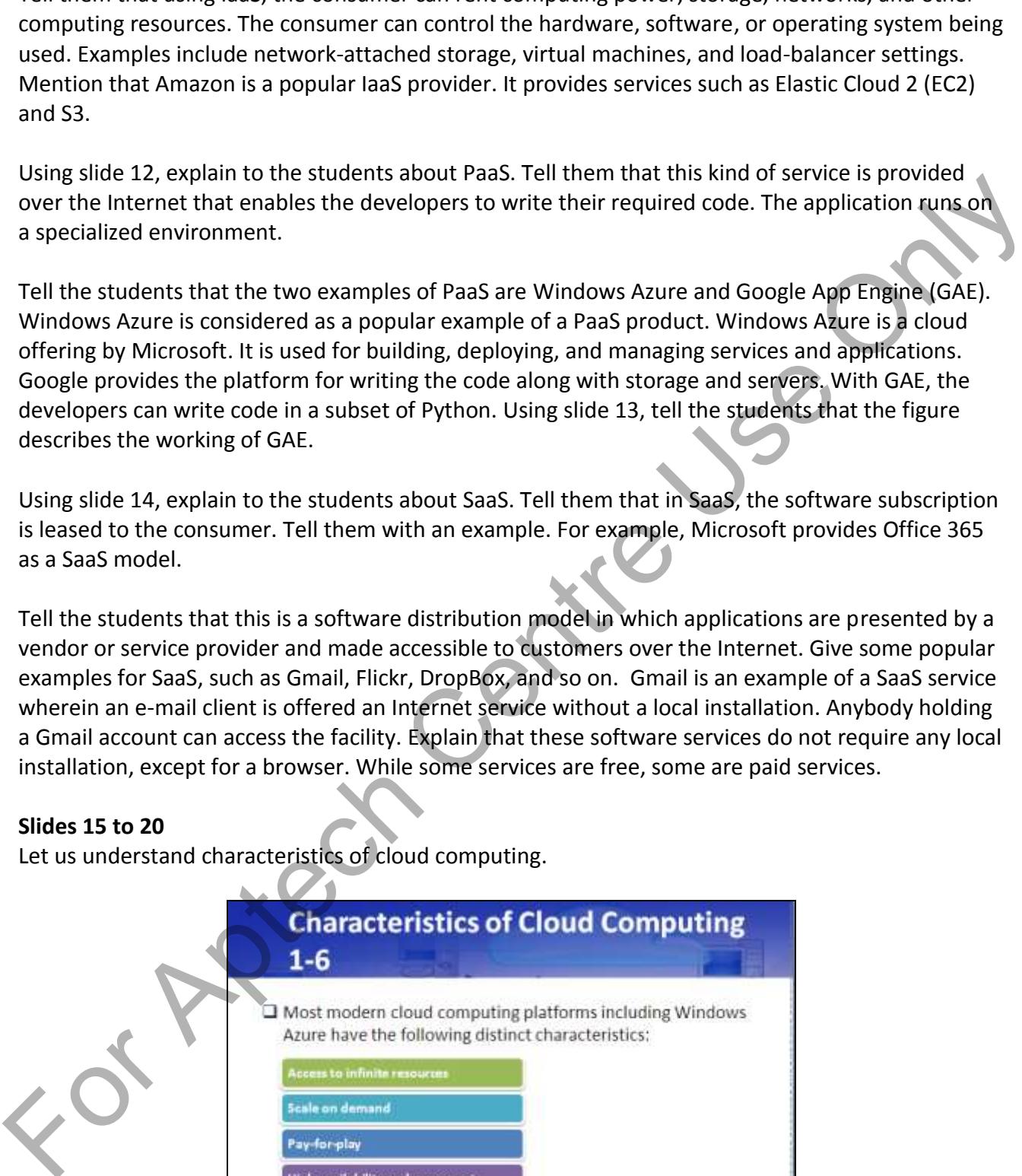
Tell the students that the two examples of PaaS are Windows Azure and Google App Engine (GAE). Windows Azure is considered as a popular example of a PaaS product. Windows Azure is a cloud offering by Microsoft. It is used for building, deploying, and managing services and applications. Google provides the platform for writing the code along with storage and servers. With GAE, the developers can write code in a subset of Python. Using slide 13, tell the students that the figure describes the working of GAE.

Using slide 14, explain to the students about SaaS. Tell them that in SaaS, the software subscription is leased to the consumer. Tell them with an example. For example, Microsoft provides Office 365 as a SaaS model.

Tell the students that this is a software distribution model in which applications are presented by a vendor or service provider and made accessible to customers over the Internet. Give some popular examples for SaaS, such as Gmail, Flickr, DropBox, and so on. Gmail is an example of a SaaS service wherein an e-mail client is offered an Internet service without a local installation. Anybody holding a Gmail account can access the facility. Explain that these software services do not require any local installation, except for a browser. While some services are free, some are paid services.

Slides 15 to 20

Let us understand characteristics of cloud computing.



Characteristics of Cloud Computing

1-6

Most modern cloud computing platforms including Windows Azure have the following distinct characteristics:

- Access to infinite resources
- Scale on demand
- Pay-for-play
- High availability and agreements
- Geographically distributed datacenters

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Characteristics of Cloud Computing

2-6

Access to infinite resources	→	
Scale on demand	→	<ul style="list-style-type: none">The cloud computing platforms provide an illusion of providing infinite capacity of computing and storage of resources.Need not plan much about storage or usage of your computing or infrastructural resources.Once a company or organization deploys its own storage on a cloud computing platform, it can leverage large datacenters that can span across the globe.
Pay-for-play		
High availability and agreements		
Geographically distributed datacenters		

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Characteristics of Cloud Computing

3-6

Access to infinite resources	→	
Scale on demand	→	<ul style="list-style-type: none">Cloud computing allow you to add resources only when you need them.It helps you to economize on your cost and time to acquire resources.
Pay-for-play		
High availability and agreements		
Geographically distributed datacenters		

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Characteristics of Cloud Computing

4-6

Access to infinite resources	→	
Scale on demand	→	<ul style="list-style-type: none">All initial investment, setup fees, and reservation are minimized and you incur only the software and hardware fees.Cloud computing allows you to reduce the upfront Capital Expenditure (CapEx) costs and incur only the Operating Expenditure (OpEx) cost.Your expenditure is only for what you use.
Pay-for-play		
High availability and agreements		
Geographically distributed datacenters		

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The image shows two slides from a presentation titled "Characteristics of Cloud Computing".

Slide 5-6: The title is "Characteristics of Cloud Computing 5-6". It lists five characteristics in a vertical stack: "Access to infinite resources" (green), "Scale on demand" (blue), "Pay-for-play" (dark blue), "High availability and agreements" (purple), and "Geographically distributed datacenters" (orange). An arrow points from the "Geographically distributed datacenters" box to a callout box. The callout box contains a small icon of a person at a desk and a bulleted list: "Cloud computing platform providers:" followed by two points: "Will create a Service Level Agreement (SLA) for storage and other computing outages." and "Will guarantee a set level of uptime and if they cannot meet the SLA, they will then provide you a refund." Below this, a note says: "For example, the SLA that Windows Azure platform (which is a cloud platform from Microsoft) takes care of both its hosting and its storage." The slide footer includes "© Aptech Ltd.", "Enterprise Application Development Using Windows Azure and Web Services/Session 3", and "19".

Slide 6-6: The title is "Characteristics of Cloud Computing 6-6". It lists the same five characteristics. An arrow points from the "Geographically distributed datacenters" box to a callout box. The callout box contains a world map and a bulleted list: "Cloud computing spreads your data in datacenters globally located in different geographies." and "You can make maximum use of:" followed by three points: "Load balancing", "Network latency", and "Edge caching". The slide footer includes "© Aptech Ltd.", "Enterprise Application Development Using Windows Azure and Web Services/Session 3", and "20".

Using slide 15, explain the characteristics of cloud computing to the students such as access to infinite resources, scale on demand, pay-for-play, high availability, and so on as given on the slide. Mention that Windows Azure is the most modern cloud computing platforms.

Using slide 16, explain about the access to infinite resources. Tell them that the cloud computing platforms provide infinite capacity of computing and storage of resources to the end users.

The end user does not have to plan much about storage or usage of computing or infrastructural resources. A company or organization can handle large datacenters across the globe on deploying its own storage on a cloud computing platform.

Using slide 17, explain scaling on demand, which is an important characteristic of cloud computing. Tell the students that earlier you had to wait for resources to synchronize with servers and their hardware. However, with cloud computing platforms you can add resources only required. This characteristic allows to reduce the cost and time to acquire resources.

Using slide 18, explain pay-for-play. Tell the students that the concept of cloud computing reduces the cost of computing resources such as all initial investment, setup fees, and reservation. It also minimizes the cost that you incur on the software and hardware fees.

Here, you tell them that cloud computing platforms reduces the upfront Capital Expenditure (CapEx) costs. It includes only the Operating Expenditure (OpEx) cost. You only pay for what you use.

Using slide 19, explain high availability and agreements. Cloud computing platform providers sign a Service Level Agreement (SLA) for storage and other computing outages wherein the provider guarantees a set level of uptime. In addition, if they are unable to meet the SLA, they refund the amount incurred. For example, Windows Azure platform is a cloud platform from Microsoft. It takes care of both its hosting and its storage.

Using slide 20, explain to the students about geographically distributed datacenter. Cloud computing spreads your datacenter globally across different geographical locations. When datacenters are geographically distributed, you can make maximum use of load balancing, network latency, edge caching, as well as take care of all legal or regulatory hassles.

Explain that network latency is a delay that occurs in data communication over a network. Edge caching involves distributing content from a local Web server to a caching server nearer to the user.

Additional Information:

To know more about cloud computing, visit the following links:

<http://cloudoftdata.com/>

<http://computer.howstuffworks.com/cloud-computing/cloud-computing.htm>

<http://www.reservoir-fp7.eu/index.php?page=cloud-computing>

<http://www.cloud-competence-center.com/understanding/cloud-computing-service-models/>

In-Class Question:

After you finish explaining cloud computing, you will ask the students an In-Class question. This will help you in reviewing their understanding of the topic.



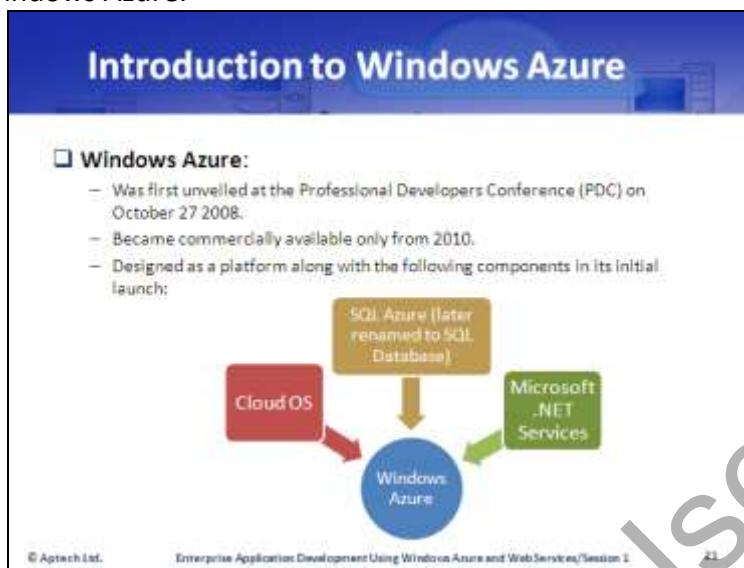
List the three core reasons to use cloud computing.

Answer:

The three core reasons to use cloud computing are economical, scalability, and deployment.

Slide 21

Let us understand Windows Azure.



Using slide 21, tell the students that Windows Azure was first unveiled on October 27, 2008 at the Professional Developers Conference. It became commercially available only from 2010.

Tell them that the core components of Windows Azure platform are Cloud OS, SQL Azure, and Microsoft .NET Services.

Mention that over the years, Windows Azure platform has undergone many changes and have some more components now.

Additional Information:

Microsoft Windows Azure is a cloud computing platform that enables to build and run Windows applications on the cloud and also facilitates data storage on the cloud. Ask students if they know about any non-Microsoft languages. Tell them that there are many languages, which are non-Microsoft languages. Tell the students that Ruby and Python are some non-Microsoft languages. Point out that Windows Azure also supports non-Microsoft languages, such as Ruby and Python in addition to the various Microsoft languages such as C#, VB.NET, and so on. Tell the students that development environments such as Eclipse are also supported. You can explain the use of Eclipse and also give some more examples of development environments. Tell the students that Eclipse is an integrated development environment for Java and other languages such as C, C++, and PHP.

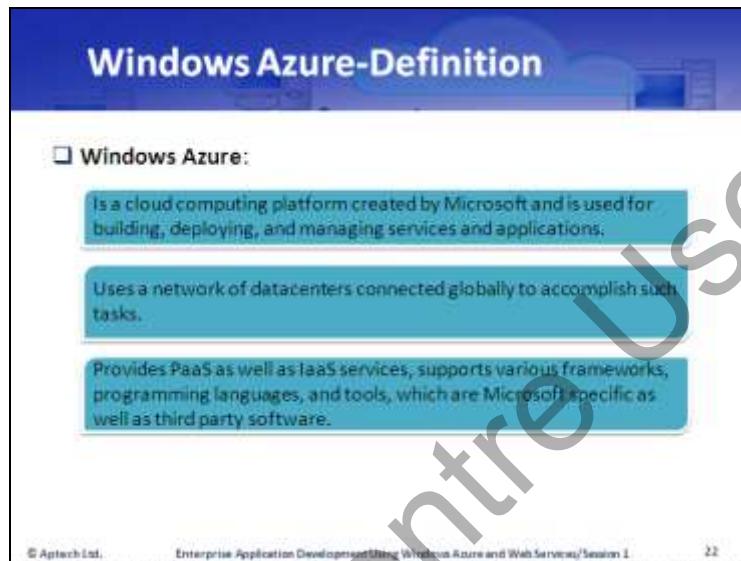
Necessity for the Windows Azure platform:

Web hosting is a hosting service provided by companies in which users can make their Web site accessible through the Internet. You can give an example of hosting service provided companies. Tell the students that godaddy.com is one of the popular Web hosting service providers. Point out that such companies have their own Web servers that are used to host the applications. Explain to the students about the Web hosting procedure.

Explain to the students about how cloud computing plays an important role in Web hosting. Tell the students that with the advent of cloud computing and globalized enterprises and organizations, there was a need for a cloud based solution for application development, deployment, and hosting. Point out that Microsoft fulfilled this need by creating Windows Azure. Then, define Windows Azure saying that it is a cloud computing platform and infrastructure that not only hosts applications, but also enables to build, deploy, and manage them.

Slide 22

Let us understand more about Windows Azure.



The slide has a blue header bar with the title "Windows Azure-Definition". Below the header, there is a section titled "□ Windows Azure:" which contains three bulleted points:

- Is a cloud computing platform created by Microsoft and is used for building, deploying, and managing services and applications.
- Uses a network of datacenters connected globally to accomplish such tasks.
- Provides PaaS as well as IaaS services, supports various frameworks, programming languages, and tools, which are Microsoft specific as well as third party software.

At the bottom left of the slide, it says "© Aptech Ltd.", in the center "Enterprise Application Development Using Windows Azure and Web Services/Session 1", and at the bottom right "22". A large watermark "FOR APTECH CENTRE USE ONLY" is diagonally across the slide.

Using slide 22, tell the students that Microsoft created Windows Azure as a cloud computing platform to build, deploy, and manage services and applications. It uses a network of datacenters that are connected globally to accomplish such tasks.

Tell them that it provides services such as PaaS and IaaS. It also supports various frameworks, programming languages, and tools, which are Microsoft specific as well as third party software.

Additional Information:

For more information, refer to the following links:

<http://msdn.microsoft.com/en-us/library/azure/ux/develop/dd163896.aspx>
<http://azure.microsoft.com/en-us/>

Slides 23 and 24

Let us understand need for Windows Azure.

Need for Windows Azure 1-2

- ❑ The need for Windows Azure arose because:
 - There were hardly any PaaS products that could be beneficial for companies.
 - It helps simplify IT based management and reduces upfront and regular expenses.
 - It is used to prepare, allocate, and upgrade Web applications instead of using expensive on site resources.

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Need for Windows Azure 2-2

- ❑ Windows Azure OS works as an integral part of the Azure Services Platform.
- ❑ Windows Azure OS, as the Azure Services Platform:
 - Covers different and separate application, storage, desktop environment, security, and so on.
 - Supports Microsoft standards, programming languages, platforms, and protocols.

Windows Azure

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Using slide 23, explain that the need for Windows Azure. Tell that although there were a variety of SaaS products, there were few PaaS products that could be beneficial for companies.

Windows Azure:

- Simplifies IT based management
- Reduces upfront and regular expenses
- Prepares, allocates, and upgrades Web applications
- Avoids using expensive on site resources

In slide 24, you will now mention that Windows Azure OS operates as an essential aspect of the Azure Services Platform that covers different and separate application, storage, desktop environment, security, and so on. This platform also supports Microsoft standards, programming languages, platforms, and protocols.

Slides 25 and 26

Let us understand Azure platform and cloud OS.

Azure Platform and Cloud OS 1-2

- Windows Azure was conceptualized as part of the cloud OS.
- The Windows Azure cloud computing platform:
 - Is built as an integrated platform that can cater to the building, deployment, and management of applications.
 - Is an open and flexible cloud platform and can also cater to workloads hosted on a global network of Microsoft managed datacenters.

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Azure Platform and Cloud OS 2-2

- Following are the most important components of the Windows Azure platform architecture:
 -  Provides a very large scale hosting and processing environment for applications.
 - Includes Cloud services, Websites, Mobile Services, and so on.
 -  Focuses on scalable storage services such as blobs, queues, and tables.
 - Includes SQL Database and Windows Azure storage.
 -  Provides a variety of services such as authentication, service bus, caching, and so on.

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Using slide 25, explain that Windows Azure is a part of the cloud OS that is built as an integrated platform to build, deploy, and manage applications. Owing to the open and flexible cloud platform, the workloads hosted on a global network of Microsoft can manage datacenters.

Using slide 26, explain that the Windows Azure platform architecture includes several components, of which the following are most important:

- **Compute:** Explain that compute provides a very large scale hosting and processing environment for applications such as cloud services, Web sites, Mobile Services, and so on.
- **Data services:** Mention that data services focus on scalable storage services such as blobs, queues and tables, SQL Database, and Windows Azure storage.
- **App services:** Also, explain that App services provide a variety of services such as authentication, service bus, caching, and so on.

Slides 27 and 28

Let us understand different features of Azure.

Different Features of Azure 1-2

□ The table lists some of the features of Windows Azure:

Feature	Description
Service Hosting	<ul style="list-style-type: none">Allows you to create your own server-side applications, such as Websites, computation services, and host them by using Windows Azure.In its current version, a code that requires administrative privileges on the machine will not be supported by Azure.
Service Management	<ul style="list-style-type: none">Allows you to use the Windows Azure in-built fabric controller that helps you deal with application monitoring and management.Monitors and maintains software automatically and hardware related upgradations or failures.

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Different Features of Azure 2-2

Feature	Description
Storage	<ul style="list-style-type: none">Allows you to store data through Azure three services:<ul style="list-style-type: none">Semi-structured tablesBinary Large Object (BLOB) storage (for storing raw data)A queue serviceBackup is prepared in case of failure, but you pay only for the storage that you use.
Windows Server	<ul style="list-style-type: none">Allows you to use the same code in Windows Azure that has been used in Windows Server.No separate code or framework is needed.The regular .NET Framework as well as ASP.NET code can be used.You can also use any other framework that supports FastCGI.
Development Tools	<ul style="list-style-type: none">Allows you to use many in-built development tools, such as:<ul style="list-style-type: none">APIs for logging and reporting errorsTools for deploying applications to cloud simulatorOther tools to read and update service configuration files

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Using slide 27, list the different features of Windows Azure. They are:

- Service Hosting
- Service Management

Explain that Service Hosting helps in creating your own server-side applications, such as Web sites, computation services, and host them by using Windows Azure.

The current version of Windows Azure does not support a code that requires administrative privileges on the machine by Azure.

Also, explain that with Service Management you can use the Windows Azure in-built fabric controller to deal with application monitoring and management. Windows Azure helps to monitor and maintain software and hardware related upgradations or failures.

Using slide 28, explain some more features of Azure. They are:

- Storage
- Windows Server
- Development Tools

Explain that Storage helps to store data through the three services provided by Azure. They are:

- Semi-structured tables
- Binary Large Object (BLOB) storage (for storing raw data)
- A queue service

Mention that Storage helps to make multiple copies of your data that helps to use as backup in case of any failure.

Tell them that another feature of Storage is that you pay only for the storage that you use.

Then, explain the features of Windows Server. Tell them that it allows to use the same code in Windows Azure that has been used in Windows Server. You do not require any separate code or framework. You can use the regular .NET Framework and ASP.NET code.

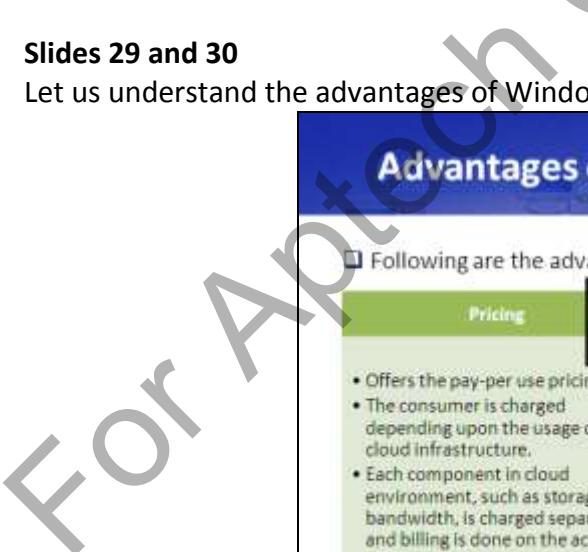
You can also use any other framework that supports FastCGI.

Mention that the Development Tools has many in-built development tools, such as Application Programming Interfaces (APIs) that helps to:

- Log and report errors
- Deploy applications to cloud simulator
- Read and update service configuration files

Slides 29 and 30

Let us understand the advantages of Windows Azure.

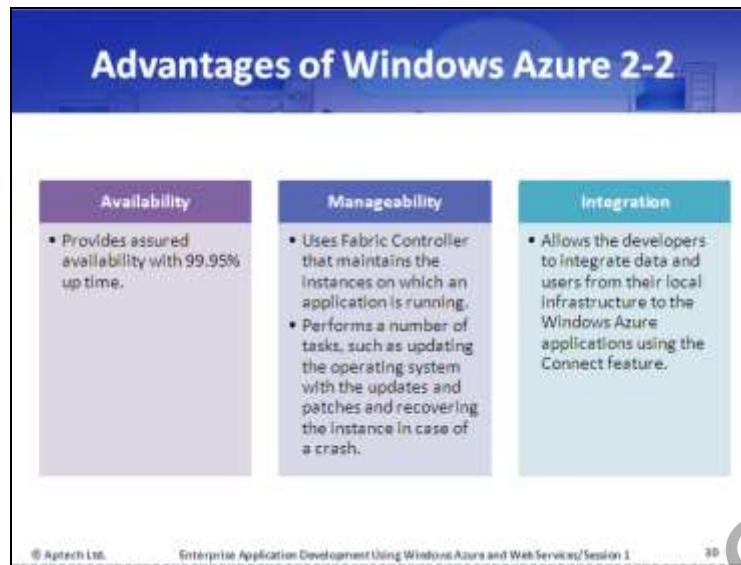


Advantages of Windows Azure 1-2

Following are the advantages of Windows Azure:

Pricing	Scalability
<ul style="list-style-type: none">Offers the pay-per-use pricing.The consumer is charged depending upon the usage of the cloud infrastructure.Each component in cloud environment, such as storage and bandwidth, is charged separately and billing is done on the actual usage.	<ul style="list-style-type: none">Offers agility in the IT infrastructure.It helps organizations to gain application performance.The scalability can be achieved within a few minutes by scaling the IT hardware in the cloud environment.The businesses pay only for what they use.

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The slide has a blue header bar with the title "Advantages of Windows Azure 2-2". Below the header, there are three columns: "Availability", "Manageability", and "Integration". Each column contains a bulleted list of advantages.

Availability	Manageability	Integration
<ul style="list-style-type: none">Provides assured availability with 99.95% uptime.	<ul style="list-style-type: none">Uses Fabric Controller that maintains the instances on which an application is running.Performs a number of tasks, such as updating the operating system with the updates and patches and recovering the instance in case of a crash.	<ul style="list-style-type: none">Allows the developers to integrate data and users from their local infrastructure to the Windows Azure applications using the Connect feature.

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Using slide 29, explain that there are some advantages of Windows Azure such as:

- Pricing
- Scalability

Explain Pricing. Tell that pricing offers the pay-per use pricing. The consumer of Windows Azure is charged and billed separately. It depends on the usage of the cloud infrastructure such as storage and bandwidth.

Explain Scalability. Tell them that scalability provides agility in the IT infrastructure. Most organizations face poor application performance when their business grows. In order to improve the application performance, the organization purchase new hardware to ensure sustainability. With Windows Azure, you can achieve scalability instantly by scaling the IT hardware in the cloud environment. The organizations pay only for what they use.

Using slide 30, explain more about the advantages of Windows Azure such as:

- Availability
- Manageability
- Integration

Explain Availability. Tell the students that this feature ensures that the server is available with 99.95% up time.

Explain Manageability. Also, mention that manageability uses Fabric Controller to maintain the instances on which an application is running. It performs a number of tasks, such as updating the operating system with the updates and patches and recovering the instance in case of a crash.

Explain Integration. Mention that integration helps the developers to integrate data and users from their local infrastructure to the Windows Azure applications.

Additional Information:

For more information, refer to the following link:

<http://www.businessproductivity.com/what-is-windows-azure-and-what-are-the-benefits/>

Using this Web page, explain to the students about business benefits of Windows Azure. Tell the students that following are the business benefits of Windows Azure:

1. Faster time to market
2. Reduced costs
3. Increased scalability
4. More flexible and creativity

In-Class Question:

After you finish explaining cloud computing, you will ask the students an In-Class question.

This will help you in reviewing their understanding of the topic.



Explain Windows Azure.

Answer:

Windows Azure is a cloud computing platform created by Microsoft and is used for building, deploying, and managing services and applications. It uses a network of datacenters connected globally to accomplish such tasks.

Slide 31

Let us understand Web services.

The slide has a blue header bar with the title "Overview of Web Services". Below the header, there are two main sections, each containing a question and its definition. To the right of the definitions are small icons: a globe with a hand pointing at it and a circular icon with various icons inside. At the bottom of the slide, there is footer text: "© Aptech Ltd.", "Enterprise Application Development Using Windows Azure and Web Services/Session 1", and "31".

❑ A Web service is:

A software component that can be accessed by other applications (such as a client, a server, or another Web service) through protocols including HTTP.

An object-oriented class that runs on the Web server and allowing the remote clients to invoke its methods.

❑ Web services facilitate most flexible infrastructure for the development of distributed cloud applications.

Using slide 31, explain that the Web services provides the most flexible infrastructure for the development of distributed cloud applications.

Mention that a Web service is a software component that can be accessed by a client, a server, or another Web service through protocols including Hypertext Transport Protocol (HTTP).

Also, mention that a Web service is an object-oriented class that runs on the Web server and allows the remote clients to invoke its methods.

Slides 32 to 34

Let us understand distributed applications.

Distributed Applications 1-3

Distributed Application:

- Helps users access information, but users are unaware where the information is coming from.
- Allows adding more systems as and when required. A single and consistent environment is provided to the users.
- Is typically used in a client/server network where the client interacts with the servers with specific requests.
- Key example of distributed application is a collaboration application.

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Distributed Applications 2-3

Following are the types of distributed applications:

General	• Are general applications that are used on systems. • Consider an application that enables a user to login at the local machine and get authenticated through the remote domain controller.
Collaboration	• Are applications that allow users to work on specific portions of an application at the same time. • Each user is assigned a specific task.
Real-time	• Are the applications in which real-time information exchange takes place. • Example: Chat application in which a user is interacting with another user.
Computational	• Are applications in which processing of code takes place on the server. • Example: A central code repository, which multiple users access at the same time.

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Distributed Applications 3-3

- ❑ Following technologies were used to create distributed applications prior to Web services:
 - Remote Method Invocation (RMI)
 - Remote Procedure Calls (RPC)
 - Distributed COM (DCOM)
- ❑ These technologies were found to be difficult to use or both client and server were required to be using the same technology.
- ❑ As a solution to these issues, the concept of Web services was conceived.

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Using slide 32, explain that earlier, applications ran on a single system. Later, the distributed applications were designed to run on multiple computers. This helps the users to access information without the user's knowledge about the source of the information.

Then, explain that one of the advantage of distributed applications helps to add more systems whenever required. A single and consistent environment is provided to the users.

Mention that a distributed application is used in a client/server network wherein the client interacts with the servers with specific requests. The server, answers the client requests and processes the data requested. For example, a collaboration application.

Using slide 33, explain the types of distributed applications such as:

- General
- Collaboration
- Real-time
- Computational

Explain general distributed applications saying that these are general type of applications that are used on systems. For example, an application that enables a user to login at the local machine and get authenticated through the remote domain controller.

Explain collaboration applications saying that this type of distributed applications allow users to work on specific portions of an application at the same time. Each user is assigned a specific task. For example, a project management system in which each user plays a key role.

Tell that in real-time distributed applications, real-time information is exchange. For example, an online chat application in which a user is interacting with another user.

Explain computational applications by saying that they process codes on the server. For example, a central code repository, which multiple users access at the same time.

Using slide 34, explain the technologies used to create the distributed applications. They are:

- Remote Method Invocation (RMI)
- Remote Procedure Calls (RPC)
- Distributed COM (DCOM)

These technologies were used to create the distributed applications prior to Web services.

Also, mention that the client and users found these technologies difficult as they were required to be using the same technology. To combat this difficulty, the concept of Web services was conceived.

Slides 35 and 36

Let us understand concept of Service Oriented Architecture (SOA).

Concept of Service Oriented Architecture (SOA) 1-2

- ❑ SOA is an architectural design that:
 - Helps to build or extend modular systems in a flexible and reusable manner.
 - Provides loose coupling among the modules of an application.
- ❑ SOA defines three key roles:
 - Service Provider (Server)
 - Service Consumer (Client)
 - Service Broker (Middleware)

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Concept of Service Oriented Architecture (SOA) 2-2

- ❑ Entities interact with each other with the help of three key components:

Service <ul style="list-style-type: none">• A self-contained piece of functionality.• It can be remotely located and invoked on a request.• It can be consumed by a remote client from any geographical location, using any operating system and language.• A service provider such as a Web server makes the service available to consumers.	Message <ul style="list-style-type: none">• Is a means of communication between service providers and service consumers.• Can be in the form of a request from a consumer or as a response from the service provider.• Are defined in Extensible Markup Language (XML).	Dynamic Discovery <ul style="list-style-type: none">• Is implemented by the directory service.• Helps providers to register themselves along with their services.• Helps to find the valid provider for invoking the required service.
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Using slide 35, explain the concept of SOA. Tell the students that SOA is an architecture that helps to build or extend modular systems in a flexible and reusable manner. Also, mention that SOA provides loose coupling among the modules of an application.

Loose coupling is a design technique that helps the modules of an application to communicate with each other without being concerned with each other's internal implementation.

Also, tell that any change in a module will not affect the remaining modules of the application. This allows independent functioning of the modules in a distributed environment and provides high maintainability, extensibility, reusability, and efficiency.

Also, mention that SOA defines three key roles. They are:

- Service provider (server)
- Service consumer (client)
- Service broker (middleware)

Using slide 36, explain the three key components of SOA. Tell that these entities interact with each other with the help of three key components. Tell them the three components are:

- Service
- Message
- Dynamic Discovery

Explain that a service is an independent functionality that can be remotely located and invoked on a request and a client can consume the service from any geographical location using any operating system and language. A service provider such as a Web server makes the service available to consumers.

Tell them that a message is a means to communicate between service providers and consumers. You can send a message in the form of a request from a consumer, or as a response from the service provider.

Also, mention that another feature of message is that the services are platform- and language-independent. This helps to define the messages in Extensible Markup Language (XML). XML is a platform-independent markup language.

Tell them that dynamic discovery is implemented by the directory service. The providers use the directory service to register themselves and their services. To find the valid provider for invoking the required service, the consumers send a query to the directory service over the network. Thereby reducing the dependency of consumers on the providers.

Also, mention that organizations that have business processes based on a loosely-coupled infrastructure can gain more benefits from SOA. This can be done by changing their processes when needed. This is not possible with organizations based on monolithic applications.

Additional Information:

To know more about SOA, visit the following links:

<http://msdn.microsoft.com/en-us/library/aa480021.aspx>
http://www.service-architecture.com/articles/web-services/service-oriented_architecture_soa_definition.html
<http://msdn.microsoft.com/en-in/library/bb833022.aspx>

Slides 37 to 39

Let us understand the features of Web services.

Introduction to Web Services 1-3

❑ Following are the features of Web services:

- They can be defined as application components
- They can use open protocols for communication
- They can be reused by multiple applications
- They use HTTP and XML as the base

Introduction to Web Services 2-3

❑ Following are the main objectives behind the development of Web services:

- The Web service and the client that will consume the service can use completely different operating systems or programming languages.
- The client and Web service are allowed to work remotely from each other.
- The Web service is made available through firewalls (allow port 80 and block other ports).

❑ These objectives can be accomplished through the use of XML by client and Web services to call services and get back the results.

The slide has a blue header bar with the title "Introduction to Web Services 3-3". Below the header, there is a list of characteristics of a Web service:

- ❑ Following are the characteristics of a Web service:
 - A Web service contains only classes that are used by the clients, but does not contain a user interface.
 - It uses only port 80 to make the Web service available to client.
 - It can be called using HTTP Get, HTTP Post, or using Simple Object Access Protocol (SOAP).
 - The clients of a Web service can be a Web browser, Web application, or desktop application.
 - All the clients using Web service require a proxy, which gathers the parameters and results to invoke a Web service.

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Using slide 37, explain the features of Web services. Tell the students that the Web services can be defined as application components, use open protocols for communication, they can be reused by multiple applications and they use HTTP and XML as the base.

Using slide 38, explain the main objectives of Web services.

Tell that the Web service and the client that will consume the service can use different operating systems or programming languages.

The client and Web service can work remotely from each other.

A Web service is made available through firewalls (allow port 80 and block other ports). You can achieve these objectives through the use of XML by client and use Web services to call services and achieve results.

Using slide 39, explain the characteristics of a Web service that include:

- It contains only classes that are used by the clients. It does not contain a user interface.
- It uses only port 80 to make the Web service available to client.
- It can be called using HTTP Get, HTTP Post, or using Simple Object Access Protocol (SOAP).
- Web browser, Web application, or desktop applications are the clients of a Web service.
- All the clients using Web service require a proxy to gather the parameters and results to invoke a Web service.

Slide 40

Let us understand the need for Web services.

Need for Web Services

Following are the key purposes of Web services:

- Function reusability**
 - A developer can expose the functions of an application over the network.
 - The exposed functions can then be reused by different applications.
- Interoperability of different types of applications**
 - A developer can integrate services and data of applications that are developed using different programming languages.
 - A developer does not need to make changes to the existing applications.
- Use of standard protocols**
 - Web services use standard protocols that allow wide adoption across different applications.
- Less expensive**
 - Since Web services use standard HTTP protocols, there is no extra cost involved in designing the applications.

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Using slide 40, explain the need for Web services by saying that they provide the following:

- Function reusability
- Interoperability of different types of applications
- Use of standard protocol
- Less expensive functionality

Tell that function reusability is a great benefit to a developer. A Web service exposes functions over the network and can be reused by different applications. These applications that make use of Web services are called clients or hosts and the action of using the service in them is called consuming.

Tell that interoperability of different types of applications allows a developer to integrate services and data of applications that are developed using different programming languages.

A developer can make changes to the existing applications to integrate multiple applications using Web services.

Tell that the use of standard protocol services allow wide adoption across different applications.

Explain that Web services use standard HTTP protocols hence, there is no extra expense involved in designing the applications.

Slides 41 and 42

Let us understand applications of Web services.

Applications of Web Services 1-2

- ❑ Web services:
 - Have been utilized for a large number of applications that people use on day-to-day basis.
 - In the backend often perform the functions, but end-users are unfamiliar about it.
- ❑ People use mobile phones, tablets, and computers to interact with online applications.

- ❑ For example:
 - A user at home orders a pizza on an online portal from a pizza joint.
 - The user is unaware that the software of the portal makes use of Web services in ordering the pizza.

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Applications of Web Services 2-2

- ❑ Some common Web services on a mobile phone, a tablet, or a computer are:
 -  Receiving online score updates from a sports site
 -  Making travel reservations
 -  Getting online weather updates
 -  Receiving a road travel map

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Using slide 41, explain that Web services have been utilized for a large number of applications that people use on day-to-day basis. As end-users, people may not be aware how the application is fetching the data for them, but the Web services in the backend often perform the functions. People use mobile phones, tablets, and computers to interact with online applications. Explain with an example. Tell that a user at home orders a pizza on an online portal from a pizza joint. The user is unaware that the software of the portal makes use of Web services in ordering the pizza.

Using slide 42, explain some of the common Web applications that include:

- Receiving online score updates from a sports site
- Making travel reservations
- Getting online weather updates
- Receiving a road travel map
- Receiving constant social media updates

Slides 43 to 45

Let us understand Web services in .NET.

Web Services in .NET 1-3

Following are the various supported Web services in .NET:

- ASP.NET Web Services
- Windows Communication Foundation (WCF)
- ASP.NET Web API Services

Web Services in .NET 2-3

ASP.NET Web Services

- Are also called as XML Web services.
- Were used in .NET Framework versions prior to 3.0.
- Are still considered as legacy services and not recommended for use in new applications.

ASP.NET Web API Services

- Used to build flexible and extensible Web services that can support a wide range of operating systems and modern devices.
- Is a framework that helps build HTTP-based services on top of the .NET Framework.
- Can also be used for building APIs while HTTP is used for building Web pages.
- Since most platforms these days have a HTTP library, creating HTTP-based services helps in reaching out to different clients such as desktop applications, browsers, mobile devices, and Smart phones.

Web Services in .NET 3-3

Windows Communication Foundation (WCF)

- Was included in the .NET Framework 3.0, a first framework.
- Has been included into the later releases of .NET Frameworks.
- Is a unified programming model that is primarily used for service-oriented applications.
- Helps to build service-oriented applications, which use message to communicate.
- Helps to build services that has number of benefits when compared with ASP.NET Web services.

Following are the benefits of WCF:

- Network Protocols: Can use multiple network protocols, such as HTTP for sending messages.
- Switching: Can switch network protocols without any effort for sending messages.
- Web Service Standards: Supports latest Web services standards, such as SOAP 1.2 and WS-*.
- Format: Can send messages in formats such as SOAP.

Using slide 43, explain that the various supported Web services in .NET are ASP.NET Web Services, Windows Communication Foundation (WCF), and ASP.NET Web API Services.

Using slide 44, explain that Web services in ASP.NET are also called as XML Web services. They were used in .NET Framework versions prior to 3.0. Today, they are considered as legacy services and not recommended for use in new applications.

Also, mention that in ASP.NET Web API Services build flexible and extensible Web services that can support a wide range of operating systems and modern devices, you need to use the ASP.NET Web API.

ASP.NET Web API is a framework that helps to build HTTP-based services on top of the .NET Framework.

Explain that HTTP is often used for building Web pages and for building APIs. Since most platforms these days have a HTTP library, creating HTTP-based services helps in reaching out to different clients such as desktop applications, browsers, mobile devices, and Smart phones.

Using slide 45, explain the Windows Communication Foundation (WCF). Tell them that .NET Framework 3.0 was the first framework that included WCF. Since then, it has been included into the later releases of .NET Frameworks.

It is a unified programming model that is primarily used for service-oriented applications. It helps to build service-oriented applications that use a message to communicate.

Mention that you could build services with one of the two methods, using ASP.NET Web services or through WCF, which has a number of benefits when compared with ASP.NET Web services.

Mention that the benefits of WCF are:

- Can use multiple network protocols such as HTTP for sending messages.
- Network protocols can switch without any effort for sending messages.
- WCF supports Web Service Standards such as SOAP 1.2 and WS-*.
- WCF can send messages in formats such as SOAP.

Slide 46

Let us understand Web services terminologies.

Web Services Terminologies

Following are Web services terminologies:

EndPoint	Contract	Consumer	Host	SOA
▪ This is the Uniform Resource Locator (URL) that is used to communicate with the Web service. ▪ A client application uses this URL for communication.	▪ This is the service agreement by a service provider and the client.	▪ It is the end user that uses the Web service.	▪ It is the server that contains the Web service and the application.	▪ It defines how the Web services will be used to support the user requirements.

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Using slide 46, explain that there are a number of common terms that form Web service terminologies. A developer must know these terms to understand the underlying concept of Web services. Explain the terminologies such as:

- Endpoint
- Contract
- Consumer
- Host
- SOA

Explain Endpoint. Tell that this is the Uniform Resource Locator (URL) that helps to communicate with the Web service. A client application can use this URL to communicate.

Explain Contract. This is the service agreement by a service provider and the client.

Explain Consumer. It is the end user that uses the Web service.

Explain Host. It is the server that contains the Web service and the application.

Explain SOA. It defines that how the Web services will be used to support the user requirements.

Slide 47

Let us understand the Windows Azure portal.

Understanding the Windows Azure Portal

Windows Azure Portal:

- Defines the access to the components based on your subscription.
- Helps a developer can gain access to Cloud Service deployment and management tasks.
- Also has a reporting mechanism in which it displays a dashboard with status information depicting overall health of your deployments and accounts.
- Is refreshed regularly to display active status. You can create and manage various Windows Azure components and services using the portal.

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Using slide 47, explain to the students that the Microsoft Windows Azure portal defines the access to the components based on your subscription.

To work with Windows Azure, a developer must understand the various components of the Windows Azure portal. Using the portal, a developer can gain access to Cloud Service deployment and management tasks.

Mention that the portal also has a reporting mechanism in which it displays a dashboard with status information depicting overall health of your deployments and accounts. The portal is refreshed regularly to display active status. You can create and manage various Windows Azure components and services using the portal.

Additional Information:

For more information on the Azure portal, visit the following links:

- <http://channel9.msdn.com/Series/Windows-Azure-Cloud-Services-Tutorials/Walkthrough-of-the-Management-Portal-for-Windows-Azure-Cloud-Services>
- <http://devproconnections.com/windows-azure-development/new-windows-azure-management-portal-quick-guide>
- <http://weblogs.asp.net/scottgu/more-great-improvements-to-the-windows-azure-management-portal>

Slide 48

Let us understand how to create a Windows Azure account.

To use Windows Azure portal, you need to create an account on the portal.

Following are the steps to create a Windows Azure account:

Step 1 Open <http://www.windowsazure.com> in a Web browser.

Step 2 Go to the free trial account page and create an account.
(For this, you need to provide your credit card number and mobile phone number as an identity proof.)

If you already have an MSDN subscription then create an account by activating your MSDN subscriber benefits from the Windows Azure Benefit for MSDN Subscribers page.

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Using slide 48, explain that to use the portal, you need to create an account on the Windows Azure portal. Tell the steps to be followed to create a Windows Azure account, perform the following steps:

1. Open <http://www.windowsazure.com> in a Web browser.
2. Go to the free trial account page and create a trial account. For this, you need to provide your credit card number and mobile phone number as an identity proof.

Mention that if you already have an MSDN subscription then create an account by activating your MSDN subscriber benefits from the Windows Azure Benefit for MSDN Subscribers page.

Slides 49 and 50

Let us understand exploring the portal.

When you log on to the portal, you get to see the following portal interface with the left and right panes:

Left pane displays the services.

Right pane displays the context-specific information depending on what you select in the left pane.

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The slide has a blue header bar with the title "Exploring the Portal 2-2". Below the header, there is a section with a blue border containing a list of steps:

Following are the steps to be followed to edit or delete subscriptions:

- Step 1 • Open the shortcut menu for the Windows Azure Compute node and then select Add Deployment Environment.
- Step 2 • In the Add Deployment Environment dialog box, select the subscription that you want to modify, and then select the Manage button.
- Step 3 • In the Windows Azure Cloud Service Project Management Settings dialog box, select the subscription that you want to modify, and then select the Edit button to change subscription details or the Delete button to delete the subscription.

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Using slide 49, explain that when you log on to the portal, you will notice that the portal interface is divided into two panes. The left pane displays the following services: Web sites, virtual machines, mobile services, cloud services, SQL Databases, storage networks, service bus, and add-ons settings.

Mention that the right pane displays the context specific information depending on what you select in the left pane.

Using slide 50, explain the steps to be followed to edit or delete subscriptions.

In step 1, tell that they need to open the shortcut menu for the Windows Azure Compute node, and then select **Add Deployment Environment**.

In step 2, tell that in the **Add Deployment Environment** dialog box, select the subscription that you want to modify, and then select the **Manage** button.

In step 3, tell that in the **Windows Azure Cloud Service Project Management Settings** dialog box, select the subscription that you want to modify, and then select the **Edit** button to change subscription details or the **Delete** button to delete the subscription.

Slides 51 to 53

Let us understand creating a cloud service through the portal.

Creating a Cloud Service through the Portal 1-3

Perform the following steps to create a cloud service using **Quick Create** on the Portal:

Step 1	• Log on to the Windows Azure portal.
Step 2	• On the portal interface, click New at the bottom of the page, select Cloud Services , and then select Quick Create .
Step 3	• In the right pane, enter a sub-domain public URL name for accessing cloud services in production deployments in the URL text box.
Step 4	• In Region/Affinity Group drop-down, select the geographic region or affinity group where you want to deploy the cloud service to.
Step 5	• Click Create Cloud Service .

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Creating a Cloud Service through the Portal 2-3

You can:

- Monitor the process as it is displayed at the bottom of the window while deploying the cloud service.
- Check the status as **Created** as it implies that the cloud service has been created successfully.
- Create a Web site using the **WEB SITES** option on the left pane.

It is mandatory to upload a cloud certificate before deploying the cloud service.

Once the certificate is uploaded, then the Windows applications running on role instances can access the certificate.

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Creating a Cloud Service through the Portal 3-3

Following are the steps to upload a certificate for the cloud service:

Step 1	• Click Cloud Services in the Windows Azure Management Portal. Note that you will see the services that you have created. Select a service to open its dashboard.
Step 2	• Click Certificates on the menu bar. The certificates page is displayed.
Step 3	• Click UPLOAD A CERTIFICATE . The Upload certificate window is displayed.
Step 4	• Click Browse next to the Certificate (.crt) file text box and select the certificate (.crt file).
Step 5	• Enter the password for the certificate in the Password text box. The password is the private key for the certificate.
Step 6	• Click OK . The certificate is now added.

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Using slide 51, explain the steps to be followed to create a cloud service using **Quick Create** on the Portal.

In step 1, log on to the Windows Azure portal.

In step 2, on the portal interface, click **New** at the bottom of the page, select **Cloud Services**, and then select **Quick Create**.

In step 3, in the right pane, enter a sub domain public URL name for accessing cloud services in production deployments in the URL text box. The URL format for production deployments is as follows:

<http://myURL.cloudapp.net>

For example, you can give **test.AztecSolutions.net**.

In step 4, in **Region/Affinity Group** drop-down, select the geographic region or affinity group where you want to deploy the cloud service to.

In step 5, click **Create Cloud Service**.

Using slide 52, explain that while deploying the cloud service, you can monitor the process as it is displayed at the bottom of the window. Once the status shows as **Created**, it implies that the cloud service has been created successfully.

Explain that using the **WEB SITES** option on the left pane, you can create a Web site. After the Web site has been successfully created, when you click the name, you will see a set of options on the bottom right of the screen.

This is the quick glance section and shows various options.

Also, mention that it is mandatory to upload a cloud certificate before deploying the cloud service. Once the certificate is uploaded, then the Windows applications running on role instances can access the certificate.

Using slide 53, explain the steps to upload a certificate for the cloud service.

In step 1, in the Windows Azure Management Portal, click **Cloud Services**. Note that you will see the services that you have created. Select a service to open its dashboard.

In step 2, on the menu bar, click **Certificates**. The Certificates page is displayed.

In step 3, click **UPLOAD A CERTIFICATE**. The Upload Certificate window is displayed.

In step 4, click **Browse** next to the **Certificate file** text box and select the certificate (.pfx file).

In step 5, in the **Password** text box, enter the password for the certificate. The password is the private key for the certificate.

In step 6, click **OK**. The certificate is now added.

Slides 54 to 57

Let us understand testing the cloud service.

Testing the Cloud Service 1-4

- In organizations, testing normally involves following tests:
 - Performance testing
 - Production service monitoring
 - General
 - Load testing
- Need for Cloud Testing:**
 - The software testing carried out by traditional approaches incurs high cost to simulate user activity from various geographical regions.
 - Testing the firewalls and load balancers involves maintenance of hardware and software.
 - A number of bugs can exist in the cloud-based applications like the local environment.
 - You must test the solution in a separate environment than the production environment.

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Testing the Cloud Service 2-4

- Limitations:**
 - The test results may not be accurate due to varying performance of service providers' network and Internet.
 - In many cases, service virtualization can be applied to simulate the specific performance and behaviours required for accurate and thorough testing.
 - Also, the initial setup cost for migrating testing to cloud is very high as it involves modifying some of the test cases to suit cloud environment.

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Testing the Cloud Service 3-4

Following are some types of testing:

The diagram illustrates the various types of cloud testing. At the center is a grey circle labeled "Cloud Testing". Surrounding it are six pink circles, each representing a different type of test: "Stress" (top), "Load & Performance" (top-right), "Functional" (right), "Latency" (bottom-right), "Browser Performance" (bottom-left), and "Compatibility" (left). Arrows point from each peripheral circle towards the central "Cloud Testing" circle.

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Testing the Cloud Service 4-4

Some of the tests are as follows:

Load test	Performance test	Functional test	Latency testing
• This involves in creating heavy user traffic and measuring its response.	• This involves testing the performance of a working load. • By using cloud testing the traffic can be varied as required, this lessens the cost and time by stimulating large number of users at various geographical locations.	• This is carried out on both internet-based and offline applications. • It involves verification of specifications and system requirements and is carried in cloud instead of on-site software testing.	• It is mainly used to test the latency between the action performed and its corresponding response for any application after installing it on cloud.

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Using slide 54, explain that in organizations, testing involves performance testing, production service monitoring, general, and load testing.

Then, explain the need for Cloud Testing. Tell that the software testing carried out by traditional approaches incurs high cost to simulate user activity from various geographical regions. Testing the firewalls and load balancers involves maintenance of hardware and software.

Mention that just like the local environment, a number of bugs can exist in the cloud-based applications. You must test the solution in a separate environment than the production environment.

Using slide 55, explain limitations of testing the cloud service. The test results may not be accurate due to varying performance of service providers' network and Internet. In many cases, service virtualization can be applied to simulate the specific performance and behaviors required for accurate and thorough testing.

Also, mention that the initial setup cost for migrating testing to cloud is very high as it involves modifying some of the test cases to suit cloud environment.

Using slide 56, explain that there are various types of testing such as Load test, Performance test, Functional test, and Latency testing.

Using slide 57, explain that the test include Load test, Performance test, Functional test, and Latency testing.

Explain that load test involves in creating heavy user traffic and measuring its response.

Explain that performance test involves testing the performance of a working load. By using cloud testing the traffic can be varied as required, this lessens the cost and time by simulating large number of users at various geographical locations.

Explain that functional test is carried out on both Internet-based and offline applications. It involves verification of specifications and system requirements and is carried in cloud instead of on-site software testing.

Explain that latency testing is mainly used to test the latency between the action performed and its corresponding response for any application after installing it on cloud.

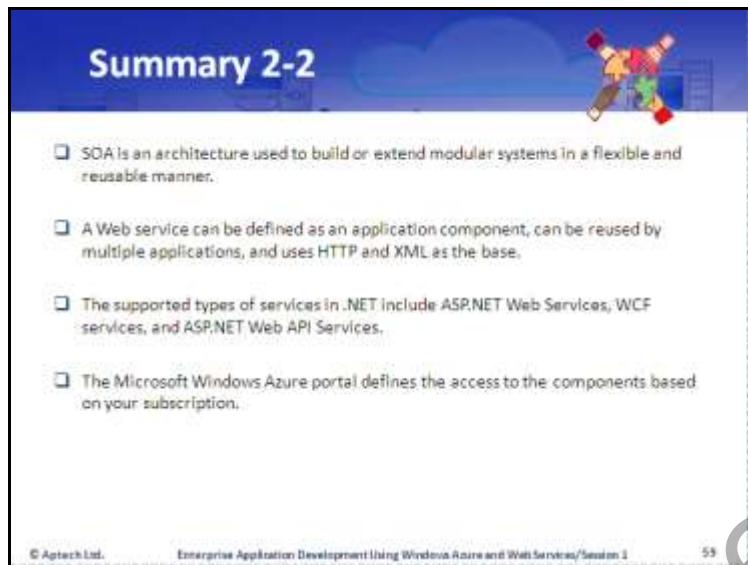
Slides 58 and 59

Let us summarize the session.

The slide has a blue header bar with the title "Summary 1-2". Below the header is a list of four bullet points:

- ❑ Cloud computing is an approach that enables convenient and on-demand access through the Internet to computing capabilities and resources.
- ❑ Cloud computing platforms provide different kinds of services, depending on the delivery model that they deploy, such as IaaS, PaaS, and SaaS.
- ❑ Windows Azure is a cloud computing platform created by Microsoft and is used for building, deploying, and managing services and applications.
- ❑ Windows Azure OS works as an integral part of the Azure Services Platform that covers different and separate application, storage, desktop environment, security, and so on.

At the bottom of the slide, there is a footer with the text "© Aptech Limited", "Enterprise Application Development Using Windows Azure and Web Services/Session 1", and "58".



The slide has a blue header bar with the title "Summary 2-2" and a small decorative graphic of colorful people. The main content area contains four bullet points:

- ❑ SOA is an architecture used to build or extend modular systems in a flexible and reusable manner.
- ❑ A Web service can be defined as an application component, can be reused by multiple applications, and uses HTTP and XML as the base.
- ❑ The supported types of services in .NET include ASP.NET Web Services, WCF services, and ASP.NET Web API Services.
- ❑ The Microsoft Windows Azure portal defines the access to the components based on your subscription.

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Using slides 58 and 59, you will summarize the session. You will end the session, with a brief summary of what has been taught in the session.

Tell the students pointers of the session. This will be a revision of the current session and it will be related to the next session. Explain each of the following points in brief. Tell them that:

- Cloud computing is an approach that enables convenient and on-demand access through the Internet to compute capabilities and resources.
- Cloud computing platforms provide different kinds of services, depending on the delivery model that they deploy, such as IaaS, PaaS, and SaaS.
- Windows Azure is a cloud computing platform created by Microsoft and is used for building, deploying, and managing services and applications.
- Windows Azure OS works as an integral part of the Azure Services Platform that covers different and separate application, storage, desktop environment, security, and so on. This platform also supports Microsoft standards, programming languages, platforms, and protocols.
- SOA is an architecture used to build or extend modular systems in a flexible and reusable manner.
- A Web service can be defined as an application component, can be reused by multiple applications, and uses HTTP and XML as the base.
- The supported types of services in .NET include ASP.NET Web Services, WCF services, and ASP.NET Web API Services.
- The Microsoft Windows Azure portal defines the access to the components based on your subscription.

1.3 Post-Class Activities for Faculty

You should familiarize yourself with the topics of the next session. You should also explore the Windows Azure Architecture that will be covered in the next session.

Tips: You can also check the Articles/Blogs/Expert Videos uploaded on the OnlineVarsity site to gain additional information related to the topics covered in the next session. You can also connect to online tutors on the OnlineVarsity site to ask queries related to the sessions.

Session 2 – Understanding Windows Azure Architecture

2.1 Pre-Class Activities

Before you commence the session, you should familiarize yourself with the topics of this session in-depth. You should revisit topics of the previous session for a brief review. Here, you can ask students the key topics they can recall from previous session. Prepare a question or two, which will be a key point to relate the current session objectives.

In the previous session, you have learned:

- Cloud computing is an approach that enables convenient and on-demand access through the Internet to compute capabilities and resources.
- Cloud computing platforms provide different kinds of services, depending on the delivery model that they deploy, such as IaaS, PaaS, and SaaS.
- Windows Azure is a cloud computing platform created by Microsoft and is used for building, deploying, and managing services and applications.
- Windows Azure OS works as an integral part of the Azure Services Platform that covers different and separate application, storage, desktop environment, security, and so on. This platform also supports Microsoft standards, programming languages, platforms, and protocols.
- SOA is an architecture used to build or extend modular systems in a flexible and reusable manner.
- A Web service can be defined as an application component, can be reused by multiple applications, and uses HTTP and XML as the base.
- The supported types of services in .NET include ASP.NET Web Services, WCF services, and ASP.NET Web API Services.
- The Microsoft Windows Azure portal defines the access to the components based on your subscription.

2.1.1 Objectives

By the end of this session, the learners will be able to:

- Describe the Windows Azure platform architecture
- Describe the components of the Windows Azure architecture
- Explain the process to create, test, and deploy an Azure cloud service using Visual Studio
- Explain the process to create, test, and deploy a Web application on the cloud

2.1.2 Teaching Skills

To teach this session successfully, you should be aware of the concept of Windows Azure. Also, familiarize yourself with the components of Windows Azure platform architecture, the process to create, test, and deploy an Azure cloud service using Visual Studio and the cloud.

For teaching in the class, you are expected to use slides and LCD projectors.

Tips:

It is recommended that you test the understanding of the students by asking questions in between the class.

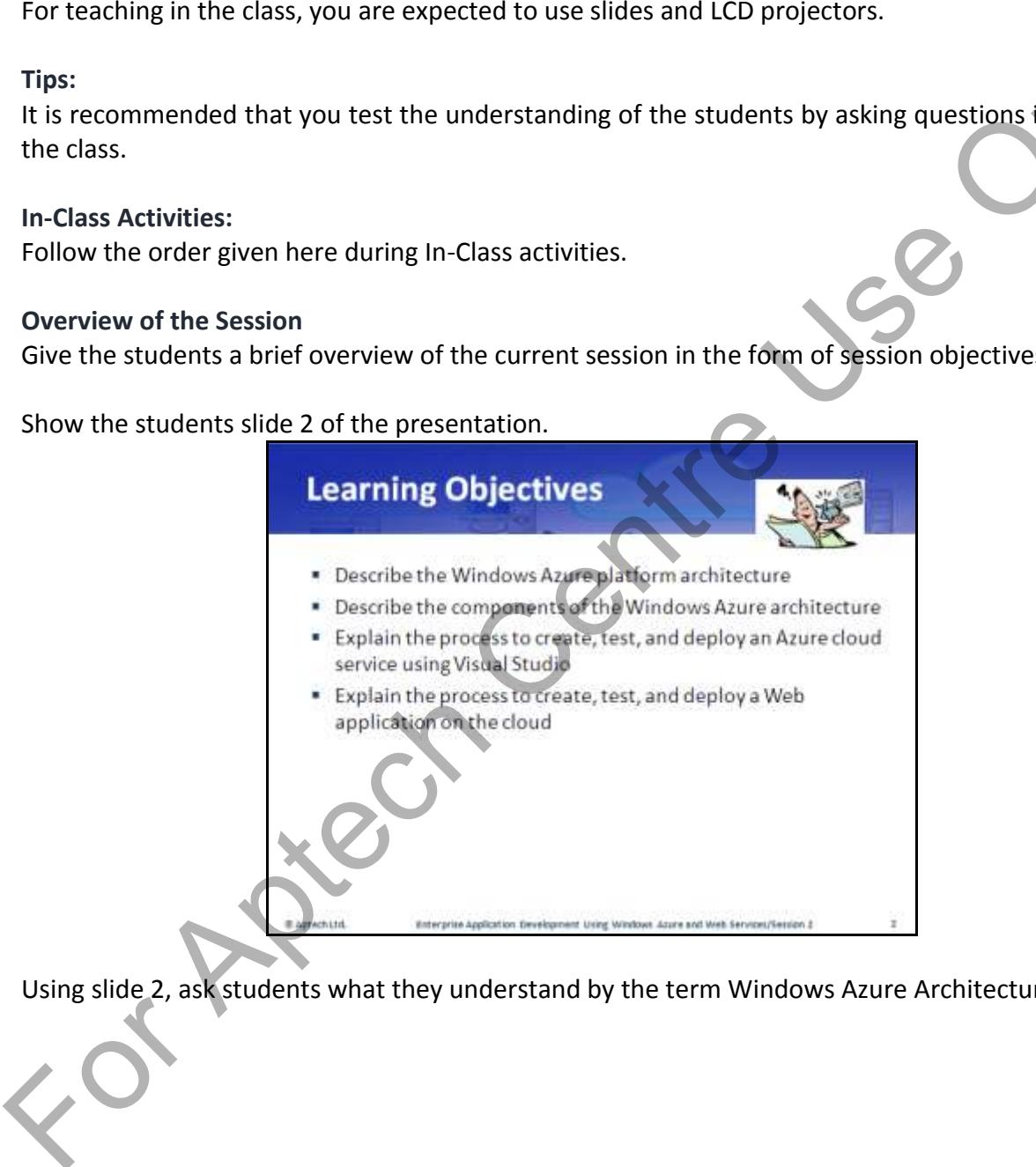
In-Class Activities:

Follow the order given here during In-Class activities.

Overview of the Session

Give the students a brief overview of the current session in the form of session objectives.

Show the students slide 2 of the presentation.



Learning Objectives

- Describe the Windows Azure platform architecture
- Describe the components of the Windows Azure architecture
- Explain the process to create, test, and deploy an Azure cloud service using Visual Studio
- Explain the process to create, test, and deploy a Web application on the cloud

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Using slide 2, ask students what they understand by the term Windows Azure Architecture.

2.2 In-Class Explanations

Slides 3 to 7

Let us understand Windows Azure architecture.

Window Azure Architecture 1-5

- ❑ The Windows Azure Services Platform has Windows Azure as its cloud OS.
- ❑ The OS:
 - Facilitates business and consumer applications to be built, deployed, and hosted in the cloud.
 - Provides a platform to developers to address both business problems as well as customer needs.
 - Allows deployment of Web based applications both in-premise and/or off-premise applications.
 - Utilizes the organization's in-house services and serves as a runtime environment for applications.
 - Includes a mix of application, virtualization service layers, storage, security, and a desktop development environment.
 - Handles the load balancing, caching, redundancy, resource management, and life cycles of hosted services.

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Window Azure Architecture 2-5

- ❑ The following figure shows the Windows Azure PaaS cloud architecture:

The diagram illustrates the Windows Azure PaaS architecture. It starts with a developer workstation on the left, featuring icons for Visual Studio, MySQL, and Java. Arrows point from these tools to a central 'Azure service' box. This box then connects via a cloud icon to a 'Windows Azure Virtual Machine' box, which contains icons for a database and a user interface. Finally, an arrow points from the virtual machine to a user icon at the bottom right, representing the end user.

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Window Azure Architecture 3-5

- ❑ The hosted services of Windows Azure OS can be categorized into one of the following roles:

Web role

- This role instance accepts all incoming HTTP or HTTPS requests. It also supports web applications that are hosted in Internet Information Services (IIS).



Worker role

- This role instance is similar to Web role, but it cannot support Web applications hosted in IIS.



Virtual Machine (VM) role

- This role instance allows creation and running of code in the Windows Azure OS.



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Window Azure Architecture 4-5

- ❑ Applications hosted in the Windows Azure OS:

- Can be of one of the mentioned roles or a combination of these roles.
- Can be used to activate multiple virtual machines with multiple role instances.



- ❑ Windows Azure OS:

- ❑ Simplifies IT management and optimizes the up-front and ongoing expenses.
- Facilitates management of scalable Web applications over the Internet.
- Reduces the need for maintaining onsite resources that are expensive and underutilized.
- Supports Microsoft based standards and protocols and also third-party standards, programming languages, and several other platforms.

For example, HTTP, HTTPS, XML, SOAP, Representational State Transfer (REST), Ruby, PHP, Python, and Eclipse.

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Window Azure Architecture 5-5

- ❑ Windows Azure Services Platform:

- Has Windows Azure as its cloud OS.
- Facilitates business and consumer applications to be built, deployed, and hosted in the cloud.
- Provides a platform to developers to address both business problems as well as customer needs.
- Allows deployment of Web based applications both in-premise and/or off-premise applications.
- Utilizes the organization's in-house services and serves as a runtime environment for applications.
- Includes a mix of application, virtualization service layers, storage, security, and a desktop development environment.
- Handles the load balancing, caching, redundancy, resource management, and life cycles of hosted services.



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Use slide 3 to explain to the students the features of Windows Azure services platform.

Tell them that the Windows Azure services platform has Windows Azure as its cloud OS. The Windows Azure OS helps business and consumer applications to build, deploy, and host in the cloud. Owing to its flexibility, the developers can use the platform to handle both business problems and customer needs. It can be built and deployed for Web based applications both in-premise and/or off-premise applications. Organizations can use Windows Azure to utilize their in-house services and to serve as a runtime environment for applications.

Next, explain that the Windows Azure OS is the central component of the Windows Azure Services Platform. It includes a mix of application, virtualization service layers, storage, security, and a desktop development environment. The developers and customers can run applications and store data in Microsoft datacenters that can be accessible through the Internet.

Also, mention that the core architecture or the infrastructure of the Windows Azure platform contains software, hardware, network, and storage resources. The Windows Azure OS functions handle the load balancing, caching, redundancy, resource management, and life cycles of hosted services. The automated service management feature of the Windows Azure OS helps in maintaining the performances of the applications.

In slide 4, tell that the figure shows the Windows Azure PaaS cloud architecture.

Using slide 5, explain the three roles of the hosted services of the Windows Azure OS. They are:

- Web role
- Worker role
- Virtual Machine (VM) role

Explain that Web role accepts all incoming HTTP or HTTPS requests and supports Web applications that are hosted in Internet Information Services (IIS).

Explain that worker role is similar to Web role. It cannot support Web applications hosted in IIS.

Explain that Virtual Machine (VM) role allows the creation and running of code in the Windows Azure OS.

In slide 6, explain that the applications hosted in the Windows Azure OS can be one of the mentioned roles or a combination of these roles. With multiple role instances, the scalability of an application can be taken care of. Thus when traffic increases, Windows Azure can be used to activate multiple virtual machines with multiple role instances.

Then, explain that Windows Azure simplifies IT management and increases the up-front and ongoing expenses. Since Azure was designed to facilitate management of scalable Web applications over the Internet, you can build, debug, and deploy with minimum expenditure. This helps to reduce the need for maintaining onsite resources that are expensive and underutilized.

In addition, mention that Windows Azure supports Microsoft based standards and protocols, third-party standards, programming languages, protocols, and several other platforms. Some of these include HTTP, HTTPS, XML, SOAP, Representational State Transfer (REST), Ruby, PHP, Python, and Eclipse.

Using slide 7, explain that the Windows Azure services platform has Windows Azure as its cloud OS. The Windows Azure OS helps business and consumer applications to be build, deploy and host in the cloud. It is flexible hence, the developers can use the platform to handle business problems and the customer needs. It can be built and deployed for Web based applications both in-premise and/or off-premise applications. Organizations can use Windows Azure to utilize their in-house services and use it to serve as a runtime environment for applications.

Also, explain that the Windows Azure OS is the central component of the Windows Azure services platform and includes a mix of application, virtualization service layers, storage, security, and a desktop development environment. This enables developers and customers to run applications and store data in Microsoft datacenters that can be accessible through the Internet.

Additional Information:

To know more about Windows Azure architecture, visit the following links:

<http://azure.microsoft.com/en-us/documentation/articles/fundamentals-introduction-to-azure/>

<http://richhewlett.com/category/architecture/cloud-computing/azure/>

<http://blogs.msdn.com/b/brunoterkaly/archive/2012/05/13/essential-windows-azure-microsoft-cloud-knowledge-part-1-web-roles-worker-roles.aspx>

<http://blogs.perficient.com/microsoft/2013/12/windows-azure-web-roles-vs-websites/>

In-Class Question:

After you finish explaining Windows Azure architecture, you will ask students an In-Class question. This will help you in reviewing their understanding of the topic.



What is the purpose of Web role?

Answer:

Web role accepts all incoming HTTP or HTTPS requests and supports Web applications that are hosted in Internet Information Services (IIS).

Slide 8

Let us understand Windows Azure Compute.



Enterprise Application Development Using Windows Azure and Web Services/Version 2

Compute

- ❑ **Compute** is one of the core components of Windows Azure.
- ❑ Windows Azure provides four services under Compute, which are Virtual Machines, Cloud Services, Websites, and Mobile Services:
 - Virtual Machines**
 - Helps to create virtual machines based on the requirements.
 - Performs a number of management tasks.
 - Cloud Services**
 - Helps to configure, manage, and scale the cloud services.
 - Perform tasks, such as creating a cloud services, linking resources to the cloud services, and so on.
 - Websites**
 - Allows hosting a large number of Websites.
 - Allows to version control the source code of these Websites through various version-controlling repositories such as Github.
 - Perform tasks such as configuring session states, and so on.
 - Mobile Services**
 - Allows to create a backend of the mobile apps. The data can be stored on the cloud and fetched on demand.

Using slide 8, explain that Compute is one of the core components of Windows Azure. Tell the students that Windows Azure provides four services under Compute; they are Virtual machines, Cloud services, Web sites, and Mobile services.

Explain that virtual machines services allow to create virtual machines based on your requirements. You can perform a number of management tasks, such as setup applications, such as MySQL, load balance virtual machines and create custom virtual machines.

Explain that with cloud services you can configure, manage, and scale the cloud services. You can also perform tasks, such as creating a cloud services, linking resources to the cloud services, deploying an application, and also scaling the application.

Explain that with Web sites you can host a large number of Web sites. These can be created either by you or through the templates. The source code of these Web sites can be version controlled through various version-controlling repositories such as Github. You can make change in the version-controlling repository and it will automatically reflect the changes in the Web site. You can also perform tasks such as configuring session states, which will allow the Web site to time out after a certain time period.

Explain that mobile services allow to create a backend of your mobile apps. The data can be stored on the cloud and fetched on demand as and when the app users access the app. You will need to create a new mobile service to store the data in it.

Slides 9 to 13

Let us understand Data Services under Windows Azure.

Data Services 1-5

- ❑ Windows Azure provides five main data services:
 - Storage
 - SQL Database
 - Windows Azure Cache
 - HDIosight
 - Recovery Manager

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Data Services 2-5

- ❑ Storage
 - Storage
- ❑ Windows Azure Backup Storage services:
 - Allows the developers to store different kinds of data, such as unstructured, non-relational, and binary data.
 - Uses blobs for storing such data and queues for storing message information for the clients.
- ❑ SQL Database
 - SQL Database
- ❑ Windows Azure Backup Storage services:
 - Allows developers to either use the SQL Database on the cloud or share data between the SQL Database on the cloud and locally installed instances. These databases can then be used by the applications that are developed by the developers.

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Data Services 3-5

- ❑ Windows Azure Cache
 - Windows Azure Cache
- ❑ The Windows Azure Cache uses Azure Redis Cache for providing fast data access in the following ways:
 - Cache Service (Preview)
 - In-Role Cache
 - Shared Cache
 - This service creates and manages a cache only for your business critical data.
 - This dedicated cache can be accessed by a secured and publicly addressable endpoint. You can also use the Windows Azure Management Portal to configure and monitor a cache.
 - This service is used in sync with the role instances of Windows Azure Cloud OS.
 - This uses the one role – one service model for hosting a cache. This implies that a running instance of a role, be it worker role or a combination of roles, and the memory or storage resource combines to form a cache cluster.
 - This is a separate service provided by the Windows Azure Management Portal. It is utilized as a shared service and it resides on a group of servers.
 - It is a paid service depending on the memory and bandwidth of client applications.

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The image shows two slides from a presentation titled "Enterprise Application Development Using Windows Azure and Web Services".

Data Services 4-5

HDInsight

- ❑ The Windows Azure HDInsight Services:
 - Uses Apache Hadoop for drawing analytics from the unstructured data.
 - Allows the developers to build an appropriately sized Hadoop clusters as and when required for analysis of large amounts of unstructured data.
- ❑ The Windows Azure PowerShell Service:
 - Helps HDInsight Service to configure, run, and post-process Hadoop jobs. To enable these jobs, HDInsight Service uses .NET library classes.

hadoop Cluster

Data Services 5-5

Recovery Manager

- ❑ The Windows Azure Services:
 - Allows you to protect data.
 - Ensures that your clouds are protected.
 - Uses services such as Hyper-V Recover Manager to automate the recovery.
 - Provides backup services to automate the backups.

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Using slide 9, explain that Windows Azure provide five main data services. They are Storage, SQL Database, Cache, HDInsight, and Recovery Services. Then tell that these will be explored one by one.

Begin with explaining Storage and SQL Database using slide 10.

Tell them that Windows Azure backup storage services allow the developers to store different kinds of data, such as unstructured, non-relational, and binary data. Developers can use blobs for storing such data. Developers can use queues for storing message information for the clients.

Next, explain SQL Database. Windows Azure SQL Database services allow developers to either use the SQL Database on the cloud or share data between the SQL Database on the cloud and locally installed instances. These databases can be used by the applications that are developed by the developers.

Using slide 11, explain Windows Azure cache. Tell them that Windows Azure cache uses Azure Redis cache that help to provide fast data access. Since the information is readily available, there is low latency requirement, as information need not be searched every time.

Explain that Windows Azure cache can be used in any one of the following ways:

Tell them that cache service (Preview) is a new offering from Windows Azure. It allows to create and manage a cache only for the business critical data. This dedicated cache can be accessed by a secured and publicly addressable endpoint. You can also use the Windows Azure management portal to configure and monitor a cache. You can use the cache service in different scenarios, such as share data between loosely-coupled application, share data between different instances of the same application, in Windows Azure Web sites and in Windows Azure Virtual Machine.

Also, tell that in-Role cache is used with the role instances of Windows Azure cloud OS. This uses the one role – one service model for hosting a cache. This implies that a running instance of a role, be it worker role or a combination of roles, and the memory or storage resource combines to form a cache cluster. This was officially launched as a service in October 2012.

Mention that shared cache is a separate service provided by the Windows Azure Management Portal. You can use it as a shared service and it resides on a group of servers. The shared cache service is a paid service depending on the memory and bandwidth of client applications.

Using slide 12, explain HDInsight. Tell the students that Windows Azure HDInsight Service uses Apache Hadoop for drawing analytics from the unstructured data. This service allows the developers to build Hadoop clusters of an appropriate size when required for analysis large amounts of unstructured data.

Also, tell that Windows Azure PowerShell helps HDInsight Service to configure, run, and post-process Hadoop jobs. To enable these jobs, HDInsight Service uses .NET library classes.

Using slide 13, explain Recovery Manager. Tell the students that Windows Azure services protect data and your clouds. It uses services such as Hyper-V Recover Manager to automate the recovery and provide backup services to automate the backups.

Additional Information:

For more information on the Data Services under Windows Azure, visit the following links:

<http://msdn.microsoft.com/en-us/library/azure/dn578288.aspx>

<http://msdn.microsoft.com/en-us/library/azure/gg278356.aspx>

<http://weblogs.asp.net/scottgu/windows-azure-new-distributed-dedicated-high-performance-cache-service-more-cool-improvements>

In-Class Question:

After you finish explaining data services, you will ask students an In-Class question. This will help you in reviewing their understanding of the topic.



List some of the Data Services available under Windows Azure.

Answer:

Data services include Storage, SQL Database, Cache, HDInsight, and Recovery Services.

Slides 14 to 17

Let us understand network services in Windows Azure.

Networking 1-4

- Datacenters are geographically spread out and they run Windows Azure cloud OS to manage and store applications and data.
 - You can use any datacenter to run your applications or to store your data. These datacenters can be connected in two ways:
 - Windows Azure Virtual Private Network (VPN)
 - Windows Azure Traffic Manager

Networking 2-4

- The following figure shows Cloud VPN and multiple datacenters for data routing:

The diagram illustrates the architecture of Cloud VPN and multiple datacenters. It shows a central 'Traffic Manager' connected to several 'Windows Azure Data Centers'. Each data center is represented by a cluster of green squares. One data center is connected to a 'Virtual Network' containing 'VMs' (represented by blue circles) and an 'On-premises network' (represented by a blue square). The 'Virtual Network' and 'On-premises network' are both connected to the 'Traffic Manager'. From the 'Traffic Manager', multiple lines connect to a group of 'Users' at the bottom, representing how requests are routed from users through the traffic manager to different data centers.

Networking 3-4

Windows Azure Virtual Private Network (VPN)

Windows Azure Virtual Network helps in:

- Extending your network to the Windows Azure environment as part of your on-premises network.
- Interacting with the datacenter as though it is present in your own premises.
- Setting up the VPN between the local machine and the groups of VMs in Windows Azure environment.

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Networking 4-4

Windows Azure Traffic Manager

Windows Azure Traffic Manager:

- Directs the user request automatically to the nearest or another datacenter.
- Instructs the Traffic Manager to perform this task, an application owner needs to define rules of how the user request would be directed to the datacenters.

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Using slide 14, explain network services in Windows Azure. Tell that datacenters are spread across geographically. They run Windows Azure cloud OS to manage and store applications and data. Datacenter can be used to run your applications or to store your data. You can connect these datacenters in two ways: Windows Azure Virtual Private Network (VPN) and Windows Azure Traffic Manager.

Explain that you can use Windows Azure Virtual Private Network (VPN) to connect an on-premises local network to a pre-defined set of Windows Azure VMs.

Explain that Windows Azure Traffic Manager manages applications that run at more than one datacenters in a Windows Azure environment. This helps to route requests from one instance to another.

Using slide 15, tell the students that the figure shows Cloud VPN and multiple datacenters for data routing.

Using slide 16, explain Windows Azure Virtual Network (VPN).

Explain to the students that Windows Azure Virtual Network helps to extend your network to the Windows Azure environment as part of your on-premises network. With the help of virtual network, the applications interact with the datacenter as though it is present in your own premises.

Also, mention that the network administrator can easily setup the VPN between the local machine and the groups of VMs in Windows Azure environment. They appear to be in your network because of the IPv4 address of the cloud VMs. The VMs can be created and removed based on the requirement, and paying only for the usage.

Using slide 17, explain Windows Azure Traffic Manager.

Explain that if an application is utilized by users scattered around the world, then it is ideal that the application should run in various datacenters. In many cases, users use datacenters close to them as it gives optimum response time.

However, if a required application is overloaded or unavailable then, Windows Azure Traffic Manager directs the user request automatically to the nearest or another datacenter. To instruct the Traffic Manager to perform this task, an application owner needs to define rules of how the user request would be directed to the datacenters.

In-Class Question:

After you finish explaining networking services in Windows Azure, you will ask students an In-Class question. This will help you in reviewing their understanding of the topic.



Define Windows Azure Virtual Private Network (VPN).

Answer:

Windows Azure Virtual Private Network (VPN) helps to connect an on-premises local network to a pre-defined set of Windows Azure VMs.

Additional Information:

For more information on the Network Services under Windows Azure, visit the following links:

<http://msdn.microsoft.com/en-us/library/azure/gg433091.aspx>

<http://www.dotnet-tricks.com/Tutorial/windowsazure/3L0D011013-Understanding-Components-of-Windows-Azure.html>

Slides 18 to 23

Let us understand App Services.

App Services 1-6

- ❑ Service Bus Queues:
 - Support messaging services.
 - Use the queue to exchange the messages.

App Services 2-6

- ❑ Steps to create a service namespace are:

- Step 1 • Using your credentials, login to <http://manage.windowsazure.com>
- Step 2 • Click Service Bus, on the left pane of the Management Portal.
- Step 3 • Click Create that is at the lower pane of the Management Portal.
- Step 4 • Enter the name of the namespace, in the Add a new namespace section. The system then checks if the name is available.
- Step 5 • On confirmation, select the country where the namespace needs to be hosted (important to remember it should not be different from the country/region in which your computing resources resides).
- Step 6 • Click the check mark. The system will create your service namespace and will enable it after you click the check mark.

App Services 3-6

- ❑ Steps to retrieve the credentials for the namespace in order to perform the management operations are:

- Step 1 • Click the Service Bus node, which is on the left navigation pane. This will display the list of available namespaces.
- Step 2 • From the populated list, select the namespace that was just created.
- Step 3 • Click Connection Information.
- Step 4 • In the Access connection information dialog box, look for the Default Issuer and Default Key entries and store them for future use.

App Services 4-6

□ Creating a queue:

- You can use the NamespaceManager class to create and manage queues. The NamespaceManager is used for managing the namespace. You can use it to create a queue.
- For example, the following code can be used to create a queue:

```
namespaceManager.CreateQueue("DataCollectionQueue");  
NamespaceManager namespaceManager = new  
NamespaceManager(uri, tokenProvider);
```

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App Services 5-6

□ Sending messages to a queue:

- For an application to send messages, it has to first create a MessagingFactory object. For example, the following code can be used to create the MessagingFactory object:

```
MessagingFactory factory = MessagingFactory.Create(uri,  
tokenProvider);
```

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App Services 6-6

□ Receiving messages from a queue:

- To be able to receive message, an application must use the MessageReceiver object, which is created from MessagingFactory using CreateMessageReceiver.
- For example, the following code can be used to create the MessageReceiver object:

```
MessageReceiver receiver = factory.CreateMessageReceiver  
("DataCollectionQueue");  
BrokeredMessage receivedMessage = receiver.Receive();
```

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Using slide 18, explain to the students that service bus queues support messaging services.

The distributed application that uses a queue does not communicate directly; instead, it uses the queue to exchange the messages. In an asynchronous manner the message producer, which is a sender, sends the message to a queue and continues its processing.

Mention that on the other side, the receiver or the message consumer pulls the message from the queue and gets back to its processing. Tell them that a queue has First In First Out (FIFO) mechanism of delivering the messages. To use the service bus queue of Windows Azure, you need to create a service namespace.

Using slide 19, explain the steps to create a service namespace.

In step 1, tell them that you use your credentials to login to <http://manage.windowsazure.com>.

In step 2, tell that you need to click **Service Bus**, on the left pane of the Management Portal.

In step 3, you click **Create** that is at the lower pane of the Management Portal.

In step 4, tell that you need to enter the name of the namespace, in the **Add a new namespace** section. The system then checks if the name is available.

In step 5, on confirmation, you need to select the country where the namespace needs to be hosted. Ensure that the country should not vary from the country/region in which your computing resources resides.

In step 6, click the check mark. The system creates your service namespace and enables it after you click the check mark.

Using slide 20, explain the steps to retrieve the credentials for management for the namespace in order to perform the management operations such as creating queues, on the new namespace.

In step 1, click the **Service Bus** node, which is on the left navigation pane. This will display the list of available namespaces.

In step 2, tell that from the populated list, select the namespace that was just created.

In step 3, click **Connection Information**.

In step 4, in the **Access connection information** dialog box, look for the Default Issuer and Default Key entries and store them for future use.

Using slide 21, explain creating a queue.

Tell that you can use the `NamespaceManager` class to create and manage queues. The `NamespaceManager` is used for managing the namespace. You can use it to create a queue.

Show the code snippet that displays how the code can be used to create a queue.

Using slide 22, explain sending messages to a queue.

Mention that for an application to send messages, it has to first create a `MessagingFactory` object.

Show the code snippet that displays how the code can be used to create the `MessagingFactory` object.

Using slide 23, tell the students receiving messages from a queue.

Mention that to be able to receive message, an application must use the `MessageReceiver` object, which is created from `MessagingFactory` using `CreateMessageReceiver`.

Show the code snippet that displays how the code can be used to create the `MessageReceiver` object.

Slides 24 to 26

Let us understand Windows Azure and commerce.

The image shows two slides from a presentation titled "Commerce 1-3" and "Commerce 2-3".

Commerce 1-3:

- ❑ With the onset of Software as a Service (SaaS):
 - Creation and usage of cloud applications have become commercial.
 - Usage of cloud applications and the associated payments are made online.
- ❑ Windows Azure:
 - Allows potential customers to search and buy Windows Azure applications and commercial datasets deployed in the cloud.
 - The service providers for such commercial exchange include Windows Azure Marketplace and Windows Azure Store.

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Commerce 2-3:

- ❑ The following figure shows the transaction Windows Azure Marketplace and other components:

A diagram showing the Microsoft Azure Marketplace interface on the left, which is described as a "One-Stop Shop for Premium Data and Applications". An arrow points from the Marketplace to a box on the right labeled "Applications" and "Data sets".

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Commerce 3-3

❑ There exists differences between Windows Azure Marketplace and Windows Azure Store:

- The former is located out of the Windows Azure Management Portal and the latter is accessible within the Windows Azure Management Portal.
- Customers can search for their required applications or datasets and then sign up to use them through the application's creator or directly either through the Marketplace or Store.
- The Bing Search Application Programming Interface (API) can also be used to search for applications through the Marketplace.



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Using slide 24, explain that Software as a Service (SaaS) allows creation and usage of cloud applications. Since these applications are developed and deployed in a cloud OS such as Windows Azure, their usage, and the associated payments are made online.

Mention that Windows Azure allows the potential customers to search and buy the Windows Azure applications and commercial datasets deployed in the cloud. The service providers for such commercial exchange include Windows Azure marketplace and Windows Azure store.

In slide 25, mention that the figure shows the transaction Windows Azure Marketplace and other components.

Using slide 26, explain to the students that there is a difference between Windows Azure Marketplace and Windows Azure Store. The former is located out of the Windows Azure Management Portal and the latter is accessible within the Windows Azure Management Portal.

Mention that the customers can search for their required applications or datasets and then sign up to use them through the application's creator or directly either through the Marketplace or Store. The Bing Search Application Programming Interface (API) can also be used to search for applications through the Marketplace.

Slide 27

Let us understand creating an Azure cloud service using Visual Studio (VS).

Creating a Azure Cloud Service

- A cloud service must be created before it can be published in Windows Azure.
- There are two methods to create a service:
 - Using the Windows Azure Management Portal
 - OR
 - Using Visual Studio

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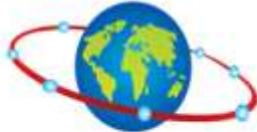
Using slide 27, explain to the students that a cloud service must be created before it can be published in Windows Azure. There are two methods to create a service. The first method is to use the Windows Azure Management Portal and second is to use Visual Studio.

Slides 28 to 31

Let us understand creating a simple Azure Cloud Service using VS 2013.

Creating a Azure Cloud Service Using VS 2013 1-4

- Steps to create an Azure cloud service using Visual Studio are:
 1. Create an Account
 2. Create a Cloud Service



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Creating a Azure Cloud Service Using VS 2013 2-4

1. Create an Account

Connect to <http://www.windowsazure.com/> and create an account, if you do not have one.
– If you already have an account, access it by clicking the Portal button.
Windows Azure also provides a free trial as shown in the following figure:



Creating a Azure Cloud Service Using VS 2013 3-4

2. Create a Cloud Service

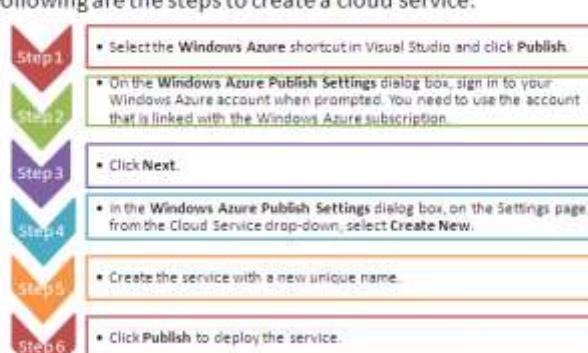
Before deploying a cloud application for Windows Azure, you must create two files:



Both these files are specific to the application that you create. You can use the Azure Tools to create these deployment packages and configuration files.

Creating a Azure Cloud Service Using VS 2013 4-4

Following are the steps to create a cloud service:



Using slide 28, explain the steps to create an Azure cloud service using Visual Studio is an easy process that includes create an account and create a cloud service.

Using slide 29, explain about creating an account.

Explain that you need to connect to <http://www.windowsazure.com/> and create an account, if you do not have one. If you already have an account, access it by clicking the **Portal** button. Windows Azure also provides a free trial for three months for which you do not need to create a paid account.

Using slide 30, explain create a cloud service Azure involves two files: cloud service package (.cspkg) and cloud service configuration file (.cscfg).

Explain that before deploying a cloud application for Windows Azure, you must create two files such as cloud service package (.cspkg) that is created from the application code.

Also, explain that cloud service configuration file (.cscfg) is the configuration file that is specific to the package.

Mention that it is important to note that both these files are specific to the application that you create. You can use the Azure Tools to create these deployment packages and configuration files.

Using slide 31, explain the steps to create a cloud service.

In step 1, select the Windows Azure shortcut in Visual Studio and click **Publish**.

In step 2, on the **Windows Azure Publish Settings** dialog box, sign in to your Windows Azure account when prompted. You need to use the account that is linked with the Windows Azure subscription.

In step 3, you need to click **Next**.

In step 4, tell that on the Windows Azure Publish Settings dialog box, on the Settings page, from the **CloudService** drop-down, select **Create New**. The **Create Azure Services** dialog box appears.

In step 5, create the service with a new unique name.

In step 6, click **Publish** to deploy the service.

Slides 32 to 39

Let us understand deploying the cloud service on compute emulator.

Deploying the Cloud Service on Compute Emulator 1-8

- The Windows Azure Software Development Kit (SDK) tool:
 - Includes a Windows Azure Compute Emulator.
 - Helps you to build and test your applications before deploying it.
 - Help you to test the basic functionalities of your services, such as configuration, roles, its instances, and its user interface status.



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Deploying the Cloud Service on Compute Emulator 2-8

Step 1: Install Prerequisites for Windows Azure Compute Emulator and the Windows Azure Storage Emulator.

- The table displays the minimum requirements for installing Windows Azure Compute Emulator:

Component	Minimum Requirement
Operating System	64-bit versions of Windows 8, Windows 7, Windows Vista SP1, or Windows Server 2008. If you intend to use 32-bit version of the SDK, then you will need 32-bit version of the mentioned operating systems.
Framework	Microsoft .NET Framework 3.5 SP1 or higher.
Database	Microsoft SQL Server Express 2005, SQL Server 2008 R2 Express or higher.
Web Server	IIS 7.0 with ASP.NET.

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Deploying the Cloud Service on Compute Emulator 3-8

Step 2: Configure operating system features to emulate Windows Azure

- By default, Windows Server 2008 and IIS 7.0 do not install all services.
- For example, Windows Azure requires IIS 7.0 with ASP.NET enabled. By default, this service is not installed in Windows Server 2008.
- You need to ensure all services that you require in cloud are enabled and configured in the same way in Compute Emulator.

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The image displays three vertically stacked slides from a presentation, each with a blue header and a light blue footer bar containing navigation links. A large, diagonal watermark reading "For Ap tech Limited Only" is overlaid across all three slides.

Slide 1: Deploying the Cloud Service on Compute Emulator 4-8

Step 3: Trace the execution flow of application

- ❑ After you execute the application, you can monitor the application using the following three classes:
 - System.Diagnostics.Trace
 - System.Diagnostics.Debug
 - System.Diagnostics.TraceSource
- ❑ You can use these classes to record the execution data, which can be stored in the logs and text file.

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Slide 2: Deploying the Cloud Service on Compute Emulator 5-8

Step 4: Package and run the application.

- ❑ After you create the application and test its execution, you need to package the application to run in Compute Emulator.
- ❑ You can use **CSPack**, which is a command-line tool for packaging the applications.
- ❑ After the application is successfully packaged, you can run the **CSRun** command-line tool to run the application.

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Slide 3: Deploying the Cloud Service on Compute Emulator 6-8

Step 5: Change the configuration of a running application.

- ❑ You can add more instances of a role to the application without shutting down the running application.
- ❑ To achieve this goal, you will need to use an editor, such as Visual Studio, to modify the configuration file and then, update the application using the **CSRun** command-line tool.

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Deploying the Cloud Service on Compute Emulator 7-8

Step 6: Determine Compute Emulator limits

The following table lists the limitations of Compute Emulator:

Component	Minimum	Maximum
Roles	1	25
Core	1	20
Input Endpoints	1	25
Internal Endpoints	1	25

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Deploying the Cloud Service on Compute Emulator 8-8

Step 7: Configure Internet Protocol (IP) addresses and port allocation.

- Each Web role is assigned a different IP address.
- The range of IP address starts from 127.0.0.1 and then incremented by one.
- For example, the first Web role will be assigned 127.0.0.1 and then second Web role will be 127.0.0.2.
- If both the Web roles are assigned the same port, then the same port is suffixed after the IP address.
- For example, the first Web role will be used as 127.0.0.1:8181, here, 8181 being the port.
- You can also configure a range for the port numbers.

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Using slide 32, explain that the Windows Azure Software Development Kit (SDK) tool includes a Windows Azure compute emulator. This is a local emulator of Windows Azure and helps to build and test your applications before deploying it.

Mention that the Windows Azure compute emulator and the Windows storage emulator, together help to test the basic functionalities of your services, such as configuration, roles, its instances, and its user interface status.

Using slide 33, explain the steps to test the functionalities, your local system needs to have some minimum requirements to run the compute and storage emulators.

In step 1, you need to install Prerequisites for Windows Azure compute emulator and the Windows Azure storage emulator.

Tell the students that the table displays the minimum requirements for installing Windows Azure compute emulator.

Using slide 34, explain the next step. In step 2, configure operating system features to emulate Windows Azure. Explain that by default, Windows Server 2008 and IIS 7.0 do not install all services. For example, Windows Azure requires IIS 7.0 with ASP.NET enabled. By default, this service is not installed in Windows Server 2008. You need to ensure all services that you require in cloud are enabled and configured in the same way in compute emulator.

Using slide 35, explain the next step. In step 3, trace the execution flow of the application.

Tell that after you execute the application, you can monitor the application using three classes that include `System.Diagnostics.Trace`, `System.Diagnostics.Debug`, and `System.Diagnostics.TraceSource`.

Mention that these classes can be used to record the execution data, which can be stored in the logs and text file.

Using slide 36, explain the next step. In step 4, package and run the application.

Mention that after you create the application and test its execution, you need to package the application to run in compute emulator. You can use `CSPack`, which is a command-line tool for packaging the applications. After the application is successfully packaged, you can run the `CSR` uncommand-line tool to run the application.

Using slide 37, explain the next step. In step 5, change the configuration of a running application.

Mention that you can add more instances of a role to the application without shutting down the running application. To achieve this goal, you will need to use an editor, such as Visual Studio, to modify the configuration file and then, update the application using the `CSRun` command-line tool.

Using slide 38, explain the next step. In step 6, compute Emulator limits.

Tell them that the table lists the limitations of compute emulator. Using slide 39, explain the next step. In step 7, configure Internet Protocol (IP) addresses and port allocation.

Mention that each Web role is assigned a different IP address. The range of IP address starts from 127.0.0.1 and then incremented by one. For example, the first Web role will be assigned 127.0.0.1 and then second Web role will be 127.0.0.2. If both the Web roles are assigned the same port, then the same port is suffixed after the IP address. For example, the first Web role will be used as 127.0.0.1: 8181, here, 8181 being the port.

Also, tell that you can also configure a range for the port numbers. When one port number is in use, compute emulator will use the second port. However, it will issue a warning about the port being in use.

Slides 40 to 46

Let us understand deploying the cloud service on Windows Azure.

Deploying the Cloud Service on Windows Azure 1-7

- ❑ Deploying a cloud service on Windows Azure comprises the following processes:
 1. Use the development and deployment tools to create an application service provided by the Windows Azure SDK.
 2. Perform the testing and debugging of the application using Windows Azure compute and storage emulators.
- ❑ To package the application for deployment, use the **CSPack Command-Line Tool**.

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Deploying the Cloud Service on Windows Azure 2-7

- ❑ The following figure gives an overall picture of development and deployment stages:

The diagram shows the flow from local development to deployment. It starts with two separate 'Development Fabric' boxes containing 'Roles'. Arrows point from these to a central 'Windows Azure Storage Services' box. From there, an arrow points to a 'Deployment Fabric' box containing a 'Role'. This leads to the final stage: 'Deploy Using the Portal'.

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Deploying the Cloud Service on Windows Azure 3-7

- ❑ Following are the development and deployment stages:

- Step 1 Test your service locally with the Windows Azure compute and storage emulators
- Step 2 Debug your service in mixed mode
- Step 3 Package your service with CSPack
- Step 4 Deploy your service using the Management Portal

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Deploying the Cloud Service on Windows Azure 4-7

Test your service locally with the Windows Azure compute and storage emulators



- Using the Windows Azure compute and storage emulators, you can:
 - Test your application locally because the Windows Azure Compute Emulator simulates the Windows Azure fabric.
 - Check the accuracy of the code locally.
 - Simulates the Windows Azure storage services.
 - Helps you to run and debug code from the storage services.

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Deploying the Cloud Service on Windows Azure 5-7

Debug your service in mixed mode



- In the production environment of Windows Azure services:
 - Run in mixed mode,
 - Execute in the compute emulator while the data is hosted in Windows Azure.
 - Test in the staging environment.
 - Debug and deploy in Windows Azure.

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Deploying the Cloud Service on Windows Azure 6-7

Package your service with CSPack



- During this stage:
 - Use the CSPack Command-Line Tool to package your service.
 - Use the **cspack.exe** utility file to upload the packaged service to Windows Azure.
 - Upload the packaged service to the Windows Management Portal and name as <service-name>.cspkg by default.

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Deploying the Cloud Service on Windows Azure 7-7

Deploy your service using the Management Portal

In this last stage:

- Use the Windows Azure Management Portal to create a cloud service deployable in Windows Azure.
- Upload the following two files, namely, the service package file and the service configuration file. On uploading these files, an internal staging URL will be provided. This URL helps you to test your service in private in the Windows Azure staging environment.
- Finally, when your services are ready, change the service from the staging URL to the production URL.

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Using slide 40, explain deploying a cloud service on Windows Azure comprises the following processes. First, use the development and deployment tools to create an application service provided by the Windows Azure SDK. Then, perform the testing and debugging of the application using Windows Azure compute and storage emulators.

Next, to package the application for deployment, use the CSPack Command-Line Tool. Now that your application is ready to be deployed to Windows Azure, you can see the stages in detail.

Using slide 41, tell that the figure shows an overall picture of development and deployment stages.

Using slide 42, explain the stages of development and deployment.

In step 1, test your service locally with the Windows Azure compute and storage emulators.

In step 2, debug your service in mixed mode.

In Step 3, package your service with CSPack.

In step 4, deploy your service using the Management Portal.

Using slide 43, explain you can test your service locally with the Windows Azure compute and storage emulators.

Explain that using the Windows Azure compute and storage emulators, you can test your application locally. This is made possible because the Windows Azure compute emulator simulates the Windows Azure fabric. Therefore, instead of running and testing your services in Windows Azure, you can do the same job locally. This way, you can check the accuracy of the code locally. The storage emulator, on the other hand, simulates the Windows Azure storage services. This helps to run and debug code from the storage services.

Using slide 44, explain debug your service in mixed mode.

Explain that in the production environment of Windows Azure, services run in mixed mode. In a mixed mode, services are executed in the compute emulator while the data is hosted in Windows Azure. After local testing is completed in the mixed mode, services are tested in the staging environment. Once debugged, services are ready to be deployed in Windows Azure.

Using slide 45, explain package your service with CSPack.

Explain that during this stage, use the CSPack Command-Line Tool to package your service. You also need to use the cspack.exe utility file to upload the packaged service to Windows Azure. The packaged service is uploaded to the Windows Management Portal and is named as <service-name>.cspkg by default.

Using slide 46, explain deploy your service using the management portal.

Explain that in this last stage; use the Windows Azure management portal to create a cloud service deployable in Windows Azure.

You also need to upload the following two files, namely, the service package file and the service configuration file.

Mention that on uploading these files, an internal staging URL will be provided. This URL helps to test your service in private in the Windows Azure staging environment. Finally, when your services are ready, change the service from the staging URL to the production URL.

Slides 47 to 49

Let us understand testing the cloud service.

Testing the Cloud Service 1-3

Using Visual Studio, you can:

- Perform a number of tests on a cloud service.
- Gather performance reports on Web pages, services, roles, and memory usage.
- Perform the performance testing with the help of Visual Studio Profiler, which is installed by default with Visual Studio Ultimate or Visual Studio Premium.

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The image shows two slides from a presentation. The top slide is titled 'Testing the Cloud Service 2-3' and contains a list of steps to configure Visual Studio Profiler. The bottom slide is titled 'Testing the Cloud Service 3-3' and contains steps to view profiling reports.

Testing the Cloud Service 2-3

- ❑ To configure Visual Studio Profiler, use the following steps to execute performance testing:

- Step 1 • Publish your project.
- Step 2 • A dialog box is displayed. Ensure that you select **Enabling profiling**. The **Settings** link is now enabled.
- Step 3 • Click **Settings**. The **Profiling Settings** dialog box is displayed.
- Step 4 • Select one of the profiling methods, such as **CPU Sampling** (recommended).
- Step 5 • Select **Enable Tier Interaction Profiling**.
- Step 6 • Click **OK** to save the settings.

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Testing the Cloud Service 3-3

- ❑ To view the profiling reports, perform the following steps:

1. In Visual Studio, open Server Explorer.
2. Under Windows Azure Compute, right-click the server node and select **ViewProfilingReport**.

The profiling report appears in a new tab in the editor window. The tab is named as <Role name>_<Instance Number>_<Identifier>.vsp.

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Using slide 47, explain using Visual Studio, you can perform a number of tests on a cloud service. You can gather performance reports on Web pages, services, roles, and memory usage. You can perform the performance testing with the help of Visual Studio Profiler, which is installed by default with Visual Studio Ultimate or Visual Studio Premium.

Using slide 48, explain the steps to configure Visual Studio Profiler.

In step 1, publish your project.

In step 2, a dialog box is displayed. Ensure that you select **Enabling profiling**. The **Settings** link is now enabled.

In step 3, click **Settings**. The **Profiling Settings** dialog box is displayed.

In step 4, select one of the profiling methods, such as **CPU Sampling** (recommended).

In step 5, select **Enable Tier Interaction Profiling**.

In step 6, click **OK** to save the settings.

Using slide 49, explain after you have enabled profiling, you can view the profiling reports.

To view the profiling reports, perform the following steps:

In step 1, in Visual Studio, open Server Explorer.

In step 2, under **Windows Azure Compute**, right-click the server node and select **View Profiling Report**.

Mention that the profiling report appears in a new tab in the editor window. The tab is named as <Role name>_<Instance Number>_<identifier>.vsp.

Slide 50

Let us understand creating and deploying a Web application to Windows Azure.

Creating and Deploying a Web Application to Windows Azure

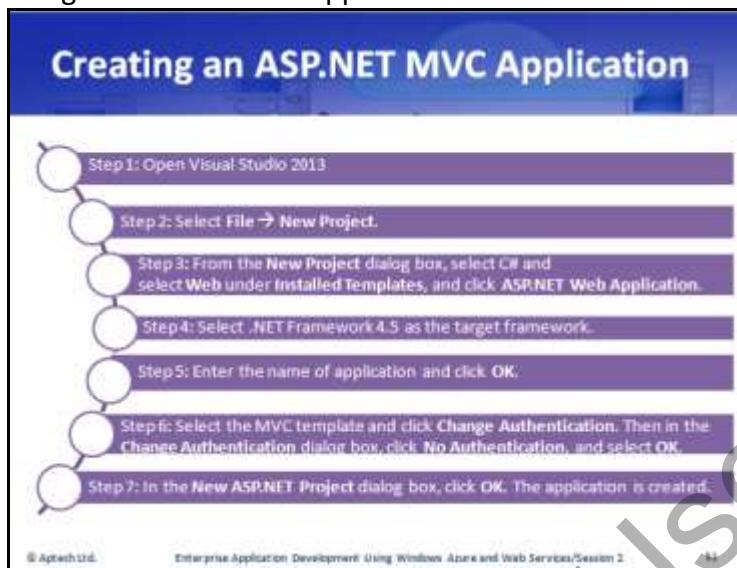
- ❑ With the Windows Azure SDK, it is easy for the Web developers to:
 - Create and deploy Web applications and deploy them to Windows Azure.
- ❑ The developer must download and install Windows Azure SDK for .NET.

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Using slide 50, explain that with the Windows Azure SDK, it is easy for the Web developers to create and deploy Web application and deploy them to Windows Azure. The developer must download and install Windows Azure SDK for .NET.

Slide 51

Let us understand creating an ASP.NET MVC application.



Using slide 51, explain before you begin to create an ASP.NET application, you need to ensure that Windows Azure SDK is already installed. If it is not done, then first download and install the SDK before proceeding further.

Explain the steps to create an ASP.NET MVC application.

In step 1, open Visual Studio 2013.

In step 2, select **File → New Project**.

In step 3, from the **New Project** dialog box, select **C#** and select **Web** under **Installed Templates**, and click **ASP.NET Web Application**.

In step 4, select **.NET Framework 4.5** as the target framework.

In step 5, enter the name of application and click **OK**.

In step 6, from the **New ASP.NET Project** dialog box, select the **MVC** template and click **Change Authentication**. Then in the **Change Authentication** dialog box, click **No Authentication**, and select **OK**.

In step 7, in the **New ASP.NET Project** dialog box, click **OK**. The application is created.

In step 8, press **Ctrl+F5** to run the application locally.

Slides 52 and 53

Let us understand deploying the Web application on compute emulator.

Deploying the Web Application on Compute Emulator 1-2

- Steps to deploy an application in Windows Azure Compute Emulator are:

- Step 1
 - Once the application is set to run by pressing Ctrl + F5, VS 2013 packages and deploys the application to the Windows Azure Emulator and later, a csx directory is created. Right-click the emulator icon to view and select the option show compute emulator UI.
- Step 2
 - In the Compute Emulator, the application is installed and runs at 127.0.0.1:81. Once the Visual Studio debugger is closed, the application stops running in Windows Azure Compute Emulator.
- Step 3
 - Now, a cts directory is created and the user can start the application (Website) without using Visual Studio. This leads to the Windows Azure Command Prompt.
- Step 4
 - Get the directory listings and from the list, select csx and also, a file with local.cscfg extension. This contains information needed to start the application in the Emulator.

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Deploying the Web Application on Compute Emulator 2-2

- Step 5
 - In the console, execute csm with the two parameters. The command to be given is: csm csx\debug Service Configuration\local.cscfg.
- Step 6
 - This will install the application into Window Azure Compute Emulator. The result of the command identifies that the Website will be running at: 127.0.0.1:81.
- Step 7
 - Now in the browser, navigate to 127.0.0.1:81 and the browser will display the page.

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Using slide 52, explain the steps to deploy an application in Windows Azure Compute Emulator.

In step 1, once the application is set to run by pressing the keys Ctrl+F5, Visual Studio will package and deploy the application to the Windows Azure Emulator and later, a csx directory is created. Right-click the emulator icon to view and select the option show compute emulator UI.

In step 2, in the Compute Emulator, the application will be installed and will run at the location 127.0.0.1:81. Once the Visual Studio debugger is closed, the application stops running in Windows Azure Compute Emulator.

In step 3, now, a cts directory is created and the user can start the application (Web site) without using Visual Studio. This leads to the Windows Azure Command Prompt.

In step 4, get the directory listings and from the list, select `csx` and also, a file with `local.cscfg` extension. This contains information needed to start the application in the Emulator.

Using slide 53, explain Step 5: In the console, execute `csrun` with the two parameters. The command to be given is: `csrun csx\debug ServiceConfiguration.local.cscfg`

In step 6, this will install the application into Windows Azure Compute Emulator. The result of the command identifies that the Web site will be running at `127.0.0.1:81`.

In step 7, now in the browser, navigate to `127.0.0.1:81` and the browser will display the page.

Slides 54 to 56

Let us understand deploying the Web application on Windows Azure.

Deploying the Web Application on Windows Azure 1-3

□ Steps to deploy an application on Windows Azure are:

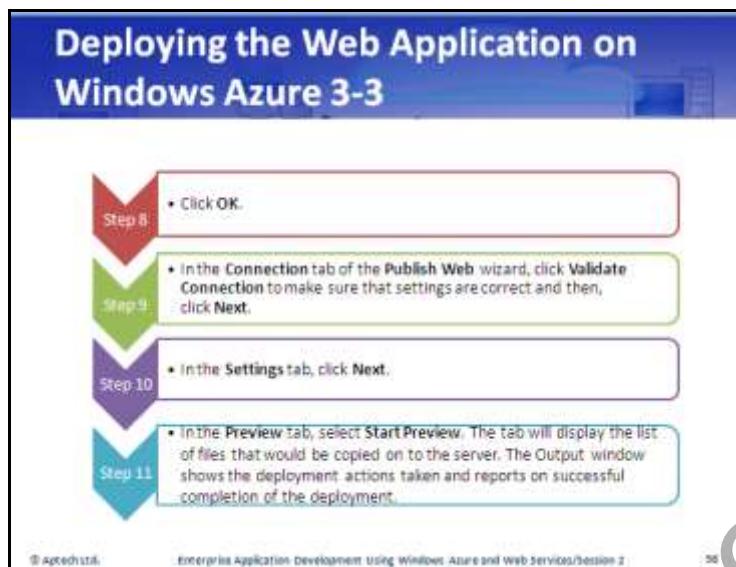
- Step 1
 - Close the browser. In Visual Studio Solution Explorer, right-click the project, and then, select Publish.
- Step 2
 - The Publish Web wizard opens, select the profile, and click Import.
- Step 3
 - Use any one of these methods to enable Visual Studio to connect to Windows Azure account:
 - Click Sign In and enter the credentials for Windows Azure account.
 - Select Manage subscriptions to install a management certificate that enables access to your account.
 - The Import Publish Settings dialog box appears.

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Deploying the Web Application on Windows Azure 2-3

- Step 4
 - Select Import from a Windows Azure Web Site radio button and select New.
- Step 5
 - In the Create a site on Windows Azure dialog box, enter text in the Site name box that is used as the unique URL for the Web application.
- Step 6
 - In the Location drop-down list, choose the location that is closest to the user.
- Step 7
 - Leave the database fields unchanged and then, click Create.
 - The Website is created. In the Import Publish Settings dialog box, the new site appears and is selected in the drop-down list.

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Using slide 54, explain the steps to deploy a Web application on Windows Azure.

In step 1, close the browser. In Visual Studio Solution Explorer, right-click the project, and then, select **Publish**.

In step 2, the **Publish Web** wizard opens, select profile and click **Import**.

In step 3, use any one of these methods to enable Visual Studio to connect to Windows Azure account: click **Sign In** and enter the credentials for Windows Azure account and select **Manage subscriptions** to install a management certificate that enables access to your account.

Using slide 55, explain the remaining steps.

In step 4, select **Import from a Windows Azure Web Site** radio button and select **New**.

In step 5, in the **Create a site** on Windows Azure dialog box, enter text in the **Site** name box that is used as the unique URL for the Web application.

In step 6, in the **Location** drop-down list, choose the location that is closest to the user.

In step 7, leave the database fields unchanged and then, click **Create**.

The Web site is created. In the **Import Publish Settings** dialog box, the new site appears and is selected in the drop-down list.

In step 8, click **OK**.

Using slide 56, explain the remaining steps.

In step 9, in the **Connection** tab of the **Publish Web** wizard, click **Validate Connection** to make sure that settings are correct and then, click **Next**.

In step 10, in the **Settings** tab, click **Next**.

In step 11, in the Preview tab, select **Start Preview**. The tab will display the list of files that would be copied on to the server. The Output window shows the deployment actions taken and reports on successful completion of the deployment. Upon successful deployment, the default browser automatically opens to the URL of the deployed Web site.

Slides 57 and 58

Let us summarize the session.

Summary 1-2

- The Windows Azure OS is the central component of the Windows Azure Services Platform.
- Windows Azure OS functions handle load balancing, caching, redundancy, resource management, and life cycles of hosted services.
- Windows Azure provides four core services, namely Virtual Machines, Cloud Services, Websites, and Mobile Services.
- Windows Azure provides three main data services, namely, Cache, HDInsight, and Recovery Services.
- Datacenters are geographically spread out and they run Windows Azure cloud OS to manage and store applications and data.

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Summary 2-2

- Windows Azure Marketplace allows potential customers to search and buy the Windows Azure applications and commercial data sets deployed in the cloud.
- A cloud service must be created before it can be published in Windows Azure.
- Windows Azure Compute Emulator and Windows Storage Emulator, together help you to test basic functionalities of your services, such as configuration, roles, its instances, and its user interface status.
- Using Visual Studio, you can perform a number of tests on a cloud service.

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Using slides 57 and 58, you will summarize the session. You will end the session, with a brief summary of what has been taught in the session.

Tell the students pointers of the session. This will be a revision of the current session and it will be related to the next session. Explain each of the following points in brief. Tell them that:

- The Windows Azure OS is the central component of the Windows Azure Services Platform.
- Windows Azure OS functions handle the load balancing, caching, redundancy, resource management, and life cycles of hosted services.

- Windows Azure provides four core services, namely, Virtual Machines, Cloud Services, Web sites, and Mobile Services.
- Windows Azure provides five data services, namely, Storage, SQL Database, Cache, HDInsight, and Recovery Services.
- Datacenters are geographically spread out and they run Windows Azure cloud OS to manage and store applications and data.
- Windows Azure allows the potential customers to search and buy the Windows Azure applications and commercial datasets deployed in the cloud.
- A cloud service must be created before it can be published in Windows Azure.
- The Windows Azure Compute Emulator and the Windows Storage Emulator, together help to test the basic functionalities of your services, such as configuration, roles, its instances, and its user interface status.
- Using Visual Studio, you can perform a number of tests on a cloud service.

2.3 Post Class Activities for Faculty

You should familiarize yourself with the topics of the next session.

Tips: You can also check the Articles/Blogs/Expert Videos uploaded on the OnlineVarsity site to gain additional information related to the topics covered in the next session. You can also connect to online tutors on the OnlineVarsity site to ask queries related to the sessions.

Session 3 – ASP.NET Web API Services

3.1 Pre-Class Activities

Before you commence the session, you should familiarize yourself with the topics of this session in-depth. You should revisit topics of the previous session for a brief review. Here, you can ask students the key topics they can recall from previous session. Prepare a question or two, which will be a key point to relate the current session objectives.

In the previous session, you have learned:

- The Windows Azure OS is the central component of the Windows Azure Services Platform.
- Windows Azure OS functions handle the load balancing, caching, redundancy, resource management, and life cycles of hosted services.
- Windows Azure provides four core services, namely, Virtual Machines, CLOUD services, Web sites, and mobile services.
- Windows Azure provides five main data services, namely, Storage, SQL Database, Cache, HDInsight, and Recovery Services.
- Datacenters are geographically spread out and they run Windows Azure cloud OS to manage and store applications and data.
- Windows Azure allows the potential customers to search and buy the Windows Azure applications and commercial datasets deployed in the cloud.
- A cloud service must be created before it can be published in Windows Azure.
- The Windows Azure compute emulator and the Windows storage emulator, together help to test the basic functionalities of your services, such as configuration, roles, its instances, and its user interface status.
- Using Visual Studio, you can perform a number of tests on a cloud service.

3.1.1 Objectives

By the end of this session, the learners will be able to:

- Define and describe ASP.NET Web API
- Define and describe HTTP, REST, and media types
- Explain how to implement a ASP.NET Web API service
- Explain how to secure a ASP.NET Web API service

3.1.2 Teaching Skills

To teach this session successfully, you should be aware of ASP.NET Web API and its features. Also, familiarize yourself with HTTP, REST, and media types, the process to implement an ASP.NET Web API service and the process to secure an ASP.NET Web API service.

For teaching in the class, you are expected to use slides and LCD projectors.

Tips:

It is recommended that you test the understanding of the students by asking questions in between the class.

In-Class Activities:

Follow the order given here during In-Class activities.

Overview of the Session

Give the students a brief overview of the current session in the form of session objectives. Show the students slide 2 of the presentation.

Learning Objectives



- Define and describe ASP.NET Web API
- Define and describe HTTP, REST, and Media Types
- Explain how to implement a ASP.NET Web API Service
- Explain how to secure a ASP.NET Web API Service

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3.2 In-Class Explanations

Slide 3

Let us understand ASP.NET Web API.

Introduction

ASP.NET Web API is a technology that allows you to create Web services that target diverse clients.

- ❑ ASP.NET Web API helps in handling client requests and sending back responses using content type, such as JavaScript Object Notation (JSON) or XML.



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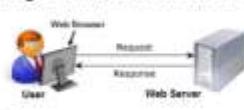
Use slide 3 to explain that with the increase in the usage of smartphones and other similar devices to access services over the Web, a technology that simplifies providing services to a variety of clients is required. ASP.NET Web API is one such technology provided by Microsoft that allows to create Web services that target diverse clients.

Mention that using ASP.NET Web API, you can handle client requests and send back responses using content type, such as JavaScript Object Notation (JSON) or XML.

Slides 4 to 9

Let us understand evolution of ASP.NET Web API.

Evolution of ASP.NET Web API 1-6

- ❑ ASP.NET Web API is the result of:
 - The gradual evolution of traditional Web services.
- ❑ Both Web services and Web Applications:
 - Receive, process, and return appropriate responses.
- ❑ Web Applications:
 - A request/response interchange comprises a user communicating with the application through a client, such as a Web browser.
- ❑ Web Services:
 - A request/response interchange involves applications.

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Evolution of ASP.NET Web API 2-6

Consider an example:

- An application provides payment information after a user checks out from an online shopping store application.
- It accesses a Web service that a payment gateway service provider utilizes to process the payment.



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Evolution of ASP.NET Web API 3-6

- To communicate with the payment gateway service provider, the shopping application and the provider both need to follow certain standards.
- These standards are also known as Web services standards.
- They include SOAP, Web Services Definition Language (WSDL), and Web Service Specifications (WS-*) that introduces formal service contracts.

SOAP WSDL
WS-*
UDDI

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Evolution of ASP.NET Web API 4-6

- In traditional Web services, a service provider uses WSDL to publish how the service can be consumed.
- A WSDL document:
 - Describes the service endpoint where the service can be accessed.
 - Describes the service methods that consumers can call to avail the service.
 - Is published to a Universal Description, Discovery, and Integration (UDDI) registry.
- UDDI registry:
 - Can both be public or private to an organization.
 - Is a repository for publishing WSDL documents.
 - Is used by service consumers to access published WSDL documents in order to access a Web service.



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Evolution of ASP.NET Web API 5-6

Following figure shows the communication flow in a Web service:

```
graph TD; Registry[UDDI Registry] -- WSDL --> Consumer[Service Consumer]; Registry -- WSDL --> Provider[Service Provider]; Consumer -- SOAP --> Provider; Provider -- SOAP --> Consumer;
```

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Evolution of ASP.NET Web API 6-6

Gradually, several standards became part of the Web services stack.

Consider an example of WS-Security:

- Introduced an extension to SOAP for securely transmitting SOAP messages.
- Introduced to manage trust relationships between entities involved in Web services communication. All the Web services standards became collectively known as WS-*.
- Introduced RESTful services that are available over plain HTTP and do not require implementation of WS-*.

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Using slide 4, tell that ASP.NET Web API is the result of the gradual evolution of traditional Web services. A Web service is similar to a Web application. Both Web services and Web applications receive requests, process the requests, and return appropriate responses.

However, the entities involved in a request/response interchange in a Web application comprises a user that communicates with the application through a client, such as a Web browser. On the other hand, the entities involved in a request/response interchange in a Web service are typically applications. Give some real life examples of Web services such as weather update service, cricket score service, and so on.

Using slide 5, explain with an example. For example, consider that an application provides payment information after a user checks out from an online shopping store application. This application will access a Web service that a payment gateway service provider utilizes to process the payment.

In slide 6, explain that in order that the online shopping store application can communicate with the payment gateway service provider, both the entities need to follow certain standards.

These standards, also known as Web services standards, primarily include SOAP, Web Services Definition Language (WSDL), and Web Service Specifications (WS-*) that introduces formal service contracts.

Using slide 7, explain that in traditional Web services, a service provider uses WSDL to publish how the service can be consumed. For example, a WSDL document describes the service endpoint where the service can be accessed.

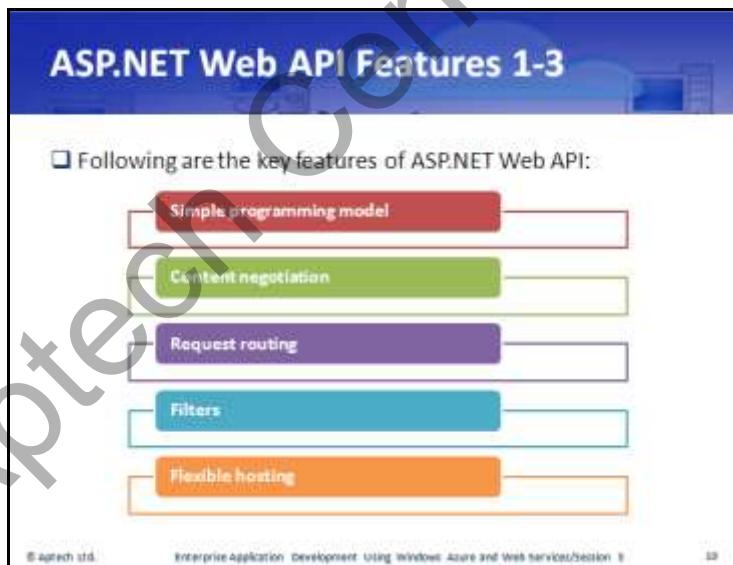
Mention that in addition, a WSDL document describes the service methods that consumers can call to avail the service. A WSDL document is published to a Universal Description, Discovery, and Integration (UDDI) registry. A UDDI registry can both be public or private to an organization. A UDDI registry is a repository for publishing WSDL documents. This repository is used by service consumers to access published WSDL documents in order to access a Web service.

Using slide 8, explain that figure shows the communication flow in a Web service.

Using slide 9, explain that several standards became part of the Web services stack. For example, WS-Security was introduced as an extension to SOAP for securely transmitting SOAP messages. Also, explain that WS-Security to manage trust relationships between entities involved in Web services communication. All the Web services standards became collectively known as WS-*.

Slides 10 to 12

Let us understand the features ASP.NET Web API.



The image shows two slides from a presentation about ASP.NET Web API features.

Slide 10: ASP.NET Web API Features 2-3

- Simple programming model**
 - Enables easy accessing and updating HTTP requests and responses in an ASP.NET Web API application.
 - Uses the same programming model as used on the server and on the client.
 - Involves any .NET application.
- Content negotiation**
 - Provides support to enable the client and server to negotiate the data format that the service returns as a response.
 - Supports JSON, XML, and Form URL-encoded formats.
 - Provides flexibility by extending the default data format by adding your own formatters.
 - Replaces the default content negotiation strategy with one of your own.

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Slide 11: ASP.NET Web API Features 3-3

- Request routing**
 - Provides a routing module for mapping request URLs to the correct controller action.
 - Defines custom routes in a centralized location without any additional configurations.
- Filters**
 - Provides filters to perform certain logic just before and after an action method of an API controller is invoked.
- Flexible hosting**
 - Provides the flexibility to be hosted with other .NET applications, such as ASP.NET MVC and ASP.NET Web Forms.
 - Supports self-hosting for applications hosted within a process that runs a console application.

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Using slide 10, explain that some of the key features of ASP.NET Web API include a simple programming model, content negotiation, request routing, filters, and flexible hosting.

Using slide 11, explain to the students about the simple programming model present in ASP.NET Web API. Also, tell them about content negotiation.

Explain that simple programming model enables to easily access and update HTTP requests and responses in an ASP.NET Web API application. In an ASP.NET Web API application, the same programming model is used on the server as well as on the client. The client can be any .NET application.

Explain that content negotiation allows the client and server to negotiate the data format that the service returns as a response. By default, ASP.NET Web API provides support for JSON, XML, and Form URL-encoded formats. ASP.NET Web API also provides the flexibility and you can extend the default data format by adding your own formatters, or even replacing the default content negotiation strategy with one of your own.

Using slide 12, explain request routing, filters, and flexible hosting.

Explain that request routing provides a routing module that is responsible for mapping request URLs to the correct controller action. Using the routing module, you can define custom routes in a centralized location without any additional configurations.

Explain that filters provide filters to perform certain logic just before and after an action method of an API controller is invoked. For example, you can use a filter to analyze the time that a method takes to process a request.

Tell that flexible hosting provides the flexibility to be hosted with other .NET applications, such as ASP.NET MVC and ASP.NET Web Forms. ASP.NET Web API also supports self-hosting, where the application is hosted within a process that runs a console application. Therefore, an ASP.NET Web API application does not require a Web server, such as IIS to be hosted for providing services.

Additional Information:

For more information on ASP.NET Web API, visit the following links:

<http://www.asp.net/web-api>

<http://www.asp.net/media/4071077/aspnet-web-api-poster.pdf>

<http://www.asp.net/web-api/videos/getting-started/aspnet-web-api>

Slide 13

Let us understand HTTP protocol.

HTTP Protocol

HTTP protocol:

- Communicates over the Web. When a URL in the Address bar of a browser is typed and submitted, an HTTP request is sent to an application running on a server that is represented by the URL.
- Returns back a HTTP response. The browser on receiving the response displays the response to you.
- Provides different types of request methods based on the type of operations that the request needs to make.

Client **Web Server**

The diagram illustrates the HTTP communication process. On the left, a blue laptop icon represents the 'Client'. An orange arrow labeled 'HTTP Request' points from the client to a green server tower icon on the right, which represents the 'Web Server'. A curved orange arrow labeled 'HTTP Response' points from the server back towards the client, indicating the flow of data.

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Using slide 13, explain that HTTP is the protocol used to communicate over the Web. When you type a URL in the Address bar of a browser and submit it, an HTTP request is sent to an application running on a server that is represented by the URL.

Also, explain that the application processes the request returns back a HTTP response. The browser on receiving the response displays the response to you.

Mention that HTTP provides different types of request methods based on the type of operations that the request needs to make.

Slide 14

Let us understand HTTP methods.

The slide has a blue header bar with the title 'HTTP Methods'. Below it is a list of four methods, each with a corresponding color-coded box:

- GET**: Requests the server to retrieve a resource.
- POST**: Requests the server that the target resource should process the data contained in the request.
- PUT**: Requests the server to create or update a request.
- DELETE**: Requests the server to delete a resource.

At the bottom left is the Aptech logo, and at the bottom right is the text 'Enterprise Application Development Using Windows Azure and Web Services/Session 1' and the number '14'.

Using slide 14, explain the four main HTTP methods such as GET, POST, PUT, and DELETE.

Additional Information:

For more information on HTTP methods, visit the following links:

http://www.tutorialspoint.com/http/http_methods.htm
<http://www.restapitutorial.com/lessons/httpmethods.html>

Slides 15 to 18

Let us understand HTTP request.

HTTP Request 1-4

- ❑ HTTP Request:
 - Irrespective of the method used in an HTTP request, all HTTP requests:
 - Have a standard format.
 - Contains request headers and a request body.
 - Provides information about the request, such as the HTTP method, the URL of the request, and the type of content that the request expects as response. The request body can be empty or can contain data.
- ❑ Following figure shows a HTTP request sent from a browser to a resource hosted on a server:

The diagram illustrates the flow of an HTTP request. On the left, a blue box labeled 'Browser' has a line connecting to a central box. This central box is titled 'HTTP Request' and contains the following text:
GET /index.html HTTP/1.1
Host: www.example.com
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,*/*;q=0.8
Accept-Language: en-US,en;q=0.8
Accept-Encoding: gzip, deflate
Connection: keep-alive
DNT: 1
User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/81.0.4044.138 Safari/537.36"/>

A line from the central box points to a blue box on the right labeled 'Server'.

HTTP Request 2-4

- ❑ The first line of the HTTP request specifies GET as the HTTP method and the resource that the request attempts to access.
- ❑ The first line is followed by these HTTP request headers:

Host	Specifies the domain name of the application whose resource is being accessed.
Accept	Specifies the content type, also known as MiME type that the request expects as response.
Accept-Language	Specifies the preferred language of the client.
Connection	Specifies whether the server should use the same connection for HTTP communication instead of creating a new connection for each new request.
KeepAlive	Specifies the duration in seconds for which the server should use the same connection for HTTP communication.

HTTP Request 3-4

- ❑ HTTP Response:
 - Whenever a server receives an HTTP request, it sends back an HTTP response.
 - An HTTP response contains response headers and a response body.
- ❑ Following figure shows a HTTP response sent from a server to a browser:

The diagram illustrates the flow of an HTTP response. On the left, a blue box labeled "Browser" has an arrow pointing to a central white box labeled "HTTP Response". This box contains the following text:
HTTP/1.1 200 OK
Date: Fri, 17 March 2017 10:11:01 GMT
Content-Type: text/html
Content-Length: 132
Connection: keep-alive
Last-Modified: Mon, 23 Feb 2015 10:11:01 GMT
Accept-Ranges: bytes
Server: Microsoft-IIS/10.0
X-Powered-By: ASP.NET
The central box is flanked by two arrows pointing to a blue box labeled "Server" on the right.

HTTP Request 4-4

- ❑ The first line of the HTTP response specifies a HTTP status code.
- ❑ The **200 OK** status code indicates that the request has succeeded.
- ❑ The first line is followed by these key HTTP response headers:
 - **Date:** Specifies the date and time when the response is being sent from the server.
 - **Server:** Specifies the server that is handling the request response exchange.
 - **Last-Modified:** Specifies the date and time at which the resource was last modified.
 - **Content-Length:** Specifies the size of the response body, in decimal number of octets.
 - **Content-Type:** Specifies the type of content that the response contains. In this example, the **text/html** value specifies the browser known to render the response body as HTML.

18

Using slide 15, explain that irrespective of the method used in an HTTP request, all HTTP requests have a standard format. An HTTP request contains request headers and a request body. The request header provides information about the request, such as the HTTP method, the URL of the request, and the type of content that the request expects as response. The request body can be empty or can contain data.

Mention for example, a GET request that requests a resource will have an empty body, while a POST request will contain data that needs to be processed by the resource.

Tell that the figure on slide 15 shows a HTTP request sent from a browser to a resource hosted on a server.

Using slide 16, explain that in the figure, a browser sends an HTTP request to the server. The first line of the HTTP request specifies GET as the HTTP method and the resource that the request attempts to access.

Explain that the first line is followed by these HTTP request headers:

- Host
- Accept
- Accept-Language
- Connection
- Keep alive

Tell them that Host specifies the domain name of the application whose resource is being accessed.

Tell that Accept specifies the content type, also known as MIME type that the request expects as response.

Mention that Accept-Language specifies the preferred language of the client.

Explain that Connection specifies whether the server should use the same connection for HTTP communication instead of creating a new connection for each new request. The keep-alive value for this header specifies that the server should use the same connection.

Explain that Keep-alive specifies the duration in seconds for which the server should use the same connection for HTTP communication.

Mention that the preceding HTTP request header declarations are followed by an empty or blank line that is followed by the HTTP request body. In this example, as the request is of type GET, the request body is empty.

Using slide 17, explain HTTP Response.

Explain that on receiving an HTTP request, a server sends back an HTTP response. This response can be the output of the requested resource or an HTTP status code to indicate that the requested resource is not available. Similar to an HTTP request, an HTTP response contains response headers and a response body.

Also, tell that the figure on slide 17 shows a HTTP response sent from a server to a browser.
Using slide 18, explain that the figure shows that a server sends an HTTP response to the browser.
The first line of the HTTP response specifies a HTTP status code.

Tell that the figure on slide 18 shows that the 200 OK status code indicates that the request has succeeded.

The first line is followed by these key HTTP response headers:

- Date
- Server
- Last-Modified
- Content-Length
- Content-Type

Explain that Date specifies the date and time when the response is being sent from the server.

Tell that Server specifies the server that is handling the request response exchange.
Mention that Last-Modified specifies the date and time at which the resource was last modified.

Explain that Content-Length specifies the size of the response body, in decimal number of octets.

Explain that Content-Type specifies the type of content that the response contains. In this example, the text/html value specifies the browser known to render the response body as HTML.

Also, mention that the preceding HTTP response header declarations are followed by an empty or blank line that is followed by the HTTP response body. In this example, the response body contains HTML markup that the browser will parse and display to the user.

Slides 19 to 22

Let us understand REST.

REST 1-4

- ❑ REST:
 - Stands for Representational State Transfer; an architecture built over HTTP.
 - Each request URL is unique and points to a specific resource.
 - Web services created using the REST architecture are called RESTful services.
 - Such services, as compared to traditional Web services, are simple and provide high performance.

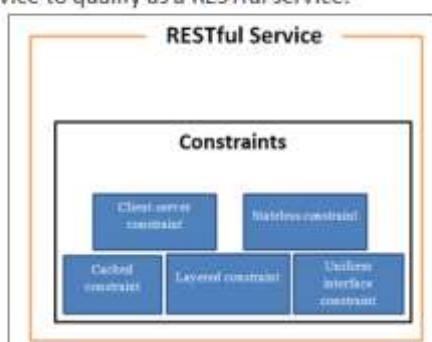
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REST 2-4

- ❑ To create RESTful services, you need to address the following basic design principles:
 - Explicitly and consistently use the HTTP methods to interact with services. For example, use the GET HTTP method to retrieve a resource and the POST HTTP method to create a resource.
 - HTTP is stateless and therefore, each HTTP request should be created with all the information required by the server to generate the response.
 - URLs should only be used to access resources of a RESTful service. These URLs should be consistent and intuitive.
 - The XML and JSON data format must be supported for request/response exchange between clients and the RESTful service.
- ❑ For a Web service to qualify as a RESTful service, the service has to conform to certain defined constraints.

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REST 3-4

- ❑ Following figure illustrates the mandatory constraints for a Web service to qualify as a RESTful service:

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REST 4-4

❑ The various terms shown in the figure are explained as follows:

Client-server constraint	Specifies that the user interface of the service should be separate from the data storage of the service.
Stateless constraint	Specifies that a request should be an atomic unit containing all information that the server requires to generate a response.
Cached constraint	Specifies whether the server has the capability to inform that a response could be cached so that clients can accordingly handle the response.
Layered constraint	Specifies that the service should be composed of layers where each layer can access and is accessible to its neighbor layer.
Uniform interface constraint	Specifies a uniform interface that is used to identify, access, and manipulate resources through self-descriptive messages.

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Using slide 19, explain that REST stands for Representational State Transfer, an architecture built over HTTP. In the REST architecture, each request URL is unique and points to a specific resource. Web services created using the REST architecture are called RESTful services. Such services, as compared to traditional Web services, are simple and provide high performance.

Using slide 20, explain the basic design principles to be followed to create RESTful services. Explain that you need to explicitly and consistently use the HTTP methods to interact with services. For example, use the GET HTTP method to retrieve a resource use GET and the POST HTTP method to create a resource.

Tell that HTTP is stateless and therefore, each HTTP request should be created with all the information required by the server to generate the response.

Tell them that URLs should only be used to access resources of a RESTful service. These URLs should be consistent and intuitive.

Explain that the XML and JSON data format must be supported for request/response exchange between clients and the RESTful service.

Also, mention that for a Web service to qualify as a RESTful service, the service has to conform to certain defined constraints.

Using slide 21, tell that the figure illustrates the mandatory constraints for a Web service to qualify as a RESTful service.

Using slide 22, tell the various terms used in REST. They are:

- Client-server
- Stateless constraint
- Cached constraint
- Layered constraint
- Uniform interface constraint

Explain that Client-server constraint specifies that the user interface of the service should be separate from the data storage of the service.

Tell them that Stateless constraint specifies that a request should be an atomic unit containing all information that the server requires to generate a response.

Mention that Cached constraint specifies whether the server has the capability to inform that a response could be cached so that clients can accordingly handle the response.

Explain to them that Layered constraint specifies that the service should be composed of layers where each layer can access and is accessible to its neighbor layer.

Explain that Uniform interface constraint specifies a uniform interface that is used to identify, access, and manipulate resources through self-descriptive messages.

Additional Information:

For more information on REST, visit the following links:

<http://www.restapitutorial.com/>
<http://rest.elkstein.org/>

Slides 23 to 25

Let us understand media types.

Media Types 1-3

Media Types:

- Is also known as content type, a standard to identify the type of data being exchanged over the internet.
- Are used by browsers to specify the type of data they expect as response from the server.
- A particular media type is identified using an identifier based on the Multipurpose Internet Mail Extensions (MIME) specification. This identifier is known as MIME type.
- An HTTP request uses the Accept HTTP request header to specify the MIME type that the request expects as a response.
- In an ASP.NET Web API service, XML and JSON are used as the data formats to deliver service responses.



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Media Types 2-3

- ❑ Following code snippet shows a response of an ASP.NET Web API service that sends a response in XML format:

```
HTTP/1.1 200 OK
Content-Type: application/xml; charset=utf-8

<?xml version="1.0" encoding="utf-8"?>
<Product xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema">

  <Id>36</Id>
  <Name>Laptop</Name>
  <Category>Electronics</Category>
</Product>
```
- ❑ This code shows a response whose MIME type is application/xml, as indicated by the Content-Type response header. The response body contains the information of a specific product in XML format.
- ❑ ASP.NET Web API service uses the `JsonMediaTypeFormatter` to send response in JSON format.

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Media Types 3-3

- ❑ Following code snippet shows a response of an ASP.NET Web API service that sends a response in JSON format:

```
HTTP/1.1 200 OK
Content-Type: application/json; charset=utf-8

{"Id": "36", "Name": "Laptop", "Category": "Electronics"}
```
- ❑ This code shows a response whose MIME type is application/json, as indicated by the Content-Type response header. The response body contains the information of a specific product in JSON format.

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Using slide 23, explain Media type. It is also referred as content type. It is a standard that identifies the type of data being exchanged over the Internet.

Media types are used by browsers to specify the type of data they expect as response from the server. When a specific media type is sent by the server, the browser uses the media type to determine how to display the response.

Explain that a particular media type is identified using an identifier based on the Multipurpose Internet Mail Extensions (MIME) specification. This identifier is known as MIME type. For example, `text/html` is the MIME type for an HTML document.

Also, mention that an HTTP request uses the `Accept` HTTP request header to specify the MIME type that the request expects as a response. The server sends the `Content-Type` HTTP response header to indicate the MIME type of the response. Based on the MIME type sent as the `Content-Type` HTTP response header, the browser accordingly parses and displays the response.

Then explain that in an ASP.NET Web API service, XML and JSON are used as the data formats to deliver service responses. The MIME type for an XML response is application/xml, while the MIME type for a JSON response is application/json. To send responses in XML or JSON format, ASP.NET Web API uses media-type formatters. The `XmlMediaTypeFormatter` is used to send response in XML format.

Using slide 24, show the code snippet that displays a response of an ASP.NET Web API service that sends a response in XML format.

Explain that this code shows a response whose MIME type is application/xml, which is indicated by the Content-Type response header. The response body contains the information of a specific product in XML format.

Mention that ASP.NET Web API service uses the `JsonMediaTypeFormatter` to send response in JSON format.

Using slide 25, show the code snippet that a response of an ASP.NET Web API service that sends a response in JSON format.

Explain that this code shows a response whose MIME type is application/json, as indicated by the Content-Type response header. The response body contains the information of a specific product in JSON format.

Additional Information:

To know more about HTTP, REST, and media types, visit the following links:

<http://soabits.blogspot.in/2013/05/the-role-of-media-types-in-restful-web.html>
<http://www.asp.net/web-api/overview/formats-and-model-binding/media-formatters>
<http://chimera.labs.oreilly.com/books/1234000001708/ch02.html>

In-Class Question:

After you finish explaining HTTP, REST, and media types, you will ask students an In-Class question. This will help you in reviewing their understanding of the topic.



Define a WSDL document.

Answer:

A WSDL document describes the service methods that consumers can call to avail the service. It is published to a Universal Description, Discovery, and Integration (UDDI) registry.

Slide 26

Let us understand designing and implementing an ASP.NET Web API service.

Designing and Implementing an ASP.NET Web API Service

- ❑ Visual Studio 2013 provides templates and tools to simplify developing ASP.NET Web API services.
- ❑ When you create an ASP.NET Web API service in Visual Studio 2013, the Integrated Development Environment (IDE):
 - Creates a skeleton application with a default directory structure.
 - Contains the basic ASP.NET Web API components, such as a controller, route configurations, and the reference libraries.
 - Adds the required services based on the application requirements.
 - Debugs and tests the application before finally hosting it to a production server.

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Using slide 26, explain designing and implementing an ASP.NET Web API service.

Tell the students that Visual Studio 2013 provides templates and tools to simplify developing ASP.NET Web API services.

Explain that when you create an ASP.NET Web API service in Visual Studio 2013, the Integrated Development Environment (IDE) creates a skeleton application with a default directory structure. This directory structure contains the basic ASP.NET Web API components, such as a controller, route configurations, and the reference libraries.

Also, mention that based on the IDE-generated application, you can add the required services based on the application requirements. You can then debug and test the application before finally hosting it to a production server.

Slides 27 and 28

Let us understand creating an ASP.NET Web API application.

The image contains two screenshots from a presentation slide titled "Creating an ASP.NET Web API Application".

Screenshot 1 (Top): A list of six steps to create a new ASP.NET Web API application in Visual Studio 2013:

- Step 1: Open Visual Studio 2013.
- Step 2: Click File → New → Project in Visual Studio 2013.
- Step 3: In the New Project dialog box, select Web under the Installed section, and then select the ASP.NET Web Application template.
- Step 4: Type WebAPIDemo in the Name text field.
- Step 5: Click Browse in the dialog box and specify the location where the application has to be created.
- Step 6: Click OK. The New ASP.NET Project – WebAPIDemo dialog box is displayed.

Screenshot 2 (Bottom): Two windows illustrating the process:

- Step 7:** Shows the "New ASP.NET Project" dialog box with "Select Web API" selected under the "Select a template section of the New ASP.NET Project – WebAPIDemo dialog box".
- Step 8:** Shows the "Your ASP.NET application" window, displaying the project details: "This application consists of: controllers, views, models, and web.config".

Using slide 27, explain the steps to create a new ASP.NET Web API application in Visual Studio 2013.

In step 1, open Visual Studio 2013.

In step 2, click File → New → Project in Visual Studio 2013.

In step 3, in the New Project dialog box that appears, select Web under the Installed section, and then select the ASP.NET Web Application template.

In step 4, type **WebAPIDemo** in the **Name** text box.

In step 5, click **Browse** in the dialog box and specify the location where the application has to be created.

In step 6, click **OK**. The **New ASP.NET Project – WebAPIDemo** dialog box is displayed.

Using slide 28, explain step 7 as follows. Select **Web API** under the Select a template section of the **New ASP.NET Project – WebAPIDemo** dialog box.

Tell that the figure on slide 28 shows selecting Web API under the Select a template section.

In step 8, click **OK**. Visual Studio 2013 displays the newly created ASP.NET Web API application.

Tell that the figure on slide 28 shows the newly created ASP.NET Web API application.

Slides 29 to 32

Let us understand adding a model.

Adding a Model 1-4

- ❑ Once you have created the ASP.NET Web API application, you need to create a model.
- ❑ A model in an ASP.NET Web API service represents application specific data.
 - For example, if you are creating a service for online social integration, your service will typically contain a Profile model to represent profile information of user, a Login model to represent the login information of users, and a Post model to represent information that you post online.

Adding a Model 2-4

- ❑ To create a model in Visual Studio 2013, you need to perform the following steps:

Step 1 Right-click the **Models** folder in the Solution Explorer window and select **Add → Class** from the context menu that appears. The **Add New Item – WebAPIDemo** dialog box is displayed.

Step 2 Type **Album.cs** in the **Name** text field of the **Add New Item – WebAPIDemo** dialog box.

The image contains two screenshots from a presentation slide. The top screenshot shows the 'Add New Item - WebAPIDemo' dialog box in Visual Studio 2013. The 'Model' category is selected, and 'Album.cs' is typed into the 'Name' field. A callout box labeled 'Step 3' points to the 'Add' button. The bottom screenshot shows the 'Code Editor' displaying the generated C# code for the 'Album' class.

Adding a Model 3-4

Figure shows the Add New Item – WebAPIDemo dialog box:

Step 3 Click Add. The Code Editor displays the newly created Album class.

Adding a Model 4-4

Step 4 In Code Editor, add the code shown in the following code snippet to the Album class to represent a product.

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Web;
namespace WebAPIDemo.Models
{
    public class Album
    {
        public int Id { get; set; }
        public string Name { get; set; }
        public string Genre { get; set; }
        public decimal Price { get; set; }
    }
}
```

This code declares variables named Id, Name, Genre, and Price along with the get and set methods.

Using slide 29, explain that after creating the ASP.NET Web API application, you need to create a model. A model in an ASP.NET Web API service represents application specific data.

Explain with an example. Tell that if you are creating a service for online social integration, your service will typically contain a Profile model to represent profile information of user, a Login model to represent the login information of users, and a Post model to represent information that you post online.

Using slide 30, explain the steps to be followed to create a model in Visual Studio 2013.

In step 1, right-click the **Models** folder in the Solution Explorer window and select Add → Class from the context menu that appears. The **Add New Item – WebAPIDemo** dialog box is displayed.

In step 2, type **Album.cs** in the Name text box of the **Add New Item – WebAPIDemo** dialog box.

Using slide 31, tell that the figure shows the **Add New Item – WebAPIDemo** dialog box.

In step 3, click Add. The code Editor displays the newly created Album class.

Using slide 32, explain that in step 4, in code Editor, you need to add the code. Show the code snippet to the Album class to represent a product.

Mention that this code declares variables named Id, Name, Genre, and Price along with the get and set methods.

Slides 33 to 40

Let us understand adding a repository.

The image contains two screenshots from a presentation slide titled "Adding a Repository".

Screenshot 1: Adding a Repository 1-8

- In an ASP.NET Web API service-based application, a repository is:
 - A data source that stores the data of the application
 - An in-memory application object
 - An XML file
 - A separate Relational Database Management System (RDBMS)
 - A cloud-base storage system
- For the **WebAPIDemo** project, create an in-memory application object as a repository to store a collection of albums. Perform the following steps to create a repository in Visual Studio 2013:
 - Step 1: Right-click the **Models** folder in Solution Explorer and select **Add → New Item**. The **WebAPIDemo** dialog box is displayed.
 - Step 2: Select **Visual C#** in the Templates panel, and **Interface** on the right of the **Add New Item** - **WebAPIDemo** dialog box.
 - Step 3: Type **IAlbumRepository** in the **Name** field.

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Screenshot 2: Adding a Repository 2-8

- Figure shows the process of adding the interface.

A screenshot of the "Add New Item" dialog box in Visual Studio 2013. The "Template" dropdown is set to "Interface". The list shows "IAlbumRepository" selected. Other options include "Class", "Web API Controller", "Application Service", "Assembly Information File", "Class Diagram", and "Code Analysis Rules".

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Adding a Repository 3-8

Step 5: In Code Editor, add the following code to the IAlbumRepository repository.

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Text;
using System.Threading.Tasks;

namespace WebAPIDemo.Models
{
    interface IAlbumRepository
    {
        IEnumerable<Album> GetAll();
        Album Get(int id);
        void Add(Album item);
        void Remove(int id);
        bool Update(Album item);
    }
}
```

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Adding a Repository 4-8

- The code creates an **IAlbumRepository** interface and declares the following methods:

GetAll()	Get(int id)	Add(Album item)	Remove(int id)	Update(Album item)
<ul style="list-style-type: none"> • An implementation of this method should return an IEnumerable<Album> object that contains details of all the albums. 	<ul style="list-style-type: none"> • An implementation of this method should return an Album object of the specified id passed as parameters to the method. 	<ul style="list-style-type: none"> • An implementation of this method should add a new Album object to the IAlbumRepository object. Once added, this method should return the new Album object. 	<ul style="list-style-type: none"> • An implementation of this method should remove an Album object specified by the id passed as parameter from the IAlbumRepository object. 	<ul style="list-style-type: none"> • An implementation of this method should update the IAlbumRepository object with the Album object passed as parameter.

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Adding a Repository 5-8

Step 6: Similarly, create another class named **AlbumRepository** in the **Models** folder.

Step 7: In the Code Editor, add the code to the **AlbumRepository** class.

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Web;

namespace WebAPIDemo.Models
{
    public class AlbumRepository : IAlbumRepository
    {
        private List<Album> _albums = new List<Album>();
        private int _nextId = 1;
        public AlbumRepository() { }
```

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The image displays three vertically stacked slides, each showing a portion of the same C# code for an `AlbumRepository` class. A large, diagonal watermark reading "For Aptech Centre Use Only" is overlaid across all three slides.

Slide 6-8:

```
    Add(new Album { Name = "The Band", Genre = "Classic Rock", Price = 150 });
    Add(new Album { Name = "The Blueprint", Genre = "Hip Hop", Price = 200 });
    Add(new Album { Name = "Unconditional", Genre = "Hard Rock", Price = 175 });
}
public IEnumerable<Album> GetAll()
{
    return albums;
}
public Album Get(int id)
{
    return albums.Find(p =>p.Id == id);
}
public Album Add(Album item)
{
    if (item == null)
```

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Slide 7-8:

```
    throw new ArgumentNullException("item");
}
item.Id = _nextId++;
albums.Add(item);
return item;
}
public void Remove(int id)
{
    albums.RemoveAll(p =>p.Id == id);
}
public bool Update(Album item)
{
    if (item == null)
        throw new ArgumentNullException("item");
}
```

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Slide 8-8:

```
int index = albums.FindIndex(p =>p.Id == item.Id);
if (index == -1)
{
    return false;
}
albums.RemoveAt(index);
albums.Add(item);
return true;
}
```

In this code, the `AlbumRepository` class implements the `IAlbumRepository` interface that it created.
 For each of the methods declared in the `IAlbumRepository` interface, the `AlbumRepository` class provides implementation to retrieve, add, and delete albums that the `Album` model represents.

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Using slide 33, explain in an ASP.NET Web API service-based application, a repository is a data source that stores the data of the application.

A repository can be an in-memory application object, an XML file, a separate Relational Database Management System (RDBMS) or a cloud-base storage system.

Also, explain the **WebAPIDemo** project, you can create an in-memory application object as a repository to store a collection of albums.

Mention that to create a repository in Visual Studio 2013, you need to perform the following steps:

In step 1, right-click the **Models** folder in Solution Explorer and select **Add → New Item**. The **WebAPIDemo** dialog box is displayed.

In step 2, select **Visual C#** in the **Templates** pane, and Interface on the right of the **Add New Item - WebAPIDemo** dialog box.

In step 3, type `IAlbumRepository` in the Name box.

Using slide 34, tell that the figure shows the process of adding the interface.

In step 4, click Add. The code Editor displays the newly created `IAlbumRepository` repository.

Using slide 35, explain that in step 5, in code Editor, add the code given in the code snippet to the `IAlbumRepository` repository.

Using slide 36, explain the methods to create an `IAlbumRepository` interface that includes `GetAll()`, `Get(int id)`, `Add(Album item)`, `Remove(int id)`, and `Update(Album item)`.

Explain `GetAll()`: An implementation of this method should return an `IEnumerable<Album>` object that contains details of all the albums.

Explain `Get(int id)`: An implementation of this method should return an `Album` object of the specified `Id` passed as parameters to the method.

Explain `Add(Album item)`: An implementation of this method should add a new `Album` object to the `AlbumRepository` object. Once added, this method should return the new `Album` object.

Explain `Remove(int id)`: An implementation of this method should remove an `Album` object specified by the `Id` passed as parameter from the `AlbumRepository` object.

Explain `Update(Album item)`: An implementation of this method should update the `AlbumRepository` object with the `Album` object passed as parameter.

Using slides 37 to 40, explain that in step 6, create another class named `AlbumRepository` in the `Models` folder.

In step 7, in the code Editor, add the code shown in code snippet to the `AlbumRepository` class. Show the code and explain its working.

Mention that in this code, the `AlbumRepository` class implements the `IAlbumRepository` interface that it created. For each of the methods declared in the `IAlbumRepository` interface, the `AlbumRepository` class provides implementation to retrieve, add, and delete albums that the `Album` model represents.

Slides 41 to 49

Let us understand adding an ASP.NET Web API controller.

Adding an ASP.NET Web API Controller 1-9

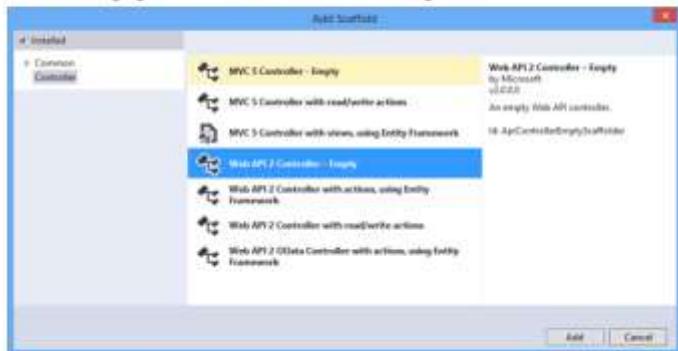
- ❑ After creating the model named, `Album` and the repository implementation that acts as a data source for `Album` objects, add an ASP.NET Web API controller to the application.
- ❑ The ASP.NET Web API controller is a class that handles HTTP requests from the client.
- ❑ This class extends the `ApiController` class and provides methods that are invoked for various types of requests, such as GET, POST, PUT, and DELETE.

Adding an ASP.NET Web API Controller 2-9

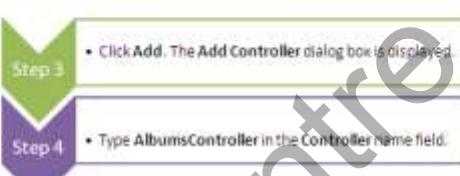
- ❑ Following steps help to create an ASP.NET Web API controller in Visual Studio 2013:
 - Right click the `Controllers` folder in the Solution Explorer window and select `Add → Controller` from the context menu that appears. The `Add Scaffold` dialog box is displayed.
 - Select the `Web API 2 Controller – Empty` template in the `Add Scaffold` dialog box.

Adding an ASP.NET Web API Controller 3-9

Following figure shows the **Add Scaffold** dialog box:



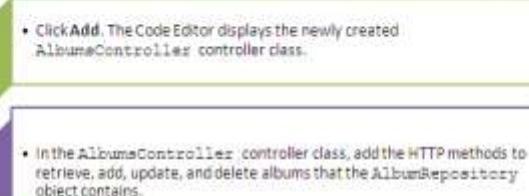
Adding an ASP.NET Web API Controller 4-9



Following figure shows the **Add Controller** dialog box:



Adding an ASP.NET Web API Controller 5-9



Adding an ASP.NET Web API Controller 6-9

Following code shows the AlbumsController class:

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Net;
using System.Net.Http;
using System.Web.Http;
using WebAPIDemo.Models;

namespace WebAPIDemo.Controllers
{
    public class AlbumsController : ApiController
    {
        static readonly IAlbumRepository albumRepository = new
        AlbumRepository();
        public IEnumerable<Album> Get()
        {
            return albumRepository.GetAll();
        }
    }
}
```

Adding an ASP.NET Web API Controller 7-9

```
        return albumRepository.GetAll();
    }

    public Album Get(int id)
    {
        Album album = albumRepository.Get(id);
        if (album == null)
        {
            throw new HttpResponseException(HttpStatusCode.NotFound);
        }
        return album;
    }
    public IEnumerable<Album> GetAlbumByGenre(string genre)
    {
        return albumRepository.GetAll().Where(
            p =>p.Genre.Equals(p.Genre, StringComparison.OrdinalIgnoreCase));
    }
}
```

Adding an ASP.NET Web API Controller 8-9

```
    public string Post(Album album)
    {
        album = albumRepository.Add(album);
        return "Album added successfully";
    }
    public void Put(int id, Album album)
    {
        album.Id = id;
        albumRepository.Update(album);
    }
    public void Delete(int id)
    {
        Album album = albumRepository.Get(id);
        albumRepository.Remove(id);
    }
}
```

Adding an ASP.NET Web API Controller 9-9

In this code:

- The `AlbumsController` class extends the `ApiController` class.
- The `Get()` method accesses the album repository to return all albums as an `IEnumerable <Album>` object. The `Get(int id)` method accesses the album repository to return an album with the specified Id as an `Album` object.
- The `GetAlbumByGenre(string genre)` method returns all albums of the specified genre as an `IEnumerable <Album>` object.
- The `Post(Album album)` method adds the `Album` object passed as parameter to the album repository. The `Put(int id, Album album)` method updates an album in the album repository based on the specified id.
- The `Delete(int id)` method deletes an album from the album repository based on the specified id.

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Using slide 41, explain that once you have created the model named `Album` and the repository implementation that acts as a data source for `Album` objects, you need to add an ASP.NET Web API controller to the application. The ASP.NET Web API controller is a class that handles HTTP requests from the client. This class extends the `ApiController` class and provides methods that are invoked for various types of requests, such as GET, POST, PUT, and DELETE.

Using slide 42, explain the steps to create an ASP.NET Web API controller in Visual Studio 2013.

In step 1, right-click the **Controllers** folder in the Solution Explorer window and select **Add → Controller** from the context menu that appears. The **Add Scaffold** dialog box is displayed.

In step 2, select the **Web API 2 Controller – Empty** template in the **Add Scaffold** dialog box.

Using slide 43, tell that the figure shows the **Add Scaffold** dialog box.

Using slide 44, explain Step 3: Click **Add**. The **Add Controller** dialog box is displayed.

In step 4, type `AlbumsController` in the **Controller** name box.

Also, tell that the figure on slide 44 shows the **Add Controller** dialog box.

Using slide 45, explain that in step 5, click **Add**. The Code Editor displays the newly created `AlbumsController` controller class.

In step 6, in the `AlbumsController` controller class, add the HTTP methods to retrieve, add, update, and delete albums that the `AlbumRepository` object contains.

Using slides 46 to 49, tell that the code shows the `AlbumsController` class. Explain the code. Tell that in this code, the `AlbumsController` class extends the `ApiController` class.

The Get () method accesses the album repository to return all albums as an `IEnumerable<Album>` object. The Get (`int id`) method accesses the album repository to return an album with the specified Id as an `Album` object.

Mention that the `GetAlbumByGenre (string genre)` method returns all albums of the specified genre as an `IEnumerable<Album>` object. The `Post (Album album)` method adds the `Album` object passed as parameter to the album repository. The `Put (int id, Album album)` method updates an album in the album repository based on the specified id. Finally, the `Delete (int id)` method deletes an album from the album repository based on the specified id.

Slides 50 to 52

Let us understand defining routes.

Defining Routes 1-3

- ❑ After creating the ASP.NET Web API controller, register it with the ASP.NET routing Framework.
- ❑ When the Web API application receives a request, the routing framework tries to match the Uniform Resource Identifier (URI) against one of the route templates defined in the `WebApiConfig.cs` file.
- ❑ If no route matches, the client receives a 404 error.
- ❑ When an ASP.NET Web API application is created in Visual Studio 2013, by default, the IDE configures the route of the application in the `WebApiConfig.cs` file under the `App_Start` folder.

Defining Routes 2-3

- ❑ Following code shows the default route configuration of the ASP.NET Web API application:

```
config.Routes.MapHttpRoute(
    name: "DefaultApi",
    routeTemplate: "api/{controller}/{id}",
    defaults: new { id = RouteParameter.Optional }
)
```

- This code shows the default route configuration for an ASP.NET Web API application. This route configuration contains a route template specified by the `routeTemplate` attribute that defines the following pattern:
"api/{controller}/{id}"
- ❑ In the preceding route pattern:
 - `api`: is a literal path segment
 - `{controller}`: is a placeholder for the name of the controller to access
 - `{id}`: is an optional placeholder that the controller method accepts as parameter
- ❑ Use the `RouteTable.MapHttpRoute ()` method to configure additional routes of an ASP.NET Web API application.

Defining Routes 3-3

To configure a new route in the `WebApiConfig.cs` file, refer the following code:

```
config.Routes.MapHttpRoute(
    name: "AlbumWebApiRoute",
    routeTemplate: "album/{controller}/{id}",
    defaults: new { id = RouteParameter.Optional }
);
```

In this code, a route named, `AlbumWebApiRoute` is created with the route pattern `album/{controller}/{id}`.

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Using slide 50, explain that once you have created the ASP.NET Web API controller, you need to register it with the ASP.NET routing Framework. When the Web API application receives a request, the routing Framework tries to match the Uniform Resource Identifier (URI) against one of the route templates defined in the `WebApiConfig.cs` file. If no route matches, the client receives a 404 error.

Also, mention that when you create an ASP.NET Web API application in Visual Studio 2013, by default, the IDE configures the route of the application in the `WebApiConfig.cs` file under the `App_Start` folder.

Using slide 51, tell that the code shows the default route configuration of the ASP.NET Web API application.

Then, explain that this code shows the default route configuration for an ASP.NET Web API application. This route configuration contains a route template specified by the `routeTemplate` attribute that defines the following pattern:

`"api/{controller}/{id}"`

Mention the preceding route pattern:

`api`: It is a literal path segment.

`{controller}`: It is a placeholder for the name of the controller to access.

`id`: It is an optional placeholder that the controller method accepts as parameter.

Tell that you can also use the `RouteTable.MapHttpRoute()` method to configure additional routes of an ASP.NET Web API application.

Using slide 52, tell that the code shows how to configure a new route in the `WebApiConfig.cs` file.

Explain that in this code, a route named `AlbumWebApiRoute` is created with the route pattern `album/{controller}/{id}`.

Slides 53 and 54

Let us understand accessing the application.

The image contains two slides from a presentation. Both slides have a blue header with the title 'Assessing the Application' followed by a number (1-2 or 2-2). The first slide, 'Assessing the Application 1-2', contains the following text:

- After creating the controller class and configuring the routing of the ASP.NET Web API application, access it from a browser using the following steps:

Step 1: Click Debug → Start Without Debugging

Step 2: Type the following URL in the address bar of the browser:
`http://localhost:2276/album/albums`
This URL retrieves details of all the albums.

The second slide, 'Assessing the Application 2-2', contains the following text:

- The browser displays the album details as shown in the following figure:

A screenshot of a browser window shows the JSON response from the API endpoint. The JSON data is:

```
[{"Id":1,"Name":"The Band","Genre":"Classic Rock","Price":150.0}, {"Id":2,"Name":"The Beatles","Genre":"Rock","Price":200.0}, {"Id":3,"Name":"Unconditional","Genre":"Hard Rock","Price":175.0}]
```

- To access a specific album, based on the Id, type the following URL in the address bar of the browser:
`http://localhost:2276/album/albums/1`

Using slide 53, explain that once you have created the controller class and configure the routing of the ASP.NET Web API application, you can access it from a browser using the following steps:

In step 1, click **Debug → Start Without Debugging**. The browser window displays the home page of the application.

In step 2, type the following URL in the Address bar of the browser:
<http://localhost:2276/album/albums>

Tell that this URL retrieves details of all the albums.

Using slide 54, explain that the browser displays the album details.

To access a specific album, based on the Id, type the following URL in the Address bar of the browser:

<http://localhost:2276/album/albums/1>

Slides 55 and 56

Let us understand securing an ASP.NET Web API service.

Securing an ASP.NET Web API Service
1-2

- ❑ Securing an ASP.NET Web API service involves two key security concepts:
 - Authentication
 - This is the process of identifying an individual, usually based on the username and password provided by the user.
 - An ASP.NET Web API service does not provide any new authentication mechanism since that is already taken care of by the Web application that the Web API service is part of.
 - Authorization
 - This is the process of either allowing or denying an authenticated user access to a restricted resource. For example, consider an ASP.NET Web API controller that contains two GET methods: `GetNewsHeadlines()` and `GetNews()` that allow a user to retrieve news headlines and complete news respectively.
 - Authorization can be enforced using the `Authorize` action filter.

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Securing an ASP.NET Web API Service
2-2

- ❑ Following code shows using the `Authorize` filter:

```
[Authorize]
public Album GetNews(id)
{
    News news= newsRepository.GetNews(id);
    if (news == null)
        throw new
            HttpResponseException(HttpStatusCode.NotFound);
    else
        return news;
}
```

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Using slide 55, explain that securing an ASP.NET Web API service involves two key security concepts, namely, authentication and authorization.

Explain Authentication: Authentication is the process of identifying an individual, usually based on the username and password provided by the user. An ASP.NET Web API service does not provide any new authentication mechanism since that is already taken care of by the Web application that the Web API service is part of.

Explain Authorization: Authorization is the process of either allowing or denying an authenticated user access to a restricted resource. For example, consider an ASP.NET Web API controller that contains two GET methods:

GetNewsHeadlines () and GetNews () that allow a user to retrieve news headlines and complete news, respectively. In this controller, you might want that all users should be able to retrieve news headlines. However, only authenticated users should be authorized to access the GetNews () method and retrieve complete news.

Mention in such an ASP.NET Web API controller, you can enforce authorization using the Authorize action filter.

Using slide 56, tell that the code shows an example of using the Authorize filter.

Slides 57 to 61

Let us understand authentication and authorization in an ASP.NET Web API service.

The image consists of two screenshots of Microsoft Visual Studio 2013. The top screenshot, titled 'Authentication and Authorization in an ASP.NET Web API Service 1-5', shows a list of five steps to secure an ASP.NET Web API service. Step 1: Open Visual Studio 2013. Step 2: Select File → New → Project. The New Project dialog box is displayed. Step 3: Select Web under the Installed option and then select the ASP.NET Web Application template. Step 4: In the Name text field, type SecureService and click OK. The New ASP.NET Project – Secure Service dialog box is displayed. Step 5: From the Select a template section, select MVC and then, select the Web API check box. The bottom screenshot, titled 'Authentication and Authorization in an ASP.NET Web API Service 2-5', shows the 'New ASP.NET Project - SecureService' dialog box. It displays project templates like Empty, Web Forms, MVC, and Web API. Under 'Add folders and core references for:', there are checkboxes for Web Pages, MVC, and Web API. Under 'Add unit tests', there is a checkbox for 'Add unit tests'. The 'Authentication' section is set to 'Windows Azure' with the 'Create remote resources' checkbox checked. The 'File project name' field is set to 'SecureService'. At the bottom right of the dialog box are 'OK' and 'Cancel' buttons.

Authentication and Authorization in an ASP.NET Web API Service 3-5

Step 6

- Click OK. Visual Studio 2013 creates the project and adds an AccountController controller class to the project. The AccountController class is responsible for implementing authentication in the application.

Step 7

- In the Solution Explorer window, right-click the Controllers folder and select Add → Web API Controller Class (v2). The Specify Name for Item dialog box is displayed.

Step 8

- Type ValuesController in the Item name text box.

Step 9

- Click OK. Visual Studio 2013 adds an API controller named ValuesController in the Controllers directory.

Step 10

- To test the Web API Service, select Debug → Start Without Debugging. The browser displays the home page of the application.

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Authentication and Authorization in an ASP.NET Web API Service 4-5

Step 11

- Type the following URL in the address bar of the browser to access the ASP.NET Web API service: `http://localhost:3476/api/values`

Step 12

- Close the browser.

Step 13

- In Visual Studio 2013, double-click `ValuesController.cs` file under the Controllers directory to open in Code Editor.

Step 14

- Add the `[Authorize]` attribute to the `Get()` method.

Step 15

- To test whether the `Get()` method of the Web API Service requires authorization, select Debug → Start Without Debugging. The browser displays the home page of the application.

Step 16

- Type the following URL at the address bar of the browser to access the ASP.NET Web API service: `http://localhost:3476/api/values`

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Authentication and Authorization in an ASP.NET Web API Service 5-5

Register with the application and then log in to access the Web API service.

Steps to register with the application are:

Step 1

- Click the Register hyperlink. The Register page is displayed.

Step 2

- Type Andy in the User name text box and pass@123 in the Password and Confirm Password text boxes.

Step 3

- Click Register. Once you have registered with the application, type the following URL to access the ASP.NET Web API service:
`http://localhost:3476/api/values`

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Using slide 57, explain the steps to secure an ASP.NET Web API service.

In step 1, open Visual Studio 2013.

In step 2, select **File → New → Project**. The **New Project** dialog box is displayed.

In step 3, select **Web** under the Installed section and then, select the **ASP.NET Web Application** template.

In step 4, in the **Name** text box, type **SecureService** and click **OK**. The **New ASP.NET Project – Secure Service** dialog box is displayed.

In step 5, from the **Select a template** section, select **MVC** and then, select the **Web API** check box.

Using slide 58, tell that the figure shows the **New ASP.NET Project – Secure Service** dialog box.
Using slide 59, explain the next steps.

In step 6, click **OK**. Visual Studio 2013 creates the project and adds an `AccountController` controller class to the project. The `AccountController` class is responsible for implementing authentication in the application.

In step 7, in the Solution Explorer window, right-click the **Controllers** folder and select **Add → Web API Controller Class (v2)**. The **Specify Name for Item** dialog box is displayed.

In step 8, type `ValuesController` in the Item name text box.

In step 9, click OK. Visual Studio 2013 adds an API controller named `ValuesController` in the **Controllers** directory.

In step 10, to test the Web API Service, select **Debug → Start without Debugging**. The browser displays the home page of the application.

Using slide 60, explain the next steps.

In step 11, type the following URL in the Address bar of the browser to access the ASP.NET Web API service <http://localhost:3476/api/values>

In step 12, close the browser.

In step 13, in Visual Studio 2013, double-click `ValuesController.cs` file under the **Controllers** directory to open in code Editor.

In step 14, add the **Authorize** attribute to the `Get ()` method as shown in code snippet.

In step 15, to test whether the `Get ()` method of the Web API Service requires authorization, select **Debug → Start Without Debugging**. The browser displays the home page of the application.

In step 16, type the following URL at the Address bar of the browser to access the ASP.NET Web API service <http://localhost:3476/api/values>

Using slide 61, explain that you will need to register with the application and then log in to access the Web API service. In order to register with the application,

In step 1, click the **Register** hyperlink. The Register page is displayed.

In step 2, type **Andy** in the **UserName** text box and type **pass@123** in the **Password** and **Confirm password** text boxes.

In step 3, click **Register**. Once you have registered with the application, type the following URL to access the ASP.NET Web API service <http://localhost:3476/api/values>

Mention that the application authenticates the request and authorizes it to access the ASP.NET Web API service.

Additional Information:

To know more about authenticating an ASP.NET Web API service, visit the following links:

<http://www.asp.net/web-api/overview/security>

<http://www.asp.net/web-api/overview/security/authentication-and-authorization-in-aspnet-web-api>

<http://www.dotnet-tricks.com/Tutorial/webapi/E3K8220314-Securing-ASP.NET-Web-API-using-Basic-Authentication.html>

In-Class Question:

After you finish explaining designing and implementing an ASP.NET Web API service, you will ask students an In-Class question. This will help you in reviewing their understanding of the topic.



Explain what happens when you create an ASP.NET Web API service in Visual Studio 2013.

Answer:

When you create an ASP.NET Web API service in Visual Studio 2013, the Integrated Development Environment (IDE) creates a skeleton application with a default directory structure. This directory structure contains the basic ASP.NET Web API components, such as a controller, route configurations, and the reference libraries.

Slide 62

Let us summarize the session.



The slide has a blue header bar with the word "Summary" in white. Below the header is a white content area containing a bulleted list of eight points. At the bottom of the slide, there is a small footer with the text "© Aptech Limited" and "Enterprise Application Development Using Windows Azure and Web Services Session 3".

- ❑ ASP.NET Web API is a .NET Framework technology to create Web services for different types of clients.
- ❑ ASP.NET Web API is an implementation of RESTful service that removes the complexities of creating Web services by relying purely on HTTP.
- ❑ HTTP is the standard protocol for communication over the Web.
- ❑ REST is a service architecture where each request URL is unique and points to a specific resource.
- ❑ Media type is a standard to identify the type of data being exchanged over the Internet between the browser and the server.
- ❑ In an ASP.NET Web API service, the routing framework is responsible to match request URI against one of the route templates defined in the WebApiConfig.cs file.
- ❑ Authentication and authorization are two mechanisms to secure ASP.NET Web API services.

Using slide 62, you will summarize the session. You will end the session, with a brief summary of what has been taught in the session.

Tell the students pointers of the session. This will be a revision of the current session and it will be related to the next session. Explain each of the following points in brief. Tell them that:

- ASP.NET Web API is a .NET framework technology to create Web services for different types of clients.
- ASP.NET Web API is an implementation of RESTful service that removes the complexities of creating Web services by relying purely on HTTP.
- HTTP is the standard protocol for communication over the Web.
- REST is a service architecture where each request URL is unique and points to a specific resource.
- Media type is a standard to identify the type of data being exchanged over the Internet between the browser and the server.
- In an ASP.NET Web API service, the routing Framework is responsible to match request URI against one of the route templates defined in the WebApiConfig.cs file.
- Authentication and authorization are two mechanisms to secure ASP.NET Web API services.

3.3 Post Class Activities for Faculty

You should familiarize yourself with the topics of the next session.

Tips: You can also check the Articles/Blogs/Expert Videos uploaded on the OnlineVarsity site to gain additional information related to the topics covered in the next session. You can also connect to online tutors on the OnlineVarsity site to ask queries related to the sessions.

Session 4 – Hosting and Consuming ASP.NET Web API Services

4.1 Pre-Class Activities

Before you commence the session, you should familiarize yourself with the topics of this session in-depth. You should revisit topics of the previous session for a brief review. Here, you can ask students the key topics they can recall from previous session. Prepare a question or two, which will be a key point to relate the current session objectives.

The summary of the previous session is as follows:

- ASP.NET Web API is a .NET Framework technology to create Web services for different types of clients.
- ASP.NET Web API is an implementation of RESTful service that removes the complexities of creating Web services by relying purely on HTTP.
- HTTP is the standard protocol for communication over the Web.
- REST is a service architecture where each request URL is unique and points to a specific resource.
- Media type is a standard to identify the type of data being exchanged over the Internet between the browser and the server.
- In an ASP.NET Web API service, the routing Framework is responsible to match request URI against one of the route templates defined in the WebApiConfig.cs file.
- Authentication and authorization are two mechanisms to secure ASP.NET Web API services.

4.1.1 Objectives

By the end of this session, the learners will be able to:

- Define and describe how to host and manage a Web API service
- Explain how to consume a Web API service
- Explain how to host a Web API service in a Windows Azure worker role
- Define and describe the best practices to employ while developing Web API services

4.1.2 Teaching Skills

To teach this session successfully, you should be aware of how to host and manage a Web API service. Also, familiarize yourself with how to consume a Web API service and how to host a Web API service in a Windows Azure worker role and the best practices to employ while developing Web API services.

For teaching in the class, you are expected to use slides and LCD projectors.

Tips:

It is recommended that you test the understanding of the students by asking questions in between the class.

In-Class Activities:

Follow the order given here during In-Class activities.

Overview of the Session

Give the students a brief overview of the current session in the form of session objectives. Show the students slide 2 of the presentation.

The slide has a blue header bar with the title "Learning Objectives". Below the title is a cartoon illustration of a person sitting at a desk with a computer monitor, holding a book and a coffee cup. The main content area contains a bulleted list of learning objectives:

- Define and describe how to host and manage a Web API service
- Explain how to consume a Web API service
- Explain how to host a Web API service in a Windows Azure worker role
- Define and describe the best practices to employ while developing Web API services

At the bottom left is the copyright notice "© Aptech Limited" and at the bottom right is the slide number "2".

Tell them that they will be introduced to the concept of hosting and consuming ASP.NET Web API services. This session explains how an ASP.NET Web API service makes its services available to different types of clients. It also explains how to make these services accessible over the Web.

4.2 In-Class Explanations

Slide 3

Let us understand the process of hosting and managing a Web API service.

Hosting and Managing a Web API Service

- ❑ If an ASP.NET Web API service is part of a Web application, it needs to be hosted on a Web server, such as IIS.
- ❑ You can also:
 - Create a service and host the service in a self-hosted process, for example, a process that executes a console application.
 - Host ASP.NET Web services in a Windows Azure worker role.

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Use slide 3 to explain how to host ASP.NET Web API service on a Web server.

Then, explain the two ways to host an ASP.NET Web API service.

Explain that you can also create a service and host the service in a self-hosted process and you can also host ASP.NET Web services in a Windows Azure worker role.

Slides 4 to 10

Let us understand how to host a Web API service on IIS.

Hosting a Web API Service on IIS 1-7

- ❑ When you host an ASP.NET Web API service on a server, such as IIS:
 - The Web server is responsible for providing the runtime environment for the application to service client information.
 - The Web server provides several functionalities, such as;
 - Listeners that listen for incoming client requests at a specific port
 - Forwarding requests to the hosted application
 - Returning back the application response to the client

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Hosting a Web API Service on IIS 2-7

Following are the steps to host a Web API service in Visual Studio 2013:

- Step 1
 - Start Visual Studio 2013 in Administrator mode and create a Web API project named WebAPIIISHostingDemo in Visual Studio 2013.
- Step 2
 - Create a folder named WebAPIIISHostingDemo in the C:\inetpub\wwwroot folder.
- Step 3
 - Press the Windows+R key. The Run dialog box is displayed.

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Hosting a Web API Service on IIS 3-7

Step 4

- Type inetmgr in the Open text field and click OK.
- The Internet Information Services (IIS) Manager window is displayed.
- Following figure shows the Internet Information Services (IIS) Manager window.



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Hosting a Web API Service on IIS 4-7

Step 5

- Expand the connection node under the Connections pane.

Step 6

- Expand the Sites node.

Step 7

- Right-click the Default Web Site node under the Sites node and then, select Add Application. The Add Application dialog box is displayed.

Step 8

- In the Add Application dialog box, type WebAPIIISHostingDemo in the Alias text field and type C:\inetpub\wwwroot\WebAPIIISHostingDemo in the Physical path textfield.

Step 9

- Click OK in the Add Application dialog box. The WebAPIIISHostingDemo node is displayed under the Connection node of the Internet Information Services (IIS) Manager window.

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Hosting a Web API Service on IIS 5-7

Step 10 • Close the Internet Information Services (IIS) Manager window.

Step 11 • Right-click the WebAPIIISHostingDemo application in the Solution Explorer window of Visual Studio 2013 and then select Publish. The Publish Web dialog box is displayed.

Step 12 • From the Select or import a publish profile drop-down list, select the <New...> option. The New Profile dialog box is displayed.

Step 13 • Type WebAPIIISHostingDemo in the Profile name text field.

Step 14 • Click OK. The Publish Web dialog box is displayed. Ensure that Web Deploy is selected in the Publish method drop-down list.

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Hosting a Web API Service on IIS 6-7

Step 15 • In the Server text field, type localhost and in the Site name text field, type DefaultWebSite/WebAPIIISHostingDemo.

Step 16 • Click Validate Connection. When the connection is valid, a correct mark is displayed by the side of the Validate Connection button.

Step 17 • Click Next. The Publish Web dialog box is displayed.

Step 18 • Click Publish. The Output window of Visual Studio 2013 displays a message to indicate that the project has been successfully published.

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Hosting a Web API Service on IIS 7-7

Test the published application by typing following URL in the browser:
<http://localhost/WebAPIIISHostingDemo/api/values>

Following figure shows the response of the Web API service hosted on IIS:



The screenshot shows a Microsoft Edge browser window. The address bar contains the URL "http://localhost:10000/api/values". The main content area of the browser displays the JSON array ["value1", "value2"].

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Using slide 4, explain that when you host an ASP.NET Web API service on a server, such as IIS, the Web server is responsible for providing the runtime environment for the application to service client information.

Tell them about functionalities provided by the Web server.

Explain that the functionalities include:

- HTTP listeners that listen for incoming client requests at a specific port.
- Forwarding requests to the hosted application.
- Returning back the application response to the client.

Using slide 5, explain to the students that they need to first start Visual Studio 2013 in **Administrator** mode and create a Web API project named **WebAPIIISHostingDemo** in Visual Studio 2013. Then, create a folder named **WebAPIIISHostingDemo** in the **C:\inetpub\wwwroot** folder. After this, they need to press the **Windows logo+R** key so that the **Run** box is displayed.

In slide 6, explain to the students that they need to type **inetmgr** in the **Run** box and click **OK**. This displays the Internet Information Services (IIS) Manager window.

Also, tell that the figure on slide 6 shows the Internet Information Services (IIS) Manager window.

Using slide 7, explain that the students need to expand the connection node under the **Connections** pane. Then, they need to expand the **Sites** node. After this, right-click the **Default Web Site** node under the **Sites** node and then, select **AddApplication** so that the **AddApplication** dialog box is displayed.

Next, to go to the **Add Application** dialog box, and type **WebAPIIISHostingDemo** in the **Alias** text box and type **C:\inetpub\wwwroot\WebAPIIISHostingDemo** in the **Physical path** text box.

After this, click **OK** in the **Add Application** dialog box. You will now see the **WebAPIIISHostingDemo** node displayed under the **Connection** node of the **Internet Information Services (IIS) Manager** window.

Using slide 8, tell the students to close the IIS Manager window. Then, right-click the **WebAPIIISHostingDemo** application in the Solution Explorer window of Visual Studio 2013 and then, select **Publish**. The **Publish Web** dialog box is displayed.

Next, select or import a publish profile drop-down list, select the **<New...>** option. The **New Profile** dialog box is displayed. Then, type **WebAPIIISHostingDemo** in the **Profile name** text box and click **OK**. The Publish Web dialog box is displayed.

Tell them that they need to ensure that **Web Deploy** is selected in the **Publish** method drop-down list.

Using slide 9, tell the students that in the **Server** text box, they need to type localhost and in the **Site name** text box, type **Default Web Site/WebAPIIISHostingDemo**.

Next, tell them to click **Validate Connection** and then, click **Next**. The **Publish Web** dialog box is displayed. You need to now click **Publish**. The Output window of Visual Studio 2013 displays a message to indicate that the project has been successfully published.

Using slide 10, tell that you can test the published application by typing the following URL at the Address bar of the browser:

<http://localhost/WebAPIIISHostingDemo/api/values>

Also, tell that the figure on slide 10 shows the response of the Web API service hosted on IIS.

Additional Information:

To know more about hosting on IIS, visit the following links:

<http://www.codeproject.com/Articles/702747/A-Beginners-Tutorial-on-ASP-NET-WebApi-Hosting-IIS>

<http://www.developer.com/net/asp/self-hosting-an-asp.net-web-api.html>

<http://www.asp.net/web-api/overview/hosting-aspnet-web-api>

Slides 11 to 13

Let us understand how to self-host a Web API service.

Self-Hosting a Web API Service 1-3

- For a standalone Web API service, you do not require a Web server, such as IIS to host the service.
- You can create a host process and self-host the Web API service on it.
- For example:
 - You have the flexibility to self-host a Web API service on a host process that runs a console application.
 - To self-host a Web API service, you can use Open Web Interface for .NET (OWIN) that acts as an interface between Web servers and .NET applications.

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The image shows two slides from a presentation. The top slide is titled "Self-Hosting a Web API Service 2-3" and contains a section titled "□ OWIN:" with two bulleted lists. The left list describes OWIN's role in receiving client requests and routing them to appropriate controllers. The right list defines OWIN as an open API enabling pluggability. The bottom slide is titled "Self-Hosting a Web API Service 3-3" and contains a section titled "□ In order to self-host a Web API service using OWIN, you need to:" with two steps: creating a Web API service as a console application and starting the OWIN host. Both slides include the copyright notice "© Aptech Ltd." and the title "Enterprise Application Development Using Windows Azure and Web Services/Session 4". A large watermark reading "For Aptech Centre Only" is diagonally across the slides.

Self-Hosting a Web API Service 2-3

□ OWIN:

- Abstracts the functionalities for receiving requests from client.
- Routes it to the appropriate Web API controller.
- Returns the response to the client.

- Defines an open API that enables you to build Web applications over a hosting platform by providing an architecture that is structured well and supports pluggability.

Self-Hosting a Web API Service 3-3

□ In order to self-host a Web API service using OWIN, you need to:

- Create a Web API service as a console application and configure it for self-hosting.
- Start the OWIN host in order to consume the service.

Using slide 11, explain the students that for a standalone Web API service, you do not require a Web server, such as IIS to host the service.

Tell that you can create a host process and self-host the Web API service on it.

Tell the students to consider the following example. Tell that you can self-host a Web API service on a host process that runs a console application. This can be done by using Open Web Interface for .NET (OWIN) that acts as an interface between Web servers and .NET applications.

Using slide 12, explain OWIN. Tell the students that OWIN receives requests from client, routes it to the appropriate Web API controller and returns the response to the client.

Also, mention that OWIN defines an open API enabling you to build Web applications over a hosting platform. It also provides an architecture that is structured well and supports pluggability.

Using slide 13, explain to the students that to self-host a Web API service using OWIN, they need to first create a Web API service as a console application and configure it for self-hosting. Then, you need to start the OWIN host in order to consume the service.

Additional Information:

To know more about OWIN and self-hosting, visit the following links:

<http://owin.org/>

<http://coding.abel.nu/2014/05/whats-this-owin-stuff-about/>

<http://www.asp.net/web-api/overview/hosting-aspnet-web-api/use-owin-to-self-host-web-api>

<http://www.c-sharpcorner.com/UploadFile/vendettamit/self-hosting-owin-and-Asp-Net-webapi/>

Slides 14 to 17

Let us understand how to create and configure a standalone Web API service.

Creating and Configuring a Standalone Web API Service 1-4

□ Steps to create a standalone Web API service using Visual Studio 2013 are:

- Step 1 Open Visual Studio 2013 in **Administrator mode**.
- Step 2 Click **File** → **New** → **Project**. The **New Project** dialog box is displayed.
- Step 3 Expand the **Installed** → **Templates** → **Visual C# node** and select **Windows** on the left pane of the **New Project** dialog box. On the right pane, select **Console Application**.
- Step 4 Type **WebAPIHostingDemo** in the **Name** text field.

Creating and Configuring a Standalone Web API Service 2-4

- Step 5 Click **OK**. The **Solution Explorer** window displays the newly created **WebAPIHostingDemo** project.
- Step 6 From the **Tools** menu, click **Library Package Manager** and then, click **Package Manager Console**.
- Step 7 Enter the following command in the **Package Manager Console** window: `Install-Package Microsoft.AspNet.WebApi.OwinSelfHost`. This command starts the OWIN installation.
- Step 8 In **Solution Explorer**, right-click the project and select **Add** → **Class** to add a new class.
- Step 9 Type **StartupService.cs** in the **Name** text field. In the **StartupService** class, add a **Configuration()** method that accepts an **IAppBuilder** object. This object is responsible for providing a host to an application.

Creating and Configuring a Standalone Web API Service 3-4

Following code shows the `StartupService` class:

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Text;
using System.Threading.Tasks;
using System.Web.Http;
using Owin;
namespace WebAPIHostingDemo
{
    class StartupService
    {
        public void Configuration(IAppBuilder appBuilder)
        {
            HttpConfiguration config = new HttpConfiguration();
            config.Routes.MapHttpRoute(name: "OwinApi",
                routeTemplate: "down/{controller}/{id}",
                defaults: new { id = RouteParameter.Optional });
        }
        appBuilder.UseWebApi(config);
    }
}
```

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Creating and Configuring a Standalone Web API Service 4-4

In this code:

- The `Configuration()` method creates an `HttpConfiguration` object that represents a configuration of an HTTP server.
- The `MapHttpRoute()` method is used to map a request URL to a route template defined by the `routeTemplate` parameter.
- The `UseWebApi()` method of the `IAppBuilder` object is called passing the initialized `HttpConfiguration` object as parameter.

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Using slide 14, explain the students the steps to create a standalone Web API service using Visual Studio 2013. You need to first launch Visual Studio 2013 in Administrator mode. After that, click **File → New → Project**. You will see the **New Project** dialog box being displayed.

Then, expand the **Installed → Templates → Visual C#** node and select **Windows** on the left pane of the **New Project** dialog box. On the right pane, select **Console Application**. Next, type **WebAPIHostingDemo** in the **Name** text box.

Using slide 15, continue explaining the students the steps to create a standalone Web API service using Visual Studio 2013. They need to click **OK**. This displays the newly created **WebAPIHostingDemo** project. Go to **Tools** menu, click **Library Package Manager**, and then click **Package Manager Console**. Now, enter the following command in the Package Manager Console window:

```
Install-Package Microsoft.AspNet.WebApi.OwinSelfHost
```

By doing this, the command starts the OWIN installation. In Solution Explorer, right-click the project and select **Add → Class** to add a new class.

You will then type `StartupService.cs` in in the **Name** text box. In the `StartupService` class, add a `Configuration()` method that accepts an `IAppBuilder` object. This object is responsible for providing a host to an application.

Using slide 16, tell the students that the code shows the `StartupService` class.

Using slide 17, explain the code to the students. Explain that in this code, the `Configuration()` method creates an `HttpConfiguration` object that represents a configuration of an HTTP server. The `MapHttpRoute()` method is used to map a request URL to a route template defined by the `routeTemplate` parameter. Finally, the `UseWebApi()` method of the `IAppBuilder` object is called passing the initialized `HttpConfiguration` object as parameter.

Additional Information:

To know more about creating and configuring a standalone Web API service, visit the following link:

<http://www.dotnetcurry.com/showarticle.aspx?ID=896>

Slides 18 and 19

Let us understand adding the Web API controller.

The slide has a blue header bar with the title "Adding the Web API Controller 1-2". Below the header, there is a bulleted list of instructions:

- You should add a Web API controller that will implement the service and provide the response, after successful installation of OWIN and configuration of the host for a Web API service.
- Steps to add a Web API controller in Visual Studio 2013 are:
 - Right-click the `WebAPIHostingDemo` project in the Projects Solution and select **Add → Class**. The `Add New Item – WebAPIHostingDemo` dialog box appears.
 - Type `WAController` in the **Name** field and click the **Add** button.
 - In the `WAController` class, add the HTTP methods to handle requests.

At the bottom left of the slide, there is a vertical icon with three colored arrows pointing downwards, labeled "Step 1", "Step 2", and "Step 3". At the bottom right, there is some small text: "© Aptech Ltd.", "Enterprise Application Development Using Windows Azure and Web Services/Session 8", and "38".

Adding the Web API Controller 2-2

Following code snippet shows the WAController class:

```
using System.Collections.Generic;
using System.Linq;
using System.Text;
using System.Threading.Tasks;
using System.Web.Http;
namespace WebAPIHostingDemo
{
    public class WAController : ApiController
    {
        public IEnumerable<string> Get()
        {
            return new string[] { "Henry", "Mark", "Mary" };
        }
    }
}
```

In this code:

- The WAController class extends the ApiController class and provides a Get() method.
- This method returns a string array as an IEnumerable object.

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Using slide 18, explain to the students that after installing OWIN and configuring the host for a Web API service, you need to add a Web API controller to implement the service and provide the response. After this, to add a Web API controller in Visual Studio 2013, you need to first right-click the **WebAPIHostingDemo** project in the Projects Solution and select **Add → Class**. The **Add New Item – WebAPIHostingDemo** dialog box appears.

Now, type **WAController** in the **Name** box and click the **Add** button and add the HTTP methods to handle requests.

Using slide 19, explain the code to the students. In this code, the WAController class extends the ApiController class and provides a Get() method. This method returns a string array as an IEnumerable object.

In-Class Question:

After you finish explaining hosting and managing a Web API service, you will ask the students an In-Class question. This will help you in reviewing their understanding of the topic.



Describe the role of OWIN.

Answer:

OWIN abstracts the functionalities for receiving requests from client, routing it to the appropriate Web API controller, and returning the response to the client. It also defines an open API that enables to build Web applications over a hosting platform by providing an architecture that is structured well and supports pluggability.

Slides 20 to 23

Let us understand how to consume the Web API service.

Consuming the Web API Service 1-4

To consume the Web API service, you need to:

- Start the OWIN host and send an asynchronous request to the service.
- Update the Main() method of the Program class in the WebAPIDemo project that Visual Studio 2013 creates for you by default.
- Implement the functionality in the Main() method to start the OWIN host, access the Web API service, and print out the response of the service.

Consuming the Web API Service 2-4

Following code snippet shows the Program class:

```
using Microsoft.Owin.Hosting;
using System;
using System.Collections.Generic;
using System.Linq;
using System.Net.Http;
using System.Text;
using System.Threading.Tasks;

namespace WebAPIDemo
{
    class Program
    {
        static void Main(string[] args)
        {
            WebApp.Start<StartupService>(url: "http://localhost:9095/");
            HttpClient client = new HttpClient();
            Task<HttpResponseMessage>
            respclient.GetAsync("http://localhost:9095/owin/WA");
            var response = resp.Result;
            Task<string> respMessageResponseContentReadAsStringAsync();
            Console.WriteLine(response);
            Console.WriteLine(respMessage.Result);
            Console.ReadLine();
        }
    }
}
```

Consuming the Web API Service 3-4

In this code:

- The Main() method specifies a base address to access the Web API service.
- Then, it calls the WebApp.Start<StartupService>() method to use a StartupService object for starting the service at the base URL passed as parameter.
- Next, the GetAsync() method of the HttpClient class is called passing the Web API service URL as a string.
- This method returns a Task<HttpResponseMessage> object that represents an asynchronous operation returning an HTTP response message as an HttpResponseMessage object.
- Finally, the response is retrieved by a call to the ReadAsStringAsync() method and the response object along with the response result is displayed as output.

Consuming the Web API Service 4-4

Following figure shows the response of the Web API service:

```
C:\Windows\system32\cmd.exe
curl http://localhost:2000/api/Books
[{"id": 1, "name": "Henry"}, {"id": 2, "name": "Mark"}, {"id": 3, "name": "Nancy"}]
```

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Using slide 20, tell the students that after learning how to create and configure a standalone Web API service and add an API controller to it, you will now learn how to consume the Web API service. To consume the Web API service you need to start the OWIN host and send an asynchronous request to the service. Then, you need to update the `Main()` method of the `Program` class in the **WebAPIDemo** project that Visual Studio 2013 creates for you by default. In the `Main()` method, you need to implement the functionality to start the OWIN host, access the Web API service, and print out the response of the service.

Using slide 21, tell that the code shows the `Program` class.

Using slide 22, explain the code to the students.

Explain that in this code, the `Main()` method specifies a base address to access the Web API service. Then, the `Main()` method calls the `WebApp.Start<StartupService>()` method to use a `StartupService` object for starting the service at the base URL passed as parameter. Next, the `GetAsync()` method of the `HttpClient` class is called passing the Web API service URL as a string.

Mention that this method returns a `Task<HttpResponseMessage>` object that represents an asynchronous operation that can return an HTTP response message as an `HttpResponseMessage` object. Finally, the response is retrieved by a call to the `ReadAsStringAsync()` method and the response object along with the response result is displayed as output.

Using slide 23, explain the code that demonstrates how that the figure on slide 23 shows the response of the Web API service.

Additional Information:

To know more about consuming the Web API service, visit the following links:

<http://www.dotnet-tricks.com/Tutorial/webapi/VG9K040413-What-is-Web-API-and-why-to-use-it-.html>

<http://www.asp.net/web-api/overview/advanced/calling-a-web-api-from-a-net-client>

<https://henry416.wordpress.com/2013/12/19/consume-web-api-in-a-net-c-client/>

In-Class Question:

After you finish explaining consuming the Web API service, you will ask the students an In-Class question. This will help you in reviewing their understanding of the topic.



Explain how to consume the Web API service OWIN for a project named **WebAPIHostingDemo**.

Answer:

To consume the Web API service, you need to first start the OWIN host and send an asynchronous request to the service. Then, you need to update the `Main()` method of the `Program` class in the **WebAPIHostingDemo** project that Visual Studio 2013 creates for you by default. In the `Main()` method, you need to implement the functionality to start the OWIN host, access the Web API service, and print out the response of the service.

Slides 24 and 25

Let us understand how to host services in a Windows Azure worker role.

The diagram is titled "Hosting Services in a Windows Azure Worker Role 1-2". It features a blue header bar with the title. Below the header, there are two main sections: "Web role" and "Worker role".

- Web role:** Represented by a red circle. A callout box states: "Enables hosting Web application in IIS that are deployed across the datacenters of Microsoft."
- Worker role:** Represented by a green circle. A callout box states: "Enables hosting on any type of application, including ASP.NET Web API services."

On the right side of the slide, there is an illustration of a blue cloud containing a white document labeled "Cloud application".

At the bottom of the slide, there is footer text: "© Aptech Ltd.", "Enterprise Application Development Using Windows Azure and Web Services/Session 2", and "24".

Creating and Configuring a Windows Azure Project

Creating a Web API Controller

Configuring Service Endpoints

Accessing the Web API Service

Using slide 24, explain to the students that Windows Azure provides compute capabilities to help you to host applications in the cloud. Tell them that a compute acts as a container for Web and worker roles.

Next, tell them the function of the Web role and Worker role.

Explain that the Web role enables hosting Web application in IIS that are deployed across the datacenters of Microsoft.

Also, explain that the worker role enables hosting on any type of application, including ASP.NET Web API services.

Using slide 25, explain to the students that there are certain tasks required to host an ASP.NET Web API service in a Windows Azure worker role.

The tasks are:

- Creating and Configuring a Windows Azure project
- Creating a Web API controller
- Configuring service endpoints
- Accessing the Web API service

Additional Information:

To know more about hosting on IIS, visit the following link:

<http://www.asp.net/web-api/overview/hosting-aspnet-web-api/host-aspnet-web-api-in-an-azure-worker-role>

Slides 26 to 30

Let us understand creating and configuring a Windows Azure project.

Creating and Configuring a Windows Azure Project 1-5

Following are the steps to create and configure a Windows Azure project:

- Step 1 • Open Visual Studio 2013 in Administrator mode.
- Step 2 • Click File → New → Project. The New Project dialog box is displayed.
- Step 3 • Expand the Installed → Templates → Visual C# node and select Cloud on the left pane of the New Project dialog box. On the right pane, select Windows Azure Cloud Service.
- Step 4 • Type AzureServiceDemo in the Name text field in the New Project dialog box.
- Step 5 • Click OK. The New Windows Azure Cloud Service window is displayed.

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Creating and Configuring a Windows Azure Project 2-5

- Step 6 • Select Worker Role under the .NET Framework 4.5 roles section.
- Step 7 • Click the (>) button to add the selected role to the New Windows Azure Cloud Service solution section.
- Step 8 • Click OK. The Solution Explorer window displays the following two projects:
 - o AzureServiceDemo: Defines the roles and configuration for the Azure application.
 - o WorkerRole1: Contains the code for the worker role.
- Step 9 • Click Tools → Library Package Manager → Package Manager Console. The Package Manager Console window is displayed.
- Step 10 • Type the following command in the Package Manager Console window:
`Install-Package Microsoft.AspNet.WebApi.OwinSelfHost`

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Creating and Configuring a Windows Azure Project 3-5

- Step 11 • In Solution Explorer, right-click the WorkerRole1 project and select Add → Class. The Add New Item – WorkerRole1 dialog box is displayed.
- Step 12 • Type Startup.cs in the Name textfield.
- Step 13 • Click Add. The Code Editor displays the code of the Startup class.
- Step 14 • In the Startup class, add a Configuration () method to configure the application.

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Creating and Configuring a Windows Azure Project 4-5

Following code snippet shows the Startup class:

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Text;
using System.Threading.Tasks;
using System.Web.Http;

namespace WorkerRole1
{
    class Startup
    {
        public void Configuration(IAppBuilder appBuilder)
        {
            HttpConfiguration config = new HttpConfiguration();
            config.Routes.MapHttpRoute(
                name: "Default",
                routeTemplate: "{controller}/{id}",
                defaults: new { id = RouteParameter.Optional }
            );
            appBuilder.UseWebApi(config);
        }
    }
}
```

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Creating and Configuring a Windows Azure Project 5-5

In this code:

- A `HttpConfiguration` object is created to define a route named `Default` with the `{controller}/{id}` routing pattern where the `id` part is optional.

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Using slide 26, explain the steps to create and configure a Windows Azure project. Tell them that you need to first open Visual Studio 2013 in **Administrator** mode. Then, click **File → New → Project**. This displays the **New Project** dialog box.

Next, expand the **Installed → Templates → Visual C# node** and select **Cloud** on the left pane of the **New Project** dialog box.

You will now select **Windows Azure Cloud Service**, on the right pane. Then, type **AzureServiceDemo** in the **Name** text box in the **New Project** dialog box. Now, click **OK**. The **New Windows Azure Cloud Service** window is displayed.

Using slide 27, explain the steps to the students. You need to select **Worker Role** under the **.NET Framework 4.5 roles** section and click the **(>)** button to add the selected role to the **New Windows Azure Cloud Service** solution section.

When you click **OK**, the Solution Explorer window displays the following two projects:

- **AzureServiceDemo**: Defines the roles and configuration for the Azure application.
- **WorkerRole1**: Contains the code for the worker role.

After this, click **Tools → Library Package Manager → Package Manager Console**. You will see the **Package Manager Console** window.

Now, type the following command in the **Package Manager Console** window:

```
Install-Package Microsoft.AspNet.WebApi.OwinSelfHost
```

Using slide 28, explain remaining steps to the students. You will now go to Solution Explorer, right-click the **WorkerRole1** project and select **Add → Class**. The **Add New Item – WorkerRole1** dialog box is displayed. Now, type `Startup.cs` in the **Name** text box and click **Add**. This displays the code of the `Startup` class. Lastly, go to the `Startup` class and add a `Configuration()` method to configure the application.

Using slide 29, explain the code that demonstrates the `Startup` class.

Using slide 30, explain the code that demonstrates how a `HttpConfiguration` object is created to define a route, named `Default` with the `{controller}/{id}` routing pattern where the `id` part is optional.

Slides 31 to 34

Let us understand creating a Web API controller.

Creating a Web API Controller 1-4

- After creating the `Startup` class, you need to add a Web API controller class.
- Following are the steps to add a Web API controller class:
 - Step 1** • Right-click the `WorkerRole1` project and select **Add → Class**. The **Add New Item – WorkerRole1** dialog box is displayed.
 - Step 2** • Type `TestController.cs` in the **Name** field and click the **Add** button.
 - Step 3** • In the `TestController.cs` class, add the HTTP methods to handle requests.

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Creating a Web API Controller 2-4

- Following code snippet shows the TestController class:

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Text;
using System.Threading.Tasks;
using System.Web.Http;

namespace WorkerRole1 {
    class TestController : ApiController {
        public IEnumerable<string> Get() {
            return new string[] { "Laptop", "Desktop", "Mobile", "Printer",
                "PC" };
        }
    }
}
```

- In this code:

- The Get () method of the controller returns a string array.

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Creating a Web API Controller 3-4

Step 4

- In the Solution Explorer, double-click the WorkerRole.cs file.
- In the WorkerRole class, override the OnStart () method of the RoleEntryPoint class. The OnStart () method is called to initialize a worker role object.

- Following code snippet shows the WorkerRole class:

```
using System;
using System.Collections.Generic;
using System.Diagnostics;
using System.Linq;
using System.Net;
using System.Threading;
using Microsoft.WindowsAzure;
using Microsoft.WindowsAzure.Diagnostics;
using Microsoft.WindowsAzure.ServiceRuntime;
using Microsoft.WindowsAzure.Storage;
using Microsoft.Owin.Hosting;
namespace WorkerRole1
    public class WorkerRole : RoleEntryPoint {
        private IDisposable _app = null;
    }
```

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Creating a Web API Controller 4-4

```
public override void Run() {
    Trace.TraceInformation("WorkerRole entry point called");
    while (true) {
        Thread.Sleep(10000);
        Trace.TraceInformation("Working");
    }
}

public override bool OnStart() {
    ServicePointManager.DefaultConnectionLimit = 12;
    var testEndpoint =
        RoleEnvironment.CurrentRoleInstance.InstanceEndpoints["TestEndpoint"];
    string baseUri = String.Format("{0}://{1}/test",
        testEndpoint.Protocol, testEndpoint.IPEndpoint);
    _app = WebApp.Start(new StartOptions(url: baseUri));
    returnbase.OnStart();
}
```

- This code overrides the OnStart () method of the RoleEntryPoint class.

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Using slide 31, explain that once you have created the Startup class, you need to add a Web API controller class. Explain the steps to create a Startup class to the students.

Tell them that they need to first right-click the **WorkerRole1** project and select **Add → Class**. This displays the **Add New Item – WorkerRole1** dialog box. Next, type **TestController.cs** in the **Name** box and click the **Add** button. Lastly, go to the **TestController** class and add the HTTP methods to handle requests.

Using slide 32, explain the code that shows the **TestController** class.

Explain that in this code, the `Get ()` method of the controller returns a string array.

Using slide 33, explain the next step. Go to the **Solution Explorer** and double-click the **WorkerRole.cs** file. Then, you need to go to the **WorkerRole** class and override the `OnStart()` method of the **RoleEntryPoint** class. The `OnStart()` method is called to initialize a worker role object.

Then, explain the code snippet that shows the **WorkerRole** class.

Using slide 34, explain the code that demonstrates how the code overrides the `OnStart()` method of the **RoleEntryPoint** class.

Slides 35 and 36

Let us understand how to configure service endpoints.

The slide has a blue header bar with the title "Configuring Service Endpoints 1-2". Below the header, there is a bulleted list:

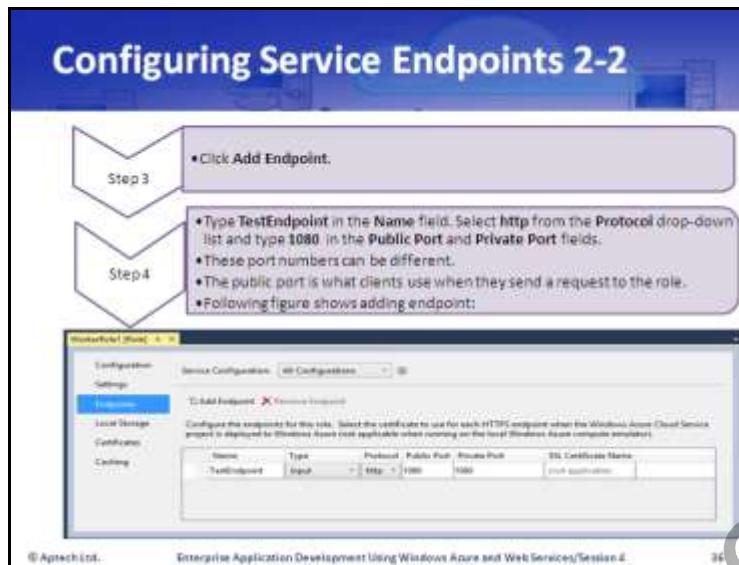
- After creating the Web API controller, you configure the service endpoint using these steps:

Step 1: In the Solution Explorer window, expand the AzureServiceDemo node. The Roles node is displayed.

Step 2: Right-click WorkerRole1 under Roles and select Properties from the context menu that appears. Visual Studio 2013 displays the properties of the AzureServiceDemo project.

Click Endpoints.

At the bottom of the slide, there is some small text: © Aptech Ltd., Enterprise Application Development Using Windows Azure and Web Services/Session 4, and a page number 35.



Using slide 35, explain to the students that once you have created the Web API controller, you need to configure the service endpoint. Explain to them the steps to configure the service endpoint in Visual Studio 2013.

First you need to go to the Solution Explorer window to expand the **AzureServiceDemo** node. The Roles node is displayed.

Now, right-click **WorkerRole1** under **Roles** and select **Properties** from the context menu that appears. Visual Studio 2013 displays the properties of the **AzureServiceDemo** project. You need to now click **Endpoints**.

Using slide 36, explain the remaining steps to the students.

You need to then type **TestEndpoint** in the **Name** box, select **http** from the **Protocol** drop-down list and type **1080** in the **Public Port** and **Private Port** boxes.

Explain that these port numbers can be different. The public port is what clients use when they send a request to the role.

Tell that the figure on slide 36 shows adding endpoint.

Slide 37

Let us understand how to access the Web API service.



Accessing the Web API Service

- ❑ After configuring the service endpoint, you can access the Web API service.
- ❑ Following are the steps to access the Web API service:
 1. Click Build → Build Solution.
 2. Click Debug → Start Debugging. The Azure Compute Emulator assigns 127.0.0.1 as the IP address of the endpoint and 1080 as the port number that you specified while configuring the service endpoint.

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Using slide 37, explain that once you have configured the service endpoint, you can access the Web API service. Explain the steps to access the Web API service.

Firstly, click **Build → Build Solution** and then, click **Debug → Start Debugging**.

You will see that the Azure compute emulator assigns 127.0.0.1 as the IP address of the endpoint and 1080 as the port number that you specified while configuring the service endpoint.

Additional Information:

To know more about hosting services in a Windows Azure worker role, visit the following links:

<http://www.davidmakogon.com/2011/02/azure-tip-overload-your-web-role-for.html>

<http://www.troyhunt.com/2014/01/with-great-azure-vm-comes-great.html>

<http://www.wadewegner.com/2010/11/significant-updates-released-in-the-bidnow-sample-for-windows-azure/>

In-Class Question:

After you finish explaining hosting services in a Windows Azure worker role, you will ask the students an In-Class question. This will help you in reviewing their understanding of the topic.



Differentiate between Web role and worker role.

Answer:

The Web role enables hosting Web application in IIS that are deployed across the datacenters of Microsoft. On the other hand, the worker role enables hosting on any type of application, including ASP.NET Web API services.

Slide 38

Let us understand best practices for HTTP services using ASP.NET Web API.

Best Practices for HTTP Services Using ASP.NET Web API

❑ Some industry-proven and tested best practices that should be applied when creating HTTP services using ASP.NET Web API are:

- ✓ Create a Simple Controller
- ✓ Use Models
- ✓ Use Attribute Routing

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Using slide 38, explain to the students that there are several industry-proven and tested best practices that you should apply when creating HTTP services using ASP.NET Web API.

Mention some of the key best practices such as:

- Create simple controller
- Use models
- Use attribute routing

Slides 39 and 40

Let us understand how to create a simple controller.

Create a Simple Controller 1-2

- ❑ It is recommended to keep the controller as simple as possible.
- ❑ For example:
 - You should try to separate data access code using data access technology, such as Entity Framework from the controller to a data access service.
 - As a result, you will not require updating data access code of each controller when the data source of the application changes.
 - You will only need to update the data access service implementation and the application can use the new data source, thereby significantly decreasing maintenance and code changes in the application.

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Create a Simple Controller 2-2

- ❑ Following code snippet shows a controller that uses an implementation of an application-specific `IDataService` interface to access data stored in a data store:

```
public class ProductsController : ApiController
{
    private readonly IDataService DataService;
    public ProductController(IDataService DataService)
    {
        this.DataService = DataService;
    }
    public IEnumerable<ProductModel> Get()
    {
        return DataService.AllProducts().AsModel();
    }
}
```
- ❑ In this code:
 - The controller is initialized with an `IDataService` implementation. In the `Get()` method, the controller uses the `IDataService` implementation to retrieve and return the records of all products that the `ProductModel` object represents.

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Using slide 39, explain how to keep the controller simple.

Explain with an example. Tell the students that you should try to separate data access code using data access technology, such as Entity Framework from the controller to a data access service.

Mention that by doing this; you will not require updating data access code of each controller when the data source of the application changes.

You need to update the data access service implementation and the application can use the new data source. This will decrease the maintenance and code changes in the application.

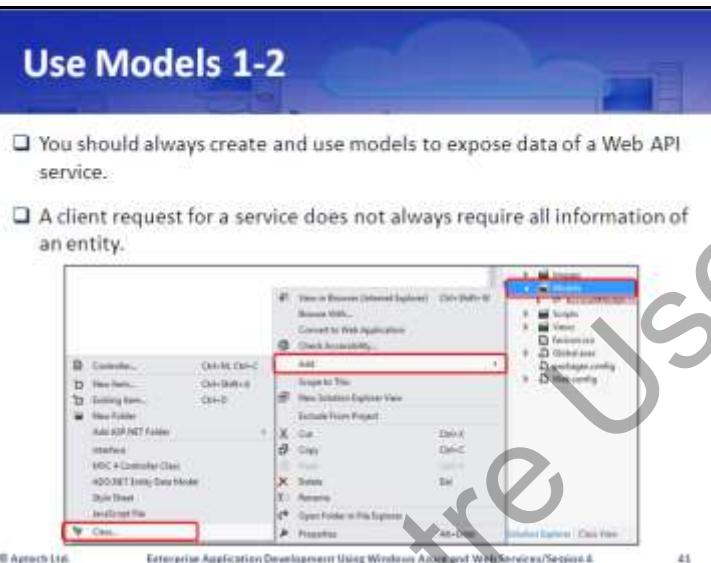
Using slide 40, tell that the code demonstrates how a controller uses an implementation of an application-specific `IDataService` interface to access data stored in a data store.

Explain the code.

Tell that in this code, the controller is initialized with an `IDataService` implementation. In the `Get()` method, the controller uses the `IDataService` implementation to retrieve and return the records of all products that the `ProductModel` object represents.

Slides 41 and 42

Let us understand use models.



The screenshot shows the 'Add' option highlighted in the context menu of the Solution Explorer. The menu also includes options like 'View in Browser (F5/F12)', 'Convert to Web Application', 'Check Accessibility', 'Scope to This', 'New Solution Explorer View', 'Exclude from Project', 'Cut (Ctrl+X)', 'Copy (Ctrl+C)', 'Paste (Ctrl+V)', 'Delete (Shift+Delete)', 'Rename', 'Open Folder in This Explorer', and 'Properties'.

Use Models 1-2

- You should always create and use models to expose data of a Web API service.
- A client request for a service does not always require all information of an entity.

Use Models 2-2

- For example:
 - A client might request only the product category and price for a particular product.
 - You should ensure that your service provides only the specific information instead of returning all the details of the product.
 - This can be achieved by creating a `Product` model with public properties that should be made accessible to clients.
 - Similarly, you should ensure that your service does not expose potentially sensitive information.
 - In such situations, you should create a model to represent the information that the service returns instead of returning all data that includes the sensitive data to the client.

Using slide 41, explain to the students that care should be taken to always create and use models to expose data of a Web API service. A client request for a service does not always require all information of an entity.

Using slide 42, explain with an example.

Tell that a client might request only the product category and price for a particular product.

Therefore, care should be taken to provide specific information instead of returning all the details of the product. You can achieve this by creating a product model with public properties that make it accessible to clients.

Mention that your services does not expose potentially sensitive information. In such situations, you should create a model to represent the information that the service returns instead of returning all data that includes the sensitive data to the client.

Slides 43 to 47

Let us understand using attribute routing.

The image shows two slides from a presentation. Both slides have a blue header bar with the title 'Use Attribute Routing' followed by a number (1-5 or 2-5). The first slide's header is partially obscured by a large watermark reading 'For Aptech Centre Use Only'. The second slide's header is also partially obscured by the watermark. The content of both slides is identical, listing pros and cons of attribute routing.

Use Attribute Routing 1-5

- ❑ In ASP.NET Web API applications:
 - It is common to use convention-based routing where you register routes with the ASP.NET Routing Framework using the `WebApiConfig.cs` file.
- ❑ ASP.NET Web API 2 introduces:
 - Attribute routing that allows you to explicitly define routes for a controller and its actions.

Use Attribute Routing 2-5

- ❑ When you work on a large scale project being developed by multiple developers:
 - You should consider using attribute routing.
 - As attribute routing is directly applied to controllers and actions, it becomes simpler and intuitive for developers to understand how to individually call and test actions and controller.
 - As the number of routes in the application increases, the task to manage the routes in the route table becomes cumbersome and error prone.
 - You can use attribute routing by applying the `RoutePrefix` attribute to the controller. This attribute specifies a common prefix for an entire controller.
- ❑ Following code snippet shows applying the `RoutePrefix` attribute to a controller:

```
[RoutePrefix("api/customers")]
public class CustomersController : ApiController
```

Use Attribute Routing 3-5

- ❑ When you use the `RoutePrefix` attribute on a controller, the action methods of the controller inherit the route prefix as the beginning of their route.
- ❑ You can apply attribute routing in an action method by applying the `Route` attribute.
- ❑ The value specified for the `Route` attribute will follow the value specified for the `RoutePrefix` attribute on the controller.

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Use Attribute Routing 4-5

- ❑ Following code snippet shows two actions that use the `Route` attribute:

```
[RoutePrefix("api/customers")]
public class CustomersController : ApiController
{
    private readonly IDataService dataService;
    public ProductController(IDataService dataservice)
    {
        dataService = dataservice;
    }
    [Route("")]
    public IEnumerable<ProductModel> Get()
    {
        return dataService.AllProducts().AsModel();
    }
    [Route("{id}")]
    public ProductModel Get(int id)
    {
        var product = dataService.GetProduct(id);
        return ok(product.AsModel());
    }
}
```

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Use Attribute Routing 5-5

- ❑ In this code:

- The first GET method uses the `Route` attribute with an empty string. Therefore, the route defined in the controller will apply to it.
- The second GET method specifies a placeholder for the product ID that will get appended to the route defined in the controller.
- For example, the URL
`http://www.webapiexample.com/api/customers`
will invoke the first GET method, while the URL
`http://www.webapiexample.com/api/customers/5`
will invoke the second GET method.

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Using slide 43, explain the use of attribute routing.

Explain the students that in ASP.NET Web API application, you will see that it is common to use convention-based routing where you register routes with the ASP.NET routing Framework using the `WebApiConfig.cs` file. Explain that ASP.NET Web API 2 introduces attribute routing that allows to explicitly define routes for a controller and its actions.

Using slide 44, explain that it is recommended that one should use attribute routing when you work on a large scale project being developed by multiple developers, you should consider using attribute routing. Mention the benefits of using attribute routing. Tell that as attribute routing is directly applied to controllers and actions, it becomes simpler and intuitive for developers to understand how to individually call and test actions and controller.

Also, mention that as the number of routes in the application increases the task to manage the routes in the route table becomes cumbersome and error prone. Explain that attribute routing can be used by applying the `RoutePrefix` attribute to the controller. This attribute specifies a common prefix for an entire controller.

Explain that the code demonstrates how to apply the `RoutePrefix` attribute to a controller.

Using slide 45, tell the students some more features of Attribute Routing. Explain that when you use the `RoutePrefix` attribute on a controller, the action methods of the controller inherits the route prefix as the beginning of their route.

Also, tell that you can apply attribute routing in an action method by applying the `Route` attribute. Mention that the value specified for the `Route` attribute always follows the value specified for the `RoutePrefix` attribute on the controller.

Using slide 46, tell that the code demonstrates two actions that use the `Route` attribute.

Using slide 47, explain the code. Explain that the first GET method uses the `Route` attribute with an empty string. Therefore, the route defined in the controller will apply to it. The second GET method specifies a placeholder for the product ID that will get appended to the route defined in the controller.

Mention an example here. For example, the URL <http://www.webapiexample.com/api/customers> will invoke the first GET method while the URL <http://www.webapiexample.com/api/customers/5> will invoke the second GET method.

Slides 48 and 49

Let us summarize the session.

The image shows two slides from a presentation, both titled "Summary".
The first slide, titled "Summary 1-2", contains the following bullet points:

- ❑ An ASP.NET Web API service must be accessible over the Web to make its services available to different types of clients.
- ❑ When you provide a Web API service as a Web application, the application is hosted on a server, such as IIS.
- ❑ Using OWIN, you can self-host a Web API service.
- ❑ Windows Azure Compute acts as a container for Web and worker roles that enables you to host applications in the cloud.

The second slide, titled "Summary 2-2", contains the following bullet points:

- ❑ Key best practices when creating HTTP services using ASP.NET Web API include creating a simple controller, using models, and attribute routing.
- ❑ To expose data of a Web API service, you should create and use models.
- ❑ Routing in ASP.NET Web API 2 allows you to explicitly define routes for a controller and its actions.

Using slides 48 and 49, you will summarize the session. You will end the session, with a brief summary of what has been taught in the session.

Tell the students pointers of the session. This will be a revision of the current session and it will be related to the next session. Explain each of the following points in brief. Tell them that:

- An ASP.NET Web API service must be accessible over the Web in order to make its services available to different types of client.
- When you provide a Web API service as a Web application, the application is hosted on a server, such as IIS.
- Using Open Web Interface for .NET (OWIN) you can self-host a Web API service.
- Windows Azure Compute acts as a container for Web and worker roles that enables to host applications in the cloud.
- Some of the key best practices that should apply when creating HTTP services using ASP.NET Web API are, creating a simple controller, using models and attribute routing.

- In order to expose data of a Web API service, you should create and use models.
- Routing in ASP.NET Web API 2 allows to explicitly define routes for a controller and its actions.

4.3 Post-Class Activities for Faculty

You should familiarize yourself with the topics of the next session such as the various approaches for accessing and manipulating data.

Tips: You can also check the Articles/Blogs/Expert Videos uploaded on the OnlineVarsity site to gain additional information related to the topics covered in the next session. You can also connect to online tutors on the OnlineVarsity site to ask queries related to the sessions.

Session 5 – Accessing and Manipulating Data

5.1 Pre-Class Activities

Before you commence the session, you should familiarize yourself with the topics of this session in-depth. You should revisit topics of the previous session for a brief review. Here, you can ask students the key topics they can recall from previous session. Prepare a question or two, which will be a key point to relate the current session objectives.

The summary of the previous session is as follows:

- An ASP.NET Web API service must be accessible over the Web in order to make its services available to different types of client.
- When you provide a Web API service as a Web application, the application is hosted on a server, such as IIS.
- Using Open Web Interface for .NET (OWIN), you can self-host a Web API service.
- Windows Azure Compute acts as a container for Web and worker roles that enables you to host applications in the cloud.
- Some of the key best practices that you should apply when creating HTTP services using ASP.NET Web API are creating a simple controller and using models and attribute routing.
- In order to expose data of a Web API service, you should create and use models.
- Routing in ASP.NET Web API 2 allows you to explicitly define routes for a controller and its actions.

5.1.1 Objectives

By the end of this session, the learners will be able to:

- Define and describe various data access technologies
- Explain asynchronous data access using ADO.NET
- Explain XML data access and manipulation

5.1.2 Teaching Skills

To teach this session successfully, you should be aware of various data access technologies in .NET. Also, familiarize yourself with asynchronous data access using ADO.NET and XML data access and manipulation.

For teaching in the class, you are expected to use slides and LCD projectors.

Tips:

It is recommended that you test the understanding of the students by asking questions in between the class.

In-Class Activities:

Follow the order given here during In-Class activities.

Overview of the Session:

Give the students a brief overview of the current session in the form of session objectives. Show the students slide 2 of the presentation.

Learning Objectives



- Define and describe various data access technologies
- Explain asynchronous data access using ADO.NET
- Explain XML data access and manipulation

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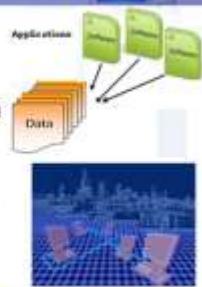
Tell them that they will be introduced to the concept of accessing and manipulating data. This session explains that Enterprise applications may need to access data from data sources. The data source can be a relational database, an XML file, or a spreadsheet. The .NET Framework provides several technologies that you can use to access and manipulate data from enterprise applications.

5.2 In-Class Explanations

Slide 3

Let us understand various data access technologies.

Various Data Access Technologies



- The .NET Framework provides several technologies that you can use in enterprise Web application to work with data stored in a database or other data sources.
- The key data access technologies of the .NET Framework include:
 - ADO.NET
 - Entity Framework
 - WCF Data Services

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Use slide 3 to explain to the students that .NET Framework supports various data access technologies such as ADO.NET, Entity Framework, and WCF data services. These technologies help you to work with data in enterprise Web applications. The data may be stored in a database or other data sources such as XML files and so on.

Slides 4 and 5

Let us understand ADO.NET.

The image contains two slides from a presentation about ADO.NET.

Slide 1: ADO.NET 1-2

- ADO.NET:**
 - Consists of a set of classes provided by the .NET Framework that you can use to access the data stored in a database.
 - Helps you to connect with a database, execute commands, and populate a data set that provides forward-only and read-only access to data.

Diagram: A flowchart showing the interaction between a .NET Application (green box), ADO.NET (yellow diamond), and a Database (green cylinder).

Slide 2: ADO.NET 2-2

- ADO.NET provides the following key objects to enable data access:**

Diagram: A pyramid diagram showing the four key objects of ADO.NET: Connection Object, Command Object, Data Reader Object, and Data Set Object.

Using slide 4, explain that ADO.NET consists of a set of classes and namespaces. These classes help you to access the data stored in a database or other data sources. ADO.NET also enables you to perform various data related operations such as connecting with a database, executing commands, and populating a data set that provides forward-only and read-only access to data. Explain to the students that the two key components of ADO.NET are Data Providers and DataSet.

The Data Provider classes allow you to work with different kinds of data sources. They are used to perform various data-management operations on specific databases. DataSet class provides mechanisms for managing data when it is disconnected from the data source.

System.Data namespace is the core of ADO.NET and it comprises classes used by all data providers. ADO.NET is designed to be easy to use, and Visual Studio provides several wizards and other features that you can use to generate ADO.NET data access code.

Using slide 5, explain to the students that ADO.NET provides the following objects to help you work with data:

- Connection Object
- Command Object
- DataReader Object
- DataSet Object

The .NET Framework includes mainly three Data Providers for ADO.NET. They are the Microsoft SQL Server Data Provider, OLEDB Data Provider, and ODBC Data Provider. SQL Server uses the SqlConnection object, whereas OLEDB and ODBC use the OleDbConnection object and OdbcConnection object respectively.

Slides 6 to 8

Let us understand about the Connection object.

The slide has a blue header bar with the title 'Connection Object 1-3'. The main content area contains a bulleted list of four points. The fourth point is expanded into a callout box with three sub-points. The footer of the slide includes copyright information and the slide number.

Connection Object 1-3

- ❑ It enables an application to connect with a database.
- ❑ The .NET Framework provides the abstract `DbConnection` class to represent a connection to a database.
- ❑ For specific databases, you can use concrete subclasses of the `DbConnection` class.
- ❑ You need to use:
 - `SqlConnection` class to connect to a Microsoft SQL Server database
 - `OracleConnection` class to connect to an Oracle database
 - `ConnectionString` property of the object when you create an object of a connection class

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The image shows two slides from a presentation titled "Enterprise Application Development Using Windows Azure and Web Services". Both slides are titled "Connection Object 2-3" and "Connection Object 3-3".
Slide 2-3 content:

- Following code snippet shows an example of creating a `SqlConnection` object and setting the `ConnectionString` property:

```
SqlConnection testConnection = new SqlConnection();  
testConnection.ConnectionString = "Data Source = 172.23.3.56;  
Initial Catalog=AppDb; Integrated Security=SSPI; Persist Security  
Info=False";
```
- In this code:
 - A `SqlConnection` object is created and its `ConnectionString` property is set.
 - The connection string contains the `DataSource` property that specifies the address of the data source.
 - The `InitialCatalog` property specifies the name of the database to access.
 - The `SSPI` value of the `IntegratedSecurity` property specifies that the Windows user account should be used to connect to the database.
 - The `False` value of the `PersistSecurityInfo` property specifies that the authentication information used to connect to the database should be discarded once the connection is established.

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Slide 3-3 content:

- Once you have created the connection string, you need to open the connection by calling the `Open()` method of the `SqlConnection` object.
- Following code snippet opens a connection to the AppDb database, as specified in the connection string:

```
testConnection.Open();
```

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In slide 6, explain the Connection object to the students. Tell them that Connection object helps an application to connect with a database.

The .NET Framework provides the abstract `DbConnection` class to represent a connection to a database. For specific databases, you can use concrete subclasses of the `DbConnection` class. For example, to connect to a Microsoft SQL Server database, you need to use the `SqlConnection` class. To connect to an Oracle database, you need to use the `OracleConnection` class. When you create an object of a connection class, set the `ConnectionString` property of the object. This property defines the information required to find the data source, log on, and then, choose an initial database.

Using slide 7, tell them that the code shows an example of how to create a `SqlConnection` object and set the `ConnectionString` property. The actual values used in a connection string differ from database to database.

Next, explain the code. Tell them that in this code, a `SqlConnection` object is created and its `ConnectionString` property is set. The connection string contains the `DataSource` property that specifies the address of the data source. The `InitialCatalog` property specifies the name of the database to access. The `SSPI` value of the `IntegratedSecurity` property specifies that the Windows user account should be used to connect to the database. The `False` value of the `PersistSecurityInfo` property specifies that the authentication information used to connect to the database should be discarded, once the connection is established.

Using slide 8, tell the students that after creating the connection string, you need to open the connection by calling the `Open()` method of the `SqlConnection` object.

Explain the code. Tell that the code opens a connection to the `AppDb` database, as specified in the connection string.

Additional Information:

For more information on the Connection object, refer to the following links:

<http://www.csharp-station.com/Tutorial/AdoDotNet/lesson02>
<http://msdn.microsoft.com/en-us/library/aa984327%28v=vs.71%29.aspx>
<http://www.codeproject.com/Articles/8477/Using-ADO-NET-for-beginners>

Slide 9

Let us understand the Command object.

The slide has a blue header bar with the title 'Command Object'. Below the header, there is a bulleted list of four points. The fourth point includes a code snippet in a blue box, followed by a note explaining it. At the bottom of the slide, there is a footer with the text '© Aptech Limited' and 'Enterprise Application Development Using Windows Azure and Web Services / Session 5'.

- Enables an application to execute commands against the database and retrieve results.
- The `SqlCommand` class represents a command object for Microsoft SQL Server database.
- This object specifies the SQL statement that needs to be executed and the connection that needs to be used to execute the statement.
- Following code snippet creates a `SqlCommand` object:

```
SqlCommand cmd = new SqlCommand("Select * from employees", testConnection);
```

This code creates a `SqlCommand` object initialized with a SQL SELECT statement and the opened `SqlConnection` object.

Using slide 9, explain the Command object. Tell the students that Command object helps an application to execute commands against the database and retrieve results. The `SqlCommand` class represents a command object for Microsoft SQL Server database. This object specifies the SQL statement that needs to be executed and the connection that needs to be used to execute the statement.

Tell that the code creates a `SqlCommand` object. Explain the code. Tell that the code creates a `SqlCommand` object. This code is initialized with a SQL Select statement and the opened `SqlConnection` object.

Additional Information:

For more information on the Command object, refer to the following links:

<http://www.csharp-station.com/Tutorial/AdoDotNet/lesson02>

<http://www.c-sharpcorner.com/UploadFile/c5c6e2/working-with-command-object/>

<http://www.codeproject.com/Articles/8477/Using-ADO-NET-for-beginners>

Slides 10 and 11

Let us understand DataReader object.

Data Reader Object 1-2

- It enables storing the data retrieved by executing the command object.
- The `SqlDataReader` class represents a data reader for Microsoft SQL Server database.
- You can create a data reader object by calling the `ExecuteReader()` method of the `SqlCommand` object.



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Data Reader Object 2-2

- Following code snippet creates a data reader object:

```
SqlDataReader dataReader = cmd.ExecuteReader();
```
- Once you have created the data reader object, you can retrieve a single row of data at a time by calling the `Read()` method of the `SqlDataReader` object.
- Following code shows reading the first row stored in the data reader object:

```
dataReader.Read();
```

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Using slide 10, tell that Data Reader object helps you to store the data retrieved. This is done by executing the command object.

The `SqlDataReader` class represents a data reader for Microsoft SQL Server database. You can create a data reader object by calling the `ExecuteReader()` method of the `SqlCommand` object.

Using slide 11, explain to the students that the code creates a data reader object.

Tell that after creating the data reader object, you can retrieve a single row of data at a time by calling the `Read()` method of the `SqlDataReader` object.

Tell that the code shows reading the first row stored in the data reader object.

Additional Information:

For more information on the Data Reader object, refer to the following links:

<http://www.codeproject.com/Articles/8477/Using-ADO-NET-for-beginners>
<http://msdn.microsoft.com/en-us/library/haa3afyz%28v=vs.110%29.aspx>

Slides 12 to 14

Let us understand the `DataSet` object.

Data Set Object 1-3

- Represents a memory-based relational representation of data. A dataset is a disconnected, cached set of records that are retrieved from a database.
- The dataset acts like a virtual database containing tables, rows, and columns.
- Datasets are extensively used to retrieve data from data sources in Web applications because they do not require the connection to be opened all the time.


The diagram illustrates the architecture of a `DataSet`. It shows a `Client` computer on the left, a `Dataset` represented as a table in the center, and a `Database` server on the right. Arrows indicate data flow: one arrow goes from the Client to the Dataset, labeled "Modifying the Records"; another arrow goes from the Dataset to the Database, labeled "No Connection". A red 'X' is drawn over the Client icon, suggesting it is no longer connected to the database.
- Instead, they cache data from the database and after that, the connection can be closed.
- The `DataSet` object requires the data adapter to retrieve data from the data source.

Source: http://www.codeproject.com/Articles/8477/Using-ADO-NET-for-beginners

The image shows two slides from a presentation. The top slide is titled "Data Set Object 2-3" and contains a bullet point and a code snippet. The bullet point says: "Following code snippet creates a dataset filled with data:". The code snippet is:

```
SqlConnection testConnection = new SqlConnection();
testConnection.ConnectionString = "Data Source=172.23.0.88;Initial Catalog=AppDb;Integrated Security=SSPI; Persist Security Info = False";
DataSet ds = new DataSet();
testConnection.Open();
SqlDataAdapter da = new SqlDataAdapter("Select * from employees", testConnection);
da.Fill(ds, "employees");
```

The bottom slide is titled "Data Set Object 3-3" and contains several bullet points and a code snippet. The bullet points are:

- Once a DataSet is created with data, the DataSource property of a control can be used to bind the DataSet with the control.
- This enables displaying data in the DataSet in the control.
- For example, you can use a GridView as a User Interface (UI) control.
- Following code snippet displays the data in the dataset in a GridView control named gvwEmp:

```
gvwEmp.DataSource = ds;
gvwEmp.DataBind();
```

Using slide 12, explain the DataSet object. Tell them that the DataSet object represents a memory-based relational representation of data. A dataset is a disconnected, cached set of records that are retrieved from a database.

The dataset acts like a virtual database that are used to retrieve data from data sources in Web applications as they do not require the connection to be opened all the time. Dataset contain tables, rows, and columns.

Also, mention that once the dataset cache data from the database, you can close the connection. The DataSet object requires the data adapter to retrieve data from the data source.

Using slide 13, explain to the students that the code creates a dataset filled with data. Explain the code. Tell that in this code, the data from the data source is retrieved by the data adapter and filled into the dataset.

Using slide 14, explain to the students that after a DataSet is created with data, the DataSource property of a control can be used to bind the DataSet with the control.

This enables displaying data in the DataSet in the control. For example, you can use a GridView as a User Interface (UI) control.

Tell them that the code displays the data in the dataset in a GridView control named gvwEmp.

Additional Information:

For more information on the DataSet object, refer to the following links:

<http://msdn.microsoft.com/en-us/library/zb0sdh0b%28v=vs.110%29.aspx>

In-Class Question:

After you finish explaining DataSets, you will ask the students an In-Class question. This will help you in reviewing their understanding of the topic.



Name the key data access technologies of the .Net Framework.

Answer:

The key data access technologies are ADO.NET, Entity Framework, and WCF data services.

Slides 15 to 17

Let us understand Entity Framework.

Entity Framework 1-3

In an ASP.NET Web application, you can use an Object-Relationship Mapping (ORM) framework to simplify the process of accessing data from the application.

An ORM framework performs the necessary conversions between item-at-a-time type systems in relational databases and object-oriented programming languages.

The ADO.NET Entity Framework is an ORM framework often used in .NET applications.

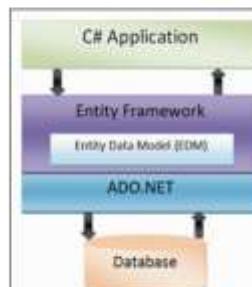
The Entity Framework is an implementation of the Entity Data Model (EDM) describing the entities and the associations that participate in an application.

EDM allows you to handle data access logic by programming against entities without having to worry about the structure of the underlying data store and how to connect with it.

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Entity Framework 2-3

- ❑ The `System.Data.Entity` namespace of the Entity Framework:
 - Provides classes that you can use to synchronize between the model classes and its associated database.
 - Also provides the `DbContext` class that coordinates with Entity Framework and allows you to query and save application data in the database.



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Entity Framework 3-3

- ❑ Entity Framework:
 - Eliminates the need to write most of the data-access code that would otherwise need to be written.
 - Uses different approaches to manage data related to an application:



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Using slide 15, explain Entity Framework. Tell them that ASP.NET Web application uses an Object Relationship Mapping (ORM) framework. This helps to simplify the process of accessing data from the application.

An ORM framework performs important conversions between incompatible type systems in relational databases and object-oriented programming languages. The ADO.NET Entity Framework is an ORM framework often used in .NET applications.

Then, explain them that the Entity Framework is an implementation of the Entity Data Model (EDM). EDM is a conceptual model that helps to describe the entities and the associations they participate in an application. It also helps in handling data access logic by programming against entities without worrying about the structure of the underlying data store and how to connect with it.

Using slide 16, tell the students that the System.Data.Entity namespace of the Entity Framework provides classes that help in synchronizing between the model classes and its associated database. The System.Data.Entity namespace also provides the DbContext class that helps to coordinate with Entity Framework and also enables you to query and save application data in the database.

Using slide 17, explain that the Entity Framework provides the facility to eliminate the need to write most of the data-access code that would otherwise need to be written. It uses approaches such as database-first and code-first to manage data related to an application.

Slides 18 to 20

Let us understand Database-First and code-First approaches.

The image shows two slides from a presentation. The top slide is titled 'Database-First and Code-First' and compares the two approaches. The bottom slide is titled 'Code-First Approach' and provides details about it.

Database-First Approach

- The Entity Framework creates model classes and properties corresponding to the existing database objects, such as tables and columns.
- Applicable in scenarios where a database already exists for the application.

Code-First Approach

- The Entity Framework creates database objects based on custom classes that a programmer creates to represent the entities and their relationships in the application.
- It allows you to develop your application by coding model classes and properties and delegate the process of creating the database objects to the Entity Framework.
- The classes and properties will later correspond to tables and columns in the database.

Code-First Approach

- Allows you to provide the description of a model by using the C# classes.
- Based on the class definitions, the code-first conventions detect the basic structure for the model.
- The System.Data.Entity.ModelConfiguration.Conventions namespace provides several code-first conventions that enable automatic configuration of a model.

The slide has a blue header bar with the title 'Conventions'. Below the header, there is a bulleted list: 'Some of these conventions are as follows:'.

- Table Naming Convention
 - Entity Framework by default creates a table named `Users` when you have created an object of the `User` model and need to store its data in the database.
- Primary Key Convention
 - When you create a property named `User.Id` in the `User` model, the property is accepted as a primary key.
 - The Entity Framework sets up an auto-incrementing key column to hold the property value.

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Using slide 18, explain to the students that in the database-first approach, you can create model classes and properties correspond to the existing database objects, such as tables and columns. You can apply this approach in scenarios that has a database for the application.

Tell them that in the code-first approach, the Entity Framework creates database objects based on custom classes that a programmer creates to represent the entities and their relationships in the application.

Tell them you can develop your application by coding model classes and properties and delegate the process of creating the database objects to the Entity Framework. Later, these classes and properties correspond to tables and columns in the database.

Using slide 19, explain the important features of the code-first approach. Tell them that the code-first approach uses C# to describe a model. This approach detects the basic structure for the model based on the class definitions.

The `System.Data.Entity.ModelConfiguration.Conventions` namespace provides several code-first conventions that enable automatic configuration of a model.

Using slide 20, tell the students that there are some Entity Framework conventions such as table naming convention and primary key convention.

Explain the table naming convention. Tell them that after creating an object of the `User` model and storing its data in the database, the Entity Framework by default creates a table named `Users`.

Explain the primary key convention. Tell them that after creating a property named `User.Id` in the `User` model, the property is accepted as a primary key.

Also, tell them that the Entity Framework sets up an auto-incrementing key column to hold the property value.

Additional Information:

For more information on Database-First and code-First approaches, refer to the following links:

<http://www.codeproject.com/Articles/318010/Entity-Framework-code-First-Let-s-Try-It>
<http://www.entityframeworktutorial.net/database-first-with-entity-framework.aspx>
<http://www.entityframeworktutorial.net/EntityFramework5/create-dbcontext-in-entity-framework5.aspx>
<http://www.entityframeworktutorial.net/code-first/simple-code-first-example.aspx>
<http://www.entityframeworktutorial.net/code-first/entity-framework-code-first.aspx>
<http://www.c-sharpcorner.com/UploadFile/abhikumarvatsa/database-first-approach-in-entity-framework/>

Slides 21 to 25

Let us understand relationship conventions.

Relationship Convention 1-5

Relationship Convention

- Entity Framework provides different conventions to identify a relationship between two models.
- You can use navigational properties in order to define relationship between two models.
- You should define a foreign key property on types that represents dependent objects.

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Relationship Convention 2-5

Consider a scenario:

- You are developing an online shopping store.
- For the application, you have created two model classes named Customer and Order.
- Now, you need to declare properties in each class that allows navigating to the properties of another class.
- You can then, define the relationship between these two classes.

Online Shopping Store



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Relationship Convention 3-5

- Following code snippet creates the Customer model class:

```
public class Customer
{
    public int CustId { get; set; }
    public string Name { get; set; }
    // Navigation property
    public virtual ICollection<Order> Orders { get; set; }
}
```

- This code creates a model named `Customer` that contains two properties named `CustId` and `Name`.

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Relationship Convention 4-5

- Following code snippet creates the Order model class:

```
public class Order
{
    public int Id { get; set; }
    public string ProductName { get; set; }
    public int Price { get; set; }
    // Foreign key
    public int CustId { get; set; }
    // Navigation properties
    public virtual Customer cust { get; set; }
}
```

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Relationship Convention 5-5

- In the code:

- `Orders`: Is the navigational property in the `Customer` class.
- `Cust`: Is the navigational property in the `Order` class.
- These two properties are known as navigational properties as they allow to navigate to the properties of another class.

- For example:

- You can use the `cust` property to navigate to the orders associated with that customer.
- In the `Customer` class, the `Orders` navigational property is declared as a collection, as one customer can place multiple orders.
- This indicates a one-to-many relationship between the `Customer` and `Order` classes.
- The `CustId` property in the `Order` class is inferred as the foreign key by Entity Framework.

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Using slide 21, explain relationship convention. Tell the students that the Entity Framework provides different conventions. These help in identifying a relationship between two models.

Using navigational properties helps to define relationship between two models. You should define a foreign key property on types that represents dependent objects.

Tell the students that conventions are sets of rules used to automatically configure a conceptual model based on class definitions when working with code-First.

The aim of designing conventions is to provide a starting point for a model. The basic shape of the model is detected by using conventions. The conventions are defined in the `System.Data.Entity.ModelConfiguration.Conventions` namespace.

Using slide 22, explain relationship convention with an example. Ask the students to consider a scenario. Tell them that you have developed an online shopping store and have created two model classes named, `Customer` and `Order`.

You need to declare properties in each class to navigate to the properties of another class. Then, you need to define the relationship between these two classes.

Using slides 23 and 24, explain to the students that the code creates the `Customer` and the `Order` model classes.

Using slide 25, explain the code to the students. Tell them that in this code, `Orders` is the navigational property in the `Customer` class and `cust` is the navigational property in the `Order` class. These two properties are known as navigational properties because they allow us to navigate to the properties of another class.

Explain with an example. For example, the `cust` property helps to navigate to the orders given by the customer. In the `Customer` class, the `Orders` navigational property is declared as a collection. One customer can place multiple orders. This indicates a one-to-many relationship between the `Customer` and `Order` classes. The `CustId` property in the `Order` class is inferred as the foreign key by Entity Framework.

Additional Information:

For more information on code-first conventions, refer to the following links:

<http://msdn.microsoft.com/en-in/data/jj679962.aspx>

<http://www.entityframeworktutorial.net/code-first/configure-one-to-many-relationship-in-code-first.aspx>

<http://blogs.msdn.com/b/efdesign/archive/2010/06/01/conventions-for-code-first.aspx>

Slides 26 and 27

Let us understand database context.

Database Context 1-10

- ❑ The `System.Data.Entity` namespace provides a `DbContext` class.
- ❑ After creating the model class, you can use the `DbContext` class to define the database context class.
- ❑ This class coordinates with Entity Framework and allows you to query and save the data in the database.
- ❑ The database context class uses the `DbSet<T>` type to define one or more properties.
- ❑ In the type, `DbSet<T>`, `T` represents the type of an object that needs to be stored in the database.

Database Context 2-10

- ❑ Following code snippet shows how to use the `DbContext` class:

```
public class OLShopDataContext : DbContext
{
    public DbSet<Customer> Customers { get; set; }
    public DbSet<Product> Products { get; set; }
}
```

- ❑ In the code:
 - A database context class named `OLShopDataContext` is created that derives from the `DbContext` class.
 - This class creates the `DbSet` property for both the `Customer` class and the `Product` class.

Using slide 26, explain that the `System.Data.Entity` namespace provides a `DbContext` class. After creating the model class, the `DbContext` class helps to define the database context class. This class coordinates with Entity Framework and allows you to query and save the data in the database.

Also, tell them that the database context class uses the `DbSet<T>` type to define one or more properties. In the type, `DbSet<T>`, `T` represents the type of an object that can be stored in the database.

Using slide 27, tell the students that the code shows how to use the `DbContext` class. Tell that in the code, a database context class named, `OLShopDataContext` is created that derives from the `DbContext` class. This class creates the `DBSet` property for both, the `Customer` class and the `Product` class.

Additional Information:

For more information on database context, refer to the following link:

<http://www.entityframeworktutorial.net/EntityFramework4.3/dbcontext-vs-objectcontext.aspx>

Slide 28

Let us understand more about database context.

Database Context 3-10

In a Web application:

- You might need to change the model classes to implement various new features.
- This also requires maintaining the database related to the model based on the changes made in the model class.
- So while modifying the model classes, you should ensure that any changes in the model are reflected back in the database.
- To maintain the synchronization between the model classes and its associated database, you need to recreate databases.

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Using slide 28, explain to the students that in a Web application, you might change the model classes to implement various new features. You will need to maintain the database related to the model based on the changes made in the model class. Ensure that any changes in the model are reflected back in the database. To maintain the synchronization between the model classes and its associated database, you need to recreate databases.

Slide 29

Let us understand more about database context.

Database Context 4-10

Entity Framework provides the `System.Data.Entity` namespace that contains the following two classes to recreate databases:

<code>DropCreateDatabaseAlways</code>	<code>DropCreateDatabaseIfModelChanges</code>
<ul style="list-style-type: none">• Allows recreating an existing database whenever the application starts,	<ul style="list-style-type: none">• Allows recreating an existing database whenever the associated model class changes.

Based on your requirements, you can use one of these two classes in your application:

- To recreate a database.
- While calling the `SetInitializer()` method of the `Database` class defined in the `System.Data.Entity` namespace.

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Using slide 29, explain that the Entity Framework provides the System.Data.Entity namespace that contains the two classes to recreate databases such as DropCreateDatabaseAlways and DropCreateIfModelChanges.

Explain to them that DropCreateDatabaseAlways helps to recreate an existing database whenever the application starts.

Then, say that DropCreateDatabaseIfModelChanges helps to recreate an existing database whenever the associated model class changes.

Slides 30 and 31

Let us understand more about database context.

Database Context 5-10

- Following code snippet shows:
 - Creation of a new instance of the DropCreateDatabaseAlways class inside the Application_Start() method of the Global.asax.cs file:

```
...  
Database.SetInitializer(new  
    DropCreateDatabaseAlways<ShopDataContext>());
```

- In this code:
 - The DropCreateDatabaseAlways class is used while calling the SetInitializer() method to ensure that the existing database is recreated whenever the application starts.
 - You can use the DropCreateDatabaseIfModelChanges class to recreate a database only when the model changes.

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Database Context 6-10

- The code snippet demonstrates:
 - Creation of an instance of the DropCreateDatabaseIfModelChanges class inside the Application_Start() method of the Global.asax.cs file:

```
Database.SetInitializer(new  
    DropCreateDatabaseIfModelChanges<ShopDataContext>());
```

- In this code:
 - The DropCreateDatabaseIfModelChanges class is used while calling the SetInitializer() method to ensure that the existing database is recreated whenever the model changes.

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Using slide 30, tell the students that the code shows the creation of a new instance of the DropCreateDatabaseAlways class inside the Application_Start() method of the Global.asax.cs file.

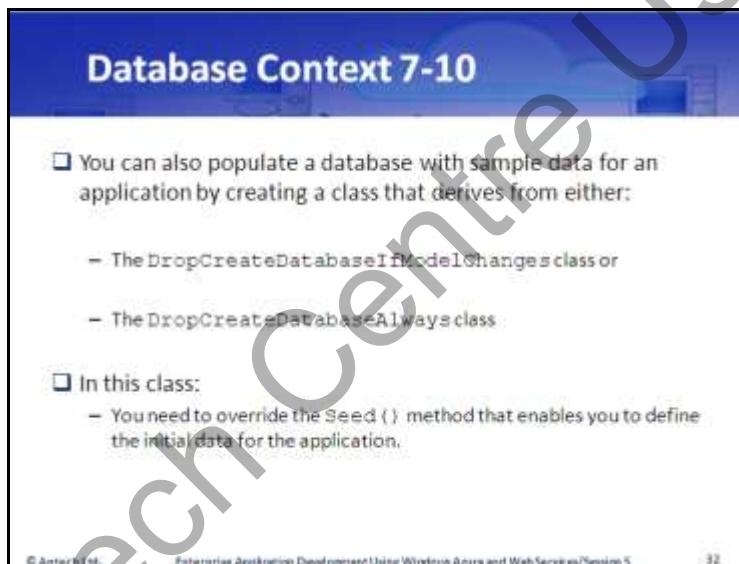
Explain the code. Tell them that in this code, the `DropCreateDatabaseAlways` class is used while calling the `SetInitializer()` method to ensure that the existing database is recreated whenever the application starts. On the other hand, you can use the `DropCreateDatabaseIfModelChanges` class to recreate a database only when the model changes.

Using slide 31, explain that the code shows creation of an instance of the `DropCreateDatabaseIfModelChanges` class inside the `Application_Start()` method of the `Global.asax.cs` file.

Explain the code. Tell them that in this code, the `DropCreateDatabaseIfModelChanges` class is used while calling the `SetInitializer()` method to ensure that the existing database is recreated whenever the model changes.

Slide 32

Let us understand more about database context.



The slide has a blue header bar with the title "Database Context 7-10". The main content area contains two bullet points:

- ❑ You can also populate a database with sample data for an application by creating a class that derives from either:
 - The `DropCreateDatabaseIfModelChanges` class or
 - The `DropCreateDatabaseAlways` class
- ❑ In this class:
 - You need to override the `Seed()` method that enables you to define the initial data for the application.

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Using slide 32, explain to the students that to populate a database with sample data for an application, you need to create a class that derives from either the `DropCreateDatabaseIfModelChanges` class or the `DropCreateDatabaseAlways` class.

In this class, you need to override the `Seed()` method that enables you to define the initial data for the application.

Additional Information:

For more information on database context, refer to the following links:

<http://www.entityframeworktutorial.net/code-first/database-initialization-strategy-in-code-first.aspx>

<http://patrickdesjardins.com/blog/dropcreatedatabaseifmodelchanges-will-create-your-database-every-time-you-start-your-application>

Slides 33 and 34

Let us understand more about database context.

Database Context 8-10

□ Following code snippet shows:

- The `MyDbInitializer` class that uses the `Seed()` method to insert some sample data in the `Customers` database:

```
public class MyDbInitializer : DropCreateDatabaseIfModelChanges<OLShopDataContext>
{
    protected override void Seed(OLShopDataContext context)
    {
        context.Customers.Add(new Customer() { Name = "John Parker", Address="Park Street", Email = "john@webexample.com" });base.Seed(context);
    }
}
```

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Database Context 9-10

□ In the code:

- The `MyDbInitializer` class is derived from the `DropCreateDatabaseIfModelChanges` class.
- Then, the `Seed()` method is overridden to define the initial data for the `Customer` model.
- After defining the initial data for the customers, you need to register the `MyDbInitializer` model class in the `Global.asax.cs` file by calling the `SetInitializer()` method.

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Using slide 33, explain to the students that the code shows the `MyDbInitializer` model class that uses the `Seed()` method to insert some sample data in the `Customers` database.

Using slide 34, explain the code. Tell them that in this code, the `MyDbInitializer` class is derived from the `DropCreateDatabaseIfModelChanges` class. Tell them that the `Seed()` method is overridden to define the initial data for the `Customer` model.

Once you have defined the initial data for the customers, you need to register the `MyDbInitializer` model class in the `Global.asax.cs` file by calling the `SetInitializer()` method.

Slide 35

Let us understand more about database context.

Database Context 10-10

Following code snippet shows:

- Use of the `SetInitializer()` method inside the `Application_Start()` method:

```
protected void Application_Start()
{
    System.Data.Entity.Database.SetInitializer(new
    MyDbInitializer());
}
```

- This code uses the `SetInitializer()` method to register the `MyDbInitializer` model class.

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Using slide 35, explain to the students that the code shows use of the `SetInitializer()` method inside the `Application_Start()` method.

Explain the code. Tell that this code uses the `SetInitializer()` method to register the `MyDbInitializer` model class.

Slides 36 to 40

Let us understand how to implement the code-First approach.

Implementing the Code-First Approach 1-5

To implement a code-first approach using Visual Studio 2013, you need to perform the following steps:

- Step 1 • Create an ASP.NET MVC Web application named `EFCODEFIRSTDEMO`.
- Step 2 • Right-click the **Models** folder in the **Solution Explorer** window. The context menu options of the **Models** folder are displayed.
- Step 3 • Click **Add → New Item**. The **Add New Item - EFCODEFIRSTDEMO** dialog box is displayed.

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Implementing the Code-First Approach 2-5

- Step 4 • Select **Code** in the left pane of the **AddNewItem - EFCodeFirstDemo** dialog box and the **Class** template in the right pane.
- Step 5 • Type **Employee.cs** in the **Name** field.
- Step 6 • Click **Add**. The Code Editor window displays the default code of the **Employee** model class.
- Step 7 • Add the code in the **Employee** class to define three properties named **Name**, **Designation**, and **Department**.
- Step 8 • To create the database context class, add a new class named **AppDBContext** to the project.

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Implementing the Code-First Approach 3-5

- Step 9 • Create another class named **AppData** to the project to update the **AppData** class to create a database whenever the model class changes.
- Step 10 • Right-click **Global.asax** file in the **Solution Explorer** window. The Code Editor window displays the code of the **Global.asax** file.
- Step 11 • To register the **AppData** class, use the **SetInitializer()** method inside the **Application_Start()** method of the **Global.asax** file.
- Step 12 • Add a controller named **EmployeeController** to the project using the **MVC3 Controller - Empty template**.
- Step 13 • Right-click inside the **Index** action method and select **Add View**. The **Add View** dialog box is displayed.

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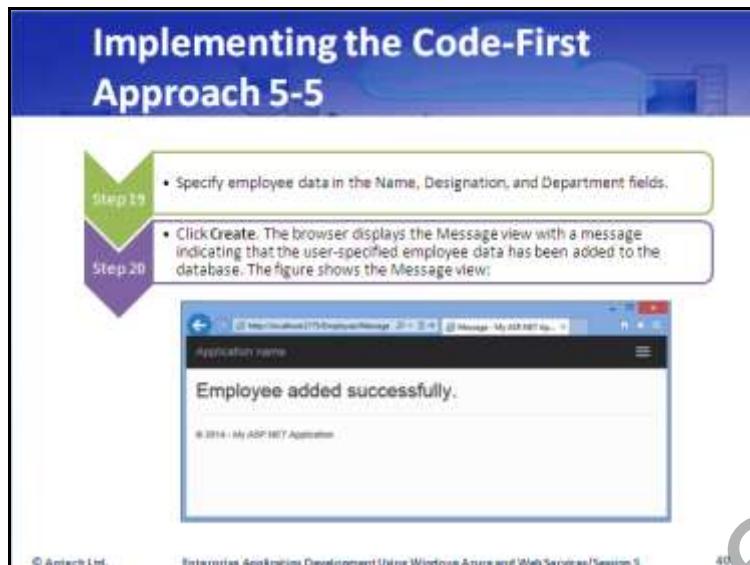
38

Implementing the Code-First Approach 4-5

- Step 14 • Select **Create** from the **Scaffold** template drop-down list and then, select **Employee|EFCodeFirstDemo.Models** from the **Model class** drop-down list.
- Step 15 • Click **Add**. The Code Editor window displays the code of the **Index.cshtml** view.
- Step 16 • Add another view named **Message** for the **Message()** action method. Update the code of the **Message** view to display a message to indicate that user specified data is added to the database.
- Step 17 • In the menu bar, click **Debug → Start Without Debugging**. The Home page of the project is displayed in a browser.
- Step 18 • In the address bar of the browser, type the URL: <http://localhost:2173/Employee/Index>. The browser displays the **Index** view.

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Using slide 36, explain the steps to implement the code-First Approach to the students.

In Step 1, one needs to create an ASP.NET MVC Web application named **EFcodeFirstDemo**.

In Step 2, one has to right-click the **Models** folder in the Solution Explorer window. This will cause the context menu options of the **Models** folder to be displayed.

In Step 3, one needs to click **Add → New Item**. The **Add NewItem - EFcodeFirstDemo** dialog box will be displayed.

Continue to explain the next steps to implement the code-First approach to the students using slide 37.

In Step 4, one needs to select code in the left pane of the **AddNewItem - EFcodeFirstDemo** dialog box and the Class template in the right pane.

In Step 5, one has to type `Employee.cs` in the **Name** box.

In Step 6, one has to click **Add**. The code Editor window displays the default code of the `Employee` model class.

In Step 7, one has to add the code in the `Employee` class to define three properties named, `Name`, `Designation`, and `Department`.

In Step 8, to create the database context class, add a new class named, `AppDBContext` to the project.

Using slide 38, explain the remaining steps 9 to 13 to implement the code-First approach.

Using slide 39, explain the remaining steps to implement the code-First approach to the students.

In step 14, select **Create** from the **Scaffold template** drop-down list and then, select **Employee(EFcodeFirstDemo.Models)** from the **Model class** drop-down list.

In step 15, click **Add**. The code Editor window displays the code of the **Index.cshtml** view.

In step 16, add another view named **Message** for the **Message ()** action method. Update the code of the **Message** view to display a message to indicate that user specified data is added to the database.

In step 17, in the menu bar, click **Debug → Start Without Debugging**. The Home page of the project is displayed in a browser.

In step 18, in the Address bar of the browser, type the following URL:

<http://localhost:2175/Employee/Index>

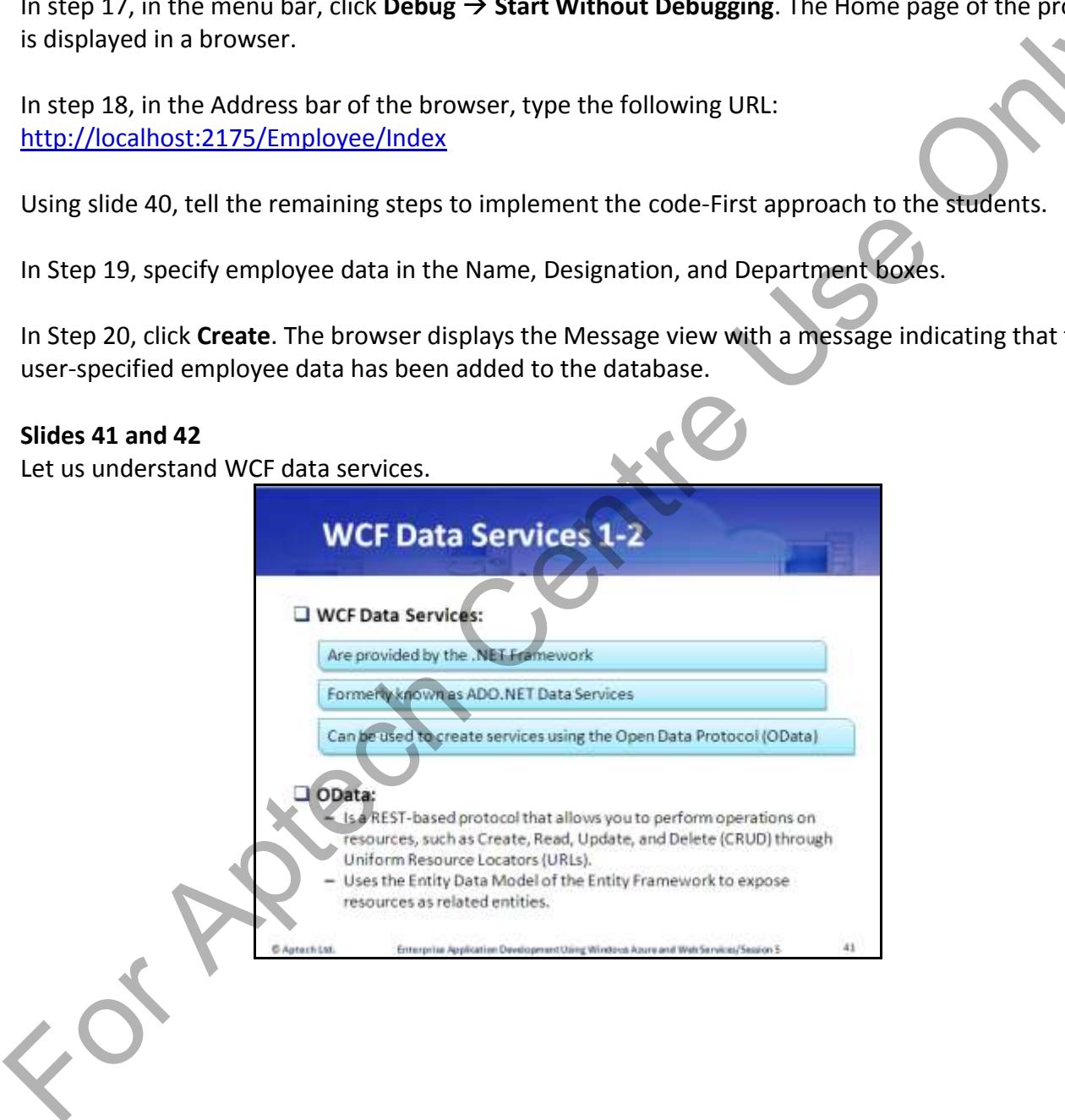
Using slide 40, tell the remaining steps to implement the code-First approach to the students.

In Step 19, specify employee data in the Name, Designation, and Department boxes.

In Step 20, click **Create**. The browser displays the **Message** view with a message indicating that the user-specified employee data has been added to the database.

Slides 41 and 42

Let us understand WCF data services.



WCF Data Services 1-2

WCF Data Services:

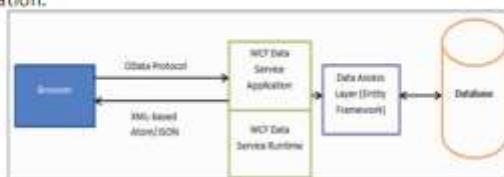
- Are provided by the .NET Framework
- Formerly known as ADO.NET Data Services
- Can be used to create services using the Open Data Protocol (OData)

OData:

- Is a REST-based protocol that allows you to perform operations on resources, such as Create, Read, Update, and Delete (CRUD) through Uniform Resource Locators (URLs).
- Uses the Entity Data Model of the Entity Framework to expose resources as related entities.

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WCF Data Services 2-2

- You can perform CRUD operations on the entities using the standard HTTP methods such as:
 - GET, PUT, POST, and DELETE
- The result returned by the WCF data service can be in XML-based Atom and JSON formats.
- Following figure shows the role of WCF data service in an enterprise application:

Using slide 41, explain WCF data services to the students. Tell them that the .NET Framework provides WCF data services, which was earlier called ADO.NET data services. WCF data services help to create services using the Open Data Protocol (OData).

Explain to them that OData is a REST-based protocol that helps to perform operations on resources. You can perform operations such as Create, Read, Update, and Delete (CRUD) through Uniform Resource Locators (URLs). OData uses the Entity Data Model of the Entity Framework to expose resources as related entities.

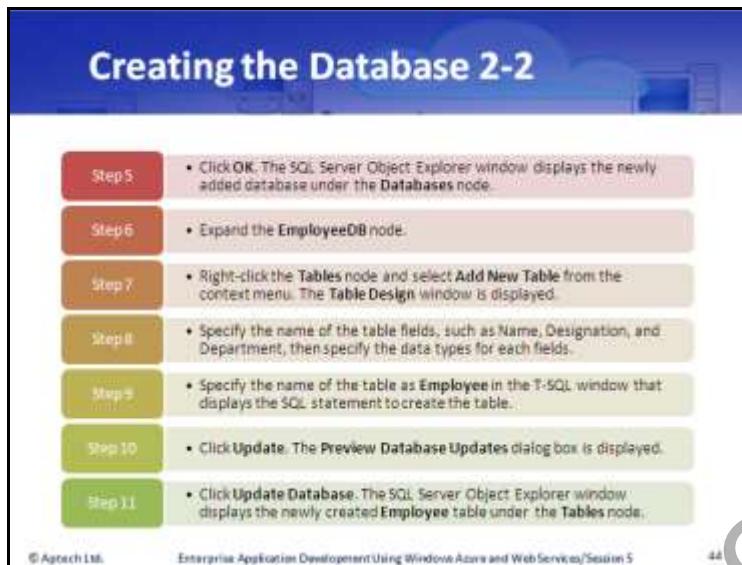
Using slide 42, explain to them that CRUD operations on the entities can be performed using the standard HTTP methods, such as GET, PUT, POST, and DELETE. The result returned by the WCF data service can be in XML-based Atom and JSON formats.

Slides 43 and 44

Let us understand the process of creating a database through the IDE.

Creating the Database 1-2

- To create the database and table in Visual Studio 2013, you need to perform the following tasks:
 - Step 1 • Open the SQL Server Object Explorer window in Visual Studio 2013.
 - Step 2 • Expand the [LocalDb]\v11.0 → Databases node in the SQL Server Object Explorer window.
 - Step 3 • Right-click the Databases node and select Add New Database from the context menu. The Create Database dialog box is displayed.
 - Step 4 • Type EmployeeDB in the Database Name field.



Using slide 43, explain how to create the database. Explain the steps to create the database and table in Visual Studio 2013.

In Step 1, you need to open the SQL Server Object Explorer window in Visual Studio 2013.

In Step 2, expand the **(Localdb)\v11.0 → Databases** node in the SQL Server Object Explorer window.

In Step 3, right-click the **Databases** node and select **Add New Database** from the context menu, which displays the **CreateDatabase** dialog box.

In Step 4, you need to type **EmployeeDB** in the **DatabaseName** box.

Using slide 44, explain remaining steps to create the database to the students.

In Step 5, you need to click **OK**. The SQL Server Object Explorer window displays the newly added database under the **Databases** node.

In Step 6, expand the **EmployeeDB** node.

In Step 7, right-click the **Tables** node and select **Add New Table** from the context menu. The Table Design window is displayed.

In Step 8, specify the name of the table fields, such as Name, Designation, and Department, then specify the data types for each fields.

In Step 9, specify the name of the table as Employee in the T-SQL window that displays the SQL statement to create the table.

In Step 10, click **Update**. The **Preview Database Updates** dialog box is displayed.

In Step 11, click **UpdateDatabase**. The SQL Server Object Explorer window displays the newly created **Employee** table under the **Tables** node.

Slides 45 to 48

Let us understand how to create the EDM.

Creating the EDM 1-4

To create the EDM in Visual Studio 2013, you need to perform the following tasks:

- Step 1**
 - Create an ASP.NET Web Application project by selecting the Empty template and name it as WCFDataServiceDemo.
- Step 2**
 - Right-click WCFDataServiceDemo in the Solution Explorer window and select Add → New Item. The Add New Item – WCFDataServiceDemo dialog box is displayed.
- Step 3**
 - Select Data in the left pane and ADO.NET Entity Data Model in the right pane of the Add New Item – WCFDataServiceDemo dialog box.

Creating the EDM 2-4

- Step 4**
 - Specify the name of the model as EmpModel.edmx.
- Step 5**
 - Click Add. The Entity Data Model Wizard dialog box is displayed.
- Step 6**
 - Select Generate from database in the Entity Data Model Wizard dialog box.
- Step 7**
 - Click Next. The Choose Your Data Connection screen is displayed.
- Step 8**
 - Click New Connection. The Connection Properties dialog box is displayed.

Creating the EDM 3-4

- Step 9**
 - Specify {localdb}\v11.0 on the Server Name field and select EmployeeDB from the Select or enter a database name drop-down list.
- Step 10**
 - Click OK. The Choose Your Data Connection screen displays the new connection and the database name.
- Step 11**
 - Click Next. The Choose Your Version screen is displayed.
- Step 12**
 - Select the Entity Framework 5.0 option.
- Step 13**
 - Click Next. The Choose Your Database Objects and Settings screen is displayed.

Creating the EDM 4-4

- Step 14 • Select the Tables check box.
- Step 15 • Click Finish. The Entity Data Model Designer displays the newly added Employee entity.
- Step 16 • Build the project.

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Using slides 45 to 48, explain the students the various steps needed to perform the tasks to create the EDM in Visual Studio 2013.

Slides 49 to 52

Let us understand how to create the WCF data service.

Creating the WCF Data Service 1-4

To create WCF Data Service in Visual Studio 2013, you need to perform the following tasks:

- Step 1 Right-click **WCFDataServiceDemo** in the Solution Explorer window and select **Add → New Item**. The **Add New Item – WCFDataServiceDemo** dialog box is displayed.
- Step 2 Select **Web** in the left pane and **WCF Data Service 5.6** in the right pane of the **Add New Item – WCFDataServiceDemo** dialog box.
- Step 3 Click **Add**. The Code Editor window displays the code of the newly added data service **EmpWcfDataService.svc.cs**.

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The image displays three slides from a presentation, each titled "Creating the WCF Data Service".

- Slide 2-4:** This slide shows steps 4 through 9. Step 4: "Update the code of the EmpWcfDataService.svc.cs data service." Step 5: "Open Internet Explorer. From the Tools menu, select Internet Options. The Internet Options dialog box is displayed." Step 6: "Click the Content tab." Step 7: "Click Settings under the Feeds and Web Sites section. The Feeds and Web Sites dialog box is displayed." Step 8: "Clear the Turn on feed reading view check box." Step 9: "Click OK. The main screen of the Internet Options dialog box is displayed."
- Slide 3-4:** This slide shows steps 10 through 12. Step 10: "Click OK to close the dialog box." Step 11: "Execute the project. The browser displays the output of the data service." Step 12: "Type the following URL in the address bar of the browser: http://localhost:1588/EmpWcfDataService.svc/Employees. The browser displays the employee data."
- Slide 4-4:** This slide contains a bullet point: "Following figure shows the employee data in the browser:" followed by a screenshot of a Microsoft Edge browser window displaying a table of employee data.

Using slides 49 to 52, explain the various steps to create the WCF data service.

Using slide 52, tell the students that the figure shows the employee data in the browser.

Additional Information:

To know more about WCF data services, visit the following links:

[http://www.jamesrichards.com/post/2010/04/01/ADONET-\(WCF\)-Data-Services-Paging-e28093-Where-is-SetEntitySetPageSize-Method.aspx](http://www.jamesrichards.com/post/2010/04/01/ADONET-(WCF)-Data-Services-Paging-e28093-Where-is-SetEntitySetPageSize-Method.aspx)

Slide 53

Let us understand asynchronous data access with ADO.NET.

Asynchronous Data Access with ADO.NET

- Enterprise application needs to be responsive and the responsiveness of an application depends on how the application performs data access.
- Accessing a database across a network can cause delays.
- Delays also occur when the database processes a query and returns some results.
- Delays affect the responsiveness of an application.
- A solution to avoid such delays caused due to data access is to implement asynchronous data access in the application.

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Using slide 53, explain asynchronous data access with ADO.NET. Begin with explaining the need for asynchronous operations. Say that, an enterprise application needs to be responsive in terms of how the application performs data access. In an enterprise application, accessing a database across a network can cause delays.

There can be delays occurring when the database processes a query and returns some results that affect the responsiveness of an application. You can implement asynchronous data access in the application to avoid such delays caused due to data access. Then, tell them that the .NET Framework provides strong support for asynchronous data access with ADO.NET.

Slides 54 and 55

Let us understand the `async` keyword.

async Keyword 1-2

- ❑ **async Keyword:**
 - Enables support for asynchronous programming in .NET Framework 4.5.
 - Can be used to asynchronously access data.
 - A method marked with this keyword notifies the compiler that the method will contain at least one `await` keyword.
 - If the compiler finds a method marked as `async` but without an `await` keyword, it reports a compilation error.
 - The `await` keyword is applied to an operation to temporarily stop the execution of the `async` method until the operation completes.
 - In the meantime, control returns to the `async` method's caller.
 - Once the operation marked with `await` completes, execution resumes in the `async` method.

Temporarily stop execution

STOP

async Keyword 2-2

- ❑ A method marked with the `async` keyword can have either one of the following return types:

void
Task
Task<TResult>
- ❑ Some methods for asynchronous programming with the ADO.NET classes in .NET Framework 4.5 are:

Method	Description
<code>SqlConnection.OpenAsync()</code>	Asynchronously opens a database connection.
<code>SqlCommand.ExecuteNonQueryAsync()</code>	Asynchronously executes a SQL statement on a database connection.
<code>SqlDataReader.ReadAsync()</code>	Asynchronously advances a reader to the next record of a resultset.
<code>SqlDataReader.NextResultAsync()</code>	Asynchronously advances a reader on the results of a batch of statements.

Using slide 54, explain `async` keyword. Tell them that the .NET Framework 4.5 supports asynchronous programming through the `async` keyword. This keyword can be used to asynchronously access data. A method marked with the `async` keyword notifies the compiler that the method will contain at least one `await` keyword. If the compiler finds a method marked as `async`, but without an `await` keyword, it reports a compilation error.

Then, tell the students that the `await` keyword is applied to an operation to temporarily stop the execution of the `async` method until the operation completes. In the meantime, control returns to the `async` method's caller.

After the operation marked with `await` completes, execution resumes in the `async` method.

Using slide 55, explain that a method marked with the `async` keyword can have either one of the return types:

- `void`
- `Task`
- `Task<TResult>`

In addition, tell the students that the .NET Framework 4.5 adds several methods for asynchronous programming to the ADO.NET classes.

Tell the students that the table on slide 55 describes some of the methods.

Additional Information:

To know more about asynchronous data access with ADO.NET, visit the following links:

<http://www.dotnet-tricks.com/Tutorial/aspnet/R8SX290512-Asp.Net-asynchronous-file-upload-using-jquery.html>

<http://www.go4expert.com/articles/adonet-aspnet-t30175/>

In-Class Question:

After you finish explaining asynchronous data access with ADO.NET, you will ask the students an In-Class question. This will help you in reviewing their understanding of the topic.



What is the use of the `async` keyword?

Answer:

`async` keyword can be used to asynchronously access data. A method marked with the `async` keyword notifies the compiler that the method will contain at least one `await` keyword. If the compiler finds a method marked as `async` but without an `await` keyword, it reports a compilation error.

Slide 56

Let us understand how to access and manipulate XML data.

Accessing and Manipulating XML Data 1-7

- Enterprise applications often need to store data in XML format.
- In such applications, you will need to access data from XML documents.
- For example:

Consider an XML document used to store names and e-mail IDs of employees in a Web application.

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Using slide 56, explain that you need to store data in XML format for such Web or enterprise applications.

Discuss an example to illustrate this. Tell the students that, for example, names and e-mail IDs of employees can be stored within an XML document in a Web application. Book details for a library application, customer details for an online shopping application can be other examples that you may mention to demonstrate this.

Slide 57

Let us understand accessing and manipulating XML Data.

Accessing and Manipulating XML Data 2-7

- Following code snippet creates the Employees.xml file:

```
<?xml version="1.0" encoding="utf-8" ?>
<root>
<user>
<name>John Smith</name>
<email>john.smith@example.com</email>
</user>
<user>
<name>Mark Parker</name>
<email>mark.parker@example.com</email>
</user>
</root>
```
- This code:
 - Creates a <root> element with two <user> sub elements.
 - Each <user> subelement further contains the <name> and <email> sub elements.

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Tell the students that the code on slide 57 shows how to create the Employees.xml file. Explain the code. Tell them that this code, creates a <root> element with two <user> sub elements. Each <user> sub element contains the <name> and <email> sub elements.

Slide 58

Let us understand how to access and manipulate XML data.

Accessing and Manipulating XML
Data 3-7

- ❑ In order to read the data from the XML file, you need to load the XML file into an XmlDocument object.
- ❑ This object represents an XML document.
- ❑ You can then retrieve the <root> element of the XML document as an XmlNode object.
- ❑ Once you have access to the XmlNode object, you can use a foreach loop to traverse the different elements of the document and access the values of the elements.

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Using slide 58, tell them that to be able to read the data from the XML file using a .NET Web application, you need to load the XML file into an XmlDocument object that represents an XML document. You can then retrieve the <root> element of the XML document as an XmlNode object. After accessing the XmlNode object, you can use a foreach loop to traverse the different elements of the document and access the values of the elements.

Slide 59

Let us understand how to access and manipulate XML data.

Accessing and Manipulating XML
Data 4-7

- ❑ Following code snippet uses the XmlDocument class to read data stored in the employees.xml file.

```
 XmlDocument doc = new XmlDocument();
doc.Load(Server.MapPath("~/Xml/Employees.xml"));
XmlNode node = doc["root"];
foreach (XmlNode childNode in node.ChildNodes)
{
    string value = childNode.InnerText;
```

— This code creates the XmlDocument object and calls the Load() method to load the content of the employees.xml file in the XmlDocument object.
— An XmlNode object that represents the <root> element is then retrieved.
— Finally, a foreach loop traverses the XmlNode object to retrieve the values of the XML elements.

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Using slide 59, tell that the code uses the XmlDocument class to read data stored in the employees.xml file.

Then, explain the code. Tell that this code creates the XmlDocument object and calls the Load() method to load the content of the employees.xml file in the XmlDocument object. An XmlNode object that represents the <root> element is then retrieved. Finally, a foreach loop traverses the XmlNode object to retrieve the values of the XML elements.

Slide 60

Let us understand how to access and manipulate XML data.

Accessing and Manipulating XML Data 5-7

- ❑ You can also use the following classes to manipulate an XML document:
 XmlDocument
 XmlNode
- ❑ For example:
Consider that you need to update the value of the <email> element whose <name> element contains the value John Smith.

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Using slide 60, tell them that use the XmlDocument and XmlNode classes to manipulate an XML document. For example, consider that you need to update the value of the <email> element whose <name> element contains the value John Smith.

Slides 61 and 62

Let us understand how to access and manipulate XML data.

Accessing and Manipulating XML Data 6-7

- ❑ Following code snippet updates the employees.xml document:

```
 XmlDocument doc = new XmlDocument();
doc.Load(Server.MapPath("~/Xml/Employees.xml"));
XmlNode node = doc["root"];

foreach (XmlNode childNode in node.ChildNodes)
{
    if (childNode["name"].InnerText.Equals("John Smith"))
        childNode["email"].InnerText = "johns@example.com";

}
doc.Save(Server.MapPath("~/Xml/Employees.xml"));
```

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Accessing and Manipulating XML

Data 7-7

- ❑ This code creates a `XmlDocument` object and calls the `Load()` method to load the content of the `Employees.xml` file in the `XmlDocument` object.
- ❑ An `XmlNode` object that represents the `<root>` element is then retrieved.
- ❑ A `foreach` loop traverses the `XmlNode` object to retrieve the values of the XML elements.
- ❑ Inside the `foreach` loop, an `if` loop checks for the `XmlNode` object that represents the `<name>` element with the value is `John Smith`.
- ❑ When that `XmlNode` is encountered, the value of the `XmlNode` that represents the `<email>` element is changed to `johns@webexample.com`.

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Using slide 61, tell them that the code updates the `Employees.xml` document. Explain the code using slide 62. Tell them that this code creates an `XmlDocument` object and calls the `Load()` method to load the content of the `Employees.xml` file in the `XmlDocument` object.

An `XmlNode` object that represents the `<root>` element is then retrieved. Finally, a `foreach` loop traverses the `XmlNode` object to retrieve the values of the XML elements. Inside the `foreach` loop, an `if` loop checks for the `XmlNode` object that represents the `<name>` element with the value is John Smith.

When that `XmlNode` is encountered, the value of the `XmlNode` that represents the `<email>` element is changed to `johns@webexample.com`.

Slides 63 and 64

Let us summarize the session.

Summary 1-2

- ❑ The .NET Framework provides various data access technologies, such as `ADO.NET`, `Entity Framework`, and `WCF Data Services`.
- ❑ `ADO.NET` allows you to connect with a database, execute commands, and populate a dataset that provides forward-only and read-only access to data.
- ❑ In an `ASP.NET` Web application, to simplify the process of accessing data from the application, you can use an Object Relationship Mapping (ORM) framework.

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The slide has a blue header bar with the title "Summary 2-2". Below the header is a white content area containing four bullet points. At the bottom of the slide are two small text elements: "© Aptech Limited" and "Enterprise Application Development Using Windows Azure and Web Services/Session 5".

- ❑ The Entity Framework is an implementation of the EDM, which is a conceptual model that describes the entities and the associations they participate in an application.
- ❑ The .NET Framework provides WCF data service that you can use to create services using OData.
- ❑ You can use the standard HTTP methods, such as GET, PUT, POST, and DELETE to perform CRUD operations on the entities.
- ❑ The XmlDocument and XmlNode classes enable accessing and manipulating XML data.

Using slides 63 and 64, summarize the session. End the session, with a brief summary of what has been taught in the session.

Tell the students pointers of the session. This will be a revision of the current session and it will be related to the next session. Explain each of the following points in brief. Tell them that:

- The .NET Framework provides various data access technologies, such as ADO.NET, Entity Framework, and WCF data services.
- ADO.NET allows you to connect with a database, execute commands, and populate a data set that provides forward-only and read-only access to data.
- In an ASP.NET Web application, to simplify the process of accessing data from the application you can use an Object Relationship Mapping (ORM) framework.
- The Entity Framework is an implementation of the Entity Data Model (EDM), which is a conceptual model that describes the entities and the associations they participate in an application.
- The .NET Framework provides WCF data service that you can use to create services using the Open Data Protocol (OData).
- You can use the standard HTTP methods, such as GET, PUT, POST, and DELETE to perform CRUD operations on the entities.
- The XmlDocument and XmlNode classes enable accessing and manipulating XML data.

5.3 Post-Class Activities for Faculty

You should familiarize yourself with the topics such as advanced concepts of data access that will be covered in the next session.

Tips: You can also check the Articles/Blogs/Expert Videos uploaded on the OnlineVarsity site to gain additional information related to the topics covered in the next session. You can also connect to online tutors on the OnlineVarsity site to ask queries related to the sessions.

Session 6 – Advanced Concepts of Data Access

6.1 Pre-Class Activities

Before you commence the session, you should familiarize yourself with the topics of this session in-depth. You should revisit topics of the previous session for a brief review. Here, you can ask students the key topics they can recall from previous session. Prepare a question or two which will be a key point to relate the current session objectives.

The summary of the previous session is as follows:

- The .NET Framework provides various data access technologies, such as ADO.NET, Entity Framework, and WCF Data Services.
- ADO.NET allows you to connect with a database, execute commands, and populate a dataset that provides forward-only and read-only access to data.
- In an ASP.NET Web application, to simplify the process of accessing data from the application, you can use an Object Relationship Mapping (ORM) framework.
- The Entity Framework is an implementation of the EDM, which is a conceptual model that describes the entities and the associations they participate in an application.
- The .NET Framework provides WCF data service that you can use to create services using OData.
- You can use the standard HTTP methods, such as GET, PUT, POST, and DELETE to perform CRUD operations on the entities.
- The XmlDocument and XmlNode classes enable accessing and manipulating XML data.

6.1.1 Objectives

By the end of this session, the learners will be able to:

- Define and describe how to query data with Entity Framework
- Explain how to work with transactions
- Explain how to create and use Entity Framework data model

6.1.2 Teaching Skills

To teach this session successfully, you should be aware of Entity Framework fundamentals. You must also know the process of querying data with Entity Framework. Also, familiarize yourself with process of creating and using Entity Framework data model.

For teaching in the class, you are expected to use slides and LCD projectors.

Tips:

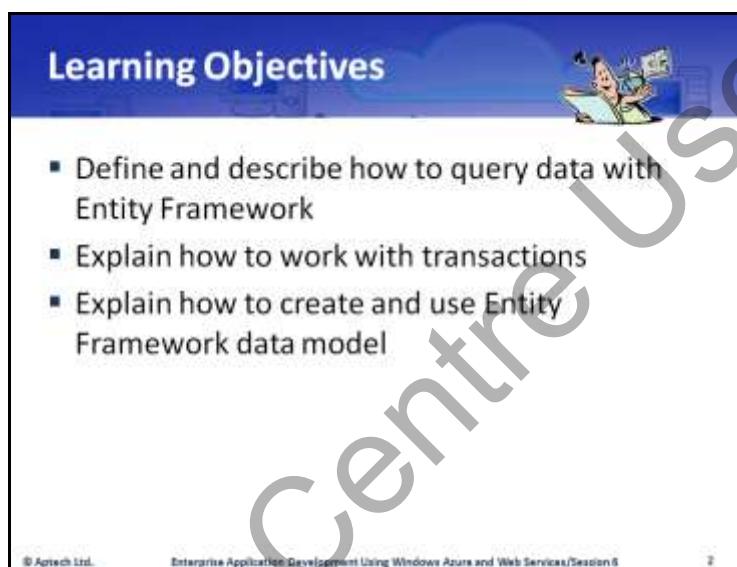
It is recommended that you test the understanding of the students by asking questions in between the class.

In-Class Activities:

Follow the order given here during In-Class activities.

Overview of the Session:

Give the students a brief overview of the current session in the form of session objectives. Show the students slide 2 of the presentation.



The slide has a blue header bar with the title "Learning Objectives". Below the header is a cartoon illustration of a person sitting at a desk with a computer monitor. The main content area contains a bulleted list of three objectives:

- Define and describe how to query data with Entity Framework
- Explain how to work with transactions
- Explain how to create and use Entity Framework data model

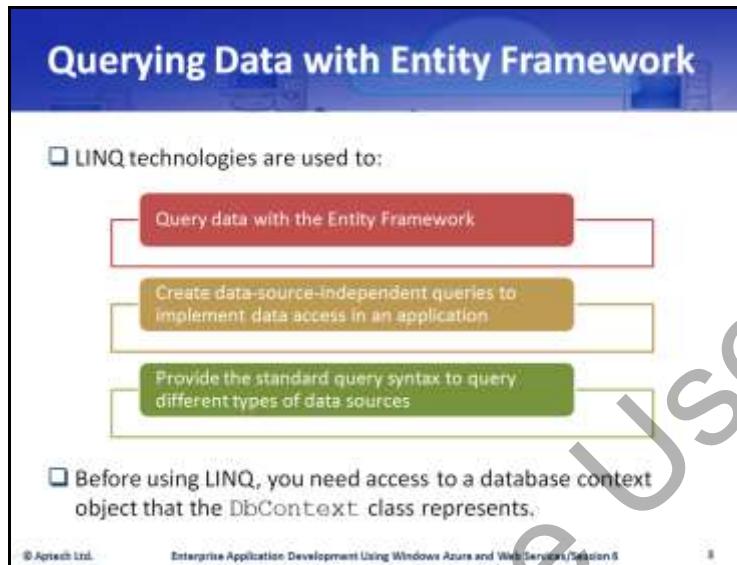
At the bottom left is the copyright notice "© Aptech Ltd." and at the bottom center is the slide number "2".

Using slide 2, tell the students that they will learn about querying data with Entity Framework. They will also learn how to work with transactions. Tell them that they will learn how to create and use Entity Framework data model.

6.2 In-Class Explanations

Slide 3

Let us understand Language Integrated Query (LINQ) technologies.



The slide has a blue header bar with the title "Querying Data with Entity Framework". Below the header, there is a list of bullet points:

- ❑ LINQ technologies are used to:
 - Query data with the Entity Framework
 - Create data-source-independent queries to implement data access in an application
 - Provide the standard query syntax to query different types of data sources
- ❑ Before using LINQ, you need access to a database context object that the `DbContext` class represents.

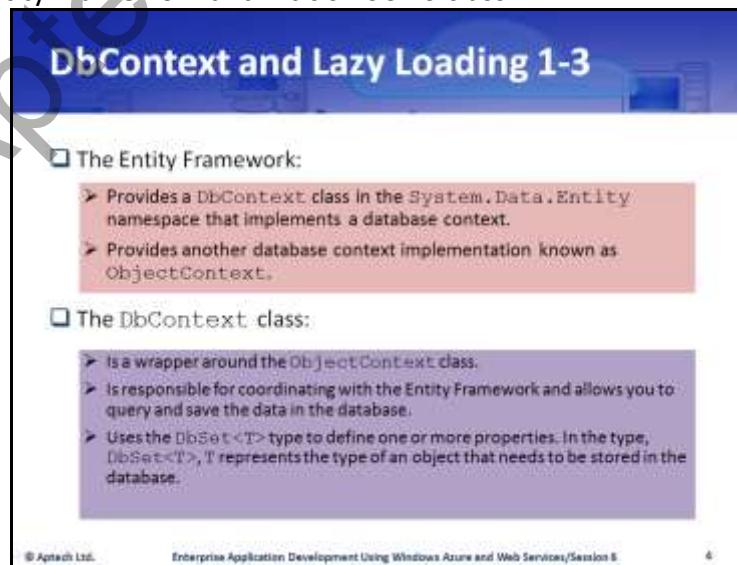
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Use slide 3 to explain the usage of LINQ technologies. Tell the students that these technologies are used to query data with the Entity Framework. Tell them that LINQ is a set of APIs that allows them to create data-source-independent queries to implement data access in an application.

It has a programming model that provides the standard query syntax to query different types of data sources. However, before using LINQ, you need access to a database context object that the `DbContext` class represents.

Slide 4

Let us understand Entity Framework and `DbContext` class.



The slide has a blue header bar with the title "DbContext and Lazy Loading 1-3". Below the header, there is a list of bullet points:

- ❑ The Entity Framework:
 - Provides a `DbContext` class in the `System.Data.Entity` namespace that implements a database context.
 - Provides another database context implementation known as `ObjectContext`.
- ❑ The `DbContext` class:
 - Is a wrapper around the `ObjectContext` class.
 - Is responsible for coordinating with the Entity Framework and allows you to query and save the data in the database.
 - Uses the `DbSet<T>` type to define one or more properties. In the type, `DbSet<T>`, `T` represents the type of an object that needs to be stored in the database.

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In slide 4, explain the Entity Framework and DbContext class to the students. Tell them that in the Entity Framework, a database context acts as a bridge between the model classes of your application and the Entity Framework. The Entity Framework provides a DbContext class in the System.Data.Entity namespace that implements a database context. The Entity Framework provides another database context implementation known as ObjectContext.

Explain them that the DbContext class is a wrapper around the ObjectContext class to provide a simple interface to perform common tasks with the database context. The DbContext class is responsible for coordinating with the Entity Framework and allows querying and saving the data in the database.

Mention that the DbContext class uses the DbSet<T> type to define one or more properties. In the type, DbSet<T>, T represents the type of an object that needs to be stored in the database.

Slide 5

Let us understand the code of DbContext class.

DbContext and Lazy Loading 2-3

Following code shows how to use the DbContext class:

```
public class OLShopDataContext : DbContext
{
    public DbSet<Customer> Customers { get; set; }
    public DbSet<Product> Products { get; set; }
}
```

In this code:

- A database context class named OLShopDataContext is created that derives from the DbContext class. This class creates the DbSet property for both, the Customer class and the Product class.
- The key method of the DbContext class that you will most commonly use is the SaveChanges() method.
- This method saves all changes made in the DbContext object to the underlying database. The DbContext class supports lazy loading that delays the loading of data until a specific request for the data arrives.
- You can configure lazy loading by setting the DbContext.Configuration.LazyLoadingEnabled property to True.

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Using slide 5, show and explain the code snippet that displays how to use the DbContext class.

Explain that in this code, a database context class named OLShopDataContext is created that derives from the DbContext class. This class creates the DbSet property for both, the Customer class and the Product class.

Explain that the key method of the DbContext class that used commonly is the SaveChanges() method. This method saves all changes made in the DbContext object to the underlying database. The DbContext class supports lazy loading that delays the loading of data until a specific request for the data arrives.

Mention that a user can configure lazy loading by setting the DbContext.Configuration.LazyLoadingEnabled property to true.

Slide 6

Let us understand the code that uses lazy loading to retrieve the category of the product.

DbContext and Lazy Loading 3-3

Following code uses lazy loading to retrieve the category of a product:

```
using (var ctx = new ProductDbContext())
{
    ctx.Configuration.LazyLoadingEnabled = true;
    IList<Product> productList = ctx.Products.ToList<Product>();
    Product product = productList[0];
    Category cat = product.Category;
}
```

In this code:

- Lazy loading is used as a result of which two SQL queries will get executed.
- The first query will retrieve all products, while the second query will only execute to retrieve the Category property of the referred product, which in this case, is the first product of the product list.

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In slide 6, explain the example to the students and inform them that the code snippet in the slide uses lazy loading to retrieve the category of a product. Tell them that this code uses lazy loading as a result of which two SQL queries will get executed. The first query will retrieve all products, while the second query will only execute to retrieve the Category property of the referred product, which in this case, is the first product of the product list.

Additional Information:

To know more about LINQ, visit the following links:

<http://msdn.microsoft.com/en-IN/library/bb397926.aspx>
<http://www.codeproject.com/KB/linq/>
http://en.wikipedia.org/wiki/Language_Integrated_Query

In-Class Question:

After you finish explaining DbContext and Lazy Loading, you will ask students an In-Class question. This will help you in reviewing their understanding of the topic.



Explain what is meant by LINQ technologies.

Answer:

The LINQ technologies are used to query data with the Entity Framework. It is a set of APIs that allows to create data-source-independent queries to implement data access in an application. It has a programming model that provides the standard query syntax to query different types of data sources.

Slide 7

Let us understand querying with LINQ to SQL.

Querying with LINQ to SQL 1-2

- ❑ LINQ to SQL is used to:
- Access SQL-compliant databases.
- Make data available as objects in an application to map with the database objects to enable working with data.
- Map objects help to perform all the database operations, such as select, insert, update, and delete on a database.
- Retrieve the data from a database, the LINQ to SQL query are converted into SQL queries.
- Send the query to the database where the database query execution engine executes the query and returns results.
- Use an instance of the database context class of the application to cache the data retrieved from the database and send the data to the application.
- Use the instances of the model class to represent the tables of the database in the application.

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Using slide 7, tell the students that LINQ to SQL enables the user to access SQL-complaint databases and makes data available as objects in an application. These objects in the application are mapped with the database objects to enable you to work with data.

Explain that the object model of the programming language and the data model of the relational database are mapped to each other. A user can perform all the database operations, such as select, insert, update, and delete, on a database with the help of mapped objects.

Tell them that on executing a LINQ to SQL query to retrieve the data from a database, the LINQ to SQL query are converted into SQL queries. The query is then sent to the database where the database query execution engine executes the query and returns results. These results are converted back to objects by using LINQ to SQL, and then sent to the application.

Mention that during this process, LINQ to SQL uses an instance of the database context class of the application to cache the data retrieved from the database and send the data to the application. In addition, LINQ to SQL uses the instances of the model class to represent the tables of the database in the application.

Slide 8

Let us understand the code to access customers' names of online shopping store.

Querying with LINQ to SQL 2-2

Following code describes how to access the names of the customers of an online shopping store from the Customer table:

```
string names = "";
IQueryable <Customer> q = from s in db.customers
select s;
foreach (var cust in q)
{
    names += " " + cust.Name;
}
```

This code retrieves the names of the customers from the Customers table.



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Show the code snippet given on slide 8 to the students and tell them that it describes how to access the names of the customers of an online shopping store from the Customer table. Tell the students that this code will retrieve the names of the customers from the Customers table.

Slide 9

Let us understand Entity SQL.

Querying with Entity SQL 1-2

Entity SQL is a query language that you can use to:

- Query entity models in the Entity Framework. Entity SQL is similar to SQL.
- Query data with Entity SQL against the Entity Framework without requiring a steep learning curve.
- Query data either as objects or in a tabular form.
- Construct a query statement dynamically as a string, instead of committing to its structure in code.

Entity SQL resembles Structured Query Language (SQL), but instead of using table or view names inside a statement, Entity SQL uses domain class names.

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Using slide 9, explain that Entity SQL is a query language that can use to query entity models in the Entity Framework. It is similar to SQL. Therefore, developers who are familiar with SQL can query data with Entity SQL against the Entity Framework without requiring a steep learning curve.

Mention that the students can use Entity SQL to query data either as objects or in a tabular form. Also, explain to the students that Entity SQL resembles Structured Query Language (SQL), but instead of using table or view names inside a statement, Entity SQL uses domain class names.

Entity SQL statements can return entities and scalar values. Tell them that they should consider using Entity SQL if a LINQ to Entities statement becomes too complex.

Moreover, they use Entity SQL to construct a query statement dynamically as a string, instead of committing to its structure in code.

Slide 10

Let us understand the code that uses Entity SQL to query a database.

Following code uses Entity SQL to query a database:

```
var context = new AppDbContext();
var ObjectContext = (context as
IOObjectContextAdapter).ObjectContext;
string eSql= "SELECT VALUE prod FROM AppDbContext.Product AS
prod";
var query = ObjectContext.CreateQuery<Product>(eSql);
List<Product> products =query.ToList();
```

In this code:

- An `ObjectContext` instance is obtained from the `DbContext` object.
- Then, the `CreateQuery<T>` generic method of the `ObjectContext` class is called to execute the Entity SQL query and retrieve objects from the database.

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In slide 10, show the code snippet to students and tell them that this code uses Entity SQL to query a database.

Also, tell them that this code obtains an `ObjectContext` instance from the `DbContext` object. Then, the `CreateQuery<T>` generic method of the `ObjectContext` class is called to execute the Entity SQL query and retrieve objects from the database.

Slides 11 to 13

Let us understand LINQ to Entities.

Querying with LINQ to Entities 1-3

- ❑ In LINQ to Entities, a programmer:
 - Creates a query that returns a collection of zero or more typed entities.
 - Needs a data source against which the query will execute.
 - An instance of the ObjectQuery class represents the data source.
 - Stores a query in a variable.
 - When the query is executed, it is first converted into a command tree representation that is compatible with the Entity Framework.

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Querying with LINQ to Entities 2-3

- ❑ Following code creates and executes a query to retrieve the records of all Customer entities along with the associated Order entities:

```
public static void DisplayAllCustomers()
{
    using (Model1Container dbContext = new Model1Container())
    {
        IQueryables<Customer> query = from c in dbContext.Customers
        select c;
        Console.WriteLine("Customer Order Information");
        foreach (var cust in query)
        {
            Console.WriteLine("Customer ID: {0}, Name: {1}, Address: {2}", cust.CustomerId, cust.Name, cust.Address);
            foreach (var ord in cust.Orders)
            {
                Console.WriteLine("Order ID: {0}, Cost: {1}", ord.OrderId, ord.Cost);
            }
        }
    }
}
```

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Querying with LINQ to Entities 3-3

- ❑ In this code:
 - The `from` operator specifies the data source from where the data has to be retrieved.
 - `dbContext` is an instance of the `DbContext` class that provides access to the Customers data source, and `c` is the range variable.
 - When the query is executed, the `range` variable acts as a reference to each successive element in the data source.
 - The `select` operator in the LINQ query specifies the type of the returned elements as an `IQueryable<Customer>` object. The `foreach` loops iterate through the results of the query returned as an `IQueryable<Customer>` object to print the customer and order details.
- ❑ Output:

```
Customer Order Information
Customer ID: 1, Name: Alex Parker, Address: 10th Park Street, Neo Mount
Order ID: 1, Cost: 575
Customer ID: 2, Name: Peter Milne, Address: Lake View Street, Cheron Mount
Order ID: 2, Cost: 800
```

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Using slide 11, explain that in LINQ to Entities, a programmer creates a query that returns a collection of zero or more typed entities. To create a query, the programmer needs a data source against which the query will execute. An instance of the `ObjectQuery` class represents the data source.

Tell them that in LINQ to entities, a query is stored in a variable. When the query is executed, it is first converted into a command tree representation that is compatible with the Entity Framework. Then, the Entity Framework executes the query against the data source and returns the result.

In slide 12, show the code snippet to the students and tell them that this code creates and executes a query to retrieve the records of all `Customer` entities along with the associated `Order` entities.

Using slide 13, tell the students that in this code, the `from` operator specifies the data source from where the data has to be retrieved. `dbContext` is an instance of the `DbContext` class that provides access to the `Customers` data source, and `c` is the range variable. When the query is executed, the range variable acts as a reference to each successive element in the data source.

Tell them that the `select` operator in the LINQ query specifies the type of the returned elements as an `IQueryable<Customer>` object. The `foreach` loops iterate through the results of the query returned as an `IQueryable<Customer>` object to print the customer and order details.

Show the output of the code to the students in the slide.

Additional Information:

To know more about querying with LINQ to Entities, visit the following links:

[http://msdn.microsoft.com/en-us/library/vstudio/bb399367\(v=vs.100\).aspx](http://msdn.microsoft.com/en-us/library/vstudio/bb399367(v=vs.100).aspx)

<http://www.codeproject.com/Articles/493917/Dynamic-Querying-with-LINQ-to-Entities-and-Express>

<http://www.entityframeworktutorial.net/Querying-with-EDM.aspx>

<http://blogs.msdn.com/b/wriju/archive/2008/07/01/linq-to-entity-querying-data-using-ado-net-entity-framework.aspx>

In-Class Question:

After you finish explaining querying with LINQ to Entities, you will ask the students an In-Class question. This will help you in reviewing their understanding of the topic.



What is LINQ to Entities?

Answer:

In LINQ to Entities, a programmer creates a query that returns a collection of zero or more typed entities. To create a query, the programmer needs a data source against which the query will execute. An instance of the `ObjectQuery` class represents the data source.

Slides 14 to 16

Let us understand more about LINQ to SQL and the Entity Framework.

LINQ to SQL and the Entity Framework

1-3

- LINQ to SQL and the Entity Framework:
 - Provides support for precompiled queries.
 - Performs the query transformation when the query is first executed.
 - Reuses the transformed query each time it executes.
- Following code shows the LINQ query that you can use to address this requirement:

```
ctx.Students.Where(s=>s.StudentID==_studentID)
```
- In this code,
 - You can convert the preceding query into a precompiled query by using the `CompiledQuery` class of the Entity Framework.
 - This class present in the `System.Data.Objects.CompiledQuery` namespace provides a `Compile()` method.
 - This method takes the current `DataContext` or `ObjectContext` object as parameter.
 - This method also accepts any parameters that need to be passed to the query and the type that the query returns. This method returns a `Func<T>` (delegate) that can be later invoked.

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LINQ to SQL and the Entity Framework

2-3

- Following code shows a query that will be precompiled by the Entity Framework:

```
var _studentRec = CompiledQuery.Compile<StudentsEntities, int, Student>((ctx, id)>>ctx.Students.Where(s=>s.StudentID==_studentID).Single());
```
- The `Compile()` method when executed will generate the following result:

```
private System.Func<StudentsEntities, int, Student> studentRec
```
- Once the query is compiled, it can be invoked from the application, as shown in the following code:

```
#Student student = studentRec.Invoke(ctx, studentID);
```

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LINQ to SQL and the Entity Framework

3-3

- LINQ provides several operators, which are methods that you can use to query data. These operators support functionalities such as:
 - Filtering Data**
 - Sorting Data**
 - Grouping Data**
 - Joining Data**

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Before explaining about LINQ to SQL and the Entity Framework, tell the students that in applications, they will often need to create LINQ queries that will execute repeatedly. When a LINQ query executes, the Entity Framework is responsible for transforming the query to the underlying database language. This could be, for example, to a T-SQL statement if the database is SQL Server. However, the process of this transformation has performance overhead. Hence, if a query needs to execute repeatedly in an application, the overall performance of the application gets affected.

As a solution, explain using slide 14 that LINQ to SQL and the Entity Framework provides support for precompiled queries. When user uses precompiled queries, Entity Framework and LINQ to SQL will perform the query transformation when the query is first executed and reuse the transformed query each time it executes.

Ask students to consider an example where they need to repeatedly retrieve student records based on a student ID.

Then, show the code snippet that displays the LINQ query that they can use to address this requirement.

Tell them that they can convert the preceding query into a precompiled query by using the `CompiledQuery` class of the Entity Framework. This class present in the `System.Data.Objects.CompiledQuery` namespace provides a `Compile()` method. This method takes the current `DataContext` or `ObjectContext` object as parameter. This method also accepts any parameters that need to be passed to the query and the type that the query returns. This method returns a `Func<T>` (delegate) that can be later invoked.

In slide 15, show the code snippet that displays a query that will be precompiled by the Entity Framework.

Mention that the `Compile()` method when executed will generate the following result:

```
private System.Func<StudentsEntities, int, Student> studentRec
```

Tell them that once the query is compiled, it can be invoked from the application, as shown in the given code snippet.

Explain to the students using slide 16 that LINQ provides several operators, which are methods that can be used to query data. These operators support functionalities to filter, sort, group, and join data.

Additional Information:

To know more about Entity Framework, visit the following links:

<http://msdn.microsoft.com/en-in/data/ef.aspx>
http://en.wikipedia.org/wiki/Entity_Framework
<http://www.entityframeworktutorial.net/>

<http://www.asp.net/entity-framework>

<http://www.codeproject.com/Articles/363040/An-Introduction-to-Entity-Framework-for-Absolute-B>

Slides 17 and 18

Let us understand filtering data.

Filtering Data 1-2

- ❑ You can use the `where` operator in a LINQ query to perform data filtering based on a Boolean condition, known as the **predicate**. The `where` operator applies the predicate to the `range` variable that represents the source elements and returns only those elements for which the predicate is `true`.
- ❑ Following code uses the `where` operator to filter customer records:

```
public static void DisplayCustomerByName()
{
    using (ModelContainer dbContext = new ModelContainer())
    {
        IQueryable<Customer> query = from c in dbContext.Customers
                                       where c.Name == "Alex Parker" select c;
        Console.WriteLine("Customer Information:");
        foreach (Customer cust in query)
        {
            Console.WriteLine("Customer ID: {0}, Name: {1}, Address: {2}", cust.CustomerId, cust.Name, cust.Address);
        }
    }
}
```

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Filtering Data 2-2

- ❑ This code uses the `where` operator to retrieve information of the customer with the name `AlexParker`. The `foreach` statement iterates through the result to print the information of the customer.
- ❑ Output:
Customer Information:
Customer ID: 1, Name: Alex Parker, Address: 10th Park Street, Leo Mount



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In slide 17, explain the concept of filtering data.

Explain to the students that they can use the `where` operator in a LINQ query to perform data filtering based on a Boolean condition, known as the predicate. The `where` operator applies the predicate to the `range` variable that represents the source elements and returns only those elements for which the predicate is `true`.

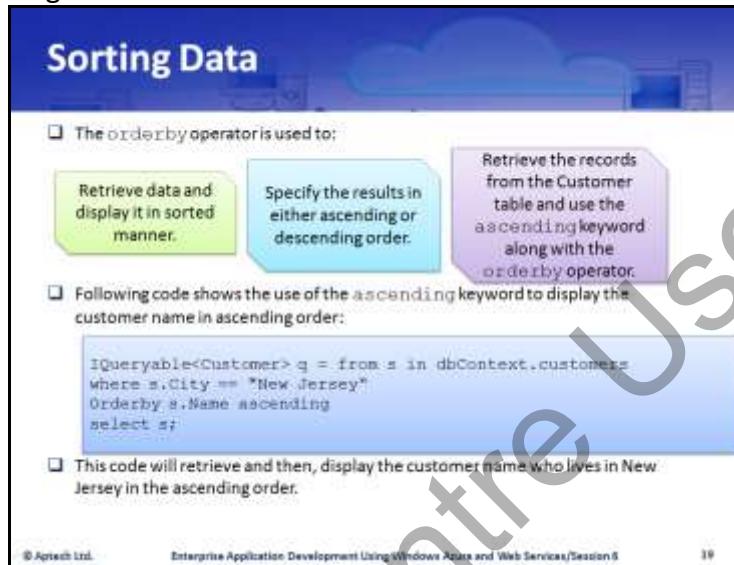
Then, show the code snippet that uses the `where` operator to filter customer records.

In slide 18, tell the students that this code uses the `where` operator to retrieve information of the customer with the name `AlexParker`. The `foreach` statement iterates through the result to print the information of the customer.

Show the output of the code to the students.

Slide 19

Let us understand sorting data.



The slide has a blue header with the title "Sorting Data". Below the header, there are three bullet points:

- The `orderby` operator is used to:
 - Retrieve data and display it in sorted manner.
 - Specify the results in either ascending or descending order.
 - Retrieve the records from the Customer table and use the ascending keyword along with the `orderby` operator.
- Following code shows the use of the `ascending` keyword to display the customer name in ascending order:

```
IQueryable<Customer> q = from s in dbContext.customers  
where s.City == "New Jersey"  
orderby s.Name ascending  
select s;
```
- This code will retrieve and then, display the customer name who lives in New Jersey in the ascending order.

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Using slide 19, tell the students that they can use the `orderby` operator to retrieve data and then, display it in sorted manner. The `orderby` operator specifies whether the result should be displayed in either ascending or descending order.

Explain them that though the result is displayed in the ascending order by default, they can also use the `ascending` keyword to sort in the ascending order.

Explain the following scenario to the students:

'Consider the scenario, where you want to display the customer name that lives in New Jersey in an ascending order. For this, you first need to retrieve the records from the Customer table and then, use the `ascending` keyword along with the `orderby` operator.'

Tell them that the given code snippet in the slide shows the use of `ascending` keyword to display the customer name in ascending order. Mention that this code will retrieve and then, displays the customer name who lives in New Jersey in the ascending order.

Also, mention that user can also sort the customer name in descending order by specifying `descending` in the `orderby` clause.

Slide 20

Let us understand grouping data.

The slide has a blue header bar with the title 'Grouping Data'. Below the header, there is a list of bullet points:

- ❑ The `group` operator is used to:
 - Retrieve and display the data as a group.
 - Group the results based on a specified key.
- ❑ Following code shows how to group the customers according to their cities:

```
var q = from s in dbContext.customers groups by s.City;
```
- ❑ This code retrieves the customer records and groups, these records are based on the city where the customers lives.

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In slide 20, explain to the students that they can use the `group` operator to retrieve and display the data as a group. Using the `group` operator allows user to group the results based on a specified key.

Explain the following example to the students:

For example, you need to group the customers by the city name so that all the customers from a particular city are arranged in individual groups.

Show the given code snippet on the slide and tell them that this code shows how to group the customers according to their cities. Mention that this code retrieves the customer records and groups these records based on the city where the customers lives.

Slides 21 and 22

Let us understand `join` operator.

The slide has a blue header bar with the title 'Joining Data 1-2'. Below the header, there is a list of bullet points:

- ❑ The `join` operator is used to:
 - Associate the elements in one table with the elements in another table, where the two tables share a common attribute.
 - Retrieve the elements from different tables on the basis of a common attribute.

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Joining Data 2-2

Following code shows usage of the join operator to retrieve records of all the male customers who have placed an order online:

```
var customers = db.customers;
var orderdetails = db.orderdetails;
var list = (from s in customers
join t in orderdetails on
s.Name equals t.Customer
where s.Gender == "M"
select new {Customer=s.Name,
Product=t.Product}).ToList();
var orders = "";
foreach (var order in list)
{
    orders += order.Customer + " : " + order.Product + "\r\n"
}
```

This code retrieves the details of the customers from the Customer and orderdetails tables by joining the tables using the join operator.

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Using slide 21, explain the `join` operator.

Explain that the students can use the `join` operator to associate the elements in one table with the elements in another table, where the two tables share a common attribute. The `join` operator enables user to retrieve the elements from different tables on the basis of a common attribute. While using the `join` operator to retrieve elements, user needs to use the `equals` keyword to compare the data in the common attribute.

In slide 22, tell the students to consider the scenario where an online shopping store need to retrieve the records of all the male customers who have placed an order online. This requires retrieving information from the `Customer` table and the `orderdetails` table. For this, tell them that the students can use the `join` operator in the query.

Show the code snippet that displays using the `join` operator to retrieve records of all the male customers who have placed an order online.

Tell the students that this code retrieves the details of the customers from the `Customer` and `orderdetails` tables by joining the tables using the `join` operator.

In-Class Question:

After you finish explaining usage of `join` operator, you will ask students an In-Class question. This will help you in reviewing their understanding of the topic.



Which are the functionalities that are supported by operators of LINQ?

Answer:

LINQ provides several operators that support functionalities such as Filtering Data, Sorting Data, Grouping Data, and Joining data.

Slides 23 and 24

Let us understand the CRUD operations.

CRUD with LINQ to SQL 1-2

- To perform CRUD operations using the LINQ to SQL queries:
 - Log the query that is executed to database out of the LINQ query.
 - Use the `Log` property of the `DataContext` class.
 - Analyze and identify any problems in the LINQ query you executed.
- Following code uses the `Log` property of the `DataContext` class to log the queries that are executed:

```
using (System.IO.StreamWriter sw = new System.IO.StreamWriter(@"C:\tempdatacontext.log")) {
    AppDataContext ctx = new AppDataContext();
    ctx.Log = sw;
    var cust = from c in ctx.Customers
    select c;
    List<Customer> custList = cust.ToList();
}
```

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CRUD with LINQ to SQL 2-2

- The code creates a `StreamWriter` object to write to the `C:\tempdatacontext.log` file.
- An `AppDataContext` object that is an implementation of the `DataContext` class is created and the `Log` property is used to set the `StreamWriter` object as the destination to write the SQL query.
- Finally, a LINQ to SQL query is executed.
- At runtime, when the LINQ to SQL query executes, the `tempdatacontext.log` file stores the SQL code.

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Using slides 23 and 24, explain CRUD operations.

Tell the students that while using the LINQ to SQL queries to perform CRUD operations, they might want to log the query that is executed to database out of the LINQ query. For this, tell them that they can use the `Log` property of the `DataContext` class. The `Log` property allows logging the queries that are executed in a file. Tell them that by logging queries, they can analyze and identify any problems in the LINQ query that is executed.

Show the code snippet to the students and tell them that it uses the `Log` property of the `DataContext` class to log the queries that are executed.

Tell the students that the code shown in slide 23 creates a `StreamWriter` object to write to the `C:\tempdatacontext.log` file. An `AppDataContext` object that is an implementation of the `DataContext` class is created and the `Log` property is used to set the `StreamWriter` object as the destination to write the SQL query.

Mention that a LINQ to SQL query is executed. At runtime, when the LINQ to SQL query executes, the `tempdatacontext.log` file stores the SQL code.

Additional Information:

To know more about CRUD with LINQ, visit the following links:

<http://www.c-sharpcorner.com/UploadFile/3d39b4/crud-operations-using-linq-to-sql-in-mvc/>

<http://www.codeproject.com/Articles/38010/CRUD-Operations-using-LINQ-Entities>

<http://chsakell.com/2013/05/09/linq-to-sql-crud-operations-and-stored-procedures/>

Slides 25 to 27

Let us understand the guidelines for using LINQ to query data from database and collections.

The slide has a blue header bar with the title "Implementing Query Boundaries 1-3". Below the header, there is a bulleted list: "While using LINQ to query data from database and collections:" followed by four green callout boxes containing the following text:

- Use both `IEnumerable` and `IQueryable` objects for data manipulation.
- Understand their differences and when to use either of the `IQueryable` or `IEnumerable` objects in an application.
- The `IEnumerable` interface is available in the `System.Collections` namespace and is suitable for LINQ to Object and LINQ to XML queries.
- Use an `IEnumerable` object to query data from collections such as `List` and `Array`.
- Use an `IEnumerable` object to query data from a database, the object executes the query on the database server, loads the retrieved results, and performs any specified data filtration.

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The image shows two slides from a presentation. Both slides have a blue header bar with the title 'Implementing Query Boundaries'.

Slide 25 (Top):

- Question: Following code uses an `IEnumerable` object to query data from a `Students` table for students whose name starts with the letter E:

```
AppDataContext ctx = new AppDataContext ();
IQueryable<Student> list = ctx.Students.Where(s =>s.Name.StartsWith("E"));
```

Slide 26 (Bottom):

- Question: The `IQueryable` interface:
 - Is available in the `System.Linq` namespace and derives from the `IEnumerable` interface.
 - Should be used for LINQ to SQL queries to query data sources, such as remote databases or Web services.
 - Provides methods, such as `CreateQuery()` and `Execute()` to create custom queries.
 - When you use an `IQueryable` object to query data from a database, the object executes the query along with any specified filters on the database server and then loads the filtered records.
- Following code uses an `IQueryable` object to query data from a `Students` table for students whose name starts with the letter E:

```
AppDataContext ctx = new AppDataContext ();
IQueryable<Student> list = ctx.Students.Where(s =>s.Name.StartsWith("E"));
```

Using slide 25, explain that while using LINQ to query data from database and collections, students can use both `IEnumerable` and `IQueryable` objects for data manipulation. However, they should understand their differences and when to use either of the `IQueryable` or `IEnumerable` objects in an application.

Tell them that the `IEnumerable` interface is available in the `System.Collections` namespace and is suitable for LINQ to Object and LINQ to XML queries.

Mention that the students can use an `IEnumerable` object to query data from collections such as `List` and `Array`. When they use an `IEnumerable` object to query data from a database, the object executes the query on the database server, loads the retrieved results, and performs any specified data filtration.

Show the code snippet using slide 26 to the students and tell them that the code uses an `IEnumerable` object to query data from a `Students` table for students whose name starts with the letter E.

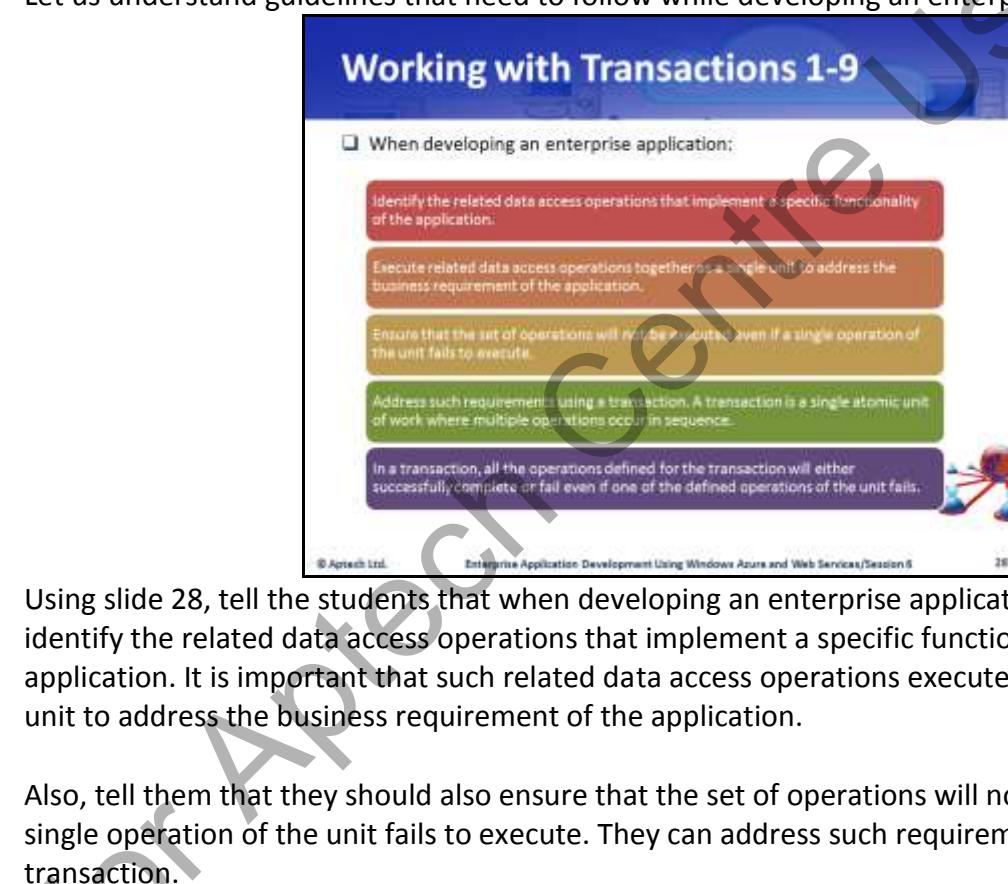
Using slide 27, explain that the `IQueryable` interface is available in the `System.Linq` namespace and derives from the `IEnumerable` interface. Tell them that they should use an `IQueryable` object for LINQ to SQL queries to query data sources, such as remote databases or Web services. The `IQueryable` object provides methods, such as `CreateQuery()` and `Execute()` to create custom queries.

Mention that when they use an `IQueryable` object to query data from a database, the object executes the query along with any specified filters on the database server and then loads the filtered records.

Show the code snippet that uses an `IQueryable` object to query data from a `Students` table for students whose name starts with the letter E.

Slide 28

Let us understand guidelines that need to follow while developing an enterprise application.



Working with Transactions 1-9

When developing an enterprise application:

- Identify the related data access operations that implement a specific functionality of the application.
- Execute related data access operations together as a single unit to address the business requirement of the application.
- Ensure that the set of operations will not be executed even if a single operation of the unit fails to execute.
- Address such requirements using a transaction. A transaction is a single atomic unit of work where multiple operations occur in sequence.
- In a transaction, all the operations defined for the transaction will either successfully complete or fail even if one of the defined operations of the unit fails.

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Using slide 28, tell the students that when developing an enterprise application, they should identify the related data access operations that implement a specific functionality of the application. It is important that such related data access operations execute together as a single unit to address the business requirement of the application.

Also, tell them that they should also ensure that the set of operations will not be executed even if a single operation of the unit fails to execute. They can address such requirements using a transaction.

Slide 29

Let us understand four key transaction properties.

The slide has a blue header bar with the title "Working with Transactions 2-9". Below the header, there is a list of four properties with corresponding colored boxes:

- Atomicity**: Specifies that a transaction should be considered a single unit of operation consisting of a sequence of independent operations, where all the operations complete either successfully or unsuccessfully.
- Consistency**: Ensures that a transaction ends by leaving the database in a valid state. This means that even if the transaction fails, the state of the database remains the same as it was before the transaction started.
- Isolation**: Ensures that multiple transactions occurring simultaneously remain isolated from each other to prevent data corruption.
- Durability**: Ensures that the results of a successful transaction are permanent, regardless of any system failure.

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Using slide 29, tell the students that a transaction is a single atomic unit of work where multiple operations occur in sequence.

In a transaction, all the operations defined for the transaction will either successfully complete or fail even if one of the defined operations of the unit fails.

Tell them that the four key transaction properties are Atomicity, Consistency, Isolation, and Durability (ACID). Explain these properties as follows:

Explain Atomicity.

Explain that Atomicity specifies that a transaction should be considered a single unit of operation consisting of a sequence of independent operations, where all the operations complete either successfully or unsuccessfully.

Explain Consistency.

Explain that Consistency ensures that a transaction ends by leaving the database in a valid state. This means that even if the transaction fails, the state of the database remains the same as it was before the transaction started.

Explain Isolation.

Explain that Isolation ensures that multiple transactions occurring simultaneously remain isolated from each other, to prevent data corruption.

Explain Durability.

Explain that durability ensures that the results of a successful transaction are permanent, regardless of any system failure.

Slide 30

Let us understand the System.Transactions API namespace.

Working with Transactions 3-9

System.Transactions API

- ❑ The System.Transactions namespace:
 - Contains classes that can be used to implement transactions in applications.
 - Implements transaction programmatically in an application.
 - Uses the classes of the System.Transactions namespace for implicit transaction management, where transaction is managed by the infrastructure.
- ❑ Following table lists the key classes of the System.Transactions namespace:

Class	Description
Transaction	Represents a transaction.
TransactionInformation	Provides additional information regarding a transaction.
TransactionManager	Contains methods used for transaction management. This class cannot be inherited.
TransactionScope	Makes a code block transactional. This class cannot be inherited.

- ❑ When Entity Framework is used in an enterprise application, the framework handles transaction management.

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Using slide 30, explain to the students that the System.Transactions namespace contains classes that they can use to implement transactions in applications. Using the classes of the System.Transactions namespace, they can implement transaction programmatically in an application.

Tell them that they can also use the classes of the System.Transactions namespace for implicit transaction management, where transaction is managed by the infrastructure.

Show a table that lists the key classes of the System.Transactions namespace.

Tell the students that when they use Entity Framework in an enterprise application, the framework handles transaction management for them. For example, when they add, update, or delete entities to the database by calling the SaveChanges () method of the DbContext class, the method automatically starts a transaction and does not commit the transaction until all the operations on the entities complete.

Slide 31

Let us understand distributed transactions.

The slide has a blue header bar with the title 'Working with Transactions 4-9'. Below the header is a yellow callout box containing the text: 'A transaction that updates data on two or more computers in a network is known as distributed transaction.' Underneath this is a section titled '❑ Distributed transactions:' with three bullet points:

- Involve multiple resources, such as database servers and messaging systems.
- Involve a transaction manager that controls and coordinates the transaction on the resources.
- If any failure occurs in any resource, the transaction must roll back in all other resources participating in the transaction.

At the bottom left of the slide is the copyright notice: '© Aptech Ltd.' and at the bottom right: 'Enterprise Application Development Using Windows Azure and Web Services/Sesson 8'.

In slide 31, explain that a transaction allows user to update data on two or more computers in a network is known as distributed transaction.

To understand distributed transaction, tell the students to consider the following scenario:

'Consider a scenario where a banking application transfers funds from one account to another account and both the account records are stored in different database servers located in different locations. This application will first need to withdraw the amount from the account that needs to be debited. The application will then need to add the amount to the account that needs to be credited. As both the operations are atomic, they must be performed within a transaction. Such a transaction is known as distributed transaction.'

Explain that distributed transactions involve multiple resources, such as database servers and messaging systems.

Tell the students that distributed transaction also involves a transaction manager that controls and coordinates the transaction on the resources.

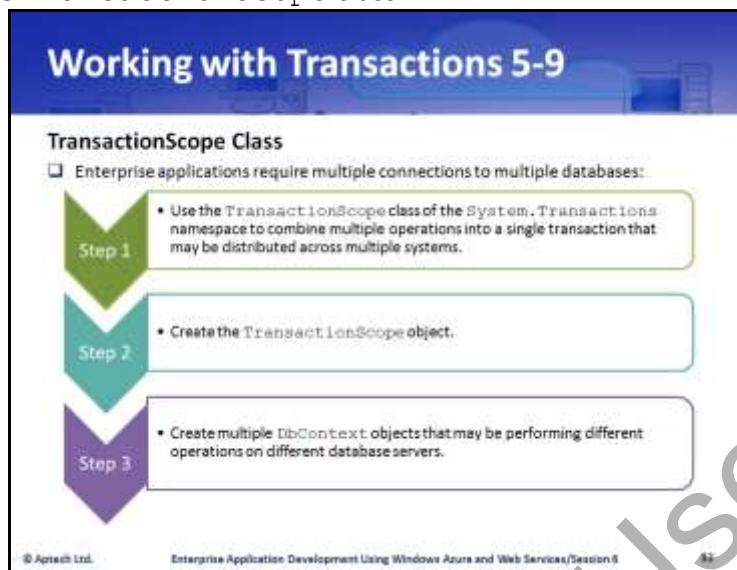
The transaction manager must ensure that if any failure occurs in any resource the transaction must roll back in all other resources participating in the transaction.

Mention that in enterprise applications, students can use the `TransactionScope` class to manage distributed transaction.

Also, tell them that a distributed transaction should include all four ACID properties like any other transaction.

Slide 32

Let us understand the TransactionScope class.



Using slide 32, tell the students that in enterprise applications, they might require multiple connections to multiple databases. Explain the three steps to the students.

In Step 1, tell them that in such scenarios, they can use the TransactionScope class of the System.Transactions namespace to combine multiple operations into a single transaction that may be distributed across multiple systems.

In Step 2, tell them to create the TransactionScope object.

After that, in Step 3, tell them that they can create multiple DbContext objects that may be performing different operations on different database servers. Finally, they call the Complete() method of the TransactionScope class. This method will ensure that the transaction will only get completed if all the operations performed by the DbContext objects completes successfully.

Slide 33

Let us understand executing multiple operations of `DbContext` objects in a single transaction.

Working with Transactions 6-9

- ❑ Following code uses the `TransactionScope` class to execute multiple operations of `DbContext` objects in a single transaction:

```
using(var transactionScope = new TransactionScope())
{
    AppDbContext1 appCtx1= new AppDbContext1();
    appCtx1.SaveChanges();
    AppDbContext2 appCtx2= new AppDbContext2();
    appCtx2.SaveChanges();
    AppDbContext3 appCtx3= new AppDbContext3();
    appCtx3.SaveChanges();
    transactionScope.Complete();
}
```
- ❑ In this code, the `TransactionScope` class is created to execute different operations performed by three `DbContext` objects in a single transaction.

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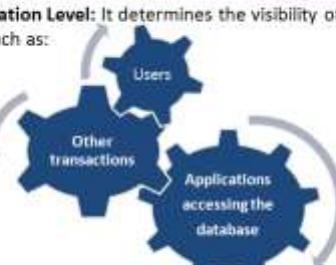
Using slide 33, show the code snippet given on the slide to the students and tell them that it uses the `TransactionScope` class to execute multiple operations of `DbContext` objects in a single transaction.

Tell them that in this code, the `TransactionScope` class is created to execute different operations performed by three `DbContext` objects in a single transaction.

Slide 34

Let us understand transaction isolation level.

Working with Transactions 7-9

- ❑ **Transaction Isolation Level:** It determines the visibility of transactions to other entities such as:
- ❑ Consider an example:
 - A transaction is storing invoice records in a database and the transaction has inserted the invoice headers and data of five invoices.
 - It is yet to insert all the invoices in the system. At this stage, transaction isolation determines whether or not the partial data entered is accessible to other entities.

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In slide 34, explain transaction isolation level to the students. Tell them that transaction isolation determines the visibility of transactions to other entities, such as other transactions, users, or applications accessing the database.

Tell them to consider the following scenario:

'For example, consider that a transaction is storing invoice records in a database and the transaction has inserted the invoice headers and data of five invoices. It is yet to insert all the invoices in the system. At this stage, transaction isolation determines whether or not the partial data entered is accessible to other entities.'

Slide 35

Let us understand lower isolation level and higher isolation level.

The slide has a blue header bar with the title 'Working with Transactions 8-9'. Below the header, there are two blue callout boxes. The first box contains the text: 'A lower isolation level will enable other entities to access the partial data being inserted by the current transaction, but at the risk of data inconsistency.' The second box contains the text: 'A higher isolation level will prevent other entities from accessing the data until the current transaction completes successfully.' At the bottom left of the slide, it says '© Aptech Ltd.' and at the bottom right, it says 'Enterprise Application Development Using Windows Azure and Web Services/Session 8' and '35'.

In slide 35, tell the students that a lower isolation level will enable other entities to access the partial data being inserted by the current transaction, but at the risk of data inconsistency.

Tell them that a higher isolation level will prevent other entities from accessing the data until the current transaction completes successfully.

Mention that a higher isolation level is implemented by a database system by applying a lock on the schema object being operated by the current transaction, so that the other entities cannot access that schema object. The database system releases the lock when the current transaction completes.

Mention that a disadvantage of a higher isolation level is that the performance of the entire system might be affected because the other entities will need to wait until the current transaction completes.

Slide 36

Let us understand isolation levels defined by ISO standard.

Working with Transactions 9-9

The ISO standard defines the following isolation levels, all of which are supported by the SQL Server Database Engine:

Read uncommitted	Read committed	Repeatable read	Serializable
<ul style="list-style-type: none">Lowest level of transaction isolation.Ensures that corrupt data is not being made accessible to the entities accessing it.	<ul style="list-style-type: none">Intermediate isolation level at a higher level of the Read uncommitted mode.Ensures that a transaction may read only the data that has been committed in the database.	<ul style="list-style-type: none">Intermediate isolation level after the Read committed level.Ensures that a transaction may read only the data that has been committed in the database.	<ul style="list-style-type: none">Highest level of transaction isolation.One transaction is completely isolated from one another based on the ACID principles.

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In slide 36, explain the following isolation levels defined by the ISO standard. Tell them that all these levels are supported by the SQL Server Database Engine:

- **Read uncommitted:** This is the lowest level of transaction isolation that ensures that corrupt data is not being made accessible to the entities accessing it.
- **Read committed:** This is an intermediate isolation level at a higher level of the Read uncommitted mode to ensure that a transaction may read only the data that has been committed in the database.
- **Repeatable read:** This is an intermediate isolation level after the Read committed level to ensure that a transaction may read only the data that has been committed in the database.
- **Serializable:** This is the highest level of transaction isolation, where one transaction is completely isolated from one another based on the ACID principles.

In-Class Question:

After you finish explaining isolation levels defined by ISO standard, you will ask students an In-Class question. This will help you in reviewing their understanding of the topic.



Which are the four important key transaction properties?

Answer:

Tell them that the four key transaction properties are Atomicity, Consistency, Isolation, and Durability (ACID).

Slide 37

Let us understand Entity Data Model (EDM) and Plain Old CLR Objects (POCO).

Creating and Using Entity Data and Model

- Entity Data Model (EDM) is a conceptual model that:
 - Describes the entities and the associations they participate in an application.
 - Allows a programmer to handle data access logic by programming against entities.
- Plain Old CLR Objects (POCO):
 - Is an object of a normal class that remains independent and has no concern about the infrastructure, such as the Entity Framework to execute as a part of the infrastructure.



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Explain to the students using slide 37 that EDM is a conceptual model that describes the entities and the associations they participate in an application. It allows a programmer to handle data access logic by programming against entities without having to worry about the structure of the underlying data store and how to connect with it.

Explain the following example to understand the concept of EDM:

For example, in an order placing operation of a customer relationship management application, a programmer using EDM can work with the Customer and Order entities in an object-oriented manner without writing database connectivity code or SQL-based data access code.

When you create an EDM and generate the entity classes from it, the classes are tightly coupled to the Entity Framework. These classes are derived from the EntityObject class or implement interfaces of Entity Framework that enables relationship management between the entities and change tracking of entities. Alternatively, instead of creating such tightly coupled classes, you can create a POCO.

Explain POCO to the students. Tell them that a POCO is an object of a normal class that remains independent and has no concern about the infrastructure, such as the Entity Framework to execute as a part of the infrastructure. As a POCO class is a normal class, it does not derive from the EntityObject class. To enable POCO objects to gain the same functionality as objects of entity classes that derive from the EntityObject class, the Entity Framework provides the ObjectContext class. This class is responsible to provide relationship and change tracking information of POCO to the Entity Framework.

Mention that Visual Studio 2013 generates entity classes from the EDM as POCO classes.

Additional Information:

To know more about EDM and POCO, visit the following links:

[http://msdn.microsoft.com/en-us/library/vstudio/ee382825\(v=vs.100\).aspx](http://msdn.microsoft.com/en-us/library/vstudio/ee382825(v=vs.100).aspx)
[http://msdn.microsoft.com/en-us/library/vstudio/bb399249\(v=vs.100\).aspx](http://msdn.microsoft.com/en-us/library/vstudio/bb399249(v=vs.100).aspx)
[http://msdn.microsoft.com/en-us/library/vstudio/bb399247\(v=vs.100\).aspx](http://msdn.microsoft.com/en-us/library/vstudio/bb399247(v=vs.100).aspx)
[http://msdn.microsoft.com/en-us/library/vstudio/cc716685\(v=vs.100\).aspx](http://msdn.microsoft.com/en-us/library/vstudio/cc716685(v=vs.100).aspx)
<http://stackoverflow.com/questions/250001/poco-definition>
<http://programmers.stackexchange.com/questions/222395/net-programming-and-poco-classes>
<http://rlacovara.blogspot.in/2009/03/what-is-difference-between-dto-and-poco.html>

Slides 38 to 41

Let us understand the steps to implement a data model in Visual Studio 2013.

Implementing a Data Model 1-4

Steps to implement a data model in Visual Studio 2013:

- Step 1 Open Visual Studio 2013.
- Step 2 Create an ASP.NET Web Application project named EDMDemo with the MVC template.
- Step 3 Right-click EDMDemo in the Solution Explorer window, and select Add → New Item.
- Step 4 Select Data from the left menu and then select ADO.NET Entity Data Model.
- Step 5 Click Add. The Entity Data Model Wizard is displayed.
- Step 6 Select Empty model.

Implementing a Data Model 2-4

- Step 7 Click Finish. The Entity Data Model Designer is displayed.
- Step 8 Right-click the Entity Data Model Designer, and select Add New Entity.
- Step 9 Enter Student in the Entity name field.
- Step 10 Click OK.
- Step 11 Right-click the Student entity and select Add New → Scalar Property.
- Step 12 Enter Name as the name of the property.
- Step 13 Similarly, add a Term property to the Student entity.
- Step 14 Add another Address property to the Student entity.

The image shows two slides from a presentation. Both slides have a blue header bar with the title 'Implementing a Data Model' and a blue footer bar with copyright information.

Slide 1: Implementing a Data Model 3-4

Step 15	Right-click the Entity Data Model Designer, and select Generate Database from Model.
Step 16	Click New Connection.
Step 17	Enter (localdb)\v11.0 in the Servername field and EDMDEMO.StudentDB in the Select or enter a database name field.
Step 18	Click OK. Visual Studio will prompt whether to create a new database.
Step 19	Click Yes.
Step 20	Click Next. The Generate Database Wizard window displays the generated DLL scripts required to create the database objects.
Step 21	Click Finish. Visual Studio 2013 opens the file containing the SQL scripts to create the database objects.
Step 22	Right-click the file and select Execute. The Connect to Server dialog box is displayed.

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Slide 2: Implementing a Data Model 4-4

Step 23	Click Connect. Visual Studio will create the database objects.
Step 24	Click Build → Build Solution. This will add the Student.cs class.
Step 25	Expand the Controllers folder in the Solution Explorer window.
Step 26	Double-click the HomeController controller class. The Code Editor displays the code of the HomeController class.
Step 27	Add the AddStudent () method after the default Index () method.
Step 28	Right-click inside the AddStudent () method and select Add View from the context menu. The Add View dialog box is displayed.
Step 29	Click Add. The Code Editor displays the code of the AddStudent.cshtml view.
Step 30	Add the code to display a message in the AddStudent.cshtml view.
Step 31	Click Debug → Start Without Debugging. The browser displays the home page of the application.
Step 32	Type the following URL in the address bar of the browser: http://localhost:12719/Home/AddView

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Tell the students that to implement a data model, they will first need to create the EDM using the Entity Data Model Designer, also known as the Entity Designer.

Then, they can implement a data model in Visual Studio 2013 using the steps from slides 38 to 41. Explain all these steps to the students in detail.

At the end, mention that user can create and implement data models for applications by using all these steps.

Slides 42 and 43

Let us summarize the session.

The image shows two slides from a presentation. The top slide is titled "Summary 1-2" and contains four bullet points about LINQ and Entity Framework. The bottom slide is titled "Summary 2-2" and contains four bullet points about the Entity Framework's DataContext class and transactions. Both slides have a blue header and footer with the text "© Aptech Ltd." and "Enterprise Application Development Using Windows Azure and Web Services/Session 8". A large watermark reading "Aptech Centre" diagonally across the slides is present.

Summary 1-2

- ❑ You can use LINQ to query data with the Entity Framework that allows you to create data-source-independent queries to implement data access in an application.
- ❑ The Entity Framework provides a DbContext class that coordinates with the Entity Framework and allows you to query and save the data in the database.
- ❑ Entity SQL is query language similar to Structured Query Language (SQL) that you can use to query entity models in the Entity Framework.
- ❑ LINQ provides several operators, which are methods that you can use to query data that support functionalities to filter, sort, group, and join data.

Summary 2-2

- ❑ The DataContext class provides the Log property that allows you to log the queries that are executed in a file.
- ❑ The IEnumerable interface is suitable for LINQ to Object and LINQ to XML queries while the IQueryable object should be used for LINQ to SQL queries to query data sources.
- ❑ A transaction is a single atomic unit of work where all the operations defined for the transaction will either successfully complete or fail even if one of the defined operations of the unit fails.

Using slides 42 and 43, you will summarize the session. You will end the session, with a brief summary of what has been taught in the session.

Tell the students pointers of the session. This will be a revision of the current session and it will be related to the next session. Explain each of the following points in brief. Tell them that:

- You can use LINQ to query data with the Entity Framework that allows to create data-source-independent queries to implement data access in an application.
- The Entity Framework provides a DbContext class that coordinates with the Entity Framework and allows to query and save the data in the database.
- Entity SQL is query language similar to Structured Query Language (SQL) that can use to query entity models in the Entity Framework.
- LINQ provides several operators, which are methods that can use to query data that support functionalities to filter, sort, group, and join data.

- The `DataContext` class provides the `Log` property that allows to log the queries that are executed in a file.
- The `IEnumerable` interface is suitable for LINQ to Object and LINQ to XML queries while the `IQueryable` object should be used for LINQ to SQL queries to query data sources.
- A transaction is a single atomic unit of work where all the operations defined for the transaction will either successfully complete or fail even if one of the defined operations of the unit fails.

6.3 Post-Class Activities for Faculty

You should familiarize yourself with the topics of the next session, related to Windows Azure Storage.

Tips: You can also check the Articles/Blogs/Expert Videos uploaded on the OnlineVarsity site to gain additional information related to the topics covered in the next session. You can also connect to online tutors on the OnlineVarsity site to ask queries related to the sessions.

Session 7 – Windows Azure Storage

7.1 Pre-Class Activities

Before you commence the session, you should familiarize yourself with the topics of this session in-depth. You should revisit topics of the previous session for a brief review. Here, you can ask students the key topics they can recall from previous session. Prepare a question or two which will be a key point to relate the current session objectives.

The summary of the previous session is as follows:

- You can use LINQ to query data with the Entity Framework that allows to create data-source independent queries to implement data access in an application.
- The Entity Framework provides a DbContext class that coordinates with the Entity Framework and allows to query and save the data in the database.
- Entity SQL is query language similar to Structured Query Language (SQL) that you can use to query entity models in the Entity Framework.
- LINQ provides several operators, which are methods that you can use to query data that support functionalities to filter, sort, group, and join data.
- The DataContext class provides the Log property that allows to log the queries that are executed in a file.
- The IEnumerable interface is suitable for LINQ to Object and LINQ to XML queries while the IQueryable object should be used for LINQ to SQL queries to query data sources.
- A transaction is a single atomic unit of work where all the operations defined for the transaction will either successfully complete or fail even if one of the defined operations of the unit fails.

7.1.1 Objectives

By the end of this session, the learners will be able to:

- Describe the characteristics of Windows Azure Storage
- Understand Azure Storage Services
- Explain how to use storage accounts
- Explain routing requests
- Describe URL patterns

7.1.2 Teaching Skills

To teach this session successfully, you should be aware of Windows Azure Storage and Azure Storage Services. You should be familiar with their concepts and functionality and procedure to use them. Since the session also covers the storage accounts and routing requests, you must be familiar with these concepts. In addition, you should also know about URL patterns.

For teaching in the class, you are expected to use slides and LCD projectors.

Tips:

It is recommended that you test the understanding of the students by asking questions in between the class.

In-Class Activities:

Follow the order given here during In-Class activities.

Overview of the Session

Give the students a brief overview of the current session in the form of session objectives. Show the students slide 2 of the presentation.

The slide has a blue header bar with the text "Learning Objectives". Below the header is a cartoon illustration of a person sitting at a desk with a computer monitor. The main content area contains a bulleted list of learning objectives:

- Describe the characteristics of Windows Azure Storage
- Understand Azure Storage Services
- Explain how to use storage accounts
- Explain routing requests
- Describe URL patterns

At the bottom left is the copyright notice "© Aptech Ltd.", and at the bottom right is the page number "2".

Tell them that in this session they will be introduced to the concept of Windows Azure Storage. Also, tell them that they will learn the characteristics of Windows Azure Storage.

Inform them that they will learn about Azure Storage services. Also, tell them that they will learn about using Storage accounts, routing requests, and URL patterns.

7.2 In-Class Explanations

Slides 3 to 9

Let us understand the characteristics of Windows Azure.

Characteristics of Windows Azure Storage 1-7

- ❑ Windows Azure offers a number of characteristics such as:
 -  Distribution of data and services
 -  Scalability across multiple systems
 -  Replication based on primary and secondary locations
 -  The use of HTTP APIs with RESTful APIs

Characteristics of Windows Azure Storage 2-7

Space Management:

- ❑ One of the key characteristics of Windows Azure is space management.
- ❑ When a database is configured on a local system, there are space limitations.

However, with Windows Azure, space is not a constraint - the Business Edition Database supports upto 150 GB as the size.

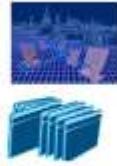
As a customer, a developer only pays for what is being used. In the backend, the data may be distributed across multiple racks, datacenters, and geographical locations. However, to the user in the front-end, the data is fetched and displayed.

Characteristics of Windows Azure Storage 3-7

Distribution:

- Windows Azure:
 - Uses distributed software techniques to manage the services and its data across a number of systems.
 - The data is scattered over multiple systems in the backend.
 - Distributed software techniques are used to manage the services and its data to prevent from failure.





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Characteristics of Windows Azure Storage 4-7

Scalability:

- Windows Azure offers unlimited scalability.
 - Typically, with the locally hosted applications, when the load increases, the performance of the application goes down.
 - However, Windows Azure storage can be configured to offer scalability without impacting the performance.
- Two most common methods are as follows:
 - Using multi-level hot data caching
 - Using replicas of the data





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Characteristics of Windows Azure Storage 5-7

Replication:

- Reasons for replicating are:
 - The primary reason for replicating data from one system to another system is to ensure that there is a redundant copy of the data.
 - The secondary copy of the data is useful when the primary copy of the data becomes unavailable.
 - Windows Azure storage replicates the data from the primary to the secondary location.
 - This way, the customer does not have to worry about primary data being unavailable because the secondary data is readily available.
 - Windows Azure offers a special method for replicating blob and table data. This method is known as Geo-Replication.



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Characteristics of Windows Azure Storage 6-7

Following table shows the primary and their secondary locations:

Primary	Secondary
North Central US	South Central US
South Central US	North Central US
East US	West US
West US	East US
North Europe	West Europe
West Europe	North Europe
South East Asia	East Asia
East Asia	South East Asia

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Characteristics of Windows Azure Storage 7-7

HTTP APIs with RESTful APIs:

HTTP APIs with RESTful APIs are meant to be used when you want to host a number of services in your own datacenters and then use selective services somewhere else, such as Microsoft datacenters.

The RESTful APIs are supported by a number of languages, such as:

Python Ruby Erlang

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Using slide 3, tell the students that Windows Azure Storage is one of the key components or services in the Windows Azure platform. It offers a number of characteristics. Tell them that some of the key characteristics include distribution of data and services, scalability across multiple systems, replication based on primary and secondary locations, and the use of HTTP APIs with RESTful APIs. Tell them that each of these characteristics will be explained in detail in the following slides.

Mention that before they can use Windows Azure Storage, they must create a Storage account. This can be done through the Windows Azure Management Portal. They need to have an active subscription in order to create this.

Using slide 4, tell the students that space management is one of the key characteristics of Windows Azure. When a database is configured on a local system, there may be space limitations as far as large databases are concerned. Give them the example of data being generated by companies such as Facebook, Twitter, Google, and so on. These data are very large in size and a local system database would be incapable of maintaining them properly.

However, with Windows Azure Storage, space is not a constraint - the Business Edition Database, for example, supports upto 150 GB of data.

Explain them that as a customer, a developer only pays for what is being used. This is a great advantage since it is cost effective and often costs lesser than what you would spend for on-premises storage options.

In the backend, the data may be distributed across multiple racks, datacenters, and geographical locations. However, to the user in the front-end, the data is fetched and displayed seamlessly. The user may not even realize that the data is being retrieved from a remote datacenter in a distant location. Using slide 5, explain that Windows Azure uses distributed software techniques to manage the services and its data across a number of systems to prevent from failure. Tell them that in Windows Azure Storage environment, the data is scattered over multiple systems in the backend.

Using slide 6, tell the students that Windows Azure offers high levels of scalability. Tell them that with the locally hosted applications, when the load increases, the performance of the application goes down. However, Windows Azure storage can be configured to offer scalability without impacting the performance. Give an example to illustrate this. A small company selling books and stationery online has a Web site catering to a few thousand customers. The company gains overnight success and as a result, millions of customers start visiting the site and making transactions. To deal with such a large customer base, the company Web site and infrastructure needs to scale up greatly. If this is implemented without using a cloud based environment, this can prove very costly, cumbersome, and time consuming. However, using a product like Windows Azure and its component, Windows Azure Storage, in particular, the company can implement scalability easily. Explain to the students that using multi-level hot data caching and multiple copies of the data' are two common methods of implementing this.

Tell the students that organizations and enterprises who use cloud storage to store their customers' data must ensure that the data is safe and secure and readily available even in case of failure of hardware. Using slide 7, explain to the students that the primary reason for replicating data from one system to another system is to ensure that there is a redundant copy of the data. The secondary copy of the data is useful when the primary copy of the data becomes unavailable.

Explain them that Windows Azure offers a special method for replicating blob and table data. This method is known as Geo-Replication. Through geo-replication, Windows Azure Storage keeps customer data durable in two different locations. The customer chooses a primary location to create, update, or delete data. The secondary location for replicating the data is automatically selected by Windows Azure.

In slide 8, show the table listing the primary and secondary locations to the students. Explain this table to them.

Using slide 9, tell the students that HTTP APIs with RESTful APIs is a last characteristic of Windows Azure Storage.

Tell them that HTTP APIs with RESTful APIs are meant to be used when you want to host a number of services in your own datacenters and then use selective services somewhere else, such as Microsoft datacenters.

Mention that the RESTful APIs are supported by a number of languages, such as Python, Ruby, and Erlang.

In-Class Questions:

After you finish explaining the characteristics of Windows Azure, you will ask students a few In-Class questions. This will help you in reviewing their understanding of the topic.



What is geo-replication in Windows Azure?

Answer:

Windows Azure supports a feature called geo-replication which allows the same data to be stored on servers in multiple geographic locations to ensure high availability.



List some of the characteristics of Windows Azure.

Answer:

Some of the key characteristics of Windows Azure include distribution of data and services, scalability across multiple systems, replication based on primary and secondary locations, and the use of HTTP APIs with RESTful APIs.

Additional Information:

To know more about Windows Azure Storage, visit the following links:

<http://azure.microsoft.com/en-us/documentation/services/storage/>

<http://azure.microsoft.com/en-us/services/storage/>

<http://msdn.microsoft.com/en-us/library/azure/gg433040.aspx>

<http://www.slideshare.net/AntonVidishchev/windows-azure-storage-overview-internals-and-best-practices>

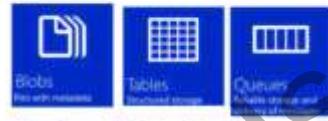
Slides 10 to 16

Let us understand the types of storage in Azure Storage Services.

Azure Storage Services 1-7

❑ Four types of storage in Azure Storage Services are:

- Blobs
- Tables
- Queues
- Database

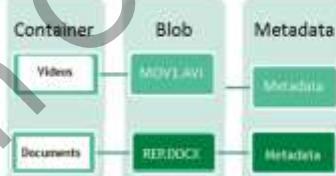


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Azure Storage Services 2-7

Blob Storage

❑ Blobs can store a variety of data, such as images, video, and code, which may typically be large in size.
❑ The data stored in blobs can be structured or unstructured.
❑ The blobs are stored in a container, which is similar to a directory on a file system.
❑ A container can hold a large number of blobs.
❑ A container is mainly used for creating the security boundaries for blob and blob storage.



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Azure Storage Services 3-7

Blob Storage

There are two ways in a blob can be accessed:

- 1) Using the container name in the URL. An example of this method of blob is as follows:
`http(s)://<client-account-name>.blob.core.windows.net/<container>/<blob name>`
- 2) Referencing the root container in the blob URL. An example of this method of blob is as follows:
`http://<client-account-name>.blob.core.windows.net/$root/<blob name>`

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Azure Storage Services 4-7

Blob Storage

Two types of blobs are:

- Block blob**: Each blob is capable of storing upto 200 GB of data and is divided into blocks that can be up to 4 MB in size. These types of blobs are used for streaming workloads.
- Page blob**: Each blob can have maximum size of 1 TB. These types of blobs are optimized for random access read/write input/output operations.

It is important to note that the blobs can be managed through REST API. A developer can create, update, or delete blobs using the REST API.

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Azure Storage Services 5-7

Table Storage

Table storage in Windows Azure is used for storing structured data. In Windows Azure, tables are linked with a specific storage account that work with entities. Each entity in a table in Windows Azure has three key properties:

- PartitionKey**: This is used for physically partitioning the data. The PartitionKey is also used for ensuring the related entities are always bound together.
- RowKey**: When combined with PartitionKey, it is used for uniquely identifying the entities in a table.
- LastUpdate**: This is a system-controlled property.

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Azure Storage Services 6-7

Table Storage

Following figure shows the relationship between table, entities, and properties:

The diagram illustrates the hierarchical structure of Azure Table Storage. At the top level, there are three boxes labeled 'Table'. Below them, a dashed box contains three boxes labeled 'Entity'. Within each 'Entity' box, there are three boxes labeled 'Property'. At the bottom level, there is a single box labeled 'Value' with a 'Type' field. Dashed lines connect the 'Table' boxes to the 'Entity' boxes, and the 'Entity' boxes to the 'Property' boxes, indicating the relationship between tables, entities, and properties.

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Queues

- Queues in Windows Azure are mainly used for:
 - Notifications and task scheduling
 - Persistent asynchronous messaging
 - Each generated message can be maximum of 8 KB in size
 - REST API
- A developer can access and manage queues through the Internet.

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Using slide 10, introduce the four types of storage in Azure Storage Services as blobs, tables, queues, and database (or file).

Explain these four types of storage will be discussed in detail over the next few slides.

Using slide 11, explain that blobs can store a variety of data present in user files, such as images, video, and code, which may typically be large in size. The data stored in blobs can be structured or unstructured. The blobs are stored in a container, which is similar to a directory on a file system. A container can hold a large number of blobs. A container is mainly used for creating the security boundaries for blob and blob storage.

Show the figure on slide 11 to support this explanation.

Using slide 12, tell the students that there are two ways in a blob can be accessed. The first method is using the container name in the URL.

Show the following example of this method of blob to the students:

[http\(s\):// <client-account-name>.blob.core.windows.net/<container>/<blob name>](http://<client-account-name>.blob.core.windows.net/<container>/<blob name>)

Tell them that the second method of accessing the blob is by referencing the root container in the blob URL. Show the following example of this method of blob to the students:

[http://<client-account-name>.blob.core.windows.net/\\$root/<blob name>](http://<client-account-name>.blob.core.windows.net/$root/<blob name>)

Using slide 13, tell the students that the two types of blobs are **Block blob** and **Page blob**. Explain them as shown here:

In the **Block blob**, explain that each blob is capable storing up to 200 GB of data. Each of the block blobs is divided into blocks that can be up to 4 MB in size.

These types of blobs are used for streaming workloads and can handle large data comprising streaming video, code, documents, and images.

In the **Page blob**, tell that each blob can have maximum size of 1 TB. These types of blobs are optimized for random access read/write input/output operations.

Mention that it is important to note that the blobs can be managed through REST API. A developer can create, update, or delete blobs using the REST API.

Using slide 14, explain table storage to the students. Tell them that table storage in Windows Azure is used for storing structured data. In Windows Azure, tables are linked with a specific storage account. However, the tables in Windows Azure are different from the normal relational databases, which are dependent on relationships and schemas.

Also, tell them that the tables in Windows Azure do not have relationships and schemas. Rather, they work with entities. The data in these tables is stored in the form of entities, where each entity has its own set of properties. A developer can modify the data based on the time stamps using optimistic concurrency.

Then, explain that each entity in a table in Windows Azure has three key properties. Explain these three key properties as follows to the students:

- **PartitionKey** – This is used for physically partitioning the data. The partition key is also used for ensuring the related entities are always bound together.
- **RowKey** – When combined with PartitionKey, it is used for uniquely identifying the entities in a table.
- **LastUpdate** – This is a system-controlled property.

Use slide 15 to explain the figure that shows the relationship between table, entities, and properties.

Using slide 16, explain queues. Tell the students that queues in Windows Azure are mainly used for notifications and task scheduling. The queues use persistent asynchronous messaging. Each generated message can be maximum of 8 KB in size.

Mention that similar to the other Windows Azure services, queues in Windows Azure use REST API. A developer can access and manage queues through the Internet.

Finally, mention that the fourth type file storage offers shared storage for legacy applications.

Mention that blob, table, and queue storage are included in every storage account, whereas File storage is available only by request through the Azure Preview page.

Additional Information:

To know more about types of storage in Azure Storage Services, visit the following links:

<http://azure.microsoft.com/en-us/services/storage/>
<http://azure.microsoft.com/en-us/documentation/articles/storage-introduction/>
<http://msdn.microsoft.com/en-us/library/azure/dd179355.aspx>
<http://www.asp.net/aspnet/overview/developing-apps-with-windows-azure/building-real-world-cloud-apps-with-windows-azure/data-storage-options>

Slide 17

Let us understand various activities of a Windows Azure application developer in using a storage account.

Using a Storage Account 1-11

- ❑ Before beginning with a Windows Azure application, the developer must complete two tasks:
 - Create a storage account (optional, if no data needs to be stored)**
 - Create a Windows Azure account**
- ❑ To be able to store data and files in the Blob, Table, and Queue services, the developer must create a storage account.
- ❑ Depending upon where the data needs to be stored, the developer must create the storage account in that specific geographic region.

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In slide 17, tell the students that a Windows Azure application developer needs to have access to Windows Azure. Tell them that before beginning with a Windows Azure application, the developer must complete two tasks which are, creating a Windows Azure account and creating a storage account. Explain them that to be able to store data and files in the Blob, Table, and Queue services, the developer must create a storage account.

Depending upon where the data needs to be stored, the developer must create the storage account in that specific geographic region. However, these actions are optional if the developer does not want to utilize the Blob, Table, or Queue services.

Tell the students that depending on when the storage account was created, the space allocation differs. Microsoft had changed the space allocation for the storage accounts that were created on or before June 8th 2012. Each of the storage accounts created on or before the specified date can contain up to 200 TB of data. However, if the developer had created the storage account before the specified date, the storage account can accommodate only 100 TB of data.

Additional Information:

To know more about using a storage account, visit the following links:

<http://azure.microsoft.com/en-us/documentation/articles/storage-create-storage-account/>

<http://azure.microsoft.com/en-us/documentation/articles/storage-whatis-account/>

<http://blogs.msdn.com/b/brunoterkaly/archive/2013/09/26/how-to-create-a-windows-azure-storage-account.aspx>

Slides 18 to 27

Let us understand setting up a storage account.

The image contains two screenshots from a presentation slide titled "Using a Storage Account".

Screenshot 1 (Top): The title is "Using a Storage Account 2-11". It features a section titled "Setting Up a Storage Account:" with a checkbox question: "Following steps are used to set up a storage account:". Below this is a diagram with two steps: "Step 1" (red arrow) and "Step 2" (green arrow). Step 1 lists: "Log on to the Windows Azure account, which can be done through the Management Portal." Step 2 lists: "After a successful log on, click New, Storage, and then click Quick Create."

Screenshot 2 (Bottom): The title is "Using a Storage Account 3-11". It features a section with a checkbox question: "Following figure shows the Windows Azure Storage Account Creation page:". Below this is a screenshot of the Windows Azure Management Portal's "Storage Accounts" blade. It shows a list of accounts (including "myfirststorageaccount") and a form for creating a new account. The form fields include "Account Name" (set to "myfirststorageaccount"), "Region" (set to "Central US"), and "Create in" (set to "New storage account").

Using a Storage Account 4-11

Queue Storage

Step 3

- In the right column, note that there are three fields in which the data needs to be populated. In the URL field, enter a name for the subdomain. This defined subdomain name is used as the storage account URL.

Step 4

- In the Location/Affinity Group field, select either a region or an affinity group. Depending upon the requirement for storage, the developer may choose to select either of them.

Step 5

- If there is more than one subscription, the developer needs to select the appropriate subscription to which the storage account needs to be linked with.

Step 6

- In the Replication field, select level of replication for the storage account. By default, replication is configured to be Geo-Redundant.

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Using a Storage Account 5-11

Queue Storage

Step 7

- Click **Create Storage Account** to create the storage account for the subscription.

Step 8

- After the storage account is created, the new storage account is listed on the Management Portal with the **Online** status.

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Using a Storage Account 6-11

Following figure shows the **Windows Azure Storage Account Listing** page:



The screenshot shows the Windows Azure Management Portal interface. On the left, there is a navigation menu with options like Home, Compute, Storage, and more. The main area is titled "Storage" and displays a table with columns for Name, Type, Status, and Last modified. There is one row visible in the table. At the bottom of the screen, there are several buttons and links related to storage management.

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Using a Storage Account 7-11

Selecting the Geographical Location:

- When creating a storage account, a developer can choose:
 - The geographical location where the customers are located. For example, if the customer is located in an Asian country, then the developer should opt for selecting **Anywhere in Asia or Southeast Asia** depending on the location of the customer in the Asian region.
 - A specific geographical location is the compliance with the regulatory requirements.



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Using a Storage Account 8-11

Following table shows the list of geographical locations. Each geographical location is shown with the Geo and Region:

GEO	REGION
United States	US East (Virginia)
	US West (California)
	US North Central (Illinois)
	US South Central (Texas)
Europe	Europe North (Ireland)
	Europe West (Netherlands)
Asia Pacific	Asia Pacific East (Hong Kong)
	Asia Pacific Southeast (Singapore)
	Japan East (Saitama Prefecture)
Japan	Japan West (Osaka Prefecture)

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Using a Storage Account 9-11

Selecting Affinity Group:

When a developer creates a service and places it one location and then the storage account in another location, there is a high possibility of increased cost and latency.

When the developer chooses to put both of them in the same location, there is no guarantee that service and storage account will still be together even within a single datacenter.

To tie them together in something like a container or cluster, it is better to put them in an affinity group, which ensures both these elements are always together.

- With the use of affinity group, you can ensure increased performance with reduced latency and cost.

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The image shows two slides from a presentation. Both slides have a blue header with the title 'Using a Storage Account' followed by a number (10-11 for the top slide, 11-11 for the bottom slide). The top slide has a purple footer with the text '© Aptech Ltd.' and 'Enterprise Application Development Using Windows Azure and Web Services/Session 7'. The bottom slide has a similar footer with the number '27'.

Slide 10-11: Pricing Model:

- Windows Azure pricing depends on the following:
 - Storage capacity
 - Total amount of storage consumed
 - Storage transactions
 - Number of read/write operations performed on storage
 - Data transfer
 - Data transferred out from the Windows Azure datacenters

Slide 11-11: Pricing Models:

- The pricing is available in two different models:

Pay-as-you-go Plans	6 or 12-month Plans
<ul style="list-style-type: none">• Total amount of storage consumed	<ul style="list-style-type: none">• Number of read/write operations performed on storage


- For both the pricing models, the pricing is available per region and currency. The developer can choose a specific region and then a specific currency from the available options.

Using slide 18 to 22, explain all the steps of setting up a storage account.

In Step 1, tell the students that to set up a storage account, the developer must log on to the Windows Azure account, which can be done through the Management Portal.

In Step 2, tell the students to click **New → Storage**, and then, click **Quick Create** after a successful log on.

Using slide 19, show the figure that displays the **Windows Azure Storage Account Creation** page.

Using slide 20, explain the further steps.

In Step 3, tell the students that in the right column, note that there are three fields in which the data needs to be populated. In the **URL** field, enter a name for the subdomain. This defined subdomain name is used as the storage account URL.

In Step 4, explain them that in the **Location/Affinity Group** field, select either a region or an affinity group. Depending upon the requirement for storage, the developer may choose to select either of them.

In Step 5, explain that if the developer needs the Windows Azure services are located in different locations and data is located in a different location, then the developer needs to select region, rather than affinity group. Depending on whether affinity group or region is selected, the performance may vary for certain Windows Azure services.

Then, tell them that if there is more than one subscription, the developer needs to select the appropriate subscription to which the storage account needs to be linked with.

In Step 6, tell the students to select level of replication for the storage account in the **Replication** field. Mention that by default, replication is configured to be **Geo-Redundant**.

In this, transactions are replicated synchronously to three storage nodes within the primary region that was chosen while creating the storage account. Geo-redundant Storage (GRS), as it is called, maintains six copies of your data. With GRS, your data is replicated three times within the primary region, and is also replicated three times in a secondary region many away from the primary region, in order to provide the highest level of durability. In case a failure occurs in the primary region, Azure Storage will look to the secondary region for providing the backup data. Thus, GRS ensures that your data is durable in two separate regions.

In step 7, tell students that they need to click **Create Storage Account** to create the storage account for the subscription.

In Step 8, explain that after the storage account is created, the new storage account is listed on the **Management Portal** with the **Online** status.

Using slide 22, explain the given figure that shows the **Windows Azure Storage Account Listing** page to the students.

Using slide 23, explain how to select the geographical location while creating a storage account.

Tell the students that when creating a storage account, a developer can choose the geographical location where the customers are located. For example, if the customer is located in an Asian country, then the developer should opt for selecting **Anywhere in Asia** or **Southeast Asia** depending on the location of the customer in the Asian region.

Mention that another factor that can drive the developer to choose a specific geographical location is the compliance with the regulatory requirements.

Using slide 24, explain the various geographical locations by displaying a table that shows the list of geographical locations. Each geographical location is shown with the Geo and Region.

Use slide 25 to explain the use of affinity group.

Tell the students that when a developer creates a service and places it one location and then the storage account in another location, there is a high possibility of increased cost and latency. When the developer chooses to put both of them in the same location, there is no guarantee that service and storage account will still be together even within a single datacenter. To tie them together in something like a container or cluster, it is better to put them in an affinity group, which ensures both these elements are always together.

Explain them that you can ensure increased performance with reduced latency and cost using the affinity group.

Ask students to remember that it is not possible to change the geographical locations or affinity groups once they are set up. Therefore, it is important that they must be carefully selected.

Using slides 26 and 27, inform the students about the Windows Azure pricing and its pricing models.

Tell the students that Windows Azure pricing depends on the following:

- **Storage capacity** – total amount of storage consumed
- **Storage transactions** – number of read/write operations performed on storage
- **Data transfer** – data transferred out from the Windows Azure datacenters

Using slide 27, tell that there are two pricing models. Explain to the students that the pricing is available in the following two different models:

- **Pay-as-you-go Plans** – total amount of storage consumed
- **6 or 12-month Plans** – number of read/write operations performed on storage

Mention that for both the pricing models, the pricing is available per region and currency.

The developer can choose a specific region and then a specific currency from the available options.

In-Class Question:

After you finish explaining using a storage account of a Windows Azure application, you will ask students an In-Class question. This will help you in reviewing their understanding of the topic.



List some factors on which Windows Azure pricing is dependent.

Answer:

Windows Azure pricing depends on storage capacity, storage transactions, and data transfer.

Slides 28 and 29

Let us summarize the session.

The image shows two slides from a presentation, both titled "Summary".
The top slide is titled "Summary 1-2" and contains the following bullet points:

- ❑ Windows Azure offers a number of characteristics, such as space management, distribution of data, scalability across multiple systems, and replication of data across primary and secondary locations.
- ❑ There are four types of Windows Azure Storage Services, namely, blobs, tables, queues, and databases.
- ❑ Blobs can store a variety of data, such as images, video, documents, and code, which may typically be large in size.
- ❑ The table storage in Windows Azure is used for storing the structured data.

The bottom slide is titled "Summary 2-2" and contains the following bullet points:

- ❑ The queues in Windows Azure are mainly used for notifications and task scheduling.
- ❑ Windows Azure can utilize a database storage, which is Microsoft SQL Server running in a cloud.
- ❑ A Windows Azure application developer needs to have access to the Windows Azure.
- ❑ Windows Azure pricing depends upon Storage capacity, Storage transactions, and Data transfer.

Both slides include a header bar with the text "© Aptech Ltd.", "Enterprise Application Development Using Windows Azure and Web Services/Session 7", and slide numbers "28" and "29".

Using slides 28 and 29, you will summarize the session. You will end the session, with a brief summary of what has been taught in the session.

Tell the students pointers of the session. This will be a revision of the current session and it will be related to the next session.

Explain each of the following points in brief.

Tell them that:

- Windows Azure offers a number of characteristics, such as space management, distribution of data, scalability across multiple systems, and replication of data across primary and secondary locations.
- There are four types of Windows Azure storage services namely, blobs, tables, queues, and databases.
- Blobs can store a variety of data, such as images, video, documents, and code, which may typically be large in size.
- The table storage in Windows Azure is used for storing the structured data.
- The queues in Windows Azure are mainly used for notifications and task scheduling.
- Windows Azure can utilize a database storage, which is Microsoft SQL Server running in a cloud.
- A Windows Azure application developer needs to have access to the Windows Azure.
- Windows Azure pricing depends upon storage capacity, storage transactions, and data transfer.

7.3 Post-Class Activities for Faculty

You should familiarize yourself with the topics of the next session. You should also explore advanced Windows Azure Storage Concepts that will be discussed in the next session.

Tips: You can also check the Articles/Blogs/Expert Videos uploaded on the OnlineVarsity site to gain additional information related to the topics covered in the next session. You can also connect to online tutors on the OnlineVarsity site to ask queries related to the sessions.

Session 8 – Advanced Windows Azure Storage Concepts

8.1 Pre-Class Activities

Before you commence the session, you should familiarize yourself with the topics of this session in-depth. You should revisit topics of the previous session for a brief review. Here, you can ask students the key topics they can recall from previous session. Prepare a question or two which will be a key point to relate the current session objectives.

The summary of the previous session is as follows:

- Windows Azure offers a number of characteristics, such as space management, distribution of data, scalability across multiple systems, and replication of data across primary and secondary locations.
- There are four types of Windows Azure Storage Services namely, blobs, tables, queues, and databases.
- Blobs can store a variety of data, such as images, video, documents, and code, which may typically be large in size.
- The table storage in Windows Azure is used for storing the structured data.
- The queues in Windows Azure are mainly used for notifications and task scheduling.
- Windows Azure can utilize a database storage, which is Microsoft SQL Server running in a cloud.
- A Windows Azure application developer needs to have access to the Windows Azure.
- Windows Azure pricing depends upon Storage capacity, Storage transactions, and Data transfer.

8.1.1 Objectives

By the end of this session, the learners will be able to:

- Describe Blob storage
- Describe Table storage
- Describe Queue storage

8.1.2 Teaching Skills

To teach this session successfully, you should know the concept of Blob storage and Table storage. Also, you should know the Queue storage. For teaching in the class, you are expected to use slides and LCD projectors.

Tips:

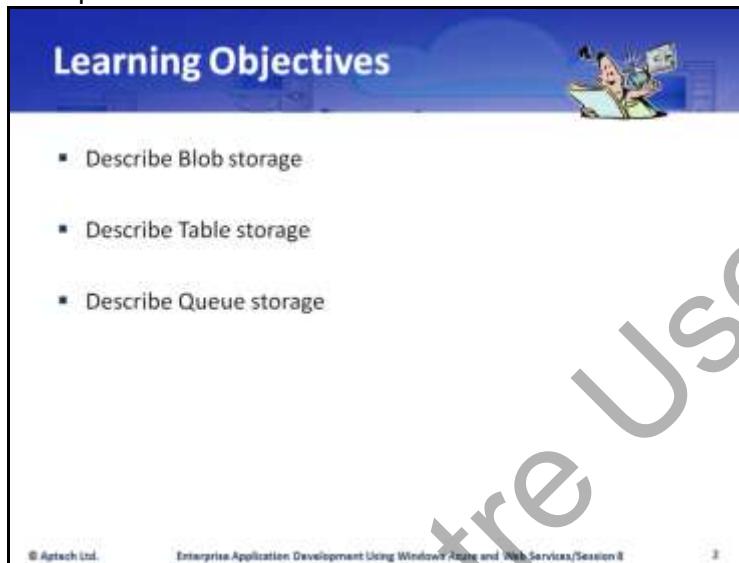
It is recommended that you test the understanding of the students by asking questions in between the class.

In-Class Activities:

Follow the order given here during In-Class activities.

Overview of the Session:

Give the students a brief overview of the current session in the form of session objectives. Show the students slide 2 of the presentation.



The slide has a blue header bar with the title "Learning Objectives". Below the header is a cartoon illustration of a person sitting at a desk with a computer monitor. The main content area contains three bullet points:

- Describe Blob storage
- Describe Table storage
- Describe Queue storage

At the bottom left is the copyright notice "© Aptech Ltd." and at the bottom right is the slide number "3".

In slide 2, tell the students that they will learn about various types of storage such as Blob, Table, and Queue in this session.

8.2 In-Class Explanations

Slides 3 to 7

Let us understand blobs and containers.



The slide has a blue header bar with the title "Blob Storage 1-5". The content is organized into two main sections: "Blobs:" and "Containers:". Each section contains a bulleted list of characteristics and a diagram illustrating the relationship between Container, Blob, and Metadata.

Blobs:

- Can store a large amount of data.
- Data can include images, videos, documents, and codes.
- Can store data in both structured and unstructured formats.
- Can store data in binary format.
- Are stored in containers.

Containers:

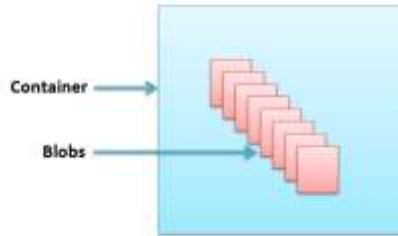
- Can hold a number of blobs.
- Are similar to the directory structure on your hard drive.
- Can hold any number of directories with data as long as you do not run out of space.
- Can be created in your Windows Azure account.
- Used to contain blobs.

On the right side, there is a diagram showing a "Container" box containing a "Video" blob and a "Documents" blob, each associated with its own "Metadata" box.

At the bottom left is the copyright notice "© Aptech Ltd." and at the bottom right is the slide number "3".

Blob Storage 2-5

- If you consider a container similar to a folder, then the blobs are similar to files within the folder.



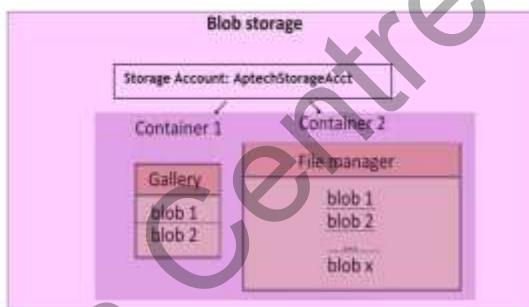
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Blob Storage 3-5

- Following figure displays the concept of containers and blobs:



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Blob Storage 4-5

- You can essentially create two types of blobs:

Block blobs

- Mainly used for streaming data.
- Each block blob can grow up to maximum of 200 GB.

Page blobs

- Mainly used for read/write access and can grow up to maximum of 1 TB in size.

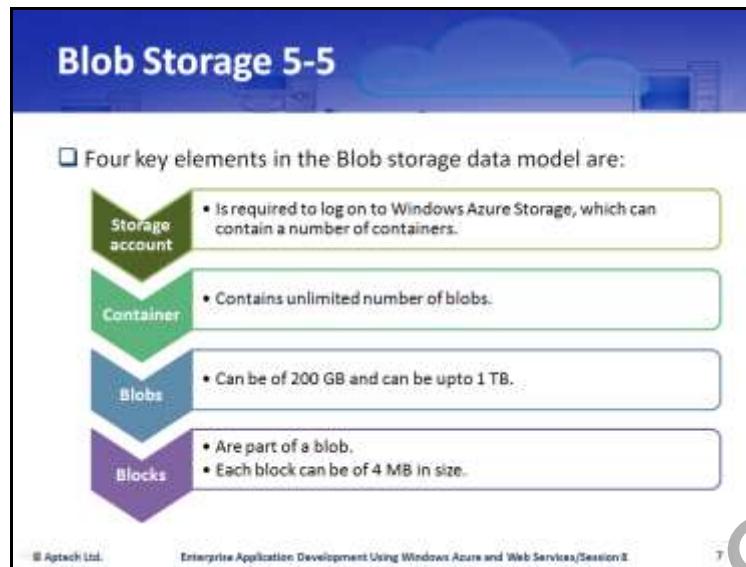
- Each blob that you create:

- Can have up to 8 KB of metadata.
- Is replicated at least three times to ensure scalability and fault tolerance, after it is created.

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Using slide 3, explain that Blobs can store a large amount of data that can be in a variety of forms, such as images, videos, documents, and codes. Tell them that user can store data in blobs in both structured and unstructured formats.

Also, tell them that in order to store data in blobs, they need to create a container in which first they store the blob. A container can hold a number of blobs. It is important to note that blobs store data in binary format.

Mention that containers are similar to the directory structure on your hard drive, which can hold any number of directories with data as long as you do not run out of space. Similarly, you can create any number of containers in your Windows Azure account and then use them to contain blobs.

In slide 4, explain that if a container similar to a folder, then the blobs are similar to files within the folder.

In slide 5, show a figure that displays the difference between containers and blobs.

Explain that a user can create two types of blobs; Block blobs and Page blobs.

Using slide 6, tell the students that **Block blobs** mainly used for streaming data. Each block blob can grow up to maximum of 200 GB.

Also, tell them that **Page blobs** are mainly used for read/write access and can grow up to maximum of 1 TB in size.

Mention that each of the blobs that you create can have up to 8 KB of metadata. Each blob, after it is created, is replicated at least three times to ensure scalability and fault tolerance.

Use slide 7 to explain four key elements in the Blob storage data model. Explain them as follows:

- **Storage account** is required to log on to Windows Azure Storage, which can contain a number of containers.
- **Container** contains unlimited number of blobs.
- **Blobs** can be of 200 GB and can be upto 1 TB.
- **Blocks** are part of a blob. Each block can be of 4 MB in size.

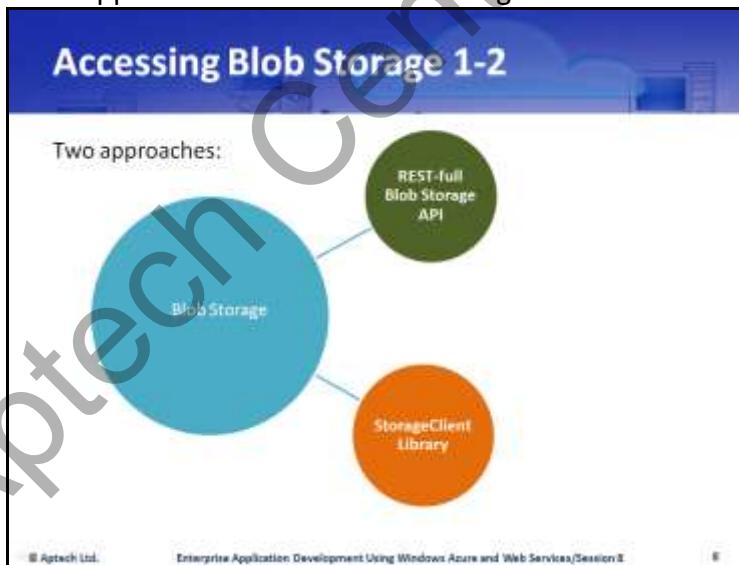
Additional Information:

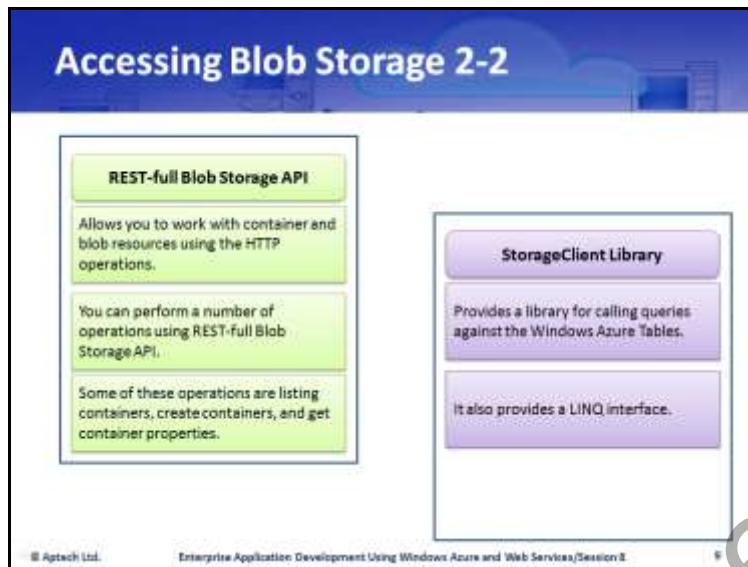
To know more about blob storage, visit the following links:

<http://azure.microsoft.com/en-us/documentation/articles/storage-dotnet-how-to-use-blobs/>
http://en.wikipedia.org/wiki/Binary_large_object
<https://www.simple-talk.com/cloud/cloud-data/an-introduction-to-windows-azure-blob-storage-/>
<http://www.codeproject.com/Articles/490178/How-to-Use-Azure-Blob-Storage-with-Azure-Web-Sites>
<http://www.codeproject.com/Articles/597940/UnderstandingplusWindowsplusAzureplusBlobplusS>
tora

Slides 8 and 9

Let us understand the two approaches to access blob storage.





Using slides 8 and 9, explain the two approaches to access blob storage.

Tell the students that Blob storage can be accessed using one of the two methods; REST-ful Blob Storage API or StorageClient Library.

Explain REST-ful Blob Storage API.

Tell the students that the **REST-ful Blob Storage API** allows user to work with container and blob resources using the HTTP operations. A user can perform a number of operations using REST-ful Blob Storage API. Some of these operations are listing containers, create containers, and get container properties.

Explain StorageClient Library.

Tell them that the StorageClient Library provides a library for calling queries against the Windows Azure Tables. It also provides a LINQ interface.

In-Class Question:

After you finish explaining the two approaches of accessing blob storage, you will ask students an In-Class question. This will help you in reviewing their understanding of the topic.



What are the differences between blobs and containers?

Answer:

Blobs can store a large amount of data that can be in a variety of forms, such as images, videos, documents, and codes. A user can store data in blobs in both structured and unstructured formats. Containers are created to store data in blobs. A container can hold a number of blobs and these blobs store data in binary format.

A container similar to a folder, then the blobs are similar to files within the folder.

Additional Information:

To know more about accessing blob storage, visit the following links:

<http://msdn.microsoft.com/en-us/library/azure/ee393343.aspx>

<http://msdn.microsoft.com/en-us/library/azure/gg433040.aspx>

<http://www.dotnetcurry.com/showarticle.aspx?ID=901>

Slides 10 to 15

Let us understand Table storage.

Table Storage 1-6

- Table storage in Windows Azure is used for storing structured data.
- Tables in table storage:
 - Does not follow relational mechanism, but they rather follow the object-based storage approach.
 - Can grow exceptionally large in size, such as in terabytes.
 - Can store billions of entities.
 - Will typically be spread over multiple servers that are part of the load balancing mechanism.
 - Also have names as the database tables.
 - Have entities and they are equal to the rows of database storage.
 - Can be split across multiple partitions or can even be moved from one partition to another partition.

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Table Storage 2-6

- The data storage in Table storage is persistent.
- If servers shut down all of a sudden, the data will be retrieved from the exact point when the servers were shut down.
- The PartitionKey is used to keep track of all entities that are part of the table and glue them together.
- In the case of a table in Table storage, the PartitionKey and RowKey together form a key, which is known as primary key in relational databases.

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Table Storage 3-6

- One of the biggest differences that tables in Table storage have as against database tables is that there is no fixed schema.
- Each entity can have a different set of properties.
- In database tables, each row is defined with fixed set of columns that define the same set of information.

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Table Storage 4-6

- Following table displays different properties for each entity of a table in table storage:

Contacts table	PartitionKey	RowKey	Properties
	JohnBee	NameRow	FirstName:John, LastName:Bee
	JohnBee	CareerRow	Company:CitizenComdocs
	JohnBee	PersonalRow	Hobby:Reading
	ElizabethSmith	NameRow	FirstName:Elizabeth, LastName:Smith
	ElizabethSmith	CareerRow	Company:SoftEducation
	ElizabethSmith	PersonalRow	Hobby:PlayingFootball
	DonWillis	NameRow	FirstName:Don, LastName:Willis
	DonWillis	CareerRow	Company:TecPark Systemplus
	DonWillis	PersonalRow	Hobby:Gardening

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13

Table Storage 5-6

- Following are advantages of tables in Table Storage:



- | | |
|------------|--|
| Size | • Each table can grow without limitations on the size. |
| Spread | • Each table can be spread across multiple partitions on multiple servers. |
| Persistent | • Each table is persistent, which means that it retains the last known status of the table when the servers are shut down or turned off. |
| Access | • Each table can be accessed via REST API or queried using client library for ADO.NET Data Services. |

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Table Storage 6-6

Following are limitations of tables in Table Storage:

Category	Restriction
Size	Each entity can be of maximum of 1 MB in size.
PartitionKey and RowKey	Can be of only Data type.
Entity Properties	Each entity can have maximum of 255 properties. There can be 252 user-defined properties and remaining three properties are fixed, which are PartitionKey, RowKey, and Timestamp.
Partial Modification	An entity's individual properties cannot be modified. You must rewrite the entire entity.

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Using slide 10, explain the concepts of Table storage.

Explain that table storage in Windows Azure is used for storing structured data. Also, tell them that tables in table storage does not follow relational mechanism, but they rather follow the object-based storage approach.

After that, explain that the tables in Table storage can grow exceptionally large in size such as in terabytes. Each table can store billions of entities. It is important to note that the tables in Table Storage will typically be spread over multiple servers that are part of the load balancing mechanism.

Tell them that tables in Table storage also have names just like the database tables. However, the entities in the tables of Table storage are equal to the rows of database storage. Mention that a table in Table storage can be split across multiple partitions or can even be moved from one partition to another partition.

Using slide 11, explain that the data storage in Table storage is persistent, which means that if servers go Off or shut down all of a sudden, the data will be retrieved from the exact point when the servers where shut down.

Mention that the PartitionKey is used to keep track of all entities that are part of the table and glue them together. In the case of a table in Table storage, the PartitionKey and RowKey together form a key, which is known as primary key in relational databases.

In slide 12, tell the students that one of the biggest differences that tables in Table storage have as against database tables is that there is no fixed schema. This means that each entity can have a different set of properties. This is not true in database tables because each row is defined with fixed set of columns that define the same set of information.

Using slide 13, show a table that displays different properties for each entity of a table in Table storage.

Using slide 14, tell the students that there are a number of advantages of tables in Table Storage. Then, explain them as follows:

- **Size:** Each table can grow without limitations on the size.
- **Spread:** Each table can be spread across multiple partitions on multiple servers.
- **Persistent:** Each table is persistent, which means that it retains the last known status of the table when the servers are shut down or turned off.
- **Access:** Each table can be accessed via REST API or queried using client library for ADO.NET Data Services.

Using slide 15, tell the students that along with the number of advantages, there are a few key limitations for tables in Table storage as follows:

- **Size:** Each entity can be of maximum of 1 MB in size.
- **PartitionKey and RowKey:** Can be of only Data type.
- **Entity Properties:** Each entity can have maximum of 255 properties. There can be 252 user-defined properties and remaining three properties are fixed, which are PartitionKey, RowKey, and Timestamp.
- **Partial Modification:** An entity's individual properties cannot be modified. You must rewrite the entire entity.

Additional Information:

To know more about table storage, visit the following links:

<http://azure.microsoft.com/en-us/documentation/articles/storage-dotnet-how-to-use-tables/>

<http://msdn.microsoft.com/en-us/magazine/ff796231.aspx>

<http://msdn.microsoft.com/en-us/library/azure/jj553018.aspx>

In-Class Question:

After you finish explaining limitations for tables in Table storage, you will ask the students an In-Class question. This will help you in reviewing their understanding of the topic.



Why table storage is used in Windows Azure?

Answer:

The table storage in Windows Azure is used for storing structured data.

Slide 16

Let us understand Queues in Windows Azure and Queue storage.

The slide has a blue header bar with the title 'Queue Storage 1-8'. Below the header, there are three bullet points, each followed by a callout box containing additional information:

- ❑ **Queues in Windows Azure:**
Are mainly used for notifications and task scheduling.
- ❑ **The basic intent of Queue storage is:**
To allow frontend servers to communicate with the backend servers, which are typically the database servers.
- ❑ **Queue storage is:**
Automatically created when you create a storage service in your Windows Azure Storage account.

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Using slide 16, tell the students that Queues in Windows Azure are mainly used for notifications and task scheduling. Tell them that the basic intent of Queue storage is to allow front-end servers to communicate with the back-end servers, which are typically the database servers.

Mention that Queue storage is automatically created when user create a storage service in Windows Azure Storage account.

Slide 17

Let us understand some more about Queue storage.

The slide has a blue header bar with the title 'Queue Storage 2-8'. Below the header, there are two bullet points:

- ❑ You can view the default Queue storage with the following URL:
<http://<accountname>/queue.core.windows.net/>
- ❑ You can create a large number of queues in your Windows Azure account.

A 'Remember!' icon (a yellow cartoon character pointing) is located next to a callout box containing the following text:

Queue Storage is mainly used for delivering messages from the frontend servers to the backend servers, which upon receiving the message, will process them.

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Using slide 17, tell the students that they will be able to view the default Queue storage with the following URL:

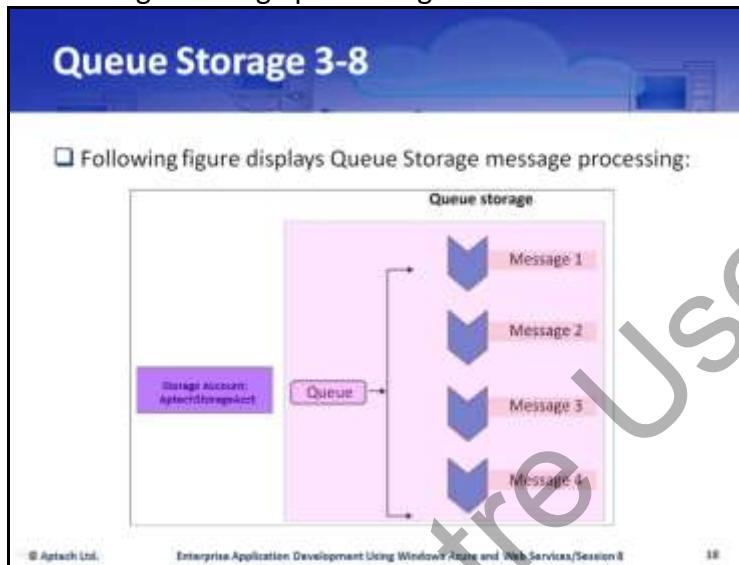
<http://<accountname>/queue.core.windows.net/>

Tell them that they can create a large number of queues in Windows Azure account.

Also, mention to remember that Queue Storage is mainly used for delivering messages from the frontend servers to the backend servers, which upon receiving the message, will process them.

Slide 18

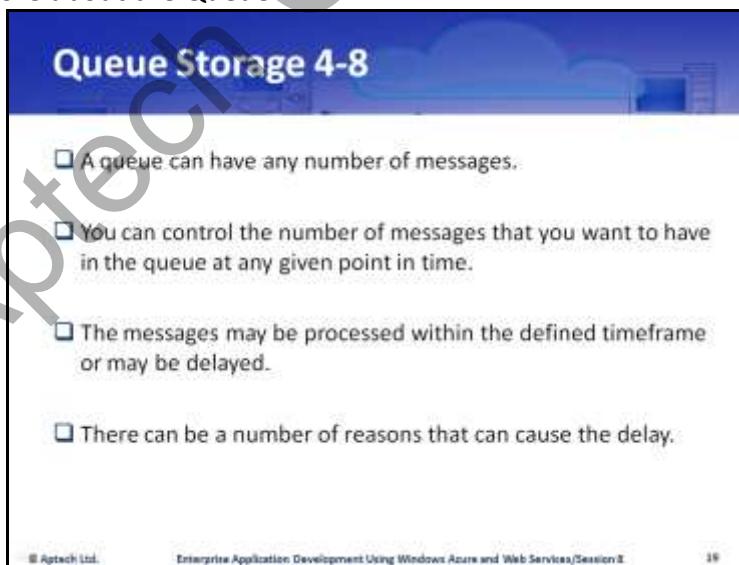
Let us understand Queue Storage message processing.



In slide 18, explain the figure that displays Queue Storage message processing.

Slide 19

Let us understand more about the Queue.



Using slide 19, tell the students that a queue can have any number of messages. However, a user can control the number of messages that you want to have in the queue at any given point in time. The messages may be processed within the defined timeframe or may be delayed.

Tell them that there can be a number of reasons that can cause the delay.

Slide 20

Let us understand the key reasons of delaying the process of the messages.

The slide is titled "Queue Storage 5-8". It lists two key reasons for delaying the process of messages:

- Backend Processing**
 - Servers in the backend are not able to process the messages being received from the frontend servers.
 - Queue is not able to release messages or releases with high latency.
- Large Data**
 - Each message is limited to 8 KB in size.
 - If the message is larger than this, then it is not going to go through the queue.

Solution

- Depending on the issue, either add more backend servers to speed up the processing or customize and optimize the existing processes in the backend servers.
- Your solution will largely depend on your existing infrastructure and requirements.

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Using slide 20, tell the students that two key reasons of delaying the process of the messages are backend processing and large data. Explain them as shown here along with the solutions to them.

Explain Backend processing.

Tell the students that the servers in the backend are not able to process the messages being received from the frontend servers. Therefore, the queue is not able to release messages or releases with high latency.

Explain the following solutions for **Backend processing**.

Tell the students that depending on the issue, you can either add more backend servers to speed up the processing or customize and optimize the existing processes in the backend servers to take care of the messages in the queue. The solution will largely depend on your existing infrastructure and requirements.

Explain Large data.

Tell the students that each message is limited to 8 KB in size. If the message is larger than this, then it is not going to go through the queue.

Explain the following solution for **Large data**.

Tell the students that the data should be stored in a blob or table in this case.

Slide 21

Let us understand reasons why queues are used.

The slide has a blue header bar with the title 'Queue Storage 6-8'. Below the header, there is a bullet point: 'Some of the reasons why queues are used, are as follows:' followed by four categories: 'Persistent data', 'Priority', 'Language', and 'Geography'. Each category has a list of benefits:

- Persistent data**
 - Queue storage stores the data in a persistent manner. If an application crashes, you can recover the in-process data.
 - It also offers recovery mechanism to recover the processes that fail to process in the queue.
- Priority**
 - You can have multiple queues working at the same time. You can set high priority for a queue by redirecting more processes to them.
 - You can create and attach services for queues with higher importance.
- Language**
 - You can use processes in different language in a single application.
- Geography**
 - Processes can run from different geographical locations.

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Using slide 21, explain some of the reasons why queues are used to the students.

Explain Persistent data.

Queue storage stores the data in a persistent manner. This means that if an application crashes, user can recover the in-process data. Queue storage also offers recovery mechanism to recover the processes that fail to process in the queue.

Explain Priority.

User can have multiple queues working at the same time and also set high priority for a queue by redirecting more processes to them. Alternatively, user can create and attach services for queues with higher importance.

Explain Language.

User can use processes in different language in a single application.

Explain Geography.

Processes can run from different geographical locations.

Slide 22

Let us understand scalability.

The screenshot shows a slide titled "Queue Storage 7-8". A purple header bar contains the title. Below it is a white content area. In the top left of the content area, there is a purple rounded rectangle containing the word "Scalability". To its right is a list of bullet points:

- Queue storage removes the dependency from the backend servers to process information.
- Consider the following scenario of an application:
 - In the application, you execute an action on the frontend server, which sends a message to the backend server.
 - The message is processed in the backend server.
 - The second message is processed when the processing of the first message is complete.
 - In the scenario where Queue storage is used, messages are processed differently.
 - Processes in Queue storage can work independently of each other.
 - You can have five frontend servers and a single backend server to handle the queue load.

At the bottom left of the slide, it says "© Aptech Ltd." and at the bottom center "Enterprise Application Development Using Windows Azure and Web Services/Session 8".

Using slide 22, tell the students that queue storage removes the dependency from the backend servers to process information.

Tell them to consider the following typical scenario of an application:

'A user executes an action on the frontend server, which sends a message to the backend server. The message is processed in the backend server. The second message is processed when the processing of the first message is complete. In the scenario, where Queue storage is used, messages are processed differently. Processes in Queue storage can work independently of each other. The user can have five frontend servers and a single backend server to handle the queue load.'

Slide 23

Let us understand comparison of blob, table, and message queue.

Queue Storage 8-8

Following table summarizes the comparison of blob, table, and message queue:

Storage Type	Purpose of Use	Maximum Capacity
Blob	Large binary objects	200 GB/1 TB
Table	Structured data	100 TB
Queue	Structured data	100 TB

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Using slide 23, display a table that summarizes the comparison of blob, table, and message queue to the students.

Additional Information:

To know more about queue storage, visit the following links:

<http://azure.microsoft.com/en-us/documentation/articles/storage-dotnet-how-to-use-queues/>

<http://msdn.microsoft.com/en-us/library/azure/hh767287.aspx>

<http://msdn.microsoft.com/en-us/library/microsoft.windowsazure.storage.queue.aspx>

In-Class Question:

After you finish explaining the comparison of blob, table, and message queue, you will ask the students an In-Class question. This will help you in reviewing their understanding of the topic.



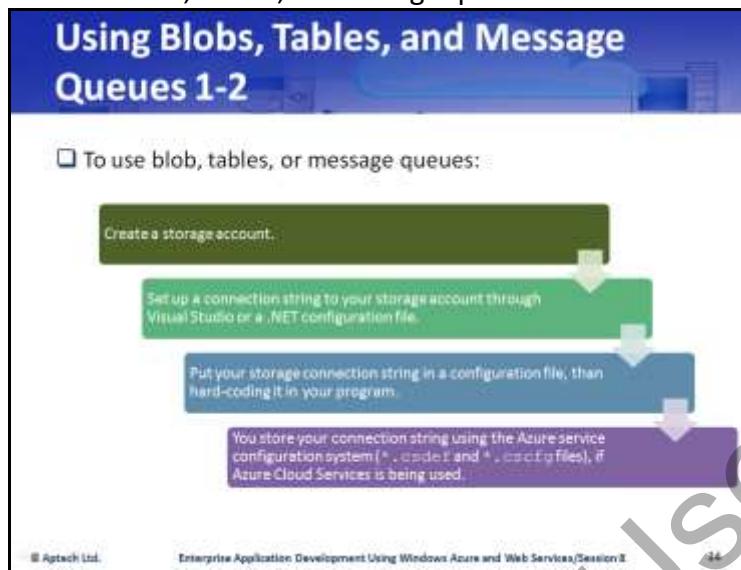
What is the basic intent of Queue storage?

Answer:

The basic intent of Queue storage is to allow frontend servers to communicate with the backend servers, which are typically the database servers.

Slide 24

Let us understand how to use blob, tables, or message queues.



Using slide 24, explain how to use blob, tables, or message queues. Tell the students that in order to use blob, tables, or message queues, they need to first create a storage account.

After creating the storage account, they need to set up a connection string to your storage account. This can be done either through Visual Studio or through a .NET configuration file.

Then, explain them that it is a best practice to put their storage connection string in a configuration file, than hard-coding it in your program.

Finally, mention that if they are using Azure Cloud Services, it is recommended that they store connection string using the Azure service configuration system (*.csdef and *.cscfg files).

Slide 25

Let us understand more about using blob, tables, or message queues.

Using Blobs, Tables, and Message Queues 2-2

- When using .NET, you can use the web.config or app.config files.
- The <appSettings> element needs to be configured to create the connection string.
- You can use the following syntax:

Syntax

```
<configuration>
<appSettings>
<add key="StorageConnectionString"
value="DefaultEndpointsProtocol=https;AccountName=<accountname>;AccountKey=<your-account-key>" />
</appSettings>
</configuration>
```

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Using slide 25, tell the students that when using .NET, they can use the web.config or app.config files. The <appSettings> element needs to be configured to create the connection string. For example, they can use the syntax as shown in the slide.

Additional Information:

To know more about message queues, visit the following links:

<http://msdn.microsoft.com/en-us/library/azure/hh767287.aspx>

<http://azure.microsoft.com/en-us/documentation/articles/storage-dotnet-how-to-use-queues/>

Slides 26 to 31

Let us understand the steps of using blob storage programmatically.

Working with Blobs 1-6

- ❑ To use blob storage programmatically, you need to:
 - 1 Import Microsoft.WindowsAzure.Storage.dll, which is provided in Azure SDK for .NET.
 - 2 Declare the namespaces using the following code:

```
using Microsoft.WindowsAzure.Storage;
using Microsoft.WindowsAzure.Storage.Auth;
using Microsoft.WindowsAzure.Storage.Blob;
```
 - 3 After namespace declaration, you need to retrieve your connection string from the Azure service configuration using the following code:

```
CloudStorageAccount storageAccount=CloudStorageAccount.Parse(
CloudConfigurationManager.GetSetting("StorageConnectionString"));
```

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Working with Blobs 2-6

- 4 If a container does not exist, you need to create the container by first creating the blob client and then creating the container by using the following code:

```
// Create the blob client
CloudBlobClient blobClient = storageAccount.CreateCloudBlobClient();

// Retrieve a reference to a container if it exists
CloudBlobContainer container = blobClient.GetContainerReference(
"photos");

// Create the container if it does not exist.
container.CreateIfNotExists();
```
- ❑ In the code:
 - An instance of CloudBlobClient is created.
 - The CloudBlobClient class defined in the Microsoft.WindowsAzure.Storage.Blob namespace which enables you to retrieve objects representing containers and blobs stored within the Blob Storage Service.

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Working with Blobs 3-6

Reference a Blob

- ❑ You can reference a blob that exists or create a new blob using the following code:

```
CloudBlockBlob blockBlob=container.GetBlockBlobReference("photoblob");
```

Create or Overwrite a Blob

- ❑ You can create or overwrite a blob using contents present in a local file with the following code:

```
using(var fileStream=System.IO.File.OpenRead(@"path\photofiles"))
{
    blockBlob.UploadFromStream(fileStream);
}
```

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Working with Blobs 4-6

List the existing blobs in a container

- You can also list the existing blobs in a container shown in the following code.
- The CloudBlobContainer class represents a single container and is defined in the Microsoft.WindowsAzure.StorageClient namespace.

```
CloudBlobContainer container = GetContainerReference("photos");
foreach (IListBlobItem item in container.ListBlobs(null, false))
{
    if(item.GetType() == typeof(CloudBlockBlob))
    {
        CloudBlockBlob blob = (CloudBlockBlob)item;

        Console.WriteLine("Block blob of length {0}: {1}",
            blob.Properties.Length, blob.Uri);
    }
    elseif(item.GetType() == typeof(CloudPageBlob))
    {
    }
```

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Working with Blobs 5-6

```
CloudPageBlob pageBlob = (CloudPageBlob)item;
Console.WriteLine("Page blob of length {0}: {1}",
    pageBlob.Properties.Length, pageBlob.Uri);
}
elseif(item.GetType() == typeof(CloudBlobDirectory))
{
    CloudBlobDirectory directory = (CloudBlobDirectory)item;
    Console.WriteLine("Directory: {0}", directory.Uri);
}
```

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Working with Blobs 6-6

Save the contents of a blob into a file

- Reference the blob and then save the contents into a file as shown in the following code:

```
CloudBlockBlob blockBlob = container.GetBlockBlobReference("pic.jpg");
using (var fileStream = System.IO.File.OpenWrite(@"path\photofiles"))
{
    blockBlob.DownloadToStream(fileStream);
}
```

Delete a blob

- Delete a blob by referencing it and then sending the delete command by using the following code:

```
CloudBlockBlob blockBlob = container.GetBlockBlobReference("blockblob.txt");
blockBlob.Delete();
```

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Using slides 26 and 27, explain that in order to use blob storage programmatically, a user needs to import Microsoft.WindowsAzure.Storage.dll, which is provided in Azure SDK for .NET.

Then, the user needs to declare the namespaces using the code as shown in the given code snippet.

After namespace declaration, user needs to retrieve your connection string from the Azure service configuration using the code.

Explain that if a container does not exist, you need to create the container by first creating the blob client and then creating the container. The code snippet shows the code for it.

Mention that in the code, an instance of `CloudBlobClient` is created. The `CloudBlobClient` class defined in the `Microsoft.WindowsAzure.Storage.Blob` namespace enables user to retrieve objects representing containers and blobs stored within the Blob Storage Service.

In slide 28, tell the students that they can refer a blob that exists or create a new blob. To reference a blob, use the code given in the code snippet.

Also, tell them that they can create or overwrite a blob using contents present in a local file with the code as shown in the given code snippet.

In slides 29 and 30, tell the students that they can also list the existing blobs in a container as shown in the given code snippet. The `CloudBlobContainer` class represents a single container and is defined in the `Microsoft.WindowsAzure.StorageClient` namespace.

Explain to the students using slide 31 that they can also save the contents of a blob into a file. First, you will need to refer to the blob and then save the contents into a file as shown in the given code snippet.

Mention that students can also delete a blob by referencing it and then sending the delete command. You can use the code as shown in the given code snippet to refer and delete the blob.

Slides 32 to 36

Let us understand steps to create a table, an entity in the table, and insert and delete data in the table.

Working with Tables 1-5

Create a table: Similar to blobs, refer following steps to create a table:

- Step 1 • Create a storage account
- Step 2 • Set up the connection string by using the same code
- Step 3 • Create a table client
- Step 4 • Create the table by using the following code:

```
CloudTableClient tableClient =  
storageAccount.CreateCloudTableClient();  
CloudTable table = tableClient.GetTableReference("employees");  
table.CreateIfNotExists();
```

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Working with Tables 2-5

Create an entity in the table: After creating a table, create an entity in the table with the help of a custom class named TableEntity and using the following code:

```
public class CustomerEntity : TableEntity  
{  
    public CustomerEntity(string lastName, string firstName)  
    {  
        this.PartitionKey=lastName;  
        this.RowKey=firstName;  
    }  
  
    public CustomerEntity(){  
    }  
    public string Email {get;set;}  
    public string PhoneNumber {get;set;}}
```

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Working with Tables 3-5

Insert the customer entity into the entity: You can insert the customer entity into the entity with the help of following code:

```
CustomerEntity customer1 = new CustomerEntity("McClane", "John");  
customer1.Email="John@McClane.com";  
customer1.PhoneNumber="123-111-1234";  
  
// Create the TableOperation that inserts the customer entity.  
TableOperation insertOperation=TableOperation.Insert(customer1);  
  
// Execute the insert operation.  
table.Execute(insertOperation);
```

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The image shows two slides from a presentation. Both slides have a blue header bar with the title 'Working with Tables' in white. The first slide is titled 'Working with Tables 4-5' and contains a section titled 'Delete an entity'. It includes a code snippet for deleting an entity from a table:

```
CloudTable table =tableClient.GetTableReference("employees");
TableOperation retrieveOperation=TableOperation.Retrieve<CustomerEntity>("McClane","John");
TableResult retrievedResult=table.Execute(retrieveOperation);
CustomerEntity deleteEntity=(CustomerEntity)retrievedResult.Result;
if(deleteEntity!=null)
{
    TableOperation deleteOperation=TableOperation.Delete(deleteEntity);
    table.Execute(deleteOperation);
    Console.WriteLine("Entity deleted.");
}
else
    Console.WriteLine("Could not retrieve the entity.");
```

The second slide is titled 'Working with Tables 5-5' and contains a section titled 'Delete a table'. It includes a code snippet for deleting a table:

```
CloudTable table =tableClient.GetTableReference("employees");
table.DeleteIfExists();
```

Both slides have a footer bar with the text 'Aptech Ltd.' and 'Enterprise Application Development Using Windows Azure and Web Services/Session 3'. The slide on the right has the number '35' in the bottom right corner.

Using slide 32, explain to the students that they need to first create a storage account and set up the connection string similar to blobs. Tell them that they can use the same code as earlier to achieve this. After this, they need to create a table client and then the table with the help of code given in the code snippet.

Using slide 33, tell the students that after the table is created, you need to create an entity in the table with the help of a custom class named `TableEntity`. Tell them that they can use the code given in the code snippet to achieve this.

In slide 34, tell the students that they can insert the customer entity into the entity with the code given in the code snippet.

Explain that after creating an entity, they can later delete it when not required as described in slide 35. To delete an entity, tell them to use the code given in the code snippet on slide 35.

Using slide 36, tell the students that if they need to delete a table, use the code given in the code snippet.

Slides 37 to 40

Let us understand how to create a message queue.

Working with Queue Storage 1-4

Create a message queue: Similar to blobs and tables, refer the following steps to create a message queue:

Step 1 • Create a storage account.
Step 2 • Set up the connection string.
Step 3 • Create a message queue by creating an instance of CloudQueueClient as shown in the following code:

```
CloudQueueClient queueClient = storageAccount.CreateCloudQueueClient();
```

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Working with Queue Storage 2-4

Create the queue: After you create the queueClient object, you need to:

- Reference it.
- Create the queue if it does not exist, by using the following code:

```
CloudQueue queue
queueClient.GetQueueReference("ourmessagequeue");
// Create the queue if it does not already exist
queue.CreateIfNotExists();
```

Insert a message into the message queue: After the message queue is created, you need to insert a message into it, as shown in the following code:

```
CloudQueueMessage message = new CloudQueueMessage("Hello and
welcome");
queue.AddMessage(message);
```

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The image shows two slides from a presentation. Both slides have a blue header bar with the title 'Working with Queue Storage' followed by a slide number (3-4 or 4-4). The first slide (3-4) contains two bullet points: 'Display the message' and 'Get the message queue length'. It includes code snippets for both. The second slide (4-4) contains one bullet point: 'Delete a message queue', also with a code snippet. A large watermark 'Aptech Centre Only' is diagonally across the slides.

Working with Queue Storage 3-4

- Display the message:** After you insert the message, you can peek and display the message using the following code:

```
CloudQueueMessage peekedMessage=queue.PeekMessage();
Console.WriteLine(peekedMessage.AsString);
```
- Get the message queue length:** If you have queued up a number of messages, you can get the message queue length with the help of code shown as follows:

```
CloudQueue queue
=queueClient.GetQueueReference("ourmessagequeue");
queue.FetchAttributes();
int? cachedMessageCount=queue.ApproximateMessageCount;
Console.WriteLine("Number of messages in queue:
"+cachedMessageCount);
```

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Working with Queue Storage 4-4

- Delete a message queue:** You can delete a message queue by using the following code:

```
CloudQueue queue =queueClient.GetQueueReference("myqueue");
queue.Delete();
```

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In slide 37, explain the steps to create a message queue. Tell the students that similar to blobs and tables, they need to first create a storage account and set up the connection string. Then, they will need to create a message queue by creating an instance of `CloudQueueClient` as shown in the given code snippet.

Using slide 38, tell the students that after they create the `queueClient` object, they need to reference it and then create the queue if it does not exist. The code for this is given in the code snippet.

Mention that after the message queue is created, they need to insert a message into it as given in the code snippet.

Tell the students that after they insert the message, they can peek and display the message using the code as shown in the given code snippet.

Using slide 39, explain them that if they have queued up a number of messages, now they can get the message queue length with the help of code given in the code snippet.

As shown in slide 40, you can also delete a message queue by using the code given in the code snippet.

Slides 41 and 42

Let us summarize the session.

Summary 1-2

- Blobs can store a large amount of data that can be in variety of forms, such as images, videos, documents, and codes.
- A container can hold a number of blobs.
- You can create two types of blobs: Block blobs and Page blobs.
- Each blob can have 8 KB of metadata.
- The Table storage in Windows Azure is used for storing structured data.

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Summary 2-2

- The data storage in Table storage is persistent.
- A table in Table storage can be split across multiple partitions or can even be moved from one partition to another partition.
- Queues in Windows Azure are mainly used for notifications and task scheduling.
- You can create a large number of queues in your Windows Azure account.

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Using slides 41 and 42, you will summarize the session. You will end the session, with a brief summary of what has been taught in the session.

Tell the students pointers of the session. This will be a revision of the current session and it will be related to the next session. Explain each of the following points in brief. Tell them that:

- Blobs can store a large amount of data that can be in variety of forms, such as images, videos, documents, and codes.

- A container can hold a number of blobs.
- You can create two types of blobs: Block blobs and Page blobs.
- Each blob can have eight KB of metadata.
- The Table storage in Windows Azure is used for storing structured data.
- The data storage in Table storage is persistent.
- A table in Table storage can be split across multiple partitions or can even be moved from one partition to another partition.
- Queues in Windows Azure are mainly used for notifications and task scheduling.
- You can create a large number of queues in your Windows Azure account.

8.3 Post-Class Activities for Faculty

You should familiarize yourself with the topics of the next session. You should also explore the concepts of WCF services that will be taught in the next session.

Tips: You can also check the Articles/Blogs/Expert Videos uploaded on the OnlineVarsity site to gain additional information related to the topics covered in the next session. You can also connect to online tutors on the OnlineVarsity site to ask queries related to the sessions.

Session 9 –WCF Services

9.1 Pre-Class Activities

Before you commence the session, you should familiarize yourself with the topics of this session in-depth. You should revisit topics of the previous session for a brief review. Here, you can ask students the key topics they can recall from previous session. Prepare a question or two which will be a key point to relate the current session objectives.

The summary of the previous session is as follows:

- Blobs can store a large amount of data that can be in variety of forms, such as images, videos, documents, and codes.
- A container can hold a number of blobs.
- You can create two types of blobs: Block blobs and Page blobs.
- Each blob can have eight KB of metadata.
- The Table storage in Windows Azure is used for storing structured data.
- The data storage in Table storage is persistent.
- A table in Table storage can be split across multiple partitions or can even be moved from one partition to another partition.
- Queues in Windows Azure are mainly used for notifications and task scheduling.
- You can create a large number of queues in your Windows Azure account.

9.1.1 Objectives

By the end of this session, the learners will be able to:

- Describe WCF services
- List the features of WCF that are not supported by ASP.NET Web API
- Explain the steps to create a WCF service
- Explain the process to define a service contract and implement it
- Explain how to host and configure a WCF service
- Describe the procedure to consume a WCF service from a client application
- Explain how to create and deploy a WCF cloud service to Azure

9.1.2 Teaching Skills

To teach this session successfully, you should be familiar with the concept of WCF Framework and creating and using services through WCF.

For teaching in the class, you are expected to use slides and LCD projectors.

Tips:

It is recommended that you test the understanding of the students by asking questions in between the class.

In-Class Activities:

Follow the order given here during In-Class activities.

Overview of the Session:

Give the students a brief overview of the current session in the form of session objectives. Show the students slide 2 of the presentation.

The slide has a blue header bar with the text "Learning Objectives". Below the header is a cartoon illustration of a person sitting at a desk with a computer monitor. The main content area contains a bulleted list of learning objectives:

- Describe WCF services
- List the features of WCF that are not supported by ASP.NET Web API
- Explain the steps to create a WCF service
- Explain the process to define a service contract and implement it
- Explain how to host and configure a WCF service
- Describe the procedure to consume a WCF service from a client application
- Explain how to create and deploy a WCF cloud service to Azure

At the bottom left is the copyright notice "© Aptech Ltd.", in the center is the slide title "Enterprise Application Development Using Windows Azure and Web Services/Session 2", and at the bottom right is the number "2". A large watermark reading "For Aptech Centre Only" is diagonally across the slide.

Using slide 2, tell the students that they will learn about the WCF services in this session. Tell them the features of WCF that are not supported by ASP.NET Web API will be explored in this session. The students will learn the steps to create a WCF service and the process to define a service contract and implement it. Inform them that the session will describe how to host and configure a WCF service and the procedure to consume a WCF service from a client application to the students. At the end, tell them that the session shows how to create and deploy a WCF cloud service to Azure.

9.2 In-Class Explanations

Slides 3 and 4

Let us understand WCF framework.

Introduction to WCF 1-2

- ❑ WCF framework is:
 - One of the best distributed computing technologies available to us.
 - The most up-to-date communication infrastructure made available to us by Microsoft.
 - One of the best solutions for building distributed applications that are based on SOA.

Introduction to WCF 2-2

.NET Framework

- Parallel LINQ
- LINQ
- WPF
- WinForms
- Base Framework Classes
- DLR
- CLR

ADO.NET Entity Framework

WF

CardSpace

ASP.NET

ADO.NET

Using slide 3, first introduce the concept of client/server architecture in brief. The students will be already familiar with this concept hence just give a brief brushing up on this topic.

Then tell the students that they develop applications for client/server architecture, they have a choice of technologies and frameworks to choose from. Most technologies and frameworks have their own pros and cons. One of the best available modern technologies to us in .NET is the WCF framework. It is the most up-to-date communication infrastructure made available to us by Microsoft, and it is one of the best solutions for building distributed applications that are based on SOA.

Using slide 4, tell the students that WCF is a unified .NET framework for building service-oriented applications. WCF was first introduced in .NET Framework 3.0 and then extended in .NET 3.5 and .NET 4. Show them the image on slide 4.

Mention that WCF is the foundation for other Microsoft-distributed technologies.

Additional Information:

To know more about WCF framework, visit the following links:

<http://msdn.microsoft.com/en-us/library/dd936243.aspx>

<http://wcftutorial.net/introduction-to-wcf.aspx>

[http://www.codedigest.com/Articles/WCF/254 Beginning Windows Communication Foundation \(WCF\) Service Development and Consuming it.aspx](http://www.codedigest.com/Articles/WCF/254_Beginning_Windows_Communication_Foundation_(WCF)_Service_Development_and_Consuming_it.aspx)

Slide 5

Let us understand Web services and WCF.



In slide 5, explain that WCF provides the same functionality as a Web Service, but the only difference is Web services use HyperText Transfer Protocol (HTTP) for communication, whereas WCF can use any protocol for communication. So it becomes easier to communicate with components of other languages.

Then, explain the advantages of WCF. Explain them that one of the main advantages of using WCF is it can also support proprietary protocols. WCF supports protocols and transports such as SOAP with HTTP, TCP/IP, and Named pipes. WCF can exchange data and information using formats such as SOAP, XML, and JavaScript Object Notation (JSON).

Slide 6

Let us understand SOAP.

The slide has a blue header bar with the title 'Overview of WCF Services 2-6'. Below the header, there is a green button-like box containing the word 'SOAP'. To the right of this box is a yellow rounded rectangle containing a bulleted list of three items:

- Is a lightweight protocol used to exchange data over the distributed environments.
- Uses XML for its message formatting, and usually relies on HTTP for message negotiation and transmission.
- Is also known as Remote Procedure Call (RPC) protocol.

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Using slide 6, explain SOAP to the students. Tell them that SOAP is a lightweight protocol used to exchange data over the distributed environments. SOAP uses XML for its message formatting, and usually relies on HTTP for message negotiation and transmission. It was created by Microsoft and adopted by W3C as a standard. SOAP is used as the underlying layer for ASP.NET Web Services (ASMX) and for WCF. SOAP-based services are being used for more than a decade. SOAP is now maintained by the W3C. It is also known as Remote Procedure Call (RPC) protocol. It was designed as a protocol specification for invoking methods on servers, services, and objects. It was developed as a language-independent way and multi-environment of exchanging structured data between services.

Additional Information:

To know more about SOAP, visit the following links:

<http://publib.boulder.ibm.com/infocenter/iadthelp/v6r0/index.jsp?topic=/com.ibm.etools.webservices.doc/concepts/csoap.html>

<http://searchsoa.techtarget.com/tutorial/Simple-Object-Access-Protocol-SOAP-Tutorial>

http://www.cs.colorado.edu/~kena/classes/7818/f08/lectures/lecture_3_soap.pdf

Slide 7

Let us understand the process of requesting to the WCF and its response.

Overview of WCF Services 3-6

Figure shows how a request is sent to a WCF service and how the service responds to the request:

In the figure:

- A client sends a request to the service.
- The request goes as a message with one or more endpoints.
- A service endpoint (comprising A-Address, B-Binding, and C-Contract) that defines how the service is exposed to the clients.

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Show the figure on slide 7 that displays how a request is sent to a WCF service and how the service responds to the request. Explain the working of this figure and the points given on slide 7.

Slide 8

Let us understand endpoints.

Overview of WCF Services 4-6

The endpoint comprises A-Address, B-Binding, and C-Contract, each of which are defined as follows:

- Specifies where the service resides. The address is a Uniform Resource Locator (URL) that is used by the client applications to locate the service.
- Specifies how clients should communicate with the service. The binding specifies the message encoding, transport type, security modes, session support, and other protocols.
- Specifies the operations supported by the endpoint. The contract needs to match one of the contract interfaces implemented by your service class.

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Tell the students that slide 8 defines endpoints. Tell that as shown in the earlier slide 7, a client sends a request to the service. Tell them that the request goes as a message with one or more endpoints. A service endpoint defines how the service is exposed to the clients.

Using slide 8, explain that the endpoint comprises A- Address, B-Binding, and C-Contract. Then elaborate on each of them as follows:

Address - Specifies where the service resides. The address is a Uniform Resource Locator (URL) that is used by the client applications to locate the service.

Binding - Specifies how clients should communicate with the service. The binding specifies the message encoding, transport type, security modes, session support, and other protocols.

Contract - Specifies the operations supported by the endpoint. The contract needs to match one of the contract interfaces implemented by your service class.

Additional Information:

To know more about WCF components, visit the following links:

<http://msdn.microsoft.com/en-us/library/dd936243.aspx>

<http://wcftutorial.net/introduction-to-wcf.aspx>

[http://www.codedigest.com/Articles/WCF/254 Beginning Windows Communication Foundation \(WCF\) Service Development and Consuming it.aspx](http://www.codedigest.com/Articles/WCF/254_Beginning_Windows_Communication_Foundation_(WCF)_Service_Development_and_Consuming_it.aspx)

Slide 9

Let us understand features provided by WCF.

The slide has a blue header bar with the title 'Overview of WCF Services 5-6'. Below the header, there is a list of three features, each enclosed in a horizontal bar with a colored background (purple, blue, and teal).

- Features provided by WCF are:
 - Allows security features such as authentication and authorization
 - Has performance tuning features such as throttling, concurrency, and load balancing
 - Provides hosting environments such as IIS, Windows Services, and Self-hosting

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In slide 9, explain some of the features provided by WCF. Tell the students that WCF allows security features such as authentication and authorization. It has performance tuning features such as throttling, concurrency, and load balancing. Also, it provides hosting environments such as IIS, Windows Services, and Self-hosting.

Additional Information:

To know more about features of WCF framework, visit the following links:

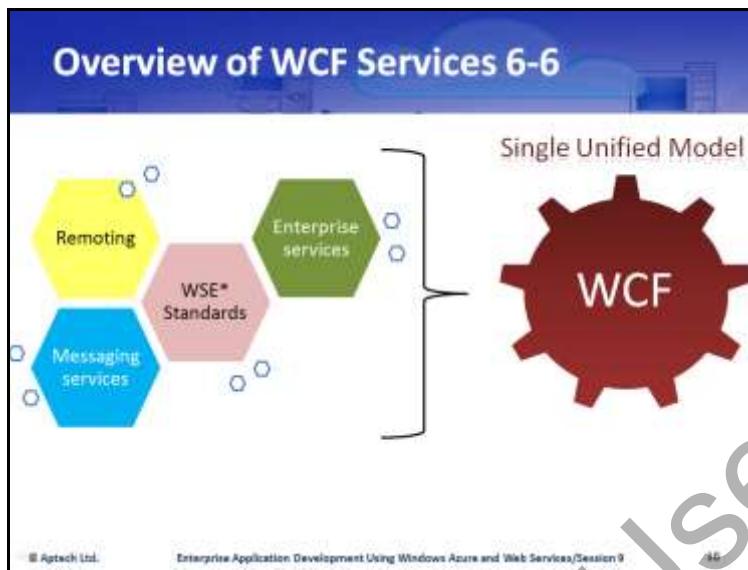
<http://msdn.microsoft.com/en-us/library/ms733103%28v=vs.110%29.aspx>

<http://www.codemag.com/Article/1006061>

<http://www.dotnetcurry.com/showarticle.aspx?ID=383>

Slide 10

Let us understand the WCF unified model.



In slide 10, show the figure to the students and tell them that the WCF framework combines the benefits of various .NET technologies such as Remoting, Web Services, Enterprise Services, WSE *Standards, and Messaging services into a single unified model.

The students may not be familiar with these technologies so briefly define them saying that these are technologies that make distributed computing and programming possible in .NET.

Additional Information:

To know more about the various distributed technologies, visit the following links:

<http://msdn.microsoft.com/library/kwdt6w2k%28v=VS.71%29.aspx>

<http://www.codeproject.com/Articles/45698/WCF-Comparison-with-Web-Services-and-NET-Remoting>

<http://www.webpronews.com/an-extensive-examination-of-web-services-wse-standards-2005-08>

In-Class Question:

After you finish explaining .NET technologies, you will ask the students an In-Class question. This will help you in reviewing their understanding of the topic.



Explain the advantages of WCF?

Answer:

WCF supports proprietary protocols and protocols and transports such as SOAP with HTTP, TCP/IP, and Named pipes. It can also exchange data and information using formats such as SOAP, XML, and JavaScript Object Notation (JSON).

Slide 11

Let us understand the components of a WCF service.

Components of WCF Services

- The three main components of a WCF service:
 - Service contracts
 - Host environment
 - One or more endpoints

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Using slide 11, tell the students that a WCF service is composed of three main components such as Service contracts, Host environment, and one or more endpoints.

Explain them an analogy as given in the session to understand these three components in detail.

Tell the students that when they withdraw money from an ATM machine, the host environment is the ATM machine itself from where they try requesting for different services such as checking balance, booking an Air ticket, and so on. These requests that they make are serviced using a service class, which is predefined in the application. Tell them that they can connect to these service classes using one or more endpoints. These services might be running on a remote machine or in some rare cases on the local machine.

Slide 12

Let us understand Contracts.

Service Contracts

- Contracts:
 - Define an important part of the architecture.
 - **Data contract:** consists of parameters that make up a message which a service can use.
 - **Message contract:** uses protocols like SOAP, which helps you acquire a finer control over the message.
- A Service contract consists of an interface with declarations of methods (in VB or C#) that will be used in them.

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Using slide 12, explain the concept of Contracts. Tell the students that Contracts define an important part of the architecture. The data contract consists of parameters that make up a message which a service can use. Message contracts use protocols like SOAP, which helps them acquire a finer control over the message. A Service contract consists of declarations of methods that are used in them. These methods are declared in an interface, which can be used in various programming languages such as Visual Basic or C#.

Additional Information:

To know more about WCF contracts, visit the following links:

<http://devlb.wordpress.com/2008/06/>

<http://www.codeproject.com/Articles/664238/Understanding-Contracts-in-WCF>

<http://msdn.microsoft.com/en-us/library/ff183866.aspx>

Slide 13

Let us understand various ways to host a WCF service.

Host Environment

- ❑ Environment that hosts the developed service.
- ❑ Various ways to host a WCF service:
 - Windows Service
 - Self-hosting
 - Through IIS

A diagram illustrating the three ways to host a WCF service. It features three interlocking gears: a green gear labeled 'Windows Service', a yellow gear labeled 'Self-hosting', and a red gear labeled 'Through IIS'. The gears are arranged in a triangular configuration.

In slide 13, tell the students that they can host a WCF service by using Windows service, through self-hosting and through IIS.

Slide 14

Let us understand the concept of Bindings.

The slide has a blue header with the word 'Bindings'. The content area contains a list of bullet points and four orange rectangular buttons. The buttons are labeled 'BasicHttpBinding', 'NetTcpBinding', 'NetMsmqBinding', and 'WSHttpBinding'. At the bottom left is the Aptech logo, and at the bottom center is the text 'Enterprise Application Development Using Windows Azure and Web Services/Session 9'.

- ❑ Bindings apply the conditions required to communicate with a service.
- ❑ Various kinds of bindings that can be used based on your requirements:
 - BasicHttpBinding
 - NetTcpBinding
 - NetMsmqBinding
 - WSHttpBinding

In slide 14, explain that policies and bindings apply the conditions required to communicate with a service. For example, the binding specifies the transport protocol, such as HTTP or TCP, to be used for communication. Security requirements and other conditions are defined by policies.

Tell the students that there are various kinds of bindings that can be used based on your requirements, such as BasicHttpBinding, NetTcpBinding, NetMsmqBinding, and WSHttpBinding.

Slide 15

Let us understand Endpoints.

The slide has a blue header with the word 'Endpoints'. The content area contains a list of bullet points. At the bottom left is the Aptech logo, and at the bottom center is the text 'Enterprise Application Development Using Windows Azure and Web Services/Session 9'.

- ❑ Endpoints are Universal Resource Identifiers (URI) which are exposed to the outside world.
- ❑ The client can connect to these WCF services from these endpoints.

Using slide 15, explain Endpoints to the students. Tell them that the Endpoints are Universal Resource Identifiers (URIs) which are exposed to the outside world. The client can connect to these WCF services from these endpoints.

Additional Information:

To know more about endpoints, visit the following link:

<http://msdn.microsoft.com/en-us/library/ms733821%28v=vs.110%29.aspx>

In-Class Question:

After you finish explaining endpoints, you will ask the students an In-Class question. This will help you in reviewing their understanding of the topic.



Which are three main components of WCF service?

Answer:

A WCF service is composed of three main components such as Service contracts, Host environment, and one or more endpoints.

Slide 16

Let us understand hosts used to run a WCF service.

The slide has a blue header bar with the title "Popularly Used Hosts". Below the header, there is a bullet point: "Some of the popularly used hosts include:". There are four colored boxes, each containing a host type and a brief description:

- Console Application**: Simple Console application host
- Windows Service**: WCF service can be controlled by the Service control manager
- IIS**: WCF services can be hosted in IIS provided the service exposes at least one HTTP endpoint
- Windows Azure**: WCF services can be hosted on Windows Azure

At the bottom of the slide, there is some small text: "© Aptech Ltd.", "Enterprise Application Development Using Windows Azure and Web Services/Session 8", and "16".

Using slide 16, tell the students that there are various hosts that are used to run a WCF service. The selection of a host entirely depends upon the kind of application.

Explain following popularly used hosts to the students:

- Console application: Simple Console application host
- Windows Service: WCF service can be controlled by the Service control manager
- IIS: WCF Services can be hosted in IIS provided the service exposes at least one HTTP endpoint
- Windows Azure: WCF services can be hosted on Windows Azure

Slide 17

Let us understand differences between ASP.NET Web API and WCF Services.

ASP.NET Web API versus WCF Services	
Following table shows the main differences between Web API and WCF:	
Web API	WCF
Supports only HTTP and allows accessing from various mobile devices, browsers, and so on.	Supports transport protocols such as TCP, HTTP, UDP, and custom transports. It also allows switching between them.
Enables building Web APIs that support XML and JSON.	Supports Binary, Text, and MTOM encoding.
Uses basic protocol and formats such as XML, SSL HTTP, WebSockets, SSL, JQuery, and JSON.	Supports building services with WS-* standards such as Message Security, Transactions, and Reliable Messaging.
Allows describing a Web API such as auto-generated HTML.	Allows describing WCF SOAP services in WSDL.
Ships with .NET framework but is also available as open-source.	Ships with the .NET framework.

Using slide 17, explain that there are situations in which ASP.NET Web API does not provide a solution, or in which WCF provides a better infrastructure.

Show a table on the slide to the students and tell them that the main differences between Web API and WCF are listed in the table.

Tell the students that the Web API:

- Supports only HTTP and allows accessing from various mobile devices, browsers, and so on.
- Enables building Web APIs that support XML and JSON.
- Uses basic protocol and formats such as XML, SSL HTTP, WebSockets, SSL, JQuery, and JSON.
- Allows describing a Web API such as auto-generated HTML.
- Ships with .NET framework but is also available as open-source.

Explain them that WCF:

- Supports transport protocols such as TCP, HTTP, UDP, and custom transports. It also allows switching between them. Binary, Text, and MTOM encoding is supported by WCF.
- Supports building services with WS-* standards such as Message Security, Transactions, and Reliable Messaging.
- Allows describing WCF SOAP services in WSDL.
- Ships with the .NET framework.

In-Class Question:

After you finish explaining Web API and WCF Services, you will ask the students an In-Class question. This will help you in reviewing their understanding of the topic.



Which are the popularly known hosts used to run a WCF service?

Answer:

The popularly known hosts used to run a WCF service are Console application, Windows Service, IIS, and Windows Azure.

Slide 18

Let us understand the working of WCF.

Working with WCF 1-10

- Endpoints:
 - Are a major infrastructure for communication in a WCF service.
 - Provide clients access to the functionality offered by a WCF service.
- Each endpoint consists of the following four properties:
 - Address
 - Binding
 - Contract
 - Behaviors

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Using slide 18, tell the students that Endpoints are a major infrastructure for communication in a WCF service. Endpoints provide clients access to the functionality offered by a WCF service. Each endpoint consists of four properties, such as Address, Binding, Contract, and Behaviors.

Slides 19 to 21

Let us understand the basic syntax for address, binding, and contract in Web.config and bindings and endpoints in code.

Working with WCF 2-10

The basic syntax for each of these in the configuration through Web.config is as follows:

Address

Syntax

```
<endpoint address="http://localhost/MyService"  
binding="..." contract="..."/>
```

In this example, the address specifies the location of the endpoint.

Binding

Syntax

```
<endpoint address="http://localhost/MyService"  
binding="wsHttpBinding" contract="..."/>
```

Here, the wsHttpBinding specifies the binding policy to be used.

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Working with WCF 3-10

Contract

Syntax

```
<endpoint address="http://localhost/MyService"  
binding="wsHttpBinding" contract="IMain"/>
```

Here, the contract IMain specifies contract service that needs to be accessed by the host.

Defining the Contracts

Following syntax helps to create a ServiceContract and OperationContract in code:

Syntax

```
[ServiceContract]  
public interface <Name of interface>  
{  
}  
[OperationContract]  
void operation();
```

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Working with WCF 4-10

Bindings

Following syntax helps you create a new binding instance:

Syntax

```
<specify binding type> binding = new <specify binding type>();
```

Endpoints

Following syntax helps you create endpoints in code:

Syntax

```
Uri MyUri = new Uri("<specify address>");  
<specify binding type> binding = new <specify binding type>();  
ServiceHost.AddEndpoint(<type of <specify the service interface>>, binding,  
MyUri);
```

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Using slides 19 to 21, explain the basic syntax for address, binding, and contract in the configuration through `Web.config` are explained as follows:

- Show the syntax for **Address** and explain that `address` specifies the location of the endpoint in this example.
- Show the syntax for **Binding** and explain that the binding `wsHttpBinding` specifies the binding policy to be used.

Using slide 20, show the syntax for **Contract** and explain that the contract `IMinfo` specifies contract service that needs to be accessed by the host.

Explain that Web Services Description Language (WSDL) is used to define the Web Service and Web Service contract. It is an XML document, which contain custom tags used to define the elements and attributes of the service. WSDL also defines a standard manner in which a Web Service can be accessed.

Using slide 20, show the syntax for **Defining the Contracts** in code and explain that it helps to create a `ServiceContract` and `OperationContract` respectively in code.

Using slide 21, show the syntax for **Bindings** to the students and explain that it helps them create a new binding instance. Then, show the syntax for **Endpoints** and explain that it helps them create endpoints in code.

Slides 22 to 26

Let us understand the steps to create and consume the service.

Working with WCF 5-10

□ Steps to create and consume the service are:

In SQL Server 2012, create a database named Bank with a table named BankAccounts. Insert sample records into the table.

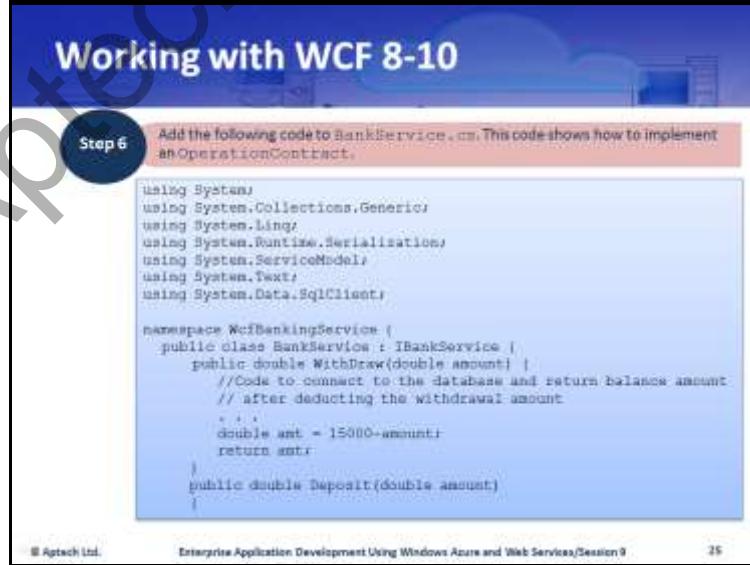
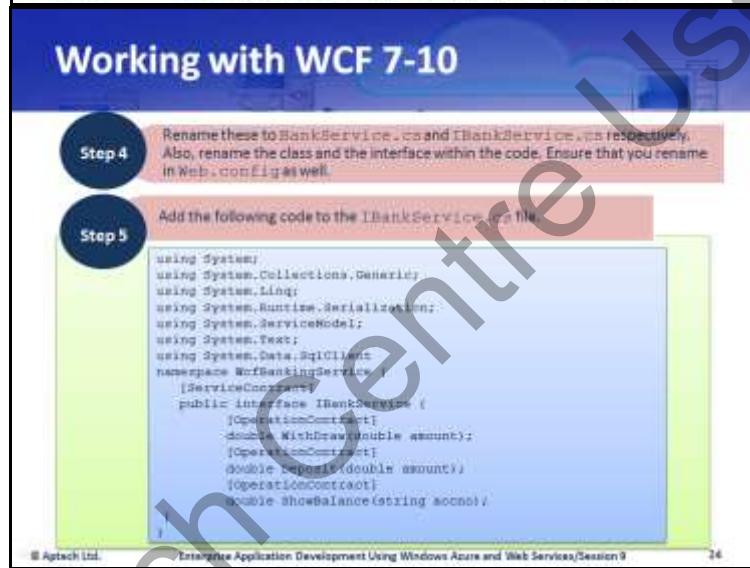
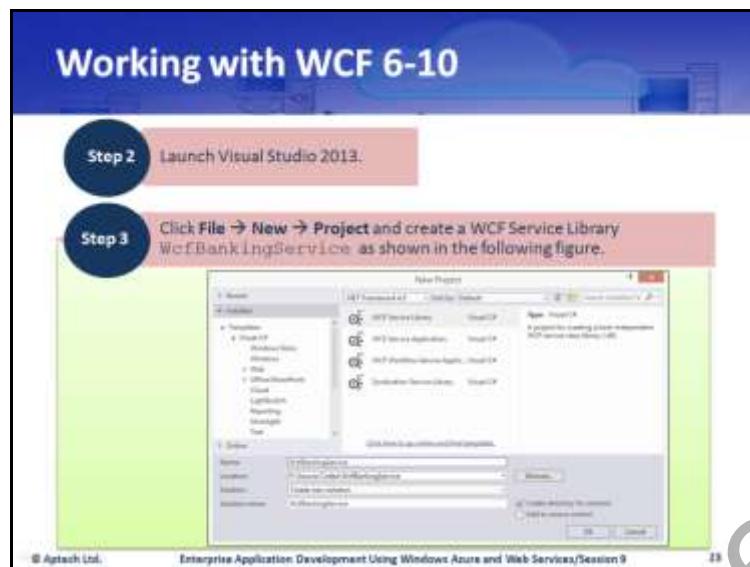
Step 1

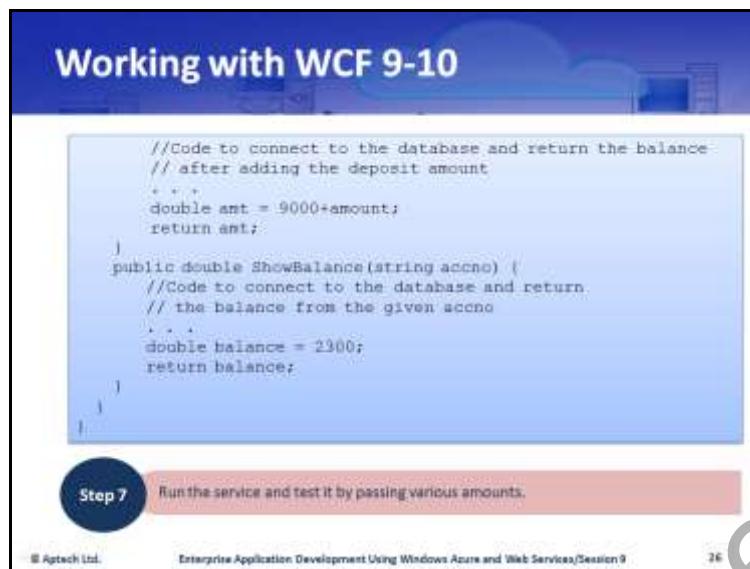
```
CREATE TABLE BankAccounts
(
    accNo int,
    accName varchar(20),
    accPhone varchar(10),
    accEmail varchar(10),
    accountType varchar(50),
    accountBal float
);

Insert into BankAccounts values('9811234', 'Charles', '8989999999', 'charles@abc.com', 'Savings', 10000);
Insert into BankAccounts values('9811235', 'Hector', '8989999999', 'hector@abc.com', 'Savings', 10000);
Insert into BankAccounts values('9811236', 'Mark', '8989999999', 'mark@abc.com', 'Savings', 10000);
Insert into BankAccounts values('9811237', 'Peter', '8989999999', 'peter@abc.com', 'Savings', 10000);
Insert into BankAccounts values('9811238', 'George', '8989999999', 'george@abc.com', 'Savings', 10000);
```

accNo	accName	accPhone	accEmail	accountType	accountBal
1	Charles	8989999999	charles@abc.com	Savings	10000
2	Hector	8989999999	hector@abc.com	Savings	10000
3	Mark	8989999999	mark@abc.com	Savings	10000
4	Peter	8989999999	peter@abc.com	Savings	10000
5	George	8989999999	george@abc.com	Savings	10000

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Using slides 22 to 26, explain the step by step procedure to create and consume the service.

Explain that before creating a service, the developer must answer the following questions:

- What functionality will be provided the service?
- Where is the service located?
- How can one send messages to the service and how to invoke it?

Explain the following example to the students:

Consider an example that demonstrates how to create and implement WCF service. The service contract for the example will be defined as an interface named as `IBankService`. It has three methods `Withdraw()`, `Deposit()`, and `ShowBalance()`. These methods are the Operation Contracts. These methods will be implemented in a service class named `BankService`.

Then, explain the steps to create and consume the service. In this slide, explain step 1 to the students and tell them that in SQL Server 2012, create a database named `Bank` with a table named `BankAccounts`. Tell them to insert sample records into the table as shown in figure on slide 22.

Explain step 2 and step 3 as follows:

Step 2 - Launch Visual Studio 2013.

Step 3 - Click File → New → Project and create a WCF Service Library called `WcfBankingService` as shown in figure on slide 23. By default, the project creates a `Service1.cs` class and an `IService1.cs` interface.

Explain step 4 and step 5 as follows:

Step 4 - Rename these to `BankService.cs` and `IBankService.cs` respectively. Also, rename the class and the interface within the code. Ensure that you rename in `Web.config` as well.

Step 5 - Add the code given in the code snippet to the `IBankService.cs` file.

In slide 25, explain step 6 to the students as follows:

Step 6 - Add the code given in the code snippet in slides 25 and 26 to BankService.cs. This code shows how to implement an OperationContract, which is a method that returns the service output to the calling client. In this example, the code to connect to SQL server and fetching the data is not shown. It is assumed the users are aware of how to write the code to connect to the server.

Explain step 7 to the students:

Step 7 - Run the service and test it by passing various amounts.

Slide 27

Let us understand the steps to create a Web application to consume the BankingService.

The slide has a blue header with the title 'Working with WCF 10-10'. Below the header is a list of eight steps, each with a small icon and a numbered list of actions:

- Step 1:** Create an ASP.NET Web application named Banking.
- Step 2:** Create a Web form with components.
- Step 3:** Add a service reference by using the shortcut menu options **Add → Service Reference**.
- Step 4:** Enter the address of **WCFBankingService** and click **Go** to search for the WCF service. Specify the name as **BankServiceReference**.
- Step 5:** Click **OK** to create the reference to this service.
- Step 6:** Double-click **ShowBalance**. It will open the default code window.
- Step 7:** Modify the default code.
- Step 8:** Once the code is added, build and test the application.

At the bottom left is the Aptech logo, and at the bottom right is the page number 27.

Using slide 27, tell the students that once the service has been created and its service contract defined, you need to create an application to consume the service. In the current example, you will create a Web application to consume the BankingService.

Explain the following eight steps to create a Web application to consume the BankingService:

1. Create an ASP.NET Web application named **Banking**.
2. Create a Web form with components.
3. Add a service reference by using the shortcut menu options **Add→Service Reference**.
4. Enter the address of **WCFBankingService** and click **Go** to search for the WCF service. It will search the service and show the service that is running at the given address. It also shows the methods provided by the service. Specify the name as **BankServiceReference**.
5. Click **OK** to create the reference to this service. A reference to the **WcfBankingService** will be added as **BankServiceReference**.
6. Double-click **ShowBalance**. It will open the default code window.
7. Modify the default code.

8. Once the code is added, build and test the application. The output will be when user clicks **ShowBalance**, after filling the data into Account Number and Amount boxes. The current balance will be shown in the Balance box. In this case, it shows amount as 2300.

Explain that when the user clicks **Show Balance**, the application makes a call to WcfBankingService, which in turn calls the OperationContract named ShowBalance () .

Explain that when the user clicks **Deposit**, the application makes a call to WcfBankingService, which in turn calls the OperationContract named Deposit () .

Additional Information:

To know more, visit the following links:

<http://blogs.msdn.com/b/jnak/archive/2009/12/01/how-to-add-an-https-endpoint-to-a-windows-azure-cloud-service.aspx>
<http://msdn.microsoft.com/en-us/library/azure/dn268600.aspx>
<http://msdn.microsoft.com/en-us/library/azure/ee405486.aspx>

In-Class Question:

After you finish explaining the steps to create a Web application, you will ask the students an In-Class question. This will help you in reviewing their understanding of the topic.



Which are the four important properties of endpoint?

Answer:

The four important properties of endpoint are Address, Binding, Contract, and Behaviors.

Slide 28

Let us understand types of contract attributes for WCF services.

The slide has a blue header with the title 'Types of Contract Attributes'. Below the header is a bullet point: 'Following are the different types of contract attributes for WCF services:'

Service Contract	Operation Contract	Data Contract	Fault Contract
<ul style="list-style-type: none">A WCF service contract is a standard interface. You specify an interface as a service contract by adding [ServiceContract] attribute above the interface definition.	<ul style="list-style-type: none">Every method that is to be exposed to the client must have the OperationContract attribute.	<ul style="list-style-type: none">This is declared as a class and then decorated it with theDataContract attribute and each of the properties to be serialized with the DataMember attribute.	<ul style="list-style-type: none">Use the FaultContract attribute in a service to define strongly typed exceptions as SOAP faults.

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In slide 28, explain the following four different types of contract attributes for WCF services.

Explain Service Contract.

Explain that a service contract describes the functionality that is exposed by the service. The interface is decorated with ServiceContract attribute to let WCF know that this interface is a contract. A WCF service contract is a standard interface. You specify an interface as a service contract by adding [ServiceContract] attribute above the interface definition.

Explain Operation Contract.

Explain that every method that is to be exposed to the client must have the OperationContract attribute. Methods that are not decorated with the OperationContract attribute will not be visible as well as accessible to the client, even though they are declared inside the interface.

Explain Data Contract.

Explain that data contract is declared as a class and then decorated it with the DataContract attribute and each of the properties to be serialized with the DataMember attribute. This is another important aspect of the service contract. Data contracts define the data that can be exchanged between the service and the client. Data contract defines data that is either returned by a service or received by a service operation as a parameter.

Explain Fault Contract.

Explain that to use the FaultContract attribute in a service to define strongly typed exceptions as SOAP faults. The developer specifies the possible faults that can occur by using the FaultContract attribute in a service contract.

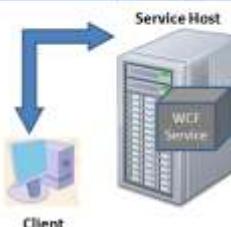
Slide 29

Let us understand the service host.

Configuring WCF Services 1-3

The service host:

- Prepares the service implementation class that will be addressed by clients.
- Opens ports and listens to requests according to the configuration.
- Manages the incoming requests of service and allocates resources such as memory and threads.



Aptech Ltd. Enterprise Application Development Using Windows Azure and Web Services/Session 3 29

In slide 29, tell the students that implementing a service is not enough to make it run, you also need a host to listen for incoming requests and direct them to your service. The service host prepares the service implementation class that will be addressed by clients, allocating the resources the service requires and managing the execution state of the service.

Explain them that the service host is responsible for opening ports and listening to requests according to the configuration. The host manages the incoming requests of service, allocates resources such as memory and threads, creates the service instance context, and then passes the instance context through the WCF runtime.

Slide 30

Let us understand the two ways to host a WCF service.

The slide has a blue header bar with the title "Configuring WCF Services 2-3". Below the header, there is a bullet point: "Two ways to host a WCF service are:"

- Self-hosting**
 - Application itself hosts the service. For instance, Windows Presentation Foundation (WPF) application or a Windows Service.
 - The host will start when application starts, and shutdown along with application.
- Web hosting**
 - When the user uses IIS to host WCF service, it is known as Web Hosting.
 - The service is invoked after IIS receives the first request to the service, and shut down when the Web application shuts down.

At the bottom left of the slide, it says "© Aptech Ltd." and at the bottom right, it says "Enterprise Application Development Using Windows Azure and Web Services/Session 9".

In slide 30, tell the students that Self-hosting and Web hosting are the two ways to host a WCF service.

Explain Self-hosting.

Explain that own application can be created and the service can be hosted using this application such as Windows Presentation Foundation (WPF) application or a Windows Service. The host will start when application starts, and shutdown along with application.

Explain Web hosting.

Explain that when the user uses IIS to host WCF service, it is known as Web Hosting. The service is invoked after IIS receives the first request to the service, and shut down when the Web application shuts down.

Tell the students that the base class that manages WCF hosts is the `ServiceHostBase` type. This class is an abstract class. The concrete class that they will use to host your services is the `ServiceHost` type, which is declared in the `System.ServiceModel` assembly.

Slide 31

Let us understand the code that demonstrates how to host a WCF service with the ServiceHost class.

Following code demonstrates how to host a WCF service with the ServiceHost class:

```
ServiceHost bankServiceHost = new ServiceHost(typeof(Services.WcfBankingService));
bankServiceHost.Open();

Console.WriteLine("Service has been hosted. Press Enter to stop");
Console.ReadLine();
bankServiceHost.Close();
```

In the code:

- Each ServiceHost can manage a single service type, but it opens many listeners for that service type, each with a different listening on different protocol and port.
- The configuration can be set by using code itself, before calling the Open method, or it can be specified in the application configuration file (app.config).
- After the service host has opened, you can close it at any time by calling the Close method. The Close method will stop the host from listening to any communication, making the service unavailable for clients.

Aptech Ltd. Enterprise Application Development Using Windows Azure and Web Services/Session 9 31

In slide 31, explain the code that demonstrates how to host a WCF service with the ServiceHost class.

Explain that each ServiceHost can manage a single service type, but it opens many listeners for that service type, each with a different listening on different protocol and port. For example, a single ServiceHost can listen to HTTP, Named Pipe, and UDP communication, and invoke a service method when a request is received on either of these transports.

Tell the students that before opening the service by using Open method, the host requires configuration details such as the protocol and the port tells which communication channel it should listen on and at which address it should be available. This configuration can be set by using code itself, before calling the Open method, or it can be specified in the application configuration file (app.config).

Mention that after the service host has opened, they can close it at any time by calling the Close method. The Close method will stop the host from listening to any communication, making the service unavailable for clients.

Additional Information:

To know more about configuring WCF services, visit the following links:

<http://msdn.microsoft.com/en-us/library/ee530014%28v=vs.110%29.aspx>

<http://msdn.microsoft.com/en-us/library/ms733932%28v=vs.110%29.aspx>

<http://www.codeproject.com/Articles/300606/No-more-pain-to-configure-WCF-services>

Slides 32 to 36

Let us understand the process of hosting WCF Services.

The figure consists of three vertically stacked screenshots from a Windows application, likely Visual Studio, demonstrating the process of creating and publishing a WCF service to Windows Azure.

Step 1: Launch Visual Studio 2013.

Step 2: Click File → New → Project and create a Windows Azure Cloud service called CloudBankService as shown in the figure.

Step 3: In the New Windows Azure Cloud Service dialog box, select WCF Service Web Role in the left pane and rename it to WCFBankServiceWebRole as shown in the figure.

Step 4: After the service is successfully created and code is added, select Publish to Windows Azure option on the BUILD menu as shown in the figure.

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The image contains two slides from a presentation titled "Enterprise Application Development Using Windows Azure and Web Services".

Slide 35: Hosting WCF Services 4-5

This slide shows a screenshot of the "Windows Azure Publish Settings" dialog box. A callout bubble labeled "Step 5" points to the "Cloud Service" dropdown, which is set to "AptechWeb-Svc-Azure". Other settings visible include "Environment" (Production), "Build Configuration" (Release), "Service configuration" (Cloud), and checkboxes for "Enable Remote Desktop for all roles" and "Enable VNC Display for all web roles (requires Remote Desktop)".

Slide 36: Hosting WCF Services 5-5

This slide lists steps 6 through 9 for publishing:

- Step 6:** When all the settings are done, click Publish in the dialog box. The application will be successfully published.
- Step 7:** Launch and sign in to the Windows Azure Management portal.
- Step 8:** When you click the site address (for example, <http://aptechweb.cloudapp.net>), you will see the service listed there. This means that it has been successfully hosted in Windows Azure.
- Step 9:** To use the service, you can then add it as a service reference in any Web application using the appropriate URL (for example, <http://aptechweb.cloudapp.net/BankService.svc>).

Using slides 32 to 36, explain the steps to create a new cloud service with a WCF Worker or Web Role and host it on Azure. In slide 32, explain steps 1 and 2:

Step 1 - Launch Visual Studio 2013.

Step 2 - Click **File** → **New** → **Project** and create a Windows Azure Cloud service called **CloudBankService** as shown in figure on slide 32.

Explain step 3 to the students:

Step 3 - In the **New Windows Azure Cloud Service** dialog box, select **WCF Service Web Role** in the left pane and rename it to **WCFBankServiceWebRole**.

Explain step 4 to the students:

Step 4 - After the service is successfully created and you have added the desired code for its functionality, select **Publish to Windows Azure** option on the **BUILD** menu.

Explain following step 5 to the students:

Step 5 - In the **Publish Windows Azure Application** dialog box, select or specify appropriate settings. Figure on slide 35 shows an example.

Using slide 36, explain following step 6 to step 9 to the students:

Step 6 - When all the settings are done, click **Publish** in the dialog box. The application will be successfully published.

Step 7 - Launch and sign in to the Windows Azure Management portal.

Step 8 - When you click the site address (for example, <http://aptechweb.cloudapp.net>), you will see the service listed there. This means that it has been successfully hosted in Windows Azure.

Step 9 - To use the service, you can then add it as a service reference in any Web application using the appropriate URL (for example, <http://aptechweb.cloudapp.net/BankService.svc>).

Additional Information:

To know more about hosting WCF services, visit the following links:

<https://www.develop.com/wcfservices>

[http://msdn.microsoft.com/en-us/library/ms733766\(v=vs.110\).aspx](http://msdn.microsoft.com/en-us/library/ms733766(v=vs.110).aspx)

<http://www.dotnetcurry.com/showarticle.aspx?ID=819>

<https://code.msdn.microsoft.com/windowsazure/CSAzureWCFServices-20c7d9c5>

Slide 37

Let us summarize the session.

The slide has a blue header bar with the word "Summary". The main content area contains a bulleted list of 10 points about WCF:

- ❑ WCF is a unified .NET framework for building service-oriented applications.
- ❑ WCF supports protocols and transports such as SOAP with HTTP, TCP/IP, and Named pipes.
- ❑ A WCF service is composed of three main components, namely, Service contracts, Host environment, and one or more endpoints.
- ❑ A service endpoint defines how the service is exposed to the clients.
- ❑ A service contract describes the functionality that is exposed by the service.
- ❑ A data contract is declared as a class and then decorated with the `DataContract` attribute and each of its properties are serialized with the `DataMember` attribute.
- ❑ The service host is responsible for opening ports and listening to requests according to the configuration.

At the bottom of the slide, there is footer text: © Aptech Ltd., Enterprise Application Development Using Windows Azure and Web Services (Session 3), and a page number 37.

Using slide 37, you will summarize the session. You will end the session, with a brief summary of what has been taught in the session.

Tell the students pointers of the session. This will be a revision of the current session and it will be related to the next session. Explain each of the following points in brief. Tell them that:

- WCF is a unified .NET framework for building service-oriented applications.
- WCF supports protocols and transports such as SOAP with HTTP, TCP/IP, and Named pipes.
- A WCF service is composed of three main components, namely, Service contracts, Host environment, and one or more endpoints.
- A service endpoint defines how the service is exposed to the clients.
- A service contract describes the functionality that is exposed by the service.
- A data contract is declared as a class and then decorated with the `DataContract` attribute and each of its properties are serialized with the `DataMember` attribute.
- The service host is responsible for opening ports and listening to requests according to the configuration.

9.3 Post-Class Activities for Faculty

You should familiarize yourself with the topics of the next session.

Tips: You can also check the Articles/Blogs/Expert Videos uploaded on the OnlineVarsity site to gain additional information related to the topics covered in the next session. You can also connect to online tutors on the OnlineVarsity site to ask queries related to the sessions.

Session 10 – Service Bus in Windows Azure

10.1 Pre-Class Activities

Before you commence the session, you should familiarize yourself with the topics of this session in-depth. You should revisit topics of the previous session for a brief review. Here, you can ask students the key topics they can recall from previous session. Prepare a question or two, which will be a key point to relate the current session objectives.

The summary of the previous session is as follows:

- WCF is a unified .NET framework for building service-oriented applications.
- WCF supports protocols and transports such as SOAP with HTTP, TCP/IP, and Named pipes.
- A WCF service is composed of three main components, namely, Service contracts, Host environment, and one or more endpoints.
- A service endpoint defines how the service is exposed to the clients.
- A service contract describes the functionality that is exposed by the service.
- A data contract is declared as a class and then decorated with the `DataContract` attribute and each of its properties are serialized with the `DataMember` attribute.
- The service host is responsible for opening ports and listening to requests according to the configuration.

10.1.1 Objectives

By the end of this session, the learners will be able to:

- Explain Service Bus in Windows Azure
- Describe queues, topics, and relays
- State the use of AMQP in Service Bus
- Describe the use of Service Bus relays in cloud hybrid applications

10.1.2 Teaching Skills

To teach this session successfully, you should be aware of Service Bus in Windows Azure. Also, familiarize yourself with the use of AMQP in Service Bus, Service Bus relays in cloud hybrid applications and queues, topics, and relays.

For teaching in the class, you are expected to use slides and LCD projectors.

Tips:

It is recommended that you test the understanding of the students by asking questions in between the class.

In-Class Activities:

Follow the order given here during In-Class activities.

Overview of the Session

Give the students a brief overview of the current session in the form of session objectives. Show the students slide 2 of the presentation.

Learning Objectives



- Explain Service Bus in Windows Azure
- Describe queues, topics, and relays
- State the use of AMQP in Service Bus
- Describe the use of Service Bus relays in cloud hybrid applications

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Tell them that they will be introduced to the concept of Service Bus in Windows Azure. This session explains how Azure Service Bus allows to connect cloud applications to the services, systems, and on-premises applications.

10.2 In-Class Explanations

Slides 3 to 5

Let us understand Service Bus.

Service Bus 1-3

- Service Bus:**
Is a core feature of Windows Azure that acts as a messaging channel.
 - Sits between various components of the cloud app or between the cloud and on-premises applications and enables them to communicate through messages.
 - Is based on the multi-tenant concept.
- According to this concept, several users can use the same service.
- Application developers will create a namespace within which one or more communication mechanisms will be defined.



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Service Bus 2-3

□ An application developer can use from any one of the three communication mechanisms offered:

Queues	Topics	Relays
• Allows unidirectional communication, that is, every queue needs to store messages until they are received.	• Offers unidirectional communication. • Uses subscription and based on these criteria, it shows the message to the subscription.	• Offers bi-directional communication. • Passes messages to the application, that is, the destination application.

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Service Bus 3-3

□ Following figure depicts an overview of a Service Bus:

```
graph TD; subgraph Namespace1 [Namespace 1]; QueueX[Queue x]; QueueY[Queue y]; TopicX[Topic x]; end; subgraph Namespace2 [Namespace 2]; RelayX[Relay x]; end; subgraph Namespace3 [Namespace 3]; TopicX[Topic x]; TopicY[Topic y]; RelayX[Relay x]; end; QueueX --> App1[Application]; QueueY --> App1; TopicX --> App1; RelayX --> App2[Application]; TopicX --> App3[Application]; TopicY --> App3;
```

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Use slide 3 to explain to the students the features of Service Bus. Windows Azure Service Bus acts as a messaging channel. It is located between various components of the cloud app or between the cloud and on-premises applications that helps to communicate through messages.

The Service Bus is a multi-tenant concept that allows several users to use the same service. It also allows the application developers to create namespaces within which one or more communication mechanisms can be defined.

Using slide 4, explain to the students that an application developer uses any one of the three communication mechanisms in the Service Bus:

- Queues
- Topics
- Relays

Tell the students that the Queues mechanism allows unidirectional communication, which means all the queues need to store messages until they are received.

Then, tell that Topics mechanism allows unidirectional communication that uses subscription to show the message.

Next, tell that Relays mechanism allows bi-directional communication that sends messages to the destination application.

Using slide 5, explain to the students that the figure depicts an overview of a Service Bus.

Additional Information:

To know more about Service Bus, visit the following links:

<http://www.cloudcasts.net/devguide/Default.aspx?id=11030>

<http://azure.microsoft.com/en-us/services/service-bus/>

<http://channel9.msdn.com/posts/Service-Bus-Introduction/>

<http://www.wadewegner.com/2010/05/host-wcf-services-in-iis-with-service-bus-endpoints/>

<http://www.dotnet-tricks.com/Tutorial/windowsazure/3L0D011013-Undestanding-Components-of-Windows-Azure.html>

In-Class Question:

After you finish explaining Service Bus, you will ask students an In-Class question. This will help you in reviewing their understanding of the topic.



What is the Relays mechanism?

Answer:

Relays mechanism allows bi-directional communication that sends messages to the destination application.

Slide 6

Let us understand advantages of Service Bus.

Advantages of Service Bus

- ❑ Azure Service Bus helps in:
 - Managing the delivery of messages in the cloud.
 - Connecting the cloud to on-premises applications
 - Pushing notifications easily to mobile apps or devices
 - Controlling the access to services at a basic level
 - Exposing the application functionality and data from the existing enterprise solutions and taking advantage of it from the cloud

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In slide 6, explain advantages of Service Bus to the students. Tell them that Service bus help to manage the delivery of messages in the cloud. You can connect the cloud to on-premises applications, push notifications easily to mobile apps or devices, and control the access to these services at a basic level. Another advantage of Service bus is it exposes the application functionality and data from the existing enterprise solutions and takes advantage of it from the cloud.

You can also tell the students that the Service Bus allows to de-couple and communicate between services and applications through Queues and Topics. Customers in real world scenarios are using Service Bus to scale their solutions with messaging patterns.

Additional Information:

To know more about advantages of Service Bus, visit the following links:

<http://travisdbrown.wordpress.com/2013/07/19/understanding-the-basics-of-windows-azure-service-bus/>

http://oakleafblog.blogspot.in/2010/12/windows-azure-and-cloud-computing-posts_17.html

Slide 7

Let us understand the Service Bus communication mechanisms.

Understanding the Service Bus Communication Mechanisms

❑ Integral aspects to the Service Bus messaging system are:

The diagram illustrates the integral components of the Service Bus Messaging System. At the center is a red circle labeled "Service Bus Messaging System". Surrounding it are three other circles: a green circle labeled "Queues" at the top, a purple circle labeled "Relays" on the left, and a teal circle labeled "Topics" on the right. Double-headed arrows connect the central system to each of the peripheral components, indicating a bidirectional communication flow between them.

Using slide 7, tell them that the Service Bus messaging system comprises integral components such as queues, topics, and relays.

The Service Bus works on a publisher/subscriber model.

Additional Information:

For more information, refer to the following links:

- <http://www.codemag.com/Article/1112041>
- <http://www.codeproject.com/Articles/276400/Using-Windows-Azure-Service-Bus-Messaging>
- <http://blogs.technet.com/b/meamcs/archive/2011/12/23/my-hello-azure-service-bus-wcf-service-step-by-step-guide.aspx>

Slides 8 to 10

Let us understand the Service Bus queues.

Queues 1-3

Queues

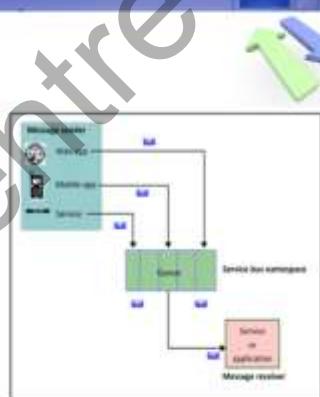
- ❑ Service Bus Queues works on the brokered messaging communication model and act as a mediator.
- ❑ A distributed application exchanges messages through queues and does not communicate directly.
- ❑ Queues follow First In First Out (FIFO) message delivery system.

Queues 2-3

The sender:

- Sends the message to the queue; the receiver receives the message from the queue to processes it further.
- Can send further messages without waiting for a reply.

The messages are received and processed by only one message receiver in the same sequence that was followed for sending to the queue.



Queues 3-3

Service Bus queues can be used for communication:

- In a multi-tier Azure application that involves Web and worker roles
- In a hybrid solution that involves on-premises apps and Azure hosted apps
- In different organizations of a distributed application running on-premises

Queues help to scale out the applications to improve architecture and resiliency.

Using slide 8, tell the students that Service Bus Queues acts as a mediator as it exchanges messages through queues and does not communicate directly. It works on the brokered messaging communication model and follows First In First Out (FIFO) message delivery system.

Using slide 9, explain to the students how the queue mechanism works. First, the sender sends the message to the queue. The receiver on receiving the message from the queue processes it further. The sender then sends the message without waiting for a reply.

Tell them that the message follows the same sequence that was followed for sending to the queue. The messages are received and processed by only one message receiver.

Tell them that the figure on slide 9 shows the working mechanism of queues.

Using slide 10, tell them the uses of Service Bus queues. They can be used for communication at different levels such as in a multi-tier Azure application that involves Web and worker roles, or in a hybrid solution that involves on-premises apps and Azure hosted apps and also in different organizations of a distributed application running on-premises.

Queues are used to scale out the applications to improve architecture and resiliency.

Slides 11 and 12

Let us understand about the Service Bus topics.

Topics 1-2

- Service Bus topics works on a publish/subscribe messaging communication model and acts as a mediator.
- A distributed application exchanges messages through a topic and does not communicate directly.

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Topics 2-2

- Topics/subscriptions follow one-to-many form of communication using publish/subscribe pattern.
- Multiple subscriptions to a topic can be registered.
- Each message sent to a topic is made available to each subscription to process.
- Filter rules can be registered for a topic for each subscription to filter the topic of messages received by a topic subscription.
- Service Bus topics and subscriptions help scale large number of messages to a large number of applications and users.

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Using slide 11, explain to the students that the Service Bus Topics acts as a mediator. It operates on a publish/subscribe messaging communication model. In a distributed application, the messages are exchanged through a topic and not communicated directly.

The figure on slide 11 shows the working of Topics mechanism.

Using slide 12, explain that Topics work on one-to-many form of communication mechanism. It uses publish/subscribe pattern. You can register multiple subscriptions to a topic. Each message sent to a topic is made available to each subscription to process.

You can register filter rules for a topic for each subscription. This helps to filter the topic of messages received by a topic subscription.

Large number of messages can be scaled to a large number of applications using Service Bus topics and subscriptions.

Slides 13 to 15

Let us understand about the Service Bus relays.

Relays 1-6

- Enterprise applications comprise several features in the form of services, components, and so on.
- Consolidating all these diverse components together into the single system is not easy even when all of them reside locally.
- If some of the components reside on a cloud, then it becomes even more tough.

Components



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Relays 2-6

- Consider a Windows Azure based enterprise application:
 - Having Web and worker roles
 - Storing its data in SQL Database
 - Interacting with third-party provider services for authentication or other tasks
- The application may also make use of some local components that cannot be migrated to the cloud,
- Such applications are called cloud hybrid applications.



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Relays 3-6

- The Service Bus Relay:
 - Helps to build cloud hybrid application that run in an Azure datacenter and on-premises environment.
- In cloud hybrid applications:
 - The service bus relay is quite useful as it takes existing WCF Web services and makes them accessible to cloud-based solutions without compromising on security or infrastructure.



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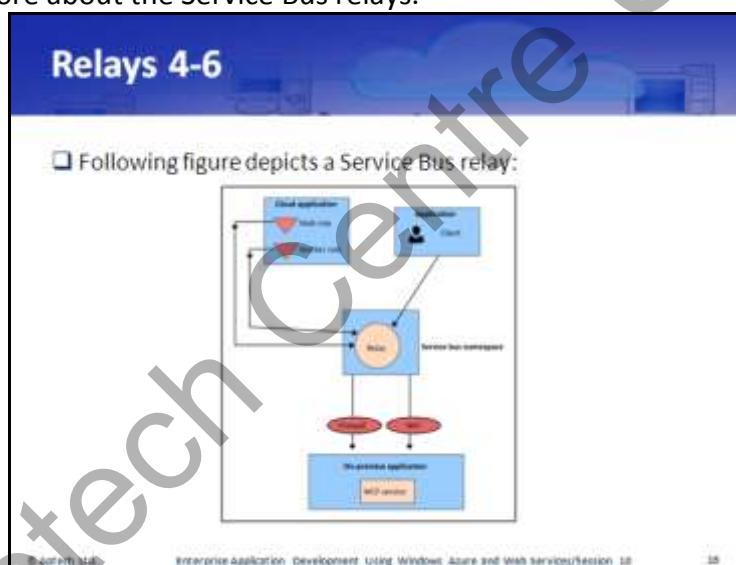
Using slide 13, explain to the students that the Enterprise applications today are no longer simple and straightforward. They consist of several features such as services, components, and so on. It is difficult to consolidate all these diverse components together into the single system when all of them reside locally. It becomes difficult if the components reside on a cloud.

Using slide 14, tell the students to consider a scenario. Tell them that a Windows Azure based enterprise application that has Web and worker roles, stores its data in SQL Database. It interacts with third-party provider services for authentication or other tasks. The application can use local components that cannot be migrated to the cloud. Such applications are called cloud hybrid applications.

Using slide 15, explain to them that the Service Bus Relay allows to build cloud hybrid application that run in an Azure datacenter and on-premises environment. In cloud hybrid applications, the service bus relay is quite useful as it takes existing WCF Web services and makes them accessible to cloud-based solutions without compromising on security or infrastructure.

Slides 16 to 18

Let us understand more about the Service Bus relays.



The image shows two slides from a presentation. The top slide is titled "Relays 5-6" and contains three bullet points:

- ❑ WCF services can be hosted in the existing enterprise environment using the Service Bus relay.
- ❑ Incoming sessions and requests to these WCF services can be delegated to the Service Bus running in Azure.
- ❑ The services are then exposed to the application code running in Azure or to mobile workers or extranet partner environments.

The bottom slide is titled "Relays 6-6" and contains one bullet point:

- ❑ Service Bus offers two types of messaging capabilities:
 - Relayed
 - Allows request/response messaging, direct one-way messaging and peer-to-peer messaging
 - Brokered
 - Allows Subscriptions, Topics, and Queues that are components of asynchronous messaging

Both slides have a blue header bar with the title and a footer bar with the text "© Aptech Ltd. Enterprise Application Development Using Windows Azure and Web Services/Session 10".

Using slide 16, tell the students that the figure shows the working of a Service Bus relay. Using slide 17, explain that you can host the WCF services in the existing enterprise environment using the Service Bus relay. You can also delegate the incoming sessions and requests to these WCF services to the Service Bus running in Azure. These services are then exposed to the application code running in Azure or to mobile workers or extranet partner environments.

Using slide 18, explain to the students two types of messaging capabilities offered by Service Bus: relayed and brokered.

Explain that relayed messaging capabilities allow to request/response messaging. Relayed messaging can be direct, one-way, or peer-to-peer messaging.

Tell that brokered messaging capabilities enable Subscriptions, Topics, and Queues, which are components of asynchronous messaging.

Additional Information:

For more information, refer to the following links:

<http://www.codemag.com/Article/1112041>

<http://www.codeproject.com/Articles/276400/Using-Windows-Azure-Service-Bus-Messaging>

<http://blogs.technet.com/b/meamcs/archive/2011/12/23/my-hello-azure-service-bus-wcf-service-step-by-step-guide.aspx>

Slides 19 to 21

Let us understand creating a Windows Azure Service Bus queue.

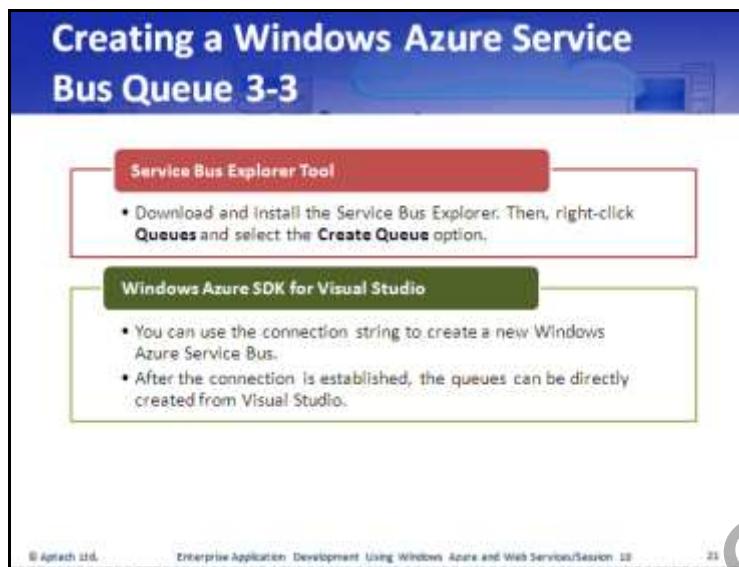
The image displays two slides from a presentation, both titled "Creating a Windows Azure Service Bus Queue".

Slide 1 (Top): The title is "Creating a Windows Azure Service Bus Queue 1-3". It contains a bullet point: "Service Bus queues offer messaging capabilities, which help various applications to run in the cloud or on-premises to exchange messages across trust and network boundaries in a flexible manner." Below the text is a diagram showing a central globe with multiple arrows pointing towards it from various directions, representing connectivity and message exchange between different applications.

Slide 2 (Bottom): The title is "Creating a Windows Azure Service Bus Queue 2-3". It contains a bullet point: "Some of the common ways of creating a Windows Azure Service Bus Queue are:". This section is divided into two main methods:

- .NET Code:** A list of steps: "You can create queues from .NET code by downloading the NuGet package from Visual Studio."
- Windows Azure Portal:** A list of steps: "You can create queues from the Windows Azure Portal. For this, you need to login to the portal, choose the Service Bus option from the menu icons that are on the left pane. Choose the namespace where you want to create a queue and click New."

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Using slide 19, explain that the Service Bus queues offer messaging capabilities that allow the applications to run in the cloud or on-premises, exchange messages across trust and network boundaries in a flexible manner.

Using slides 20 and 21, tell the students that there are some common ways of creating a Windows Azure Service Bus Queue.

Tell them that the first way is .NET code, which helps to create queues from .NET code by downloading the NuGet package from Visual Studio. Here, mention that NuGet is the package manager for the Microsoft development platform including .NET. The NuGet client tools enable to produce and consume packages.

Explain that Windows Azure Portal is another way to create queues from the Windows Azure Portal. This is done by logging in to the portal and choosing the **Service Bus** option from the menu icons that are on the left pane. You can choose the namespace where you want to create a queue and click **New**.

Explain that Service Bus Explorer Tool enables to download and install the Service Bus Explorer. You need to right-click **Queues** and select the **Create Queue** option.

Also, explain that Windows Azure SDK for Visual Studio enable to use the connection string to create a new Windows Azure Service Bus. Once the connection is established, you can directly create the queues from Visual Studio.

Additional Information:

To know more about creating a Windows Azure Service Bus queue, visit the following links:

<http://forums.netduino.com/index.php?/topic/10267-azure-service-bus-connection/>
<http://www.dotnet-tricks.com/Tutorial/windowsazure/3L0D011013-Understanding-Components-of-Windows-Azure.html>

In-Class Question:

After you finish explaining creating a Windows Azure Service Bus queue, you will ask students an In-Class question. This will help you in reviewing their understanding of the topic.



What is the role of Service Bus queue?

Answer:

The Service Bus relay allows to build cloud hybrid application that run in an Azure datacenter and on-premises environment.

Slide 22

Let us understand AMQP support.

The slide has a blue header bar with the title 'AMQP Support'. The main content area contains two bullet points. The first bullet point is 'AMQP is a consistent and well-organized wire-level protocol that helps to build easy messaging applications between different vendor products.' The second bullet point is 'Following are the features of AMQP:' followed by a list of seven items. A red rectangular callout box highlights this second bullet point and its list. At the bottom of the slide, there is small text indicating it is from '© Aptech Ltd. Enterprise Application Development Using Windows Azure and Web Services/Session 10' and page number '23'.

- ❑ AMQP is a consistent and well-organized wire-level protocol that helps to build easy messaging applications between different vendor products.
- ❑ Following are the features of AMQP:
 - Enables building cross-platform and hybrid applications using an open standard protocol
 - Constructs applications using components with different languages and frameworks
 - Runs the applications on different operating systems
 - Connects Service Bus and exchanging business messages easily and efficiently
 - Provides flexible protocol that supports communications at all levels
 - Exchanges reliable messages
 - Supports existing messaging brokers

Using slide 22, explain AMQP is a wire-level protocol that is consistent and well organized. It allows to build easy messaging applications between different vendor products.

Tell the students the features of AMQP include:

- Building cross-platform and hybrid applications with an open standard protocol
- Constructing applications with components of different languages and frameworks
- Running the applications on different operating systems
- Connecting Service Bus and exchanging business messages easily and efficiently
- Providing flexible protocol to support communications at all levels
- Exchanging reliable messages
- Supporting existing messaging brokers

Slides 23 and 24

Let us understand using AMQP support in Service Bus.

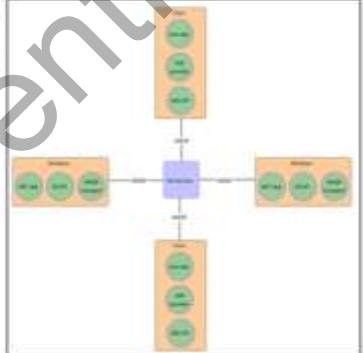
Using AMQP in Service Bus 1-2

- ❑ AMQP 1.0 influences the queuing, publishing, or subscribing brokered messaging features of Service Bus.
- ❑ Applications can be built using different languages, operating systems, and frameworks.

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Using AMQP in Service Bus 2-2

- ❑ The figure shows deployment in which messages are exchanged through Service Bus using AMQP 1.0 for the Java clients.
- ❑ These run on Linux and are written using the standard Java Message Service (JMS) API and .NET clients that run on Windows.



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Using slide 23, explain that AMQP 1.0 helps the queuing and publishing or subscribing brokered messaging features of Service Bus. You can build applications using different languages, operating systems, and frameworks.

Using slide 24, explain to the students that the figure shows deployment in which messages are exchanged through Service Bus using AMQP 1.0 for the Java clients. These messages run on Linux and are written using the standard Java Message Service (JMS) API and .NET clients that run on Windows.

Slides 25 and 26

Let us understand Notification Hub.

The image shows two slides from a presentation. The top slide is titled "Notification Hub 1-4" and contains a bulleted list: "Azure Notification Hubs have a Push feature that helps the consumers and enterprise applications for mobile platforms to access the infrastructure with ease." and "Push Notification: Is a feature that notifies users about an event that has occurred. Is found exclusively in tablets and smartphones. For example, In Windows Store applications, the notification appears in a window with a sound that indicates a new push." The bottom slide is titled "Notification Hub 2-4" and contains a bulleted list: "Push Notifications offer following benefits: Enable mobile devices to display new information keeping the energy intact. Increase app engagement and usage. Update information to employees regularly. Increase user awareness." To the right of this list is a circular diagram showing various mobile devices (smartphones, tablets, laptop) connected to a central hub, symbolizing connectivity and data flow.

Using slide 25, explain Notification Hub to the students. Tell them that the Azure Notification Hubs consist of a Push feature. This allows the consumers and enterprise applications for mobile platforms to access the infrastructure without any difficulty.

Explain Push Notifications. Tell that it is a feature to alert users about an event that has occurred. You can use the feature in tablets and smartphones. In Windows Store applications, the notification appears in a window with a sound that indicates a new push.

Using slide 26, explain benefits of the Push Notifications.

Tell them that Push Notifications allows mobile devices to display new information keeping the energy intact. Tell that it helps to increase app engagement and usage, update information to employees regularly and increase user awareness.

Slides 27 and 28

Let us understand Notification Hub.

The image shows two slides from a presentation. The top slide is titled "Notification Hub 3-4" and contains the following content:

- ❑ Platform Notification Systems (PNS) are platform-specific infrastructures that are used to notify Push Notifications.
- ❑ For example:
 - A developer needs to contact the Windows Notification Service (WNS) to notify a Windows Store app. Here, PNS is implemented as WNS.

The bottom slide is titled "Notification Hub 4-4" and contains the following content:

- ❑ The limitations of Push Notifications include:

Dependency on different platforms	Constant updating and refreshing	Route notifications
• Used to notify devices on different platforms.	• Is required each time the app is launched leading to traffic.	• Increases the maintenance costs of an app.

Both slides have a footer with the text: © Aptech Limited Enterprise Application Development Using Windows Azure and Web Services/Session 10 [slide number]

Using slide 27, explain that Platform Notification Systems (PNS) are platform-specific infrastructures that help on alerting the Push Notifications. Tell an example. For example, to notify a Windows Store app, a developer needs to contact the Windows Notification Service (WNS). In this case, the PNS is implemented as WNS.

Using slide 28, tell the students that the Push Notifications has some limitations.

Explain the following limitations to them:

- It depends on different platforms and multiple interfaces to notify devices on different platforms.
- It needs constant updating and refreshing each time the app is launched. This causes traffic.
- It needs route notifications, which leads to increase in the maintenance costs of an app.

Additional Information:

To know more about creating a Windows Azure Service Bus queue, visit the following links:

<http://azure.microsoft.com/en-in/documentation/articles/service-bus-dotnet-how-to-use-queues/>
<http://msdn.microsoft.com/en-us/library/azure/hh367516.aspx>

Slides 29 and 30

Let us understand working with Service Bus.

The image shows two slides from a presentation. Both slides have a blue header bar with the title 'Working with Service Bus'. The first slide, titled 'Working with Service Bus 1-2', contains two bullet points: 'The Service Bus is useful in integrating on-premises and cloud hybrid applications.' and 'Consider an example of a library system maintaining books and various details pertaining to the books.' Below the text are two small images: one of a man in a suit looking at a bookshelf, and another of a stack of books. The second slide, titled 'Working with Service Bus 2-2', contains a single bullet point: 'Fundamental tasks to be performed for this application are:'. Below this is a horizontal flowchart with four colored boxes connected by arrows: 1. Red box: 'Create a Service namespace in the Azure portal.' 2. Orange box: 'Retrieve the management credentials.' 3. Yellow box: 'Create an On-premises server.' 4. Blue box: 'Create an ASP.NET Web application, preferably, MVC application.' 5. Green box: 'Run and deploy.' The flowchart ends with an arrow pointing to the green box.

Using slide 29, explain to the students that the Service Bus helps to integrate on-premises and cloud hybrid applications.

Tell an example to the students to understand the use of service bus in an on-premises application. For example, a library system maintaining books and various details related to those books.

Using slide 30, explain the fundamental tasks needed Service Bus application.

Firstly, you need to create a Service namespace in the Azure portal so that you can use Service Bus features in Azure.

Then, you need to retrieve the management credentials.

Next, you will create an On-premises server.

After that, you need to create an ASP.NET Web application, preferably, MVC application.
Lastly, you need to run and deploy.

Slide 31

Let us understand Service Bus namespace setup using the Management Portal.



Using slide 31, explain the students the following steps for Service Bus namespace setup using the Management Portal:

In Step 1, you need to log in to the Azure Management Portal by typing the username and password.

In Step 2, from the list of items on the left, select **Service Bus**.

In Step 3, from the options mentioned at the bottom of page, select **CREATE**.

In Step 4, type the name in the **Namespace Name** box to create a new namespace.

On entering the name, the system immediately checks the availability of the name. Consider that you have specified **sampleservicebusdemo** as the namespace name.

In Step 5, select the region. Assume that you have selected East Asia for the current example.

In Step 6, click the check mark. This helps to create and enable the service namespace.

Slide 32

Let us understand how to retrieve the management credentials.

Retrieve the Management Credentials

Following are the steps to retrieve the management credentials:

- Step 1 • Select the name of the service namespace in the main window.
- Step 2 • Select Connection Information from the options mentioned at the bottom of page.
- Step 3 • Find the Default Issuer and Default Key values in the Access connection information pane.
- Step 4 • Copy the key to the clipboard, which will be used for creating an on-premises server.

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Using slide 32, explain that the following steps to retrieve the management credentials:

In Step 1, select the name of the service namespace in the main window.

In Step 2, from the options mentioned at the bottom of page, select **Connection Information**.

In Step 3, find the Default Issuer and Default Key values in the Access connection information pane.

In Step 4, copy the key to the clipboard, which will be used for creating an on-premises server.

Slides 33 to 37

Let us understand creating an on-premises server.

Create On-Premises Server 1-5

Steps to create an on-premises server using Visual Studio 2013:

- Step 1 • Go to Microsoft Visual Studio 2013; Right-click and select Run as administrator.
- Step 2 • Click File → New, and then click Project.
- Step 3 • Under Installed Templates and Visual C#, click Console Application. Type BooksServer in the Name box.
- Step 4 • Click OK.
- Step 5 • In the Solution Explorer, right-click BooksServer, and then click Properties.
- Step 6 • Go to Application tab. Use the drop-down menu to select .NET Framework 4 or .NET Framework 4.5 in the Target framework. Click Yes to reload the project.

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Create On-Premises Server 2-5

Step 7 • Navigate to the Solution Explorer, right-click the project name to open the shortcut menu for the project.

Step 8 • Click Install NuGet if NuGet is not already present by default.

Step 9 • Click Manage NuGet Packages and then click Online in the NuGet dialog box.

Step 10 • Click SearchResults, enter WindowsAzure, and select the Windows Azure Service Bus item. Click Install and close the dialog box. The client assemblies have been referenced.

Step 11 • To add a new class, go to Solution Explorer, right-click the BooksServer project, click Add, and click Class.

Step 12 • Go to Name box, enter the name BooksContract.cs, and click Add.

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Create On-Premises Server 3-5

Step 13 • Go to BooksContract.cs to replace the namespace definition with the help of following code.

```
namespace BooksServer {
    [DataContract]
    public class BookData{
        [DataMember]
        public string BookCode { get; set; }
        [DataMember]
        public string Title { get; set; }
        [DataMember]
        public string Author { get; set; }
    }
    [ServiceContract]
    interface IBooks{
        [OperationContract]
        IList<BookData> GetBooks();
    }
    interface IBooksChannel : IBooks, IClientChannel
}
```

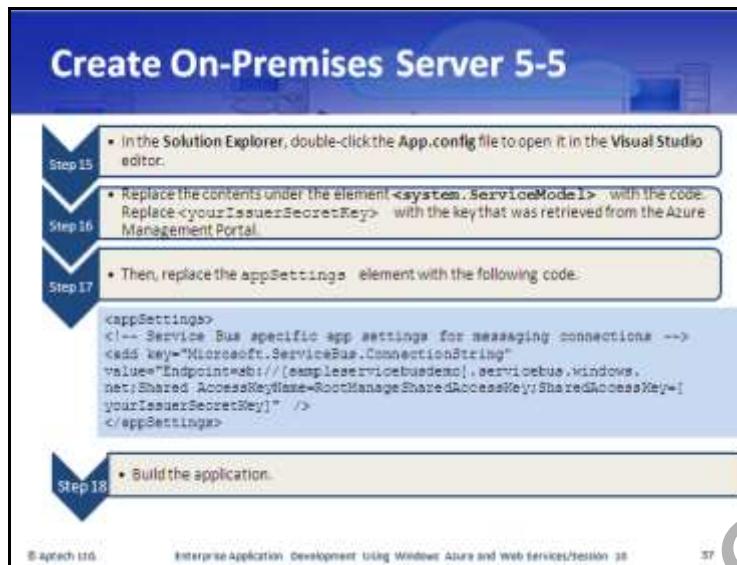
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Create On-Premises Server 4-5

Step 14 • In the file Program.cs, edit the namespace definition and add the following code to add the profile service and host for it.

```
namespace BooksServer{
    class BooksService : IBooks {
        BookData[] products = new[]{};
        new BookData{BookCode = "1", Title = "Under the Rock", Author = "Tim Simmons"}, new BookData{BookCode = "2", Title = "Paper Sciences", Author = "Yuan Lee"}, new BookData{BookCode = "3", Title = "Scientific Dreams", Author = "William Klingelby"}, new BookData{BookCode = "4", Title = "Wellness Demystified", Author = "Heather Robin"};
        public IList<BookData> GetBooks() {
            Console.WriteLine("GetBooks has been called.");
            return products;
        }
    }
    class Program{
        static void Main(string[] args){
            var host = new ServiceHost(typeof(BooksService));
            host.Open();
            Console.WriteLine("Press ENTER to close");
            Console.ReadLine();
            host.Close();
        }
    }
}
```

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Using slides 33 to 37, explain to the students the steps to create an on-premises server using Visual Studio 2013.

In Step 1, go to Microsoft Visual Studio 2013 in the Windows 8 start screen and right-click it. Click **Run as administrator**.

In Step 2, click **File** and then click **New** and **Project**.

In Step 3, under **Installed Templates** and **Visual C#**, click **Console Application**. Type **BooksServer** in the **Name** box.

In Step 4, click **OK**.

In Step 5, in the Solution Explorer, right-click **BooksServer**, and then, click **Properties**.

In Step 6, go to **Application** tab. Use the drop-down arrow to select .NET Framework 4 or .NET Framework 4.5 in the Target framework. Click **Yes** to reload the project.

In Step 7, navigate to the Solution Explorer, right-click the project name to open the shortcut menu for the project.

In Step 8, click **Install NuGet** if NuGet is not already present by default.

In Step 9, click **Manage NuGet Packages** and then click **Online** in the **NuGet** dialog box.

In Step 10, click **Search Results**, enter Windows Azure, and select the Windows Azure Service Bus item. Click **Install** and close the dialog box. The client assemblies have been referenced.

In Step 11, to add a new class, go to Solution Explorer, right-click the **BooksServer** project, click **Add**, and click **Class**.

In Step 12, go to **Name** box; enter the name **BooksContract.cs**, and click **Add**.

In Step 13, go to **BooksContract.cs** to replace the namespace definition.

Tell them that the code shows how to replace the namespace definition.

In Step 14, in the file, **Program.cs**, edit the namespace definition and add the code as shown in the code snippet. This will add the profile service and the host for it.

In Step 15, in the Solution Explorer, double-click the **App.config** file to open it in the Visual Studio editor.

In Step 16, replace the contents under the element `<system.ServiceModel>` with the code given in the code snippet. Replace `<yourIssuerSecretKey>` with the key that was retrieved from the Azure Management Portal.

In Step 17, replace the `appSettings` element as shown in the code snippet.

In Step 18, build the application.

Slides 38 to 43

Let us understand creating an application that uses a server.

The slide has a blue header bar with the title "Create an Application that Uses Server 1-6". Below the header, there is a section titled "Steps to create an application that will make use of this server are:" with two numbered steps:

- Step 1:** Create an ASP.NET MVC application named BooksPortal that will consume this service.
- Step 2:** Open the `_Layout.cshtml` present under Shared folder of Views in the Solution Explorer. Delete the following lines from the `_Layout.cshtml`.

```
<ul>
<li>&#Html.ActionLink("Home", "Index", "Home")</li>
<li>&#Html.ActionLink("About", "About", "Home")</li>
<li>&#Html.ActionLink("Contact", "Contact", "Home")</li>
</ul>
```

The image consists of three vertically stacked screenshots from a software application, likely Microsoft Visual Studio, demonstrating the creation of an ASP.NET MVC application.

Screenshot 1: Create an Application that Uses Server 2-6

Step 3: Add a new Model class named Book.cs. Add the following code:

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Web;
namespace BooksPortal.Models
{
    public class Book
    {
        public string BookCode { get; set; }
        public string Title { get; set; }
        public string Author { get; set; }
    }
}
```

Screenshot 2: Create an Application that Uses Server 3-6

Step 4: Open the HomeController.cs file and add the code:

```
using BooksPortal.Models;
using System;
using System.Collections.Generic;
using System.Linq;
using System.Web;
using System.Web.Mvc;

namespace BooksPortal.Controllers
{
    public class HomeController : Controller
    {
        public ActionResult About()
        {
            ViewBag.Message = "Books page.";
            return View();
        }
    }
}
```

Screenshot 3: Create an Application that Uses Server 4-6

Step 5: Replace the default text 'My ASP.NET MVC Application' with 'Delaware Books' wherever applicable.

```
public ActionResult Contact()
{
    ViewBag.Message = "Your contact page.";
    return View();
}
public ActionResult Index(string Identifier, string BookTitle)
{
    var books = new List<Book> { new Book { BookCode = Identifier, Title = BookTitle } };
    return View(books);
}
```

Create an Application that Uses Server 5-6

Step 5 • Open the Index.cshtml file and replace its contents with the code.

```
@model IEnumerable<BooksPortal.Models.Book>
@{ ViewBag.Title = "Index";}
<h2>Book Inventory</h2>
<table>
<tr> <th>
    @Html.DisplayNameFor(model => model.Title)
  </th>
<th></th>
<th>
    @Html.DisplayNameFor(model => model.Author)
  </th>
</tr>
@foreach (var item in Model) {
<tr> <td>
    @Html.DisplayFor(modelItem => item.Title)
  </td>
<td>
    @Html.DisplayFor(modelItem => item.Author)
  </td>
</tr>
}
</table>
```

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Create an Application that Uses Server 6-6

Step 7 • Click Build → Build Solution.

Step 8 • Execute the application locally to view the output.

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Using slides 38 to 43, explain the steps to create an application that will make use of this server.

In Step 1, create an ASP.NET MVC application named **BooksPortal** that will consume this service.

In Step 2, open the `_Layout.cshtml` present under Shared folder of Views in the Solution Explorer. Delete the lines shown on slide 38 from the `_Layout.cshtml` file.

Using slide 39, explain to the students the next step.

In Step 3, add a new Model class named `Book.cs`. Add the code as shown in the code snippet.

In Step 4, open the `HomeController.cs` file and add the following code as shown in the code snippet.

In Step 5, replace the default text 'My ASP.NET MVC Application' with 'Delaware Books' wherever applicable.

In Step 6, open the `Index.cshtml` file and replace its contents as shown in the code snippet.

In Step 7, click **Build** and then, click **Build Solution**.

In Step 8, execute the application locally to view the output.

Additional Information:

To know more about creating a Windows Azure Service Bus queue, visit the following links:

<http://azure.microsoft.com/en-us/documentation/articles/service-bus-dotnet-how-to-use-queues/>

<http://msdn.microsoft.com/en-us/library/azure/hh689723.aspx>

<http://blogs.msdn.com/b/brunoterkaly/archive/2014/08/07/learn-how-to-create-a-queue-place-and-read-a-message-using-azure-service-bus-queues-in-5-minutes.aspx>

Slides 44 to 47

Let us understand linking on-premises server with the application.

Linking On-Premises Server with the Application 1-7

To link the on-premises server, **BooksServer**, with the ASP.NET MVC application using the following steps:

- Step 1 Open the **BooksPortal** project and in the Solution Explorer, right-click and select **Manage NuGet Packages**.
- Step 2 Search for **WindowsAzure.ServiceBus**, select the **Windows Azure Service Bus** item, and click **Install**.
- Step 3 Right-click **BooksPortal** in the Solution Explorer and click **Add → Existing Item**.
- Step 4 Browse to the **BooksContract.cs** file from the **BooksServer** console project and add it as a link by clicking the down arrow next to **Add**.

Linking On-Premises Server with the Application 2-7

Step 5 In the **HomeController.cs** file, add the following code. Replace your **IssuerSecret** with the actual key. This enables the client to call the on-premises service and display the output.

```
using System.Linq;
using System.ServiceModel;
using System.Web.Mvc;
using Microsoft.ServiceBus;
using Models;
using BooksServer;

namespace BooksPortal.Controllers
{
    public class HomeController : Controller
    {
        // Declare the channel factory
        static ChannelFactory<IBooksChannel> channelFactory;
        static HomeController()
        {
            // Create shared secret token credentials for authentication
            channelFactory = new ChannelFactory<IBooksChannel>(new
                NetTcpRelayBinding());
            channelFactory.Endpoint.Behaviors.Add(new
                TransportClientEndpointBehavior());
        }
}
```

Linking On-Premises Server with the Application 3-7

```
TokenProvider = TokenProvider.CreateSharedSecretTokenProvider("owner", "yourIssuerSecret");
}

public ActionResult Index()
{
    using (IBooksChannel channel = channelFactory.CreateChannel())
    {
        // Return a view of the products inventory
        return this.View(from bks in channel.GetBooks()
                         select new Book { BookCode = bks.BookCode,
                                           Title = bks.Title, Author = bks.Author });
    }
}
```

Step 6 Right-click **BooksPortal** solution in the Solution Explorer and then, click **Add** → **Existing Project**.

Step 7 Browse to the **BooksServer** project and add the **BooksServer.csproj** solution file.

Linking On-Premises Server with the Application 4-7

Step 8 Open the Properties window for the **BooksPortal** solution; click **Startup Project** on the left, and then select **Multiple startup projects**.

Step 9 Ensure that **BooksServer** is the first in the list.

- ❑ Press **F5** to build and run the application.
- ❑ The **BooksServer** console application, which acts as on-premises server should start first.
- ❑ Then the **BooksPortal** application should start in a browser window.

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Using slides 44 to 47, explain the steps to the students to link the on-premises server **BooksServer** with the ASP.NET MVC application.

In Step 1, open the **BooksPortal** project and in the Solution Explorer, right-click, and select **Manage NuGet Packages**.

In Step 2, search for **WindowsAzure.ServiceBus**, select the **Windows Azure Service Bus** item, and click **Install**.

In Step 3, right-click **BooksPortal** in the Solution Explorer and click **Add** and then click **Existing Item**.

In Step 4, browse to the **BooksContract.cs** file from the **BooksServer** console project and add it as a link by clicking the down arrow next to Add.

In Step 5, in the **HomeController.cs** file, add the code as shown in the code snippet.

You need to replace `yourIssuerSecret` with the actual key to enable the client to call the on-premises service and display the output.

In Step 6, right-click **BooksPortal** solution in the Solution Explorer and then, click **Add** and then click **Existing Project**.

In Step 7, browse to the **BooksServer** project and add the `BooksServer.csproj` solution file.

In Step 8, open the Properties window for the **BooksPortal** solution, click **Startup Project** on the left, and then, select **Multiple startup projects**.

In Step 9, ensure that **BooksServer** is the first in the list.

Lastly, you need to press **F5** to build and run the application. You will notice that the **BooksServer** console application, which acts as on-premises server starts first, then the **BooksPortal** application starts in a browser window.

Slides 48 to 50

Let us understand more about linking on-premises server with the application.

Linking On-Premises Server with the Application 5-7

- This time, you will see that the books catalog lists data retrieved from the **BooksServer** present on-premises.
- Following figure displays the **BooksServer** running in the command window:



The screenshot shows a command-line interface window titled 'file:///F:/Source Code/BooksServer/BooksServer/bin/Debug/Books...'. The window is dark and mostly blank, with the text 'Press SHIFT to close' visible at the top. The window has a standard Windows title bar and a scroll bar on the right side.

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Linking On-Premises Server with the Application 6-7

Following figure displays the output of the **BooksPortal** Web application:

Title	Author	Publisher
Java for Dummies	Tom巳lone	Wiley
Python Crash Course	Eric Matthes	Packt
JavaScript Essentials	William Knott	Wrox
Windows Troubleshooting	Heather Robins	Microsoft Press

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Linking On-Premises Server with the Application 7-7

If you check the command window running the server, you will see a message saying GetBooks has been called, as shown in the following figure:

```
# file:///F:/Source Codes/BooksServer/BooksServer/bin/Debug/Blo...  
Press ENTER to close  
GetBooks has been called.
```

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Using slides 48 to 50, explain that you will also see the books catalog lists data retrieved from the **BooksServer** present on-premises.

Also, tell them that the figure on slide 48 displays the **BooksServer** running in the command window.

Using slide 49, explain to them that the figure displays the output of the **BooksPortal** Web application.

Using slide 50, tell the students that the figure shows if you check the command window running the server, you will see a message saying GetBooks has been called.

Slides 51 and 52

Let us understand publishing the Web application to Windows Azure.

Publishing to Windows Azure 1-2

- You have created an on-premises server and an MVC application and linked them to each other.
- The real use of the Service Bus comes into picture when you publish your application to Windows Azure and run the application.
- Following are the steps to do this:
 - Step 1**
 - Right-click the BooksPortal project in Solution Explorer and click Publish.
 - Provide the required credentials for your subscription and follow all the steps in the dialog box.
 - Step 2**
 - Run the on-premises server.
 - Step 3**
 - Open the Windows Management Portal, click the Web Site, which is associated with the BooksPortal application, and then click the BROWSE option present at the bottom of the portal.

Publishing to Windows Azure 2-2

- The output in the Management Portal is as shown in the following Figure:
- The role of the Service Bus in this example is to leverage the existing on-premises server and enable it to be used across the cloud-based Azure infrastructure.

Using slide 51, tell the students that after you have created an on-premises server and an MVC application and linked them to each other your task is still not complete. The real use of the Service Bus will come into picture when you publish your application to Windows Azure and run the application.

Tell the steps to publish your application to Windows Azure and run the application.

In Step 1, you need to right-click the **BooksPortal** project in Solution Explorer and click **Publish**. Provide the required credentials for your subscription and follow all the steps in the dialog box.

In Step 2, run the on-premises server.

In Step 3, open the Windows Management Portal, click the Web site, which is associated with the **BooksPortal** application, and then, click the **BROWSE** option present at the bottom of the portal.

Using slide 52, tell the students that the figure shows the output in the Management Portal. Tell them that the role of the Service Bus in this example is to leverage the existing on-premises server and enable it to be used across the cloud-based Azure infrastructure.

Slides 53 and 54

Let us summarize the session.

The image displays two slides from a presentation. Both slides have a blue header bar with the title 'Summary' followed by a number (1-2 or 2-2). The background of the slides features a stylized cloud and server icon graphic. The first slide, 'Summary 1-2', contains four bullet points: 1. Service Bus is a Windows Azure Cloud Computing initiative that provides a solution for security and scalability issues. 2. Queues, topics, and relays are integral to the Service Bus messaging system. 3. AMQP is a consistent and well-organized wire-level protocol that helps to build easy messaging applications between different vendor products. 4. Azure Notification Hubs have a Push feature that helps the consumers and enterprise applications for mobile platforms to access the infrastructure with ease. The second slide, 'Summary 2-2', contains five bullet points: 1. Push Notifications is a feature that notifies users about an event that has occurred. 2. Service Bus Queues work on the brokered messaging communication model and acts as a mediator. 3. Service Bus Topics work on a publish/subscribe messaging communication model and acts as a mediator. 4. Service Bus Relays help to build cloud hybrid applications that run in an Azure datacenter and on-premises environment. The footer of both slides includes the text '© Aptech Ltd.', 'Enterprise Application Development Using Windows Azure and Web Services/Session 10', and the slide number (53 or 54).

Using slides 53 and 54, you will summarize the session. You will end the session, with a brief summary of what has been taught in the session.

Tell the students pointers of the session. This will be a revision of the current session and it will be related to the next session. Explain each of the following points in brief.

Tell them that:

- Service Bus is a Windows Azure Cloud Computing initiative that provides a solution for security and scalability issues.
- Queues, topics, and relays are integral to the Service Bus messaging system.
- AMQP is a consistent and well-organized wire-level protocol that helps to build easy messaging applications between different vendor products.
- Azure Notification Hubs have a Push feature that helps the consumers and enterprise applications for mobile platforms to access the infrastructure with ease.
- Push Notifications is a feature that notifies users about an event that has occurred.
- Service Bus Queues work on the brokered messaging communication model and acts as a mediator.
- Service Bus Topics work on a publish/subscribe messaging communication model and acts as a mediator.
- Service Bus Relays help to build cloud hybrid applications that run in an Azure datacenter and on-premises environment.

10.3 Post-Class Activities for Faculty

You should familiarize yourself with the topics of the next session.

Tips: You can also check the Articles/Blogs/Expert Videos uploaded on the OnlineVarsity site to gain additional information related to the topics covered in the next session. You can also connect to online tutors on the OnlineVarsity site to ask queries related to the sessions.

Session 11 – Windows Azure SQL Database

11.1 Pre-Class Activities

Before you commence the session, you should familiarize yourself with the topics of this session in-depth. You should revisit topics of the previous session for a brief review. Here, you can ask students the key topics they can recall from previous session. Prepare a question or two, which will be a key point to relate the current session objectives.

The summary of the previous session is as follows:

- Service Bus is a Windows Azure Cloud Computing initiative that provides a solution for security and scalability issues.
- Queues, topics, and relays are integral to the Service Bus messaging system.
- AMQP is a consistent and well-organized wire-level protocol that helps to build easy messaging applications between different vendor products.
- Azure Notification Hubs have a Push feature that helps the consumers and enterprise applications for mobile platforms to access the infrastructure with ease.
- Push Notifications is a feature that notifies users about an event that has occurred.
- Service Bus Queues work on the brokered messaging communication model and acts as a mediator.
- Service Bus Topics work on a publish/subscribe messaging communication model and acts as a mediator.
- Service Bus Relays help to build cloud hybrid applications that run in an Azure datacenter and on-premises environment.

11.1.1 Objectives

By the end of this session, the learners will be able to:

- Describe SQL Database
- List and describe the features of SQL Database
- Explain the working of SQL Database
- Compare between SQL Azure and SQL Server
- Describe the procedure to create a Cloud database
- Explain the process to configure Firewall
- Explain the process to manage the cloud database
- Describe connecting to SQL Database using SQL Server Management Studio
- Describe connecting to SQL Database using ADO.NET
- Explain the process to query SQL Database

11.1.2 Teaching Skills

To teach this session successfully, you should be aware of the concepts of Windows Azure SQL Database, also called SQL Database. Also, familiarize yourself with the features of SQL Database and working of SQL Database.

You should be aware of the features of SQL Database, the difference between SQL Azure and SQL Server, the process to configure Firewall, and the procedure to connect SQL Database using SQL Server Management Studio.

You should also be aware of the process to manage and query the cloud database.

For teaching in the class, you are expected to use slides and LCD projectors.

Tips:

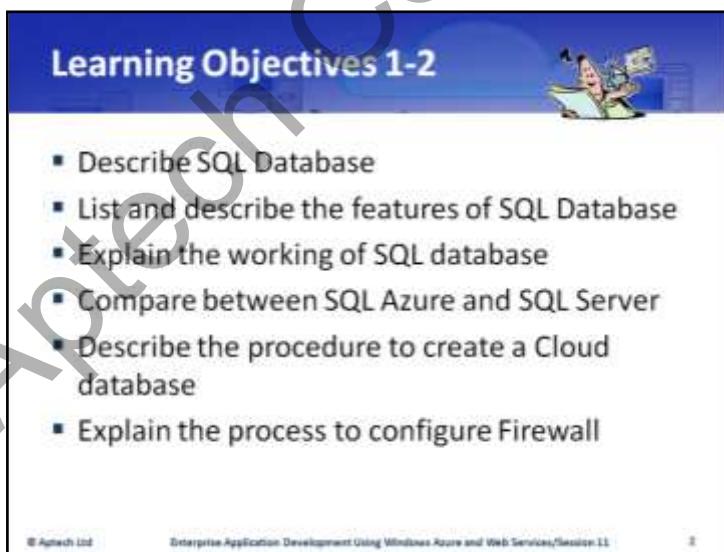
It is recommended that you test the understanding of the students by asking questions in between the class.

In-Class Activities:

Follow the order given here during In-Class activities.

Overview of the Session:

Give the students a brief overview of the current session in the form of session objectives. Show the students slide 2 and 3 of the presentation.



The slide has a blue header bar with the text "Learning Objectives 1-2". Below the header is a cartoon illustration of a person holding a book and a graduation cap. The main content area contains a bulleted list of learning objectives:

- Describe SQL Database
- List and describe the features of SQL Database
- Explain the working of SQL database
- Compare between SQL Azure and SQL Server
- Describe the procedure to create a Cloud database
- Explain the process to configure Firewall

At the bottom left is the copyright notice "© Aptech Ltd." and at the bottom center is the page number "2".

Learning Objectives 2-2

- Explain the process to manage the cloud database
- Describe connecting to SQL Database using SQL Server Management Studio
- Describe connecting to SQL Database using ADO.NET
- Explain the process to query SQL Database

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Tell the students that in this session, they will be introduced to the concept of SQL Database. Tell them that the session also discusses SQL Server 2012 and its merits and demerits. Also, inform them that in this session, the SQL Database features and its working are explained.

11.2 In-Class Explanations

Slide 4

Let us understand the need for SQL Database.

Need for SQL Database

□ SQL Server 2012, as an RDBMS, had a few merits and demerits:

Merits	Demerits
<ul style="list-style-type: none">▪ Full control of the databases and the server.▪ Latency does not cause an issue.▪ Hosting requirements can be customized.	<ul style="list-style-type: none">▪ Scaling of databases running in local instances of SQL Server restricted with the hardware resources.▪ Hardware management of the host also a tedious task.

□ Solution to these issues:

- Adopt a cloud environment that can host SQL databases.
- Resources can be scaled up or down as and when required.
- Hardware is taken care of by Microsoft teams across different datacenters.

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Using slide 4, explain the SQL Server 2012 and its merits and demerits. Before explaining the SQL Server 2012, tell them the following example:

Consider a scenario where a toy-selling company named Kool Toyz based in Texas is using SQL Server 2012 installed in a local environment for its database needs. When the company decided to expand their operations into five more states in the US, they found that SQL Server 2012, as an RDBMS, had a few merits and demerits.

Then, explain the following merits of SQL Server 2012. Tell them that there are three main merits such as Full control, Latency, and Hosting.

Explain Full control.

Tell them that the database administrator has full control of the databases and the server.

Explain Latency.

Explain that since most of the databases will be co-located on the same host or multiple hosts within a single datacenter, the latency does not cause an issue. The response time is usually in sub-milliseconds.

Explain Hosting.

Explain that the database administrator can customize the hosting requirements and move databases from one server to another server in case of an issue. The administrator is aware of where and on which host the databases are located.

Then, explain the following demerits of SQL Server 2012:

Explain Scalability.

Explain that most of the time; the databases running in a local instance of SQL Server are restricted with the hardware resources. A number of issues can arise due to hardware resources restrictions. One such issue is scaling of the database. It can be one of the biggest demerits of hosting the SQL Server 2012 in a local environment. When you need to either scale-up or scale-down the hardware of the host, it can be quite a challenging task. Organizations need to first procure the hardware and then upgrade to scale-up.

Explain Hardware Management.

Explain that hardware management of the host can also be a tedious task. You need to continuously monitor when the hardware resources are falling short to cater to the business demand.

Then explain the solution to these issues to the students lay in adopting a cloud environment that can host SQL Databases. In such an environment, scalability is not an issue. The resources can be scaled up or down as and when required. This kind of environment is provided by Windows Azure SQL Database, which is Microsoft's implementation of SQL Server in a cloud environment.

Explain them that with SQL Database, hardware management need not be your concern; it is taken care of by Microsoft teams across different datacenters.

Slide 5

Let us understand fundamental goal of SQL Database.

The screenshot shows a presentation slide with a blue header bar containing the title 'Introduction to SQL Database'. Below the header, there are two main bullet points, each preceded by a square checkbox:

- ❑ The fundamental goal of SQL Database is to:
 - Provide database services to the users such as cloud computing services rather than local services.
 - Enable developers to work on SQL Azure in the same manner as they would when working on the local instance.
 - Provide deployment of databases in the cloud, which is hosted in the Microsoft datacenters across the globe.
- ❑ Developer can perform the following tasks in the cloud environment:
 - Connect to the SQL Database using SQL Server Management Studio (SSMS)
 - Use libraries, such as ADO.NET to write code and deploy it
 - Perform replication

At the bottom left of the slide, there is a small logo and the text '© Aptech Ltd.' At the bottom right, there is some very small, illegible text.

In Slide 5, explain that the fundamental goal of SQL Database is to provide database services to the users. These services are provided as cloud computing services rather than local services. The developers working on SQL Azure still work in the same manner as they would when working on the local instance. However, the deployment of these databases is in the cloud, which is hosted in the Microsoft datacenters across the globe.

Then, tell them that a developer can still work with the databases in the cloud environment and perform the following tasks, which are typically performed in the local environment:

- Connect to the SQL Database using SQL Server Management Studio (SSMS)
- Use libraries, such as ADO.NET to write code and deploy it
- Perform replication

Mention that with the SQL Database environment, the developer need not be worried about the hardware restrictions or any related constraints. The hardware requirements are taken care of by the deployment infrastructure in the cloud. The hardware is scaled up and down automatically based on the usage.

Additional Information:

To know more about SQL Database, visit the following links:

- <http://azure.microsoft.com/en-us/documentation/services/sql-database/>
- <http://www.microsoftvirtualacademy.com/training-courses/windows-azure-sql-database>
- <http://channel9.msdn.com/Series/Windows-Azure-Storage-SQL-Database-Tutorials/Introduction-to-Windows-Azure-SQL-Databases>

Slide 6

Let us understand the key features of SQL Database.

The slide has a blue header bar with the title 'Features of SQL Database'. Below the header, there is a list of seven features arranged in a grid:

Following are the key features of SQL Database:		
Enables copies of data to be spread across multiple nodes in a datacenter or multiple datacenters	Supports high availability, fault tolerance, and scaling	Requires no provisioning such as no installation, updates or patches, or physical management of the database or the database server
Requires no purchase for hardware or software	Uses existing tools and applications to manage the databases in cloud environment	Provides bi-directional data synchronization
Uses Transact SQL and the existing capabilities of SQL Server with minor differences		

At the bottom left of the slide is the copyright notice '© Aptech Ltd.' and at the bottom right is the text 'Enterprise Application Development Using Windows Azure and Web Services/Session 13'.

Using slide 6, tell the students that SQL Database has a number of key features. Explain some of them to them. Tell them that SQL Database:

- Enables copies of data to be spread across multiple nodes in a datacenter or multiple datacenters
- Supports high availability, fault tolerance, and scaling. All these features are automatically available with the deployment
- Requires absolutely no provisioning – which means no installation, no updates or patches, or no physical management of the database or the database server
- Requires no purchase for hardware or software
- Uses existing tools and applications to manage the databases in cloud environment
- Provides bi-directional data synchronization, which means data synchronization can happen with the local and cloud hosted databases
- Uses Transact SQL and the existing capabilities of SQL Server with minor differences

Additional Information:

To know more about the features of SQL Database, visit the following links:

- <http://msdn.microsoft.com/en-us/library/azure/ee336281.aspx>
- <http://www.databasejournal.com/features/mssql/introduction-to-sql-server-in-microsoft-azure.html>
- http://en.wikipedia.org/wiki/SQL_Azure

Slides 7 to 9

Let us understand the four layers on which the SQL Database is built.

Working of SQL Database 1-3

Following are the four layers on which the SQL Database is built:

Client layer	Services layer	Platform layer	Infrastructure layer
Used by the application to connect with the SQL Database.	Used for provisioning, billing, and metering.	Used for hosting the data. This layer contains a number of SQL Databases, which are managed by SQL Database Fabric.	Used for managing the physical hardware and operating system.

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Working of SQL Database 2-3

Following figure displays the SQL Database architecture:

The diagram illustrates the SQL Database architecture across four layers:

- Client layer:** Includes ASP.NET, Win-forms, WCF, and REST API.
- Application layer:** Contains Application-tier services, Application-tier databases, Application-tier monitoring, and Application-tier scaling.
- Platform layer:** Features SQL databases, Administration databases, Management databases, and Log databases.
- Infrastructure layer:** Composed of DB servers, Application servers, and Infrastructure monitoring.

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Working of SQL Database 3-3

Following are the five editions of SQL Database where each of the editions has a unique set of capabilities:

A pyramid diagram representing the five SQL Database editions:

- Basic
- Standard
- Premium
- Web
- Business

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Through slides 7 to 9, inform the students that the SQL Databases are hosted in the Microsoft Datacenter and are deployed for companies to use them on the subscription basis.

Explain them that the SQL Database is built on an architecture that contains four layers such as **Client layer**, **Services layer**, **Platform layer**, and **Infrastructure layer**. Explain them the following layers:

Explain them that **Client layer** is used by the application to connect with the SQL Database.

Tell them that **Services layer** is used for provisioning, billing, and metering.

Mention that **Platform layer** is used for hosting the data. This layer contains a number of SQL Databases, which are managed by SQL Database Fabric.

Explain them that **Infrastructure layer** is used for managing the physical hardware and operating system.

Using slide 8, show figure that displays the SQL Database architecture to the students. Explain this figure to the students.

In slide 9, explain that the SQL Database is available in five different editions where each of the editions has a unique set of capabilities. The five editions are Basic, Standard, Premium, Web, and Business.

Also, explain them that Microsoft is planning to retire Web and Business editions in the coming months. When you use a SQL Database in any of these editions, the billing is done based on the service tier. Billing for Web and Business editions is done on the database size.

Mention that to make an SQL Database instance work, you need to first purchase the subscription and then activate the subscription. After this is done, you can start creating the databases. It is important to note that when you create a database, you can make copies of the database.

However, each copy is accounted as a database and is billed as per the source database cost.

Additional Information:

To know more about the four layers on which the SQL Database is built, visit the following links:

<http://technet.microsoft.com/en-us/library/ms172387%28v=sql.110%29.aspx>

<http://www.ntchosting.com/databases/structured-query-language.html>

<http://php.about.com/od/learnmysql/ss/mysql.htm>

In-Class Question:

After you finish explaining the five different editions of the SQL Database, you will ask the students an In-Class question. This will help you in reviewing their understanding of the topic.



Which are the four important layers on which the SQL Database is built?

Answer:

The SQL Database is built on an architecture that contains four layers such as Client layer, Services layer, Platform layer, and Infrastructure layer.

Slide 10

Let us understand the differences between SQL Database and SQL Server.

Comparing SQL Azure and SQL Server	
<input type="checkbox"/> Following table lists the primary differences between SQL Database and SQL Server:	
Feature	SQL Database
Location	Databases can be spread across multiple nodes and even datacenters across geographical locations.
Latency	The latency is in milliseconds and depends on the location of the databases that may be on different nodes, datacenters, or geographical locations.
Hardware	Hardware is not a limitation. The databases are typically replicated across number of nodes. Hardware failure is hidden from the end users.
Resource Capacity	Individual application databases have their dedicated hardware. Upgrade or downgrade may be required from time to time depending on the usage.
Tables	Tables are designed and optimized for high data access but do not support referential integrity. The data is stored in non-relational format.
<small>© Aptech Ltd. Enterprise Application Development Using Windows Azure and Web Services/Section 11.</small>	

Use slide 10 to explain the differences between SQL Database and SQL Server. Tell the students that SQL Database is the low cost version of SQL Server that is delivered as a service and offers elastic and high availability. However, there are a few areas in which SQL Database is different from SQL Server.

Show the table of comparison to the students and explain them as per the features.

Tell them that the SQL Databases can be spread across multiple nodes and even datacenters across geographical locations whereas SQL Server Databases are typically co-located within either the same node or the location. The location of the database is controlled by the developer.

Explain them that in the SQL Database, the latency is in milliseconds and depends on the location of the databases that may be on different nodes, datacenters, or geographical locations. In the SQL Server, the latency is in sub-milliseconds.

Explain them that in the SQL Database, hardware is not a limitation. The databases are typically replicated across number of nodes. Hardware failure is hidden from the end users. But in the local SQL Server, the hardware requirement may increase or decrease depending on the size and use the database. Manual intervention for the hardware maintenance is required.

Mention that in the SQL Database, individual application databases have their dedicated hardware. Upgrade or downgrade may be required from time to time depending on the usage. But in the SQL Server, a developer can create premium and secondary databases. Premium databases have dedicated hardware even if a single system hosts multiple databases.

Also, mention that in the SQL Database, tables are designed and optimized for large data access but does not support referential integrity. The data is stored in non-relational format whereas in the SQL Server, tables support referential integrity. The data is stored in the relational format.

Additional Information:

To know more about differences between SQL Database and SQL Server, visit the following links:

<http://msdn.microsoft.com/en-us/library/azure/jj879332.aspx>

<http://blogs.technet.com/b/dataplatforminsider/archive/2013/02/05/windows-azure-sql-database-and-sql-server-performance-and-scalability-compared-and-contrasted.aspx>

Slide 11

Let us understand the usage of SQL Database.

The screenshot shows a slide titled "Using SQL Database". The main content is a bulleted list under the heading "Before a developer can use a SQL Database:":

- It needs to be created.
- Developer must have an account on the <http://azure.microsoft.com> portal.
- After the account is created, then the developer can continue with creating the database.

At the bottom of the slide, there is footer text: "© Aptech Ltd.", "Enterprise Application Development Using Windows Azure and Web Services/Session 11", and "11".

In slide 11, tell the students that before a developer can use a SQL Database, it needs to be created. It is essential to understand that before creating a database, the developer must have an account on the <http://azure.microsoft.com> portal. After the account is created, then the developer can continue with creating the database.

Slides 12 to 15

Let us understand the steps of creating a Cloud database.

Creating a Cloud Database 1-4

Following are the steps to create a cloud database:

Step 1

- Connect to the portal <http://manage.windowsazure.com>.
- The figure displays the left pane of the Management Portal after successful login.



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Creating a Cloud Database 2-4

Step 2

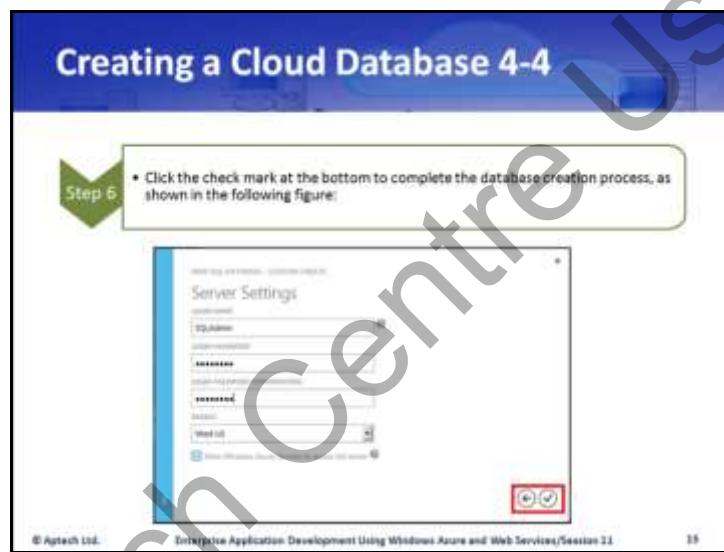
- Click New at the bottom of the browser screen. A list is displayed on the screen.

Step 3

- From the list, click SQL DATABASE and then, click CUSTOM CREATE as shown in the following figure:



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Using slides 12 to 15, explain the steps of creating a Cloud database to the students as follows:

Step 1: Connect to the portal <http://manage.windowsazure.com>. A figure on slide 12 displays a part of the **Management Portal** after successful login.

Step 2: Click **New** at the bottom of the browser screen. A list is displayed on the screen.

Step 3: From the list, click **SQL DATABASE** and then, click **CUSTOM CREATE** as shown in figure on slide 13.

Step 4: On the **NEW SQL DATABASE – CUSTOM CREATE** page, enter information, such as database name, size, and type. A developer can also choose to create a new database server. Click the arrow indicating next.

Step 5: On the **CREATE SERVER** page, enter the login details. Ensure that the **Allow Windows Azure Services to access the server** check box is selected. The figure on slide 15 shows the **NEW SQL DATABASE – CUSTOM CREATE** page with login details.

Step 6: Click the check mark at the bottom to complete the database creation process as shown in figure on slide 15.

Additional Information:

To know more about a cloud database, visit the following links:

http://en.wikipedia.org/wiki/Cloud_database

<http://www.rackspace.com/cloud/databases/>

<http://www.networkworld.com/article/2162274/cloud-computing/10-of-the-most-useful-cloud-databases.html>

http://www.webopedia.com/TERM/C/cloud_database.html

In-Class Question:

After you finish explaining the steps of creating a Cloud database, you will ask the students an In-Class question. This will help you in reviewing their understanding of the topic.



What is needed to use a SQL Database?

Answer:

Developer must have an account on the <http://azure.microsoft.com> portal to use a SQL Database.
Blank page – needs to be deleted.

Slides 16 to 18

Let us understand the Firewall Rules.

Firewall Rules 1-3

Following steps are used to configure the firewall through the portal:

- Step 1 • From the left pane on the portal, click SQL Databases and click Servers.
- Step 2 • Select the database server that was created in the previous task. The server specific information is displayed.
- Step 3 • Click Configure. A new page is displayed with the allowed ip addresses settings.

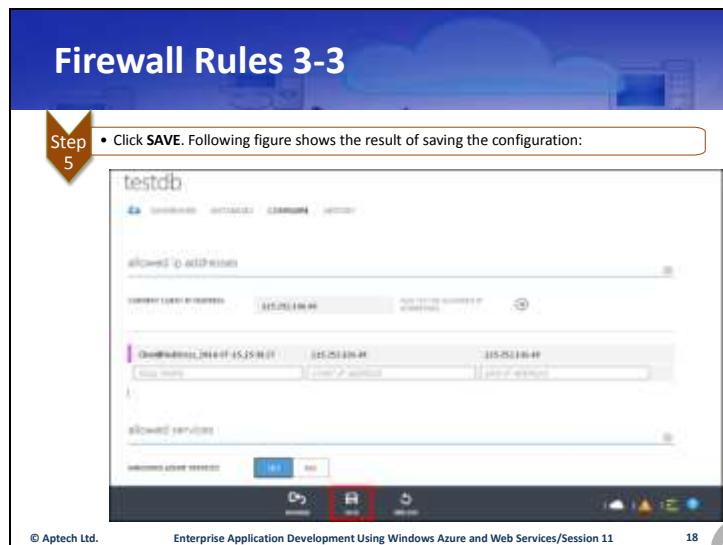
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Firewall Rules 2-3

Step 4 • Add the IP address in the CURRENT CLIENT IP ADDRESS text box and then click ADD TO THE ALLOWED IP ADDRESS link as shown in the following figure:



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Using slides 16 to 18, explain the Firewall Rules to the students.

Tell them that after the developer has set up the database and its server, it is essential to configure access to the database. By default, access to the SQL Database is not configured. You must manually configure the access.

Explain the following steps to configure the firewall:

Step 1: From the left pane, click **SQL Databases** and then, click **Servers**.

Step 2: Select the database server that was created in the previous task. The server specific information is displayed.

Step 3: Click **Configure**. A new page is displayed with the **allowed ip addresses** settings.

Step 4: Add the IP address in the **CURRENT CLIENT IP ADDRESS** textbox and then click **ADD TO ALLOWED IP ADDRESS** link as shown in figure on slide 17. To ensure that this server can interact with the other Windows Azure Services, click **Yes**.

Step 5: Click **SAVE**. Figure on slide 18 shows the result of saving the configuration.

Additional Information:

To know more, visit the following links:

<http://msdn.microsoft.com/en-us/library/azure/ee621782.aspx>

<http://blogs.msdn.com/b/umits/archive/2012/11/20/windows-azure-sql-database-how-to-manage-your-firewall-rules-with-windows-azure-management-portal.aspx>

<http://msdn.microsoft.com/en-us/library/azure/jj553530.aspx>

Slide 19

Let us understand the managing the Cloud Database and SQL Server Management Studio (SSMS).

Managing the Cloud Database

□ Microsoft SQL Server Management Studio (SSMS) is:

- Is an integrated environment that can be used for managing local and cloud databases.
- Is installed with the SQL Server on a local system.
- Can be downloaded in Express edition for free (SQL Server 2012 Management Studio Express).

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In slide 19, explain that the Microsoft SQL Server Management Studio (SSMS) is an integrated environment that can be used for managing local and cloud databases. SSMS is installed with the SQL Server on a local system. Alternatively, a developer can download the free version of SQL Server 2012 Management Studio Express (SSMSE).

Slide 20

Let us understand the steps to connect to SQL Database through SSMS.

Connecting through SSMS

□ Following steps are used to connect to SQL Database through SSMS:

- Step 1** • Click Start, select All Programs, select Microsoft SQL Server 2012, and then select Server Management Studio. The Connect to Server dialog box is displayed.
- Step 2** • Enter the fully-qualified server name such as `servername.database.windows.net`.
- Step 3** • From the Authentication drop-down list, select SQL Server Authentication.
- Step 4** • In the Login text box, enter the login name using the syntax `login@servername`.
- Step 5** • In the Password text box, enter the password that you specified in the portal when creating your server.
- Step 6** • Click Connect.

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Using slide 20, explain the following steps to connect to SQL Database through SSMS to the students:

Step 1: Click **Start**, select **All Programs**, select **Microsoft SQL Server 2012**, and then select **Server Management Studio**. The **Connect to Server** dialog box is displayed.

Step 2: Enter the fully qualified server name such as **servername.database.windows.net**. Note that this name is automatically generated when you create a cloud database for the first time.

Step 3: From the **Authentication** drop-down list, select **SQL Server Authentication**.

Step 4: In the **Login** text box, enter the login name using the syntax **login@servername**.

Step 5: In the **Password** text box, enter the password that you specified in the portal when creating your server.

Step 6: Click **Connect**.

Mention that after the connection is successfully established, the SSMS will display the Object Explorer. Here, you can perform all the routine database operations.

Additional Information:

To know more, visit the following links:

<http://msdn.microsoft.com/en-IN/library/ms174173.aspx>

http://en.wikipedia.org/wiki/SQL_Server_Management_Studio

<http://learningsqlserver.wordpress.com/2011/02/04/sql-server-management-studio-ssms-basics/>

<http://stackoverflow.com/questions/11276167/how-to-install-sql-server-management-studio-2012-ssms-express>

Slide 21

Let us understand the connection with SQL Database through ADO.NET.

The slide has a blue header bar with the title. Below it, there are two bullet points:

- ❑ ADO.NET has a limitation to connect to a single database. Switching between databases is not supported.
- ❑ Following code allows you to connect to the SQL Database named, aptechdb using ADO.NET within an application:

```
SqlConnectionStringBuilder connectionBuilder= new  
    SqlConnectionStringBuilder();  
    . . .  
connectionBuilder.DataSource =  
    "dbserver.database.windows.net";  
connectionBuilder.InitialCatalog = "master";  
connectionBuilder.Encrypt = true;  
connectionBuilder.UserID = "alex";  
connectionBuilder.Password= "aptech123*";
```

At the bottom left, it says "© Aptech Ltd." and at the bottom right, "Enterprise Application Development Using Windows Azure and Web Services/Session 21".

Use slide 21 to explain the connection with SQL Database through ADO.NET. Explain that, a developer can also use ADO.NET to connect to the SQL Database just like connecting through SSMS. However, SSMS allows you to connect and switch between databases. ADO.NET, on the other hand, has a limitation to connect to a single database. Switching between databases is not supported.

Then, show the code snippet in the slide to the students and tell them that it allows them to connect to the SQL Database named, aptechdb using ADO.NET within an application.

Additional Information:

To know more, visit the following links:

- <http://msdn.microsoft.com/en-us/library/aa719765%28v=vs.71%29.aspx>
- <http://www.codeproject.com/Articles/8157/ADO-NET-SQL-Connection>
- <http://msdn.microsoft.com/en-us/library/ee336243.aspx>
- <http://www.developerfusion.com/article/4278/using-adonet-with-sql-server/>
- http://www.w3schools.com/aspnet/aspnet_dbconnection.asp

Slide 22

Let us understand the creating SQL Database Instance.

Creating an SQL Database Instance

- A database named aptechdb can be created using the following code:

```
using (SqlConnection objConn = new SqlConnection(connectionBuilder.ToString()))  
{  
    using (SqlCommand objCommand = objConn.CreateCommand())  
    {  
        objConn.Open();  
        // Create the aptechdb database  
        string cmdText = String.Format("CREATE DATABASE [0]",  
            aptechdb);  
        objCommand.CommandText = cmdText;  
        objCommand.ExecuteNonQuery();  
        objConn.Close();  
    }  
}
```
- After creating the aptechdb database, a developer can connect to it and perform various operations such as create, modify, or delete tables and records.

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Show the code snippet in the slide 22 to the students and tell them that a database named aptechdb can be created using this code.

Next, tell them that after creating the aptechdb database, a developer can connect to it and perform various operations such as create, modify, or delete tables and records.

Slides 23 and 24

Let us understand the querying SQL Database.

Querying SQL Database 1-2

- Once the connection to the SQL Database is successfully established, the developer can perform various query operations.
- Following steps show how to insert and retrieve data:
 - Step 1 • Go to the account home page on the portal.
 - Step 2 • Click **aptechdb** to select it and then, click **Manage** at the bottom of the page. This displays the Management Portal for SQL Database, which is different from the Azure Management Portal.
 - Step 3 • Enter the login name and password to login to the **aptechdb** database.
 - Step 4 • Click **New Query** in the ribbon. An empty query window is displayed.

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Use slides 23 and 24 to explain the steps of querying SQL Database. Tell the students that once the connection to the SQL Database is successfully established, the developer can perform various query operations.

Next, explain the following steps for inserting and retrieving data.

Step 1: Go to the account home page on the portal.

Step 2: Click **aptechdb** to select it and then, click **Manage** at the bottom of the page. This displays the Management Portal for SQL Database, which is different from the Azure Management Portal.

Step 3: Enter the login name and password to login to the **aptechdb** database.

Step 4: Click **New Query** in the ribbon. An empty query window is displayed.

Step 5: Copy the code shown in the code snippet and paste it into the query window.

In slide 24, show the code to the student.

Additional Information:

To know more, visit the following links:

- <http://technet.microsoft.com/en-us/library/bb264565%28v=sql.90%29.aspx>
- <http://www.microsoftvirtualacademy.com/training-courses/querying-microsoft-sql-server-2012-databases-jump-start>
- <http://www.tizag.com/sqlTutorial/sqlqueries.php>
- <http://msdn.microsoft.com/en-IN/library/ms189499.aspx>

In-Class Question:

After you finish explaining the steps for inserting and retrieving data, you will ask the students an In-Class question. This will help you in reviewing their understanding of the topic.



What is SSMS?

Answer:

SSMS or SQL Server Management Studio is an integrated environment that can be used for managing local and cloud databases.

Slides 25 and 26

Let us summarize the session.

Summary 1-2

- SQL Database is Microsoft's implementation of SQL Server as a cloud service.
- SQL Database offers high availability and scalability.
- An SQL Database instance must be created before it can be used by a developer.
- An SQL Database instance is created through the Management Portal for SQL Azure.

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Summary 2-2

- Microsoft SQL Server Management Studio (SSMS) is an integrated environment that can be used for managing local and cloud databases.
- A developer can also use ADO.NET to connect to the SQL Database similar to the connection through SSMS.
- After creating an SQL Database instance, a developer can perform various operations such as create, modify, or delete tables and records.

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Using slides 25 and 26, you will summarize the session. You will end the session, with a brief summary of what has been taught in the session.

Tell the students pointers of the session. This will be a revision of the current session and it will be related to the next session. Explain each of the following points in brief. Tell them that:

- SQL Database is Microsoft's implementation of SQL Server as a cloud service.
- SQL Database offers high availability and scalability.
- An SQL Database instance must be created before it can be used by a developer.
- An SQL Database instance is created through the Management Portal for SQL Azure.
- Microsoft SQL Server Management Studio (SSMS) is an integrated environment that can be used for managing local and cloud databases.
- A developer can also use ADO.NET to connect to the SQL Database similar to the connection through SSMS.
- After creating an SQL Database instance, a developer can perform various operations such as create, modify, or delete tables and records.

11.3 Post-Class Activities for Faculty

You should familiarize yourself with the topics of the next session.

Tips: You can also check the Articles/Blogs/Expert Videos uploaded on the OnlineVarsity site to gain additional information related to the topics covered in the next session. You can also connect to online tutors on the OnlineVarsity site to ask queries related to the sessions.

Session 12 – Advanced Concepts of SQL Database

12.1 Pre-Class Activities

Before you commence the session, you should familiarize yourself with the topics of this session in depth. You should revisit topics of the previous session for a brief review. Here, you can ask students the key topics they can recall from previous session. Prepare a question or two, which will be a key point to relate the current session objectives.

In the previous session, you have learned:

- SQL Database is Microsoft's implementation of SQL server as a service.
- SQL Database offers high availability and scalability.
- An SQL Database instance must be created before it can be used by a developer.
- An SQL Database instance is created through the management portal for SQL Azure.
- Microsoft SQL Server Management Studio (SSMS) is an integrated environment that can be used for managing local and cloud databases.
- A developer can also use ADO.NET to connect to the SQL Database similar to the connection through SSMS.
- After creating an SQL Database instance, a developer can perform various operations such as create, modify, or delete tables and records.

12.1.1 Objectives

By the end of this session, the learners will be able to:

- Explain Windows Azure SQL Database Architecture
- Describe Windows Azure SQL Database Provisioning Model
- Compare Windows Azure Table Storage with SQL Database
- Describe troubleshooting and error handling

12.1.2 Teaching Skills

To teach this session successfully, you should be familiar with the Windows Azure SQL Database architecture.

You should also know the Windows Azure SQL Database provisioning model and Windows Azure table storage with SQL Database. You should also be familiar with the processes of troubleshooting and error handling.

For teaching in the class, you are expected to use slides and LCD projectors.

Tips:

It is recommended that you test the understanding of the students by asking questions in between the class.

In-Class Activities:

Follow the order given here during In-Class activities.

Overview of the Session

Give the students a brief overview of the current session in the form of session objectives. Show the students slide 2 of the presentation.

The slide has a blue header bar with the title "Learning Objectives". Below the title is a cartoon illustration of a person sitting at a desk with a computer monitor. The main content area contains a bulleted list of learning objectives:

- Explain Windows Azure SQL Database Architecture
- Describe Windows Azure SQL Database Provisioning Model
- Compare Windows Azure Table Storage with SQL Database
- Describe troubleshooting and error handling

At the bottom left is the copyright notice "© Aptech Ltd.", and at the bottom right is the slide number "2".

Tell them that they will be introduced to the concept of the Windows Azure SQL Database architecture and the Windows Azure SQL Database provisioning model. Tell them that this session compares Windows Azure table storage with SQL Database.

Furthermore, this session covers troubleshooting and error handling processes.

12.2 In-Class Explanations

Slides 3 and 4

Let us understand the concept of SQL Database.

Introduction 1-2

- Windows Azure SQL Database, also called SQL Database.
 - It is hosted in the cloud environment in Microsoft's datacenters across the world.
 - It is created and replicated on various hosts in one or more servers in the datacenters depending on the geographical location chosen while setting up the cloud application.

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Introduction 2-2

- Advantages of SQL Database:
 - The database can be used with different types of applications, such as Microsoft, custom applications, and third-party.
 - You are not restricted to use only Microsoft technologies.
 - You can choose a technology of your choice as the front-end and for the back-end.

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Use slide 3 to introduce the concept of SQL Database. Tell the students that Windows Azure SQL Database is hosted in the cloud environment in Microsoft's datacenters across the world.

Depending on the geographical location chosen while setting up the cloud application, the SQL Database is created and replicated on various hosts in one or more servers in the datacenters.

In slide 4, explain the advantages of SQL Database to the students. Tell them that SQL Database can be used with different types of applications, such as Microsoft, custom applications, and third-party. This is one of the key advantages of using SQL Database where the user is restricted to use only Microsoft technologies. The users can choose a technology of their choice as the front-end and for the back-end and use SQL Database to leverage its powerful features.

Additional Information:

To know more about SQL Database, visit the following links:

<http://azure.microsoft.com/en-us/services/sql-database/>

<http://msdn.microsoft.com/en-us/library/azure/ee336279.aspx>

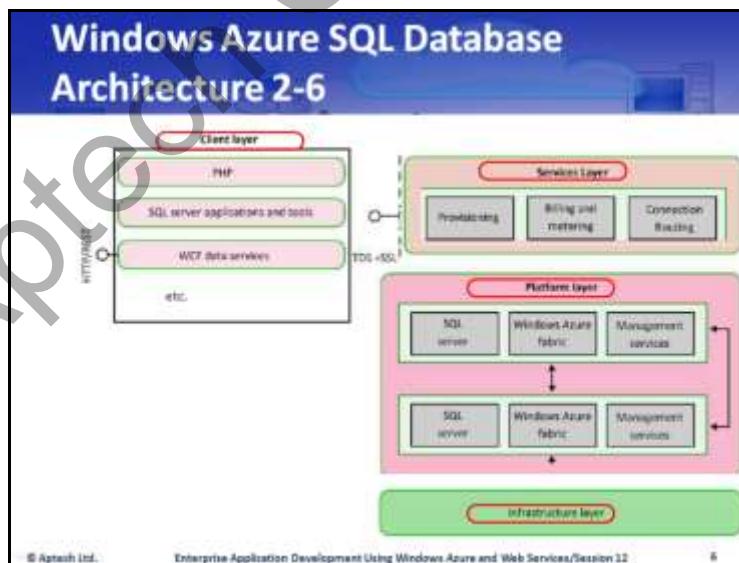
<http://azure.microsoft.com/en-us/documentation/services/sql-database/>

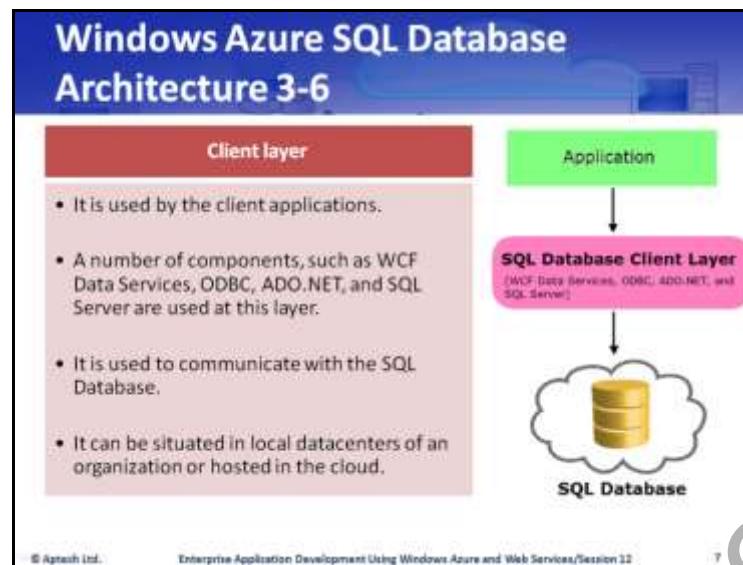
<http://azure.microsoft.com/en-us/documentation/articles/sql-database-get-started/>

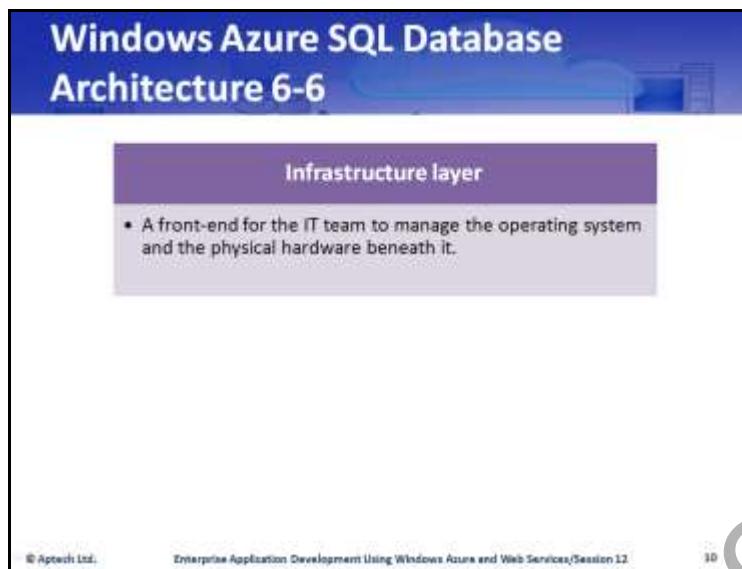
http://en.wikipedia.org/wiki/SQL_Azure

Slides 5 to 10

Let us understand the four key layers of SQL Database.







Using slide 5, tell the students that SQL Database consists of four key layers, which are client, services, platform, and infrastructure.

Using slide 6, show the students the structure of the SQL Database and the location of the four key layers.

Using slide 7, explain client layer to the students.

Tell the students that the client layer is used by the client applications such as WCF data services, ODBC, ADO.NET, and SQL server. This layer is used to communicate with the SQL Database.

Mention that this layer can be situated in local datacenters of an organization or hosted in the cloud.

Using slide 8, explain the service layer to the students.

Explain to them that the service layer connects both the client layer and the platform layer. Some of the key tasks that this layer performs are provisioning, billing, and connection routing.

Using slide 9, explain platform layer to the students.

Tell the students that a combination of physical servers and services is presented on the platform layer. A number of SQL server instances are contained at this level. These instances are managed by the Azure SQL Database fabric.

Using slide 10, explain the infrastructure layer to the students.

Tell the students that the infrastructure layer has a front-end for the IT team to manage the operating system and the physical hardware.

Additional Information:

To know more about key layers of SQL Database, visit the following links:

http://www.tomstpro.com/articles/paas-transact-sql-cloud_computing-dba-migrating,2-490.html
http://books.google.co.in/books?id=aXqbg5erPUMC&pg=PR14&lpg=PR14&dq=platform+layer+of+SQL+Database+azure&source=bl&ots=cWrKgJ916&sig=L8P4oDlv503rDKvHCZkVOVEuiLc&hl=en&s_a=X&ei=nOI2VO6eMcOVuATH6IDwCQ&ved=0CDEQ6AEwAw#v=onepage&q=platform%20layer%20of%20SQL%20Database%20azure&f=false

In-Class Question:

After you finish explaining SQL Database, ask students an In-Class question. This will help you in reviewing their understanding of the topic.



Which are the four key layers of SQL Database?

Answer:

SQL Database consists of four key layers, namely, the client layer, services layer, platform layer, and the infrastructure layer.

Slides 11 to 18

Let us understand SQL Database server.

Windows Azure SQL Database Provisioning Model 1-8

- An SQL Database Server:
 - Can run a number of SQL databases.
 - Acts as a single entry point for the databases that are hosted on it.
 - Acts as a security boundary for the databases hosted on it.
 - Is assigned to host the databases associated with your subscription when you create a subscription.
- A single subscription can have maximum of six SQL Database servers assigned.

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Windows Azure SQL Database Provisioning Model 2-8

- When an SQL Database server is assigned to a subscription, it can hold up to 150 databases as the upper limit.
- This limit also includes the **master** database.
- You need to use the Windows Azure Portal to provision an SQL Database instance.



Provisioning means arranging for access to data repositories or granting authorization to systems, databases, and so on.

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Windows Azure SQL Database Provisioning Model 3-8

- Following steps need to be performed to provision an SQL Database:

Provision an SQL Server virtual machine from the existing gallery

Connect with the virtual machine using Remote Desktop

Connect to the virtual machine from other computers

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Windows Azure SQL Database Provisioning Model 4-8

Provision an SQL Server virtual machine from the existing gallery



- In this process:

- You need to provide the name of the SQL Server virtual machine, a user account, and password, and then select the size of the virtual machine.
 - There are different sizes of virtual machines available in the gallery.
 - Following recommended sizes can be considered as the minimum requirements for creating the SQL Server virtual machine:
 - A2: Use it for production environment
 - A3: Use it for SQL Server Enterprise Edition
 - A6: Use it for SQL Server 2012 Enterprise for Data Warehousing
 - A7: Use it for SQL Server 2014 for Data Warehousing

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Windows Azure SQL Database Provisioning Model 5-8

Connect with the virtual machine using Remote Desktop

You will need to connect with the virtual machine after creating it.



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Windows Azure SQL Database Provisioning Model 6-8

Connect to the virtual machine from other computers

After you create and connect to the virtual machine, you need to complete the following tasks:

Step 1: Create a Transport Control Protocol (TCP) Endpoint: You will need to create this for the virtual machine.

Step 2: Create firewall rules: The ports for the virtual machine need to be created. You need to open TCP Port 1433.

Step 3: Enable TCP/IP: You will need to enable the TCP/IP protocol in SQL Server Configuration Manager on the system.

Step 4: Enable mixed mode authentication: You will need to connect to the virtual machine and enable mixed mode authentication for the SQL Server instance.

Step 5: Create SQL Server logins: After you enable mixed mode authentication, create one or more users in SQL Server.

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Windows Azure SQL Database Provisioning Model 7-8

You need to figure out the DNS name for your virtual machine, once you have performed the steps.

You can get this name from the Azure Portal.

Following figure shows the DNS name for the virtual machine:



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Windows Azure SQL Database Provisioning Model 8-8

The slide contains three bullet points describing the provisioning process:

- ❑ The DNS name consists of a randomly generated server name with the standard URL, which is .database.windows.net.
- ❑ After the DNS name is determined, you can use SQL Server Management Studio on your local system to connect with the virtual machine as shown in the figure:
- ❑ In the provisioning process, the master database is automatically created.



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Using slide 11, explain to the students that an SQL Database server can run a number of SQL Databases and can also act as a single entry point for the databases that are hosted on it. It acts as a security boundary for the databases hosted on it. When a user creates a subscription, one or more SQL Database servers are assigned to host the databases associated with the subscription. A single subscription can have maximum of six SQL Database servers assigned.

Using slide 12, tell the students that it is important to note that when an SQL Database server is assigned to a subscription, it can hold up to 150 databases as the upper limit. This limit also includes the **master** database.

Tell them that they need to use the Windows Azure portal to provision an SQL Database instance.

Using slide 13, explain the following steps that are needed to perform for provisioning an SQL Database:

- Provision an SQL server virtual machine from the existing gallery
- Connect with the virtual machine using remote desktop
- Connect to the virtual machine from other computers

Using slide 14, tell the students that in this process, they need to provide the name of the SQL server virtual machine, a user account and password. They also need to select the size of the virtual machine as there are different sizes of virtual machines available in the gallery. The recommended sizes can be considered as the minimum requirements for creating the SQL server virtual machine.

Mention that some of the SQL server virtual machine includes:

- A2: for production environment
- A3: for SQL server enterprise edition
- A6: for SQL server 2012 enterprise for data warehousing
- A7: for SQL server 2014 for data warehousing

Using slide 15, tell the students that they will need to connect with the virtual machine after creating it.

Using slide 16, explain that to create and connect to the virtual machine, they need to complete the following tasks:

- **Create a Transport Control Protocol (TCP) Endpoint:** You will need to create this for the virtual machine.
- **Create firewall rules:** The ports for the virtual machine need to be created. You need to open TCP Port 1433.
- **Enable TCP/IP:** You will need to enable the TCP/IP protocol in SQL server configuration manager on the system from where you will use the SQL server management studio. After enabling TCP/IP, you need to restart the SQL server instance.
- **Enable mixed mode authentication:** You will need to connect to the virtual machine and enable mixed mode authentication for the SQL server instance.
- **Create SQL Server logins:** After you enable mixed mode authentication, create one or more users in SQL server.

Explain all these tasks in detail to the students.

Using slide 17, tell the students that after performing these steps, they need to figure out the DNS name for the virtual machine. They can get this name from the Azure portal. Show the figure on slide 17 that displays the DNS name for the virtual machine.

Using slide 18, tell the students that the DNS name consists of a randomly generated server name with the standard URL, which is **.database.windows.net**.

Mention that after the DNS name is determined, they can use SQL server management studio on the local system to connect with the virtual machine. In the provisioning process, the master database is automatically created.

Additional Information:

To know more about Windows Azure SQL Database provisioning model, visit the following links:

<http://blogs.msdn.com/b/umits/archive/2012/11/16/windows-azure-sql-database-how-to-create-windows-azure-sql-database.aspx>

<http://azure.microsoft.com/en-us/documentation/articles/virtual-machines-provision-sql-server/>

In-Class Question:

After you finish explaining about SQL Database server, you will ask students an In-Class question. This will help you in reviewing their understanding of the topic.



Which are the three steps that you need to perform for provisioning an SQL Database?

Answer:

The three steps needed to provision an SQL Database are provisioning an SQL server virtual machine from the existing gallery, connecting with the virtual machine using remote desktop, and connecting to the virtual machine from other computers.

Slides 19 and 20

Let us understand Windows Azure table storage and SQL Database.

Windows Azure Table Storage versus SQL Database 1-2

- Windows Azure Table Storage and SQL Database have their own primary benefits and features.

SQL Database is a relational database service

Windows Azure Table Storage is NoSQL key-value store, which is fault tolerant

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Windows Azure Table Storage versus SQL Database 2-2

Following table describes the key differences between Windows Azure Table Storage and SQL Database:

Comparison Criteria	Windows Azure Table Storage	SQL Database
Data Relationship	No Relationship	Yes – using foreign keys
Processing at server side	Basic operations, such as insert, update, select, and delete are supported	Yes – uses standard SQL Server features, such as stored procedures
Transactions	Limited – Up to 100 operations in a transaction within the same table in same partition	Yes – within the same database
Geo-replication	Yes – across different regions	No
Scaling	Automatic	Manual
Data type support	Simple	Multiple – simple, complex, or user-defined
Partitioning	Can store more than 150 GB of data without partitioning	Requires partitioning when data is more than 150 GB per a single unit of co-located data sets

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Using slide 19, explain to the students that Windows Azure table storage and SQL Database have their own primary benefits. SQL Database is a relational database service, whereas, Windows Azure table storage is NoSQL key-value store, which is fault tolerant.

Using slide 20, show a table that describes the key differences between Windows Azure table storage and SQL Database. Explain the differences as shown in the table.

Additional Information:

To know more about Windows Azure table storage versus SQL Database, visit the following links:

<http://msdn.microsoft.com/en-us/library/azure/jj553018.aspx>

http://blogs.msdn.com/b/writingdata_services/archive/2012/07/26/windows-azure-storage-sql-database-versus-table-storage.aspx

Slides 21 to 28

Let us understand troubleshooting and error handling.

Troubleshooting and Error Handling 1-8

The local instance of SQL Server provides a number of utilities that you can use to troubleshoot issues such as performance. Some of these utilities are:

SQL Server Profiler Database Tuning Adviser (DTA)

In the absence of these utilities, you can use a Dynamic Management Views (DMV).

SQL Database has less number of DMVs as compared to a local instance of SQL Server.

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Troubleshooting and Error Handling

2-8

- On SQL Database, if you face following issues, you need to check the sys.event_log file:
 - Database connections
 - Connection failures
 - Throttling
 - Deadlock



- With this file, you can view the events with the following details:



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Troubleshooting and Error Handling

3-8

- If you suspect that some of the queries, which you have executed, are eating up resources, you can run the following DMVs to find those queries:

sys.dm_exec_query_stats

sys.dm_exec_sql_text

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Troubleshooting and Error Handling

4-8

- A number of errors can crop up when using SQL Database such as a local database.
- Microsoft uses a set of error numbers to identify each error; and these error numbers are called error codes.
- When working with SQL Database, you may see a number of error codes depending on the errors.



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Troubleshooting and Error Handling

5-8

- Following table describes some of the common error codes:

Error Code	Description
40014	For the same transaction, multiple databases cannot be used.
40133	It is not supported in this version of SQL Server.
40508	To switch between databases, USE statement is not supported. To connect to diverse database, use a new connection.
40607	In this version, Windows logins are not supported.
45168	<ul style="list-style-type: none">• The SQL Azure system has a load and places an upper limit on concurrent DB CRUD operations for a single server.• In the error message, the server is specified and surpassed the maximum number of concurrent connections.• You need to try again later.

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Troubleshooting and Error Handling

6-8

Error Code	Description
45169	<ul style="list-style-type: none">• The SQL Azure system has a load and places an upper limit on concurrent server CRUD operations for a single subscription (such as, create server).• In the error message, the server is specified and surpassed the maximum number of concurrent connections, a request is rejected.• You need to try again later.
40637	Create database copy is currently disabled.

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26

Troubleshooting and Error Handling

7-8

- The errors can be of two types:

Transient

Non-transient

- You need to work with the retry logic in most cases to see if the error falls into the transient or non-transient category.
- The transient errors go away by themselves and no errors are encountered after you retry the same action after some time.
- One such example is network problem.
- After you retry the same code, it works without any error.

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27

Troubleshooting and Error Handling

8-8

- In the case of non-transient error, the error will remain no matter how many times you try it.
- For example:
 - If you have a syntax error in the query, no matter how many times you try it, an error will be generated.
- The retry logic requires you to retry the action after a while, so that you can figure out whether the error is in the transient or non-transient category.

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Using slide 21, explain to the students that the local instance of SQL server provides a number of utilities that they can use to troubleshoot issues such as performance. Some of these utilities are SQL server profiler and Database Tuning Adviser (DTA). In the absence of these utilities, the students can use a Dynamic Management View (DMV). However, SQL Database has less number of DMVs as compared to a local instance of SQL server.

Using slide 22, tell the students that on SQL Database, if they face issues such as database connections, connection failures, throttling, or deadlock, they need to check the `sys.event_log` file. With this file, they can view the events in the categories such as Event category, Event type, and Event sub type.

Using slide 23, tell the students that if they suspect that some of the queries, which they have executed, are eating up resources, they can run the `sys.dm_exec_query_stats` and `sys.dm_exec_sql_text` DMVs to find the queries.

Using slide 24, explain that a number of errors can crop up when using SQL Database just like a local database. Tell them that Microsoft uses a set of error numbers to identify each error. These error numbers are called error codes. When working with SQL Database, they may see a number of error codes, which are likely to pop up when something is not done correctly or a restriction is being applied.

Using slides 25 and 26, show the table that displays the common error codes. Explain these errors codes as per their description shown in the table.

Using slide 27, tell the students that errors are of two types, transient and non-transient.

Explain to the students that they need to work with the retry logic in most cases to see if the error falls into the transient or non-transient category. The transient errors go away by themselves and no errors are encountered after they retry the same action after some time.

Mention that one such example is network problem. After they retry the same code, it works without any error.

Using slide 28, explain that in the case of non-transient error, the error will remain no matter despite several attempts. For example, if there is a syntax error in a query, an error will be generated. The retry logic requires the users to retry the action after a while so that they can figure out whether the error is in the transient or non-transient category.

Additional Information:

To know more about errors encountered with SQL Database, visit the following links:

<http://support.microsoft.com/kb/2980233>

<http://msdn.microsoft.com/en-us/library/azure/ff394106.aspx>

In-Class Question:

After you finish explaining troubleshooting and error handling, you will ask students an In-Class question. This will help you in reviewing their understanding of the topic.



Which are the two types of error?

Answer:

The two types of error are transient error and non-transient error.

Slides 29 and 30

Let us summarize the session.

Summary 1-2

- SQL Database can be used with different types of applications, such as Microsoft, custom applications, and third-party applications as well.
- SQL Database consists of four layers: Client, Services, Platform, and Infrastructure.
- An SQL Database server, which is located in a specific geographical location, can run a number of SQL Databases.
- SQL Database server can hold up to 150 databases as the upper limit.

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Summary 2-2

- There are different sizes of virtual machines available in the Windows Azure gallery.
- These recommended sizes can be considered as the minimum requirements creating the SQL Server virtual machine.
- Windows Azure Table Storage and SQL Database have their own primary benefits.
- On SQL Database, if you face issues, such as database connections, connection failures, throttling, and deadlock, you need to check the sys.event_log file.

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Using slides 29 and 30, you will summarize the session. You will end the session, with a brief summary of what has been taught in the session.

Tell the students pointers of the session. This will be a revision of the current session and it will be related to the next session. Explain each of the following points in brief. Tell them that:

- SQL Database can be used with different types of applications, such as Microsoft, custom applications, and third-party applications as well.
- SQL Database consists of four layers such as client, services, platform, and infrastructure.
- An SQL Database server, which is located in a specific geographical location, can run a number of SQL Databases.
- SQL Database server can hold up to 150 databases as the upper limit.

- There are different sizes of virtual machines available in the Windows Azure gallery. These recommended sizes can be considered as the minimum requirements creating the SQL server virtual machine.
- Windows Azure table storage and SQL Database have their own primary benefits.
- On SQL Database, if you face issues, such as database connections, connection failures, throttling, and deadlock, you need to check the `sys.event_log` file.

12.3 Post Class Activities for Faculty

You should familiarize yourself with the topics of the next session. You should also explore the features of application lifecycle management in Windows Azure covered in the next session.

Tips: You can also check the Articles/Blogs/Expert Videos uploaded on the OnlineVarsity site to gain additional information related to the topics covered in the next session. You can also connect to online tutors on the OnlineVarsity site to ask queries related to the sessions.

Session 13 –Application Lifecycle Management

13.1 Pre-Class Activities

Before you commence the session, you should familiarize yourself with the topics of this session in-depth. You should revisit topics of the previous session for a brief review. Here, you can ask students the key topics they can recall from previous session. Prepare a question or two, which will be a key point to relate the current session objectives.

The summary of the previous session is as follows:

- SQL Database can be used with different types of applications, such as Microsoft, custom applications, and third-party applications as well.
- SQL Database consists of four layers: Client, Services, Platform, and Infrastructure.
- An SQL Database server, which is located in a specific geographical location, can run a number of SQL Databases.
- SQL Database server can hold up to 150 databases as the upper limit.
- There are different sizes of virtual machines available in the Windows Azure gallery. These recommended sizes can be considered as the minimum requirements creating the SQL Server virtual machine.
- Windows Azure Table Storage and SQL Database have their own primary benefits.
- On SQL Database, if you face issues, such as database connections, connection failures, throttling, and deadlock, you need to check the sys.event_log file.

13.1.1 Objectives

By the end of this session, the learners will be able to:

- Explain Application Lifecycle Management (ALM)
- Describe ALM Tooling
- Explain how to manage lifecycle on Windows Azure

13.1.2 Teaching Skills

To teach this session successfully, you should be aware of the concept of Application Lifecycle Management (ALM) along with three core aspects of ALM.

You should also be aware of the ALM tooling such as tracking tools and profiling. Also, familiarize yourself with process of managing Lifecycle on Windows Azure.

For teaching in the class, you are expected to use slides and LCD projectors.

Tips:

It is recommended that you test the understanding of the students by asking questions in between the class.

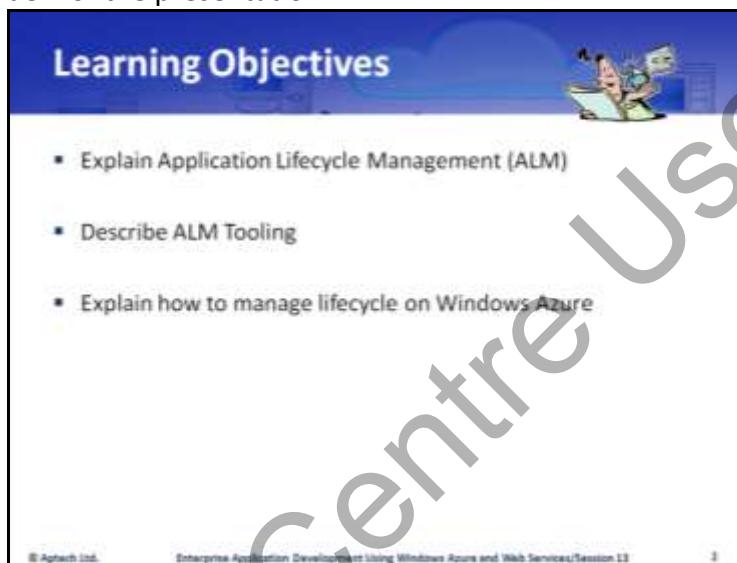
In-Class Activities:

Follow the order given here during In-Class activities.

Overview of the Session:

Give the students a brief overview of the current session in the form of session objectives.

Show the students slide 2 of the presentation.



The slide has a blue header bar with the title "Learning Objectives". Below the header, there is a cartoon illustration of a person holding a book and a magnifying glass. The main content area contains three bullet points:

- Explain Application Lifecycle Management (ALM)
- Describe ALM Tooling
- Explain how to manage lifecycle on Windows Azure

At the bottom left, it says "© Aptech Ltd." and at the bottom center, it says "Enterprise Application Development Using Windows Azure and Web Services/Session 13". There is also a small number "3" at the bottom right.

Tell them that they will be introduced to the concept of Application Lifecycle Management (ALM). In this session, activities and three core aspects of ALM are also explained.

This session covers ALM tools and Windows Azure.

At the end, mention that the session will cover the concepts of various stages in the application lifecycle such as testing and building, release drop, operations, and so on.

13.2 In-Class Explanations

Slide 3

Let us understand ALM.



Use slide 3 to introduce ALM. Tell the students that ALM can be defined as the capability to integrate, coordinate, and manage various stages of the software delivery process. From development to deployment, ALM comprises a set of pre-defined process and tools that include definition, design, development, testing, deployment, and management. Throughout the ALM process, each of these steps are monitored and controlled. There are various tools available in the software industry today to implement and configure ALM.

Additional Information:

To know more about ALM, visit the following links:

<http://blogs.msdn.com/b/buckwoody/archive/2012/02/07/application-lifecycle-management-overview-for-windows-azure.aspx>

<http://blogs.msdn.com/b/brunoterkaly/archive/2012/02/08/cloud-applications-and-application-lifecycle-management-includes-azure.aspx>

http://en.wikipedia.org/wiki/Application_lifecycle_management

Slide 4

Let us understand the ALM activities.



The slide has a blue header bar with the title "ALM Overview 2-3". Below the header, there is a bulleted list: "□ ALM comprises a number of activities such as:" followed by six colored horizontal bars. From top to bottom, the colors are red, green, purple, teal, orange, and red. Each bar contains a white text label: "Application requirements management", "Software testing", "Software maintenance", "Change management", "Project management", and "Release management". At the bottom left is the copyright notice "© Aptech Ltd." and at the bottom right is the slide number "11". A large watermark "For Aptech Centre Only" is diagonally across the slide.

- ALM comprises a number of activities such as:
- Application requirements management
- Software testing
- Software maintenance
- Change management
- Project management
- Release management

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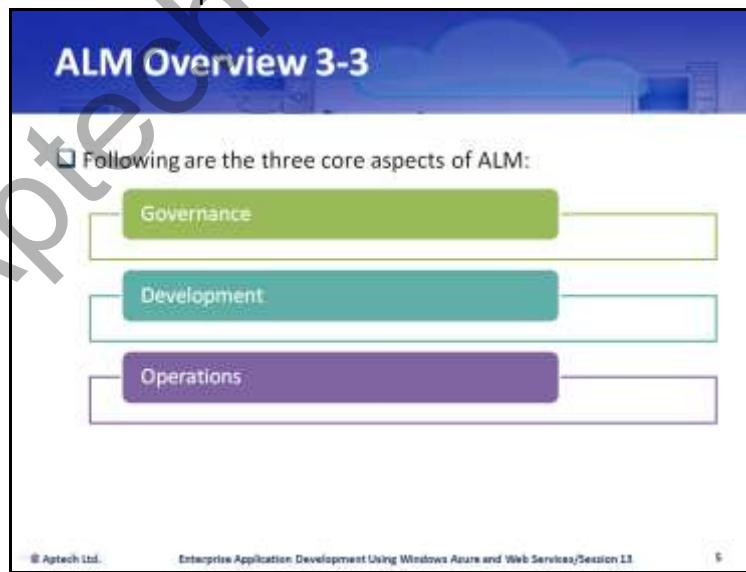
In slide 4, tell the students that the ALM comprises a number of activities. Some of the key activities include, application requirements management, software testing, software maintenance, Change management, Project management, and Release management.

Mention that there are many other activities that encompass ALM.

Also, explain that the key objective of ALM is to improve business and IT alignment using the end-to-end lifecycle activities.

Slide 5

Let us understand the three core aspects of ALM in detail.



The slide has a blue header bar with the title "ALM Overview 3-3". Below the header, there is a bulleted list: "□ Following are the three core aspects of ALM:" followed by three colored horizontal bars. From top to bottom, the colors are light green, teal, and purple. Each bar contains a white text label: "Governance", "Development", and "Operations". At the bottom left is the copyright notice "© Aptech Ltd." and at the bottom right is the slide number "11". A large watermark "For Aptech Centre Only" is diagonally across the slide.

- Following are the three core aspects of ALM:
- Governance
- Development
- Operations

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Using slide 5, tell the students that three core aspects of ALM are Governance, Development, and Operations. Explain each aspect in detail in some of the next slides.

Additional Information:

To know more about the core aspects of ALM, visit the following link:

<https://www.eventbrite.com/e/alm-for-windows-azure-tickets-1966127741>

Slide 6

Let us understand the governance model.



Explain to the students using slide 6 that a governance structure is defined in the governance model. The governance model defines what needs to be developed, which happens through the business case development. A business case defines a set of requirements for the project, which must be approved.

Also, tell them that ALM is a document that defines, assesses, and evaluates an approach for the project to be executed. Mention that ALM is implemented and managed through the Project Portfolio Management. After the business case development is completed, the next aspect, which is development model, takes place.

Additional Information:

To know more about the governance model, visit the following link:

<http://www.kevinalee.name/resources/templates/ALM-Governance-Framework.pdf>

Slide 7

Let us understand the Project Portfolio Management (PPM).

The slide is titled "Governance Model 2-3" and discusses Project Portfolio Management (PPM). It defines PPM as a centralized management of processes, technologies, and methods used by project owners (project managers) to execute and manage a project. It highlights two main ways to implement the governance model: assigning a project manager or a centralized team.

Assign a Project Manager:

- Assign a project manager to the development team.
- The project manager is responsible to manage the complete project.

Assign a Centralized Team:

- Assign this responsibility to a centralized team.
- Known as Project Management Office (PMO).
- An entity responsible to complete management of start-to-end lifecycle of an application.

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Use slide 7 to explain the concept of PPM and its relation with governance model.

Explain the students that the complete governance model is implemented and managed through the Project Portfolio Management, which can happen in two most recognized ways.

Mention that PPM is a centralized management of processes, technologies, and methods that is used by the project owners, specifically the project managers, to execute and manage a project.

Explain that PPM manages and implements the complete governance model through two most recognized ways such as by assigning a project manager or assigning a centralized team. Explain that the first way is to assign a project manager to the development team.

The project manager is responsible to manage the complete project. The second most known way is to assign this responsibility to a centralized team, which is known as Project Management Office (PMO), an entity responsible to complete management of start-to-end lifecycle of an application.

Additional Information:

To know more about PPM, visit the following links:

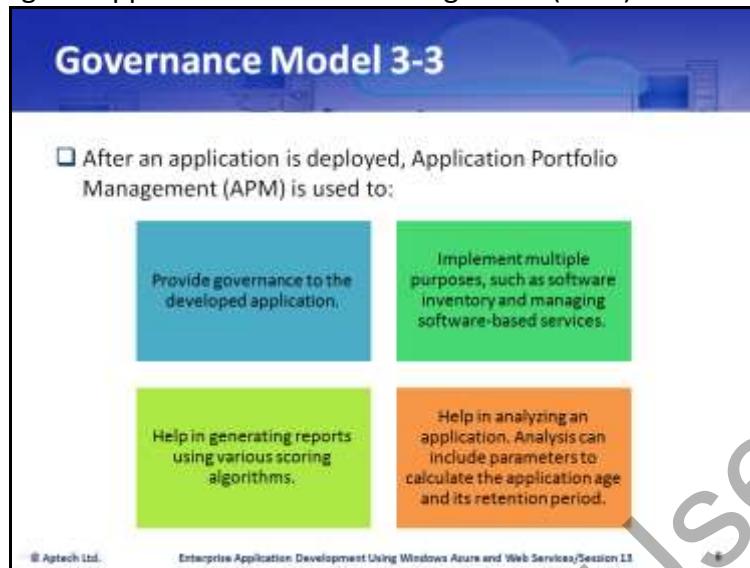
<http://www.getapp.com/project-portfolio-management-software>

<http://channel9.msdn.com/Events/SharePoint-Conference/2014/SPC376>

<http://technet.microsoft.com/en-us/library/project-portfolio-management-service-description.aspx>

Slide 8

Let us understand usage of Application Portfolio Management (APM).



Use slide 8 to explain APM. Explain to the students that APM is used to provide governance to the developed application after an application is deployed. It is simply a framework that is used for multiple purposes, such as software inventory and managing software-based services.

Then, explain number of benefits that an APM system provides. For example, APM helps in generating reports using various scoring algorithms. These reports can be specific to a software or the complete IT infrastructure. Tell them that the APM can also help in analyzing an application. Analysis can include parameters to calculate the application age and its retention period.

Additional Information:

To know more about APM, visit the following links:

- <http://www.safira.pt/en/en/pages/217/application-portfolio-management.html>
- <http://blogs.msdn.com/b/mscio/archive/2012/10/17/microsoft-it-experience-in-application-portfolio-management.aspx>
- <http://www.ilink-systems.com/Frameworks/Commsector-Frameworks/Application-Portfolio-Management>

Slide 9

Let us understand Development Model.

Development Model

- ❑ The Development Model:
 - Comes in to effect, after the governance model is completed.
 - Is the fundamental step that is necessary in an application development lifecycle.
 - Starts after the business cases are completed.
- ❑ The development can be divided into two parts:
 - Developing the application based on the business cases.

 - Periodic updates take place. The updates can be either a complete development lifecycle or just minor or major updates depending on the business requirements.


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Explain development model to the students using slide 9.

Tell the students that the development model comes in to effect, after the governance model is completed. It is the fundamental step that is necessary in an application development lifecycle. The development starts after the business cases are completed.

Explain them that the development can be divided into two parts. The first part is essentially developing the application based on the business cases. After the development in first part is completed, it is then moved to the second part in which periodic updates take place. The updates can be either a complete development lifecycle or just minor or major updates depending on the business requirements.

Slide 10

Let us understand Operation Model.



The slide has a blue header bar with the title "Operation Model". Below the header, there is a section titled "The Operation Model:" with four items:

-  Defines how the application is going to be managed and monitored.
-  After the development of the application is completed, it is then deployed.
-  The deployment phase of an application is actually part of the operations.
-  After the development is completed, the application must be regularly monitored.

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Use slide 10 to explain the Operation Model. Explain that the operation model defines how the application is going to be managed and monitored. After the development of the application is completed, it is then deployed. The deployment phase of an application is actually part of the operations.

Mention that after the development is completed, the application must be regularly monitored. As and when updates are required, the application monitoring becomes more critical and essential.

In-Class Question:

After you finish explaining Operational Model of ALM, you will ask the students an In-Class question. This will help you in reviewing their understanding of the topic.



Which are the three important aspects/models of ALM?

Answer:

Governance, Development, and Operations are the three important aspects/models of ALM.

Slide 11

Let us understand the tools that help entire ALM process.

ALM Tooling 1-3

- The ALM can be managed through various tools.
- Most of the large organizations either build their own products or buy off-the-shelf ALM tools to manage the ALM process.
- One of the most popular tools is Visual Studio Team Foundation Server.



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Using slide 11, tell the students that the entire ALM process can be managed through various tools. Most of the large organizations either build their own products or buy off-the-shelf ALM tools to manage the ALM process.

Additional Information:

An important point to note is that all tool vendors and methodologies have their own definition of ALM.

Slide 12

Let us understand Visual Studio Team Foundation Server.

ALM Tooling 2-3

- Visual Studio Team Foundation Server is one of the most popular ALM tools.
- A developer can perform the following activities:
 - Build the application
 - Test the application
 - Plan the development cycle
 - Track activities
 - Report progress

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Using slide 12, tell the students that one of the most popular tools is Visual Studio Team Foundation Server.

Explain them that using this tool, a developer can perform the activities such as build the application, test the application, plan the development cycle, track activities, and report progress.

Slide 13

Let us understand a set of team development tools in Team Foundation Server.



In slide 13, explain the figure that displays a set of team development tools in Team Foundation Server.

Additional Information:

To know more about ALM tools, visit the following links:

<http://www.rommanasoftware.com/alm-tools.php>

<http://searchsoftwarequality.techtarget.com/answer/What-exactly-is-an-ALM-tool>

<http://www.infoq.com/research/alm-survey>

Slide 14

Let us understand Tracking Tools.

Tracking Tools 1-3

- The Visual Studio Team Foundation Server allows a developer to track progress of the application.
- A developer can track the activities using two different methods:
 - Through Kanban board
 - Through Task board

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Explain the students through slide 14 that the Visual Studio Team Foundation Server allows a developer to track progress of the application.

Mention that a developer can track the activities through Kanban board or through task board.

Slide 15

Let us understand Kanban board.

Tracking Tools 2-3

Kanban board

- Is a tool to help you with an overview of the current project situation and the tasks.
- Helps the developer can view the progress of the entire project, the ownership of the tasks, and the completion of the tasks.
- Following figure displays a sample Kanban board:

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Tell the students using slide 15 that Kanban board is a tool to help you with an overview of the current project situation and the tasks. It also helps the developer can view the progress of the entire project, the ownership of the tasks, and the completion of the tasks.

Show the figure on slide 15 that displays a sample Kanban board.

Additional Information:

To know more about Kanban boards, visit the following links:

<http://msdn.microsoft.com/en-in/library/jj838789.aspx>

http://en.wikipedia.org/wiki/Kanban_board

<http://leankit.com/kanban/why-use-kanban-boards/>

<http://kanbantool.com/kanban-board>

Slide 16

Let us understand Task board.

The screenshot shows a software application window titled "Tracking Tools 3-3". A blue header bar at the top has the title. Below it, a green button labeled "Task board" is visible. The main area is titled "Sprint 1" and contains a "Task board" section. This section includes a table with columns for "Title", "Status", and "Assigned". There are three rows in the table, each with a small icon and some text. A context menu is open over the first row, with the first item "Hello World" highlighted by a red box. Other menu options include "Add an information form" and "Change initial view". At the bottom of the window, there is footer text: "Aptech Ltd.", "Enterprise Application Development Using Windows Azure and Web Services/Session 13", and the number "36".

Using slide 16, explain the task board to the students. Tell them that when using the task board, a developer can perform the same set of activities as Kanban board.

Show the figure on slide 16 that displays a sample Task board.

Additional Information:

To know more about task boards, visit the following links:

<http://www.aitgmbh.de/nc/downloads/team-foundation-server-tools/taskboard.html>

Slide 17

Let us understand Profiling.

The slide has a blue header with the title 'Profiling 1-3'. Below the header, there are two main sections:

- Through the Performance Session Wizard**:
 - A developer first needs to create a new performance session and gather the performance data.
 - This set of performance data is saved in a .vsp file, which can be viewed within the IDE.
- Through the Command-line**:
 - A developer can use the command-line to gather performance data through the automated scripts.

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Tell the students using slide 17 that Visual Studio contains a set of profiling tools that a developer can use to measure, evaluate, and check the performance of an application.

Using Visual Studio, a developer can perform profiling through the Performance Session Wizard and the command-line as follows:

- **Through the Performance Session Wizard**: A developer first needs to create a new performance session and gather the performance data. This set of performance data is saved in a .vsp file, which can be viewed within the IDE.
- **Through the command-line**: A developer can use the command-line to gather performance data through the automated scripts.

Slide 18

Let us understand the steps of Profiling.

The slide has a blue header with the title 'Profiling 2-3'. Below the header, there is a list of steps:

- Steps 1**: Create and configure a performance session. The developer specifies the collection method and the data that needs to be collected through the performance session.
- Steps 2**: Run the application in the performance session. This helps the developer in collecting the performance data.
- Steps 3**: After collecting the performance data, the developer then needs to analyze the data. In this analysis, the performance issues are identified.
- Steps 4**: Based on the performance data analysis, the developer then needs to modify code in the Visual Studio 2013 IDE. This modification should result in application performance.
- Steps 5**: Finally, the developer needs to generate a report that mentions the performance increment in the application.

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Using slide 18, explain the following steps to the students. Tell them that using the profiling tools, a developer needs to perform the following steps:

1. Create and configure a performance session. The developer specifies the collection method and the data that needs to be collected through the performance session.
2. Run the application in the performance session. This helps the developer in collecting the performance data.
3. After collecting the performance data, the developer then needs to analyze the data. In this analysis, the performance issues are identified.
4. Based on the performance data analysis, the developer then needs to modify code in the Visual Studio 2013 IDE. This modification should result in application performance.
5. Finally, the developer needs to generate a report that mentions the performance increment in the application.

Slide 19

Let us understand build processes.

The slide has a blue header bar with the title "Profiling 3-3". Below the header, there is a bulleted list:

- ❑ A developer can use Team Foundation Build (TFBuild) to manage the build processes.
- ❑ A developer can perform the following tasks using TFBuild:
 - Define the build process
 - Trigger the build
 - Test the build
 - Manage and monitor the builds
 - Diagnose the issues in the build

At the bottom of the slide, there is some small text: "© Aptech Ltd.", "Enterprise Application Development Using Windows Azure and Web Services/Session 11", and "19".

By means of slide 19, tell the students that a developer can use Team Foundation Build (TFBuild) to manage the build processes. Using TFBuild, he/she can automate application build compiling process and test the builds.

Tell them that a developer can perform the following tasks using TFBuild:

- Define the build process
- Trigger the build
- Test the build
- Manage and monitor the builds
- Diagnose the issues in the build

In-Class Question:

After you finish explaining Profiling, you will ask the students an In-Class question. This will help you in reviewing their understanding of the topic.



Which are two important ways of performing profiling?

Answer:

The two important ways of performing profiling are, through the Performance Session Wizard and through the command-line.

Slide 20

Let us understand managing Lifecycle on Windows Azure.

Managing Lifecycle on Windows Azure

- When using ALM, a developer typically performs a number of tasks.
- These are sequential tasks that are performed to ensure smooth ALM operations.
- Some of these tasks include building, deploying, and releasing a build.



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Using slide 20, introduce the process of managing lifecycle on Windows Azure. Explain that a developer typically performs a number of tasks using ALM. These sequential tasks are performed to ensure smooth ALM operations. Some of these tasks include building, deploying, and releasing a build.

Additional Information:

To know more about Windows Azure lifecycle, visit the following link:
<http://mentormate.com/blog/windows-azure-development-lifecycle/>

Slide 21

Let us understand Team Development.

Team Development

- As a team, a developer:
 - Gets a list of features that have to be implemented in an application.
 - Ensures that these features are implemented.
 - Builds test cases, which are executed using Microsoft Test Manager (MTM).
 - Develop the application in an emulated storage environment, which simulates the Windows Azure environment.
- When completed, the application can be moved from the emulated storage environment to Windows Azure storage.

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Explain that as a team, a developer gets a list of features that have to be implemented in an application. The developer, as part of the development team, ensures that these features are implemented. The development team also builds test cases, which are executed using Microsoft Test Manager (MTM). Use slide 21 to explain this.

Also, tell them that the development team will typically develop the application in an emulated storage environment, which simulates the Windows Azure environment.

Mention that when completed, the application can be moved from the emulated storage environment to Windows Azure storage.

Slides 22 and 23

Let us understand testing and building.

Testing and Building 1-2

- The application is deployed in the staging environment, which is the simulated setting of the production environment:

Staging Environment	Production Environment
• Is not visible to the end user and is mainly used for deploying and testing the application.	• Is the 'final' environment where the application is hosted and is visible to the user.

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Testing and Building 2-2

- The application is deployed on the staging environment after building.
- The deployment of the application can be either through the build tasks or through PowerShell scripts.
- After the application is deployed, tests are conducted and if results are successful, the application is deployed in the production environment.

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Using slide 22, explain the students that the application, in most cases, is deployed in the staging environment, which is the simulated setting of the production environment.

Tell them that the difference between both is that, staging environment is not visible to the end user and is mainly used for deploying and testing the application. Production environment, on the other hand, is the ‘final’ environment where the application is hosted and is visible to the user.

In slide 23, tell the students that after building the application, it is deployed on the staging environment. The deployment of the application can be either through the build tasks or through PowerShell scripts. After the application is deployed, tests are conducted and if results are successful, the application is deployed in the production environment.

Slide 24

Let us understand Release Drop.

Release Drop

- In the Windows Azure environment, you can:
 - Separate the environments for both staging and production.
 - Limit the access of one department in the company to one specific environment.
- On the staging environment:
 - A number of tests can be performed using Microsoft Test Manager (MTM).
 - After executing the tests successfully, the release is then manually dropped on the production environment.

Aptech Ltd. Enterprise Application Development Using Windows Azure and Web Services/Session 1.3 23

Using slide 24, explain to the students that you can separate the environments for both staging and production in the Windows Azure environment. Using subscriptions, you can also limit the access of one department in the company to one specific environment. For example, developers can be restricted to use only the staging environment.

Mention that a number of tests can be performed using Microsoft Test Manager (MTM) on the staging environment. Business users of an Azure application can execute their acceptance tests against the staging environment of the production subscription. By using MTM, they can execute manual tests, automated tests, and exploratory tests and so on while still being connected with the TFS repository. This provides the capabilities to provide very rich bug reports to the team. After executing the tests successfully, the release is then manually dropped on the production environment.

In-Class Question:

After you finish explaining Release drop, you will ask the students an In-Class question. This will help you in reviewing their understanding of the topic.



What is the use of MTM?

Answer:

The MTM helps you test the Azure application while still being connected with the TFS repository in the staging environment.

Slide 25

Let us understand Operations.

The slide has a blue header bar with the word 'Operations'. The main content area contains a bulleted list of four points:

- After the application is successfully deployed, the operations' team monitors the applications.
- Each application project has a set of SLAs defined that are used by the customer to ensure that performance benchmarks are as requested in the initial requirements of the project.
- The application is monitored against the defined SLAs.
- If there is a deviation from the defined SLAs, then the operations' team is informed for taking suitable actions.

At the bottom of the slide, there is footer text: © Aptech Ltd., Enterprise Application Development Using Windows Azure and Web Services/Session 1.1, and the number 25.

Using slide 25, explain that after the application is successfully deployed, the operations' team monitors the applications.

Tell the students that each application project has a set of SLAs defined that are used by the customer to ensure that performance benchmarks are as requested in the initial requirements of the project.

Mention that the application is monitored against the defined SLAs. If there is a deviation from the defined SLAs, then the operations' team is informed for taking suitable actions.

Slides 26 and 27

Let us summarize the session.

Summary 1-2

- ❑ ALM is defined as the product lifecycle management, which includes governance, development, and operations of applications.
- ❑ There are three aspects of ALM, namely, Governance, Development, and Operations.
- ❑ In the governance model, a governance structure is defined.
- ❑ The development model comes into effect after the governance model is completed. The development starts after the business cases are completed.

Summary 2-2

- ❑ The operation model defines how the application is going to be managed and monitored.
- ❑ The Visual Studio Team Foundation Server allows a developer to track progress.
- ❑ Visual Studio contains a set of profiling tools that a developer can use to measure, evaluate, and check the performance of an application.
- ❑ A developer can use TFBUILD to manage the build processes. Using TFBUILD, the developer can automate application build compiling process and also test the builds.

Using slides 26 and 27, you will summarize the session. You will end the session, with a brief summary of what has been taught in the session.

Tell the students pointers of the session. This will be a revision of the current session and it will be related to the next session. Explain each of the following points in brief.

Tell them that:

- Application Lifecycle Management (ALM) can be defined as the product lifecycle management, which includes governance, development, and operations of applications.
- There are three aspects of ALM, namely, Governance, Development, and Operations.
- In the governance model, a governance structure is defined.
- The development model comes into effect after the governance model is completed. The development starts after the business cases are completed.
- The operation model defines how the application is going to be managed and monitored.
- The Visual Studio Team Foundation Server allows a developer to track progress.
- Visual Studio contains a set of profiling tools that a developer can use to measure, evaluate, and check the performance of an application.
- A developer can use TFBUILD to manage the build processes. Using TFBUILD, the developer can automate application build compiling process and also test the builds.

13.3 Post-Class Activities for Faculty

You should familiarize yourself with the topics of the next session. You should also explore the techniques for deploying Web application and services that are taught in the next session.

Tips: You can also check the Articles/Blogs/Expert Videos uploaded on the OnlineVarsity site to gain additional information related to the topics covered in the next session. You can also connect to online tutors on the OnlineVarsity site to ask queries related to the sessions.

Session 14 – Deploying Web Application and Services

14.1 Pre-Class Activities

Before you commence the session, you should familiarize yourself with the topics of this session in-depth. You should revisit topics of the previous session for a brief review. Here, you can ask students the key topics they can recall from previous session. Prepare a question or two, which will be a key point to relate the current session objectives.

- The summary of the previous session is as follows:
- Application Lifecycle Management (ALM) can be defined as the product lifecycle management, which includes governance, development, and operations of applications.
- There are three aspects of ALM, namely, Governance, Development, and Operations.
- In the governance model, a governance structure is defined.
- The development model comes into effect after the governance model is completed. The development starts after the business cases are completed.
- The operation model defines how the application is going to be managed and monitored.
- The Visual Studio Team Foundation Server allows a developer to track progress.
- Visual Studio contains a set of profiling tools that a developer can use to measure, evaluate, and check the performance of an application.
- A developer can use TFBuild to manage the build processes. Using TFBuild, the developer can automate application build compiling process and also test the builds.

14.1.1 Objectives

By the end of this session, the learners will be able to:

- Explain planning and designing a deployment strategy for Web applications and Azure
- Describe configuring and implementing deployment
- Describe using NuGet for managing packages

14.1.2 Teaching Skills

To teach this session successfully, you should be aware of planning and designing a deployment strategy for Web applications and Azure. Also, familiarize yourself with configuring and implementing deployment and using NuGet for managing packages.

For teaching in the class, you are expected to use slides and LCD projectors.

Tips:

It is recommended that you test the understanding of the students by asking questions in between the class.

In-Class Activities:

Follow the order given here during In-Class activities.

Overview of the Session:

Give the students a brief overview of the current session in the form of session objectives. Show the students slide 2 of the presentation.

The slide has a blue header bar with the title "Learning Objectives". Below the header is a cartoon illustration of a person sitting at a desk with a computer monitor. The main content area contains three bullet points:

- Explain planning and designing a deployment strategy for Web applications and Azure
- Describe configuring and implementing deployment
- Describe using NuGet for managing packages

At the bottom left is the Aptech logo, and at the bottom center is the text "Enterprise Application Development Using Windows Azure and Web Services/Session 14". On the far right edge of the slide, there is a small number "3".

Tell them that they will be introduced to the concept of deploying Web applications and Web services. Tell them that this session explains the basics of planning and designing a deployment strategy. Furthermore, this session also covers using NuGet for managing packages and creating, configuring, and publishing a Web package.

14.2 In-Class Explanations

Slides 3 and 4

Let us understand how to plan and design a deployment strategy.

The image displays two slides from a presentation, both titled "Planning and Designing a Deployment Strategy".

Slide 1 (Top): This slide focuses on deployment. It includes a bulleted list under a checkbox: "After creating a Web application project or Website project:" followed by a callout box stating, "You need to deploy or publish the project to a Web server, so that others can access and use the application." Below this is another bulleted list under a checkbox: "Deployment:" which includes three points: "Is not just copying the application's files from one server to another.", "May involve many other tasks involved in this process.", and "Has to be planned by developers with a strategy for Web applications before publishing." To the right of the text are two small diagrams: one showing a computer icon labeled "Deployment" pointing to a "Web Server" icon, and another showing two people at a table labeled "Data Store".

Slide 2 (Bottom): This slide focuses on developers. It includes a bulleted list under a checkbox: "Developers:" followed by two points: "Select the suitable process based on the type of deployment." and "Understand deployment options for Web applications in general before choosing the appropriate deployment strategy for a Windows Azure application." To the right of the text is a diagram showing a computer icon labeled "Deployment" pointing to a cloud icon labeled "Windows Azure".

Use slide 3 to explain to the students that once you have created a Web application project or Website project, you need to deploy or publish the project to a Web server enabling others to access and use the application.

Explain to them that deployment involves a number of tasks including copying the application's files from one server to another and several other tasks. As there are many tasks, even one of them going wrong can lead to the deployment not being successful.

Hence, it is essential that before publishing an application, a proper deployment strategy and plan for Web applications needs to be created by the developer.

Using slide 4, explain to the students that based on the type of deployment, a suitable process for deployment can be selected by the developers.

Also, mention that it is important that an appropriate deployment strategy for a Windows Azure application is selected. This helps to understand the various deployment options for Web applications in general.

Additional Information:

To learn more about deployment, refer to the following links:

<http://www.asp.net/mvc/overview/deployment>

<http://haacked.com/archive/2011/05/25/bin-deploying-asp-net-mvc-3.aspx/>

<http://www.dotnetcurry.com/showarticle.aspx?ID=904>

Slide 5

Let us understand how to package and deploy using IIS and Xcopy deployment.

Packaging and Deploying Using IIS and XCopy

- ❑ Visual Studio 2013 provides powerful support for packaging and deploying Web applications and services.
- ❑ In addition to Visual Studio 2013, you can also use several other approaches to package and deploy.
- ❑ Some of them are:
1) Using IIS 2) Using Xcopy

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Using slide 5, explain to the students that they can use Visual Studio 2013 for publishing and deployment as it provides a powerful support for packaging and deploying Web applications and services. They can also use several other approaches to package and deploy such as IIS and Xcopy.

Slides 6 to 8

Let us understand about using IIS.

Using IIS 1-3

Following are the steps to create Web deployment package and install it using IIS:

- Step 1 • Run the command %windir%\system32\inetsrv\appcmdadd /backup "PreDeploy" for backing up the IIS7.0 server.
- Step 2 • Launch the IIS Manager using inetmgr in the Run command window.
- Step 3 • Expand Sites node and Server node and then, choose Default Web Site/<MyApplication>.
- Step 4 • Next, in the Manage Packages section in the Actions pane, you need to select Export Application. This application will comprise the application chosen and the corresponding folders.
- Step 5 • Select ManageComponents. In this, you will notice two prominent rows. While the first row is the application and the second, the provider name.

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Using IIS 2-3

- Step 6 • In the Path column, you need to add your script or database file path. The database will now be reflected in the package contents tree view.
- Step 7 • To continue, click Next. Now, based on the providers that have been added, the parameters will be shown on screen.
- Step 8 • Click AddParameter. Specify the parameter details for the connection string present in the Web.config file of the application.
- Step 9 • Select a location for saving the package. Once these steps are done, you will notice that the wizard will complete the packaging process. It will then save the package to disk. With this, you will finish creating the package. This will now serve helpful while installing package.
- Step 10 • Repeat steps 1 to 3. Then, select Import Application in the Actions pane.

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Using IIS 3-3

- Step 11 • Select the package that was created in step 9. In the Install an Application Package dialog box that is displayed, you will see the application, and the database.
- Step 12 • On the Parameters page, type in a new application name (if desired), and a SQL connection string.
- Step 13 • Click Next to install the package.

In 2009, Microsoft introduced a tool Web Deploy tool (MSdeploy.exe) that makes deployment of Web applications and Websites to IIS servers simpler and easier. Today, developers often prefer to use this tool.

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In slides 6 to 8, explain the steps to create Web deployment package and install it using IIS.

In Step 1, run the command %windir%\system32\inetsrv\appcmdadd backup "PreMsDeploy" for backing up the IIS 7.0 server.

In Step 2, launch the IIS Manager using **inetmgr** in the Run command window.

In Step 3, expand **Sites** node and **Server** node and then, choose **Default Web Site/<MyApplication>**.

In Step 4, in the **Manage Packages** section in the **Actions** pane, select **Export Application**. This application will comprise the application chosen and the corresponding folders.

In Step 5, select **ManageComponents**. In this, notice two prominent rows. While the first row is the application and the second, the provider name.

In Step 6, in the **Path** column, add the script or database file path. The database will now be reflected in the package contents tree view.

In Step 7, to continue, click **Next**. Now, based on the providers that have been added, the parameters will be shown on screen.

In Step 8, click **AddParameter**. Specify the parameter details for the connection string present in the Web.config file of the application.

In Step 9, select a location for saving the package. Once these steps are done, notice that the wizard will complete the packaging process. It will then save the package to disk. With this, finish creating the package. This will now serve helpful while installing package.

In Step 10, repeat steps 1 to 3. Then, select **Import Application** in the **Actions** pane.

In Step 11, select the package that was created in step 9. In the **Install an Application Package** dialog box that is displayed, it will display the application, and the database.

In Step 12, on the **Parameters** page, type in a new application name (if desired), and a SQL connection string.

In Step 13, click **Next** to install the package.

Tell them that in 2009, a deploy tool (MSdeploy.exe) was introduced by Microsoft to make the deployment of Web applications and Websites to IIS servers simpler and easier. This tool is preferred by developers.

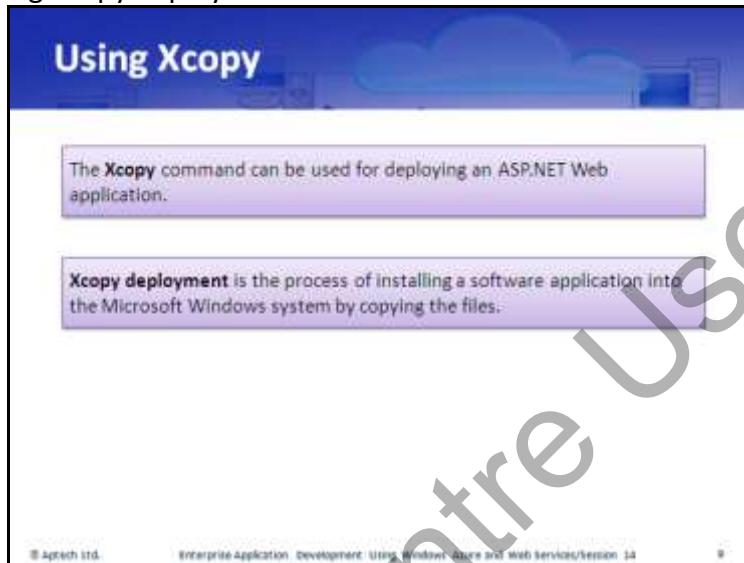
Additional Information:

To know more about using IIS, visit the following links:

<http://blog.winhost.com/using-msdeploy-to-publish-your-site/>
<http://technet.microsoft.com/en-us/library/dd569106%28v=ws.10%29.aspx>

Slide 9

Let us understand using Xcopy deployment.



Using slide 9, tell the students that they can use Xcopy to deploy an ASP.NET Web application. Introduce this command to the students saying that Xcopy deployment is based on the popular command line tool Xcopy which is now deprecated. The deployment tool makes it easier to deploy applications by copying files.

Additional Information:

To know more about using Xcopy, visit the following links:

http://en.wikipedia.org/wiki/XCOPY_deployment
<http://support2.microsoft.com/?scid=kb%3Ben-us%3B326355&x=12&y=16>

Slides 10 to 12

Let us understand the advantages of using Xcopy deployment.

The image displays three vertically stacked slides, each titled "Advantages of Using Xcopy Deployment" followed by a number (1-3). Each slide contains a bulleted list of advantages and a "Tips" section.

Slide 1-3:

- Following are some advantages of using Xcopy deployment:
 - You can use the drag-and-drop feature that is available in Microsoft Windows Explorer.
 - You can use the File Transfer Protocol (FTP) command for copying files.
 - The ASP.NET application does not require any registry related modifications.
 - The file transfer feature of Xcopy helps in simplifying the maintenance as well as deployment of ASP.NET Websites due to the absence of registry entries.

Slide 2-3:

- Xcopy style of deployment is not suitable in all cases.
 - In case of line-of-business applications and large Websites, you should make the Website offline for some time.
 - This can be done when the application assemblies and new content are going to be deployed.
 - You need to perform maintenance tasks at a predefined time.

Slide 3-3:

- Following are the tips to minimize downtime for end users:

Tips

 - Make a new physical directory for the application you plan to update. Then, make a copy of all the new content to this directory.
 - Make changes to the configuration of the virtual directory for the application, to connect it to the new physical directory. This will enable access to the new content in the new physical directory.

Using slides 10 and 11, tell the students that there are some advantages of using Xcopy deployment. The advantages of using Xcopy deployment include:

- The feature of drag-and-drop is available in Microsoft Windows Explorer.
- The File Transfer Protocol (FTP) command can be used for copying files.
- The ASP.NET application does not need any registry related modifications.
- The file transfer feature of Xcopy enables to simplify the maintenance and deployment of ASP.NET Websites as a result of the absence of registry entries.

Tell them that the Xcopy style of deployment may not be suitable in case of line-of-business applications and large Websites. They need to take the Website offline for some time while deploying the application assemblies and new content. They need to perform maintenance tasks such as these at a predefined time.

Using slide 12, explain to the students that they can follow some tips to reduce downtime for end users.

Explain the first tip. Tell that they can make a new physical directory for the application you plan to update and make a copy of all the new content to this directory.

Explain the second tip. Tell them that they can modify the configuration of the virtual directory for the application to connect it to the new physical directory. This helps to access to the new content in the new physical directory.

Additional Information:

To know more about the benefits of using Xcopy, visit the following link:

<http://codebetter.com/patricksmacchia/2009/08/10/the-benefits-of-xcopy-deployment/>

Slides 13 to 17

Let us understand how to choose a deployment strategy for Windows Azure applications.

The image shows three vertically stacked slides, each with a blue header and a white body. A large watermark reading "For Aptech Centres Only" is diagonally across the slides.

Choosing a Deployment Strategy for Windows Azure Applications 1-5

- ❑ Steps to perform to deploy a service to a Windows Azure Worker Role or Web Role are:

Step 1
Create a new Cloud Service and enable communication for role instances

Step 2
Create a package with the service files

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Choosing a Deployment Strategy for Windows Azure Applications 2-5

Step 1 Create a new Cloud Service and enable communication for role instances

- ❑ In Windows Azure, role instances are designed to run in a cloud service.
- ❑ An instance can use either internal or external connections depending on the type of communication that is required.

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Choosing a Deployment Strategy for Windows Azure Applications 3-5

- ❑ Differences between the external and internal connections are:

External connections <ul style="list-style-type: none">• Mainly used for communicating with the clients that are external to your network.• Are also known as input endpoints. Input endpoints use the TCP, HTTPS, or HTTP protocols for connectivity.• You need to associate a port to the input endpoint.	Internal connections <ul style="list-style-type: none">• Mainly used for communicating with other role instances.• Are also known as internal endpoints.• Internal endpoints use the HTTP and TCP protocols for connectivity.• You can assign a dynamic IP address to the internal endpoint.
---	---

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Choosing a Deployment Strategy for Windows Azure Applications 4-5

You have two different deployments when working in cloud environments:

Production and Staging

Choosing a Deployment Strategy for Windows Azure Applications 5-5

```
graph LR; A[An application is deployed on the staging environment in the development stage] --> B[After its production is complete, it is moved to the production environment after a thorough round of testing]; B --> C[You can continue to develop the application or its components even after the application is deployed to the production environment]; C --> D[Each of these two environments need an IP address and a DNS name for it to be accessible]; D --> E[The IP address is associated with the service until the time it is deployed]; E --> F[In the staging environment, the DNS name is dynamically generated when the service is deployed]; F --> G[In the production environment, the DNS name is assigned for lifetime and is assigned during runtime]
```

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Using slide 13, tell the students that there are two steps to deploy a service to a Windows Azure Worker Role or Web Role, they are create a new Cloud Service and enable communication for role instances and create a package with the service files.

Using slide 14, explain to the students that in Windows Azure, they can design role instances to run in a cloud service. An instance can use either internal or external connections depending on the type of communication that is required.

Using slide 15, explain to the students the difference between external and internal connections.

Tell them that the external connections help in communicating with the clients that are external to your network. They are also known as input endpoints, which use the TCP, HTTPS, or HTTP protocols for connectivity. They need to associate a port to the input endpoint.

Then, tell them that the internal connections help in communicating with other role instances. They are also known as internal endpoints, which use the HTTP and TCP protocols for connectivity. They can assign a dynamic IP address to the internal endpoint.

Using slide 16, tell the students that while working in cloud environments, there are typically two different deployments, production and staging.

Using slide 17, explain to the students the process of production and staging.

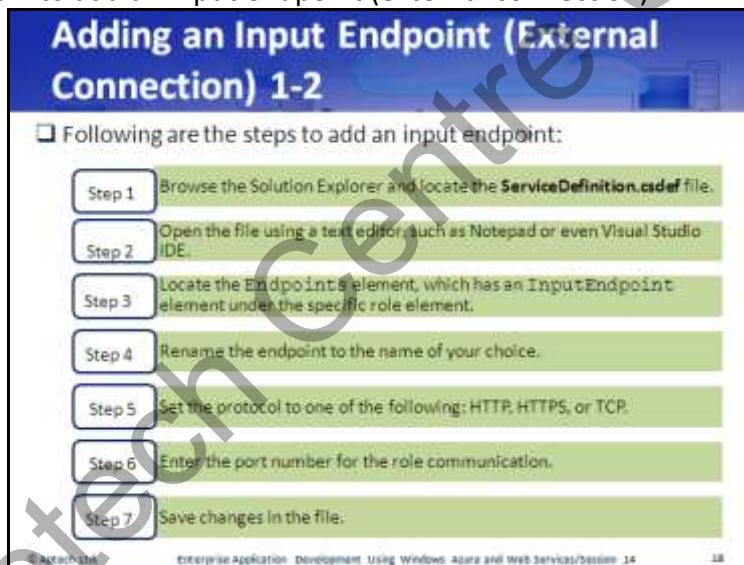
Tell them that an application in the development stage is deployed on the staging environment. Once its production is complete, it is moved to the production environment after a thorough round of testing. They can continue to develop the application or its components even after the application is deployed in the production environment.

Also, mention that both the environments need an IP address and a DNS name for it to be accessible.

In the production environment, the DNS name is assigned for lifetime and is assigned during runtime. While, in the staging environment, the DNS name is dynamically generated when the service is deployed. The IP address is associated with the service until the time it is deployed.

Slides 18 and 19

Let us understand how to add an input endpoint (external connection).



Adding an Input Endpoint (External Connection) 2-2

Following code snippet shows how to add an input endpoint named `HttpEndPt` for HTTP protocol:

```
<ServiceDefinition name="TestService"
  xmlns="http://schemas.microsoft.com/ServiceHosting/2008
  /10/ServiceDefinition">
  <WebRole name="TestWebRole">
    <Endpoints>
      <InputEndpoint name="HttpEndPt" protocol="http"
        port="80" localPort="80" />
    </Endpoints>
  </WebRole>
</ServiceDefinition>
```

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Using slide 18, explain to the students the steps needed to add an input endpoint. In Step 1, browse the Solution Explorer and locate the **ServiceDefinition.csdef** file.

In Step 2, open the file using a text editor, such as Notepad or even Visual Studio IDE.

In Step 3, locate the `Endpoints` element, which has an `InputEndpoint` element under the specific role element.

In Step 4, rename the endpoint to the name of your choice.

In Step 5, set the protocol to one of the following: HTTP, HTTPS, or TCP.

In Step 6, enter the port number for the role communication.

In Step 7, save changes in the file.

Using slide 19, explain that the code snippet shows how to add an input endpoint named `TestEndPoint` for HTTP protocol.

Additional Information:

To know more about using internal endpoints for deploying to Windows Azure, visit the following links:

<http://msdn.microsoft.com/en-us/library/azure/hh180158.aspx>

<https://brentdacodemonkey.wordpress.com/2011/05/17/windows-azure-endpoints-overview/>

Slides 20 and 21

Let us understand how to add an internal endpoint (internal connection).

Adding an Internal Endpoint (Internal Connection) 1-2

Following are the steps to add an internal endpoint:

Step 1: Edit the **ServiceDefinition.csdef** file and add the endpoints element for VM role, worker role, or a Web role. The element **InternalEndpoint** is under the specific element.

Step 2: Enter the name of the endpoint.

Step 3: Set the protocol for communication.

Step 4: Save changes in the file.

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Adding an Internal Endpoint (Internal Connection) 2-2

Following code snippet shows how to add an internal endpoint named **TestNewEndPoint** for HTTP protocol:

```
<ServiceDefinition name="TestService"
  xmlns="http://schemas.microsoft.com/ServiceHosting/2008
  /10/ServiceDefinition">
  <WebRole name="TestNewWebRole">
    <Endpoints>
      <InternalEndpoint name=" TestNewEndPoint"
        protocol="http" port="1400"/>
    </Endpoints>
  </WebRole>
</ServiceDefinition>
```

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Using slide 20, tell the students that there are some steps to add an internal endpoint.

In Step 1, edit the **ServiceDefinition.csdef** file and add the endpoints element for VM role, worker role, or a Web role. The element **InternalEndpoint** is under the specific element.

In Step 2, enter the name of the endpoint.

In Step 3, set the protocol for communication.

In Step 4, save changes in the file.

Using slide 21, tell the students that the code snippet shows how to add an internal endpoint named TestNewEndPoint for HTTP protocol.

Slides 22 and 23

Let us understand how to choose a deployment strategy for Windows Azure applications.

Choosing a Deployment Strategy for Windows Azure Applications 1-2

Step 2 Create a package with the service files

Following table outlines the three key components that are essential to deploy an application as a cloud service in Azure:

File Type	Description
Service Definition	The cloud service definition file with extension .csdef, which defines the service model, including the number of roles.
Service Configuration	The cloud service configuration file with extension .cscfg, which provides configuration settings for the cloud service and individual roles, including the number of role instances.
Service Package	The service package with extension .cspkg, which contains the application code and the service definition file.

Choosing a Deployment Strategy for Windows Azure Applications 2-2

The Azure SDK provides a command-line tool named **CSPack** for creating the application package.

Following command shows how to package a sample application named **sampledemoweb** for deployment in Azure:

```
F:\Source\Codes\sampledemoweb> cspack  
sampledemoweb\ServiceDefinition.csdef /out:sampledemoweb.cspkg  
/role:sampledemoweb_WebRole;  
sampledemoweb_WebRole /sites: sampledemoweb_WebRole\Web;  
drive:\sampledemoweb_WebRole\sampledemoweb_WebRole
```

The outcome of this is **sampledemoweb.cspkg**, which is the service package to be deployed.

Using slide 22, tell the students that the second step of choosing a deployment strategy for Windows Azure applications is to create a package with the service files.

Tell them that the table outlines the three key components that are essential to deploy an application as a cloud service in Azure. They are: Service Definition, Service Configuration, and Service Package.

Using slide 23, tell the students that the Azure SDK provides a command-line tool named CSPack for creating the application package.

Tell them that the command shows how to package a sample application named **sampledemoweb** for deployment in Azure.

Additional Information:

To know more about choosing a deployment strategy for Windows Azure applications, visit the following links:

<http://msdn.microsoft.com/en-us/library/azure/gg433027.aspx>

<http://stackoverflow.com/questions/3528265/what-is-a-recommended-develop-test-deploy-strategy-for-azure>

In-Class Question:

After you finish explaining about the planning and designing a deployment strategy, you will ask the students an In-Class question. This will help you in reviewing their understanding of the topic.



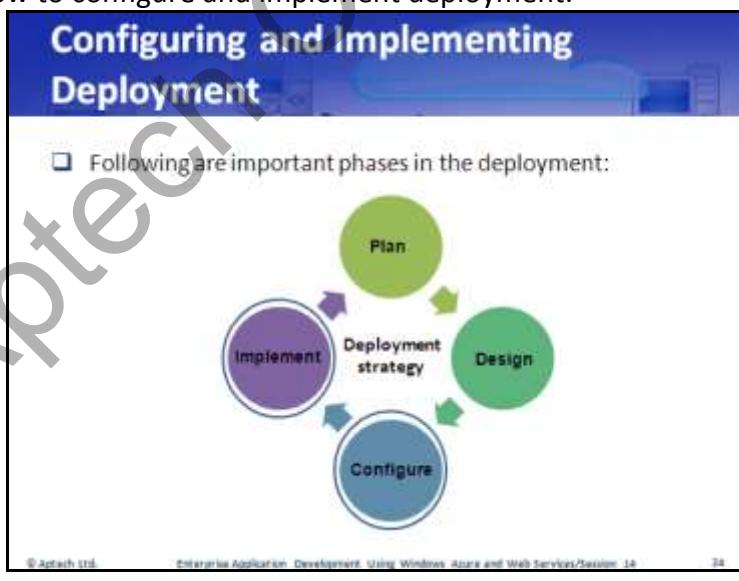
What is required after you have created a Web application project?

Answer:

After creating a Web application project or Website project, you need to deploy or publish the project to a Web server enabling others to access and use the application.

Slide 24

Let us understand how to configure and implement deployment.



Using slide 24, explain to the students that after planning and designing a deployment strategy, configuring and implementing are important phases in the deployment.

Slides 25 to 27

Let us understand how to switch from production/release mode to debug mode.

Switching from Production/Release Mode to Debug Mode 1-3

- The Debug mode has features such as:
 - Extra Initialization
 - Checking
- These features help you find and correct the issues that may occur in your application in Windows Azure environment.
- Debug mode:
 - Slows the environment as issues are being tracked in different modes, such as checking syntaxes and also verifying the code is correct.
 - Runs slower than the released mode, in which no error check takes place.

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Switching from Production/Release Mode to Debug Mode 2-3

- Following are the steps to switch from Debug or Release configuration:
 - Step 1 • Go to the Standard toolbar in the IDE.
 - Step 2 • Select **DebugMode** or **ReleaseMode** from the **Solution Configurations** list box.

Take Note:
The Standard toolbar is not present in the Visual C# Express or Visual Basic Express. Instead, you can use the **Start Debugging** and press **F5** to Build Solution and press **F6** menu items for choosing the configuration.

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Switching from Production/Release Mode to Debug Mode 3-3

- Regardless of which mode you use (Debug or Release):
 - You can use custom deployment parameters for configuration values that you may want to modify when the package is installed.
 - It can be done using the **SetParameters.xml** file.
 - This file is dynamically generated based on your Web application project file and other configuration files.

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Using slide 25, explain to the students that the Debug mode has two features:

- extra initialization
- checking

Explain to them that these features help them in location and correcting the issues that occur in the application in Windows Azure environment. Also, tell that debugging slows the environment. This is because issues such as checking syntaxes and verifying the code are being tracked in different modes. The Debug mode usually runs slower than the released mode, in which no error check takes place.

Using slide 26, explain to the students the steps to switch from Debug or Release configuration.

In Step 1, go to the Standard toolbar in the IDE.

In Step 2, from the **Solution Configurations** list box, select **DebugMode** or **ReleaseMode**.

Also, tell them that the Standard toolbar is not present in the Visual C# Express or Visual Basic Express. Use the **Start Debugging** and press **F5** to build the solution and press **F6** menu items for choosing the configuration.

Using slide 27, explain to the students that using Debug or Release mode, they can use custom deployment parameters for configuration values that want to modify when the package is installed. This can be done using the SetParameters.xml file.

This file is dynamically generated based on the Web application project file and other configuration files present in the project.

Slides 28 to 30

Let us understand use of SetParameters to set up an IIS app pool.

Use SetParameters to Set Up an IIS App Pool 1-3

- ❑ The **SetParameters.xml** file offers certain parameter values to the Web Deploy tool (MSDeploy.exe).
- ❑ You can make changes to the values in this file and forward it to Web Deploy for deploying the Web package.
- ❑ If you use IIS Manager for installing the package:
 - You must enter a value for the parameter in the **Enter Application Package Information** dialog box when you are prompted as shown in the figure.



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Use SetParameters to Set Up an IIS App Pool 2-3

When you click **Next**, you will be prompted with the **Import Application Package** dialog box.

It confirms whether you have ASP.NET 4.0 installed on your system.

If you have it installed, click **OK**.

If you do not have it installed, you will need to click **Cancel** and then install ASP.NET 4.0.

After the package is installed, you will need to change the Application Pool to the ASP.NET v4.0 application pool in the IIS Manager.

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Use SetParameters to Set Up an IIS App Pool 3-3

- ❑ Figure shows the **Import Application Package** dialog box with the error:
- ❑ After the package is deployed, the **Summary screen** is displayed as shown in figure:
- ❑ You will need to review the results and click **Finish**.

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Using slide 28, tell the students that the **SetParameters.xml** file helps them to make changes to the values in this file and forward it to Web Deploy for deploying the Web package.

While using IIS Manager for installing the package, enter a value for the parameter in the **Enter Application Package Information** dialog box when prompted.

Mention that the figure on slide 28 shows the **Enter Application Package Information** dialog box.

Using slide 29, explain to the students the steps for installing IIS Manager.

In Step 1, when you click **Next**, it will prompt with the **Import Application Package** dialog box.

In Step 2, it confirms whether ASP.NET 4.0 is installed on your system.

In Step 3, if it is installed, click **OK**.

In Step 4, if it is not installed, click **Cancel** and then install ASP.NET 4.0.

In Step 5, after the package is installed, change the Application Pool to the ASP.NET v4.0 application pool in the IIS Manager.

Using slide 30, explain them that the figure shows the **Import Application Package** dialog box with the error.

Tell them that after the package is deployed, the Summary screen is displayed. The figure on slide 30 shows the Summary screen. After reviewing the results, click **Finish**.

Additional Information:

To know more about SetParameters.xml file, refer to the following links:

<http://www.asp.net/web-forms/overview/deployment/web-deployment-in-the-enterprise/configuring-parameters-for-web-package-deployment>
<http://msdn.microsoft.com/en-us/library/ff398068%28v=vs.110%29.aspx>

Slides 31 and 32

Let us understand how to configure WCF endpoints, bindings, and behaviors.

Configuring WCF Endpoints, Bindings, and Behaviors 1-2

- In addition to configuring Web applications, you can also configure Web services for deployment.
- The behavior:**
 - The behavior element comprises a set of settings for the behavior of an endpoint.
 - The behavior is catalogued based on their name.
 - An endpoint can be linked to a behavior based on this name.
- From .NET Framework 4 onwards, behaviors and bindings are not required to have a name.

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Configuring WCF Endpoints, Bindings, and Behaviors 2-2

- In the deployment phase:**
 - Users get the flexibility of providing endpoint and service behavior data after configuring a WCF service with the help of configuration file.
- The Binding:**

Transports	Protocol
<ul style="list-style-type: none">HTTPPipesTCPMessage Queuing	<ul style="list-style-type: none">SafetyDependabilityTransaction Flow

 - The binding is made of elements of binding where each element explains the fact or way of communicating an endpoint with the world.

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Using slide 31, tell the students to configure Web applications, they need to configure Web services for deployment.

The `behavior` element comprises a set of settings for the behavior of an endpoint. The behavior is catalogued based on their name. An endpoint can be linked to a behavior based on this name. However, from .NET Framework 4 onwards, behaviors and bindings are not required to have a name.

Using slide 32, explain that in the deployment phase, users can provide endpoint and service behavior data after configuring a WCF service with the help of configuration file.

Mention that a binding describes transports such as HTTP, Pipes, TCP, and Message Queuing. It also describes protocols such as safety, dependability, and transaction flows.

It is made of elements of binding where each element explains the fact or way of communicating an endpoint with the world.

Additional Information:

To know more about configuring WCF endpoints, bindings and behaviors, visit the following links:

<http://msdn.microsoft.com/en-us/library/ms733107>

<http://msdn.microsoft.com/en-us/library/ms733099>

<http://msdn.microsoft.com/en-us/library/ms731403>

<http://wcftutorial.net/endpoint.aspx>

Slides 33 and 34

Let us understand how to transform Web.config using Extensible Stylesheet Language Transformations (XSLT).

Transforming Web.Config Using XSLT
1-2

- ❑ When you deploy an application, the settings are stored in the Web . config file.
- ❑ However, you may be making continuous changes to the application in the staging environment and want to deploy these changes.
- ❑ The Web . config file in the staging environment will be different from the one in the production environment.
- ❑ To automatically deploy these changes in the Web . config file, you can set up a Web . config transform file.
- ❑ This file contains a number of settings that you can use to automate the deployment process.
- ❑ The transform file is associated with a build configuration of an application.

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Transforming Web.Config Using XSLT
2-2

- ❑ Following are the steps for transforming the Web . Config using XSLT:
 - Step 1** • To create a transform file, you will need to create a build configuration first. You can create a build configuration using Configuration Manager.
 - Step 2** • Verify that you have an existing transform file, if it exists, it will be indicated with the name.
 - Step 3** • If the file does not exist, then you need to create one. Right-click Web . config in the Solution Explorer and select Add Config Transforms.
 - Step 4** • Open and edit the transform file with the required changes.
 - Step 5** • Save the transform file.

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Using slide 33, explain to the students that when deploying an application, the settings are stored in the Web . config file. However, they are making continuous changes to the application in the staging environment and want to deploy these changes. The Web . config file in the staging environment will be different from the one in the production environment. To automatically deploy these changes in the Web . config file, set up a Web . config transform file. This file contains a number of settings that can use to automate the deployment process.

The transform file is associated with a build configuration of an application.

Using slide 34, explain to the students the steps for transforming the Web . config using XSLT.

In Step 1, to create a transform file, create a build configuration first. Create a build configuration using Configuration Manager.

In Step 2, verify that there is an existing transform file. If it exists, it will be indicated with the name. For example, if a build name is, **Deployed**, the transform file will be named as `Web.deployed.config`.

In Step 3, if the file does not exist, then create one. Right-click `Web.config` in the Solution Explorer and select **Add Config Transforms**.

In Step 4, open and edit the transform file with the required changes.

In Step 5, save the transform file.

Slides 35 to 37

Let us understand how to configure Azure configuration settings.

Configuring Azure Configuration Settings 1-3

- The Azure Configuration Settings are defined in the service configuration file.
- You can specify the following settings:

Azure Configuration Settings			
Number of role instances for deploying the values of any configuration settings.	Every role in the service	Thumbnails for all certificates that are associated with the given role	The Virtual Network configuration information, in case the service is part of a virtual network

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Configuring Azure Configuration Settings 2-3

- The service configuration file has the `.cscfg` default extension.
- By default, the configuration schema file is found in the following directory:
`C:\Program Files\Microsoft SDKs\Windows Azure\.NET SDK\<version>\schemas`
- The service configuration file has the following default format:

```
<ServiceConfiguration serviceName="<service-name>" osFamily="<os-family-number>" osVersion="<os-version>" schemaVersion="<schemas-version>">
<Role ...>
</Role>
<NetworkConfiguration>
</NetworkConfiguration>
</ServiceConfiguration>
```

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**Configuring Azure Configuration
Settings 3-3**

Following table lists the attributes defined in the service configuration file:

Attribute	Description	Requirement
serviceName	Defines the name of the cloud service. This name must be same as the name specified in the service definition file.	Mandatory
osFamily	Defines which Guest OS will run on role instances in the cloud service.	Optional
osVersion	Defines the version of the Guest OS.	Optional
schemaVersion	Defines the version of the Service Configuration Schema.	Optional

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Using slide 35, explain to the students that the Azure Configuration Settings can be defined in the service configuration file.

You can specify the settings that include:

- Number of role instances for deploying the values of any configuration settings
- Every role in the service
- Thumbprints for all certificates that are associated with the given role
- The Virtual Network configuration information, in case the service is part of a Virtual network

Using slide 36, explain that the service configuration file has the .cscfg default extension. By default, the configuration schema file is found in the following directory: C:\Program Files\Microsoft SDKs\Windows Azure\.NET SDK\<version>\schemas.

The service configuration file has the following default format:

```
<ServiceConfiguration serviceName=""  
osFamily="" osVersion=""  
schemaVersion="">  
<Role ...>  
...  
</Role>  
<NetworkConfiguration>  
...  
</NetworkConfiguration>  
</ServiceConfiguration>
```

Using slide 37, explain that the table lists the attributes defined in the service configuration file.

Additional Information:

To know more about configuring Azure configuration settings, visit the following links:

<http://msdn.microsoft.com/en-us/library/azure/ee405486.aspx>

<http://azure.microsoft.com/en-us/documentation/articles/cloud-services-how-to-configure/>

Slides 38 to 41

Let us understand how to implement deployment on Azure.

The image contains two screenshots of the Windows Azure management portal. Both screenshots have a blue header bar with the title 'Implementing Deployment' followed by a slide number (e.g., '1-4' or '2-4'). Below the header is a white content area containing a bulleted list of instructions. A large watermark reading 'For Aptech Content Only' is diagonally across both screenshots.

Screenshot 1-4:

- Deployment of a cloud service or application involves uploading and deploying the package and configuring to Windows Azure.

Screenshot 2-4:

- Following are the steps to upload the package in the Windows Azure management portal:
 - Select your application, or cloud service and click either the **Upload icon** or the **UPLOAD A NEW PRODUCTION DEPLOYMENT** link as shown in figure.

The screenshot shows a 'PRODUCTION' tab selected in the navigation bar. Below it, a message says 'You have nothing deployed to the production environment.' At the bottom, there is a red circle around the 'UPLOAD A NEW PRODUCTION DEPLOYMENT' button.

The image shows two slides from a presentation. The top slide is titled "Implementing Deployment 3-4" and contains a screenshot of the "Upload a package" dialog box. The dialog box has fields for "Deployment Label" (set to "Deployment 1"), "Method" (set to "Production URL"), and "Configuration" (set to "Windows Azure URL"). It also includes checkboxes for "Deploy even if one or more roles contain a single instance" and "Start deployment". The bottom slide is titled "Implementing Deployment 4-4" and lists six steps: 3. Specify a name in the DEPLOYMENT LABEL box. 4. Click FROM LOCAL or FROM STORAGE next to the BROWSE FOR FILE box under Package to select the service package file (.cspkg). 5. Similarly, under Configuration sections, select the service config file (.cscfg) to be used. 6. If your cloud service includes any roles with only one instance, select the Deploy even if one or more roles contain a single instance check box. Then, click the OK checkmark to begin deployment.

Using slide 38, explain to the students that deployment of a cloud service or application requires uploading and deploying the package and configuring to Windows Azure.

Using slide 39, explain the first step to upload the package, in the Windows Azure management portal.

In Step 1, select the application, or cloud service and click either the **Upload** icon or the **UPLOAD A NEW PRODUCTION DEPLOYMENT** link. The figure on slide 39 shows how to upload the package, in the Windows Azure management portal.

Using slide 40, explain to the students that the **Upload a package** dialog box is displayed as shown in figure.

Using slide 41, explain the next steps.

In Step 3, specify a name in the **DEPLOYMENT LABEL** dialog box.

In Step 4, click **FROM LOCAL** or **FROM STORAGE** next to the **BROWSE FOR FILE** box under **Package** to select the service package file (.cspkg).

In Step 5, under **Configuration** sections, select the service configure file (.cscfg) to be used.

In Step 6, if the cloud service includes any roles with only one instance, select the **Deploy even if one or more roles contain a single instance** check box. Then, click the **OK** checkmark to begin deployment.

Additional Information:

To know more about implementing deployment, visit the following links:

<http://azure.microsoft.com/en-in/documentation/articles/cloud-services-how-to-create-deploy/>
<http://blogs.msdn.com/b/nishasingh/archive/2012/12/05/creating-and-deploying-a-wcf-service-on-windows-azure-and-consuming-it-in-windows-8-store-app.aspx>

Slide 42

Let us understand using NuGet to manage packages.

Using NuGet to Manage Packages

NuGet:

- NuGet is a package manager for .NET as well as other Microsoft development platforms.
- Using NuGet client tools, you can produce and consume packages.
- The NuGet Gallery, which is nuget.org, acts as the central package repository for all package authors and consumers who use NuGet.
- The changes are automatically made when you add or remove a package.
- When you add a package, the changes are made to the required files, such as app.config or Web.config.
If you remove a package, the changes are immediately made to ensure that there are no leftover files.

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Using slide 42, explain NuGet to the students.

Tell them that NuGet is a package manager for .NET and other Microsoft development platforms.

NuGet client tools help to produce and consume packages. The NuGet Gallery, which is nuget.org, acts as the central package repository for all package authors and consumers who use NuGet.

Notice that the changes are automatically made when user add or remove a package.

When a package is added, the changes are made to the required files, such as app.config or Web.config. If a package is removed, then the changes are immediately made to ensure that there are no leftover files.

Additional Information:

To know more about implementing deployment, visit the following links:

<http://docs.nuget.org/docs/start-here/managing-nuget-packages-using-the-dialog>
<http://docs.nuget.org/docs/creating-packages/using-a-gui-to-build-packages>

Slides 43 to 46

Let us understand how to create and configure a NuGet package.

The image contains two screenshots from a presentation slide titled "Creating and Configuring a NuGet Package".

Screenshot 1-4: This screenshot shows a right-click context menu in Visual Studio's Solution Explorer pane. A callout box highlights the "Manage NuGet Packages" option under the "Tools" section of the menu. The menu also includes options like "File", "Edit", "View", "Analyze", "Convert", "Publish", "Scope to This", "New Solution Explorer View", "Show on Context", "Add", and "Remove".

Screenshot 2-4: This screenshot shows the "Manage NuGet Packages" window. The title bar says "NuGet Package Manager - Manage NuGet Packages". The window lists several packages: "Microsoft .NET Framework", "Microsoft .NET Framework Data Provider for ODBC", "Microsoft .NET Framework Data Provider for Oracle", "Microsoft .NET Framework Data Provider for SQL Server", "Microsoft .NET Framework Data Provider for XML", and "Microsoft .NET Framework Object Model". The right side of the window displays detailed information for the selected package, including its version (4.6.1), provider (Microsoft .NET Framework), and description.

The image shows two slides from a presentation. Both slides have a blue header with the title 'Creating and Configuring a NuGet Package' followed by a slide number (3-4 or 4-4). The first slide, titled 'Creating and Configuring a NuGet Package 3-4', contains a section titled 'Creating package:' with two bullet points. It also includes a numbered list of five steps with arrows: Step 1 (Click File → New in the Package Explorer), Step 2 (Click File → Edit Package Metadata), Step 3 (Drag the contents of the package into the Package contents pane), Step 4 (Click OK to place the file in the respective folder), and Step 5 (Save the package. Click File → Save). The second slide, titled 'Creating and Configuring a NuGet Package 4-4', contains a section titled 'Publish package:' with two bullet points. It also includes a numbered list of two steps: Step 1 (Click File → Publish. The PublishPackage dialog box will appear) and Step 2 (Enter the API key and click Publish). Both slides have a footer with the text '© Aptech Ltd. Enterprise Application Development Using Windows Azure and Web Services/Session 14'.

Creating and Configuring a NuGet Package 3-4

Creating package:

- You can download and use the **NuGet Package Explorer** for creating packages.
- Following are the basic steps for creating a package using Package Explorer:

Step 1 • Click File → New in the Package Explorer.
Step 2 • Click File → Edit Package Metadata
Step 3 • Drag the contents of the package into the Package contents pane.
Step 4 • Click OK to place the file in the respective folder.
Step 5 • Save the package. Click File → Save

Creating and Configuring a NuGet Package 4-4

Publish package:

- You need to publish the package after creating and saving the package.
- Following are the steps to publish the package:

Step 1 • Click File → Publish. The PublishPackage dialog box will appear.
Step 2 • Enter the API key and click Publish

Using slide 43, explain that NuGet runs as an extension in all versions of Visual Studio IDE starting from Visual Studio 2010 onwards.

Explain the use of **Manage NuGet Packages** option.

In the Solution Explorer pane, right-click the application name and select **Manage NuGet Packages**.

Using slide 44, explain about the Manage NuGet Packages window.

Using slide 45, tell the students the steps to download and use the **NuGet Package Explorer** for creating packages.

Explain the basic steps for creating a package using Package Explorer.

In Step 1, click **File → New** in the Package Explorer.

In Step 2, click **File → Edit Package Metadata**.

In Step 3, drag the contents of the package into the Package contents pane. The Package Explorer will attempt to analyze where it should place the content. Once it is analyzed, Package Explorer will prompt the user to place the content in the appropriate directory within the package.

In Step 4, click **OK** to place the file in the respective folder.

In Step 5, save the package. Click **File → Save**.

Using slide 46, explain to the students that after creating and saving the package, there are some steps to publish the package.

In Step 1, click **File → Publish**. The **Publish Package** dialog box will appear.

In Step 2, enter the API key and press **Publish**.

Slides 47 and 48

Let us understand how to connect to a local repository cache for NuGet.

Slide 1: Connecting to a Local Repository Cache for NuGet 1-2

- ❑ In order to avoid making unnecessary downloads, NuGet stores a cache of packages that have been downloaded earlier.
- ❑ It helps NuGet:
 - To confirm before making any new downloads.
 - To download versions that are recent and not old versions, which are already stored in the cache.
- ❑ The cache is stored in the same format as the NuGet repository, so that it is easily accessible and the code can be reused.
- ❑ When you need the code, the NuGet Package Manager will access it from the cache location and pick up the packages in the cache.

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Slide 2: Connecting to a Local Repository Cache for NuGet 2-2

- ❑ Following are the steps to add the cache as a NuGet repository:
 - Step 1** * Select **Tools → Options**.
 - Step 2** * In options, select **PackageManager** and then choose **PackageSources**.
 - * If no additional NuGet repositories have been set up, it will only display one entry.

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Using slide 47, explain to them that to avoid making unnecessary downloads, NuGet stores a cache of packages that have been downloaded earlier.

This helps NuGet confirm before making any new downloads and also helps NuGet to download versions that are recent and not old versions, which are already stored in the cache. The cache is stored in the same format as the NuGet repository, so that it is easily accessible and the code can be reused. This means that when the code is needed, the NuGet Package Manager will access it from the cache location and pick up the packages in the cache.

Using slide 48, explain the steps to add the cache as a NuGet repository.

In Step 1, select **Tools → Options**.

In Step 2, in options, select **PackageManager** and then choose **PackageSources**. If no additional NuGet repositories have been set up, it will only display one entry.

Slide 49

Let us understand how to set up your own package repository.

Setting Up Your Own Package Repository

- ❑ NuGet displays packages that may be gathered from various package sources.
- ❑ Following are the steps for adding a package source:
 - Step 1 • Click the **Settings** button in the dialog box for launching the **Options** dialog box. Ensure that the **Package Sources** node is selected in the dialog box.
 - Step 2 • Next, type the source name and the folder path and click **Add**. You will now see the package source listed under the **All** node.
 - Step 3 • Select **Install** to install any package. NuGet will install the selected package as well as other packages that are depended on the given package.

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Using slide 49, explain to them that NuGet displays packages that may be gathered from various package sources.

Explain the steps to add a package source.

In Step 1, click the **Settings** button in the dialog box for launching the **Options** dialog box. Ensure that the **Package Sources** node is selected in the dialog box.

In Step 2, type the source name and the folder path and click **Add**. It will display the package source listed under the **All** node.

In Step 3, for installing any package, select **Install** and NuGet will install the selected package as well as other packages that are depended on the given package.

Slide 50

Let us summarize the session.



The slide has a blue header bar with the word "Summary". Below it is a list of points enclosed in a white box:

- A Web application or Website project needs to be deployed or published to a Web server so that others can access and use the application.
- Visual Studio 2013 provides powerful support for packaging and deploying Web applications and services.
- In addition to Visual Studio 2013, you can also use IIS or XCopy for deployment.
- When you use Xcopy deployment, you need not install any special software on the Web server.
- Microsoft's Web Deploy tool (MSdeploy.exe) makes deployment of Web applications and Websites to IIS servers simpler and easier.
- In Windows Azure, role instances run in a cloud service.
- Cloud environments that are formed in Windows Azure can be deployed into various environments, staging environment and production environment.
- The Debug has features such as extra initialization and checking.
- The SetParameters.xml file is generated from the configuration files within the project and the Web application project file.

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Using slide 50, summarize the session. End the session, with a brief summary of what has been taught in the session.

Tell the students pointers of the session. This will be a revision of the current session and it will be related to the next session. Explain each of the following points in brief. Tell them that:

- In case of Web application deployment in large organizations two servers, which may be geographically distant, are used.
- Xcopy can be used for deploying a Microsoft ASP.NET Web Application.
- When you use Xcopy deployment, you need not install any special software on the Web server.
- In Windows Azure, role instances run in a cloud service.
- Cloud environments that are formed in Windows Azure can be deployed into various environments i.e. staging environment and production environment.
- The Debug has features such as extra initialization and checking.
- The SetParameters.xml file is generated from the configuration files within the project and the Web application project file.
- The service configuration file specifies the number of role instances for deploying the values of any configuration settings, every role in the service, and the thumbprints for all certificates that are associated with the given role.

14.3 Post-Class Activities for Faculty

You should familiarize yourself with the topics of the next session.

Tips: You can also check the Articles/Blogs/Expert Videos uploaded on the OnlineVarsity site to gain additional information related to the topics covered in the next session. You can also connect to online tutors on the OnlineVarsity site to ask queries related to the sessions.

Session 15 – Continuous Deployment

15.1 Pre-Class Activities

Before you commence the session, you should familiarize yourself with the topics of this session in-depth. You should revisit topics of the previous session for a brief review. Here, you can ask students the key topics they can recall from previous session. Prepare a question or two, which will be a key point to relate the current session objectives.

The summary of the previous session is as follows:

- In case of Web application deployment in large organizations two servers, which may be geographically distant, are used.
- Xcopy deployment can be used for deploying a Microsoft ASP.NET Web Application.
- When you use Xcopy deployment, you need not install any special software on the Web server.
- In Windows Azure, role instances run in a cloud service.
- Cloud environments that are formed in Windows Azure can be deployed into various environments: staging environment and production environment.
- The Debug has features such as extra initialization and checking.
- The SetParameters.xml file is generated from the configuration files within the project and the Web application project file.
- The service configuration file specifies the number of role instances for deploying the values of any configuration settings, every role in the service, and the thumbprints for all certificates that are associated with the given role.

15.1.1 Objectives

By the end of this session, the learners will be able to:

- Describe an overview of Git and TFS
- Explain the process of using Git in Azure
- Define and describe TFS
- Describe Azure diagnostics

15.1.2 Teaching Skills

To teach this session successfully, you should be aware of Git and TFS. Also, familiarize yourself with Azure diagnostics.

For teaching in the class, you are expected to use slides and LCD projectors.

Tips:

It is recommended that you test the understanding of the students by asking questions in between the class.

In-Class Activities:

Follow the order given here during In-Class activities.

Overview of the Session:

Give the students a brief overview of the current session in the form of session objectives.
Show the students slide 2 of the presentation.

The slide has a blue header bar with the title "Learning Objectives". Below the header is a cartoon illustration of a person sitting at a desk with a computer monitor. The main content area contains a bulleted list of learning objectives:

- Describe an overview of Git and TFS
- Explain the process of using Git in Azure
- Define and describe TFS
- Describe Azure diagnostics

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Tell the students that they will be introduced to the concept of Continuous Deployment. Inform them that this session explains the basics of Azure diagnostics, Git, and Team Foundation Server (TFS). Furthermore, this session also explains how to use Git and TFS in Windows Azure, how to connect to Visual Studio Online and Windows Azure.

15.2 In-Class Explanations

Slides 3 to 6

Let us understand Git and TFS.

The image shows two slides from a presentation. The top slide is titled "Introduction 1-4" and discusses "Software development projects". It lists three points: involves more than one developer working in a team, number of developers who access and manipulate files at the same time can result in chaos and confusion, and version control is used to avoid this. The bottom slide is titled "Introduction 2-4" and discusses "Version control systems". It lists four points: have one main repository for all project files (with a sub-point about a software repository being a location for maintaining and retrieving files), enables development team members to check in and check out files, automatically monitors file changes, and tracks when changes were made. Both slides include small icons related to development and a photo of two people working at a computer.

Introduction 1-4

- ❑ Software development projects:
 - Involves more than one developer working in a team.
 - Number of developers who access and manipulate the files at the same time, it can result in chaos and confusion. To avoid this, version control is used.

Introduction 2-4

- ❑ Version control systems:
 - Have one main repository for all the project files.
 - A software repository is a location where software packages or files are maintained and retrieved when required.
 - Enables development team members to check in and check out files.
 - Automatically monitors which users changed the files, during what date/time they were changed, and what changes were made.

Introduction 3-4

Inserting comments:

- There is also an option to insert comments for each change made so that other team members can view the history and retrieve a desired file based on the comments.

A software repository:

- It is a location where software packages or files are maintained and retrieved when required.



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Introduction 4-4

Some version control systems also enable merging changes to the same file.



The system will merge both sets of modifications, resulting in a new file when two or more developers work locally on the same file at the same time or they push the files into the main repository.

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Use slide 3 to explain version control. Tell the students that in a software development projects, there are many developers working in a team and accessing the files at the same time. This causes chaos and confusion.

Explain to them that to tackle such confusion and organize the development process, you can use version control. Version control or source control helps you to manage changes to the various items (also called as assets) in a system or project such as programs, documents, reports, and so on. You can also organize and control the changes or revisions made using version control.

Using slide 4, explain version control systems to the students. Tell them that the concept of version control systems is to have one main repository for all the project files. A software repository is a location where you can maintain and retrieve software packages or files. The development team members to make changes and then check them back in (or commit them) can check these files.

The version control system helps you to monitor the users that change the files, check the date/time they were changed, and the changes that were made.

Using slide 5, explain to the students that there is also an option to insert comments for each change made that can be viewed by other team members. They can view the history and retrieve a desired file based on the comments.

Using slide 6, explain to them that there are some version control systems that help you to merge changes to the same file. For example, when two or more developers working locally on the same file at the same time, push the files into the main repository, the system will merge both sets of modifications to create a new file.

Additional Information:

To know more about version control tools, visit the following links:

<http://oss-watch.ac.uk/resources/versioncontrol>

<http://visualstudiomagazine.com/articles/2014/04/01/source-code-control-with-git-and-mercurial.aspx>

Slide 7

Let us understand version control tools.



In slide 7, explain to the students that though the market has many version control software tools, the two most popular ones are, Git and Team Foundation Server (TFS).

Slides 8 to 12

Let us understand Git.

Git 1-5

Git

- Is an open source distributed version control system.
- Allows each developer in the team to have a copy of the local source repository and work even when there is no connectivity.
- Allows the developers to perform version control operations such as viewing or maintaining history and comparing different versions of a file without a network connection.
- Provides developers a flexible workflow for creating repositories to allow the developers to save code.
- Enables code from the local repositories to be synchronized with the software repository.

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Git 2-5

□ Following figure shows repository structure in the Git framework:

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Git 3-5

□ Git is also helpful where code is distributed across many repositories as shown in the following figure:

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Git 4-5

❑ Branch:

- Means a parallel version of the software repository.
- Each developer can publish, merge, or dispose of the branch.
- Is stored within the repository, but does not affect the primary or master branch, thus enabling one to continue working without affecting the live version.
- When the changes to be made are completed, your branch can be merged back into the master branch to publish the changes.
- The default branch in Git is called **master**.

Git 5-5

❑ Git:

- Can be used with:
 - Visual Studio
 - TFS
 - Visual Studio with third-party Git services
 - Third-party Git clients with TFS
- Provides a powerful Distributed Version Control System (DVCS) feature that allows each developer to work on a local copy of an application.
- Needs separate tools such as Visual Studio to simplify work as its user interface is complicated.

Using slide 8, explain Git to the students. Tell them that Git is an open source distributed version control system. It helps developers to have a copy of the local source repository and work even when there is no connectivity, perform version control operations such as viewing or maintaining history and compare different versions of a file without a network connection.

Then, tell them that using Git, the developers can create repositories to save code. You can synchronize the code from the local repositories with the software repository.

Using slide 9, tell them that the figure shows repository structure in the Git framework.

Using slide 10, tell the students that Git helps where code is distributed across many repositories. The figure on slide 10 shows the checkins.

Using slide 11, explain branch to the students.

Tell them that a developer can publish, merge, or dispose of the branch. A branch is referred to as a parallel version of the software repository. It is stored within the repository without affecting the primary or master branch. This helps you to continue work without affecting the live version. After completing changes, you can merge the branch back into the master branch and publish the changes. The default branch in Git is called master.

Using slide 12, explain to the students that you can use Git with:

- Visual Studio
- TFS
- Visual Studio with third-party Git services
- Third-party Git clients with TFS

Git provides a powerful Distributed Version Control System (DVCS) feature enabling the developer to work on a local copy of an application.

Tell them that the Git's user interface is complicated and needs separate tools such as Visual Studio to simplify work.

Additional Information:

To know more about Git, visit the following links:

www.git-tower.com/learn

<https://www.codeschool.com/courses/try-git>

<http://www.gitology.com/>

Slide 13

Let us understand TFS.

The screenshot shows a slide from a presentation. At the top, the word 'TFS' is displayed in a blue header bar. Below the header, there is a section with a blue background and white text. The text starts with 'TFS:' followed by a small icon of a computer monitor. It then states: 'Is a Microsoft product that covers the entire ALM including:'. Below this statement is a bulleted list of features:

- Source code management through Team Foundation Version Control (TFVC) or Git
- Reporting
- Requirements management
- Project management (for both agile software development and waterfall teams)
- Automated builds
- Lab management
- Testing
- Release management capabilities

At the bottom of the slide, there is some small text: '© Aptech Limited', 'Enterprise Application Development Using Windows Azure and Web Services/Session 13', and a small number '13'.

Using slide 13, tell the students that TFS is a Microsoft product that covers the entire Application Lifecycle Management including:

- Source code management through Team Foundation Version Control (TFVC) or Git
- Reporting

- Requirements management
- Project management (for both agile software development and waterfall teams)
- Automated builds
- Lab management
- Testing
- Release management capabilities

Additional Information:

To know more about TFS, visit the following links:

<http://msdn.microsoft.com/en-in/vstudio/ff637362.aspx>

<http://msdn.microsoft.com/en-IN/library/ms181238%28v=vs.90%29.aspx>

<http://www.visualstudio.com/en-us/products/tfs-overview-vs.aspx>

Slides 14 and 15

Let us understand difference between Git and TFS.

Difference between Git and TFS 1-2

Following is the key difference between Git and TFS:

Git	TFS
• Is a distributed version control tool.	• Is a centralized version control tool.

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Difference between Git and TFS 2-2

Following are the two types of Version Control Systems:

Centralized Version Control System <ul style="list-style-type: none">• A single server acts as the code repository.• In this approach, all operations take place on the server.• The operations need a connection to the server.• As a developer, you check out a working copy, which is a snapshot of the code at a given point in time.	Distributed Version Control System <ul style="list-style-type: none">• There is no central repository.• You define a master repository and perform a clone operation on it.• The developer clones the repository (that is, makes a duplicate copy of it) on the local machine.• This clone contains all the data in the repository.• Once this is done, the developer can work offline, and work from anywhere.
---	---

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Using slide 14, explain the difference between Git and TFS to the students. Tell them that TFS is a centralized version control tool and Git is a distributed version control tool.

Using slide 15, explain the two types of version control to the students.

Tell them that in a centralized version control, a single server acts as the code repository and all operations take place on the server. The operations need a connection to the server.

The developer checks out a working copy, which is a snapshot of the code at a given point in time.

Now, tell them that in a distributed version control system, there is no central repository. A master repository is defined to perform a clone operation on it. The developer makes a duplicate repository on the local machine that contains all the data in the repository and can work offline or from anywhere.

Slides 16 and 17

Let us understand installing Git.

Installing Git 1-2

❑ Steps to install Git for Windows are:



Step 1 • Go to the <http://microsoft.github.io/> or <http://git-scm.com/downloads> and download Git for Windows.
Step 2 • Click the downloaded executable file to begin the installation process. Figure shows the installation wizard.
Step 3 • Follow the step-by-step procedure as shown in the Installation wizard.
Step 4 • Click Finish to exit the setup.

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Installing Git 2-2

❑ Steps to create a local repository are:



Step 1 Go to the folder containing your software project.
Step 2 Right-click and select Git Gui from the shortcut menu. The Git Gui dialog box is displayed as shown in figure.
Step 3 Click Create New Repository and specify the folder name as shown in figure. The repository will be created.

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Using slide 16, tell them the steps to install Git for Windows.

In Step 1, go to the <http://msysgit.github.io/> or <http://git-scm.com/download/win> and download Git for Windows.

In Step 2, click the downloaded executable file to begin the installation process.

In Step 3, follow the step-by-step procedure as shown in the installation wizard.

In Step 4, click **Finish** to exit the setup.

Also, tell them that the figure on slide 16 shows the installation wizard.

Using slide 17, explain to the students the steps to create a local repository.

In Step 1, go to the folder containing your software project.

In Step 2, right-click and select **Git Gui** from the shortcut menu. The figure on slide 17 displays the **Git Gui** dialog box.

In Step 3, click **Create New Repository** and specify the folder name. The repository will be created as displayed in the figure on slide 17.

Additional Information:

To know more about installing Git, visit the following links:

<http://git-scm.com/book/en/v2/Getting-Started-Installing-Git>

<http://www.siteground.com/tutorials/git/installation.htm>

In-Class Question:

After you finish explaining Git and TFS, you will ask the students an In-Class question. This will help you in reviewing their understanding of the topic.



What are key difference between Git and TFS?

Answer:

TFS is a centralized version control tool whereas Git is a distributed version control tool. TFS is proprietary product by Microsoft whereas Git is open source.

Slide 18

Let us understand publishing from Git to Azure Web sites.



Publishing from Git to Azure Web Sites

Azure Web Sites:

- Can host applications created in any of the one supported programming languages or frameworks such as ASP.NET, PHP, and so on.
- Provides support for continuous deployment through source control tools such as Git and TFS.

Publishing content from Git to Azure Web Sites involves a series of steps:

- Create a local repository as described earlier.
- Add a Web page to the local repository.
- Enable the Web site repository.
- Deploy the project.

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Using slide 18, explain to the students that Azure Web Sites can host applications created in any of the one supported programming languages or frameworks such as ASP.NET, PHP, and so on. It also provides support for continuous deployment through source control tools such as Git and TFS.

Explain to them the steps involved to publish content from Git to Azure Web Sites.

Tell that first you will need to create a local repository to carry out tasks. Secondly, you will need to add a Web page to the local repository. This will enable the Web site repository to deploy the project.

Additional Information:

To know more about publishing from Git to Azure Web sites, visit the following links:

<http://rickrainey.com/2014/01/21/continuous-deployment-github-with-azure-web-sites-and-staged-publishing/>

<http://blog.davidebbo.com/2013/04/publishing-to-azure-web-sites-from-any.html>

<http://blogs.msdn.com/b/kaevans/archive/2014/03/31/deploying-an-azure-web-site-using-git-and-continuous-integration.aspx>

Slides 19 and 20

Let us understand adding a Web Page to the local repository.

Adding a Web Page to the Local Repository 1-2

Following are the steps to add a Web page to the repository:

- Step 1** Create an HTML file named `home.html` in the root of the Git repository (for example, the `Source Codes` repository created earlier).
- Step 2** Add the following text in the HTML file and save it:
`<html>
Hi, a demo using Git.
</html>`
This is now a Web page.
- Step 3** Right-click the repository folder, `Source Codes`, and click **Git Bash**. The Git Bash emulation is displayed which allows you to run Git from the command line.

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Adding a Web Page to the Local Repository 2-2

- Step 4** Type the following command to add the `home.html` file to the repository:
`git add home.html`
The file will be added but the repository is still not committed.
- Step 5** Commit the change to the repository using the following command:
`git commit -m "Added home.html to the local repository"`
The file will be successfully committed into the repository.

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Using slide 19 and 20, explain the steps to add a Web page to the repository.

In Step 1, create an HTML file named `home.html` in the root of the Git repository (for example, the `Source codes` repository created earlier).

In Step 2, add the text in the HTML file and save it.

In Step 3, right-click the repository folder, `Source codes`, and click **Git Bash**. The Git Bash emulation is displayed which allows you to run Git from the command line.

In Step 4, type the command to add the `home.html` file to the repository. The file will be added but the repository is still not committed.

In Step 5, commit the change to the repository using the command. The file will be successfully committed into the repository.

Slide 21

Let us understand enabling the Web Site repository.

The slide has a blue header bar with the title "Enabling the Web Site Repository". Below the header, there is a list of steps:

- Consider that you have created and hosted a site named **sampledemoweb** on **Azure Web Sites**.
- Steps to enable a Git repository for a Web site by using the Azure portal are:
 - Step 1** • Login to the Azure portal.
 - Step 2** • Select **WEB SITES** on the left of the page and select the Web site **sampledemoweb** as shown in figure.
 - Step 3** • Select the **DASHBOARD** tab.
 - Step 4** • Click **Set up deployment from source control** in the quick glance section to enable a repository.
 - Step 5** • Select **LocalGit** and click **Next**. You may be asked to create user credentials for connecting to the repository in the future.

At the bottom of the slide, there is a copyright notice: © Aptech Ltd. Enterprise Application Development Using Windows Azure and Web Services Version 1.5 21

Using slide 21, tell the students that the next task is to enable the Web site repository. Now tell them to consider that you have created and hosted a site named **sampledemoweb** on **Azure Web Sites**.

Explain the steps to enable a Git repository for a Web site by using the Azure portal.

In Step 1, login to the Azure portal.

In Step 2, select **WEB SITES** on the left of the page and select the Web site **sampledemoweb**.

In Step 3, select the **DASHBOARD** tab.

In Step 4, click **Set up deployment from source control** in the quick glance section to enable a repository. This will launch the **SET UP DEPLOYMENT** dialog box.

In Step 5, select **LocalGit** and click **Next**. You may be asked to create user credentials for connecting to the repository in the future.

Following this step, you will see a message informing you that the repository is ready.

Slides 22 to 24

Let us understand deploying and troubleshooting.

Deploying and Troubleshooting 1-3

After you create and enable a repository, the next task is to deploy your project.

Steps used to publish the Web site to Azure Web Sites using Local Git are:

Step 1

Launch the Bash emulation window and type the following command:

```
git remote add azuresite  
https://aptechuser@sampledemoweb.scm.azurewebsites.net:443/sampledemoweb.git
```

The purpose of the remote command is to add a named reference or alias to a remote repository.

Here, you have specified 'azuresite' as a reference for your Azure Web Site repository.

The remote Web repository is also called **remote** for short.

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Deploying and Troubleshooting 2-3

Step 2

Type the following command to push the repository contents from the local repository to the 'azuresite' remote:

```
git push azuresite master
```

The contents of the local repository will be pushed to the portal.

Step 3

Click the **BROWSE** link at the bottom of the portal to confirm that the deployment of `home.html` was successful.

The page displays the text that you had added into `home.html`.

Following figure shows the Web page added from the local Git repository:



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Deploying and Troubleshooting 3-3

Step 4

Edit the contents of the HTML file, home.html, to add 'Goodbye. Git test done' and save the file.

To add and commit the changes, launch the Bash emulation window and type the commands as shown:

```
git add index.html  
git commit -m "Farewell"  
git push azuresite master
```

Press Ctrl+F5 and refresh the browser displaying the portal. The page shows the changes made to the HTML file as shown in the following figure:



The screenshot shows a browser window with the URL <http://imphub-0-0-0-0.azuresite.windows.net>. The page content is "Goodbye. Git test done."

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Using slide 22 to 24, tell the students that on creating and enabling a repository, you will now deploy your project.

Explain to them the steps to publish the Web site to Azure Web Sites using Local Git.

In Step 1, launch the Bash emulation window and type the command.

In Step 2, type the command to push the repository contents from the local repository to the 'azuresite' remote. The contents of the local repository will be pushed to the portal.

In Step 3, click the **BROWSE** link at the bottom of the portal to confirm that the deployment of home.html was successful. The page displays the text that you had added into home.html.

The figure on slide 23 shows the Web page added from the local Git repository.

In Step 4, edit the contents of the HTML file, home.html, to add 'Goodbye. Git test done' and save the file. To add and commit the changes, launch the Bash emulation window, and type the commands.

Press Ctrl+F5 and refresh the browser displaying the portal. The page shows the changes made to the HTML file as shown in the figure on slide 24.

Slide 25

Let us understand troubleshooting.

Troubleshooting

Table lists the common errors or problems faced by developers while publishing an Azure Web site using Git:

Symptom	Cause	Solution
Trouble in resolving host 'hostname'.	This error occurs if incorrect address information is entered when creating the 'azuresite' remote.	<ul style="list-style-type: none"> • To list all remotes with the associated URL, use the <code>git remote -v</code> command. • Check if the correct URL for 'azuresite' remote is entered. • Use the correct URL to remove and recreate this remote.
No refs in common and none specified. Specify a branch such as master.	This error occurs when a branch performing a Git push operation is not specified and the push default value used by Git is not set.	Repeat the push operation by specifying the master branch. For example: <code>git push azuresite master</code>
git: error: [branch.name] does not match any	This error occurs when a branch other than master on the 'azuresite' remote is pushed.	Repeat the push operation by specifying the master branch. For example: <code>git push azuresite master</code>

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Using slide 25, tell the students that the even after following all the steps, you may face some errors or issues while working with local Git repositories and Azure Web sites.

Tell them that the table lists the common errors or problems faced by developers while publishing an Azure Web site using Git.

Additional Information:

To learn more about the errors that can occur while publishing from Git to Azure Web sites and rectify them, visit the following links:

<http://azure.microsoft.com/en-in/documentation/articles/web-sites-publish-source-control/#Step8>

<http://blogs.msdn.com/b/benjaminperkins/archive/2014/04/01/why-can-t-i-publish-my-web-site-to-windows-azure-web-sites.aspx>

In-Class Question:

After you finish explaining publishing from Git to Azure Web sites, you will ask the students an In-Class question. This will help you in reviewing their understanding of the topic.



Name some of the programming languages that support Azure Web Sites.

Answer:

ASP.NET and PHP are programming languages that support Azure Web Sites.

Slides 26 to 28

Let us understand using TFS.

Using TFS 1-3

- ❑ Developers often use TFS for source control, bug tracking, requirements gathering and managing the complete lifecycle of software development.
- ❑ Following are the two ways to work with TFS:
 - On-premises**
 - Online**
(which is a cloud service hosted by Microsoft)
The online version is called Visual Studio Online (VSO).

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Using TFS 2-3

- ❑ The TFS cloud service is backed by Microsoft's cloud platform, Windows Azure.
- ❑ No need to download or install any server or SDKs to work with VSO.
- ❑ Log in using your Microsoft Account and start developing.
- ❑ You can access the TFS service at the URL: tfs.visualstudio.com.
- ❑ It publishes the build for connecting Windows Azure Web site whenever a new check-in is devised.

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Using TFS 3-3

- ❑ Steps to set up a cloud service, build, and deploy to Azure by using VSO are:
 - Step 1** • Connect to Visual Studio Online.
 - Step 2** • Connect the project to Azure.
 - Step 3** • Make corrections and prompt a rebuild and redeployment.

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Using slide 26, explain to the students that developers use TFS for source control, bug tracking, requirements gathering, and managing the complete lifecycle of software development.

Tell them that the two ways to work with TFS are on-premises and online.

Explain that online is a cloud service hosted by Microsoft and is called Visual Studio Online (VSO).

Using slide 27, explain TFS cloud service to the students. Tell them that the TFS cloud service is backed by Microsoft's cloud platform, Windows Azure. There is no need to download or install any server or SDKs to work with VSO.

All you need to do is log in using your Microsoft Account and start developing. You can access the TFS service at the URL: tfss.visualstudio.com. It publishes the build for connecting Windows Azure Web site whenever a new check-in is devised.

Using slide 28, explain to them that to set up a cloud service, build, and deploy to Azure by using VSO. Tell them the steps.

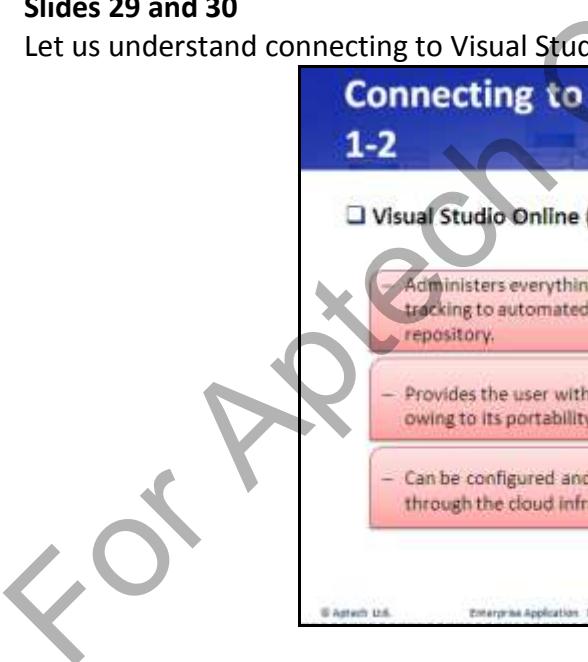
In Step 1, connect to Visual Studio Online.

In Step 2, connect the project to Azure.

In Step 3, make corrections and prompt a rebuild and redeployment.

Slides 29 and 30

Let us understand connecting to Visual Studio Online.



Connecting to Visual Studio Online

1-2

Visual Studio Online (VSO):

- Administers everything from cloud-based ALM solutions, issuing tracking to automated builds and load testing, and hosting code repository.
- Provides the user with the freedom to use applications from anywhere owing to its portability.
- Can be configured and installed on a single server by enabling users through the cloud infrastructure.

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System Requirements for linking VSO with Windows Azure:

- Visual Studio Online can be linked to Windows Azure. Ensure these basic requirements in order to get it up and running:

Pay-As-You-Go subscription <ul style="list-style-type: none">• You cannot link Windows Azure subscriptions to MSDN subscriber benefits.• Hence, you need to create a new Pay-As-You-Go subscription.	Microsoft Account <ul style="list-style-type: none">• The Microsoft Account that you use for Visual Studio Online must be the Co-Administrator or Service Administrator on the subscription.
--	---

- Then, add or adjust account users in Visual Studio Online.

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Using slide 29, explain to the students the VSO administers cloud-based ALM solutions, issuing tracking to automated builds and load testing and hosting code repository. It also provides the user with the freedom to use applications from anywhere. The cloud infrastructure enables users to configure and install it on a single server.

Using slide 30, explain them that VSO can be linked to Windows Azure.

Tell them that you must ensure some basic requirements to get it up and running. The basic requirements are pay-as-you-go subscription and Microsoft account.

Explain that pay-as-you-go subscription cannot link Windows Azure subscriptions to MSDN subscriber benefits. You need to create a new pay-as-you-go subscription.

Explain that Microsoft account used for Visual Studio Online must be the Co-Administrator or Service Administrator on the subscription.

Slides 31 and 32

Let us understand linking Visual Studio Online to Windows Azure subscription.

Linking Visual Studio Online to Windows Azure Subscription 1-2

□ Steps to link Visual Studio Online to Windows Azure Subscription:

- Step 1 • Logon to the Windows Azure subscription at <https://manage.windowsazure.com> with the same login as the owner of Visual Studio Online tenant.
- Step 2 • Click Visual Studio Online.
- Step 3 • Click Create or Link a Visual Studio Online Account and a new menu will open.

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Linking Visual Studio Online to Windows Azure Subscription 2-2

- Step 4 • Next, click Link to Existing.
• Here, you will have to confirm the Visual Studio Online tenant that is displayed is correct.
- Step 5 • Pick the type of subscription for Visual Studio Online services.
• At this stage, the account can be unlinked or relinked to a different subscription.
- Step 6 • Click Link Account. Windows Azure will show a confirmation whether it is linking the Visual Studio Online tenant.

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Using slide 31 and 32, tell the students the steps to link Visual Studio Online to Windows Azure subscription.

In Step 1, logon to the Windows Azure subscription at <https://manage.windowsazure.com> with the same login as the owner of Visual Studio Online tenant.

In Step 2, click **Visual Studio Online**.

In Step 3, click **Create or Link a Visual Studio Online Account** and a new menu will open.

In Step 4, next, click **Link to Existing**. Here, you will have to confirm the Visual Studio Online tenant that is displayed is correct.

In Step 5, pick the type of subscription for Visual Studio Online services. At this stage, the account can be unlinked or relinked to a different subscription.

In Step 6, click **Link Account**. Windows Azure will show a confirmation whether it is linking the Visual Studio Online tenant.

Slides 33 and 34

Let us understand performing project check-in.

The image contains two slides from a presentation, both titled "Performing Project Check-in".

Slide 1: Performing Project Check-in 1-2

Section: Steps to perform a project check-in are:

- Step 1**: Launch Visual Studio Online.
- Step 2**: Open an existing solution to be deployed or else, create a new one.
- Step 3**: Using Solution Explorer pane, open the shortcut menu for the solution.
- Step 4**: Click Add Solution to Source Control. The Add Solution to Source Control dialog box is displayed.
 - You can choose to accept the defaults or customize various options.

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Slide 2: Performing Project Check-in 2-2

Section: Steps to perform a project check-in are:

- Step 5**: Select OK when done.
 - After it finishes adding, the Solution Explorer displays source control icons.
- Step 6**: To perform the check in process, open the shortcut menu for the solution once again.
 - This time you will see a new option, **Check In**.
 - Click the **CheckIn** option on the shortcut menu.
- Step 7**: Then, in the Pending Changes area of the Team Explorer, type a comment for check in and click **Check In**.
 - While checking in, observe the options that have been selected.
 - If certain changes are not included, click **Include All links**.

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Using slide 33 and 34, explain to the steps to perform a project check-in.

In Step 1, launch Visual Studio Online.

In Step 2, open an existing solution to be deployed or else, create a new one.

In Step 3, using Solution Explorer pane, open the shortcut menu for the solution.

In Step 4, click **Add Solution to Source Control**. The **Add Solution to Source Control** dialog box is displayed. You can choose to accept the defaults or customize the various options.

In Step 5, select **OK** when done. After it finishes adding, the Solution Explorer displays source control icons.

In Step 6, to perform the check in process, open the shortcut menu for the solution once again. This time you will see a new option, **Check In**. Click the **Check In** option on the shortcut menu.

In Step 7, then, in the **Pending Changes** area of the Team Explorer, type a comment for the check-in and click the **Check In** button. While checking in, observe the options that have been selected. If certain changes are not included, click **Include All links**.

Tell them that the project will be successfully checked in.

Slides 35 and 36

Let us understand connecting to Windows Azure.

Connecting to Windows Azure 1-2

The project will be successfully checked in after following the steps:

- You can now connect the team project to Azure after you have a VSO project ready with some source code in it.
- The basic steps to be followed are as follows:

Step 1 <ul style="list-style-type: none">• Go to the Azure portal and choose Website or cloud service.• You might need to create a new one by choosing '+' or Add icon which is situated at the bottom left.• Then, you will have to choose the Cloud Service or Website and then click Quick Create.	Step 2 <ul style="list-style-type: none">• Click Set up publishing with Visual Studio Online.	Step 3 <ul style="list-style-type: none">• Type the name of the Visual Studio Online account in the text box.
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Connecting to Windows Azure 2-2

Step 4 <ul style="list-style-type: none">• Click Authorize Now link. At this stage, you may need to sign in to authorize.	Step 5 <ul style="list-style-type: none">• When the OAuth pop-up dialog box appears, select Accept for authorizing Azure to configure the team project in VSO.	Step 6 <ul style="list-style-type: none">• Once authorization is successful, you will see a drop-down list that has names of all the Visual Studio Online team projects.• Choose the appropriate team project that you click the wizard's checkmark button.• Once the project is connected, instructions to cross-check the changes will appear.• The next time you login to Visual Studio Online, it will build and deploy the project to Azure.
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Using slide 35 and 36, explain to the students that after you have a VSO project ready with some source code in it, you can now connect the team project to Azure. Explain the basic steps to connect to Windows Azure.

In Step 1, go to the Azure portal. Here, you will have to choose the Web site or cloud service. You might need to create a new one by choosing '+' or **Add** icon which is situated at the bottom left. Then, you will have to choose the Cloud Service or Web Site and then click **Quick Create**.

In Step 2, click **Set up publishing with Visual Studio Online**.

In Step 3, type the name of the Visual Studio Online account in the text box.

Using slide 36, explain that the next steps.

In Step 4, click **Authorize Now** link. At this stage, you may need to sign in to authorize.

In Step 5, when the OAuth pop-up dialog box appears, select **Accept** for authorizing Azure to configure the team project in VSO.

In Step 6, once authorization is successful, you will see a drop-down list that has names of all the Visual Studio Online.

Slides 37 to 39

Let us understand rebuilding and redeploying.

The slide has a blue header bar with the title 'Rebuilding and Redeploying 1-3'. Below the header, there is a question: '❑ Steps to activate a rebuild and redeploy of the project are:'. Three steps are listed in a vertical stack:

- Step 1
 - Click the Source Control Explorer link in the Team Explorer pane of Visual Studio Online.
- Step 2
 - Browse through, select, and open your solution file.
- Step 3
 - Choose any file, make changes to it, and save the file.

At the bottom of the slide, there is a footer with the text: '© Aptech Ltd.', 'Enterprise Application Development Using Windows Azure and Web Services/Session - 15', and '37'.

Rebuilding and Redeploying 2-3

- Step 4
 - In Team Explorer, click **Pending Changes** and type an appropriate comment for the changes made.
- Step 5
 - Select **Check In**.
- Step 6
 - Return to the Team Explorer home page using the **Home** button.
- Step 7
 - Choose the **Builds** link to view the builds in progress. The Team Explorer shows that a build has been triggered for your check-in.

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Rebuilding and Redeploying 3-3

- Step 8
 - Select the name and double-click to open it. This file will provide a detailed information of the progress of the build.
 - You can view the build definition that was created when you link TFS to Azure.
- Step 9
 - Select the shortcut menu to view the build definition and select **Edit Build Definition**.
 - In the **Trigger** tab, you can view the build definition.
 - The definition has been set to build whenever you check-in.
 - In the **Process** tab, you will be able to view the deployment environment. Here, you will notice the name of the cloud service.

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Using slide 37 to 39, explain to the students the steps activate a rebuild and redeploy of the project.

In Step 1, click the Source Control Explorer link in the Team Explorer pane of Visual Studio Online.

In Step 2, browse through, select, and open your solution file.

In Step 3, choose any file, make changes to it, and save the file.

In Step 4, in Team Explorer, click **Pending Changes** and type an appropriate comment for the changes made.

In Step 5, select **Check In**.

In Step 6, return to the Team Explorer home page using the **Home** button.

In Step 7, choose the **Builds** link to view the builds in progress. The Team Explorer shows that a build has been triggered for your check-in.

In Step 8, select the name and double-click to open it. This file will provide a detailed information of the progress of the build. You can view the build definition that was created when you link TFS to Azure.

In Step 9, select the shortcut menu to view the build definition and select **Edit Build Definition**. In the **Trigger** tab, you can view the build definition. Here, you will see that, by default, the definition has been set to build whenever you check-in. In the **Process** tab, you will be able to view the deployment environment. Here, you will notice the name of the cloud service.

Additional Information:

To know more about connecting to Visual Studio Online, visit the following links:

<http://www.visualstudio.com/en-us/get-started/connect-to-vs.aspx>

<http://www.visualstudio.com/get-started>

<http://www.codeguru.com/tools/beginners-guide-to-visual-studio-online.html>

Slides 40 to 42

Let us understand Azure diagnostics.

Azure Diagnostics 1-8

- ❑ A Windows Azure hosted service may often consist of several instances of roles.
- ❑ These instances may run 24 hours in a remote Windows Azure datacenter.
- ❑ It is essential to monitor these instances non-intrusively in order to detect failure and take suitable measures.
- ❑ To do this, diagnostics is often performed for Azure hosted services and applications.

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The image shows two slides from a presentation titled "Enterprise Application Development Using Windows Azure and Web Services".

Azure Diagnostics 2-8

Windows Azure Diagnostics	The Windows Azure Diagnostics Library
<ul style="list-style-type: none">Enables developers to collect and analyze diagnostic data from a worker role or Web role running in Azure.	<ul style="list-style-type: none">Is built into Windows Azure SDK for .NET.Developers can configure Diagnostics either before deployment or at runtime within Visual Studio 2013 using the Azure SDK.

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Azure Diagnostics 3-8

Through Visual Studio, developers:

- Can customize the diagnostics data that is collected for a role that runs in Azure.
- Need to change diagnostics settings in Visual Studio by changing the configuration file (`diagnostics.wadcfg`) so that when they next deploy their cloud service, the new settings are automatically reflected.

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Using slide 40, explain to the students that a Windows Azure hosted service may often consist of several instances of roles. These instances may run 24 hours in a remote Windows Azure datacenter. You need to monitor these instances non-intrusively to detect failure and take suitable measures. Diagnostics is performed for Azure hosted services and applications.

Using slide 41, explain to them the Windows Azure Diagnostics and Windows Azure Diagnostics library.

Tell them that the Windows Azure Diagnostics helps the developers to collect and analyze diagnostic data from a worker role or Web role running in Azure.

Also, tell them that the Windows Azure Diagnostics library is built into Windows Azure SDK for .NET. This helps the developers to configure Diagnostics either before deployment or at runtime within Visual Studio 2013 using the Azure SDK.

Using slide 42, explain to them that using Visual Studio, developers can customize the diagnostics data that is collected for a role that runs in Azure. You can change diagnostics settings in Visual Studio by changing the configuration file (diagnostics.wadcfg), so that when you deploy the cloud service, the new settings are reflected.

Slides 43 to 47

Let us understand more about Azure diagnostics.

The image contains two screenshots of the Azure Diagnostics configuration interface in Visual Studio:

Screenshot 1 (Step 1): A step-by-step guide. Step 1: Click Properties on the shortcut menu of the role and select the Configuration tab.

Screenshot 2 (Step 2): A screenshot of the 'Configuration' tab in the Azure Diagnostics properties window. It shows the 'Diagnostics' section with the 'Enable Diagnostics' checkbox selected. Other options like 'Log only', 'All information', and 'Custom place' are also visible. Below the checkbox, there's a note: 'Specify the storage account credentials for the Diagnostics results'. At the bottom, there are checkboxes for 'Connection attempt' and 'Update storage account connection string for Diagnostics and Caching with Windows Azure'.

Azure Diagnostics 6-8

Step 5

- Click Custom plan button to customize the settings and then, click Edit. This displays the Diagnostics configuration dialog box containing tabs for each source of diagnostic data.

Step 4

- Set the log level to one of the following values (in order from least information to most): Critical, Error, Warning, Information, or Verbose.

Step 3

- Type a value for the buffer size and transfer period for application logs.
- Applications generate application logs using the System.Diagnostics API.
- In order to generate data in these logs from your application code, you need to add a reference to System.Diagnostics.dll, and use one of the static methods defined in the Trace class.

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Azure Diagnostics 7-8

Step 6

- Select the Event log tab and then, select the check boxes for the types of events that you want to track.
- The categories that are displayed correspond to various filters in the Windows Event Viewer.
- Again, set the log level to one of the following values (in order from least information to most): Critical, Error, Warning, Information, or Verbose.

Step 7

- Click the Performance counters tab and select the check boxes for the performance counters that you want to track.
- To track a performance counter that is not in the list, enter it by using the suggested format and click Add.

Step 8

- Click the Infrastructure logs tab and specify the settings that you want. The logs indicates settings pertaining to the infrastructure of Azure Diagnostics.

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Azure Diagnostics 8-8

Step 9

- Finally, click the Log directories tab, specify the data collected from log directories for IIS requests and crash dumps, and then click OK to close the dialog box.

Step 10

- You need to re-deploy your cloud service and test it.
- There are two ways in which one can view the diagnostics data, namely, a report generated by Visual Studio 2013 or through tables in the storage account.

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Using slides 43 to 47, explain to the students the steps to configure diagnostics in Visual Studio 2013.

In Step 1, click **Properties** on the shortcut menu of the role and select the **Configuration** tab.

In Step 2, in the **Diagnostics** section, select the **Enable Diagnostics** check box if it is not already selected.

In Step 3, click **Custom plan** option button to customize the settings and then, click **Edit**. This displays the **Diagnostics configuration** dialog box containing tabs for each source of diagnostic data.

In Step 4, set the log level to one of the following values (in order from least information to most): **Critical**, **Error**, **Warning**, **Information**, or **Verbose**.

In Step 5, type a value for the buffer size and transfer period for application logs. Applications generate application logs using the `System.Diagnostics` API. In order to generate data in these logs from your application code, you need to add a reference to `System.Diagnostics.dll`, and use one of the static methods defined in the `Trace` class.

In Step 6, select the **Event logs** tab and then, select the check boxes for the types of events that you want to track. The categories that are displayed correspond to the various filters in the Windows Event Viewer. Again, set the log level to one of the following values (in order from least information to most): **Critical**, **Error**, **Warning**, **Information**, or **Verbose**.

In Step 7, next, click the **Performance counters** tab and select the check boxes for the performance counters that you want to track. To track a performance counter that is missing in the list, enter it by using the suggested format and click **Add**.

In Step 8, next, click the **Infrastructure logs** tab and specify the settings that you want. The logs indicate settings pertaining to the infrastructure of Azure Diagnostics.

In Step 9, finally, click the **Log directories** tab, specify the data collected from log directories for IIS requests and crash dumps, and then click **OK** to close the dialog box.

In Step 10, re-deploy your cloud service and test it.

There are two ways in which one can view the diagnostics data, namely, a report generated by Visual Studio 2013 or through tables in the storage account.

Slides 48 and 49

Let us summarize the session.

Summary 1-2

- ❑ Git is a distributed version control system that allows each developer to have a copy of the local source repository and work without connectivity.
- ❑ TFS is a Microsoft product that covers the entire Application Lifecycle Management and provides users with the support for distributing source control.
- ❑ The key difference between Git and TFS is that TFS is a centralized version control tool, whereas Git is a distributed version control tool.
- ❑ Publishing content from Git to Azure Websites involves tasks such as, adding a Web page to the local repository, enabling the Website repository, and deploying the project.

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Summary 2-2

- ❑ The online version of TFS is called Visual Studio Online (VSO).
- ❑ Visual Studio Online administers everything from cloud-based ALM solution, issuing tracking to automated builds and load testing and hosting code repositories.
- ❑ Windows Azure Diagnostics enables developers to collect and analyze diagnostic data from a worker role or Web role running in Azure.
- ❑ The Windows Azure Diagnostics library is built into Windows Azure SDK for .NET.

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Using slide 50, you will summarize the session. You will end the session, with a brief summary of what has been taught in the session.

Tell the students pointers of the session. This will be a revision of the current session and it will be related to the next session.

Explain each of the following points in brief. Tell them that:

- Git is a distributed version control system that allows each developer to have a copy of the local source repository and work without connectivity.
- TFS is a Microsoft product that covers the entire Application Lifecycle Management and provides users with the support for distributing source control.
- The key difference between Git and TFS is that TFS is a centralized version control tool, whereas Git is a distributed version control tool.
- Publishing content from Git to Azure Web Sites involves tasks such as, adding a Web page to the local repository, enabling the Web site repository, and deploying the project.
- The online version of TFS is called Visual Studio Online (VSO).
- Visual Studio Online administers everything from cloud-based ALM solution, issuing tracking to automated builds and load testing and hosting code repositories.
- Windows Azure Diagnostics enables developers to collect and analyze diagnostic data from a worker role or Web role running in Azure.
- The Windows Azure Diagnostics library is built into Windows Azure SDK for .NET.

15.3 Post-Class Activities for Faculty

You should familiarize yourself with the topics of the next session.

Tips: You can also check the Articles/Blogs/Expert Videos uploaded on the OnlineVarsity site to gain additional information related to the topics covered in the next session. You can also connect to online tutors on the OnlineVarsity site to ask queries related to the sessions.