

Working with Cloud Platform Services

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Working with Cloud Platform Services

Learner's Guide

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APTECH LIMITED

Contact E-mail: ov-support@onlinevarsity.com

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.

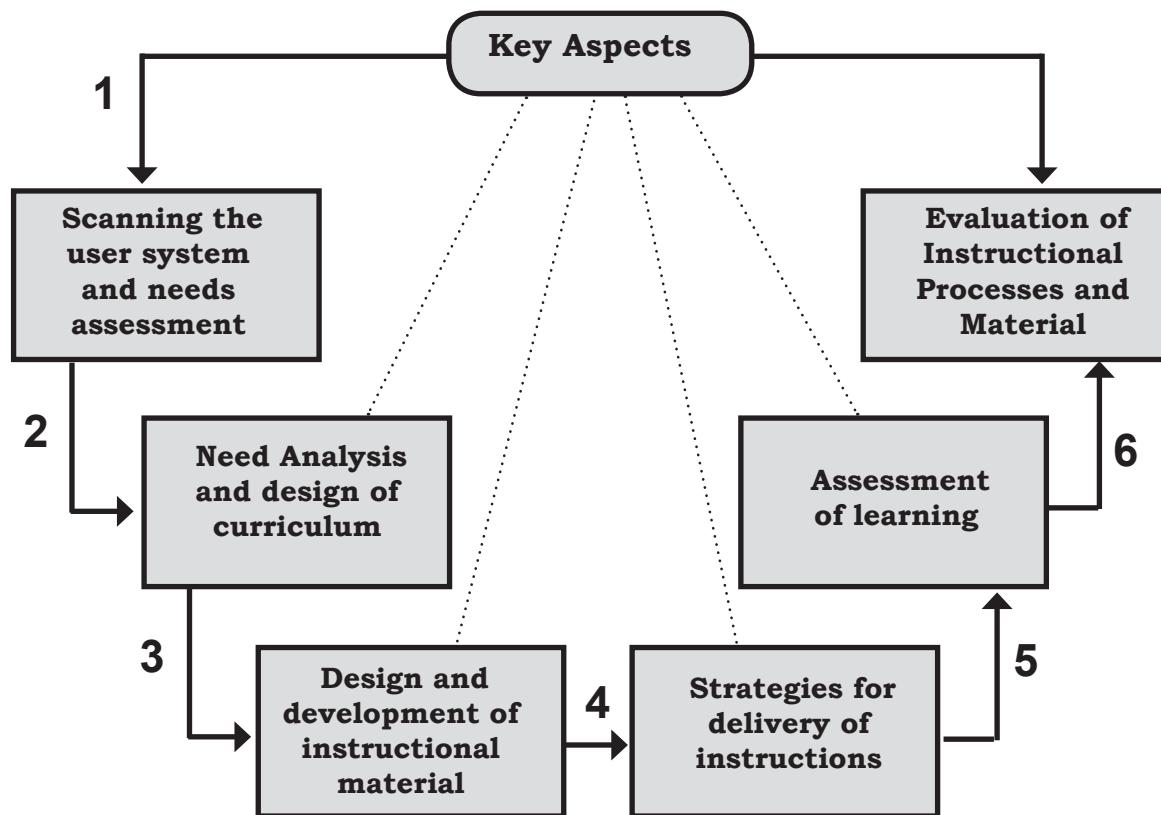
➤ Evaluation of instructional process and instructional materials

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



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Preface

Cloud computing involves the delivery of software, platforms, and infrastructure as services through the Internet or networks. The three delivery models commonly used in cloud computing are, Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS).

The book introduces cloud computing, explores the three delivery models, and discusses the services offered by the enterprise cloud computing vendor, Salesforce. The book then explains Windows Azure, which is one of the most popular PaaS products. Windows Azure is a Microsoft offering that provides an application platform using which users can develop and deploy applications to the cloud. The book then introduces Google's cloud computing environment, Google App Engine. Finally, the book describes about the prevailing challenges and threats to cloud computing and describes the concepts of cloud storage, open source clouds, and mobile cloud computing.

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

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Session - 1

Cloud Platform Services and Salesforce

Welcome to the Session, **Cloud Platform Services and Salesforce**.

This session begins with an introduction to cloud computing. Cloud computing involves the delivery of software, platforms, and infrastructure as services through the Internet or networks. The session then explores the three delivery models namely, Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS).

The session discusses the services offered by the enterprise cloud computing vendor, Salesforce. Salesforce's PaaS product is called force.com. It is used by developers to create multi-tenant applications inside the Salesforce.com platform. This session also covers in detail the procedure to create custom applications in salesforce.com.

In this Session, you will learn to:

- Define cloud computing
- Describe the cloud computing delivery models
- Describe the Salesforce platform
- Explain new features in the Salesforce platform
- Describe the services offered by Salesforce
- Explain the process of working with Salesforce
- Describe Visualforce

1.1 Introduction

Cloud computing is an approach that enables convenient and on-demand access through the Internet to computing capabilities and resources. Figure 1.1 depicts an overview of cloud computing.

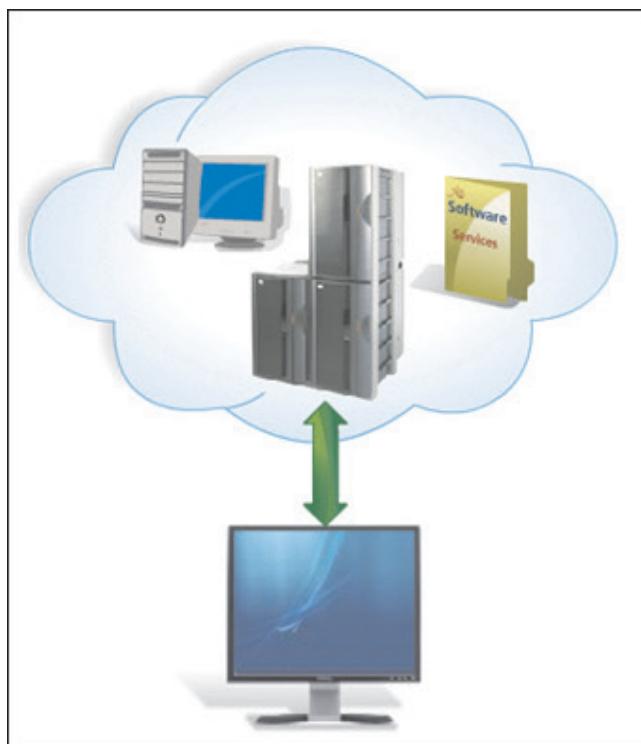


Figure 1.1: Cloud Computing

1.2 Cloud Delivery Models

Based on the type of cloud services provided, there are three categories of cloud delivery models:

→ **Software as a Service (SaaS)**

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.

→ **Platform as a Service (PaaS)**

In PaaS, a hosting environment or platform is provided to the consumer using which applications can be built and deployed to the cloud. The consumer can control the platform to an extent, but does not have any control over the hardware, software, or operating system being used.

→ **Infrastructure as a Service (IaaS)**

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.

1.3 SaaS

Figure 1.2 depicts the SaaS delivery model.

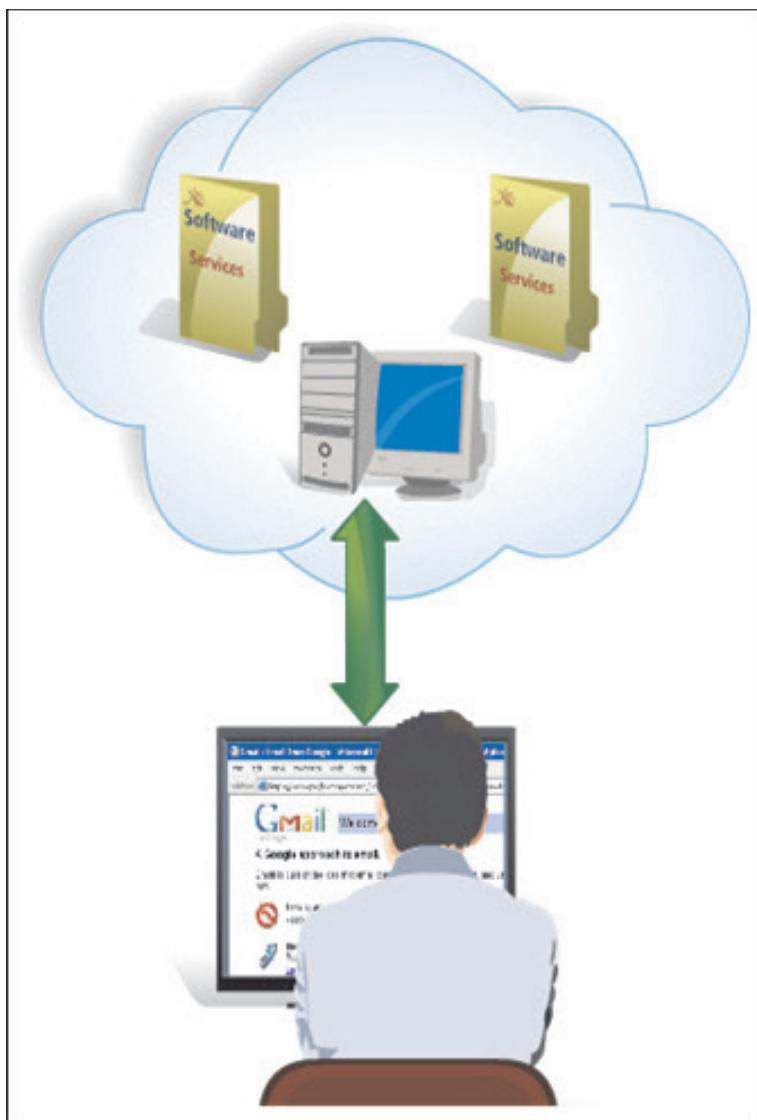


Figure 1.2: Software as Service (SaaS)

In the SaaS delivery model, software is hosted by an Application Service Provider (ASP). This software is then made available to multiple customers over the Internet. The fees for such cloud-based services may be paid through monthly fees, which cost less than actual licenses. When the subscription period expires, the software is no longer valid.

As the software is hosted remotely, the customers do not need to invest in additional hardware. The software is located in the vendor's data center. The user can launch the browser and log on to access the software. The vendor also provides the compute power, storage, and networking infrastructure necessary to run the software.

To use a SaaS application, typically, a user needs to access the Internet, create an account with a SaaS vendor, enter credit card details, and then, the user can use the application anywhere any time by logging into the software. The account will be billed based on a pay-as-you-use model.

Figure 1.3 illustrates usage of SaaS.

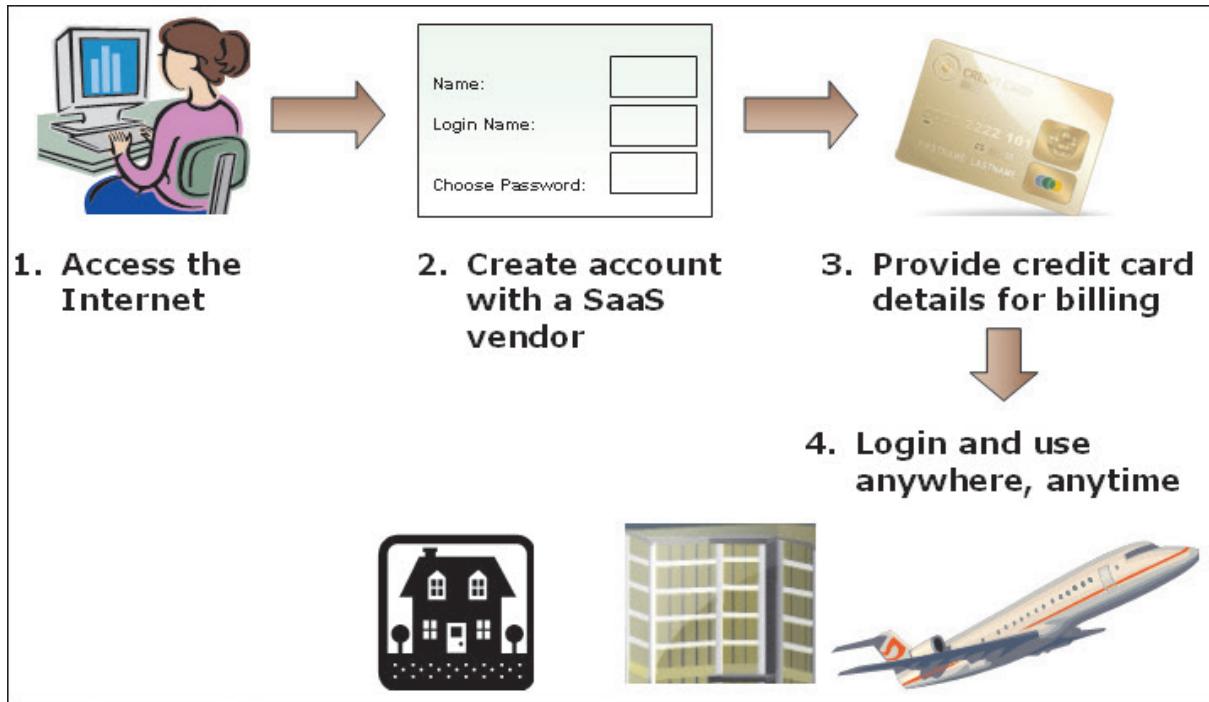


Figure 1.3: Using SaaS

Some key features of the SaaS model are as follows:

- Multi-tenant Architecture
- Simple Customization
- Improved Access to Data
- Easy Access

The brief descriptions of these features are as follows:

→ **Multi-tenant Architecture**

Multi-tenancy is an approach where a single instance of the software running on a server serves multiple clients or tenants. This means that separate hardware systems or software instances need not be created for each individual client. As the SaaS vendors maintain only the hardware resources needed to serve a single software instance, they can handle the operations more quickly and save

valuable development time. As the same application instance can serve multiple customers, the amount of Information Technology (IT) resources required is reduced at the vendor's end. This can lead to considerable cost savings for the service vendors, which in turn, will lead to lower cost of services for the users.

→ **Simple Customization**

Each user can customize applications without any hassles to fit their business processes without affecting the common infrastructure on the cloud.

→ **Improved Access to Data**

SaaS provides improved access to data from any networked device. In addition, it makes it easy to handle data and ensures everyone sees the same information at the same time.

→ **Easy Access**

A SaaS application can be easily launched through a browser.

1.3.1 Advantages and Disadvantages of SaaS

Table 1.1 lists the advantages of the SaaS delivery model.

Feature	Description
No Installation	Service vendors manage the installation and hosting of the software. Hence, the software can be used directly by end users without requiring installation on the local machine.
No Maintenance	The service vendors also manage the maintenance of the software regularly. Hence, the end user does not have to perform any maintenance.
Reduced Costs	Since the SaaS software is hosted remotely and is subscription based, the customer need not invest in hardware, software, and the resources needed to manage them. Thus, costs are considerably reduced.

Table 1.1: Advantages of SaaS

Table 1.2 lists some of the disadvantages of SaaS.

Drawback	Description
Powerful and Reliable Internet Connection Required	The Internet connection to access applications on the cloud should be high-speed as all the components have to be loaded on the browser.

Drawback	Description
Increased Security Risks	The most challenging part for SaaS and the cloud computing industry is the threat of attacks on customer data and applications. Hence, SaaS vendors need to implement strong security measures to ensure that the applications can be safely run and the customer data is secure.

Table 1.2: Disadvantages of SaaS

1.4 PaaS

Figure 1.4 shows the PaaS delivery model.

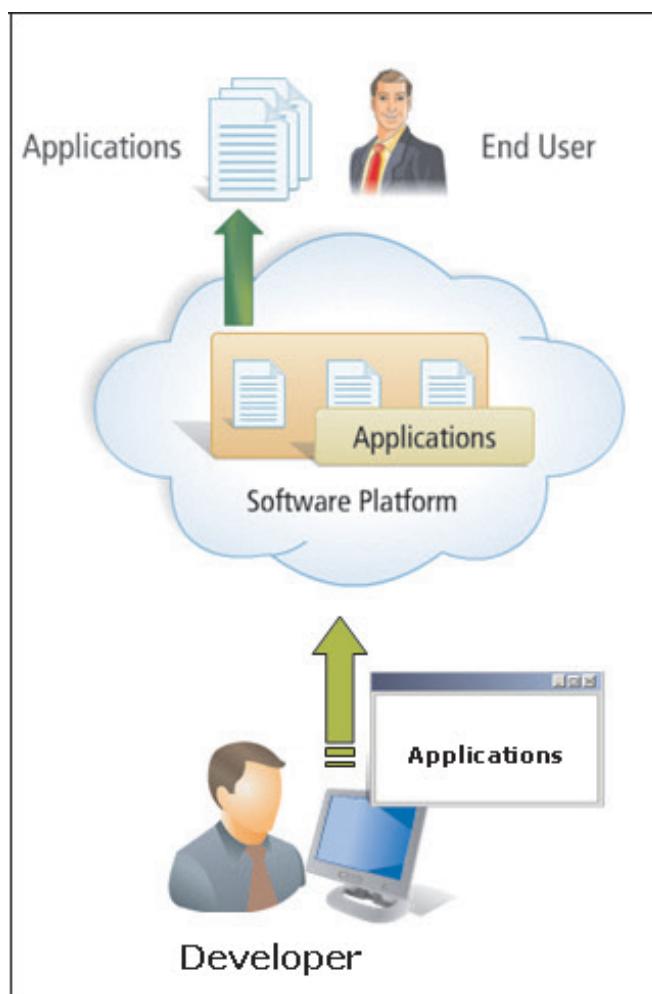


Figure 1.4: Platform as Service

A PaaS vendor provides a platform as a service through the Internet or a network. PaaS enables customer-created applications to be deployed on the cloud. It offers on-demand elasticity, scaling the platform

or runtime environment up or down as required. PaaS is also called as cloudware because it moves resources from desktop PCs to the Internet cloud.

Depending on the vendor, PaaS may offer a full or partial platform and runtime environment to develop cloud-based applications. The PaaS vendor manages and maintains the platform. In addition, depending on the vendor, developers may be able to create applications locally (offline) and then upload to the PaaS server. Some vendors may also allow development of online applications.

PaaS simplifies the process of software development because the developer need not worry about infrastructure, application hosting, security, backup, scalability, and so on. Instead, the developer can focus completely on the application and its functionality.

1.4.1 Features of PaaS

Some of the key features of PaaS are as follows:

→ **Strong Protocol Support**

There is strong support for protocols such as Simple Object Access Protocol (SOAP) and Representational State Transfer (REST). These protocols allow Web applications to communicate and exchange information using a standard approach. The protocols also enable access to Web services and databases that are present across networks.

→ **Support for Developer Collaboration**

In the global world today, developers and other staff in a team may not be located at one office but may be spread across the globe. They may often need to collaborate on data and applications. PaaS provides strong support for such collaboration. Developers can share code, schedules, objectives, roles, and responsibilities within a team and thus increase productivity.

1.4.2 Advantages and Disadvantages of PaaS

Advantages of PaaS are as follows:

→ **Simplified Deployment**

PaaS makes it easy for developers to deploy their applications. Developers need not worry about the hosting server's infrastructure, space constraints, and such issues. It is the vendor's responsibility to take care of these aspects. Hence, deployment becomes simple for a PaaS developer.

→ **Instant Scalability**

If the end users of a traditional Web application increase dynamically, it would be very difficult to scale up immediately to meet the requirement. However, with PaaS, it is easy to fulfill such requirements anytime because of the scalability it offers.

→ **Reliability**

PaaS is provided by major well-established brands such as Microsoft and Google and hence it is reliable.

The major disadvantage of PaaS is:

→ **Support for only Proprietary Languages**

Apex is a development language provided by Salesforce to work with their applications. Apex cannot be used by other PaaS software such as Windows Azure. Likewise, there are similar languages that are proprietary to one vendor and cannot be used across different platforms.

1.5 IaaS

IaaS is a delivery model that delivers computing infrastructure as a service through the Internet.

With IaaS, users create and build instances of virtual machines and then connect to them. Through the virtual machine, users can access the infrastructure that is present in the cloud. Once connected, they can work on the remote machine just as they work on local machines. They can install software on that machine, create volumes (logical hard disks), and work with documents and data. Figure 1.5 depicts IaaS.

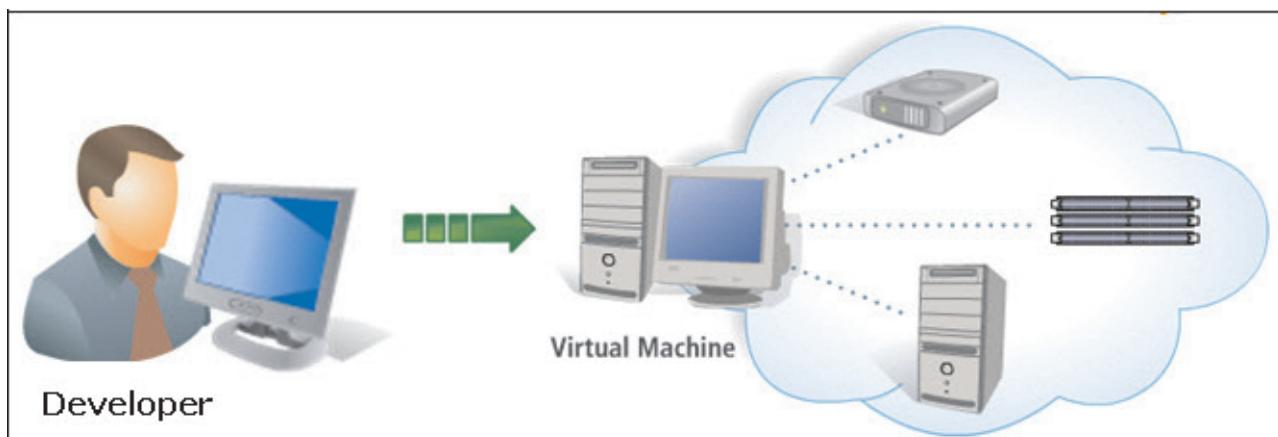


Figure 1.5: Infrastructure as Service

By using IaaS, users can avoid purchase of servers, software, data center space, or network equipment for developing and maintaining their applications. Instead, they can use these resources from vendors that offer IaaS. The service is typically billed as pay-per-use. Thus, users can save substantially on expensive infrastructure.

An IaaS vendor maintains the storage, database, message queue, or any other middleware, and the hosting environment for virtual machines.

1.5.1 Features of IaaS

Features of IaaS include:

→ **Supports Utility computing - service and billing model**

Utility computing is a model where IT resources are available to be consumed as utilities, unlike the traditional methods of paying for the package whether or not we end up using it. Utility computing treats IT resources as services/utilities that can be delivered and consumers can pay only for what they use.

→ **Enables automation of administrative task**

By principle, a cloud relies on demand resource allocation in a near instant manner and hence, almost all the traditional system administrative tasks such as server provisioning, resource allocation, backup, patch, and update are automated in a cloud environment.

→ **Provides dynamic scaling**

Since IaaS is an on-demand service-provisioning model, it has to be able to provision and de-provision resources as and when the demand increases or decreases. Thus, cloud resources are built in a way that they can dynamically scale up and down based on need.

→ **Supports Desktop virtualization**

Cloud services can provision not only server based resources but can also provision desktops over the network. Desktop virtualization is a way of delivering virtual desktops on-demand from cloud.

1.5.2 Advantages and Disadvantages

IaaS provides the core benefits of the cloud, while still affording a large degree of control to the client.

→ **Global Access:** Provides the convenience of accessing your data from any location and any device, with an Internet connection.

→ **Retained Control:** Offers more control than the other two models SaaS and PaaS, primarily because this gives access to the hardware layer (virtual) itself. Cloud consumer thus has the maximum control in this layer.

→ **Predictable Costs:** By subscribing to an IaaS cloud, you can trade these large, upfront, and uncertain costs for a predictable monthly bill, which is also less in cost.

Disadvantages of IaaS are as follows:

→ **Privileged User Access**

It is the responsibility of the cloud service vendor to implement strong security measures to protect and secure sensitive data of customers. The customers should also verify whether the vendor providing services ensures privileged and secured user access. Often, these are lacking and thus, lead to failure of the service.

→ **Regulatory Compliance**

Traditionally, the application service vendors undergo security audits and obtain certificates to prove their security credentials. In cloud computing, however, many vendors may skip this procedure. In such a case, customers should use such vendors only for trivial tasks and storage, and opt for more secure cloud vendors to store sensitive and important data.

→ **Data Location Control**

When you register with a cloud vendor to make use of their services, you have no way of knowing where exactly your data is going to be hosted. Cloud service vendors must prepare a contract for the customer stating that they will commit to store and process data in specific jurisdictions and adhere to local privacy requirements and laws of the land.

1.6 *Salesforce*

Salesforce is one of the foremost enterprise cloud computing vendors. It offers various products such as Customer Relationship Management (CRM) in the form of SaaS and Force.com in the form of PaaS.

In 2013, Salesforce introduced Salesforce1 as a new social, mobile, and cloud customer platform designed to transform sales, service, and marketing apps. Salesforce1 is the first CRM platform

for developers, Independent Software Vendors (ISVs), end users, customers, and so on who want to adopt the cloud approach for new social, mobile, and connected services.

The Salesforce1 platform is designed to accelerate the development and deployment of apps. It is 100% cloud-based and supports following features:

- Enables to create custom apps, fast, with clicks or code
- Enables to connect faster to everything, with powerful APIs
- Supports deployment and access to any app on Salesforce

The various services of the platform are now explored in detail.

→ CRM

The CRM model is delivered as a cloud service through the Internet to organizations and customers. The main advantage of using CRM as a cloud is that it makes sales, marketing, and services support easier to the users.

The two types of CRM cloud services provided by Salesforce are namely, Sales cloud and Service cloud.

- **Sales Cloud**

Sales Cloud refers to the ‘sales’ module in the Salesforce.com platform. CRM sales cloud apps provide the managers, a real-time visibility into their team’s activities so that they can forecast sales. It also helps sales representatives to manage customer’s information, which reduces the time in handling data. It comprises Leads, Accounts, Contacts, Contracts, Opportunities, Products, Pricebooks, Quotes, and so on. It has features such as Web-to-lead to support online lead capture, with auto-response rules. It is designed to be a start-to-end setup for the entire sales process.

- **Service Cloud**

Service Cloud is a social customer service application. It enables you to manage customer information and service conversations in the cloud. Service Cloud refers to the ‘service’ (as in ‘customer service’) module in the Salesforce.com platform. It comprises Accounts, Contacts, Cases, and Solutions. It also includes features such as the Public Knowledge Base, Web-to-case, Call Center, and the Self-Service Portal, in addition to customer service automation. Service Cloud helps to manage sales cases faster, in a unified experience. Whether you are on your desktop or on the go, you have everything you need to be more productive, resolve more cases, and satisfy your customers.

→ Force.com

Salesforce also offers PaaS through its **Force.com** platform. This platform is also completely cloud based. You just have to login and build your application. The application would be hosted at the Salesforce data centers and you can easily share them with clients. With **Force.com**, it is easier to build and deliver business applications, mobile applications, and Web sites.

The Force.com platform includes a database, security, workflow, and number of other tools to simplify the development process. The development tools used to create applications using Force.com are Apex and Visualforce. Apex is an object-oriented language that enables developers to create applications. Visualforce is a framework that allows you to build user interfaces that can be hosted on **Force.com**.

1.6.1 Features of Salesforce

Some of the key features of Salesforce platform are as follows:

- **Salesforce Automation:** Offers better customer/supplier service by enabling tracking or preferences and recording all interactions.
- **Marketing Automation:** Empowers integrated marketing and sales applications with automation lead conversion, real-time analytics, and multichannel campaign management and analysis.
- **Analytics and Forecasting:** Data quality can be managed by removing duplicate leads, contacts and customers, and ensure accurate demand forecasting.
- **Force.com:** Is a platform that provides infrastructure services through Internet. This enables developers to create and deliver any kind of business application.
- **AppExchange:** Provides an online marketplace for applications, which are developed by Salesforce.com.
- **Service and Support:** Salesforce.com offers its own suite of services, programs, and best practices that afford continuous improvement.

1.6.2 New Features in Salesforce1 Platform

The new features of Salesforce1 platform are as follows:

→ **Salesforce Console for Sales**

The Salesforce console increases the productivity for users in fast-paced environment. The console offers a dashboard-like interface eliminates time-consuming clicking and scrolling so you can quickly find, update, and create records. Agents can use multiple applications at once and store the context as priorities changes. The Salesforce can be customized depending upon your business needs. The various features offered by Salesforce console are as follows:

- Easily spot important fields on records.
- Limit switching between pages.
- Quickly jot notes or log interactions for each record.
- Solve cases by quickly scanning Salesforce knowledge articles.

→ **Salesforce Files (Pilot)**

Salesforce Chatterbox is a file syncing service that keeps files secure, synced, and social in the Salesforce cloud and on your computer. You can share files through Chatter, which is an enterprise social network. Files can be organized into folders on the desktop and mobile. You can drag and drop the files. Chatterbox will be available for all the chatter users.

→ **Historical Trend Reporting**

To make historical trend reports available to your users, use filters to configure the amount of data that is captured for historical reporting and then select the fields that will be available for reports.

→ **Site.com Enhancements for Communities**

The standard tabs in the community of Salesforce can be overridden by pages provided by Site.com. While creating the community, you need to choose Site.com pages. If Site.com is used, then the pages in your community will be associated.

→ **Salesforce for Outlook**

The productivity can be increased by automatically syncing the two systems. Salesforce for Outlook is an application that can be installed, automatically syncs contacts, events, and tasks. You can manually manage Outlook mails to the Salesforce contacts, leads, and opportunities.

→ **Embedded Analytics**

User can be given valuable information directly on the pages they visit often. The information needed can be drawn into charts so that they are empowered to make decisions based on the data, without going elsewhere to look for it.

Salesforce provides many types of platform services, which are discussed as follows:

→ **Identity Service**

Provides Identity and Access Management (IAM) for Web and mobile applications. This service helps to improve the adoption of applications through single sign in for end-users, simplified administration, and visibility over their cloud investments.

→ **Chatter**

It provides status information about people and important projects automatically pushed to you. It provides an easy way to connect and share the important information. Some examples of using Chatter service are as follows:

- Find hidden connections.
- Follow sales deals.
- Ask questions and get instant answers.

- Unite your team.
- Collaborate on sales presentations.

→ **Point and Click Development**

Force.com makes it easy to modify the functionality of Salesforce applications to meet the requirements. It provides the fastest and easiest way to customize applications.

→ **Multi-language Development**

Allows developers code in any language. Changes can be done in an Integrated Development Environment (IDE) and can be deployed instantly.

→ **Visual Workflow**

Visual Workflow allows administrators to build applications to guide users through screens for collecting and updating data. Applications in visual workflow can be called flows. Visual workflow has three different aspects flow design, flow management, and runtime.

→ **Drag and Drop Analytics**

Salesforce provides you a real-time, personalized view of your business, which helps us to make smarter decisions as a team.

→ **User Access**

Salesforce portals can be configured with users and administrators and add, edit, and remove users.

→ **Easy API Integration**

Force.com allows administrators to integrate with libraries such as SOAP and REST APIs that controls existing platform choices.

→ **Translation Workbench**

The Translation Workbench of Salesforce allows you to specify languages you want to use and translate. Administrators can also assign translators, create translations, and override translations from the packages.

→ **Multi-Tenant Cloud Infrastructure**

Salesforce platform is based on multi-tenant architecture. On account of using multi-tenant architecture, the Salesforce platform becomes more secure, reliable. Nearly 60,000 customers run on a shared infrastructure, which creates economies of scale not possible with other single-tenant applications such as Web-browsers.

1.7 Working with the Force.com Platform

In order to begin working on force.com, you only need a computer and an Internet connection. There is no necessity of application servers or databases. When you sign up for a **force.com** account, you get a unique username using which you can access the **force.com** cloud computing environment.

Force.com has environments stored in the cloud. An environment lets us to start developing and testing cloud computing applications without using any server. This saves the users' time.

Some of the important characteristics of an environment are as follows:

- An environment is an instance of **Force.com** infrastructure that lets you access, deploy, or create applications.
- It holds data, custom database objects and Fields, Apex business code for the application, Visualforce UI, workflow, and so on.
- All environments can be accessed through a Web browser.
- Some of the environments can be accessed from **Force.com** IDE, SOAP API, and Metadata API.
- An edition contains specific functionality, objects, storage, and limits. All environments are constructed on editions.
- Environments can be used for development, testing, and production.

1.7.1 Different Types of Environments in Force.com

There are three types of environments:

→ Production Environment

This environment allows only paid users that can access business related critical data. Salesforce customers who use Group edition, Professional Edition, or Unlimited Edition are using production environments.

→ Development Environment

This is the environment or IDE where you can extend integrate and develop on Force.com without affecting your production environment. This is the Force.com IDE, which is a powerful client application that allows you to create, modify, test, and deploy Force.com applications. It can be integrated with Eclipse as well. Development environments contain test data that are not business critical.

Two types of development environments are as follows:

- Developer Edition
- Sandbox

Both these editions are special development licenses that do not allow the conversion to production.

→ Test Environments

These are either production or development environments help to test the application's functionality before deployment or releasing it to customers. They do not support automated test scripts in user level, so another development environment should be created and beta testing should be added to it.

1.7.2 Getting Started with Salesforce

Salesforce provides you a Web-based interface and a set of APIs for developing Web-based applications. You can share the URLs for these applications with your users and business partners so that they can access and use your applications.

The following step-by-step procedure shows how to get started with Salesforce:

1. Type <http://developer.force.com> in the Address bar of the browser, such as Internet Explorer. Figure 1.6 shows the developer force Web page.

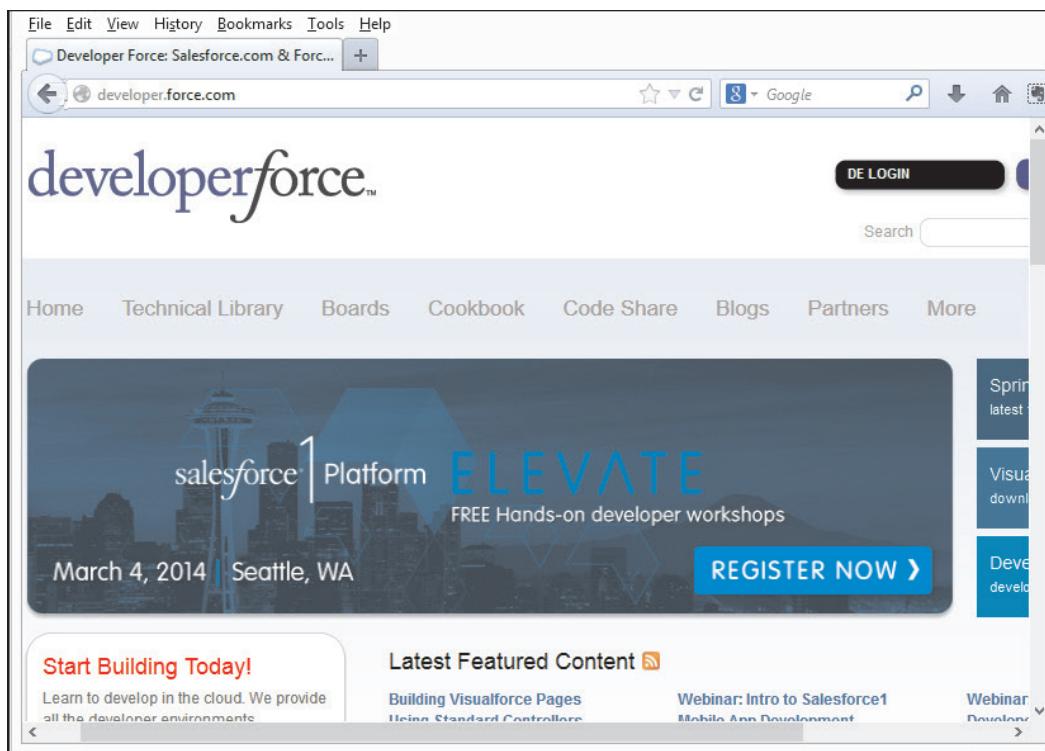


Figure 1.6: Developer.force.com Web Page

2. Click **DE Login** to open the Developer Edition login page. Figure 1.7 shows the developer login page.

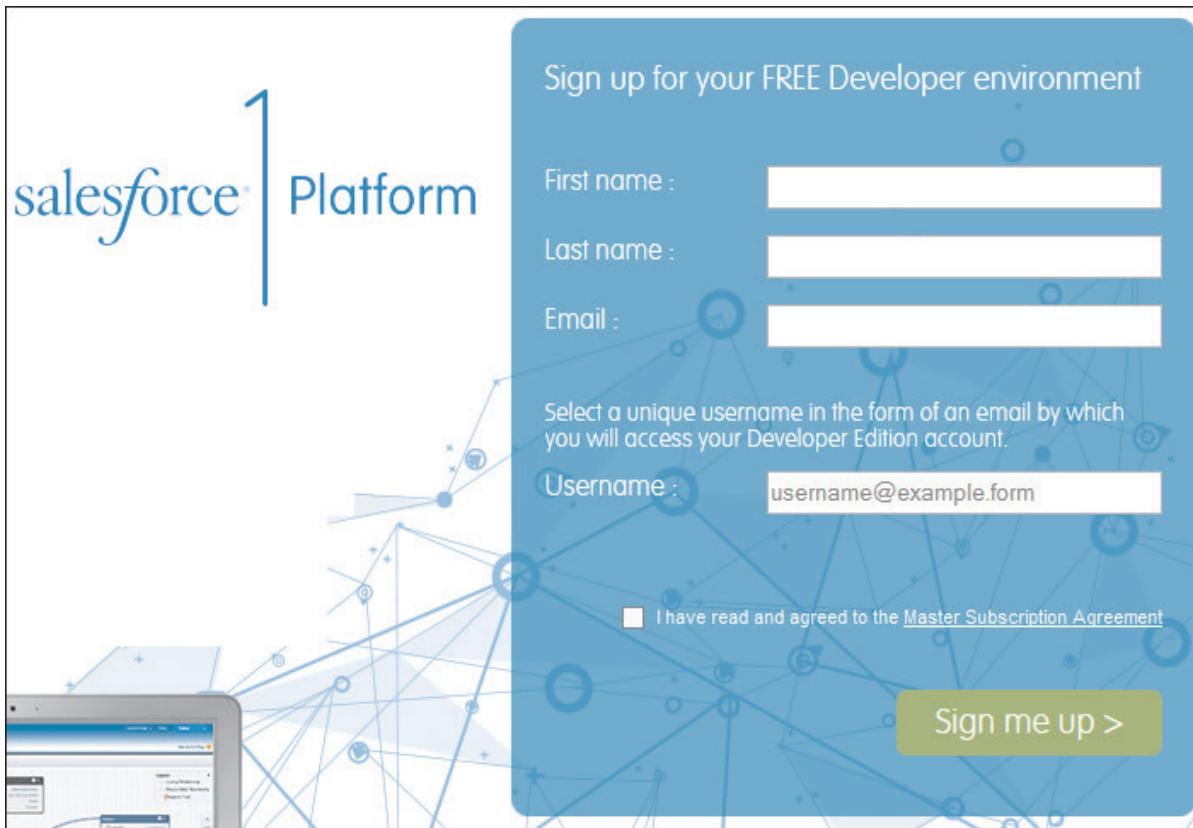


Figure 1.7: Developer Login Page

Note - For the first time, user need to click Sign up for Free at Salesforce.com site. In the sign up form, users need to provide a unique username, which will be in the form of an e-mail identification. For example, john.mathew@abc.com. After successful sign up, you will receive an e-mail to set the password for the registered username.

3. If already an existing user, then enter <user-name> value in **User name** and <password> value in **Password** fields. For example, enter **john.mathew@abc.com** and **comp@1234**.

4. Click **Log in to Salesforce1**.

The start-up page is displayed.

5. Under the username drop-down, click **Setup**.

The **Setup** page is displayed. On the left pane, you can see **Personal Setup**, **App Setup** that stands for Application Setup, and finally, **Administration Setup**.

The **Personal Setup** section helps you to personalize the application for your personal use.

6. Click **App Setup** on the left pane.

The **App Setup** page contains options to customize Salesforce.com, build, deploy, and manage applications.

7. Click **Administration Setup**. It contains the setup and customization options to help you to set up your organization.
8. Click **Logout**. The **Logout** option allows you to log out of Salesforce applications.

1.7.3 Custom Objects in Salesforce

A Salesforce application contains a number of tabs. Each tab represents a complete application or one of its modules. You can create custom objects and custom fields. These custom objects and fields represent database tables and their fields. You can enter data into these objects for retrieval at a later stage.

Custom objects are custom database tables that allow you to store information unique to your environment. An environment's data can be extended with the help of custom objects. For example, a marketing company may require a custom object called **Bids** to store data for its sales bids.

Once a custom object is defined, you can create custom fields, track the various tasks and events for custom object records. You can also associate the custom object with other records and display the custom object data in custom related lists. Further, you can create page layouts, customize the search results including the custom object fields that are displayed in them, and so on.

Custom objects can be created on the user interface by one of two methods:

- ➔ By using Metadata WSDL with a client application.
- ➔ Using the Force.com IDE.

A name field is associated with custom object, which will be defined by the Salesforce administrator during setup. If an API is used to create a custom object, the object does not have a name.

1.7.4 Reports in Salesforce

Report builder is a visual editor for reports. The report builder screen lets you work with report fields and filters, and shows you a preview of your report with just some of the data. A report type is a set of rules that determine which records and fields appear in a report. Reports can use the tabular, summary, matrix, or jointed format. An existing report can be customized using report builder.

Views represent queries using different criteria. When you run a view, Salesforce returns you relevant records and fields with data. You can create custom reports in various formats with summarization, if necessary.

1.7.5 Custom List Views

Custom list views can be created or edited to see a precise set of records such as contacts, documents, or campaigns. You can also create views for contacts, leads, users, or cases to use for mass email recipient lists. Administrators and users with 'Manage Public List Views' permission can also edit or delete public views and some of the standard Salesforce views. Users without the 'Manage Public List Views' permission cannot edit and they can only see the **Clone** link.

1.7.6 Example

The following example demonstrates working with Salesforce.

1. Login to Salesforce.

In your home page, you can see **Build App** as shown in figure 1.8.

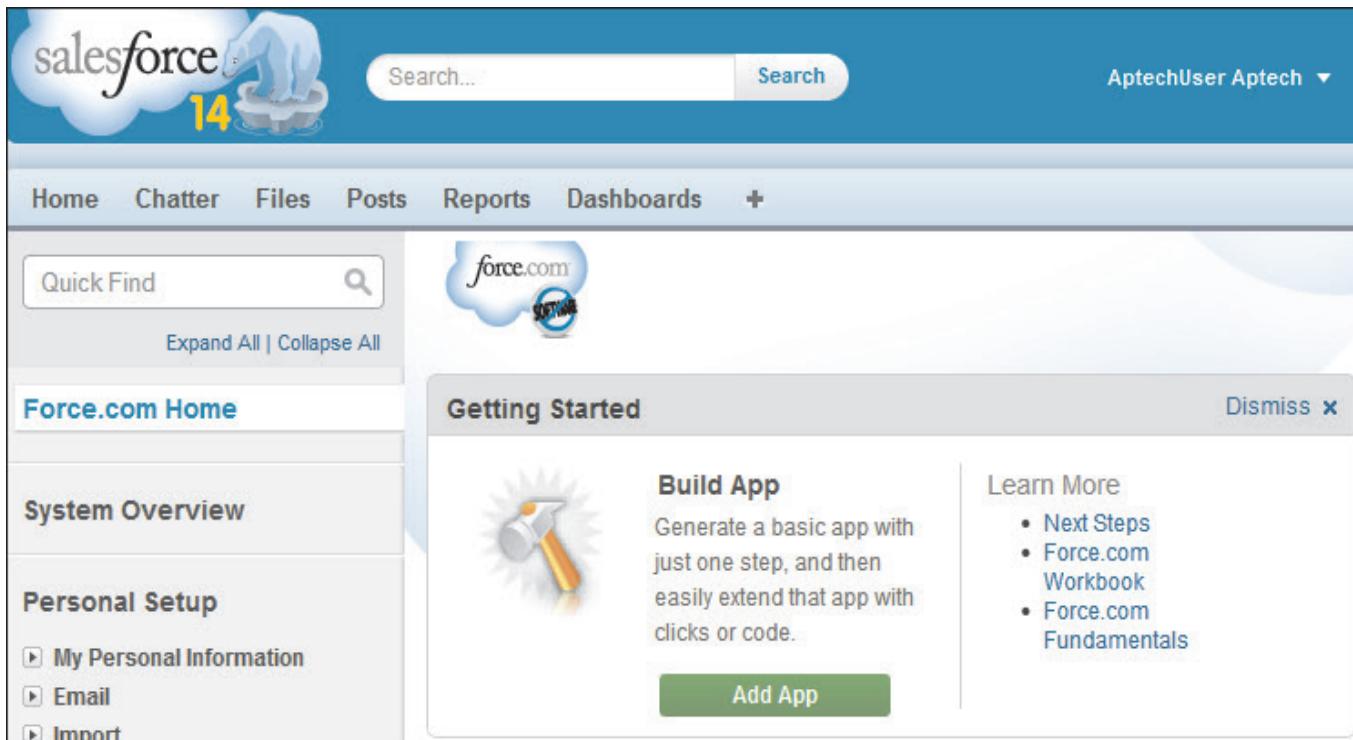


Figure 1.8: Building the Application

2. Click **Add App** to build your application.

Once you click **Add App**, a small tab opens up.

3. Add your app name, label, and other information.

Figure 1.9 shows the screen where you can add your details.

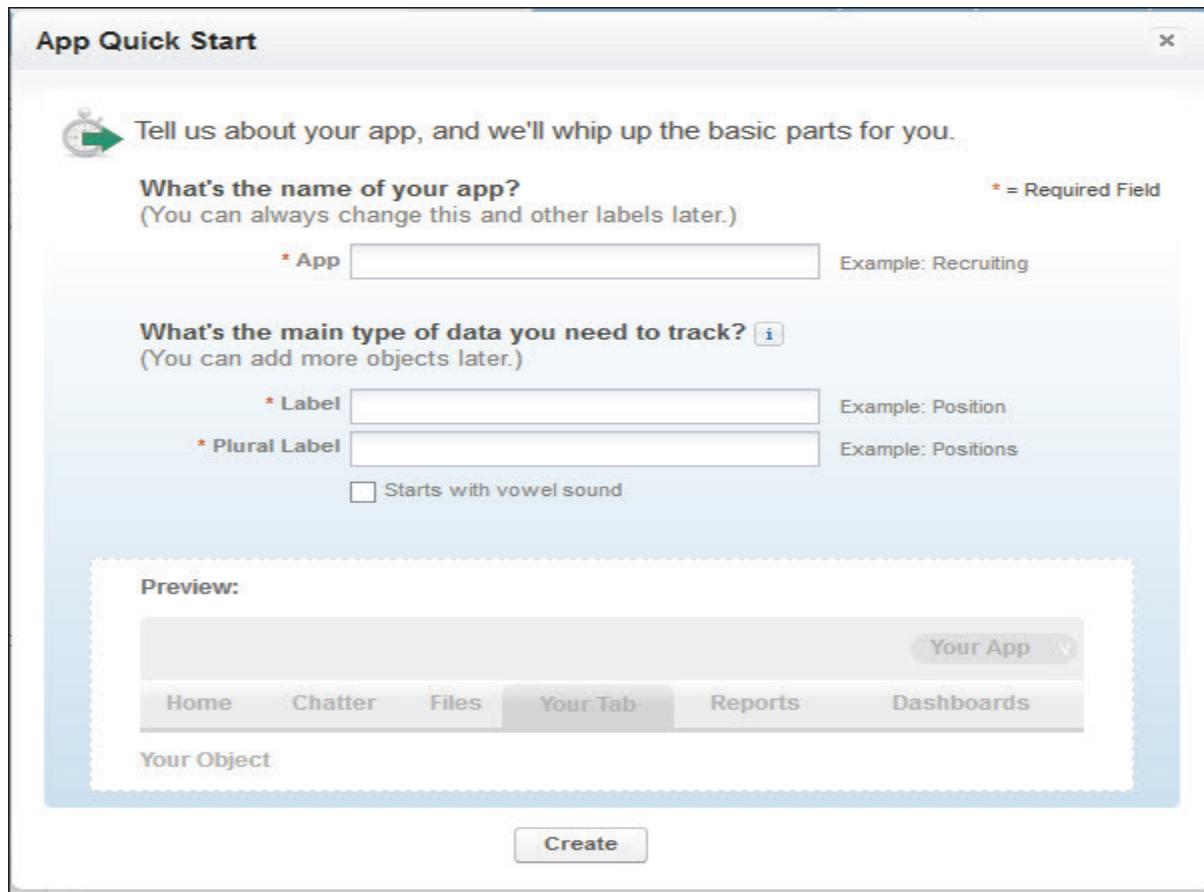


Figure 1.9: Adding Information

Once you specify all the information, a dialog box is displayed indicating that you are all set to start.

Figure 1.10 shows the dialog box.

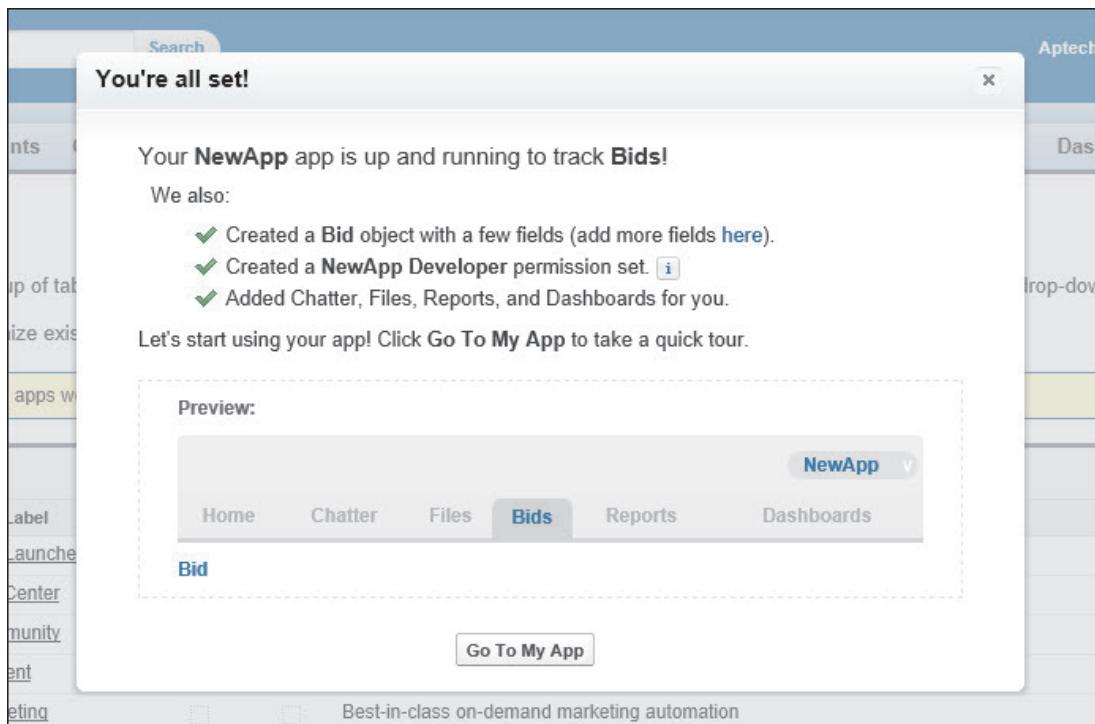


Figure 1.10: Completion of App Creation

- Click **Go To My App**. On clicking **Go To My App**, you are taken to the App Home Page as shown in figure 1.11.

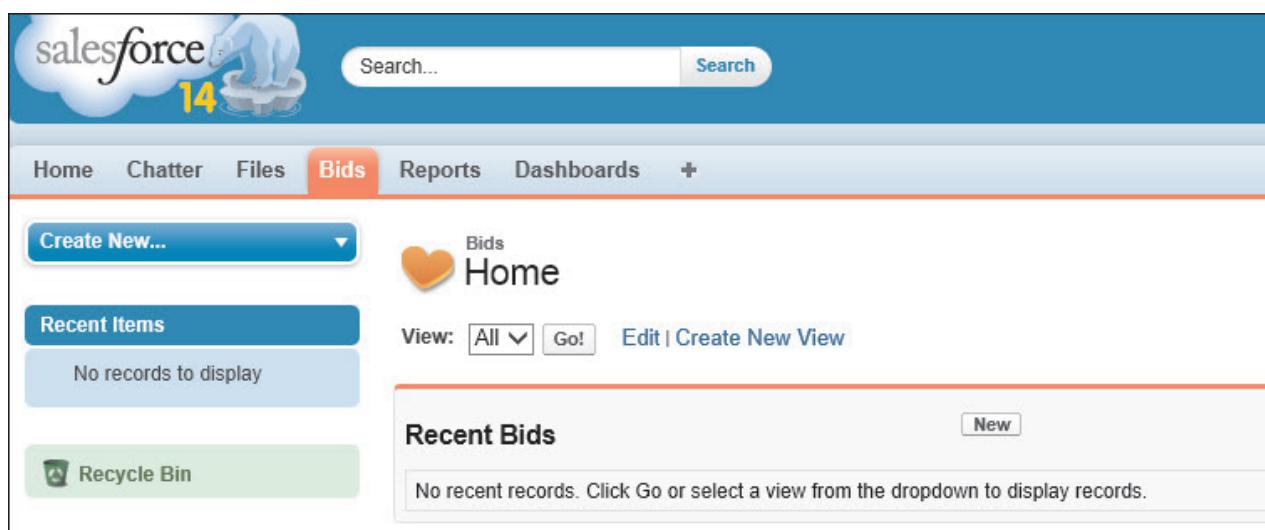


Figure 1.11: App Home Page

- Click **Create New View** beside **Edit**. Here, you can change your view name and add filters if required.

Figure 1.12 shows the screen to change the view name and filters.

The screenshot shows a web-based application titled "Create New View" under the "Bids" category. The interface is divided into two main sections: "Step 1. Enter View Name" and "Step 2. Specify Filter Criteria".

Step 1. Enter View Name:

- View Name:
- View Unique Name: [i](#)

Step 2. Specify Filter Criteria:

Filter By Owner:

- All Bids
- My Bids

Filter By Additional Fields (Optional):

Field	Operator	Value	
--None--	--None--	<input type="text"/>	AND
--None--	--None--	<input type="text"/>	AND
--None--	--None--	<input type="text"/>	AND
--None--	--None--	<input type="text"/>	AND
--None--	--None--	<input type="text"/>	

Figure 1.12: Changing View Name and Filters

6. After filling in all details, click **Save** present at the bottom of the page.
7. To create a custom report type, click the **Reports** tab and select **Bids** on your left end from the items listed.

Figure 1.13 shows the **Create New Report** page.

Figure 1.13: Selecting Reports Tab

In your Reports page, you can drag and drop items to add data as shown in figure 1.14.

Figure 1.14: Adding Items to the Reports Tab

8. Once you have added all the information, click **Run Report**. The report is generated and status is available for view. Figure 1.15 shows this.

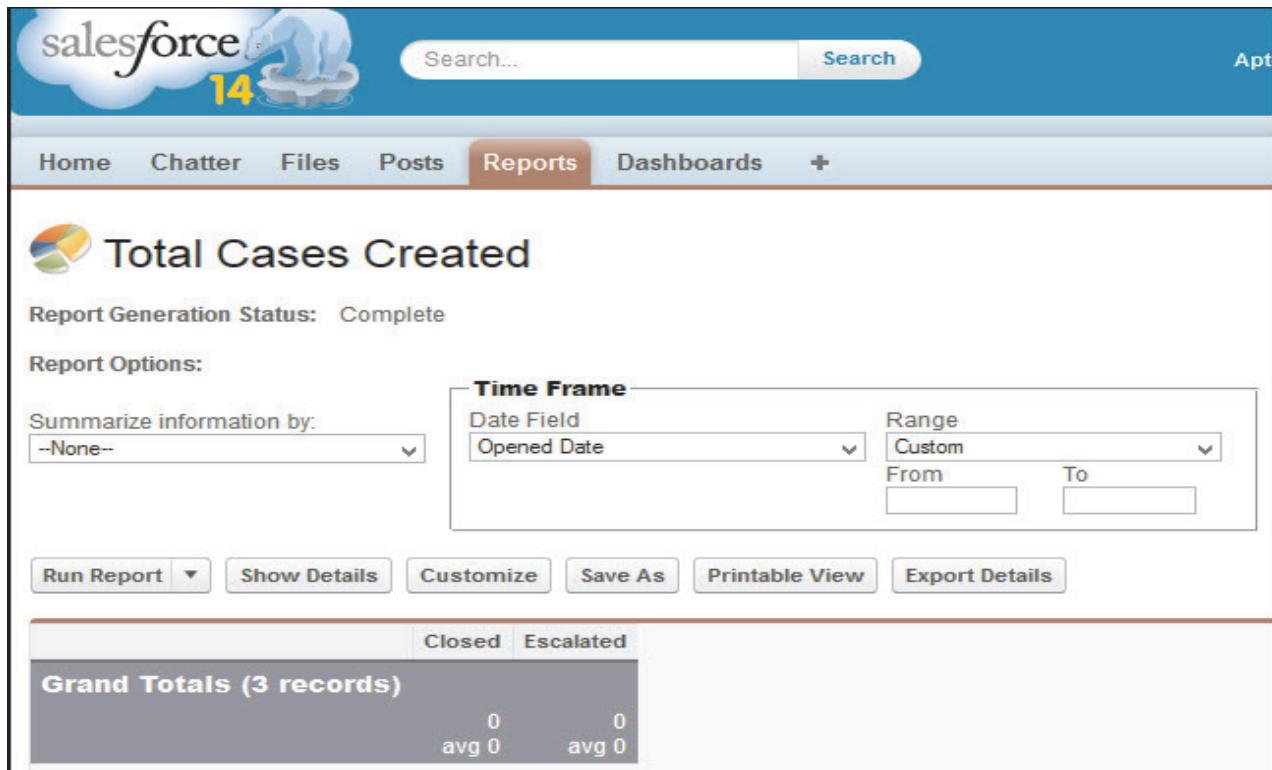


Figure 1.15: Generate Reports and View Status

9. Click **Save As** to save your report. Enter report name, description about report if any, and location of your report and click **Save**.

1.7.7 Creating an Interface in Force.com

Visualforce is a framework that helps developers to build custom user interfaces that can be hosted on the Force.com platform. It contains a tag-based language similar to HTML. Each tag corresponds to a user interface component, such as a related list or a section page, or a field. The behavior of these components can be controlled by the same logic used in Salesforce pages.

Visualforce framework is supported by most of the Web browsers, but some of the features of visual force are supported by certain Web browsers.

Developing with Visualforce

Salesforce.com created a first implementation of a Model–View–Controller (MVC) architecture as shown in figure 1.16. The MVC is widely used interface architecture, which is based on the separation of data presentation from data manipulation.

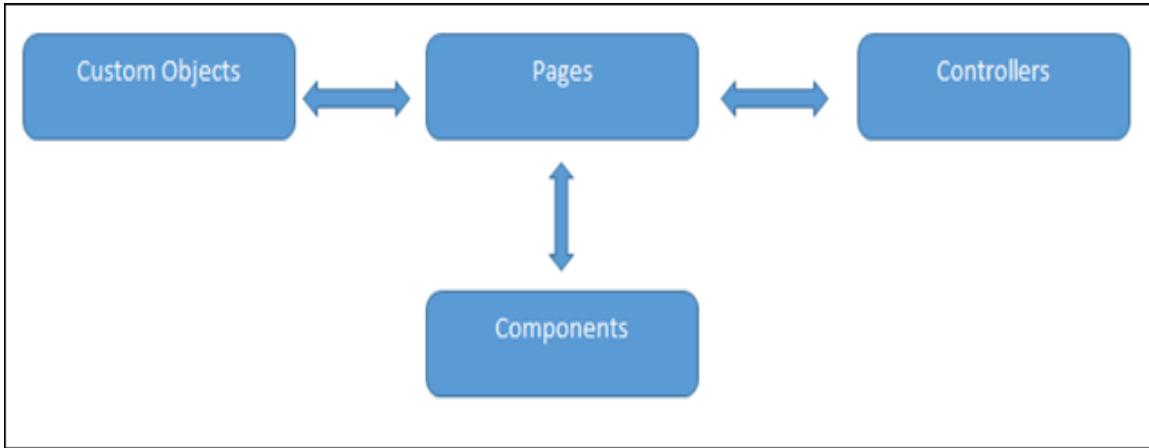


Figure 1.16: Salesforce.com Model-View-Controller Approach

Here, the ‘model’ is the data model represented by custom objects and the ‘view’ represents the presentation, which are pages and components in the Visualforce framework. The controller handles the business logic.

Visualforce Pages:

Pages are building blocks for application designers. Pages can be raised and invoked via a unique URL.

There are two primary elements to create a visual page:

- ➔ Visualforce markup
- ➔ A Visualforce controller

Visualforce tags, HTML, or any Web-enabled code comprises the elements of Visualforce markup. A controller is a set of instructions that specify what happens when a user interacts with the components that are specified such as user clicks, button, links, and so on. **Force.com** provides the facility for a developer to use either a standard controller or a custom controller. The standard controller contains the same logic used for a normal Salesforce page. If standard controller is used, the user will not be able to access the object, the page will display ‘insufficient privileges error messages’.

These components are similar to tag libraries in other systems. Components invoked with special HTML tags enable reuse of common interface elements. Some components implement common Salesforce interface elements, while others introduce new features.

Figure 1.17 depicts a Visualforce page.

The screenshot shows the Salesforce Visualforce Pages list. At the top, there's a header with 'Visualforce Pages' and a 'Help for this Page' link. Below the header, a sub-header states: 'Visualforce Pages provide a robust and easy to use mechanism to create new and exciting user experiences for your application or to enhance existing applications to optimize your users' productivity.' A 'View' dropdown menu is set to 'All' with a 'Create New View' option. Above the main table, there are navigation links for letters A through Z and an 'Other' link. The main area contains a table with columns: Action, Label, Name, Namespace Prefix, Api Version, Description, Created By Alias, Created Date, Last Modified By Alias, and Last Modified Date. One row is visible, showing 'Edit | Del | Security |' followed by a link to 'User_Details1'. The 'Name' column shows 'User_Details1', 'Namespace Prefix' is '29.0', 'Created By Alias' is 'vanan', 'Created Date' is '11/17/2013 1:52 AM', 'Last Modified By Alias' is 'vanan', and 'Last Modified Date' is '11/17/2013 1:52 AM'. There are also 'Developer Console' and 'New' buttons at the top of the table.

Figure 1.17: Visualforce Pages

Developers can use Visualforce pages to:

- Overrule standard buttons
- Overrule tab overview pages
- Embed components in page layouts
- Define custom tabs
- Create dashboard components or custom help pages

The following step-by-step procedure demonstrates how to work with Visualforce pages.

1. Click **Setup** → **Develop** → **Manage Your Pages** → **New**. Figure 1.18 shows the new Visualforce Page.

Visualforce Page

[Help for this Page](#)

Page Edit

Page Information

Label

Name

Description

Available for Salesforce mobile apps

Require CSRF protection on GET requests

Visualforce Markup **Version Settings**

```

<apex:page>
    <!-- Begin Default Content REMOVE THIS -->
    <h1>Congratulations</h1>
    This is your new Page
    <!-- End Default Content REMOVE THIS -->
</apex:page>
```

Chat

Figure 1.18: New Visualforce Page

2. Enter **UserDetails** as **Label** and **using apex form tags** as the **Description**.
3. Remove the auto-generated code within **apex:page** tags.
4. Add the following code given in **Code Snippet 1**.

Code Snippet 1:

```

<apex:page>
    <h1>Data Entry Form</h1>
    <p></p>
    <apex:form>
        Name
        <apex:inputText> </apex:inputText>
        <p><input type="button" value="Click Me"/></p>
```

This page has been created by the System Administrator.

```
</apex:form>
```

```
</apex:page>
```

- Click **Save** to save the file. Figure 1.19 shows the outcome.

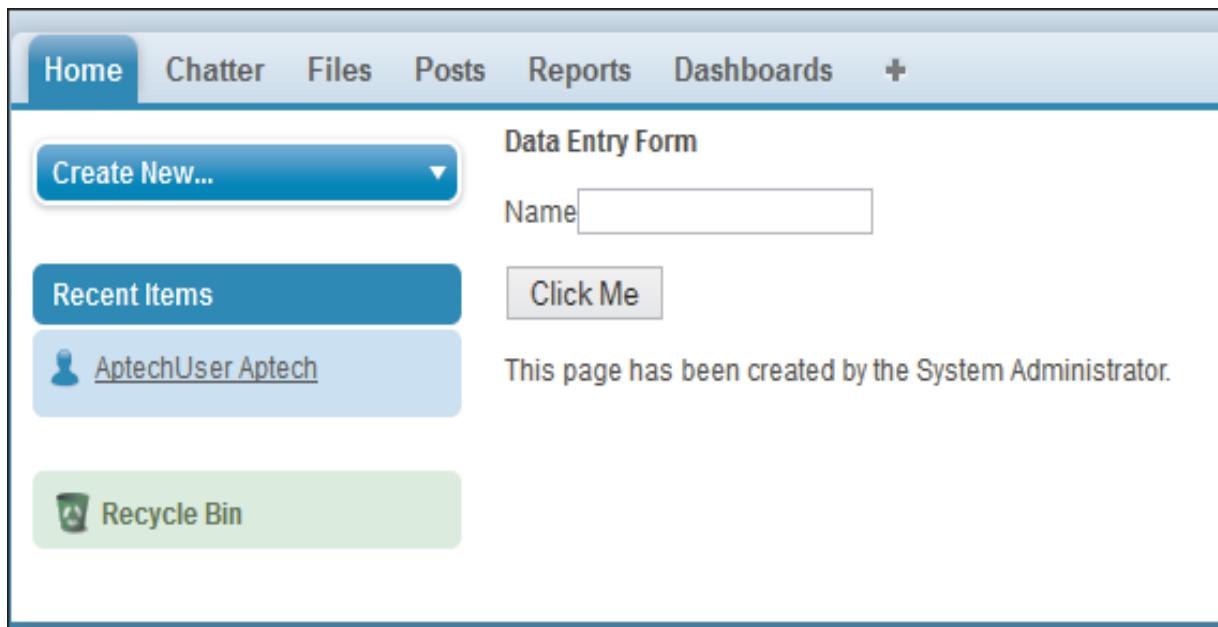


Figure 1.19: Visualforce Page after Adding the Code

- Create another page, **StaffDetails**, with **Description** as **Using apex tags for creating tabs**.
- Delete the existing code and enter the code given in Code Snippet 2.

Code Snippet 2:

```
<apex:page >
<apex:tabPanel >
<apex:tab label="Sales">
<p><b>Sales Staff</b></p>
<input type="text"/>
</apex:tab>
</apex:tabPanel>
<apex:tabPanel >
```

- Save the page.

```
<apex:tab label="Marketing">
<p><b>Marketing Staff</b></p>
</apex:tab>
</apex:tabPanel>
</apex:page>
```

9. Click **Preview**. The page opens in a new tab or window as shown in figure 1.20.

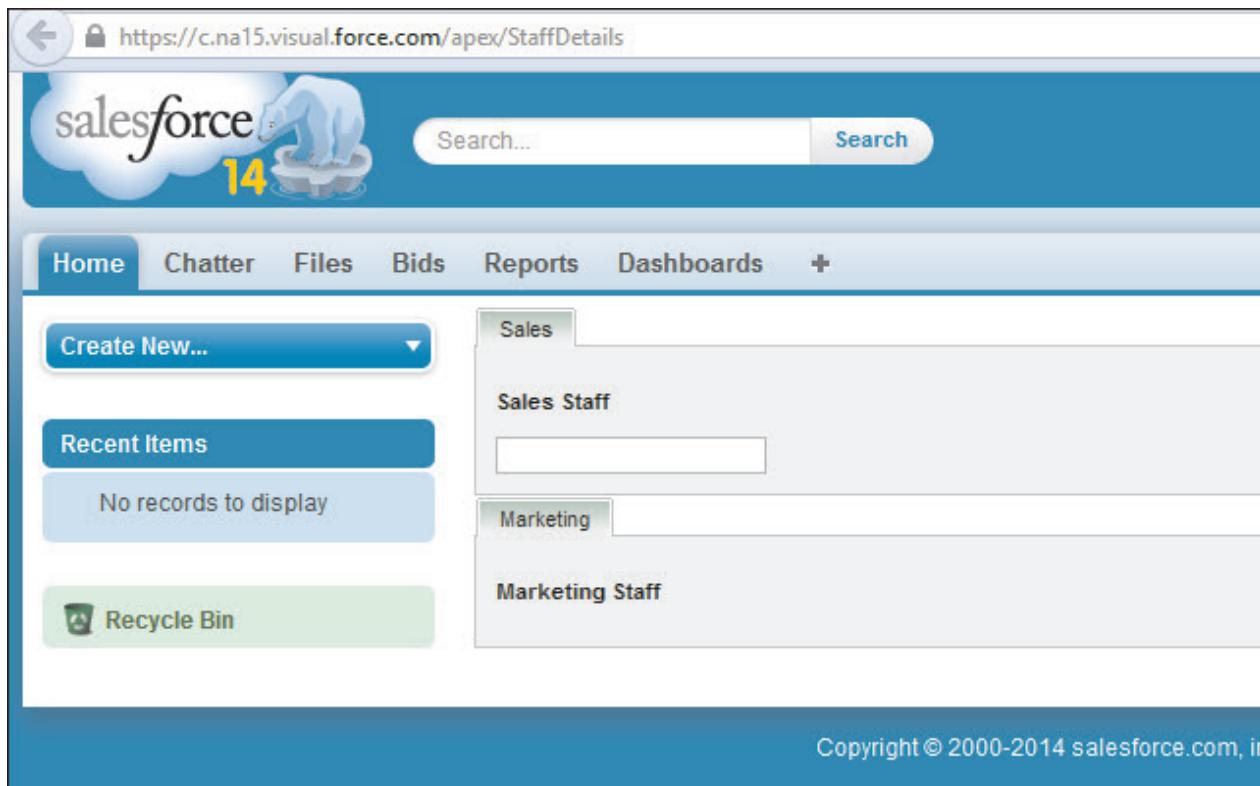


Figure 1.20: Previewing the Page

Note - Effective February 2014, Google has stopped free usage of Google Maps in Visualforce pages. If you still wish to use Google Maps API in Salesforce, you need to purchase a Business license.

1.7.8 Salesforce Data-Loader

The Force.com platform offers a development environment which can be used to create own applications. The data-loader is a graphical tool that helps you to get and extract the data from the database objects into any destination. It also performs bulk deletions by exporting ID fields for the data you wish to delete. If your Salesforce edition allows the use of the API (Enterprise, Unlimited and Developer Editions), you can download the Data Loader from the Setup menu.

Use of CSV file:

When importing data, data-loader reads, extracts, and loads data from Comma-Separated Values (CSV) files or from a database connection.

If a user needs to load 50,000 to 5,000,000 records, he/she can use Data-loader. The import wizard can only be used when you are loading less than 50,000 records and when you want to prevent duplicates by uploading records according to account name, site, and e-mail address.

Features of the Data Loader include:

- Detailed success and error log files in CSV format
- A batch mode interface with database connectivity
- Drag-and-drop field mapping
- Support for all objects, including custom objects
- Support for large files with up to millions of rows
- A built-in CSV file viewer
- An easy-to-use wizard interface
- An alternate command line interface.

Enabling bulk API allows you to load or delete a large number of records faster than using the default. One important difference when bulk data-loader is enabled, that it allows you to execute a hard delete if you have the permission and license.

The Data Loader can be downloaded by clicking **Administer** → **Data Management** → **Data Loader** and then selecting the **Download Data Loader** link.

Figure 1.21 shows the Data Loader page.



Figure 1.21: Data Loader Download

To configure Data Loader to use the Bulk API for various operations such as inserting, updating, and deleting records:

1. Start the Data Loader.
2. Choose **Settings → Settings**.
3. Select the **Use Bulk API** option.
4. Click **OK**.

To uninstall the Data Loader client application:

1. Go to **Start → Control Panel → Add or Remove Programs**.
2. Select the **Data Loader** program.
3. Click **Remove**. The uninstaller removes the program from your computer.

Data Loader supports the following data types:

- ➔ Base64
- ➔ Boolean
- ➔ Date Formats

- ➔ Double
- ➔ ID
- ➔ Integer
- ➔ String

1.8 Check Your Progress

1. _____ is a delivery model that provides access to software as a service through the Internet on demand.

(A)	SaaS	(C)	PaaS
(B)	IaaS	(D)	Salesforce

2. By using _____, users can avoid purchase of servers, software, data center space, or network equipment for developing and maintaining their applications.

(A)	Salesforce	(C)	Visualforce
(B)	SaaS	(D)	IaaS

3. _____ keeps your files secure, synced, and social in the Salesforce cloud and on your computer.

(A)	Chatterbox	(C)	Salesforce Console
(B)	Salesforce chatterbox	(D)	PaaS

4. _____ is a framework that allows you to build user interfaces that can be hosted on the Salesforce cloud platform.

(A)	Visualmarkup	(C)	Salesforce
(B)	Visualforce	(D)	Force.com IDE

5. _____ is an approach where a single instance of the software running on a server serves multiple clients or tenants.

(A)	Multi-tenancy	(C)	Multiprocessing
(B)	Single-tenancy	(D)	Cloud computing

1.8.1 Answers

1.	A
2.	D
3.	A
4.	B
5.	A



Summary

- SaaS is a delivery model that provides access to software as a service on demand through the Internet.
- PaaS is a delivery model that provides a platform as a service through the Internet or a network, enabling developers to deploy their applications on the cloud.
- IaaS is a delivery model that delivers computing infrastructure as a service through the Internet.
- Salesforce is one of the foremost enterprise cloud computing vendors and offers various products such as CRM and Sales solutions as SaaS products.
- Salesforce also offers PaaS through its **Force.com** platform, which is completely cloud based. With **Force.com**, it is easier to build and deliver business applications, mobile applications, and Web sites.
- The **Force.com** platform includes a database, security, workflow, and number of other tools to simplify the development process and includes two development tools Apex and Visualforce.
- Apex is an object-oriented language that enables developers to create applications.
- Visualforce is a framework that helps developers to build custom user interfaces that can be hosted on the Force.com platform.

GROWTH
RESEARCH
OBSERVATION
UPDATES
PARTICIPATION





Session - 2

Windows Azure

Welcome to the Session, **Windows Azure**.

One of the popular services offered by cloud computing is, Platform as a Service (PaaS). Windows Azure is one of the most popular PaaS products. Windows Azure is a Microsoft offering that provides an application platform using which users can develop and deploy applications to the cloud. Windows Azure provides many different cloud platform components to the user, one of which is SQL Database (formerly called SQL Azure).

The session describes the Windows Azure platform and its key features. The session also covers different types of Windows Azure storage. The session then describes SQL Database and Windows Azure Client Library Services (formerly called Windows Azure AppFabric).

In this Session, you will learn to:

- Explain the Windows Azure platform
- Describe the components of Windows Azure
- Describe the process of creation and deployment of a cloud service
- Describe SQL Database
- Describe the process of creation and use of a cloud database
- Explain the services under Windows Azure Client Libraries for .NET

2.1 Introduction

Microsoft Windows Azure is a cloud computing platform that enables you to build and run Windows applications and facilitates data storage on the cloud.

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. Development environments such as Eclipse are also supported.

2.2 Necessity for the Windows Azure Platform

Web hosting is a hosting service provided by companies using which users can make their Web site accessible through the Internet. These companies have their own Web servers that are used to host the applications. However, these companies do not provide any development tools or platforms and users are expected to maintain the platform infrastructure at their premises. Also, the hosting features of the companies are sometimes expensive and not always reliable.

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. Microsoft fulfilled this need by creating Windows Azure. Windows Azure is a cloud computing platform and infrastructure that not only hosts applications, but also enables you to build, deploy, and manage them.

Figure 2.1 depicts an overview of Windows Azure.

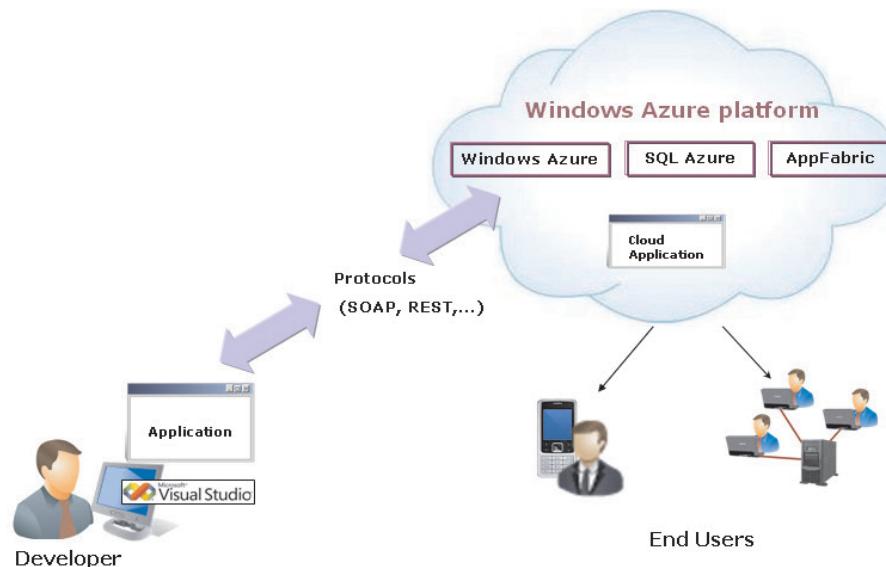


Figure 2.1: Windows Azure Platform

2.3 Key Features of Windows Azure

Windows Azure was designed to simplify IT management and minimize costs. Azure is used to manage Web based applications. Microsoft uses its data centers across various countries to host and manage applications on the Windows Azure platform.

Many services such as virtual machines, network bandwidth, and other infrastructure resources are provided by Azure. If the virtual machines being used by developers happen to crash or fail, then a new virtual machine is automatically allocated to the application. A feature called dynamic scaling is provided by Windows Azure that can increase or decrease the resources, based on the application's requirements. Windows Azure also helps the applications to use and access back end data through storage services and SQL database.

Key features of Windows Azure are listed as follows:

→ **Virtual Machines**

Enable users to use any OS image in the cloud. The images can be selected from the gallery or customized image can be used. Figure 2.2 shows some of the OS that are supported in Windows Azure.



Figure 2.2: Various OS Supported in Windows Azure

→ **Cloud Services**

Azure cloud services eliminate the need of server infrastructure. Developers can use the Windows Azure SDK and Tools to build, deploy, and manage modern applications. The Windows Azure platform carries out all the steps such as provisioning, load balancing of applications, and monitoring.

→ **Web Sites**

Windows Azure Web Sites is a feature that empowers users to organize Web applications on a reliable cloud infrastructure.

→ **Mobile Services**

The Windows Azure platform also includes support in the form of Mobile Services that supports development of applications such as Windows, Apple IOS, Android, and HTML. Mobile services provide a scalable cloud backend, authentication mechanisms, and cloud data storage.

→ **Other Features of Windows Azure**

Data Services such as Storage, SQL database, reliable backup, cache, and Hyper-V Recovery manager are also part of the platform.

App Services such as Media Services, Active Directory, Multi-Factor Authentication, Service Bus, Notification Hubs, and BizTalk Services are also included.

2.4 Benefits of Windows Azure Platform

Windows Azure offers various pricing schemes that can benefit different kinds of users. There is a free trial for a period of one-month, a pay-as-you-go pricing plan, and a 6-month, and 12-month plan. Based on individual or organizational needs, the suitable pricing scheme can be chosen.

Other advantages of using Azure platform include:

- High availability (nearly 99.9%) of the application and the data.
- Hardly any upfront costs of purchasing hardware and software licenses.
- Flexibility to support small to the very largest of customers.

2.5 Components of Windows Azure

The Windows Azure platform architecture includes several components, of which the following are most important:

→ **Compute**

→ **Data Services**

→ **App Services**

Compute provides a very large scale hosting and processing environment for applications. Cloud services, Web Sites, Mobile Services, and so on.

Data Services focuses on scalable storage services such as blobs, queues, and tables. It includes SQL Database and Windows Azure storage.

App Services provides a variety of services such as authentication, service bus, caching, and so on.

Figure 2.3 shows the detailed architecture of Windows Azure.

Windows Azure

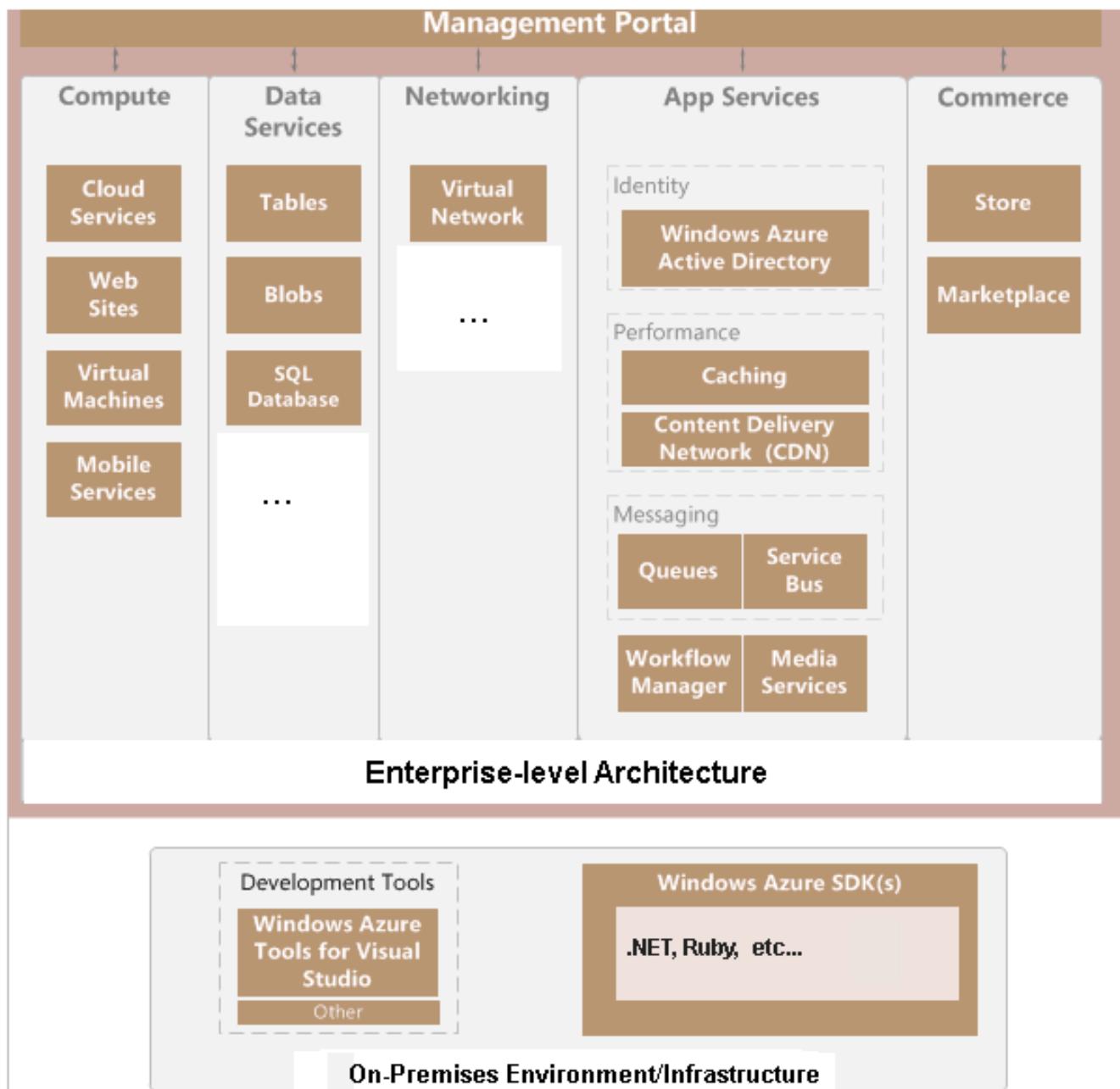


Figure 2.3: Detailed Architecture of Windows Azure

2.6 Windows Azure Storage

There are three types of storage available with the Windows Azure Platform: blobs, tables, and queues.

Each storage technique is explained in details in the following sections.

2.6.1 Windows Azure Blob Storage

Windows Azure Blob Storage is a data storing mechanism that stores large amount of raw (binary or text) data. These data can be accessed by using Internet from anywhere in the world. Each blob can store up to hundreds of gigabytes of data. Each account can hold many blobs that account to data storage up to 200 TB. Messages are stored using queues that can be accessed by the clients. Blobs also use tables to store non-relational unstructured data.

Some of the scenarios where you can make use of Windows Azure Blob storage are as follows:

- When you want to deliver images or documents directly to a browser
- When you want to store files that may be accessed across distributed networks
- For live-streaming video and audio

2.6.2 Windows Azure Table Storage

Windows Azure Table storage is a means to store structured data. Table storage is ideal for the applications that use large amount of structured data. Table storage uses keys to access the stored data. Table storage do not provide any relationships between the stored data.

Windows Azure tables do not work similar to relational database tables as they do not support relationships or schemas. Each entity in a table can have a different group of properties of different data types.

The Windows Azure Table storage service is a NoSQL data store that accepts authenticated calls from inside and outside the Windows Azure cloud.

The features of tables are as follows:

- Tables store large amount of data that can be increased or decreased depending on the requirements of the applications.
- Tables are ideal to store large data sets that do not require complex joins or relationships.
- Data query is very fast as it uses a clustered index and keys.

2.6.3 Windows Azure Queue Storage

Windows Azure Queue storage is a service for storing large numbers of messages that can be accessed from anywhere in the world via authenticated calls using HTTP or HTTPS. In the Windows Azure Queue storage, a single queue message can be up to 64 KB in size, and a queue can contain millions of messages, up to the total capacity limit of a storage account. For storage accounts created after June 8th, 2012, total capacity is 200TB; for storage accounts created prior to that date, total capacity is 100TB.

You can use queues in the following scenarios:

- You need to store over 5 GB worth of messages in a queue, where the messages may have a lifespan shorter than 7 days.
- Your application requires flexible leasing to process its messages. Windows Azure Queues allows messages to have a very short lease time, so that if a Web worker crashes, the message can be processed again quickly.
- Your application wants to track progress for processing inside of a message when the message arrives. This is useful if the Web worker working on a message crashes.

2.6.4 Restricting Access to Windows Azure Storage

Windows Azure has been designed in such a manner that only the owner can access the blobs, tables, and queue inside the owned account. If a service or application needs to make these resources available to other clients without sharing the access key, one can have the following options for permitting access:

- One can set a container's permissions to permit anonymous read access to the container and its blobs. However, this is not allowed for tables or queues.
- One can open a resource via a shared access signature, which enables to delegate restricted access to a container, blob, and table or queue resource by specifying the interval for which the resources are available and the permissions that a client will have to it.
- One can use a stored access policy to manage shared access signatures for a container or its blobs, for a queue, or for a table. The stored access policy gives an additional measure of control over the shared access signatures and also provides a simple means to revoke them.

2.7 Creating and Deploying a Cloud Service

The following example shows the step-by-step procedure to build a small .NET Web application and deploy it to the cloud. The example assumes that you have downloaded and installed the Windows Azure SDK 2.2. The SDK includes libraries for Windows Azure Storage, Windows Azure Service Bus, and so on.

1. Launch **Visual Studio 2012**.
2. Click **File → New → Project** as shown in figure 2.4.

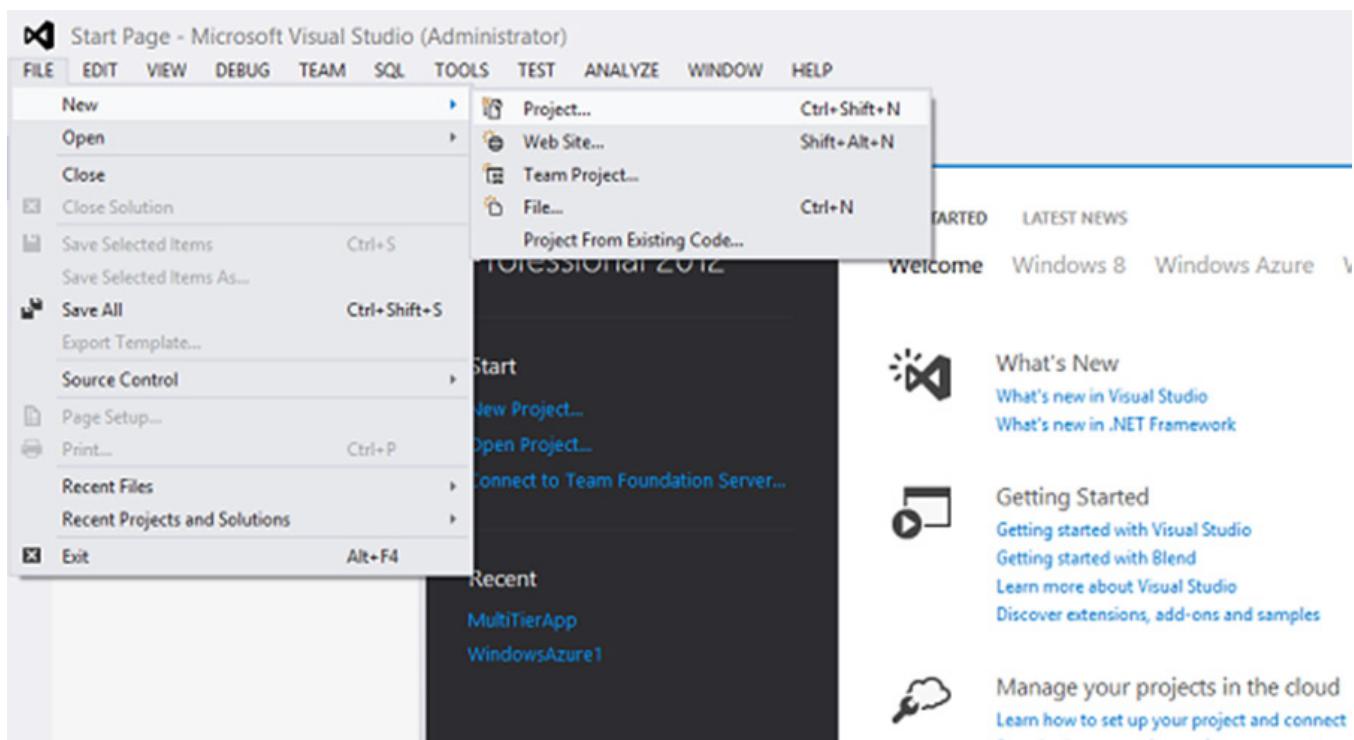


Figure 2.4: Creating a New Project in Visual Studio 2012

The **New Project** window is displayed.

3. In the **Installed Templates** pane under Visual C#, click **Cloud** and then, click **Windows Azure Cloud Service** as shown in figure 2.5. The cloud service is a compute container for highly scalable, available, and multitier cloud applications.

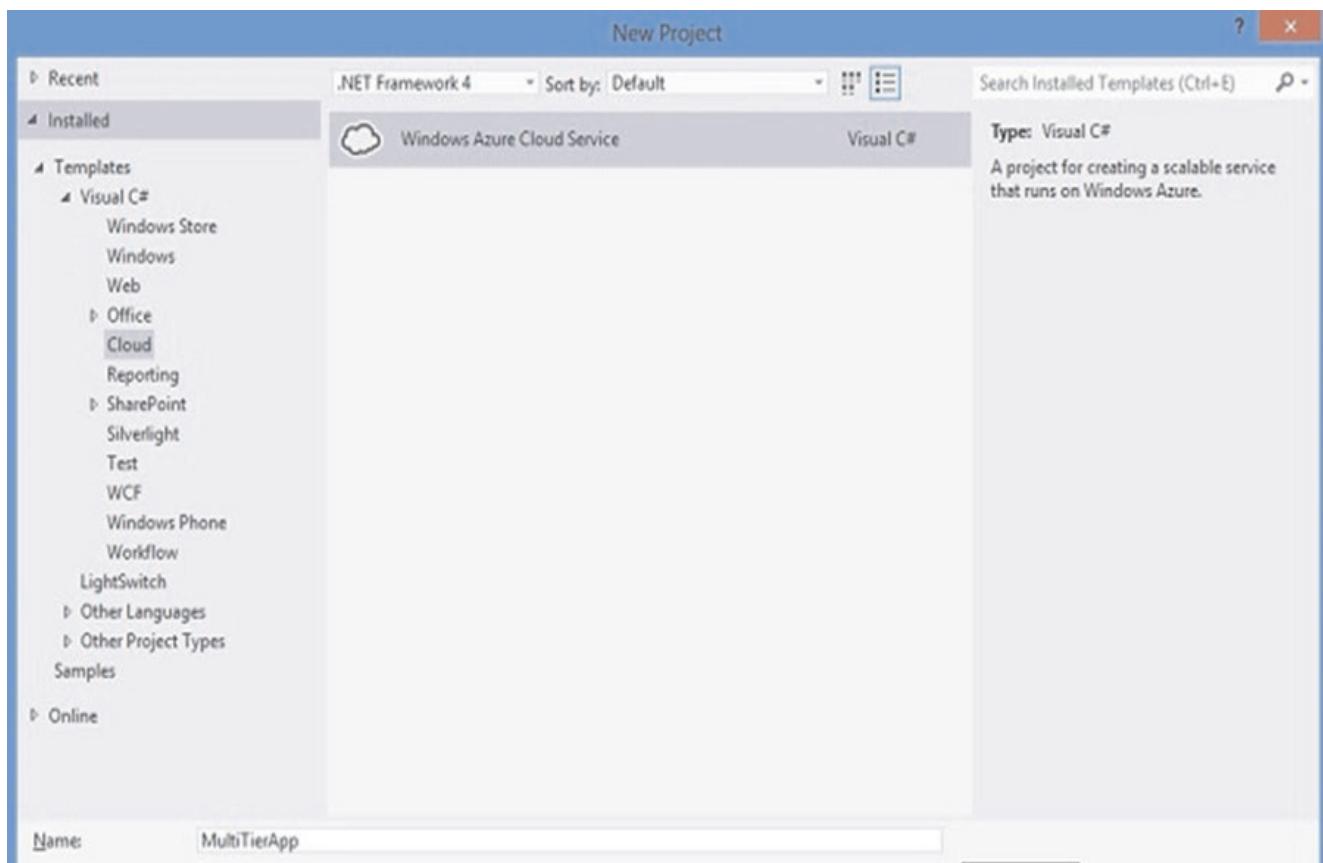


Figure 2.5: New Windows Azure Cloud Service

4. Name the project as **MultiTierApp**.
5. Click **OK**.

Now, the **New Windows Azure Cloud Service** window is displayed as shown in figure 2.6. This window shows .NET Framework 4 roles. Here, double-click **ASP.NET MVC 4 Web Role**.

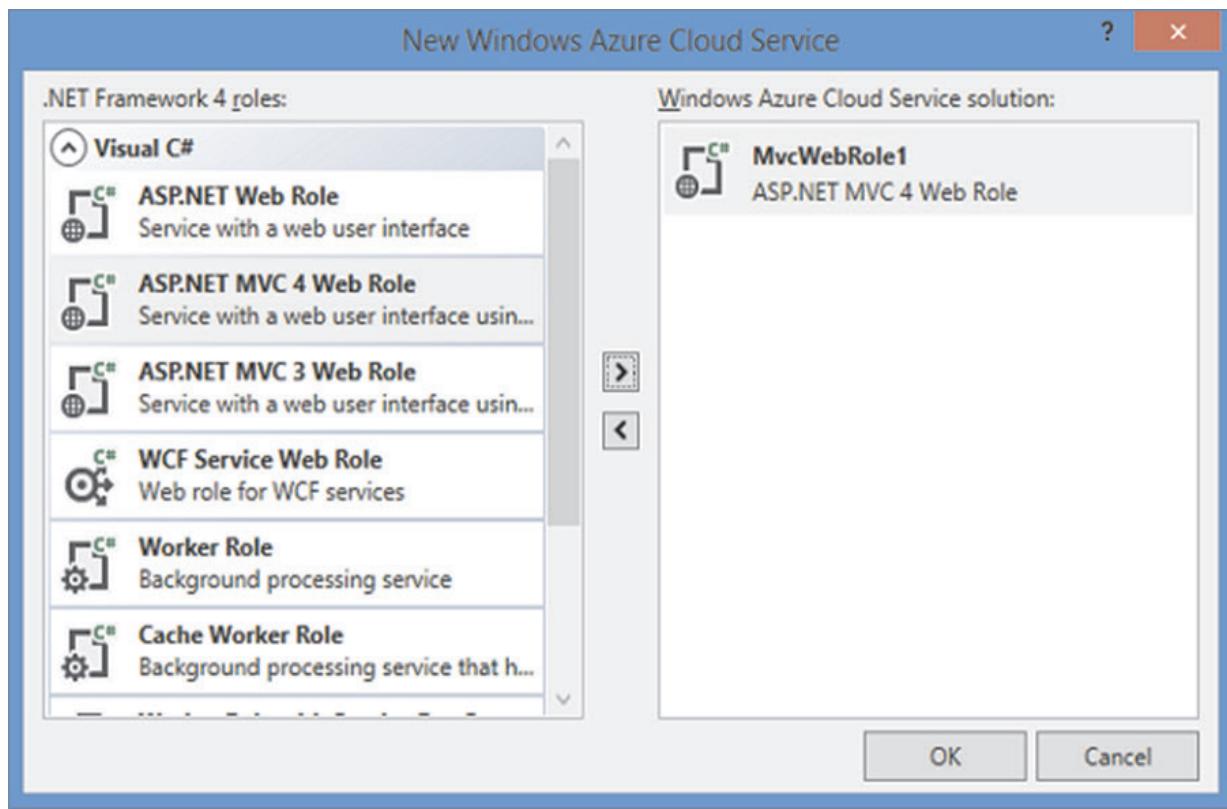


Figure 2.6: Selecting NET Framework 4 Roles

- To rename the role, hover over **MvcWebRole1** under Windows Azure Cloud Service solution. Then, click the **Pencil Icon**, and rename to **FrontendWebRole** as shown in figure 2.7.

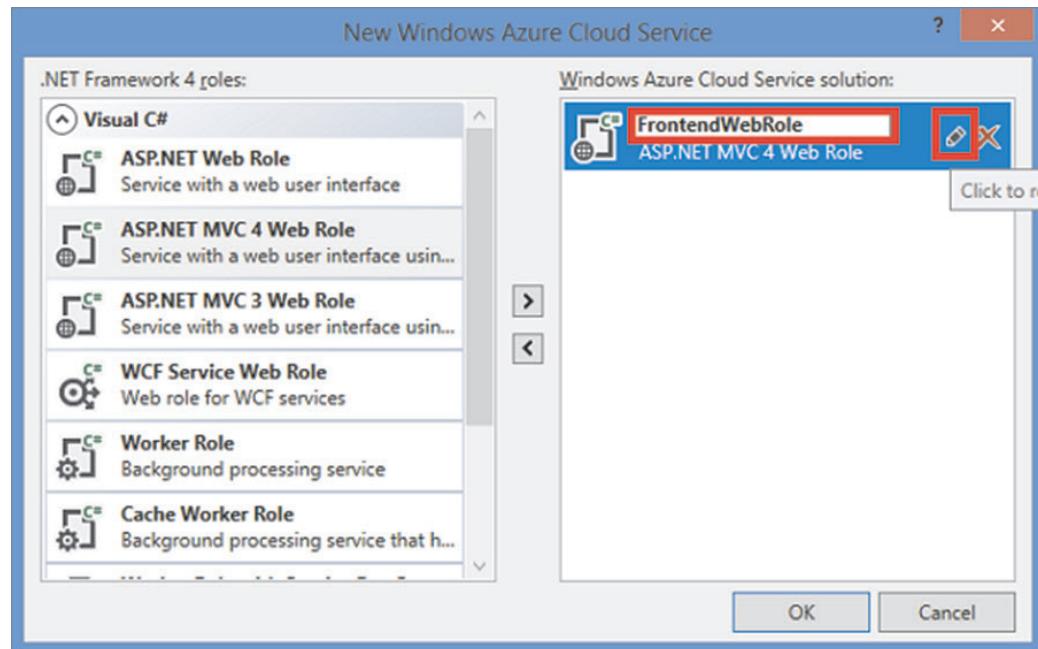


Figure 2.7: Renaming the Role

7. Click **OK**. The **New ASP.NET MVC 4 Project** window appears as shown in figure 2.8. From the **Select a template list**, click **Internet Application**.

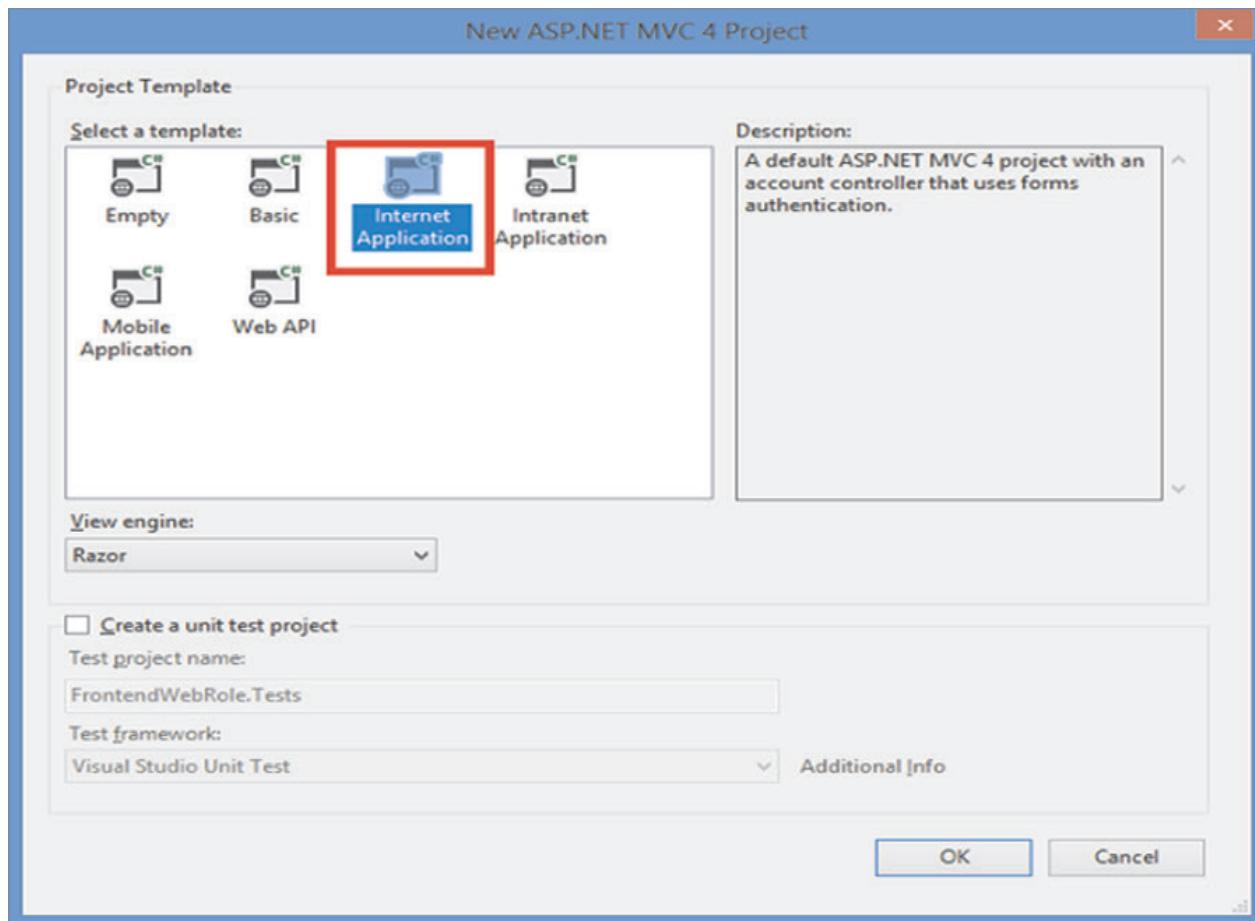


Figure 2.8: New ASP.NET MVC 4 Project

8. Click **OK**. The application will be successfully created. You can test in a browser. Right now, this application will run on a local server. To publish and run it on a cloud server, such as Windows Azure, you need to perform certain steps.

The following steps assume that you have already created a Windows Azure account/subscription. You have a choice of various pricing options to select from including a 30-day free offer. Once you have created your Windows Azure account, you can proceed further.

9. Launch any Web browser.
10. Type **<https://manage.windowsazure.com>** in the browser's address bar. You write **https** because everything under the cloud has security built-in with it.
11. Login with your Microsoft ID that you had used to sign up for Windows Azure as shown in figure 2.9.



Figure 2.9: Login Page

Upon successful login, you will see a dashboard resembling figure 2.10.

The image shows the Windows Azure dashboard. The left sidebar lists categories: ALL ITEMS, WEB SITES (0), VIRTUAL MACHINES (0), MOBILE SERVICES (0), CLOUD SERVICES (0), SQL DATABASES (0), STORAGE (0), and HDINSIGHT (0). The main area is titled "all items" and shows a table with columns NAME, TYPE, and STATUS. One item, "Default Directory", is listed as a "Directory" type with an "Active" status.

Figure 2.10: Windows Azure Dashboard

12. Go back to the Visual Studio IDE and click **Build→ Publish to Windows Azure** as shown in figure 2.11.

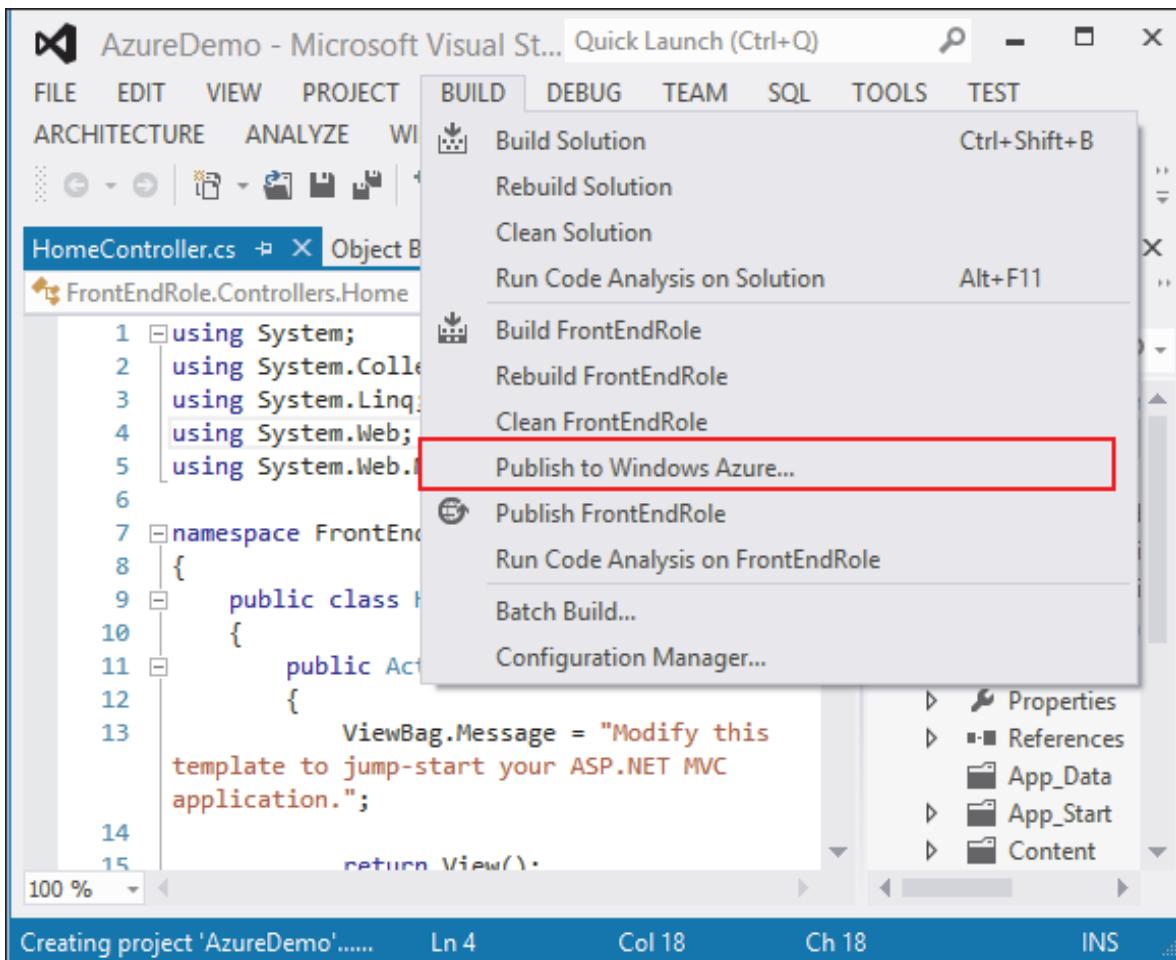


Figure 2.11: Selecting the Publish to Windows Azure Option

The **Publish Windows Azure Application** dialog box is displayed as shown in figure 2.12. Here, you can import your Windows Azure sign-in credentials.

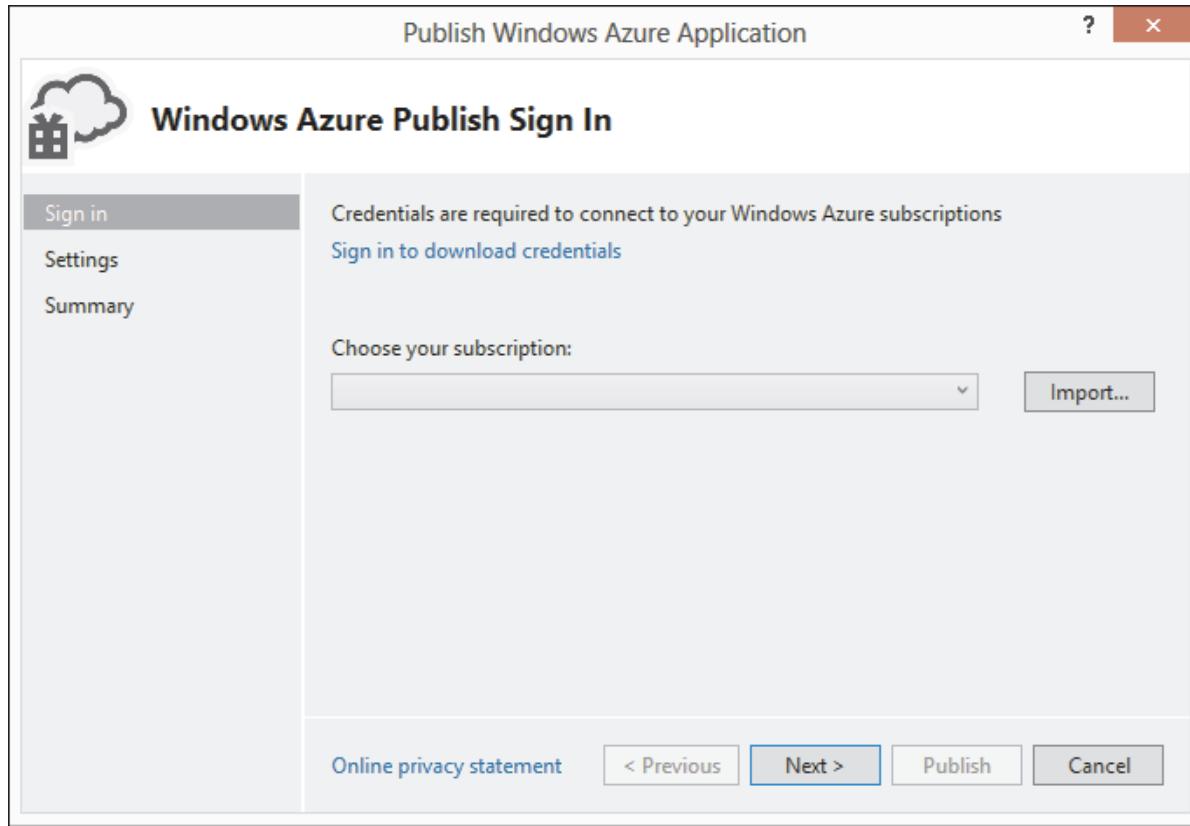


Figure 2.12: Choosing the Subscription

13. Click **Next**. The **Create Windows Azure Service** dialog is displayed as shown in figure 2.13, prompting you to enter a name for the cloud service and a region.

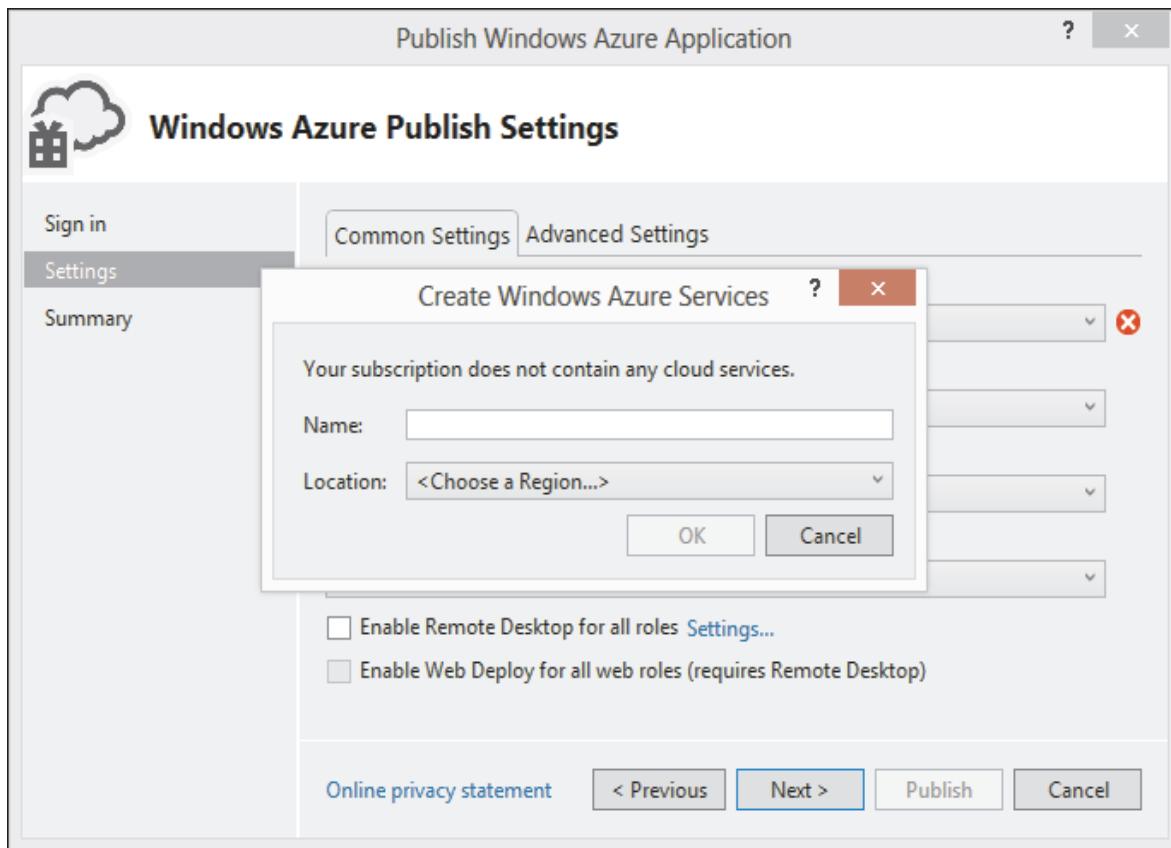


Figure 2.13: Specifying Service Name and Region

14. Type a suitable name and select a region. For example, in figure 2.14, **TestAptechService** is the service name and **Southeast Asia** is the region.

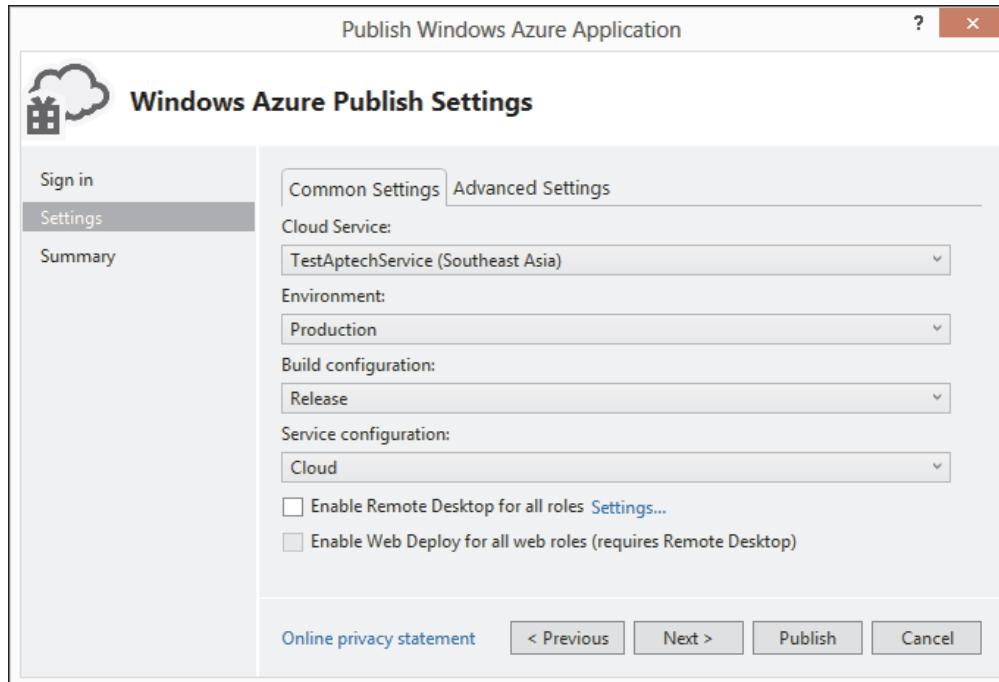


Figure 2.14: Specifying Publish Settings

15. Click **Next**. The summary of all the publish settings is displayed as shown in figure 2.15.

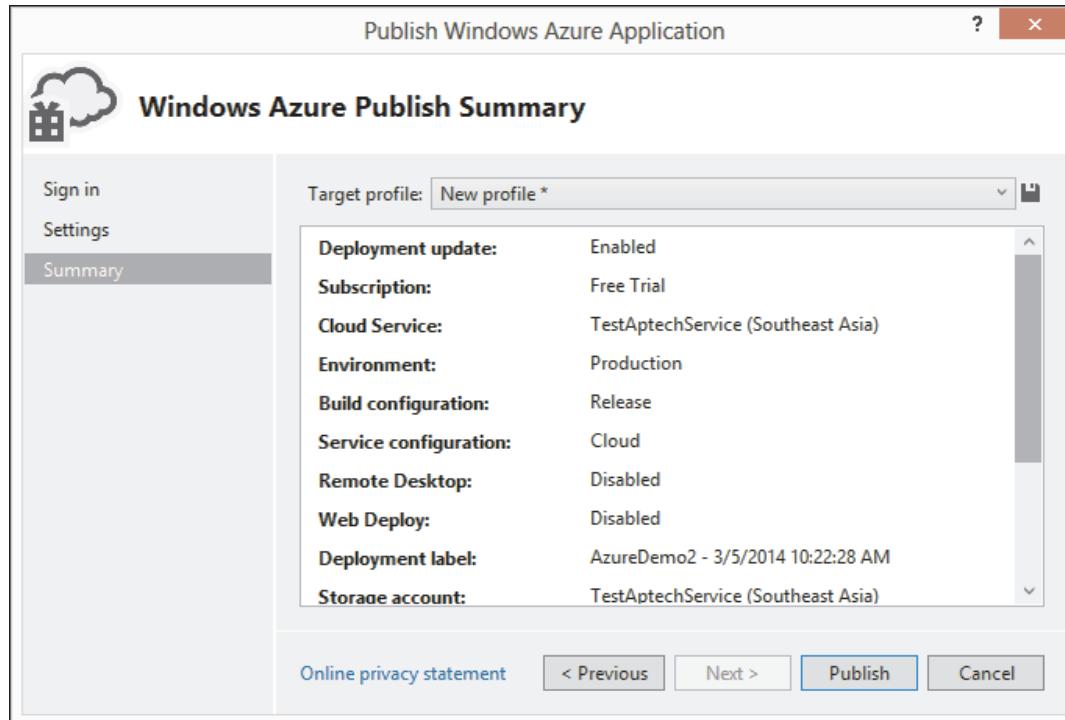


Figure 2.15: Publish Summary

16. Click **Publish**. The Visual Studio 2012 IDE begins the **publish and deploy** action. In the Windows Azure portal, you will see a success message as shown in figure 2.16.

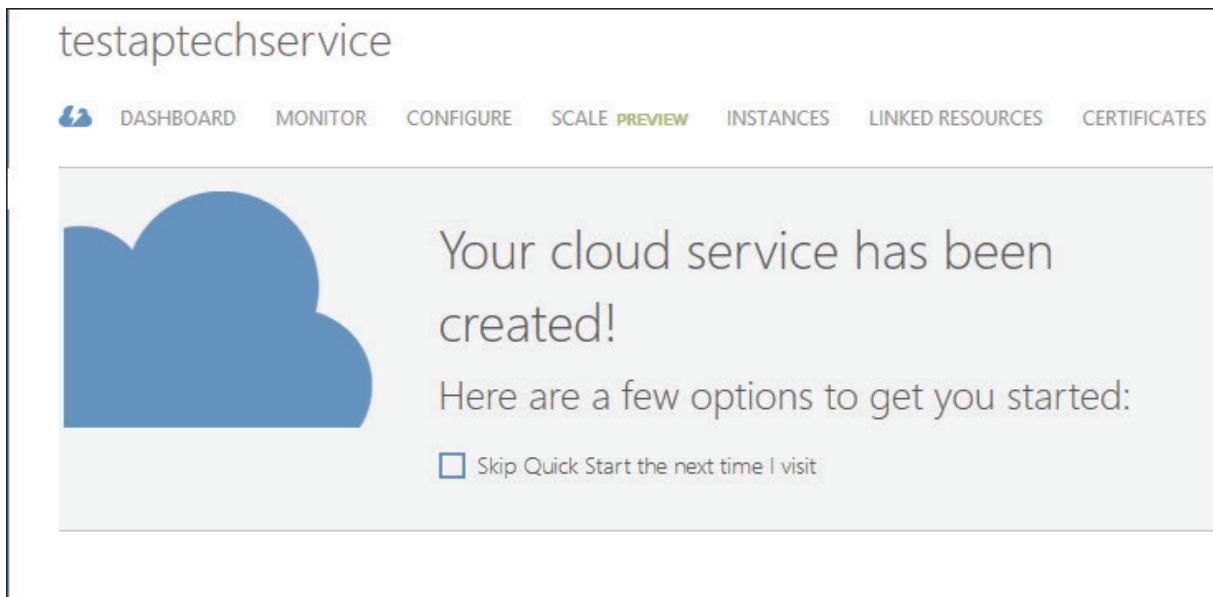


Figure 2.16: Cloud Service Created

17. Click **Cloud Services** on the left pane. You will see the cloud service details in the portal as shown in figure 2.17.

A screenshot of the Windows Azure portal. On the left, there's a sidebar with icons and labels: ALL ITEMS (grid icon), WEB SITES (globe icon, 0 items), VIRTUAL MACHINES (monitor icon, 0 items), MOBILE SERVICES (phone icon, 0 items), CLOUD SERVICES (cloud with gear icon, 1 item selected), SQL DATABASES (database icon, 0 items), and STORAGE (grid icon, 1 item). The main area is titled "cloud services". It shows a table with columns: NAME, SERVICE STATUS, PRODUCTI... (with an upward arrow), and STAGING. There is one row for the service "testaptech...", which is marked as "Created" with a checkmark and "Running" with another checkmark. The "PRODUCTI..." column is partially visible.

Figure 2.17: Cloud Service Details

2.8 SQL Database

Microsoft SQL Azure, now renamed as Windows Azure SQL Database, is a cloud based relational database service that leverages existing SQL Server technologies. SQL Database extends the functionality of Microsoft SQL Server for developing applications that are Web-based, scalable, and distributed. SQL Database enables allow users to perform relational queries, search operations, and synchronize data with mobile users and remote back offices. SQL Azure can store and retrieve both structured and unstructured data. Both cloud based as well as on-premises applications can use the SQL Database.

Applications retrieve data from SQL Database through a protocol known as Tabular Data Stream (TDS). This protocol is not new to SQL Database. Whenever on-premises applications involve interaction with SQL Server Database Engine, this protocol is used by the client and the server.

The SQL Data Sync technology is built on Microsoft Sync Framework and SQL Database. If you have data stored at the local end on SQL Server and also on the cloud through SQL Database, then SQL Data Sync helps you to synchronize both of them.

2.8.1 Architecture of SQL Database

Microsoft Windows Azure SQL Database is hosted on servers running SQL server technologies. There are four layers that provide a relational database. They are as follows:

→ The Client Layer

The Client layer communicates directly with SQL database through your application. It may either reside locally in your data center or be hosted on the cloud in Windows Azure. Since SQL Database provides the same TDS interface as SQL Server, the tools and libraries for building client applications for cloud-based data are the same as those in SQL Server.

→ The Services Layer

It acts as a gateway between the client layer and the platform layer. The Services layer is responsible for managing all the connections routing between your application and the various physical servers where data resides. The following functions are performed by the services layer:

- Provisioning or arranging for creation of the databases
- Billing and metering
- Connection routing

→ The Platform Layer

The platform layer includes the physical servers and various services that support the services layer. This layer comprises many instances of SQL Server and each of these is managed by the SQL Database fabric, which is a distributed computing system of tightly integrated networks, servers, and storage. The SQL Database fabric supports features such as automatic failover, load balancing, and so on.

→ Infrastructure Layer

The infrastructure layer indicates the IT administration of the infrastructure such as physical hardware and operating systems supporting the services layer.

2.8.2 Differences between SQL Server and Windows Azure SQL Database

In a local SQL server environment, when preparing an on-premises deployment, it may be the role of the DBA or IT department to prepare and configure the required hardware and software. When using SQL Database, these tasks are performed by the SQL Database provisioning process.

In Windows Azure SQL Database, the logical administration is separated from the physical administration. This means that while users can still administer databases, users, roles, and logins, the administration of physical hardware such as hard drives, servers, and storage is taken care of by Microsoft. This enables Windows Azure SQL Database in providing a large-scale multi-tenant database service with features such as enterprise-class availability, scalability, security, and so on.

In SQL Server, many Transact-SQL Statements have parameters that allow you to specify file groups or physical file paths. SQL Database does not support any type of parameters because they have dependencies on the physical configuration.

SQL Database does not support all of the features and data types found in SQL Server. For instance, Analysis Services, Replication, Reporting Services, and Service Broker are not currently provided as services on SQL Database.

SQL Database offers the scale and functionality required in an enterprise data center, without the administrative overheads that would be normally incurred. In an on-premise instance of SQL Server that provides such functionality, these overheads are often unavoidable.

2.8.3 Creating Databases and Tables

In order to begin creating a SQL database, the user must first create and activate a Windows Azure subscription. The user can also create SQL Database using SQL Server Management Studio. The user must be connected to the database in order to use the CREATE DATABASE, ALTER DATABASE, or DROP DATABASE statements.

To create a SQL Database:

1. Visit the Windows Azure Platform Management Portal and login with a Windows Live ID account that has been associated with the Windows Azure Platform subscription.

2. Click **SQL DATABASES** on the left. You will get a message similar to that seen in figure 2.18.

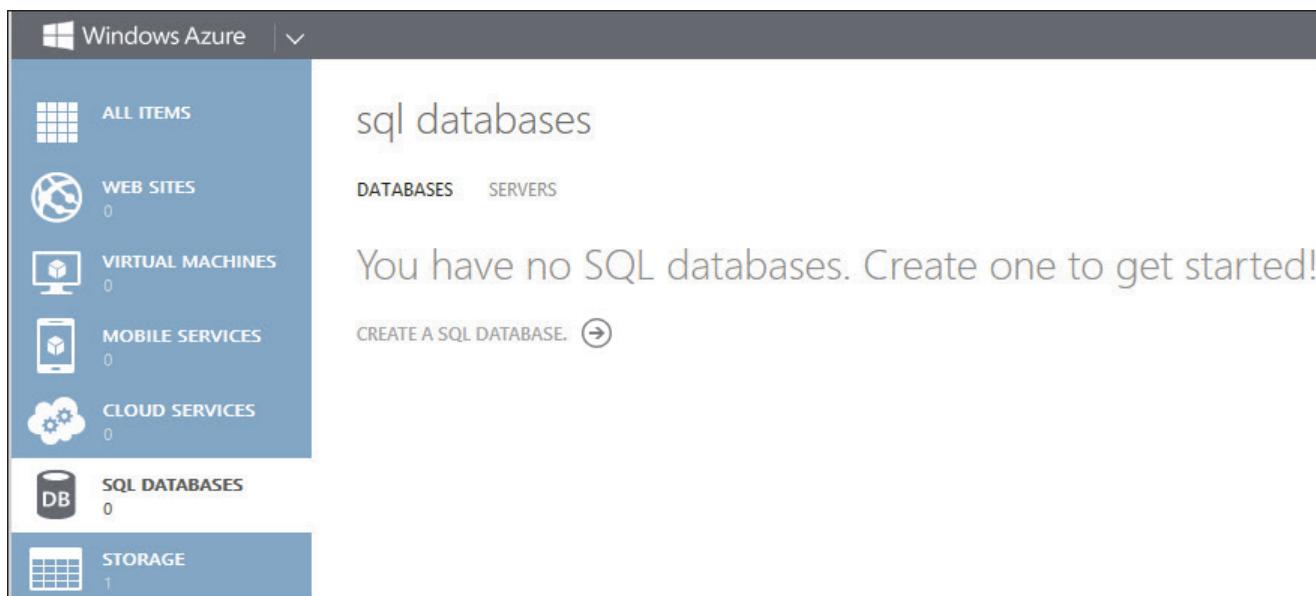


Figure 2.18: Selecting SQL Databases Option

3. Click **CREATE A SQL DATABASE**. You will be asked to specify the database details as shown in figure 2.19. Specify a suitable name.

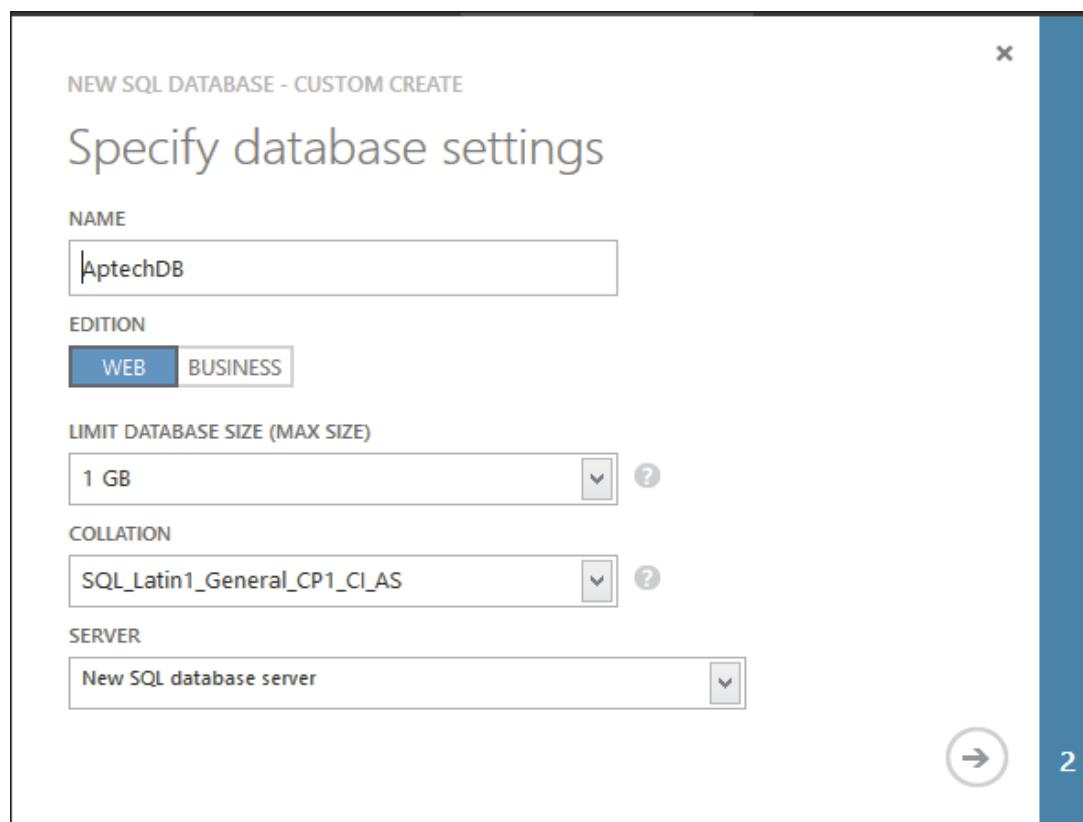


Figure 2.19: Specifying SQL Database Settings

4. Click the arrow at the bottom of the pane to proceed further. Next, you will be asked to specify login credentials that you wish for the cloud database account. Note that as shown in figure 2.20, you have to follow certain naming conventions.

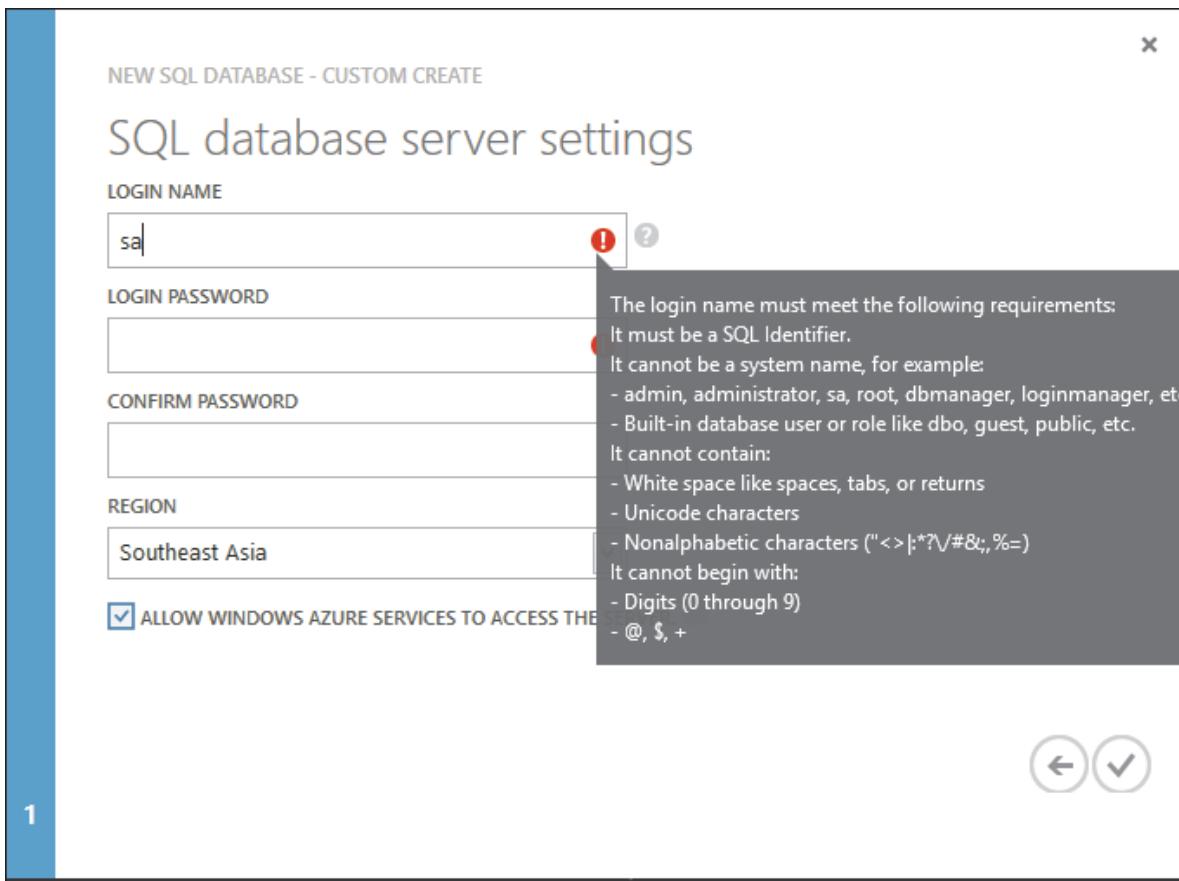


Figure 2.20: Specifying SQL Database Server Settings

5. Click the check mark arrow to complete the creation of the database. Once this is done, the database is successfully created.

Figure 2.21 shows the database created.

The screenshot shows the Windows Azure management portal. On the left, there's a sidebar with icons for All Items, Web Sites, Virtual Machines, Mobile Services, Cloud Services, SQL Databases, and Storage. The SQL Databases section is selected, showing 1 item. The main area is titled 'sql databases' and contains a table with columns: NAME, STATUS, LOCATION, SUBSCRIPTION, SERVER, EDITION, and MAX SIZE. One row is listed: AptechDB, Online, Southeast Asia, Free Trial, ocsj8abfpg, Web, 1 GB. There are tabs for DATABASES and SERVERS at the top of the table.

Figure 2.21: Database Created

If you check the main dashboard on the portal, you will see three items: the cloud service, the storage (which was automatically created when you created a cloud service), and the cloud database. Figure 2.22 shows this.

The screenshot shows the Windows Azure All Items dashboard. The title is 'all items'. Below it is a table with columns: NAME, TYPE, STATUS, SUBSCRIPTION, and LOCATION. There are four rows: 1. Default Directory, Type: Directory, Status: Active, Subscription: Shared by all Default Di..., Location: Asia, Europe, Unite... 2. testaptechservice, Type: Storage Account, Status: Online, Subscription: Free Trial, Location: Southeast Asia 3. AptechDB, Type: SQL Database, Status: Online, Subscription: Free Trial, Location: Southeast Asia 4. testaptechservice, Type: Cloud service, Status: Running, Subscription: Free Trial, Location: Southeast Asia. The second row (testaptechservice) is highlighted with a blue background.

Figure 2.22: Viewing the Dashboard

- Click the database name, **AptechDB**. You will see the various tasks that you can perform with your database. Figure 2.23 shows these.

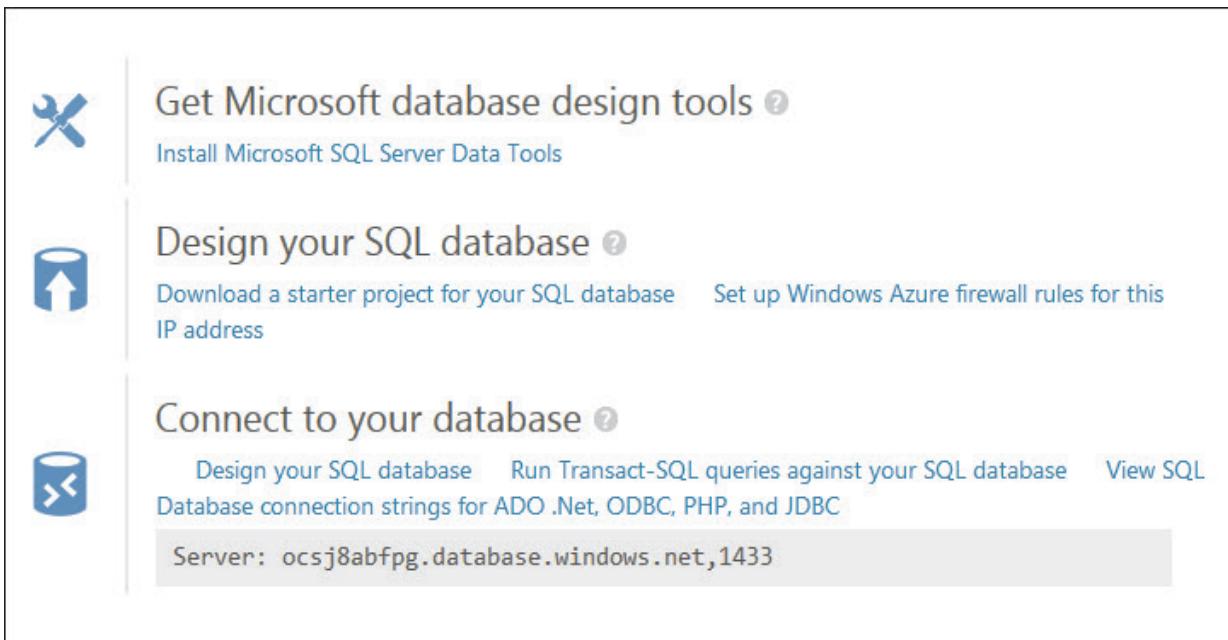


Figure 2.23: Database Tasks

Observe that this page also displays the cloud database server URL that can be used to connect to the server.

Now, each user you will see how to work with the cloud database using SQL Server Management Studio (SSMS) on your local machine.

- Launch SSMS.
- In the login credentials box, specify the cloud account credentials as shown in figure 2.24.

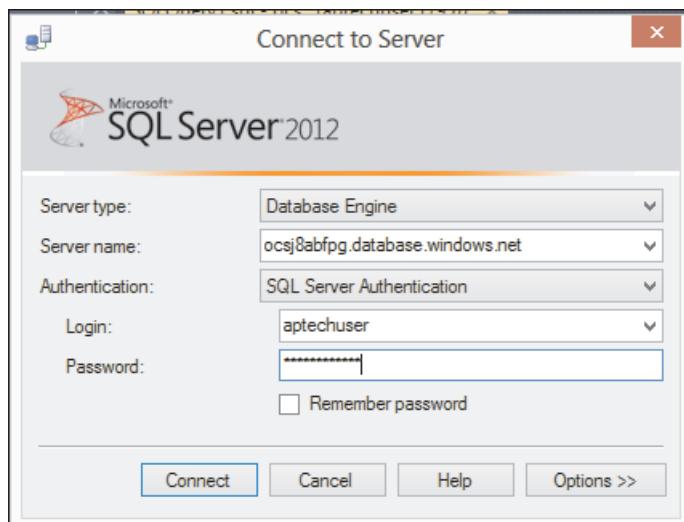


Figure 2.24: Specifying Cloud Database Server Details

The Object Explorer is displayed with the cloud database.

- Right-click **Tables** and select **New Table**. The default script for creating a new cloud based table is displayed on the right as shown in figure 2.25.

```
-- =====
-- Create table template SQL Azure Database
-- =====

IF OBJECT_ID('`<schema_name>`.', 'U') IS NOT NULL
    DROP TABLE `<schema_name>`.`<table_name>`;
GO

CREATE TABLE `<schema_name>`.`<table_name>` (
    <columns_in_primary_key>, `c1` <column1_datatype>, , int
    <column1_nullability>, NOT NULL,
    <column2_name>, sysname, `c2` <column2_datatype>, , char(10)
    <column2_nullability>, NULL,
    <column3_name>, sysname, `c3` <column3_datatype>, , datetime
    <column3_nullability>, NULL,
    CONSTRAINT <constraint_name>, sysname, PK_`<sample_table>`
PRIMARY KEY (<columns_in_primary_key>, `c1`)
)
GO
```

Figure 2.25: Cloud Database Seen in SSMS Object Explorer

- Edit the code as shown in figure 2.26 and then, click **Execute** to create a table named **Student**.

```
-- =====

CREATE TABLE Student
(
    StudId int PRIMARY KEY,
    StudName varchar(100) NOT NULL,
    Age int NOT NULL,
    StudClass varchar(20) NOT NULL,
)
GO
```

100 % < Messages Command(s) completed successfully.

Figure 2.26: Creating Student Table

The table is successfully created.

11. To run queries against this table, go to the Windows Azure portal and click **Run Transact-SQL queries against your SQL database**. You will be asked to provide cloud database server login credentials as shown in figure 2.27.

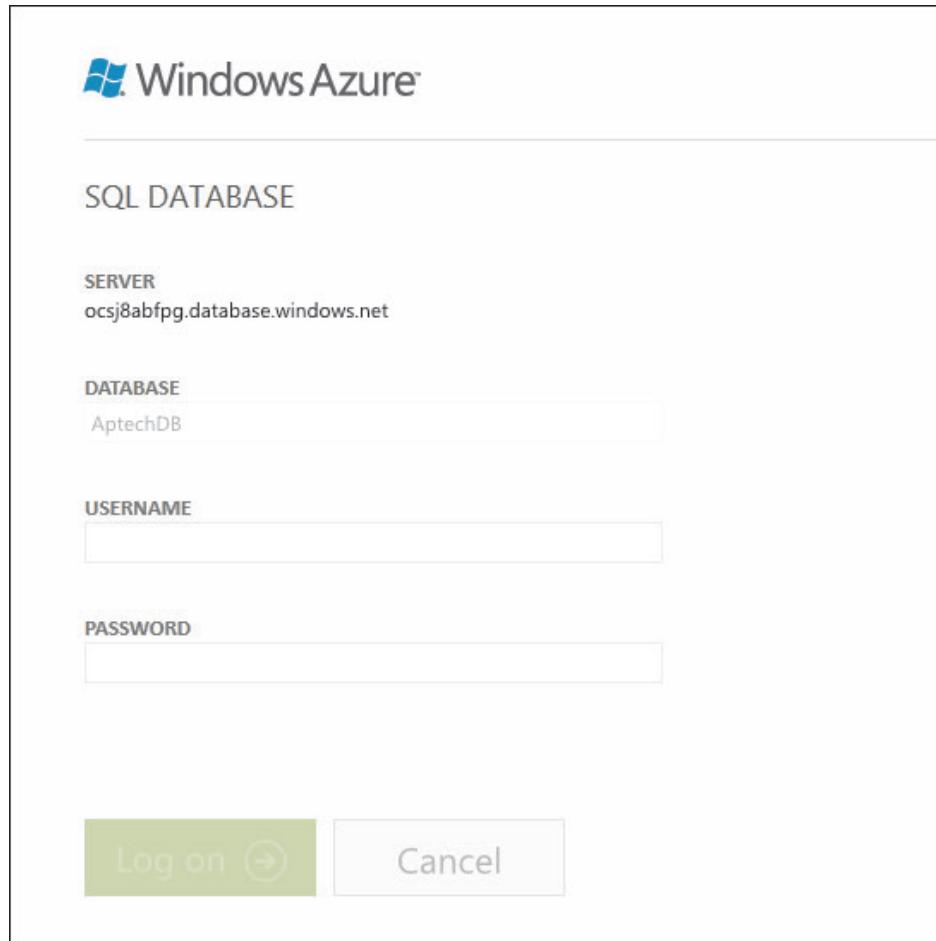


Figure 2.27: Specifying Cloud Server Login Details

On successful login, you will see a new screen where you can type and execute Transact-SQL queries on cloud-based tables.

Figure 2.28 shows an example of a query.

The screenshot shows the SSMS interface with the following details:

- Top Bar:** Shows the connection path "ocsj8abfpg.database.windows.net > [AptechDB] > Query(Untitled1.sql)*". It also displays the user "aptechuser" and links for "Log off" and "Help".
- Toolbar:** Includes buttons for "New Query", "Open", "Save As", "Run" (which is highlighted with a blue border), "Actual Plan", "Estimate...", and "Stop".
- Left Sidebar:** Titled "AptechDB" and "My Work (1)". It lists "Query(Untitled1.sql)" and has sections for "Overview", "Administration", and "Design".
- Query Editor:** Contains the Transact-SQL query: "SELECT * FROM Student".
- Results Grid:** Displays the results of the query. The header row includes columns: "StudId", "StudName", "Age", and "StudClass". Below the header, there is a message: "1 0 Row(s)".

Figure 2.28: Executing a Transact-SQL Query against a Cloud Database

2.9 Windows Azure AppFabric

In earlier versions of Windows Azure, one of the key components of its architecture was Windows Azure AppFabric. However, Windows Azure AppFabric is no longer called by that name and instead, has become a part of Windows Azure 'Client Libraries for .NET'. It represents a set of middleware services that aim to increase interoperability between the components of your software solution. It contains technologies such as Service Bus, Caching, Multi-Factor Authentication, and so on.

2.9.1 Service Bus

Regardless of whether an application is running in the cloud or on-premises, it may need to interact with other applications or software. To provide a way to do this, Windows Azure offers Service Bus as a messaging solution for applications. The Service Bus sits between components of a cloud app or between a cloud and on-premises applications and enables exchange of messages.

Service Bus is a multi-tenant cloud service, indicating that the service is shared by multiple users. Each user will create a namespace and then, define the communication mechanisms he/she needs within that namespace. Within a namespace, users can have one or more instances of the following communication mechanisms:

- **Queues:** They allow one-directional communication. Each queue acts as a middleman or broker to store sent messages until they are received.
- **Topics:** They provide one-directional communication using subscriptions. Like a queue, a topic acts as a middleman or broker, but allows each subscription to see only those messages that match specific criteria.

- **Relays:** They provide bi-directional communication. However, unlike queues and topics, a relay does not store in-flight messages – it does not behave like a broker. A relay just passes the messages to the destination application.

Each of these three connects applications in a different way.

Figure 2.29 depicts the Service Bus.

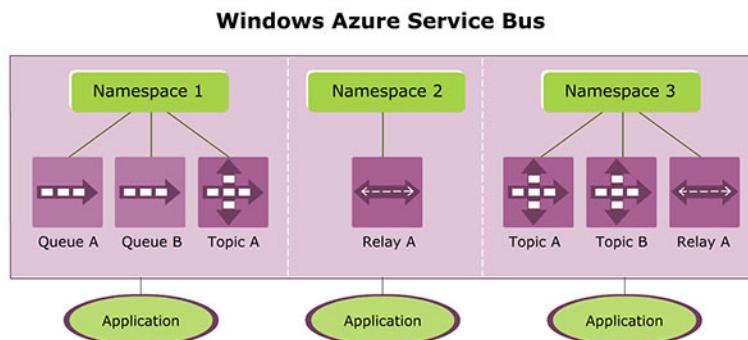


Figure 2.29: Service Bus

2.9.2 Multi-Factor Authentication

Multi-Factor authentication enables additional authentication for cloud and on-premises applications. It helps to protect and secure access to your data and applications. Users must additionally authenticate through a mobile app or by responding to an automated text message or phone call before access is given. It is implemented by enforcing any two or more of the following verification methods:

- Something the users know (such as a knowledge of a password)
- Something the users possess (such as a phone)
- Something you are (such as individual biometrics)

2.9.3 Windows Azure Cache

Windows Azure Cache is another key part of Windows Azure ‘Client Libraries for .NET’. It is a distributed, in-memory, scalable solution that gives you super-fast access to data, which in turn, allows you to create highly scalable and responsive applications.

Cache temporarily stores information from other backend sources and thus increases performance. High performance is achieved when this cache in-memory is maintained in a distributed environment.

Cache can reduce the costs of a Windows Azure project and raise the scalability of other storage services such as SQL Database or Azure storage. ASP.NET applications can use Cache for session state and output caching.

2.10 Check Your Progress

1. _____ enable users to deploy any OS image in the cloud.

(A)	Virtual Machines	(C)	Cloud Services
(B)	Web Sites	(D)	Mobile Services

2. Which of the following statements regarding Windows Azure are true?

- a. Windows Azure is a popular SaaS product.
- b. Windows Azure offers Service Bus as a messaging solution for applications.
- c. Windows Azure includes a Queue storage for storing large numbers of messages that can be accessed from anywhere in the world via authenticated calls using HTTP or HTTPS.
- d. Windows Azure platform offers high availability (nearly 99.9%) of the application and the data.
- e. The Windows Azure platform does not include taking care of tasks such as provisioning, load balancing of applications, and monitoring.

(A)	a, b, d, e	(C)	a, c, e
(B)	b, c, d	(D)	a, c, b, d

3. Which of the following statements regarding SQL Database are true?

- a. SQL Database was formerly called SQL Azure and is a key part of the Windows Azure platform.
- b. SQL Azure does not support connection through SSMS.
- c. SQL Azure stores data in the form of queues and blobs.
- d. Applications retrieve data from SQL Database through a protocol known as Tabular Data Stream (TDS).
- e. SQL Database supports use of parameters in queries.

(A)	a, b, d, e	(C)	a, c, e
(B)	b, c, d	(D)	a, d

4. Identify the communication mechanism that is not used in a namespace in a Service Bus.

(A)	Queues	(C)	Topics
(B)	Blobs	(D)	Relays

2.10.1 Answers

1.	A
2.	B
3.	D
4.	B



Summary

- Windows Azure is a cloud computing platform and infrastructure that not only hosts applications but also enables you to build, deploy, and manage them.
- Windows Azure platform offers several powerful features and benefits.
- Windows Azure platform architecture includes several components, of which the following are most important: Compute, Data Services, and App Services.
- Windows Azure platform supports three types of storage: blobs, tables, and queues.
- Windows Azure has been designed in such a manner that only the owner can access the blobs, tables, and queues inside the owned account.
- Windows Azure SQL Database is a cloud based relational database service that leverages existing SQL Server technologies.
- SQL Database supports connection through SSMS to the cloud database.



Session - 3

Google App Engine

Welcome to the Session, **Google App Engine**.

This session introduces Google's cloud computing environment called Google App Engine. The session describes features and development environments provided by Google App Engine. Further, the session describes the steps to sign in Google App Engine account and deploy applications on it. Finally, the session discusses on the data storage and various services offered by Google App Engine for the applications.

In this Session, you will learn to:

- Describe the Google App Engine cloud environment
- Describe the various features of Google App Engine
- Explain the development and deployment in Google App Engine
- Explain the different types of storage services provided in Google App Engine
- List and describe the different types of API services offered by Google App Engine

3.1 Introduction

Google provides a distributed and scalable cloud computing environment called Google App Engine. Google App Engine, also referred to as App Engine, is a platform that allows you to develop Web applications that are hosted on Google infrastructure. The Google infrastructure provides necessary software to build and maintain the Web applications and scales millions of users' requests and data storage requirements.

The users can simply upload the ready-to-run Web applications to Google-managed servers that make applications accessible to outside world in a very short time. Thus, Google App Engine platform combines building, testing, and maintaining of applications in a highly scalable cloud computing environment.

3.2 Features of Google App Engine

Google App Engine offers features that are supported across all languages and runtimes. However, there can be an exception to this, as a particular feature may be supported by only some languages.

Some of the features of Google App Engine are as follows:

- Google App Engine supports various languages, such as Java, Python, PHP, and Go to develop Web applications.
- Each language has a runtime and a SDK containing tools that can be used to develop and deploy an application, and test it locally.
- Google App Engine manages components of the Web application lifecycle such as request logs, application status check, and application version updating, and so on.
- Google App Engine makes it easy to build Web applications that are robust and reliable, even under heavy load and with large amounts of data.
- Google App Engine supports common Web technologies that can be used for building dynamic Web applications.
- Google App Engine provides APIs for authenticating users and sending email using Google accounts.
- Google App Engine provides a development environment that facilitates the development and testing of Web applications on local machines.
- Google App Engine provides a secure environment referred to as Sandbox. The applications executed in secure environment are having limited access to operating system resources. For example, applications executing in any runtime environment do not have access to write in the native file system.

- Google App Engine provides a support for NoSQL data storage that has a query engine and supports transaction properties for concurrency control.
- Google App Engine provides various services that are used to perform common operations on the applications. Some of the services are as follows:
 - URL Fetch
 - Mail
 - Memcache
 - Image manipulation
 - eXtensible Messaging and Presence Protocol (XMPP)
 - Task Queues

3.2.1 Google App Engine Quota

Google App Engine is a PaaS service that offers App Engines APIs as well as hosting services for the applications. The users do not have to maintain any physical servers at their location, instead Google App Engine offers 1 GB of free data storage for the users. However, a user can exceed the limit by making applications as paid. This provides increased storage and higher bandwidth to the applications.

Google App Engine offers three kinds of quotas that are as follows:

- **Free Quota** – It is set to provide a certain amount of free limit for deploying applications on the Google App Engine.
- **Billable Limits** – They are set by administrator and is applied for paid applications. Once set, the applications cannot exceed the limit.
- **Safety Limits** – They are set by Google for paid as well as free applications. They ensure that a single application cannot consume resources alone, leaving other applications starving for resources. In case, if the limit exceed, then an exception is thrown.

3.3 Signing Up for Google App Engine

To create an application and deploy it on Google App Engine, you need a Google App Engine account.

You can visit <http://appengine.google.com> and login with your Google account credentials. In case, you do not have a Google account, then sign up for a new Google account to create and register your Web applications on Google App Engine.

The steps to create a new Google account are as follows:

1. Type the address <http://appengine.google.com> to open the Google account page.
2. Click **Create an account** link to create a new Google account.

Figure 3.1 shows the Google account page.

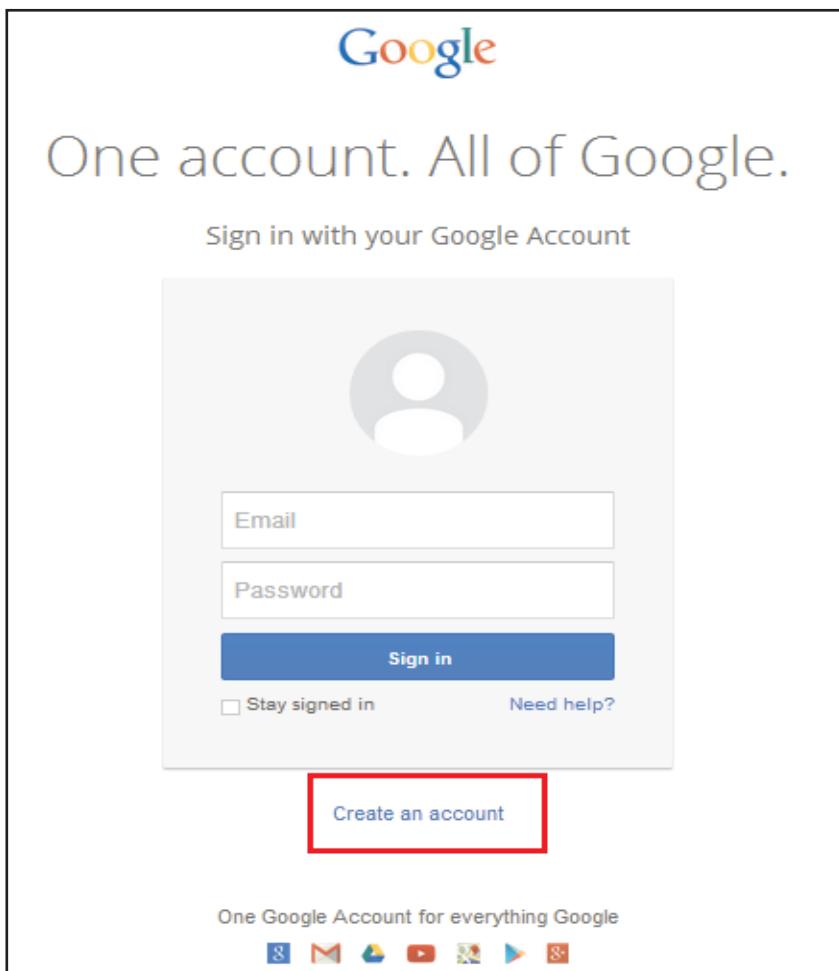


Figure 3.1: Link for a New Google Account

After the link is clicked, figure 3.2 shows the registration page to sign up a new account.

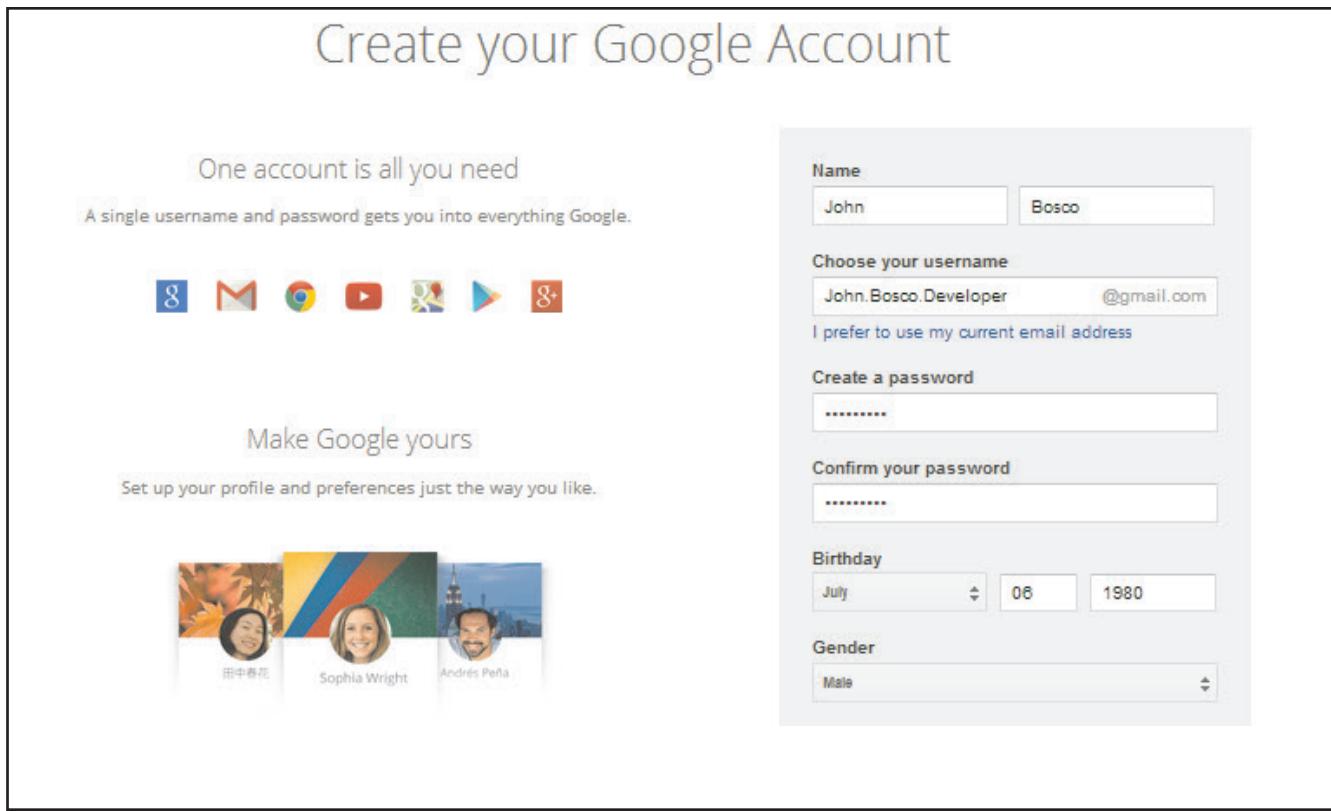


Figure 3.2: Sign Up for a Google Account

- Specify the details, accept the terms and conditions, and click **Next Step**.

After the login details are submitted, Google verifies the account by sending a code through SMS on the registered mobile number. Figure 3.3 displays the screen to enter the received verification code.

- Enter the verification code and click **Continue**.

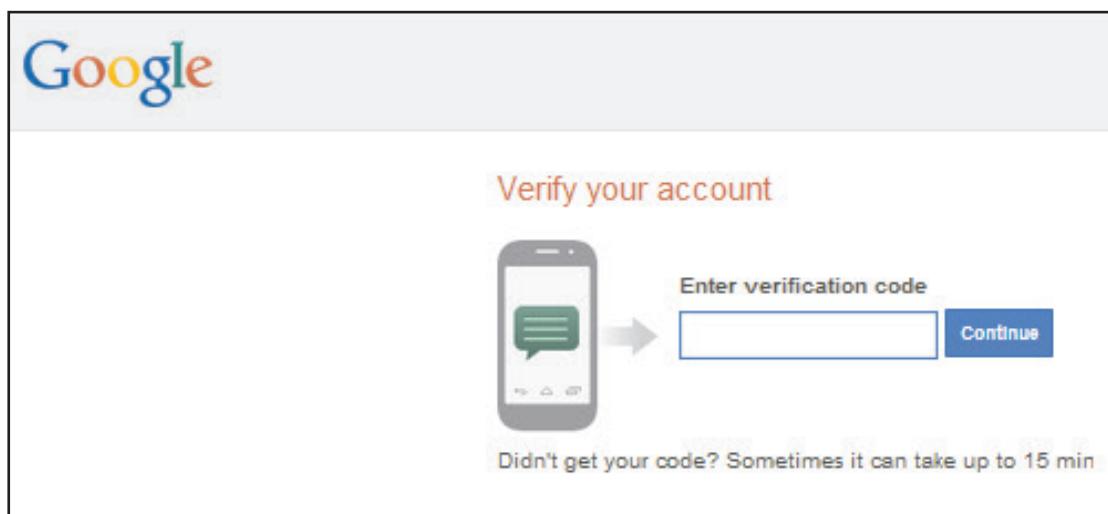


Figure 3.3: Verification Code

The next page informs users how the user name will appear on login page. Figure 3.4 shows the user profile.

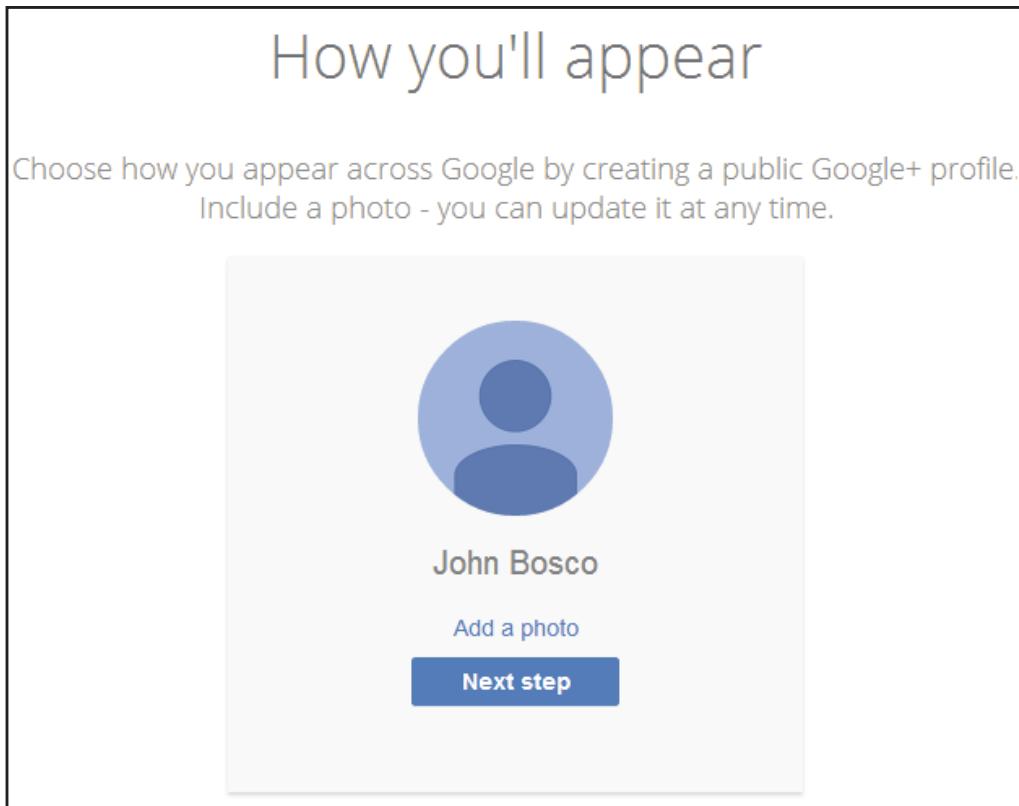


Figure 3.4: Google Profile

5. Click **Next Step** to finish creating the Google account.

Figure 3.5 displays the Google account creation page with e-mail address.

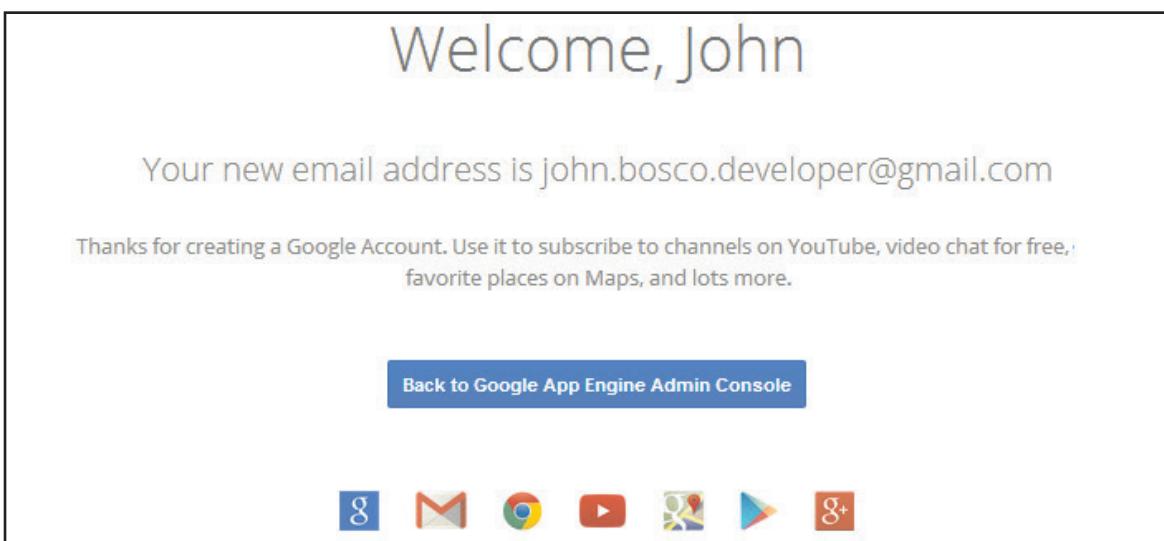


Figure 3.5: Welcome Page

6. Click **Back to Google App Engine Admin Console** to display the Google App Engine start page as shown in figure 3.6.



Figure 3.6: Google App Engine Start Page

3.3.1 Creating and Registering an Application

If you have logged in for the first time on Google App Engine page, then you need to create and register your application. The registration process is required only for the first application and will not be prompted again, while developing and deploying further applications on the Google App Engine.

The steps to create and register the first application are as follows:

1. Type `http://appengine.google.com` to login with your Google account credentials. Figure 3.7 displays the Sign in page for Google account.

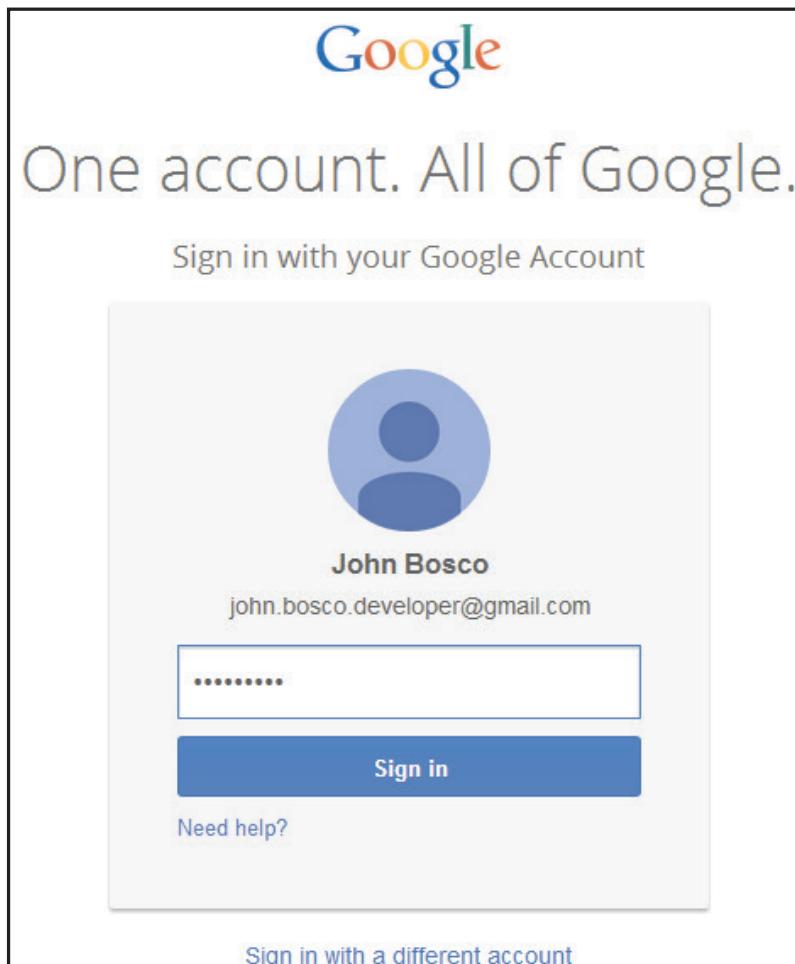


Figure 3.7: Sign in Google Account Page

2. Specify the login credentials and click **Sign in**.

This will display the Google App Engine start page as shown in figure 3.8.

Figure 3.8: Google App Engine Start Page - Sign in

3. Click **Create Application**. This will display **Create an Application** Web page as shown in figure 3.9.

You have 10 applications remaining.

Application Identifier:

 .appspot.com

All Google account names and certain offensive or trademarked names may not be used as Application Identifiers.
You can map this application to your own domain later. [Learn more](#)

Application Title:

Displayed when users access your application.

Authentication Options (Advanced): [Learn more](#)

Google App Engine provides an API for authenticating your users, including Google Accounts, Google Apps, and OpenID. If you choose to use this feature for some parts of your site, you'll need to specify now what type of users can sign in to your application:

- Open to all Google Accounts users (default)**
If your application uses authentication, anyone with a valid Google Account may sign in.
- Restricted to the following Google Apps domain:**

e.g. foo.com
If your application uses authentication, only members of this Google Apps domain may sign in. If your organization uses Google Apps, use this option to create an application (e.g. an HR tracking tool) that is only accessible to accounts on your Google Apps domain. This option cannot be changed once it has been set.
- (Experimental) Open to all users with an OpenID Provider**
If your application uses authentication, anyone who has an account with an OpenID Provider may sign in.

Figure 3.9: Create an Application Web Page

4. Type `your-app-id` in the **Application Identifier** box. The application ID is a unique name given to the application on the domain **appspot.com**. Here, **appspot.com** is the free domain on which your application is identified with unique identifier. The full URL of the application will be
`http://your-app-id.appspot.com`
5. Click **Check Availability** to check if the application ID is valid.
6. Type `your-app-title` in the **Application Title** box. This serves as a title for the application.
7. Click **I accept these terms** check box to accept the terms and conditions as shown in figure 3.10.

Create an Application

You have 10 applications remaining.

Application Identifier: helloapp123.appspot.com [Check Availability](#) Yes, "helloapp123" is available!

All Google account names and certain offensive or trademarked names may not be used as Application Identifiers.
You can map this application to your own domain later. [Learn more](#)

Application Title: Python Application
Displayed when users access your application.

Authentication Options (Advanced): [Learn more](#)
Google App Engine provides an API for authenticating your users, including Google Accounts, Google Apps, and OpenID. If you choose to use this feature for some parts of your site, you'll need to specify now what type of users can sign in to your application:

- Open to all Google Accounts users (default)**
If your application uses authentication, anyone with a valid Google Account may sign in.
- Restricted to the following Google Apps domain:**

e.g. foo.com
If your application uses authentication, only members of this Google Apps domain may sign in. If your organization uses Google Apps, use this option to create an application (e.g. an HR tracking tool) that is only accessible to accounts on your Google Apps domain. This option cannot be changed once it has been set.
- (Experimental) Open to all users with an OpenID Provider**
If your application uses authentication, anyone who has an account with an OpenID Provider may sign in.

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Figure 3.10: New Application Details

8. Click **Create Application** to create a new application. The **Application Registered Successfully** Web page is displayed as shown in figure 3.11.

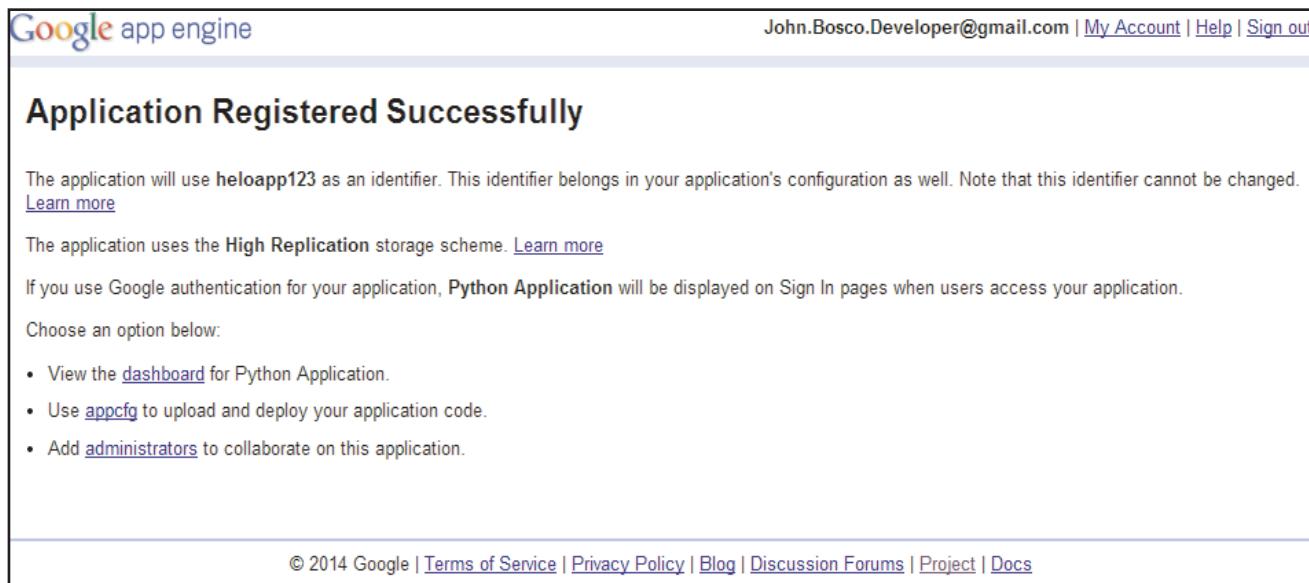


Figure 3.11: Application Registration Web Page

The registered application ID will be mapped to the application to be deployed on the Google App Engine.

3.4 Google App Engine Development Environments

Google App Engine platform supports different programming languages such as Java, Python, PHP, and Go for application development. Each language provides a Software Development Kit (SDK) and a runtime environment that includes:

- Application Programming Interfaces (APIs) classes to build an application.
- Deployment tools to upload the developed application to the Google cloud environment.
- Simulated Google App Engine sandbox environment that provides a full featured development environment on your local system.

Note - Google App Engine also supports languages such as JRuby and JPython, which are Java implementation of the Ruby language and Python language respectively.

With Google App Engine, users can build applications using many libraries, tools, and frameworks. Google App Engine applications can be written in the Go, Java, Python, or PHP programming languages. Each language provides its own Software Development Kit (SDK) and the runtime environment. The different language SDKs consists of various tools that are used for developing, deploying, and testing the applications, before uploading them on the Google infrastructure.

3.4.1 Developing Web Application with Python

Python is a high-level object-oriented programming language. Its syntax helps the programmers to develop complex code easily as compared to other languages such as C or Java. Users can use Python to develop Web applications for Google App Engine.

A pre-loaded Python interpreter on the Google App Engine is used to execute the application in a secured sandbox environment. The application interacts with the environment and performs activities such as receiving Web requests, sending responses, and so on.

The Python SDK includes a Google App Engine Launcher that runs on the local machine and provides a graphical interface that simplifies the application development.

The steps to create an application on Google App Engine using Python are as follows:

1. Download and install the latest version of Python from the Web site, <http://www.python.org/download/releases/> as shown in figure 3.12.



Figure 3.12: Python – Download Web Page

2. Download Google App Engine launcher from https://developers.google.com/appengine/downloads#Google_App_Engine_SDK_for_Python for the respective platform. For example, **GoogleAppEngine-1.9.0.msi**.
3. Install the **GoogleAppEngine-1.9.0.msi** on your local system.

4. Launch the **Google App Engine Launcher** as shown in figure 3.13.

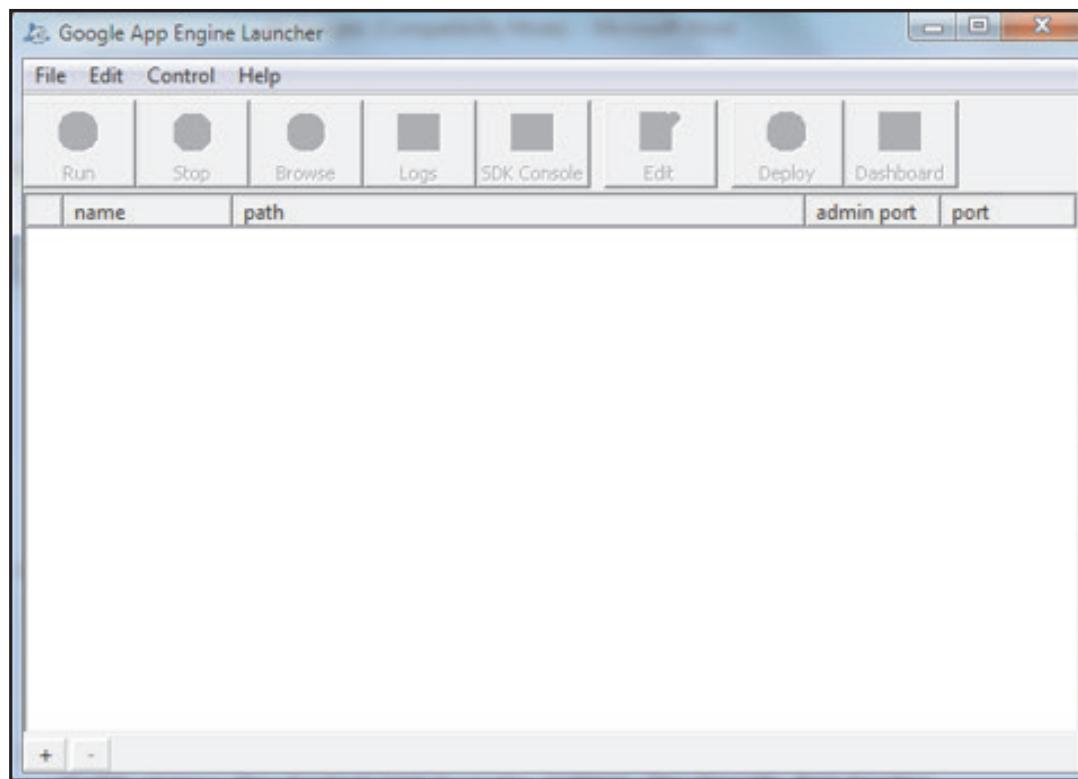


Figure 3.13: Google App Engine Launcher

5. Click **File** → **Create New Application**.
6. Type **robbapp1234** in the **Application Name**.
7. Click **Create** to create the Web application.
8. Click **Run** on the Toolbar to start the application. Then, click **Browse** to open the Web browser and view the generated output of the application.

Figure 3.14 shows the output of the Python application.

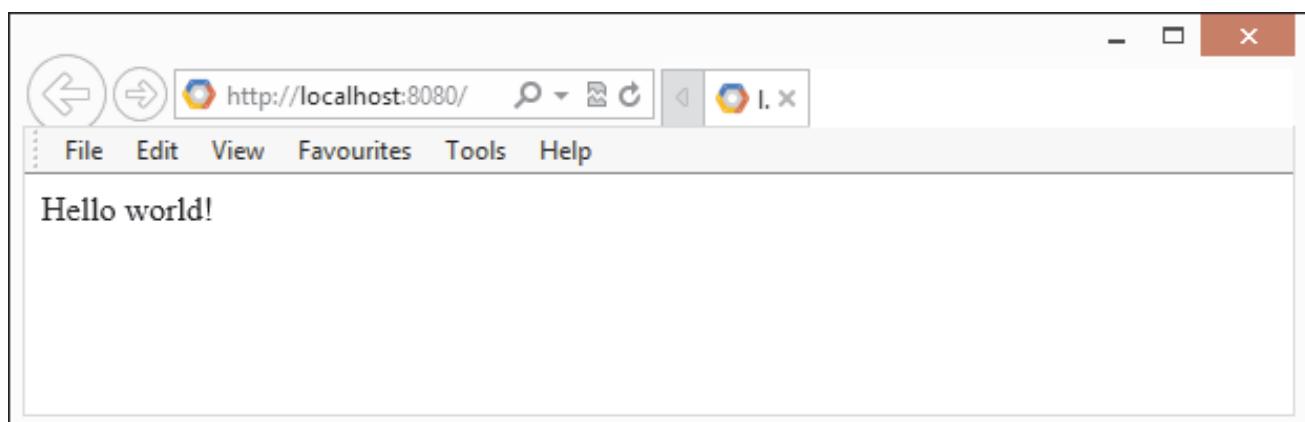


Figure 3.14: Output – Python Application

9. Click **Edit → Open in Explorer** to view the structure of the application created in the directory specified during application creation as shown in figure 3.15.

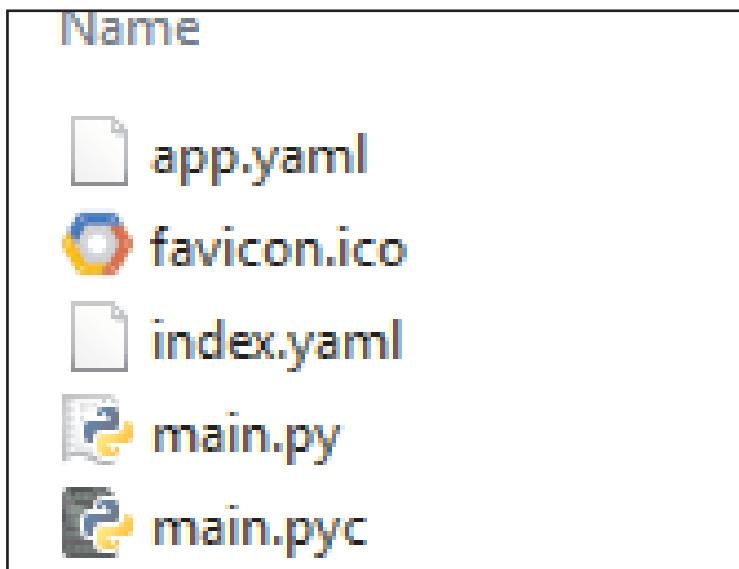


Figure 3.15: Structure of robbapp1234 Application

As shown in the figure, `main.py` is the Python script with the message, 'Hello, World!'. The `app.yaml` represents the Google App Engine configuration file.

Figure 3.16 shows the contents of the `app.yaml` file.

```
application: robbapp1234
version: 1
runtime: python27
api_version: 1
threadsafe: yes

handlers:
- url: /favicon\.ico
  static_files: favicon.ico
  upload: favicon\.ico

- url: .*
  script: main.app

libraries:
- name: webapp2
  version: "2.5.2"
```

Figure 3.16: app.yaml Configuration File

In the figure, `application: robbapp1234` is the unique application identifier name that is specified for the application on Google App Engine.

3.4.2 Developing Web Applications with Java

The Web applications can be built using standard Java technologies, such as Servlet and JSP for uploading on Google App Engine. The Google App Engine provide Java SDK, which contains JVM and a Web server for testing Java applications.

Java Virtual Machine (JVM) is used to run the Java applications in a secure sandbox environment similar to the Python. The JVM is capable of executing any Java bytecode that operates within the restrictions of the sandbox. The App Engine prompts the application servlet classes to process the requests and generate responses.

The Eclipse Integrated Development Environment (IDE) can be used to develop, execute, and upload Java applications on Google App Engine.

Note - The Google plugin for Eclipse is available to develop servlet-based Web applications for Google App Engine.

3.4.3 Deploying an Application to Google App Engine

The Web application created on local system can be deployed on Google App Engine. The Google App Engine provides Administration Console, which manages the application running on its server.

There are two ways to deploy an application on Google App Engine:

- ➔ Using command-line tool
- ➔ Using Google App Launcher

Before an application is deployed on Google App Engine, you need to register the application with a unique application ID. Once the application is registered, open the `app.yaml` configuration file and change the application: setting from `your-app-id` to the registered application ID.

For example, the Web application named **robbapp1234** created in Python can be changed to **heloapp123** application ID registered on the Google App Engine.

➔ Using command-line

The `appcfg.py` command is used to upload the ready application on Google App Engine. In order to deploy an application, type the following command in the command prompt:

```
your-sdk-install-dir-path/appcfg.py update your-app-dir
```

For example, `appcfg.py update robbapp123/`. The `appcfg.py` refers to `app.yaml` file to get the application ID registered on the Google App Engine. It prompts the user for Google account credentials and after successful signing in, deploys the application on Google App Engine. The **robbapp123** is the root directory, which contains the `app.yaml` file.

Figure 3.17 shows the command prompt to deploy **heiloapp123** application using `appcfg.py` command.

```

E:\Cloud Computing\Session 03>appcfg.py update robbapp123/
02:12 PM Application: heiloapp123; version: 1
02:12 PM Host: appengine.google.com
02:12 PM Starting update of app: heiloapp123, version: 1
02:12 PM Getting current resource limits.
Email: john.bosco.developer@gmail.com
Password for john.bosco.developer@gmail.com:
02:12 PM Scanning files on local disk.
02:12 PM Cloning 1 static file.
02:12 PM Cloning 3 application files.
02:12 PM Compilation starting.
02:12 PM Compilation completed.
02:12 PM Starting deployment.
02:12 PM Checking if deployment succeeded.
02:12 PM Deployment successful.
02:12 PM Checking if updated app version is serving.
02:12 PM Completed update of app: heiloapp123, version: 1
02:12 PM Uploading index definitions.

E:\Cloud Computing\Session 03>

```

Figure 3.17: Command Prompt - `appcfg.py` Command

→ Using Google App Engine Launcher

Click **Deploy** in the Google App Engine Launcher to deploy the application. It will prompt for Google account username and password to sign in, before application is deployed to Google App Engine.

3.5 Google App Engine Storage

Storing data for a Web application is very important because a user interacts with multiple Web servers, which in turn, interact with data storage accessible across multiple machines.

Google App Engine provides an effective solution to this. The infrastructure of Google App Engine takes care of the distribution, replication, and balancing the data load.

The various storage services in Google App Engine Storage are discussed.

3.5.1 App Engine Datastore

App Engine Datastore is a schemaless object datastore that provides scalable storage for the Web applications. Schemaless means that it does not have a schema or predefined structure. Some of the features of App Engine Datastore are as follows:

- It is highly reliable with less downtime.
- It has transaction properties termed as Atomicity Consistency Integrity Durability (ACID).
- It provides high availability for reads and writes.

- It provides strong consistency for reads and ancestor queries are maintained.
- It provides automatic caching of queries.

The Python and Java Datastore interface has a rich data modelling API and a SQL-like query language. The primary data storage technique is the **High Replication Datastore (HRD)**. Data replication in HRD takes place across multiple data centers through a system, based on the Paxos algorithm. A second storage option, the **Master/Slave Datastore**, has also been implemented in the HRD.

Some of the terms related to objects stored by App Engine Datastore are as follows:

- **Entities:** Data objects in the Datastore are known as entities.
- **Properties:** Each entity store one or more values, which are referred to as properties. Each entity is defined by the properties.
- **Key:** Each entity in the datastore is identified by a unique identification number, which is referred as a key.

The Google Cloud Datastore API provides methods for creating, modifying, and retrieving entities from the Datastore.

3.5.2 Google Cloud SQL

Google Cloud SQL is a service that facilitates creation, configuration, and use of relational databases present in Google's cloud. It provides MySQL relational database, which is a fully-managed service available on Google's cloud for your Web applications written in Java, Python, PHP, and Go. The Google Cloud SQL comes with MySQL client and administrative tools such as reporting tool to work with MySQL database.

It also facilitates easy movement of data, applications, and services in and out of the cloud. This results in high data portability and helps the users to achieve faster time to market by effectively controlling the existing database.

With Google Cloud SQL, users can choose a billing option that fits their usage pattern. The **pay per use** billing option facilitates payment only for the time the user has accessed it. Further, lower costs for frequent accesses are offered in the package option.

The features of Google Cloud SQL are as follows:

- **Easy to Use:** It has a graphical user interface, which allows the user to create, configure, manage, and monitor the database instances.
- **Fully Managed:** It has in-built services for patch management, replication, or backups.
- **Flexible Configuration:** The instances can be changed with a few seconds of downtime.

- **Exceptional Security:** Security is a design component of each of Google's cloud computing elements, such as compartmentalization, server assignment, data storage, and processing.

3.6 Google App Engine Services

Google App Engine provides several services through APIs that are described as follows:

- **Memcache Service:** The memcache service enables your applications to easily access temporary and frequently used data by using an in-memory cache.
- **Image Service:** The image service enables applications to manipulate images easily. Developers can resize, crop, and modify images in several other ways using the image service APIs. The image service accepts images in various formats.
- **URL Fetch Service:** The URL fetch service enables applications to access resources on the Internet, such as Web services or other data.
- **Mail Service:** The mail service allows applications to send e-mail using the Google infrastructure.

3.7 Check Your Progress

1. Which of the following services enables applications to access resources on the Internet, such as Web services or other data?

(A)	Mail service	(C)	Memcache service
(B)	Image service	(D)	URL Fetch service

2. Which of the following ensures that application will have limited access to operating system resources?

(A)	Web Server Gateway Interface	(C)	Sandbox
(B)	Google App Engine	(D)	Application Programming Interface

3. _____ is a service that facilitates creation, configuration, and use of relational databases.

(A)	Google Cloud SQL	(C)	Python
(B)	JavaMail	(D)	JCache

4. Which of the following makes it easier to develop and deploy Java applications on Google App Engine?

(A)	Eclipse IDE	(C)	Google Web Toolkit
(B)	Google Plugin for Eclipse	(D)	SDK

5. Which of the following commands is used to upload the ready application on Google App Engine?

(A)	index.py	(C)	app.yaml
(B)	appcfg.py	(D)	main.py

3.7.1 Answers

1.	D
2.	C
3.	A
4.	C
5.	B



Summary

- Google provides a distributed and scalable cloud computing environment called Google App Engine for developing applications and hosting them at Google data centers.
- The Google App Engine supports various programming languages to develop Web applications for Google App Engine. The primary languages supported are Python and Java.
- Google App Engine provides a secure environment referred to as Sandbox.
- Google App Engine offers three kinds of quotas that are namely, Free Quota, Billable Limits, and Safety Limits.
- A user can sign in through Google account to create and register your Web applications on Google App Engine.
- Datastore and Google Cloud SQL are few data storage services provided by Google App Engine.
- Memcache, Image, URL Fetch, and Mail are few API services supported by Google App Engine.



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Session - 4

Advanced Cloud Computing Concepts

Welcome to the Session, **Advanced Cloud Computing Concepts**.

This session describes about the prevailing challenges and security threats to cloud computing. It also introduces the concepts of cloud storage, open source clouds, and mobile cloud computing and its architecture. This session also explains the various advantages and challenges in the arena of mobile cloud computing.

In this Session, you will learn to:

- Explain various challenges and security threats associated with cloud computing
- Describe cloud storage services
- Describe open source tools to build cloud applications
- Describe mobile cloud computing
- Explain the architecture of mobile cloud computing
- Describe the various advantages and challenges of mobile cloud computing
- Explain cloud computing support for mobile devices

4.1 Introduction

Cloud computing brings value to businesses and makes them cost-effective by enabling use of sophisticated applications over the Web. Therefore, more and more businesses – small and big – are moving towards cloud computing.

However, like any other new technology, even cloud computing has its own share of risks and challenges. Therefore, it is highly important for the cloud users to do a thorough risk assessment when selecting a cloud deployment mode. It is also important to have a good understanding of the challenges and security issues to ensure a smooth transition.

4.2 Challenges and Security Threats for Cloud Computing

There are various challenges of cloud computing that should be addressed, before cloud computing is adopted in a full-fledged manner by users. Few of these specific areas of challenges and security risk are as follows:

4.2.1 Availability of Persistent and Fast Internet Connection

In order for cloud computing to work successfully, there has to be a persistent and fast Internet connection available at the user's end. Without a good connection, the services offered by the cloud-computing provider cannot be utilized properly. The challenge here is that many users even today do not have high speed or continual connections. In such scenarios, implementing or utilizing cloud-computing services remains a major challenge.

4.2.2 Widespread Adoption

As a number of cloud computing services and products may not be free and may be priced based on various factors, users may not readily adopt them into their everyday life. Many users who have become accustomed to having free services may find it difficult to transition to a paid cloud-based model even if the quality offered is much better. To overcome this challenge, providers can at least initially offer free or low-priced cloud computing solutions to lure in the users.

4.2.3 Security Threats

Cloud computing most importantly faces the challenge of addressing concerns related to security and privacy that are raised by businesses planning to adopt and implement cloud computing. The major concern for an organization or business planning to adopt cloud computing is regarding the huge enterprise data that may be stored outside the protective corporate firewall. Hacking of or an attack on even a single site in the cloud infrastructure would result in disruption of activities for the clients. However, security applications, encrypted file systems, and security hardware are a few solutions that can be used to defend against such threats.

These tools also help in tracking and monitoring any unusual behavior across the servers. It is the responsibility of a cloud service provider to implement these security measures.

Cloud security lies on a shared responsibility model. That means in the cloud both the service provider as well as the consumer are responsible for the security at different levels. There is a global body called Cloud Security Alliance that creates, manages, and governs cloud security related guidelines and best practices.

Privacy in cloud revolves around the fact that the data resides at the provider's location and hence stands the risk of being accessed by someone else. As privacy laws differ from country to country and the provider and consumer may be located in different countries, there might be a lack of clarity regarding who has access to what data, pertaining to the laws of the nation.

4.3 Introduction to Cloud Storage Services

Cloud storage is an enterprise storage model. It stores the data in a pool called virtualized pools. These pools are generally hosted by some third party or specific companies. Hosting companies operate large data centers and facilitate buying or leasing of storage capacity for people wanting to host their data.

A data center is a computer system and its associated components, which hosts large volumes of data.

The resources are presented as storage pools, which the customers use to store files or data objects. The resource's physical presence can span multiple servers and multiple locations. However, the responsibility of ensuring safety of the files lies with the hosting companies as well as the applications that control the cloud storage.

4.4 Cloud Drive Storage Services

A cloud drive is a channel to access cloud storage. It is supported by various cloud data storage providers. The installation and configuration of a cloud drive storage service is simple. It can be installed on either a laptop for personal use, a server in the office, or a group of high-end 64-bit servers for an enterprise.

The cloud storage service enables reduction of data storage requirements while facilitating performance effectiveness. This is enabled by shifting the data that has been least used until recently to the cloud storage provider and one or more data storage accelerators. Assuming that the actual write operations to data can take place any time before a subsequent read to the same data, the cloud drive speeds up the performance.

The cloud drive does this by scheduling the 'delayed' write data to periods of low activity. In addition, it does not download the data from the cloud storage provider when the data stored in the cloud has been completely overwritten by the 'delayed' write data. A cloud drive further enhances performance by presuming the occurrence of delete operations any time after the data is downloaded.

4.5 Various Cloud Storage Services

There are several cloud storage services available. Users can access the services provided by using direct APIs or by using applications that in turn make use of the API. These applications may be a cloud desktop storage, cloud storage gateway, or a Web-based content management system.

The various cloud storage services are as follows:

- Dropbox
- SkyDrive
- JustCloud.com
- SugarSync
- youSENDit
- Google Drive

4.5.1 Dropbox

Dropbox is a file-hosting service that offers many services, including storage on the cloud and synchronization of files.

Dropbox offers a special facility for users to create a special folder on their local computers. Files stored in this local 'dropbox' can then be accessible through a Web browser from anywhere as the data is stored on the servers of Dropbox. These files are synchronized across all the systems connected to the linked account on Dropbox.

The features of Dropbox are as follows:

- Offers a 2GB service free and hence, is popular with small businesses and end-users
- Makes additional storage available for paid subscriptions
- Is a simple software and can be installed on each PC, Mac, or Linux desktop where the Dropbox folder can be placed on the hard drive
- Enables users to view the files which have been recently added or changed
- Allows restoration of older files which is further accelerated by a browser-based interface
- Allows easy and efficient sharing of files through e-mail invitations, Web sites, and so on
- Allows non-Dropbox users to access files through a Web link

Figure 4.1 shows a dropbox. When the files are uploaded to the cloud, they can be accessed through linked accounts from different platforms such as laptops, computers, and smart phones.

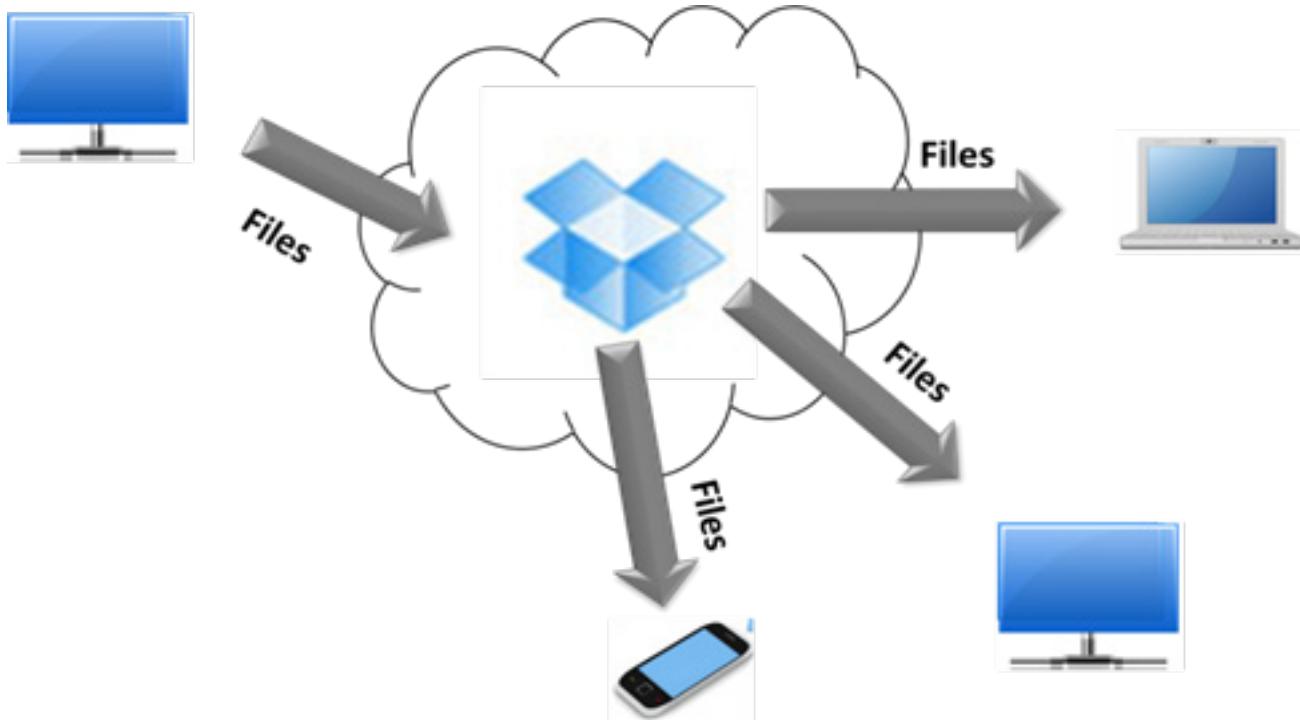


Figure 4.1: Dropbox File Hosting

4.5.2 SkyDrive

SkyDrive is a file-hosting service by Microsoft that facilitates uploading of files to a cloud storage, which can then be accessed, from a Web browser or client software. Files uploaded to an account are accessible only to the user unless he/she decides to share it. It can provide remote access to a PC, Mac, Windows Phone, Android, and iOS devices.

Figure 4.2 shows how the files can be uploaded on Skydrive. Different files from different platforms can be uploaded or downloaded to/from the drive and it can be accessed through the Web browser.

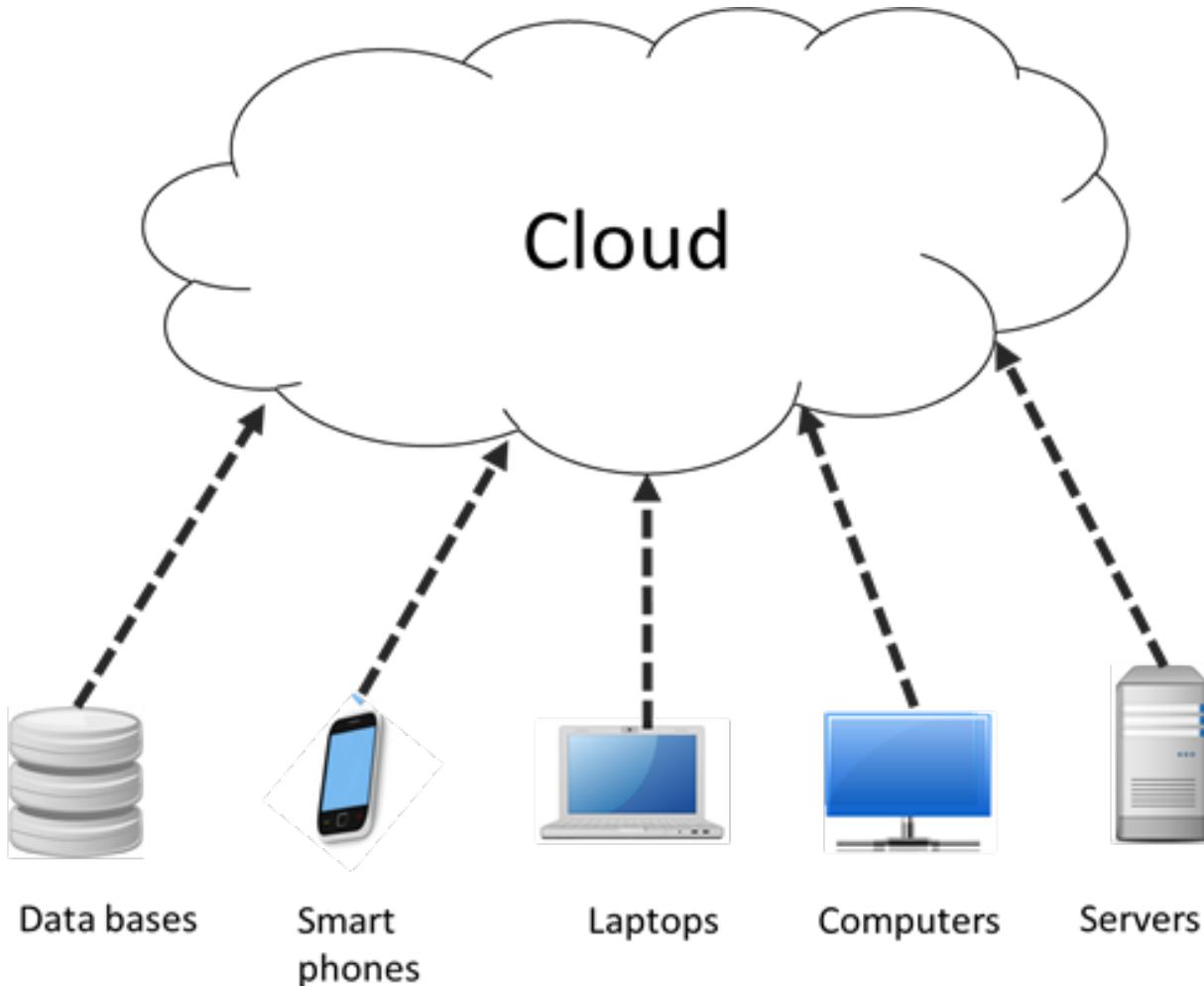


Figure 4.2: SkyDrive

The features of SkyDrive are as follows:

- Allows sharing, creating, and editing of Office documents using Office Web Apps when on the run; it does not require installation of Office suite
- Provides 7 GB storage free additional storage can be purchased
- Allows granting permission to another SkyDrive user to modify files which facilitates online collaboration, irrespective of the document type. SyncDriver for SkyDrive is a desktop application which allows a user to modify uploaded files just by accessing the local folders. Any changes such as creating, editing, or deleting in the synchronization folder are automatically uploaded to the SkyDrive cloud in the background. Thus, the user does not have to worry about updating it manually. In case of unavailability or interruption in Internet connection at the time of working, the changes are synchronized upon restoration of the connection

4.5.3 JustCloud

Similar to other storage services, JustCloud enables syncing and sharing files across Macs, Windows, Linux machines, iPads, iPhones, and Androids, to name a few. It creates a backup of all computer files to the cloud by using a desktop application. It facilitates taking constant backup that enables users to access the files any time from any device and from any location.

The key features of JustCloud are as follows:

- Does not restrict the amount of files that can be stored thus, providing the freedom of unlimited online storage to users
- Ensures that backups are automated to avoid losing any files or data
- Enables anywhere, anytime accessibility through the online control panel, mobile apps or mobile optimized site
- Facilitates syncing multiple files across computers by working in the background to sync them to the cloud
- Enables sharing files and folders through email, or even a custom link
- Ensures security by encrypting data transfers using 256-bit SSL encryption

4.5.4 SugarSync

SugarSync is a small but quick backup service that enables data syncing and sharing across any device. Apart from PC, Mac, and other Apple devices, SugarSync supports Android phones, BlackBerry phones, tablets, and so on.

The features of SugarSync are as follows:

- Facilitates syncing of multiple devices
- Does not interfere in the other activities and works in the background
- Provides accessibility to any device starting from Tablets, Smartphones, to PCs
- Ensures data security by implementing industry best practices

4.5.5 Hightail (formerly YouSENDit)

YouSENDit, now known as Hightail, offers backup services, unlimited downloads and unlimited storage amount for files. It also allows tracking of downloads, return receipts, and digital signatures.

The key features of Hightail are as follows:

- Enables secure file sharing and control as to who can view or access the files
- Facilitates sharing files such as project folders with clients and colleagues and allows to decide who can edit and update the files
- Provides unlimited file storage online, which facilitates anytime access to files using the mobile and desktop apps

4.5.6 Google Drive

Google Drive allows users to create new documents, spreadsheets, and presentations. Multiple users can work on the document and the changes are reflected instantly. The features of Google Drive are as follows:

- Integrates Gmail and hence, sending a link from Google Drive in Gmail allows everyone to access and view the same file and same version
- Enables accessing files quickly by recognizing objects in the images and text in scanned documents
- Enables viewing more than 30 file types – HD video, Adobe Illustrator, and Photoshop – in the browser even when the program is not installed on the computer
- Allows creating, editing and commenting on documents, slides and so on, using Chrome even in the absence of a network connection
- Enables chatting within the documents, sheets, or slides, and even leaving comments on files and images
- If a ‘+’ is added in front of the e-mail address in a comment, Drive sends an email to the person concerned, notifying that they should follow up

4.6 Open Source Tools to Build Cloud Applications

Open source software consists of mostly free or low-priced tools available in the market. These tools are not limited by software license models. A number of open source tools have made an impact in the field of cloud computing. Few of the tools are listed as follows:

- Kernel-based Virtual Machines (KVM)
- Deltacloud
- Eucalyptus

4.6.1 Kernel-based Virtual Machine (KVM)

Kernel-based Virtual Machine is an open source hypervisor of the Linux operating system running on x86 hardware. A hypervisor is a virtual machine monitor and helps to create and manage virtual machines. KVM supports virtualization extensions for Intel Virtualization Technology (VT) or AMD-V (AMD-Virtualization, a trademark of Advanced Micro Devices, Inc.).

KVM allows users to run multiple VMs that run unmodified Linux or Windows images.

4.6.2 Deltacloud

It is an open source project offered by RedHat. Deltacloud maps a cloud client's API to the API of other popular clouds by removing the differences between clouds. Deltacloud facilitates management of any certified virtualized environment, from a single management interface. This is enabled when Deltacloud allows transfer of different virtual machines from one virtualization capacity to another in real time. For instance, it allows from VMware to RHEV (Red Hat Enterprise Virtualization) or VMware to Microsoft. Few examples of virtualized environments are the ones based on KVM, VMware ESX, and Hyper-V.

4.6.3 Eucalyptus

Eucalyptus is a private cloud platform that implements the Amazon specification for Elastic Compute Cloud (EC2) as Infrastructure as a Service (IaaS). With a few exceptions, Eucalyptus corresponds to the definition – in terms of both syntax and semantics – of the Amazon API and tool suite. Eucalyptus offers various administrative functionalities, such as user management, storage configuration, and network management for the management and maintenance of private clouds.

4.7 Introduction to Mobile Cloud Computing

With tremendous advances in mobile communications and networks, many applications are now available on mobile devices that offer rich user experiences. However, mobile devices have their own limitations in terms of processing power, battery life, and storage. Therefore, deployment of mobile pervasive services is burdened by such restrictions of mobile devices and bandwidth limitations of wireless networks. However, Mobile Cloud Computing (MCC) is an emerging solution that attempts to extend the capabilities of mobile devices and platforms. Mobile cloud computing is a new platform and refers to a combination of mobile devices and cloud computing to create a new infrastructure. This infrastructure facilitates a cloud to carry out computing-intensive tasks and store huge amounts of data. In the new infrastructure, data processing and data storage take place outside the mobile devices.

The following factors are fostering the adoption of mobile cloud computing:

- **Changing Trends and demands:** Customers expect the convenience of accessing companies' Web sites or applications anywhere and at any time. Enterprise users require always-ON access to business applications and collaborative services so that they can increase their productivity from anywhere, even when they are on the commute. Therefore, to pace up with the changing trend and meet the customers' expectations, mobile cloud computing is being seen as a viable and effective option.
- **Enhanced broadband coverage:** Services such as 3G and 4G along with Wi-Fi, fixed wireless, and so on are providing better connectivity for mobile devices and are making them favorable to cloud computing.
- **Enabling technologies:** Customization of various technologies such as HTML5, CSS3, hypervisor, and so on for mobile devices has helped the growth of mobile cloud computing. Emergence of new elements such as cloudlets (new architectural elements that are a result of the convergence of mobile computing and cloud computing) and Web 4.0 is further boosting the growth of mobile cloud computing.

4.7.1 Architecture of Mobile Cloud Computing

The general architecture of MCC is demonstrated in figure 4.3.

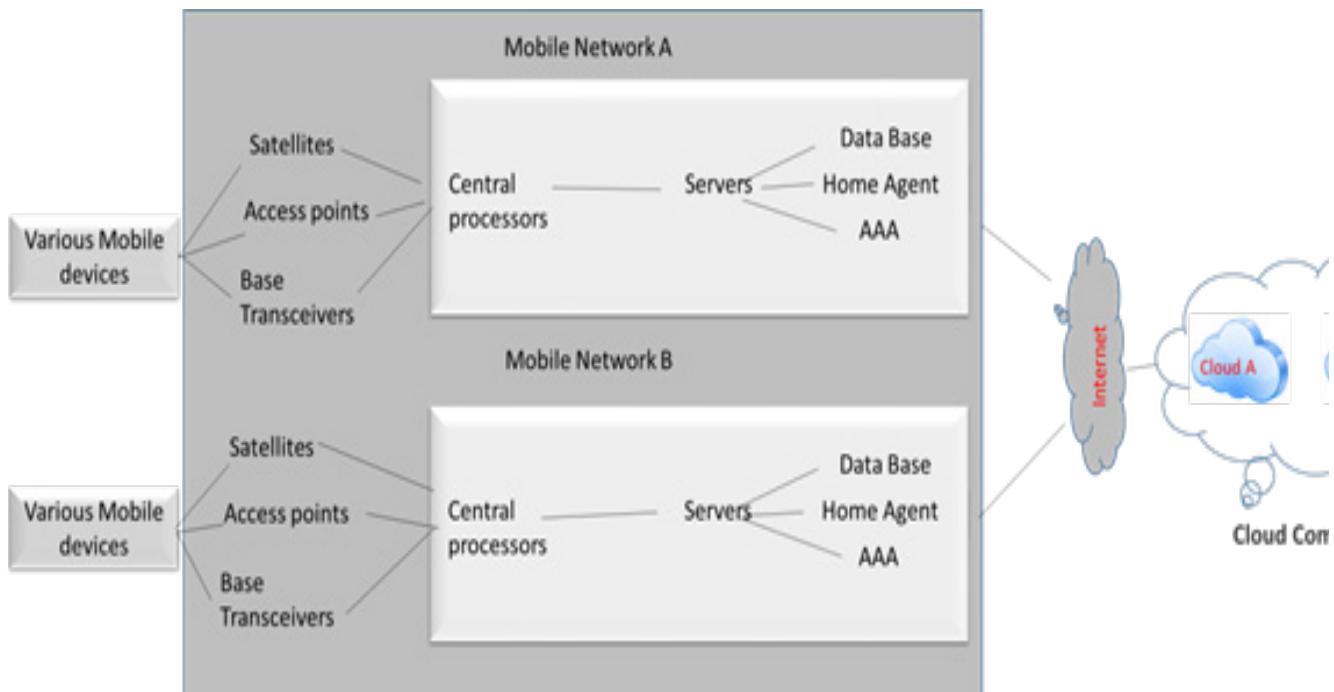


Figure 4.3: Architecture of Mobile Cloud Computing

As illustrated in figure 4.3, mobile devices are connected to the mobile networks through various base stations such as satellite, access point, or Base Transceiver Station (BTS). It facilitates wireless communication between user equipment and a network. The base stations not only establish and control the connections (also referred to as air links) but also, the functional interfaces that exist between the networks and mobile devices. The requests and information from the users such as the user ID and location are transmitted to the central processors. These processors are connected to the servers that provide the mobile network services.

AAA stands for Authentication, Authorization, and Accounting and here, it refers to the protocol that implements these functions in mobile network setup. Home agent is typically the router that is at the end mobile device's location that maintains the device's network details such as IP address and location.

Home agent is a router on mobiles home network that keeps on updating the information about the mobiles location. It uses the tunneling mechanism to forward the traffic, which helps in retaining the IP address even the device connects from different locations.

Based on the Home Agent and the data of the subscribers' stored in the database, the mobile network providers extend services as AAA to the mobile users. Further, the subscriber requests are transmitted through the Internet to a cloud wherein the cloud controllers process the requests for providing cloud services.

Note - The components of mobile cloud architecture could be different depending upon the contexts.

4.7.2 Advantages of Mobile Cloud Computing

Various characteristics such as mobility, communication, and portability, make cloud computing an effective solution for mobile computing. The advantages of mobile cloud computing are as follows:

- Enhanced battery lifetime
- Unlimited storage and processing power
- Enhanced reliability
- Cost-effective
- **Enhanced Battery Lifetime**

The key element of focus in mobile devices is the battery. There have been several proposed solutions to enhance the CPU performance or reduce power consumption in the disk and screen. However, these changes can be facilitated either by a change in the structure of phones or by using a new hardware which could in turn increase cost but may not prove effective or be applicable to all mobile devices.

Computation offloading is a proposed technique that aims at migrating the large computations and complex processing from resource-limited mobile devices, to servers in the cloud, which are resourceful machines. This technique reduces the application execution time on mobile devices in turn reducing excess power consumption.

For instance, offloading a compiler optimization for image processing can reduce up to approximately 39% of energy consumption of a mobile device, thus, giving longer battery lifetime.

- **Unlimited Storage and Processing Power**

Storage capacity is also a constraint for mobile devices. As storage information in the cloud offers unlimited storage capacity, cloud computing is a preferred option for mobile devices. The user does not have to worry about exhausting storage space or the requirement to increase the current storage availability. It enables users to access or store large amounts of data on the cloud via wireless networks. This also helps in reducing energy and storage space on their mobile devices as all images are sent and processed on the clouds. Flickr for mobile is an example of one of the successful mobile photo sharing applications that is based on MCC.

- **Enhanced Reliability**

Storing data or running applications on clouds also ensures reliability because it provides storage and backup of data on multiple computers. This reduces the risk of losing data and application on mobile devices. Further, MCC can also be designed as an all-inclusive data security model that could be used by service providers as well as users. For instance, to protect copyrighted digital contents such as videos and music from abuse and unauthorized distribution.

Also, the various other security services that the cloud can remotely provide to mobile users are virus scanning, malicious code detection, and authentication.

→ **Cost-effective**

Cloud computing is cost-effective, easy to maintain and upgrade as compared to the traditional desktop software, which costs a lot for companies.

Further, in case of traditional applications, licensing fee for multiple users also places a burden on the firm, which is not there on mobile platforms as cloud computing software for mobiles is available at cheaper rates and thus, can reduce the burden of the firm on its IT expenditure. Apart from this convenience, cloud computing also offers various options such as one-time-payment and pay-as-you-go, which make it easy for the firm implementing it.

A few more advantages of clouds for mobile services are as follows:

- **Dynamic on-demand provisioning:** Enables dynamic on-demand provisioning of resources on a self-service basis. It is a flexible way that enables service providers and mobile users to run their applications without requiring to reserve their resources in advance.
- **Scalability:** Mobile applications that have been deployed can be scaled to meet the unpredictable user demands resulting from flexible resource provisioning. It allows service providers to add and expand an application and service without or with minimal constraints on the use of resources.
- **Multi-tenancy:** Mobile cloud computing also facilitates service providers to share resources and costs in order to support varied applications and multiple users.
- **Easy integration:** Facilitates easy integration of multiple services through the cloud and the Internet from various service providers in order to meet the users' demands.

4.7.3 Challenges of Mobile Cloud Computing

Though MCC has many advantages for mobile users and service providers, it faces a few technical challenges because of the nature of the wireless devices and network and the limitations therein. A few challenges in mobile cloud computing are as follows:

→ **Low Bandwidth and Variable Reliability**

Wireless network uses more bandwidth compared to the wired networks. In fixed broadband, a physical link supports consistent network bandwidth, but in a wireless connectivity, there are variable data rates and irregular connectivity due to inconsistent coverage. The dynamic nature and other factors such as weather can cause variations in bandwidth. Mobile users also have difficulty to access the clouds due to various reasons such as traffic congestion, network failure and so on.

→ **Limited Energy Source**

Mobile devices run on batteries and hence, have limited capacity. Therefore, increasing the battery life with division of application functions across servers and devices is a challenge. As display and connectivity consume a lot of energy, application-rich devices have heavier batteries to meet the excess energy demand for larger displays and high-end applications. Therefore, applications that do not require a display such as podcasts, are better suited for implementing mobile cloud computing.

→ **Data Access Efficiency**

On the computing side, with increase in the number of cloud services, the demand for accessing data resources such as files, images, and documents on the cloud too has increased. Therefore, dealing with increasing data resources in terms of storage, management, and accessibility on the cloud is a challenge. Issues such as low bandwidth and limited resource capacity of mobile devices makes it further difficult to handle the data resources.

4.8 Mobile Support for Cloud Computing

A number of top industry giants offer mobile support for cloud computing. One among this is Apple. iCloud is Apple's popular cloud storage product. It enables users to access music, photos, documents, and many more items, from any Apple device they use. It is not only easy to set up but also makes synchronization and sharing easier. Essentially, on enabling wireless syncing in the Settings, iCloud takes the existing content on a device and sends it wirelessly to the iPhone, iPad, iPod touch, Mac, and PC.

The key features of Apple iCloud are as follows:

→ **iTunes in the Cloud**

iTunes has been the most requested feature in the cloud. Presence of iCloud facilitates iTunes to instantly download all music purchases to all the devices via Wi-Fi or 3G. It also becomes easier to download and synchronize the earlier iTunes purchases, to all iDevices without making any extra payment.

→ **Calendar, Mail, and Contacts**

On registering a device with iCloud, the user receives a 'me.com' account. This account is synchronized by iCloud. The service facilitates automatic synchronization of calendar entries, contacts, and e-mail among multiple devices. For instance, any event set on an iPhone shows on an iPad or desktop Mac.

→ **Backup**

iCloud also provides the feature of keeping a backup of data. This data includes everything from purchased music, TV shows, apps, books, photos, to device settings, app data, messages (including iMessage, SMS, and MMS), and even ring tones. Therefore, if a user buys a new iDevice, it would automatically be updated without even being connected to Mac or PC.

→ Documents in the Cloud

Having the same iCloud-enabled apps on more than one device facilitates automatic updation of all documents across all iDevices. It further allows the users to edit something in the Keynote on the iPad and everything on the iPhone is updated when the app is opened.

→ Find my iPhone, iPad, iPod touch, and Mac

This feature is very useful in the event of losing an iDevice. It enables the owners of iPhone, iPad, iPod touch, and Mac to find their lost devices with ease. The user can send a message using another device to let the person who has taken it or anyone else know that the device has been lost and they are on the way to retrieve it.

→ Find My Friends

This new Find My Friends app allows the users to find their friends and meet them. It also allows tracking down family members using the iOS and follow up whether a friend has arrived in town. However, to ensure privacy, the app allows turning off this feature easily.

→ iBooks

When a new iBook is downloaded, it is automatically made available on all other devices. Further, things such as notes, bookmarks, and highlights are synced so that all the iBooks are consistent across the iPhone, iPad, or any other device.

4.8.1 Functioning of Apple iCloud

Apple iCloud is an all-inclusive app. It facilitates arranging the content on multiple devices so that the user does not have to worry about data being restricted to one device. It shifts all the data, be it media, e-mail, contacts and so on, to Apple's Internet-based 'cloud' servers. Apple iCloud works effectively and seamlessly across all Apple devices that are connected to the Internet. For instance, a song uploaded from iPhone can be listened to from an iPod.

However, iCloud is not the first online storage service offered by Apple. MobileMe preceded iCloud and primarily offered synchronization services. It was revamped and the services were merged into iCloud. iCloud has added features and provides more flexibility as compared to MobileMe. It also offers 5 GB storage free.

Most existing cloud-driven services and apps are actually add-ons. However, Apple iCloud is different in that it is integrated into Apple's operating systems. Therefore, if a user's mobile devices and computers are Apple products, it becomes even more convenient. For instance, the applications used in Mac OS X and Apple iOS can connect to the iCloud space and automatically store the data there. iCloud ensures continuous synchronization of data among the Apple devices provided Internet connection is available. It also provides password-protected access to online storage space.

Thus, iCloud is a major leap in the field of mobile computing where access to any kind of data is just a touch away.

4.9 Check Your Progress

1. Which of the following is a desktop application and allows a user to modify uploaded files just by accessing the local folders?

(A)	SkyDrive	(C)	JustCloud
(B)	Dropbox	(D)	syncDriver

2. Which of the following cloud storage services provides unlimited online data storage to users?

(A)	YouSENDit	(C)	JustCloud
(B)	Google Drive	(D)	syncDriver

3. _____ facilitates management of any certified virtualized environment, from a single management interface.

(A)	Deltacloud	(C)	KVM
(B)	Eucalyptus	(D)	Apple iCloud

4. _____ feature of mobile clouds helps service providers to add or expand an application with minimal constraint in using the resources.

(A)	Multi-tenancy	(C)	Dynamic on-demand provisioning
(B)	Scalability	(D)	Easy integration

5. Identify Apple's popular cloud storage product.

(A)	iCloudStorage	(C)	iStorage
(B)	iOSCloud	(D)	iCloud

4.9.1 Answers

1.	D
2.	C
3.	A
4.	B
5.	D



Summary

- Availability of a persistent Internet connection, security and privacy, are some of the challenges and risks associated with cloud computing.
- Cloud storage is a model of networked enterprise storage that enables data storage in virtualized pools of storage.
- A cloud drive is a channel to access cloud storage. It is supported by various cloud data storage providers.
- Dropbox, SkyDrive, JustCloud.com, SugarSync, Hightail (youSENDit), and Google Drive are a few popular cloud storage services.
- All the cloud storage services essentially enable data storage and file synchronization facilities though with a few differences.
- KVM, Deltacloud, and Eucalyptus are a few open source tools used in cloud computing.
- Mobile Cloud Computing (MCC) is a combination of the mobile devices and cloud computing to create a new infrastructure that facilitates a cloud to carry out computing-intensive tasks and store huge amounts of data.
- iCloud is Apple's cloud storage product and enables users to access music, photos, documents, and many more from any device they use.



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