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Adama Science & Technology University

**SCHOOL OF ELECTRICAL ENGINEERING &
COMPUTING DEPARTMENT OF COMPUTING**

**A MASTER'S THESIS
ON
A Cloud Based Framework of Online shopping in Ethiopia**

**SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS OF THE DEGREE OF MASTER OF SCIENCE IN
SOFTWARE ENGINEERING**

**BY:
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Adama, Ethiopia

Declaration

The thesis is my original work and has not been presented for a degree in any other university or conferences and all sources of materials used have been acknowledged.

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June 21, 2017

The thesis has been submitted for examination with my approval as university advisor

Dr. Mesfin Abebe

June 21, 2017



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COMPUTING DEPARTMENT OF COMPUTING**

A Cloud Based Framework of Online shopping in Ethiopia

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Acknowledgement

“The fear of the LORD is the beginning of Knowledge” so that I give my praise to the Almighty God, who made everything possible.

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Abstract

A cloud based framework of online shopping service has significant role for the development of trade industry and national development in general. This study focuses on an in-depth assessment of the cloud computing and online shopping to apply it for Ethiopia. The data is qualitatively and quantitatively analyzed by using primary and secondary data sources. Random and nonrandom (purposive) sampling techniques are utilized so as to collect data from different data sources. The study briefly addressed the major problems of our traditional shopping system such as time consuming, wastage of money, infrastructure overburden and lack of competition among sellers, lack of trust, difficult to find the expected item and generally lacks efficiency and effectiveness of the trade. To reduce the above traditional shopping problems cloud based framework of online shopping is implemented. Moreover, cloud computing generally maximizes the efficiency and effectiveness of trade by solving the above traditional shopping systems. Thus, the major findings of the study are lack of awareness by the public at large about online shopping, lack of technology, lack of trust and the payment system is also another problem. The researcher develop online shopping architecture, framework and propose hybrid cloud deployment model to address the major problems and findings. Therefore we proposed a four layered framework design for online shopping in Ethiopia. The Developed online shopping in cloud based framework is cost effective, interactive, reliable and efficient than the existing method because of its immense advantage. The framework is developed and recommendations are forwarded for concerned officials for the implementation of online shopping in Ethiopia.

Keywords: Cloud Computing, Online Shopping, Online shopping framework

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List of Acronyms

API	Application Programing Interface
B2B	Business to Business
B2C	Business to Customer
C2C	Customer to Customer
CapEx	Capital Expenditure
CSPs	Cloud Service Providers
EC2	Elastic Computing Cloud
GAE	Google App Engine
Google App	Google Application
GPS	Global positioning system
GUI	Graphical User Interface
HTTP	Hypertext Transfer Protocol
HTTPS	Hypertext Transfer Protocol Security
IaaS	Infrastructure as a Service
ICT	Information Communication Technology
IDE	Integrated Development Environment
IT	Information Technology
NIST	National Institute of Standards and Technology
OpEx	Operational Expenditure
PaaS	Platform as a Service
POS	Point of sale
QOS	Quality of Service
SaaS	Software as a Service
SLAs	Service Level Agreements
SSH	Secure Shell
SSL	Secure Socket Layer
UML	Unified Model Language
US	Use Case
VMs	Virtual Machines

Chapter One

1. Introduction and Background

1.1. Introduction

The rapid and unpredictable advances in information and communication technologies (ICT) and the dissemination of networked data processing have led to widespread access to information resources and globalization of communications, businesses and services. Among leading digital technologies, internet has brought a huge impact and greatly changing the way how business is conducted, access information, acquire products and services. This day's how businesses and public services operate and typically have been aimed at the improvement of productivity, effectiveness and efficient both internally and in the external relationships with clients, customers, suppliers and business partners to accommodate the demand of this changing environment [1].

Cloud computing played a great role for the efficiency, effectiveness, accessibility and ease to use for businesses which is applied for many industries, hospitals, banks and different business sectors. It is the use of a collection of distributed services, applications, information and infrastructure comprised of pools of compute, network, information and storage resources. These components can be rapidly orchestrated, provisioned, implemented and decommissioned using an on-demand utility-like model of allocation and consumption [2].

The term cloud computing refers to the delivery of scalable information technology (IT) resources over the internet. IT infrastructure resource composes of hardware, software, network resources and services required for the existence, operation and management of an enterprise IT environment by deploying these infrastructure and services over the network, an organization can purchase these resources on an as-needed basis and avoid the capital costs of software and hardware. With cloud computing, IT capacity can be adjusted quickly and easily to accommodate changes in demand. While remotely hosted managed services have long been a part of the IT landscape, maturing standards, the rise of hardware and software virtualization, and the push to make IT costs variable and transparent [3]. Furthermore, cloud computing enables online shopping to have low cost startup by allowing them to rent resources offered by cloud providers instead of having its own infrastructure.

The main advantage of cloud computing in online shopping that it gives the low cost implementation for infrastructure (hardware, software and license for all) and some higher business units like Google and Microsoft which offer the cloud for free of cost for the business application. The cloud computing as a new service model, with network storage, on-demand access to nature, provides a new information resource sharing and processing mechanisms [4]. In the existing conditions, cloud computing framework allows enterprises with less investment to online shopping business applications. Therefore, cloud computing based online shopping application framework will have a high practical value in developed country.

In this study, the use of cloud computing for online shopping is addressed by considering the major advantages described above. This application is not adopted and still not practiced in most developing countries like Ethiopia but some researcher's recommended to use cloud computing for different sectors because of its immense advantages. Cloud computing for online shopping is not recommended in developing countries by researchers due to lack of technology to implement the system like payment system (master card, visa card, credit card, etc.), security issues and geographical location (GPS applications) is not identified easily when customers order products so it is difficult to deliver the item to the exact place. At this time, internet banking, mobile banking and some other important things are started so it is possible to adapted online shopping in our country. Though there are various reasons for the absence of this function in Ethiopia like economic problem and other problems caused by internal and external factors; the researcher proposed to use cloud computing for online shopping with minimum cost by reducing the problems and their factors.

The study encompasses the theories and concepts about cloud computing and online shopping, detail assessment, architectural framework, implementation and future works. Therefore, the major aim of the research is to provide an effective structure of cloud framework for implementing online shopping services in Ethiopia.

1.2. Statement of the Problem

In this research, an effective cloud based framework for adapting online shopping services in Ethiopia is briefly addressed. The Internet has opened up a new horizon for business, specifically for online shopping. It entails the use of internet in the marketing, identification, payment and delivery of goods and services. Currently internet facilities are available in Ethiopia. Slowly, but steadily these facilities are holding a strong position in every aspects of our life. Online shopping service is one of those business transaction areas which need more attention if we want to be a part of global business. Ethiopia is very far away to adapt the main stream of this application.

The vast developments of internet applications and infrastructures recently have led to shifts in how people make purchase of goods and service online. Traditionally, customers need to first travel to reach the physical shop, spend some time wandering inside the shops and then after they will purchase items that they want. If they cannot find the item that they want, they might need to move to other shops. The whole process could take a lot of time and energy by traveling from one place to another. Nowadays, in the developed world due to increased adoption of online shopping channel, customers could easily open websites of any retailer to conveniently buy any items that they want, without having to leave their place.

Online shopping is a very good medium for efficient business activity that can deliver quality products (i.e. goods and services) and easily accessible to various users at a time but in Ethiopia it is possible to say that the service is not yet started. Due to this, shopping is still a complex task for the citizens which have its impact on the comfort and living standard of the residents. There are a number of factors impeding the wholesale uptake of ICT for online shopping service in our country. Some of the factors are absence of adopting ICT, lack of awareness by the public at large, lack of confidence on online shopping and lack of enough investment to start this system.

There are also major problems of traditional shopping in Ethiopia. Some of the basic problems are costs of the same products are vary, unfair customer and market distribution, impossible to order item, lack of trust between the buyer and vendors (because they may sell fake products), lack of awareness about product and the system, lack of accessibility in various electronic devices like smart phone, tablets etc.. , extravagancy like fuel, parking, time and energy, difficult to get items, unfair tax payment/collection from each seller is not depending on their income.

Currently, some online display sites are started these are mekina.net, merkato.com, Gult.com etc. But these are not familiar because of some problems like security, trust, order; the only purpose is post items; which posted only with the address of vendors.

The main aim of this research is to apply cloud computing technology in online shopping by solving the above listed problems and make each and every products are available in one site by applying secure and make it efficient, effective, accessible and trust for everyone.

1.3. Objective

1.3.1. General Objective

The general objective of this study is to examine existing ICT utilization of online shopping service and to adopt cloud computing technology and to develop a cloud computing framework for online shopping service in Ethiopia.

1.3.2. Specific Objectives

The study will have the following specific objectives:

- To examine the current ICT service delivery and its efficiency for online shopping in Ethiopia.
- To analyze the major problems of traditional shopping in Ethiopia.
- To explore the potential benefit of cloud computing in online shopping.
- To compare the cost effectiveness of using cloud computing technology in online shopping service in Ethiopia.
- To design cloud based framework of online shopping service in Ethiopia.
- To develop a prototype cloud computing framework that can provide cloud service for online shopping that reduces the traditional shopping system problems.
- To identify and recommend future research directions for further investigation on the benefits of cloud computing.

1.4. Research Questions

The aforementioned challenges and problems are occurred in Ethiopia with respect to online shopping need to be analytically assessed so as to provide efficient and affordable solutions. Therefore, this research intended to get answers for the following research questions.

- What are the major challenges and problems of traditional shopping systems in Ethiopia?
- Would it possible to integrate online shopping service into cloud computing in Ethiopia?
- How far has cloud computing been an easy access to online shopping and business in the IT industry?
- Do we need to change the way we are currently deploying over the cloud and using ICT in online shopping?
- Could cloud computing based online shopping be an answer for minimizing the problems of traditional shopping system?

1.5. Significance of the Study

This research would allow the online shopping service in Ethiopia to consider alternative ways of adopting cloud computing and its infrastructures for an efficient and effective selling-buying, goods and service. Best cloud computing model and implementation plan will be proposed that can be used as a baseline for the physical realization of the cloud. Additionally this study can be used as a baseline for further studies of the newly emerged cloud computing application strategy to be considered in different business organizations in Ethiopia.

If this research is applicable, it will have the following significances;

- i) Organizations-** Expands a company's local market place to national and international markets. With minimal capital outlay, a company can quickly locate more customers, the best suppliers, and the most suitable business partners worldwide.
- ii) Customers-** Frequently provides less expensive products and services by allowing consumers to conduct quick online comparisons and gives consumers more choices than they could easily locate otherwise.
- iii) Society-** Enables individuals to work at home and to do less traveling, resulting in less road traffic and lower air pollution. It also allows some merchandise to be sold at lower prices, thereby increasing people's standard of living.

1.6. Scope of the Study

The main intent of the study is to examine cloud computing service delivery strategies to support online shopping service, by considering cloud computing in the field of business facilitation and

economic growth specifically in Ethiopia. The study thematically focused about Cloud Computing framework design, prototype development and deployment on the cloud for online shopping with various detail activities with in Ethiopia.

1.7. Limitation of the Study

The prototype of online shopping is developed and deployed in the cloud computing tools. But there are different limitations on this research; these are awareness of cloud computing at public large during data collection and difficult to get timely responses to the interview and questioners.

1.8. Organization of the Thesis

The main body of the paper accounted six chapters. Within each chapter there are different titles and sub titles but they are inter-related issues dealing about the cloud computing based framework for online shopping. The second chapter deals about related literature review. It reviews the theoretical aspects related to the study. It covers definition of cloud computing, characteristics of cloud computing, virtualisation, cloud computing service model, cloud computing deployment model, cloud computing benefits for online shopping and works related to this. It tries to explore literatures from international to local level.

The third chapter contains the research methodology which covers the research design, process model, data types and data sources, sampling and data collection techniques and data collection and analysis. The fourth chapter deals about selection of cloud service provider. Hence the best cloud provider is selected for Ethiopia.

The fifth chapter deals about cloud based framework of online shopping. Here in this chapter proposed architectural framework of cloud based online shopping, cloud based online shopping requirements, use cases, logical, process, development and deployment Views (4+1 architectural view model) and system evaluation. The last chapter focuses on conclusion and recommendation.

Chapter Two

2. Related Literature Review

This chapter reviews the different literatures that are related to the objective of the study. Literatures covered in this section are the basic concept of cloud computing: service types, tools, deployment models, adopting cloud computing in online shopping, cloud challenges and benefits for online shopping service; different publications about online shopping existing ICT usages; and related works done on cloud based service frameworks locally and abroad in order to understand how it is implemented or used in business sectors.

2.1. Cloud Computing

The vast development of cloud computing in recent years has substantial impact to information technology landscape as more and more organizations begin to adopt this technology. Cloud computing can be defined as both the applications delivered as services over the internet and the hardware and system software in the data centers that delivers those services [5]. Cloud computing offered a promising paradigm that could enable businesses to face market volatility in an agile and cost-efficient manner. Regarding its relations to other pre-existing computing models, cloud computing can be used in principle to deliver computing services, including grid computing services, high performance computing services, etc. This does not imply that cloud computing is a replacement for grid computing, high-performance computing, or any other pre-existing computing model. Instead, cloud computing should be thought of as a new business model that aims at service delivery in a highly scalable and highly flexible manner. The difference between cloud computing and other pre-existing computing models can be better demonstrated by ways of using the service and deployment models and its key enabling technologies of virtualization [6].

The term cloud computing refers to any computing capability that is delivered as a service over the internet. Cloud enhances collaboration, agility, scaling and availability and provides the potential for cost reduction through optimized and efficient computing. More specifically, cloud describes the use of a collection of services, applications, information & infrastructure comprised of pools of computing, network, information and storage resources. These components can be rapidly orchestrated, provisioned, implemented and decommissioned and scaled up or down; providing for an on-demand utility model of allocation and consumption [2].

Clouds are a large pool of easily usable and accessible virtualized resources (such as hardware, development platform and/or services). These resources can be dynamically re-configured to adjust to a variable load (scale), allowing also for an optimum resource utilization. This pool of resources is typically exploited by a pay-per-use model in which guarantees are offered by the infrastructure provider by means of customized SLAs [7].

NIST defines cloud computing by describing five essential characteristics, three cloud service models, and four cloud deployment models. They are summarized in visual form in figure 2-1 and explained in detail below.



Figure 2-1: Visual model for cloud computing working definition [48]

2.2. Characteristics of Cloud Computing

The NIST Definition of Cloud Computing described as clouds are not an isolated concept that would allow for a clear set of attributes without any overlap to another domains or interpretations. In other words, there are multiple characteristics associated with clouds. Basically cloud services have five essential characteristics described below.

2.2.1. On-demand

A consumer can unilaterally provision computing capabilities such as server time and network storage as needed automatically, without requiring human interaction with a service provider. Instead of requiring a long-term contract for services with an IT organization or a service provider, clouds work on needed model where an application may exist to run a job for a few minutes or hours, or it may exist to provide services to customers on a long-term basis.

2.2.2. Broad Network Access

Access to resources in the cloud is available over the network using standard method in a manner that provides platform independent access to client of all types. This includes a mixture of heterogeneous operating systems, and thick and thin platforms such as laptops, mobile phones, and PDA.

Virtually business organization can make available different applications to their internal and external customers using web based interfaces. While enterprises are well aware of the ability to secure communications using Secure Socket Layer (SSL) encryption along with strong authentication, bootstrapping trust in a cloud computing environment requires carefully considering the differences between enterprise computing and cloud computing. When properly architected, Internet service delivery can provide the flexibility and security required by enterprises of all sizes.

2.2.3. Resource Pooling

A cloud service provider creates resources that are pooled together in a system that supports multi-tenant usage. Physical and virtual systems are dynamically allocated or reallocated as needed. Intrinsic in this concept of pooling is the idea of abstraction that hides the location of resources such as virtual machines, processing, memory, storage, and network bandwidth and connectivity.

2.2.4. Rapid Elasticity

Cloud resources can be rapidly and elastically provisioned. The system can add resources by either scaling up systems or scaling out systems, and scaling may be automatic or manual. From the standpoint of the client, cloud computing resources should look limitless, available to providing resources and can be purchased at any time and in any quantity. Elasticity is an essential characteristic of cloud systems and circumscribes the capability of the underlying infrastructure to adapt to changing. Cloud computing system create provides service to the user in flexible manner that means it depends on the user interest by scaling up and scaling out.

2.2.5. Measured Service

The use of cloud resources is measured, audited and reported to the customer based on a metered system. A client can be changed on a known metric such as amount of storage used, number of

transaction, network Input/output or bandwidth, amount of processing speed used and so on. A client is charged based on the level of services provided, which is pay-per-use the cloud services.

2.3. Virtualization

Virtualization is one of the technologies that enables elasticity, and so has provided increased flexibility in terms of speed of deployment, dynamic auto-provisioning, and cloud management. Virtualization improves resource utilization and energy efficiency, helping to substantially reduce server maintenance overhead and providing fast disaster recovery and high availability. Virtualization has been very important for cloud computing, because it isolates software from hardware and so provides a mechanism to quickly reallocate applications across servers based on computational demands.

2.4. Cloud Computing Service Model

Cloud service models describe how cloud services are made available to clients. Most fundamental service models include a combination of IaaS (Infrastructure as a Service), PaaS (Platform as a Service), and SaaS (Software as a Service). These service models may have collaborations between each other and be interdependent, for example, PaaS is dependent on IaaS because application platforms require physical infrastructure [8]. Cloud service providers tend to offer services that can be grouped into three categories these are SaaS, PaaS and IaaS. These categories group together the various layers illustrated in Figure 2-2 below, with some overlaps.

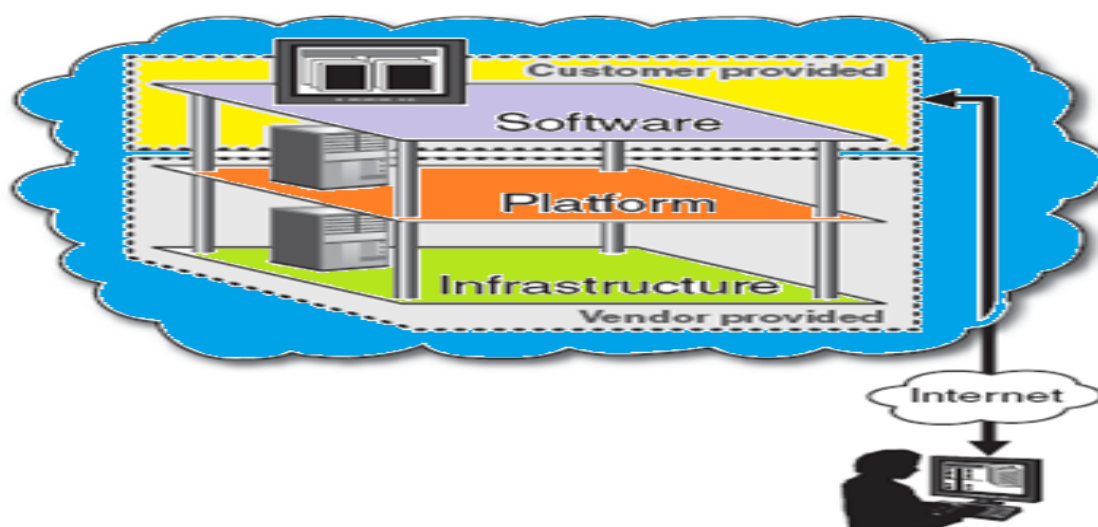


Figure 2-2: Cloud based service layers [54]

2.4.1. Infrastructure as a Service (IaaS)

IaaS is a cloud computing service model in which hardware is virtualized in the cloud. In this particular model, the service vendor owns the equipment: servers, storage, network infrastructure, and so forth. The developer creates virtual hardware on which to develop applications and services. Essentially, an IaaS vendor has created a hardware utility service where the user provisions virtual resources as required [9]. The capability provided to the consumer is to provide processing, storage, networks, and other fundamental computing resources where the consumer is able to deploy and run arbitrary software, which can include operating systems and applications. The consumer does not manage or control the underlying cloud infrastructure but has control over operating systems, storage, deployed applications, and possibly limited control of select networking components (e.g., host firewalls) [2].

2.4.2. Software as a Service (SaaS)

Software as a Service represents a hosted application that is universally available over the Internet, usually through a browser. With Software as a Service, the user interacts directly with the hosted software [9]. Software-as-a-Service (SaaS) is based on licensing software use on demand, which is already installed and running on a cloud platform. These on-demand applications may have been developed and deployed on the PaaS or IaaS layer of a cloud platform. SaaS replaces traditional software usage with a Subscribe/Rent model, reducing the user's physical equipment deployment and management costs. The SaaS clouds may also allow users to compose existing services to meet their requirements [10].

Examples of SaaS software for end user are Google Gmail and Calendar, Quick Books online, Zoho Office Suite, and others. SaaS applications come in all shapes and sizes, and include custom software such as billing and invoicing systems, Customer Relationship Management (CRM) applications, Help Desk applications, Human Resource (HR) solutions, as well as myriad online versions of familiar applications.

2.4.3. Platform as a Service (PaaS)

Platform as a Service (PaaS) cloud systems provide a software execution environment that application services can run on. The environment is not just a pre-installed operating system but is also integrated with a programming-language-level platform, which users can be used to develop and build applications for the platform. PaaS clouds' users, they can develop their own

applications with certain program languages, and APIs are supported by the container [10]. Application frameworks provide a means for creating SaaS hosted applications using a unified development environment or an integrated development environment (IDE). PaaS IDEs run the gamut from a tool that requires a dedicated programming staff to create and run to point-and-click graphical interfaces that any knowledgeable computer user can navigate and create something useful [9].

Platform as a service encapsulates a layer of software and provides it as a service that can be used to build higher-level services. There are at least two perspectives on PaaS depending on the perspective of the producer or consumer of the services. Some of PaaS types are Google App Engine, Microsoft Azure and Force.com.

2.5. Cloud Computing Deployment Model

A deployment model defines the purpose of the cloud and the nature of how the cloud is located. There are three commonly-used cloud deployment models: private, public, and hybrid. An additional model is the community cloud, which is less commonly used.

2.5.1. Public Cloud Services

Public Cloud is a type of cloud hosting in which the cloud services are delivered over a network which is open for public usage. This model is a true representation of cloud hosting; in this the service provider renders services and infrastructure to various clients. The customers do not have any distinguish-ability and control over the location of the infrastructure. From the technical viewpoint, there may be slight or no difference between private and public clouds' structural design except in the level of security offered for various services given to the public cloud subscribers by the cloud hosting providers. Public cloud is better suited for business requirements which require managing the load; host application that is SaaS based and manages applications that many users consume. Due to the decreased capital overheads and operational cost this model is economical. The dealer may provide the service free or in the form of the license policy like pay per user. The cost is shared by all the users, so public cloud profits the customers more by achieving economies of scale [11]. Security and data governance are the main concern with this approach. If a public cloud is implemented with performance, security, and data locality in mind, the existence of other applications running in the cloud should be transparent to both cloud architects and end users [3].

2.5.2. Private Cloud Service

A private cloud offers many of the benefits of a public cloud computing environment, such as being elastic and service based. The difference between a private cloud and a public cloud is that in a private cloud based service, data and processes are managed within the organization without the restrictions of network bandwidth, security exposures and legal requirements that using public cloud services might entail. In addition, private cloud services offer the provider and the user greater control of the cloud infrastructure, improving security and resiliency because user access and then networks used are restricted and designated. Advances in virtualization and distributed computing have allowed corporate network and datacenter administrators to effectively become service providers that meet the needs of their "customers" within the corporation [12]. Isolation is one of the key techniques for ensuring security and, while in the public cloud applications and data exist in a shared environment, the private cloud offers greater isolation by dedicating resources to a particular customer [12].

2.5.3. Community Cloud Service

The cloud infrastructure is shared by several organizations and supports a specific community that has shared concerns (e.g., mission, security requirements, policy, or compliance considerations). It may be managed by the organizations or a third party and may exist on-premises or off-premises [2]. Community Cloud is a type of cloud hosting in which the setup is mutually shared between many organizations that belong to a particular community, i.e. banks and trading firms. It is a multi-tenant setup that is shared among several organizations that belong to a specific group which has similar computing apprehensions. The community members generally share similar privacy, performance and security concerns. The main intention of these communities is to achieve their business related objectives. A community cloud may be internally managed or it can be managed by a third party provider. It can be hosted externally or internally. The cost is shared by the specific organizations within the community, hence, community cloud has cost saving capacity. A community cloud is appropriate for organizations and businesses that work on joint ventures, tenders or research that needs a centralized cloud computing ability for managing, building and implementing similar projects [13].

2.5.4. Hybrid Cloud Service

A hybrid cloud is a combination of a public and private cloud that interoperates. In this model users typically outsource non-business critical information and processing to the public cloud, while keeping business critical services and data in their control. A hybrid cloud can be delivered by a federated cloud provider that combines its own resources with those of other providers. Large enterprises often already have substantial investments in the infrastructure required to provide resources in-house. Furthermore, many organizations would prefer to keep sensitive data under their own control to ensure security [12]. Resources that are non-critical like development and test workloads can be housed in the public cloud that belongs to a third-party provider. While the workloads that are critical or sensitive must be housed internally. Consider an e-commerce website, which is hosted on a private cloud that gives security and scalability, since security is not a prime concern for their brochure site it is hosted on a public cloud which is more economical as compared to a private cloud. Businesses that have more focus on security and demand for their unique presence can implement hybrid cloud as an effective business strategy. When facing demand spikes the additional resources that are required by a particular application can be accessed from the public cloud. This is termed as cloud bursting and is available with the hybrid cloud [11].

The following figure summarizes the cloud computing deployment model with potential governance of the cloud.

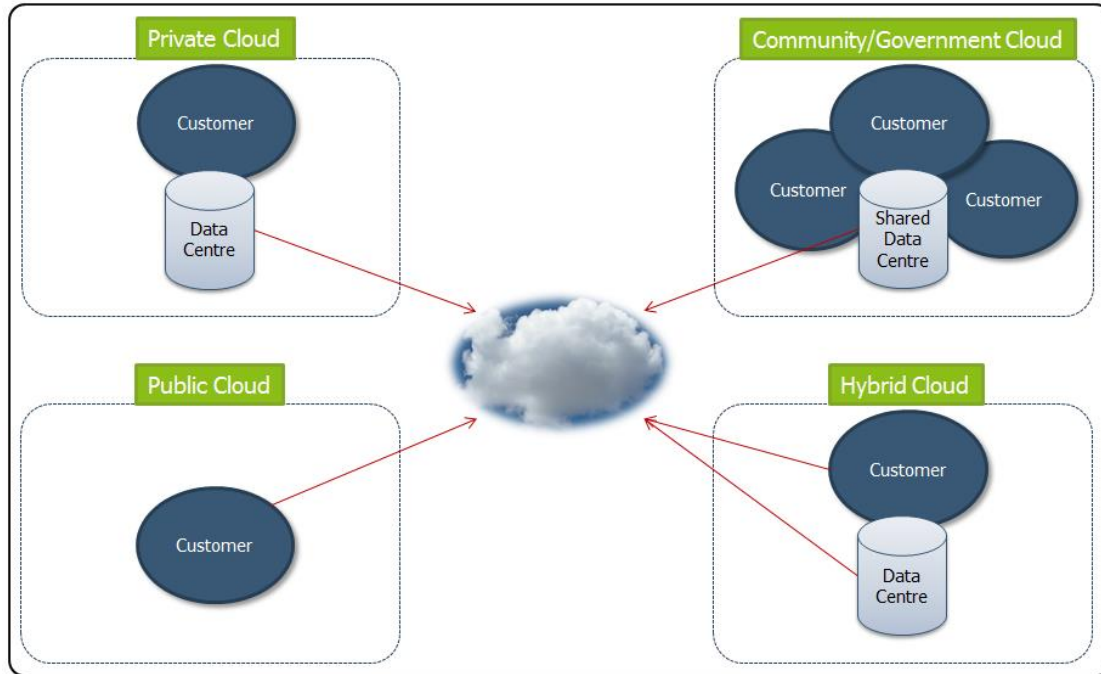


Figure 2-3: Cloud computing deployment models [4]

As a figure 2-3 shows computing infrastructure are managed and owned by third party providers, third party providers/organizations and both third party providers and organizations through different cloud service deployment models public, private and hybrid cloud respectively. Infrastructures can be located as off-premise, off-premise/ on-premise and both off-premise and on-premise ways. Finally Infrastructures can be consumed by un-trusted (authorized to consume some/all services but are not logical extension of the organization), trusted (part of an organization legal policy umbrella including employees, contractors, and business partners) and both un-trusted and trusted consumers of the cloud services.

2.6. Cloud Computing and Online Shopping

2.6.1. Cloud Computing Benefits for Online Shopping Applications

Cloud-based online shopping applications enable businesses to rapidly respond to market changes. It enables the users to make use of the network resources freely and cost-effectively, as well as with cloud computing, the majority of users need not to buy their own hardware and software, even need not to know who is providing the service, as long as you focus on the resources or services that you really need. In e-commerce cloud space, users can access to digital

services transparently at any time in anywhere [15]. Following are the top four impacts of cloud computing on online shopping applications [16].

- Cloud based online shopping applications allow companies to respond quickly to market opportunities and challenges as long as they engage IT. It's easy for business leaders to focus on the benefits of cloud computing without considering the time and effort involved in implementing a viable solution. However, whatever cloud computing solution they select, the application will need access to customer data, product data, fulfillment systems and other operational systems in order to support online shopping.
- Cloud-based online shopping applications enable IT and business leaders to evaluate new opportunities without large upfront investments. With smaller capital expenditures (CapEx) needed to launch a site, combined with operational expenditures (OpEx) that are typically billed on a "pay as you go" basis, organizations can shift their business online with minimal investment risk. A faster time to deployment allows them to streamline time-to-market for their products and services.
- Consumerism of the online shopping customer experience requires closer analysis of solution offerings. While many B2C companies use online shopping platforms for direct sales, Cloud solution providers (CSPs) that focus solely on creating retail models As a result, easy entry of large orders and repeat orders, segmented product catalogues that are based on a client hierarchy and buying privileges, con price quote capabilities and extended payment terms.
- IT leaders must understand the pros and cons of cloud-based ownership models in order to select the right solution for their needs. In addition to selecting a cloud-based online shopping solution, IT leaders are tasked with choosing from a variety of ownership options. For example, an organization can use an Infrastructure-as-a-Service (IaaS) model to run its application package or custom e-commerce software. It can use a managed service provider to manage its applications or create custom e-commerce software on IaaS or the organization can subscribe to a Software-as-a-Service (SaaS) online shopping application. IT leaders also need to determine the features and functions they require for their organization's online selling initiatives. They should collaborate with an experienced CSP to develop a solution that supports their organization's long-term online sales objectives, and outlines current and future technology needs. Cloud experts work with in-house application developers to design and build

cloud-based e-commerce environments that can help organizations lower their costs and take advantage of new business opportunities.

2.6.2. Adopting Cloud Computing for Online Shopping

Cloud computing created many new opportunities for organizations across the world. Presently, Cloud services are available at affordable prices and accessible for all scales of businesses. The economic benefits of this wider acceptance to adopting Cloud computing are enormous and many companies have embraced Cloud computing now. Over the years, technology emergence has helped to enhance the growth of Cloud computing, but the growth had not been as per expectations in the beginning era of the Cloud computing [5].

These days cloud computing is being promoted very significantly by online shopping as the many necessary for storing large number of business data might be reduced into a large extent by storing the details in cloud data centers. This technique of Hosting online shopping systems provides both commercial information like products prices and available quantities and even facilitates various commercial actions like buying, selling and negotiation[17].Some common services of e-business include online store, customer management, e-stores/digital stores, invoicing & packaging, payment options and shipping. These services can be used on cloud. Cloud computing framework allows enterprises with less investment to ecommerce business applications (B2B & B2C) [18]. The adoption of Cloud computing continues to grow and this change in adoption rate was noticed as a result of the improvements of bandwidth, security, privacy, data protection, performance and uptime, sufficient number of Cloud business brokers, and awareness.

Most of the small and medium enterprises that do not want to invest consistently on IT infrastructure decided to buy the idea of cloud computing, which has helped to reduce the cost in the areas of procurement of hardware infrastructure, installation and maintenance. The adoption of cloud computing for large enterprises that makes a larger part of the IT market place [5].

2.6.3. Challenges for Adopting Cloud Computing

Cloud computing has created a fundamental shift in how information technology infrastructure is run and managed, changing both the business and technology sides of IT. But, as with any major change in history, there are supporters and skeptics. Transferring enterprise IT to the cloud is a complex task that includes both technical and organizational challenges [8]. According to

Eugene Gorelik (2013), the top three cloud adoption barriers are security, cost uncertainty, and loss of control.

2.6.3.1. Data Security

Data security is by far the most challenging barrier to cloud adoption. Data is the most precious corporate asset, and companies want to know that their data is safe. Companies feel confident when they store data internally because they have full control over it. Although there is no guaranty that data is better protected internally comparing to public cloud. In fact, there is a possibility that data could be even safer in the public cloud because public cloud providers may pose higher level of data security expertise comparing to their customers. When stored at public cloud, data can be compromised at several different data-lifecycle stages: during transfer from the internal company network to the public cloud, when data is stored in the public cloud, and during data backup and restore processes. There are fundamental questions to ask in order to ensure data security in a public cloud:

2.6.3.2. Cost Uncertainty

There are hundreds of different cloud offerings on the market, and their pricing models vary considerably. This creates uncertainty, and makes it difficult to estimate the real financial benefits of cloud computing. This uncertainty is particularly troublesome for non-technical people within organizations, who could be confused and scared away by the complexity of pricing models. Pricing differences across cloud providers may include charges for data storage, CPU, memory, IP address, domain name service, and load balancing, among others. There is no single standard for cloud services pricing, and it can be complicated to compare prices between providers head-to-head.

2.6.3.3. Loss of Control

Loss of control factors can be subdivided into two types: technical loss of control, and organizational loss of control.

Technical loss of control: includes such factors as access control, software versions and updates, and control over the timing of technical operations such as data backups and restores, and is partially related to the data security issues discussed above. To address technical loss of

control challenges, a cloud provider should offer a company tools that provide full visibility into all cloud operations related to the company's assets.

Organizational loss of control: is instead related mostly to human factors that may create barriers for the transformation to cloud computing. These factors may include the fears of some individuals of losing influence in the organization, the fear of job loss if the cloud transformation will functionally affect specific positions, and the simple inability to embrace change. The fear of losing control is common, and applies not only specifically to the cloud computing shift but also too many other organizational changes as well.

2.7. Related Works

Cloud based framework for online shopping application system in Ethiopia will be developed and adopted to cloud computing platforms. The customers can access this online shopping application easily, safely and with trust. The customers can order products, view products, pay those ordered products and get the product within short period of time. This section describes the available literatures on the best practices of cloud based service implementations and framework development works for cloud based service in online shopping.

Sun and Yuan [32] developed an Online Selling Syndicates system with spring framework and several Apache open source projects for this market based on Software as a service (SaaS) model and analysis of customers' requirements, multi-channel and multi-tenant are supported by the system. For convert IT resource to business concept, a controller cluster mode was designed to decentralize the statue control of cloud computing. Two fast check algorithms were designed to serve the efficient control.

Jie [33] tried to solve the problem of the transaction security in C2C E-commerce. A valuation model was proposed based on cloud model theory. By means of using the algorithm of the merger of the trust cloud and the similarity computing of the trust cloud, sub-attribute valuation and comprehensive valuation is achieved. According to the valuation, the two side of transaction got strategic advices. Experiments showed that the method of valuation model was practical and valid. This model was not only applied to C2C E-commerce, but also a valuable method was provided for trust valuation in opened network.

Adewumi et al. [34] Implemented cloud computing be greatly applied in the retail industries because it transverses borders and contributes greatly to any nation's economy. A retail management system is one that is used by retail- inclined in different organizations and a host of

others. Features as Point of Sale (POS), inventories management, reports and feedbacks, employee management, customer management and supply chain management are some key components of retail management systems. The researcher has been developed and deployed as web applications and stand-alone systems. Where they are implemented as stand-alone systems, they tend to be complicated and expensive to maintain by businesses that have little or no IT knowledge. His developed application would require a whole team of experts to install, configure, test, run, secure and update such systems. In order to maximize return on investment, newer technologies can be explored. However, the researcher designed as the retailers begin to gravitate towards the cloud based approach to retail management, they will desire among other things a platform independent solution and one that is easy to customize to suit changing requirement.

L. Fiege et al. [35] Electronic commerce applications have been developed as a reaction to specific business opportunities. Their architectures, so far, have been dominated by implementation concerns, without much consideration given to the cooperation model. The researchers describe an application independent framework to classify service topologies, cooperation models, implementation techniques, and quality of service the framework is applied to some typical e-commerce scenarios. The researchers proposed the framework consists of four dimensions: topologies, cooperation models, implementation primitives, and quality of service. In this research is simply an architectural framework for electronic commerce does not integrate cloud computing technology.

Aulkemeier et al. [49] this paper presents reference architecture of pluggable service platform for e-commerce. An e-commerce platform is required that suites the advanced needs for flexible and agile service integration. Furthermore an increasing adoption of cloud computing technology could be observed resulting in more challenging integration scenarios involving cloud services. The researchers investigate the current available online shopping platform solutions and integration platform in the market. They developed architecture of a service-based pluggable Platform for online retailers and design the prototype for an e-commerce returns handling scenario. In this case the researchers are not design the complete prototype of the application they only show return handling system.

Supaartagorn [50] introduces e-retailing is the sale of goods online that takes place over the internet. World e-retailing is growing at an exponential rate in the Americas, Europe and Asia.

He investigates e-retailing costs require expensive investment, such as hardware, software and security systems, so using cloud computing is minimizing this extra costs. This paper or cloud based e-retailing application models allow enterprises to lower their cost with their effective implementation of e-retailing activities. He proposes a strategy for implementing cloud computing with e-retailing. However, the paper is not check the applicability of cloud computing in developing countries.

Liu [53] introduced the e-commerce application model based on cloud computing and coped with the problem of e-commerce and the shortage of resources by establishing the framework of e-commerce application based on the environment of cloud computing service model. He tried to solve the problems of the shortage of funds, man power and technology which were required in the activities of e-commerce. His studies had shown that, in enterprises and their own e-commerce through the network resources. Cloud based e-commerce application model allows enterprises to lower costs through the effective implementation of e-commerce activities and solves the problem of enterprises'. The traditional system cannot develop e-commerce activities due to lack of resources. But in the concept of cloud computing, it minimizes the resource problems of developing the application.

The study discusses the factors that make cloud computing an attractive option for a financial services firm. These factor are perceived cost savings, ease of scaling-in and scaling-out, faster time-to-market for deploying systems, virtualization of enterprise wide data as a service, enterprise technology standardization, and the ability to access data and applications on the move are all critical consideration factors that can drive financial services firms to adopt cloud computing.

Whereas most of the existing researchers propose framework for implementing e-commerce application, the researcher propose a justifiable, feasible and effective cloud framework for implementing online shopping by ensuring maximum utilization of existing infrastructure within Ethiopia. This research raises some points of concerns which are unique to Ethiopia and consequently, those issues were not figured out by most existing researchers in proposing and directing the implementation of online shopping in Ethiopia.

Chapter Three

3. Research Methodology

The main aim of this chapter was to design the methodology to carry out the study, which included the instruments used to develop the knowledge base to the study requirements were data collection using interview, questioners, observation and review of relevant literature including similar studies. The analysis process was based on interview and distributing questionnaires to the online displaying site manager from the selected online displaying sites and other relevant companies and reviewing relevant documents.

3.1. Research Design

A research design, which is a function of the research objectives, is defined as “a set of advance decisions that makes up the master plan specifying the methods and procedures for collecting and analyzing the needed information” [51]. For any research studies, there are four commonly used approaches which are quantitative, qualitative, design oriented and mixed method [52].

In an attempt to assess cloud based online shopping practices, opportunities, challenges an adaptation in case of Ethiopia, the researcher used design-oriented research methodology. Design-oriented research method is basically a problem solving model. The five steps of design oriented method followed in this thesis work are identification of problem, architectural framework design, architectural evaluation, revaluation and improvement of architecture and results and discussion of research. Therefore, to undertake cloud based online shopping in Ethiopia the researcher used design-oriented research methodology by utilizing both qualitative and quantitative data analysis.

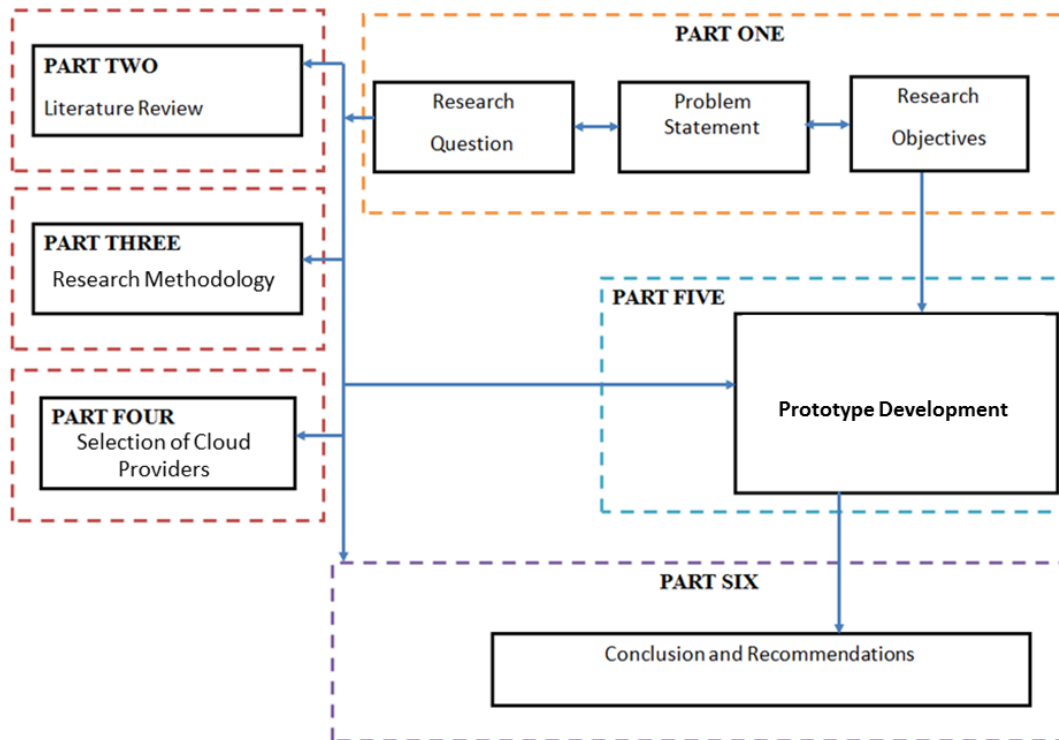


Figure 3-1: Major Steps in the Research Process

The research design is made in a way to link the related issues in the same part and across sections. It can be taken as a conceptual framework starting from the beginning to the end of the paper.

3.2. Process Model

In software Engineering, process model is a description of the sequence of activities carried out in the software project and the relative order of these activities. There are several process models which include prototyping, unified process, incremental and agile. In some cases it is possible to combine process models or use together in software development process [23]. In this study, prototyping and Unified process models were used together to accomplish the overall objectives. Prototyping is about creating some parts of the system being developed. It is not a standalone and complete development methodology rather it is a model to test specific features in the situation of complete methodology. Generally, the unified process model importantly uses cases, iteration and software architecture techniques; and the prototyping model is concerned with the development of incomplete version of the system. Therefore these are the reasons to select both of these models for this specific study.

3.3. Data Types and Sources

The research is conducted by using both quantitative (statistical analysis, questionnaire survey, etc.) and qualitative (archival analysis and interview) research methodology. The online shopping service has human and behavioral dimensions which could be addressed by qualitative methods. In addition to this, the issue has physical and numerical attribute which can be addressed by quantitative research method.

Both primary and secondary data sources are applied to acquire the necessary information. In the primary data sources the research used visual survey; interview and semi-structured interview guides for online shopping managers and owners. Secondary data are taken from related documents, online users and non-online users. The study document conducted from different researches written on the same issue in the system.

In order to conduct this research basically primary data was collected from a number of company workers. In addition to this secondary data sources are used for supporting the primary data. Here the researcher collected relevant data from different organizations. These are

- Banks: ICT professionals from working in mobile and internet banking and bank managers (from Commercial Bank of Ethiopia, Awash Bank and Oromiya International Bank). In addition to the banks Mobile agent banking is included in the study.
- Ministry of Trade.
- Ministry communication and Information Technology Sector analysis to check the rule and regulation of online shopping and the problems and challenges of online shopping from ICT directors and managers of this company.
- Display web sites. Different sites are available in the internet some of them are not official. The formal sites that are selected were kaymus.com, mekina.net, shebashopping.com, merkato.com and gult.com.

3.4. Sampling and Data Collection Technique

Sampling techniques are techniques used to clearly define the target people. A small, but carefully chosen sample through systematic random sampling technique is used to represent the professionals from selected offices described above. The sample reflects the attitude and perception of ICT professionals from different offices regarding the adaption of cloud computing

for online shopping. Moreover, the researcher used purposive sampling technique to interview the officials or leaders from different sectors. Since the leaders are few in number the best and appropriate method is to interview all of them with nonrandom sampling technique as discussed earlier. Therefore, the researcher used both purposive and random sampling technique.

3.5. Data Collection and Analysis

Interview was made from different banks, offices and online displaying site managers. A representative sample of 33 ICT professionals, directors and managers are involved in the interview from Oromiya Bank, Commercial Bank, Mobile Banking Company and Internet Banking. One of the major questions forwarded for these groups of interviewed individuals was; “is e-payment possible in Ethiopia?” Out of the respondents 23 (69.69%) individuals replied as e-payment is possible to apply in Ethiopia since most of the banks are integrated to each other it is simple to apply the newly emerged technology which is mobile and internet banking. In addition to this, the respondents are also requested to rate the barriers of cloud computing to implement online shopping in Ethiopia. Significant proportion of the respondents replied the major barriers are lack of clear strategy on cloud computing, lack of security and SLAs, lack of trust, lack of control and ownership and cost of deployment respectively.

The next interviewed organization was Minister of trade so as to know how many companies are available in the market and what factors hinder them from competition in the country and the world at large. The officials replied that there are many companies started but the sites are serving as display web sites and serve as promotion sites. Therefore, there is no company that is registered here in our office to give online shopping that incorporated payment system in the web.

The next organization included in the analysis the document was Ministry of communication and Information Technology. The researcher obtained valuable information from ministry of communication and information technology regarding the rules and regulations about online shopping in Ethiopia which is established by ministry of Information and Communication Technology. During the analysis of document which is displayed on their site explained the importance of online shopping for national development through trade and consultants and aims to regulate the developing e-commerce industry in Ethiopia. The main purpose of the consultancy was to:

- Enable by individuals and businesses to use e-commerce, essential for the efficiency in the international trade;
- Building consumer confidence and trust in e-commerce
- Advance the acceptance of e-commerce across regional and sectors in Ethiopia;
- Upgrade the e-commerce capabilities of businesses
- Provide support businesses which need to overcome the legal obstacles associated with increases use of electronic commerce.
- Assist the government in enacting legislations governing use of alternative to paper-based methods of communication and storage of information.

Although the e-commerce law it is expected to leverage Ethiopia's business sector, experts believe that the country has an unskilled labor force and limited access to technology or computers.

Furthermore, questionnaires are distributed and administered from the existing online displaying sites which were delala.com, mekina.net, shebashopping.com and gult.com. The questionnaires are directly given for the website managers. The display sites are no more online shopping sites since the payment system is not imbedded in the websites. Some of the questions are challenges and problems of online shopping in Ethiopia, existing status of online shopping, advantages of cloud computing in online shopping; those online display site managers answer the above question here in Ethiopia online shopping still not available but there are some display site but there are different challenges and problems to buy and sell product from anywhere because of lack of trust, and lack payment modes, lack of startup investment, accessibility and security now it is possible to do this online shopping because there are the advancement of technology. Cloud computing better for this application because it does not need maintenance, installation, hardware cost and it is efficient, accessible and secure to do such business. The managers replied that the technology is not available in Ethiopia to undertake payment in the internet.

The last data collection technique is observation the researcher observed the existing display sites. Detail observation is undertaken to check what the services provided by the websites and compare it with the traditional shopping.

The importance of cloud computing technology in online shopping sites is not well known by different professionals. But some of the ICT professionals like ELROZA Multimedia and

Communication Plc. and few online displaying company managers know the function of cloud computing. Cloud computing is very important for online shopping since the storage infrastructure it delivers products on the internet as well as the database and other important files are stored on the cloud. Furthermore, the sites support an application, cloud would be a tool to make the service easily accessible, available, secured and relevant.

The main aim of the research is to solve the problem which exists in developing countries specifically in Ethiopia by using cloud computing technology. Here several problems are found in the traditional shopping system like time consumption, extravagancy, untrusted, time limitations and difficulty to get exact items, etc. Even the existing displaying websites have problems. Basically the sites are established for the purpose of promotion and simply to display items on the site but it is difficult to order items, security, trust, payment, and accessibility and availability problems. But cloud computing has several advantages for online shopping since it stores and process large amount of items and products, accessing these products with cost effective, flexible, scalable and multi-tenant system. By using this technology each and every one can access and buy any product which is available in the site with 24 hours a day and 7 days in a week by using their mobile or laptops and other electronic devices.

Chapter Four

4. Selection of Cloud Platform and service provider

The previous chapter was the methodology section used to understand the existing problems by undertaking analysis using different data collection methods and techniques and the proposed solutions from various sources. This chapter discusses, analyze and select cloud service providers and cloud platforms. Here the researcher selected and discussed in detail about Microsoft Azure platforms and its implications.

4.1. Cloud Service Providers

Cloud service providers (CSP) are companies that offer network services, infrastructure, or business applications. The cloud services are hosted in a data center than can be accessed by companies or individuals using network connectivity.

The large benefit of using a cloud service provider comes in efficiency and economies of scale. Rather than individuals and companies building their own infrastructure to support internal services and applications, the services can be purchased from the CSP, which provide the services to many customers from a shared infrastructure [24].

Selection of clouds is started by analyzing the cloud service provider (CSP) that can best provide software as a Service since it is the most appropriate layer to deploy the application. These CSPs selection was depending on the ease of the use and the existence of ongoing technical support services.

There are many cloud computing providers available in industry. Few companies are leading in this is listed below [24].

- Amazon Elastic Compute Cloud (EC2)
- Microsoft Azure Services
- Google App Engine
- Salesforce.com
- Akamai Edge Platform
- IBM Computing on Demand (CoD)

- Rackspace Cloud
- Terremark
- NetSuite and many

Our cloud service provider candidates are Amazon clouds, Google App Engine and Windows Azure and also summarize these platforms in table with basic parameter. In the following sub sections, there are some details about each CSP's candidates.

4.1.1. Amazon Cloud Services

Amazon Elastic Compute Cloud (Amazon EC2) is a web service that provides resizable compute capacity in the cloud. It is designed to make web-scale computing easier for developers. Amazon EC2's simple web service interface allows you to obtain and configure capacity with minimal friction. It provides you with complete control of your computing resources and lets you run on Amazon's proven computing environment. Amazon EC2 reduces the time required to obtain and boot new server instances to minutes, allowing you to quickly scale capacity, both up and down, as your computing requirements change. Amazon EC2 changes the economics of computing by allowing you to pay only for capacity that you actually use. Amazon EC2 provides developers the tools to build failure resilient applications and isolate themselves from common failure scenarios [8].



Figure 4-1: Components of Amazon EC2 [10]

Amazon EC2 instances types are grouped into six families

- Standard
- Micro
- High-Memory
- High CPU
- Cluster Compute
- Cluster GPU

4.1.2. Windows Azure cloud

Windows Azure is Microsoft's application platform for the public cloud. Your applications can use this platform in many different ways. For instance, you can use Windows Azure to build a web application that runs & stores its data in Microsoft data centers. You can use Windows Azure only to store data, with the applications that use that data running on-premises (that is, outside the public cloud). You can use Windows Azure to help on-premises applications connect with each other or to map between different sets of identity information or in other ways. Because the platform offers a wide range of services, all of these things and more are possible [12].

Windows Azure provides two types of roles:

- Web roles: A web role is designed for code that talks directly with web browsers or other HTTP clients i.e. it depends on IIS, Microsoft's webserver. For example, ASP.NET or PHP application.
- Worker roles: A worker role is more general, designed to run a variety of different type of code. For example, application that processes lots of data in parallel.

Each role instance is really just a virtual machine (VM) running a flavor of Windows Server and each one executes in a Windows Azure data center see Figure 4-2 [12].

Components

To understand what Windows Azure offers, it's useful to group its services into distinct categories and you need to know what its components do. Figure 4-2 shows one way to do this

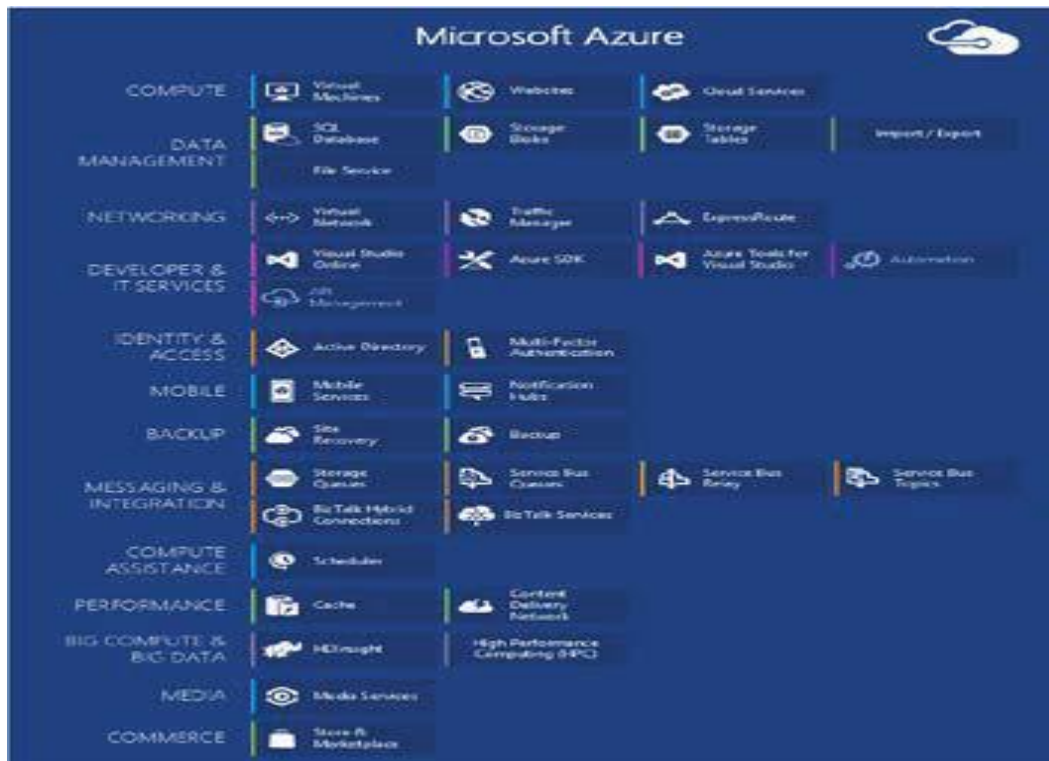


Figure 4-2: Components of Windows Azure [12]

Every Windows Azure application runs in one or more VMs. Each VM has local storage, which an application is free to use. Windows Azure provides five data management options (Figure 4-2).

- SQL Azure
- Tables
- Windows Azure Blobs Storage Service
- Import / Export
- Azure File Service

Azure runs today in many data centers spread across the world. When you run an application or store data, you can select one or more of these data centers to use. You can also connect to these data centers in various ways using the services below.

- Virtual Network
- Traffic Manager
- Express Route

Table 4-1: Comparison of Amazon EC2 and Microsoft Azure

<i>Feature</i>	<i>Amazon EC2</i>	<i>Microsoft Azure</i>
Types of Cloud Computing Provided.	Amazon provides all three types of cloud computing i.e SasS, PasS and IaaS, but major player in IaaS.	Microsoft Azure provides all three types of cloud computing i.e SasS, PasS and IaaS, but major player in PaaS.
Relational	SQL, MySQL and	SQL Azure

4.1.3. Google App Engine

Google App Engine (GAE) is cloud computing platform for developing and managing web applications in Google's infrastructure. Development and maintenance of applications are easy and these applications can be scaled up as the traffic and the storage needs grow. The capitation cost for getting started with GAE is zilch. Infrastructure facilities like servers and its maintenance are not required as the idea is to just upload the application in GAE and it is thus deployed. It provides dynamic web serving, persistent storage, automatic scaling and load balancing. Apps written in several programming languages are supported in GAE [12]. Applications in GAE are sandboxed. Sandbox is a security mechanism for running programs from illegitimate users and websites. This separates the application in a reliable environment which is independent of the operating system and hardware infrastructure.

Reason of selecting the three cloud service providers are shown in the table 4-2[25].

Table 4-2: Major CSPs and their approaches

<i>Cloud Service Provider</i>	<i>IAAS</i>	<i>PAAS</i>	<i>SAAS</i>
Amazon	X	X	
Google	X	X	X
IBM	X	X	X
Microsoft	X	X	X
Rackspace	X	X	
Salesforce.com		X	X
SAP	X	X	X
Verizon Terremark	X	X	
Century Link	X	X	

From the above table comparisons of cloud service providers according to cloud service types which is IaaS, PaaS and SaaS. Four cloud providers which provide all the three service types. These are Google, IBM, SAP and Microsoft cloud service providers. Detail comparison discussed at the end of this chapter.

4.2. Microsoft Azure Cloud Services and comparison

Cloud computing is the set of technologies and infrastructure capabilities offered in a utility-based consumption model. Microsoft Cloud Computing offers Microsoft Azure, previously known as Windows Azure, to help its customers realize the benefits of cloud computing. Microsoft provides several tools that can help optimize and automate the deployment process.

For development, Web Apps supports .NET, PHP, Node.js, Java and Python along with SQL Database and MySQL (from Clear DB, a Microsoft partner) for relational storage. It also provides built-in support for several popular applications, including Word Press, Joomla, and Drupal. The goal is to provide a low-cost, scalable, and broadly useful platform for creating websites and web applications in the public cloud [46].

Table 4-3: Comparison among the four cloud application development and hosting tools [47]

<i>Features</i>	<i>Azure</i>	<i>App Engine</i>	<i>Foundry</i>	<i>Salesforce</i>
GUI Support	Windows Azure dashboard and command line	Command line interface	CF command line and BOSH tool	Salesforce Command Line tool
Language support	.NET, Java, php, Node.js , Python and Ruby	Java, Python, Go and PHP	Java, Ruby and Node.js	Ruby, Python, Java, Scala, php, Cloture and Node.js
Middleware	Tomcat java 7	-----	Tomcat java 6,7	-----
Framework	Cakephp, Django , etc	Django,Webapp 2	Spring, play Rails, Sinatra and Grails	Play, grails Django, flask, rails
Service	No native, databases, messaging queues and caching	Storage and development services	Data storage, messaging, development and mobile services	Development, storage and message queuing

Pricing	Based on size of instances running	Based on usage, monthly bills or free usage	Based on upon request or free usage	Based on number & size of dynos, Postgres DB and add-ons used
Availability	Open source: http://azure.microsoft.com	Open source: http://www.cloud.google.com/appengine	Open source: http://www.cloudfoundry.org	Open source: http://www.Salesforce.com
Provider	Microsoft	Google	Pivotal	Salesforce

To sum up, the major cloud service providers are briefly described above. The providers have their own advantages and disadvantages which has its own impact on the implementation. The researcher put the major features /parameters to identify the best provider that suits with our context.

Azure is Microsoft cloud platform that offers the combination of IaaS, PaaS and SaaS which is establishment for running applications and storing data in the cloud. It enables developers to use any language, framework, or tool to build applications. So that Microsoft azure supports any operating system, language, tool and framework. In addition, developers can use Visual Studio for creating and deploying applications which support local debugging of application code, a trace facility and storage account diagnostics, as well as other troubleshooting features. In this platform, applications are administered through the Windows Azure dashboard or through a command line interface. Therefore, the researcher selected Microsoft Azure to develop online shopping prototype in Ethiopia.

Chapter Five

5. Cloud based service for online shopping

In this chapter, we elaborate the proposed cloud framework and implementation of this proposed framework by using prototype development tools.

5.1. Building the framework

Framework tells about the detail of how online shopping can take place. It defines actually how online shopping implemented, how online trading or business can be done. It defines important components that should be present to do some transaction. Before building a framework the researcher considers two important cloud computing solutions. First, identify the cloud services such as IaaS, PaaS and SaaS. Second, the proposed cloud deployment model evaluating the model and selecting the appropriate cloud model.

5.1.1. Identifying cloud Service

Software as a Service (SaaS) - is one of the service deployment mechanisms which enable user's access different software from the cloud wherever they are, and whenever they need without installing it on their machine. [36]. the end users use service that are deployed by the platform service providers. SaaS users can access different service from online shopping applications like accessing, ordering and view products and pay money for the ordered items and they access other different software from the cloud. Due to this the end users use the application without installing online shopping application.

Platform as a Service (PaaS) - is the second layer of service deployment mechanisms which Microsoft azure not only provides the hardware, but they also provide a toolkit and a number of supported programming languages to build higher level services i.e. online shopping applications that are made available as part of a specific platform [36]. The users of PaaS are typically software developers who are developing online shopping application by using Microsoft azure supporting platform which is ASP.NET and host this applications and provide these applications to the end-users.

Infrastructure as a Service (IaaS) - is another service mechanism which is one of the models of cloud computing used to deliver computing resources, and this is accomplished by provisioning

virtual resources to customers. For example, if a person wants to run an online business, there is no need to set up his/her own IT infrastructure. Instead he/she can rent a virtual machine from Microsoft azure and provide the service [37]. This help the business as it no longer requires investing capital in IT infrastructure and allows an enterprise to focus more on the business growth instead of thinking about over-provisioning and under-provisioning of the computing resources.

Generally, the developed framework of online shopping used for software as a service and platform as a service depending on the users, online shopping application uses as software as a service when the application is deployed and accessed by the end-users because they use the without installing, updating simply accessing and using the system. The same is true for it act as platform as a service when during the development phase the developer, develop the application by using cloud platform which is programing language, database and other tools due to this the application is platform as a service. Online shopping in the cloud computing framework used as software as a service for end users.

5.1.2. Proposed cloud delivery model for online shopping application

Cloud delivery model is important to consider issues such as data control, data storage, security, the likely elasticity of demand, and how best to manage the migration to and management of the cloud deployment. Here is important to select the best delivery model as well as the cloud service which is better for online shopping application.

First, public cloud is characterized by a simple sign-up process, relatively low price and the speed by which it is possible to quickly deploy and scale a virtual. Second, Private cloud is a cloud infrastructure build exclusively for a single organization, deployed within certain boundaries like firewall settings whether managed internally or by a third-party and hosted internally or externally. Third, Hybrid clouds combine the advantages of private and public clouds, offer flexibility, control and security of multiple deployment models IT organizations use hybrid clouds to employ cloud bursting for scaling across clouds. Cloud bursting is an application deployment model in which an application runs in a private cloud or data center and "bursts" to a public cloud when the demand for computing capacity increases. Hybrid cloud architecture requires both on-premises resources and off-site (remote) server-based cloud infrastructure [39]. Fourth, Community cloud infrastructure is shared between the organizations

with similar interests and requirements whether managed internally or by a third-party and hosted internally or externally [41].

The research considering from the literatures and the systems supporting model as well as the advantage of the model; we decided to propose a hybrid cloud delivery model for online shopping. The reasons to choose hybrid cloud because of its implication over the system. These are

- Hybrid model is well suitable for organization which has full outsourced to combine community cloud services with public cloud services.
- Hybrid clouds may be the best option for medium and large sized establishment. The application wants to use a SaaS application but is concerned about security.

Although each of the cloud deployment models offers possible for cost savings, improved services levels and faster deployment, there are some key differences between them. Organizations often choose hybrid cloud solutions for different reasons which are summarized in table 5-1.

Table 5-1: comparison of cloud delivery model [41]

<i>Parameters</i>	<i>Public Cloud</i>	<i>Private Cloud</i>	<i>Hybrid Cloud</i>	<i>Community Cloud</i>
Cost and Investment	Very Less approach to	Very high cost	Reduce total cost Of ownership	More than a private cloud
Size	Large	Small	Very large	Medium
Security and Privacy	Very less	Very much	More	More
Infrastructure Require	Off-Premise only	On-Premises or at a third party	Can be On or off-Premise	Can be On or off-Premise
Integration	Very Difficult	Very Easy	Difficult	Easy
Application	Very	Very	Very	Very
High	Business requirements organizations where manage load spikes, utilize meantime infrastructure and applications	Business and Mission critical application and IT services	Smaller and medium sized Organizations	Various Public & Private Sector companies, banks, federal agencies and Companies
Level of Control	Low	High	Moderate	High

Examples	IBM Smart Cloud Amazon EC2	Amazon VPC VMware Cloud Infrastructure Suite	Microsoft Azure and Force.com	Google Apps
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5.1.3. Proposed framework of cloud based online shopping

Cloud design framework by modeling it at the SaaS layer above the PaaS and IaaS layer. The designing framework of the general overview proposed system uses a layered structure based on the above two criteria which is selecting cloud services and cloud delivery model.

The proposed cloud based online shopping framework is mainly divided into four layers: Hardware resource layer, Software resource layer, Service layer and business layer. Figure 5-1 shows the architecture of the proposed framework. In the sub-sequent sections, the main components of the proposed system will be discussed in more detail.

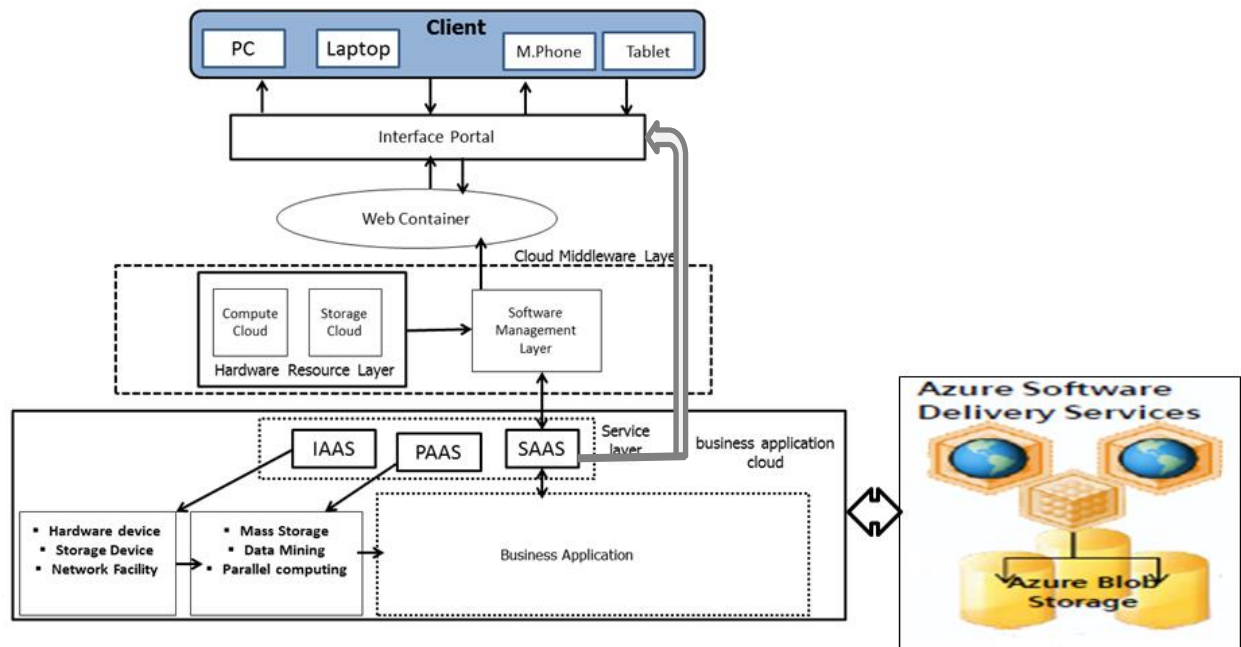
Hardware resource layer: It is the most important for the total infrastructure of the system. The physical hardware layer is virtualized to provide a flexible adaptive platform to improve resource utilization. With the help of virtualization, physical servers, network and storage are grouped and called it as upper software platform.

Software resource layer: In software resource layer many of these software solutions combine to offer the grouped interface for the software developers. Therefore, software developers can create for online shopping system and able to deployed those in cloud, which helps the cloud users to use these application through cloud.

Service layer: Service layer is divided into three sub-levels namely IAAS, PAAS and SAAS. These service layers help to cloud customers to use the various forms of cloud resources for their products like software resource, hardware resource, and Infrastructure resource. But online shopping is implemented as PAAS every operations and development are developed on this layer.

Business application layer: differs from all other layers in cloud based online shopping architecture, because this layer acts as important business logic of web shopping, and group of components for online shopping application. There is growing number of SAAS services which

could provide different aspects of capability enabling business to leverage cloud platform to run and manage business processes such as: sales tracking management, goods creation and evaluation, payment management, Stock management, Supply chain management (SCM), Shipping Management, Order management. Etc.[38] [39].



organization. One of the most important is design the detailed proposed cloud computing architectural framework of online shopping in Ethiopia context in order to make the service is more accessible/available, secure, flexible and etc. All of this needs to be done in a secure and governed environment.

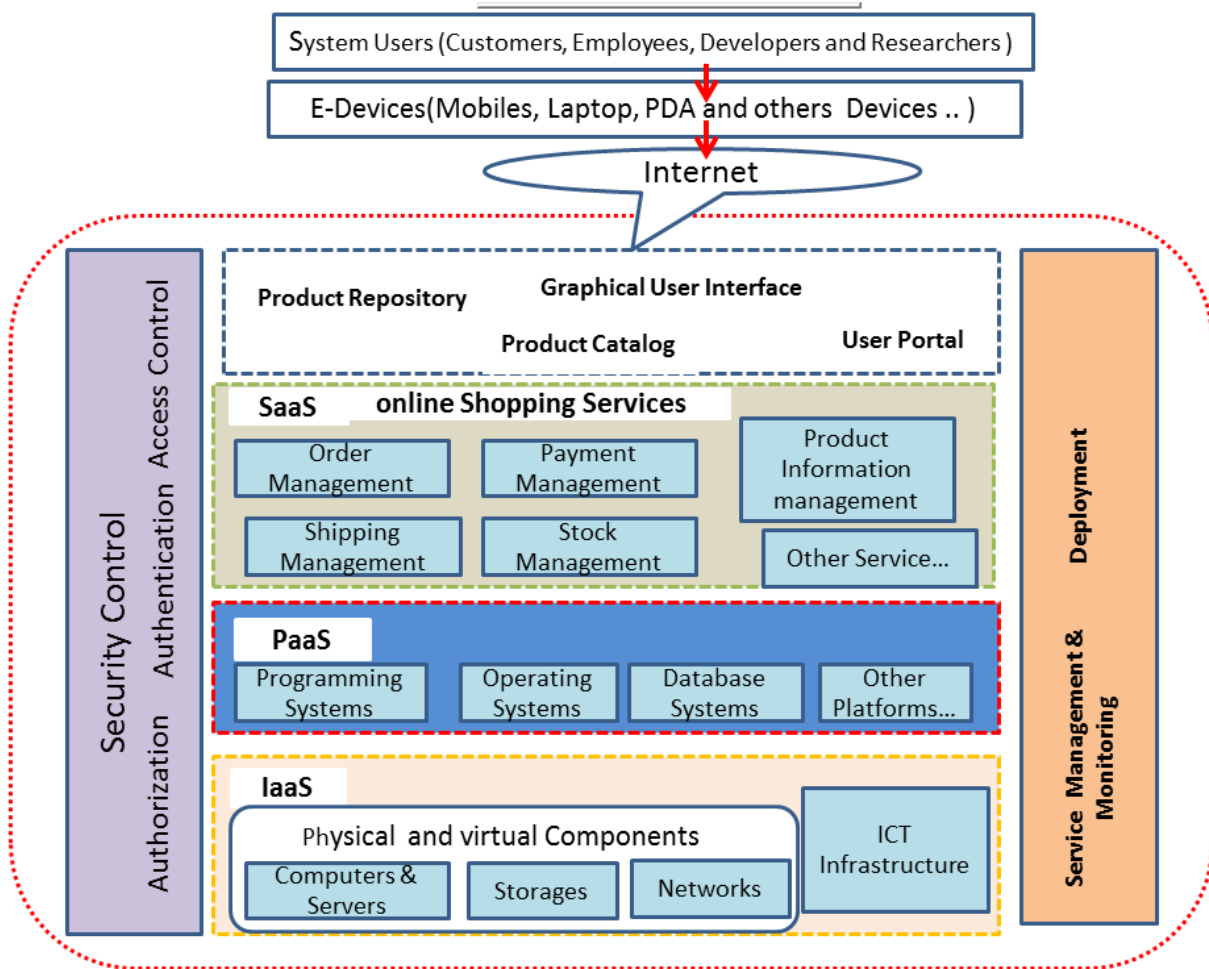


Figure 5-2: Detailed view of cloud based online shopping architecture

5.1.3.1. Graphical User Interface

It is an interface between user and machine or user interact an application or system through interface so as to access resource which is available to the system it includes, users are able to view online shopping site which is deployed over the cloud, browse the different categories, browse and add any number of items from the categories in the shopping site, look for information about each product, deleting items in the shopping cart, save order items for later view by typing its transaction id generated by the system, check out or continue shopping after adding the item to the cart and pay the items by completing the required information in the order form. The major components under user interface are;

Service Repository – which contents different service of online shopping applications like ordering items, payment options, product lists etc. categorized and arranged based on their product type.

User portals – it gives access path of every product which is available in online shopping web sites.

Product catalog – contains detailed information about the products and service in the application such as prices, quantity, types of products and soon.

5.1.3.2. Software as a service of online shopping

SAAS is the top layer of cloud architecture different software applications or services provided by online shopping company to the end users, in other ways it is provide on-demand access, according to in lower cost to avoid wasting and provide more resources can be used for business activities. End user can access products and service via internet and electronic device, users can view, order, pay and get products where they are. In online shopping SaaS cloud, users can access to good and services at anytime and anywhere.

5.1.3.3. Platform as a service of online shopping

PAAS is second cloud architecture of online shopping which support of the powerful hardware, platform layer carries out the tasks of data storage, computing and software development tools or programming language. The developers can choose the devices and the number of devices or programming languages to develop online shopping application.

5.1.3.4. Infrastructure as a service

IAAS is base layer of online shopping cloud IT infrastructure resources and connects these resources together to provide services. IaaS includes virtual and physical resources which are computers, servers, storages and networks. Virtualization technology separates the physical hardware from operating system, which on one hand can make computing and storage capacity of the existing server into smaller size and re-integration, to improve the utilization and flexibility of online shopping IT resource; on the other hand can provide a common interface for large-scale cloud computing integration. Infrastructure as a service can provide the basic hardware resources for the platform layer.

5.1.3.5. Security Controls

Cloud security control of online shopping is a set of controls that enables cloud architecture to provide protection against any vulnerability and mitigate or reduce the effect of a malicious attack. According to the Cloud Security Alliance (CSA) has created a Cloud Control Matrix (CCM), which is designed to help prospective cloud buyers evaluate a cloud solution's overall security. Cloud security controls are similar to the standard information security controls and can be categorized in different domains including [2]:

- Deterrent Controls: Don't protect the cloud architecture/infrastructure/environment but serve as warning to a potential perpetrator of an attack.
- Preventative Controls: Used for managing, strengthening and protecting the vulnerabilities within a cloud.
- Corrective Controls: Help reduce the after effects of an attack.
- Detective Controls: Used to identify or detect an attack.

In cloud computing there are a lot of security mechanisms to protect data and the whole system holding and processing it. In online shopping application in cloud computing security mechanisms should be consider ,basically the developer should consider authorization, authentication and access controls of the system in which the users have its own access privileges. User and administrators have Authentication is used by a server when the server needs to know exactly who is accessing their information or site. Authorization is a process by which a server determines if the client has permission to use a resource or access a file. In authentication, the user or computer has to prove its identity to the server or client. Usually, authentication by a server entails the use of a user name and password. The next is authorization which is a process by which a server determines if the users have permission to use a resource or access a file.

The next and the most important security mechanism is encryption involves the process of transforming data so that it is unreadable by anyone who does not have a decryption key. The Secure Shell (SSH) and Security Socket Layer (SSL) protocols are usually used in encryption processes. The SSL drives the secure part of “https://” sites used in e-commerce sites (like E-Bay and Amazon.com). All data in SSL transactions is encrypted between the client (browser) and

the server (web server) before the data is transferred between the two. By encrypting the data exchanged between the client and server information like social security numbers, credit card numbers, and home addresses can be sent over the Internet with less risk of being intercepted during transit. Due to this the researchers develop SSL protocols in online shopping application for security mechanism the http:// automatically converts in to https:// after configuring the development tools.

5.2. Prototype Development

The prototype development lifecycle of software that uses the Azure platform mainly follows two processes [45]. These are application Development and azure management portal.

5.2.1. Application Development

During the application development stage the code for Azure applications is most commonly built locally on a developer's machine. Developers to build application code directly through the Azure portal using references to a number of different Azure services. The application development process includes two phases: 1) Construct + Test and 2) deploy + Monitor. In the Construct and testing phase, a Windows Azure application is built in the Visual Studio IDE (2010 or above). Visual Studio Code is a tool that was created as a part of Microsoft efforts to better serve developers and recognize their needs for lighter and yet powerful/highly-configurable tools. Visual Studio provides developers with the best development platform to build Windows Azure applications or consume Azure services.

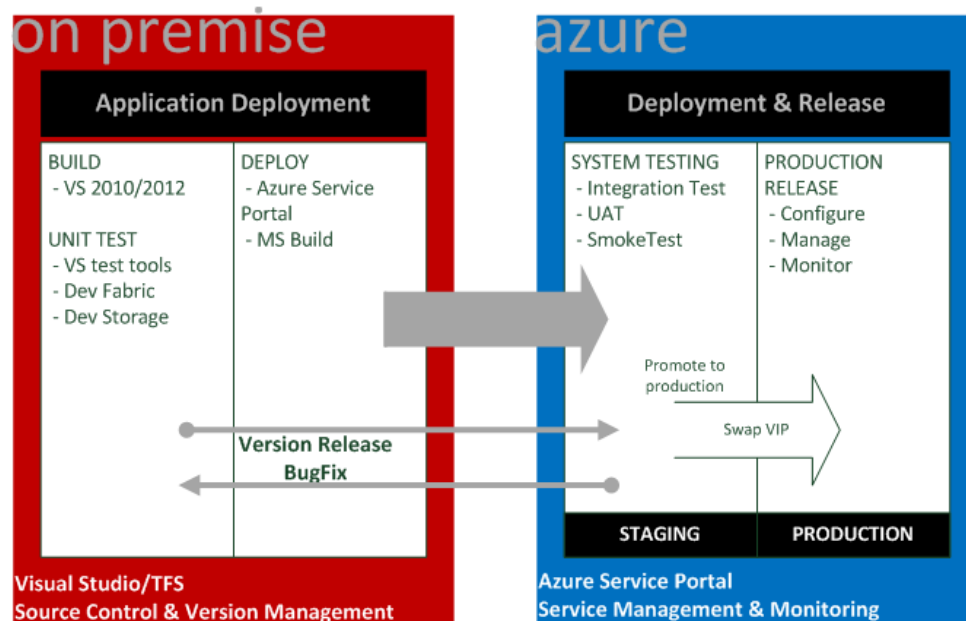


Figure 5-3: Visual Studio and the Azure SDK provide the ability to create and deploy project [45]

Visual Studio and the Azure SDK provide the ability to create and deploy project infrastructure and code to Azure directly from the IDE. A developer can define the web host, website and database for an app and deploy them along with the code without ever leaving Visual Studio. Second, Tools to Build and Deploy an Application with Microsoft Azure, Microsoft Azure provides a number of different ways to build and deploy an application. They can be grouped in several categories by Azure cloud service type; it may be web application, Mobile application.

5.2.2. Azure Management Portal

The second development lifecycle is azure management portal; a developer can use the Azure Management portal to manage an already deployed application. Each Azure service provides access to a few managed environments, the so-called deployment slots. They can be used for Staging, Production or any other environment we want to deploy to and use in the Azure cloud.

Generally, the proposed framework of online shopping service in Ethiopia which described in the previous sections that provides for efficient, accessible and secure service to the users. The framework needs an implementation plan to deploy cloud-based solutions of online shopping system. As shown in figure 5-4 the application developer develop the prototype by using an

integrated development environment which are different programming language like ASP.NET, PHP, Java ,databases and soon and the user use the application after deploying on the cloud. The prototype developed by using 3-tier architecture. Microsoft azure supports ASP.NET, Java, and PHP so that the developers select ASP.NET programming language to develop the online shopping application.

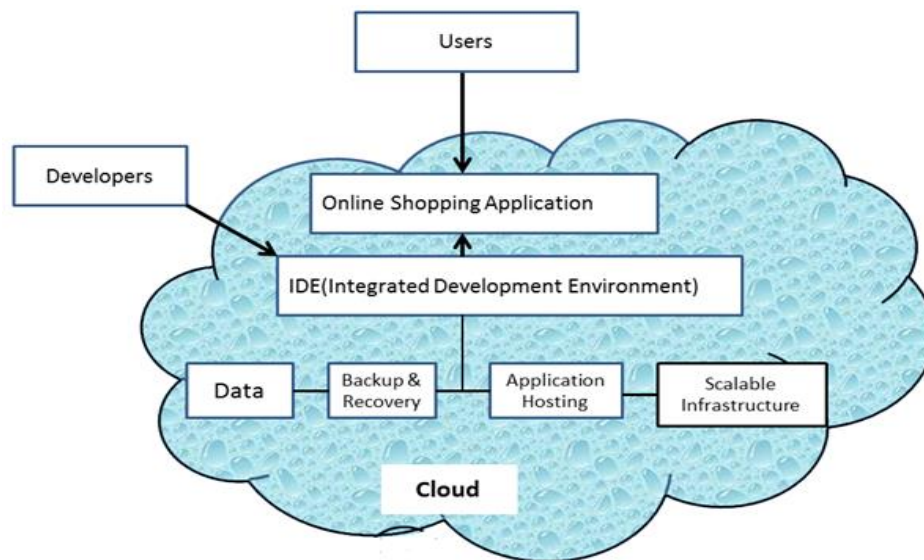


Figure 5-4: overview of cloud computing of application development and usage

Within the cloud there are data, backup and recovery, application hosting, scalable infrastructure, IDE. By using these clouds service developers can develop an application by using programming languages. After the application is developed it deployed on the cloud finally the user has been accessed. The prototype is developed by ASP.NET three-tier architecture is a client-server software architecture pattern in which the user interface (presentation), functional process logic(business rules), computer data storage and data access are developed and maintained as independent modules, most often on separate platforms [43]. The three- tiers are presentation tier, application tier and data tier as shown the figure 5-5.

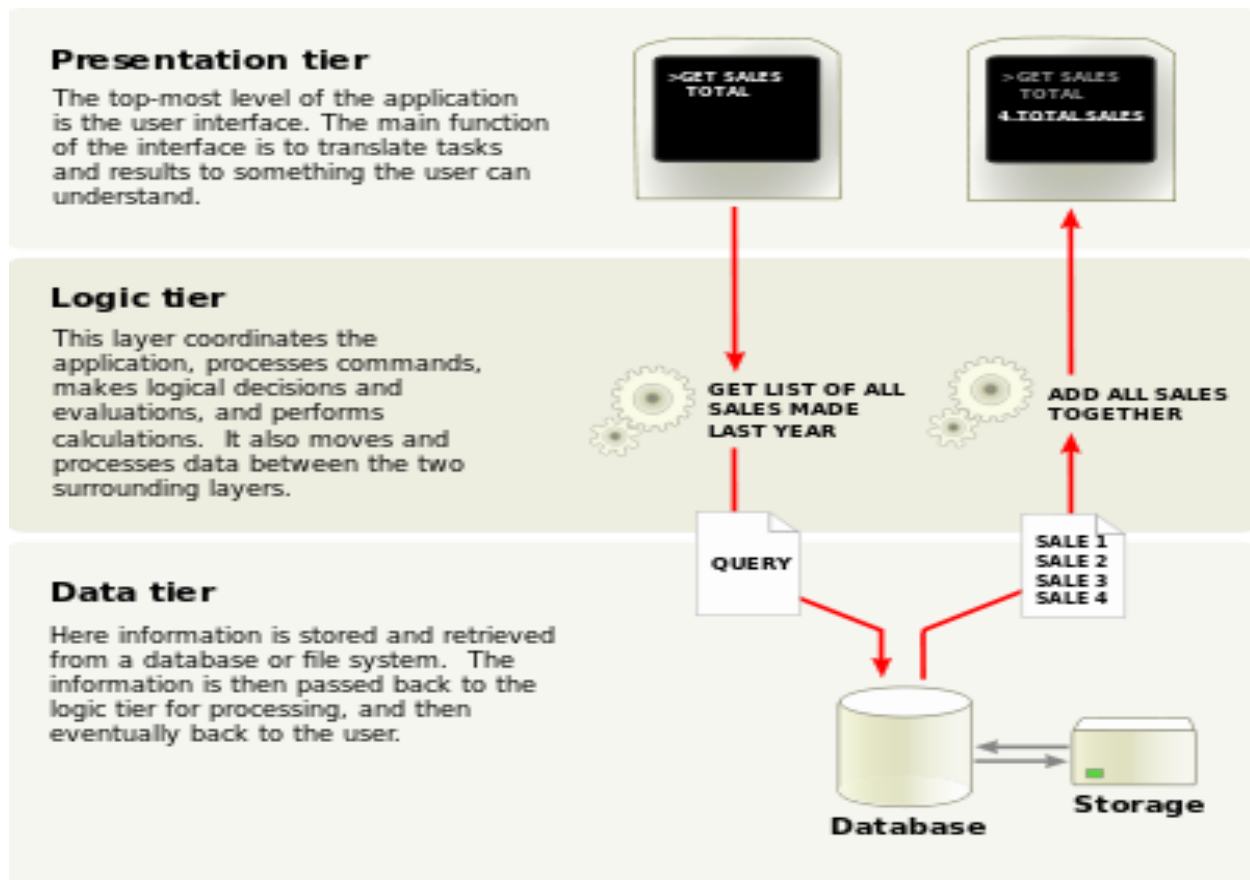


Figure 5-5: Overview of three-tier Architecture [43]

5.2.3. Cloud based online shopping Requirements

This section contains the functional and non-functional requirements of the application. These are the functional requirements of online shopping which are related to functional aspect of the system. As a result, they define functions and functionality within and from the prototype system. The types of user interactions that the system should have to:

1. Register products category
2. Upload Products Photo
3. The prototype is display products with its detail information
4. Register customers
5. Provides products to the customer so as to order products
6. Integrates payment methods like internet banking, cash delivery and mobile payment methods
7. The system support searching specific products and category
8. Provide other service like promotion
9. Provide help and support

The non- functional requirements of the system is availability, scalability, performance, cost and soon.

- Availability – online shopping service is available at any time and everywhere because this is one of the characteristics of cloud computing.
- Scalability – ability of a system to increase the workload on its current hardware resources. It is easily scale up cloud capacity
- Performance – the cloud service provider had powerful and quality servers which means high performance server. This online shopping application is deployed on the cloud the performance of the application is high. .
- Cost – cloud computing is cost effective because no need of initial investment cost to start and develop the project. It provides pay as used service. No need of maintenance, installation, hardware and software costs.

The above non-functional requirements of the system were considered during framework design to make it more efficient and effective online shopping application.

5.2.4. Architectural view model

4+1 is a view model designed by Philippe Kruchten for describing the architecture of software intensive systems based on the use of multiple, concurrent views. The views are used to describe the system from the view point of different stakeholders, such as end-users, developers, and project managers. The four views of the model are logical, development, process and physical view. In addition selected use cases or scenarios are used to illustrate the architecture serving as the 'plus one' view [31].

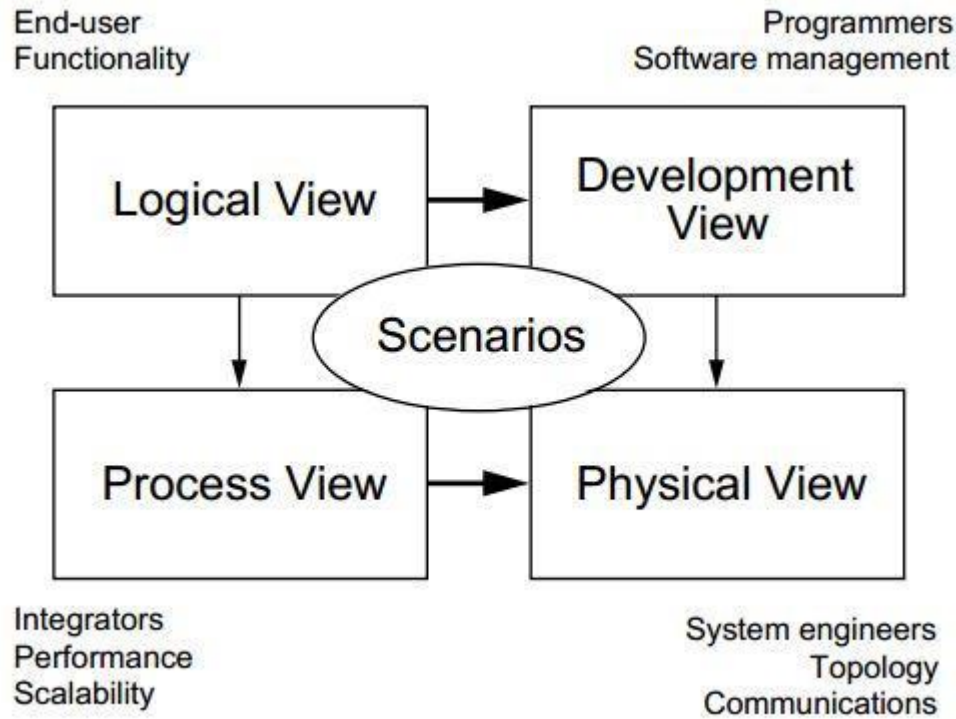


Figure 5-6: 4+1 architectural view model [44]

- **Scenarios:** The description of architecture is illustrated using a small set of use cases, or scenarios, which become a fifth view. The scenarios describe sequences of interactions between objects and between processes. They are used to identify architectural elements and to illustrate and validate the architecture design. They also serve as a starting point for tests of an architecture prototype. This view is also known as the use case view [31].

5.2.4.1. Use Cases

The system use case shows the user a detailed view of the system and how the actors would interact with each other and with the system. Use cases are more important to the development of prototype. The explanation for each use case is then provided below the system use case for the administrator, the user and the visitor (figure 5-7), helps the user to understand who are the actors areas as well as giving the description for each use case along with its precondition and post-condition that should be satisfied once the use case is implemented in the software.

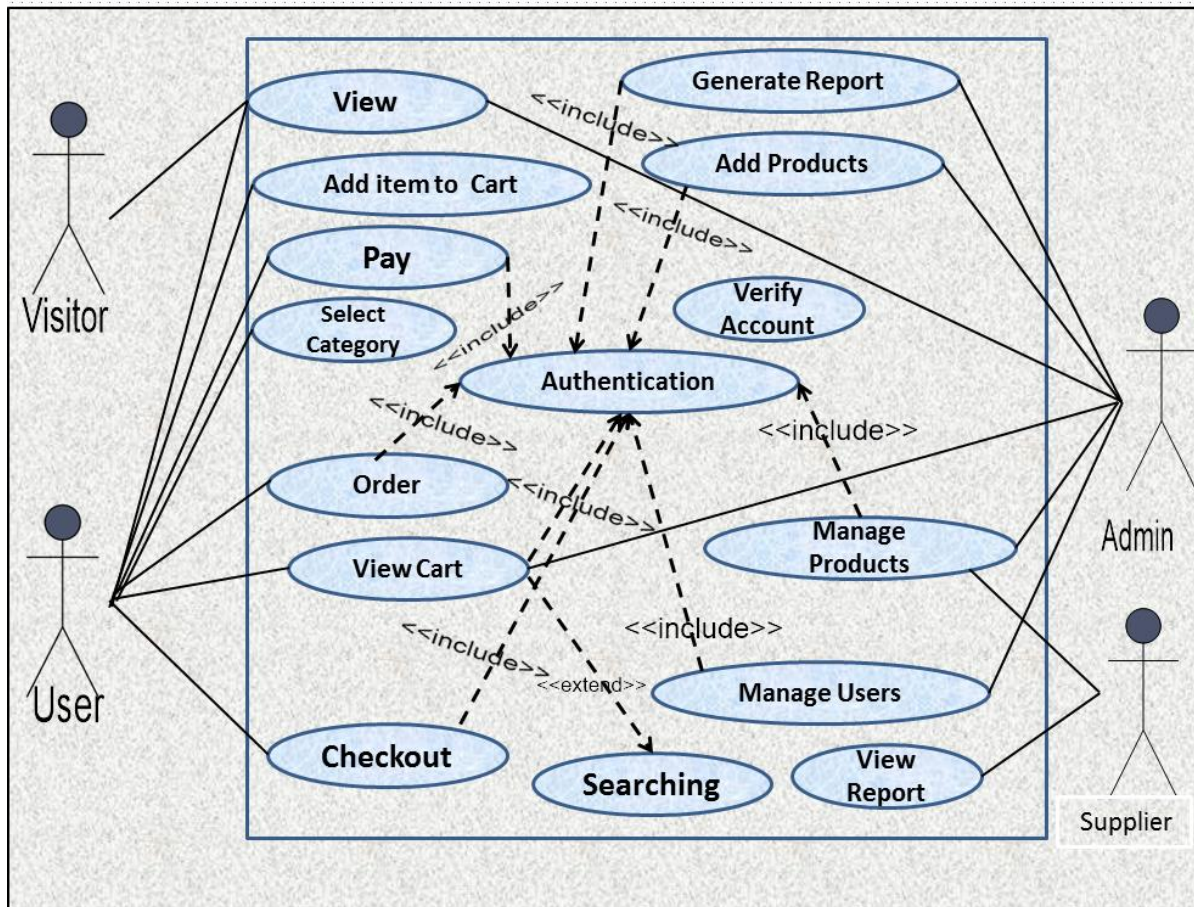


Figure 5-7: Use case diagram

Below are the different use cases in the system, the use case and the actors associated with each use case. The description is used for beginner user to better understand the workings of the system and pre-conditions that should be satisfied for each user.

1. Use-Case Number: US-01

Use-Case Name: view

Use-Case Description: This use case lets the visitor or User or Administrator view the view the home page which has different categories when they first run the application.

Primary Actor: Visitor/user/Administrator

Precondition: run the application

Post-Condition: the user successfully runs the application and is able to view the home page with the different categories.

Includes: Search

Basic flow: Run the application, View the home page and Browse the Categories.

2. Use-Case Number: US-02

Use-Case Name: Select Category

Use-Case Description: these use case details the categories for selecting a process where the user can browse through the different categories and select one category to view items.

Primary Actor: Administrator/user

Precondition: The user/administrator successfully runs the application to view the home page, browse different categories and select one category.

Post-Condition: The user successfully selects a category to view items in a particular category.

Basic flow: Run the application, view the home page, browse the categories and select a category.

3. Use-Case Number: US-03

Use-case Name: Add Item

Use-Case Description: This details the items adding process for the system to access it. The user should be able to add items to the cart and view information about the item.

Primary Actor: Administrator/User

Precondition: The items available for shopping are available for the user to browse.

Post-Condition: The user successfully adds items to the cart.

Basic flow: View the home page, browse the categories, select a category, browse through the items and add item to the cart.

4. Use-Case Number: US-04

Use-Case Name: View Cart

Use-Case Description: This use case helps the user to view the shopping cart in the application.

Primary Actor: Administrator/User

Precondition: The cart can be viewed with or without adding any items.

Post-Condition: The user successfully adds the item to the shopping cart.

Exceptional Flow: Run the application, select a category, do not add items to the cart, view empty cart.

5. Use-Case Number: US-05

Use-Case Name: Continue Shopping

Use-Case Description: This Use case helps the use to decide whether he or she would like to continue shopping after adding the item to the shopping cart or when he or she views the empty cart.

Primary Actor: Administrator/User

Precondition: Continue shopping

Post-Condition: The user is successfully able to view the shopping cart with the option to continue shopping or to check out when there are items in the cart, or to continue shopping when there are no items in the cart.

Basic Flow: View the home page, browse the categories, select a category, browse through the items, add an item to the cart, view cart and continue shopping/ Check out.

Exceptional Flow: Run the application, select a category, do not add items to the cart, view empty cart and continue shopping

6. Use-Case Number: US-06

Use-Case Name: Check Out

Use-Case Description: This use case helps the User/Administrator to check out items from the shopping cart.

Primary Actor: Administrator/User

Precondition: There is at least one item in the shopping cart to cause the checkout button to appear.

Post-Condition: The user is able to click on the checkout button when there are items in the cart.

Includes: Authorization

Basic Flow: Run the application, Add items to the cart, Go to the view cart page, Click the checkout button, Go the order form page

Exceptional Flow: Run the application, do not add any item to the cart, Go to the view cart page, the checkout button is not available to click.

7. Use-Case Number: US-08

Use-Case Name: Place Order

Use-Case Description: This use case helps the User/Administrator to checkout items in the shopping cart using the order form.

Primary Actor: User/Administrator

Precondition: the user/administrator is able to login or register on the user authentication form.

Post-Condition: The user successfully able to checkout items using the order form.

Includes: Authorization

Basic Flow: Run the application, Go to the view cart page, click the checkout button, Enter the user name and password, Login/Register, Enter the information in the order form, Place order is success.

Exception Flow: Run the application, Go to the view cart page, click the checkout button, Enter user name and password, Login/Register, Enter the information on the order form, Invalid /Incomplete information, Place order is not allowed.

8. Use-Case Number: US-09

Use-Case Name: payment

Use-Case Description: This use case helps the user to view the items, add products to cart with detail input user's information, order perform successful select the options payment modes either cash or e-payment and then transaction process occurred.

Primary Actor: User

Precondition: the user is able to pay on the user authentication form.

Post-Condition: the user successfully pay by using their prefer payment methods, after payment product delivery performed.

Includes: Authorization

Basic Flow: Run the application, order the items, select payment method and transaction occurred successfully.

9. Use-Case Number: US-010

Use-Case Name: manage products

Use-Case Description: the administrator of the cloud based online shopping system manages the products which displays to the users. The administrator of the system can add, delete, and modify products.

Primary Actor: Administrator, supplier

Precondition: the administrator login in to the cloud based online shopping system.

Post-Condition: the resource added, deleted, and updated products to the system.

Includes: Authorization

Basic Flow: Run the system, login, in category and products parts perform the operations successfully.

10. Use-Case Number: US-011

Use-Case Name: manage Users

Use-Case Description: the administrator of the system manages the users using the system in order to bought items. The administrator of the system can delete and update the users if he/she is illegal users.

Primary Actor: Administrator

Precondition: the administrator login in to the cloud based online shopping system.

Post-Condition: the users can delete and control the users if he is illegal.

Includes: Authorization

Basic Flow: Run the system, login, delete and update the users.

11. Use-Case Number: US-012

Use-Case Name: Generate Report

Use-Case Description: The administrators of the cloud based online shopping system generate a report based on customers order. The generate report in the following ways daily, monthly and yearly based on the customer's order.

Primary Actor: Administrator

Precondition: the administrator login in to the cloud based online shopping system.

Post-Condition: the users can select daily, monthly or yearly to display the items which is ordered by the customers.

Includes: Authorization

Basic Flow: Run the system, login, want to generate a report.

5.2.4.2. Logical view

One of the necessary components of logical view is a sequence diagram. Sequence diagram that shows us which object is responsible for which function in given code [26]. A sequence diagram is an interaction diagram that emphasizes the time ordering of message. Sequence diagram are used to depict the iteration among the objects during certain period of time. After analyzing the system, constructing the following sequence diagrams, these are users and administrator interacts with application.

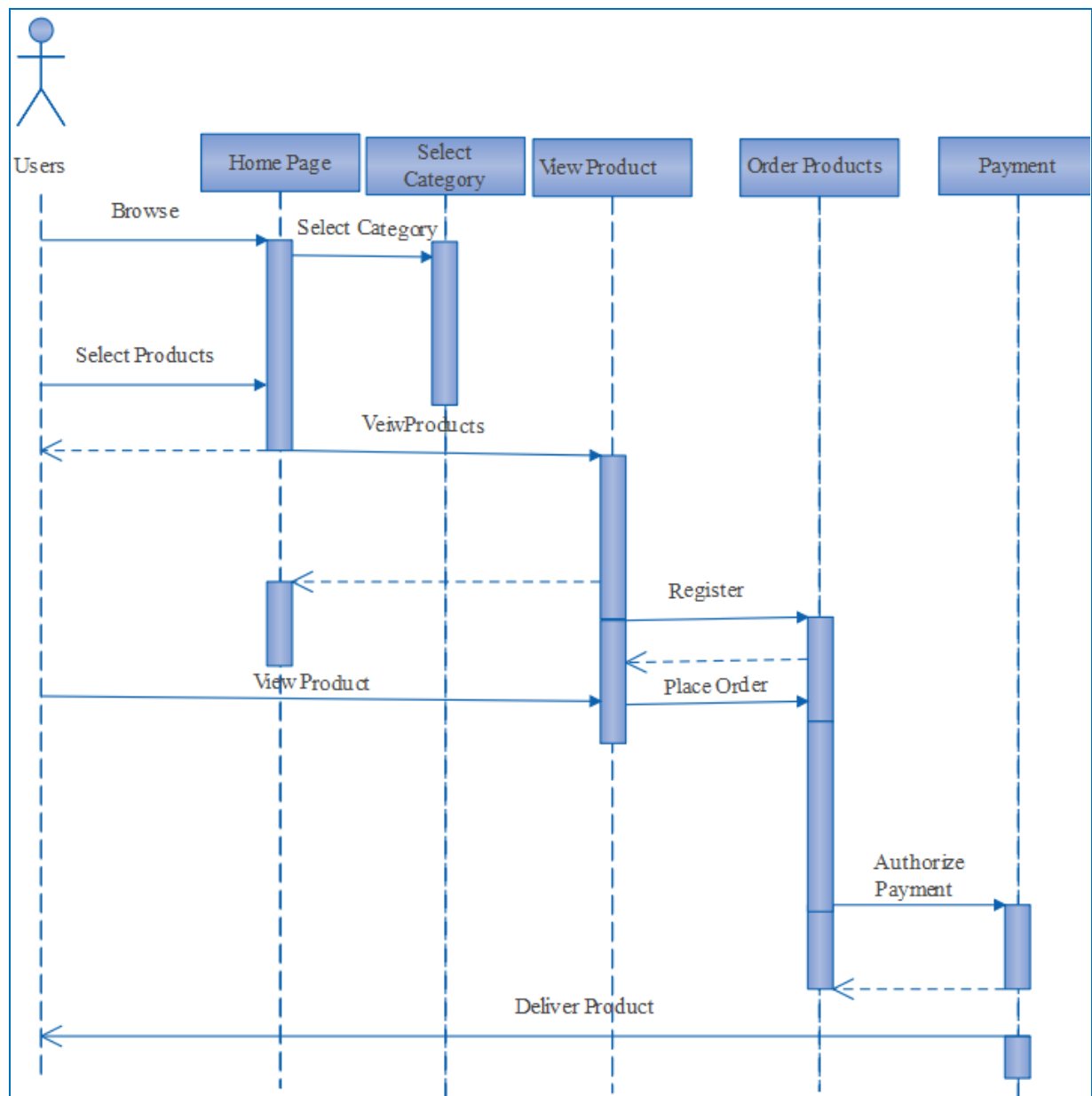


Figure 5-8: Sequence diagram of Users

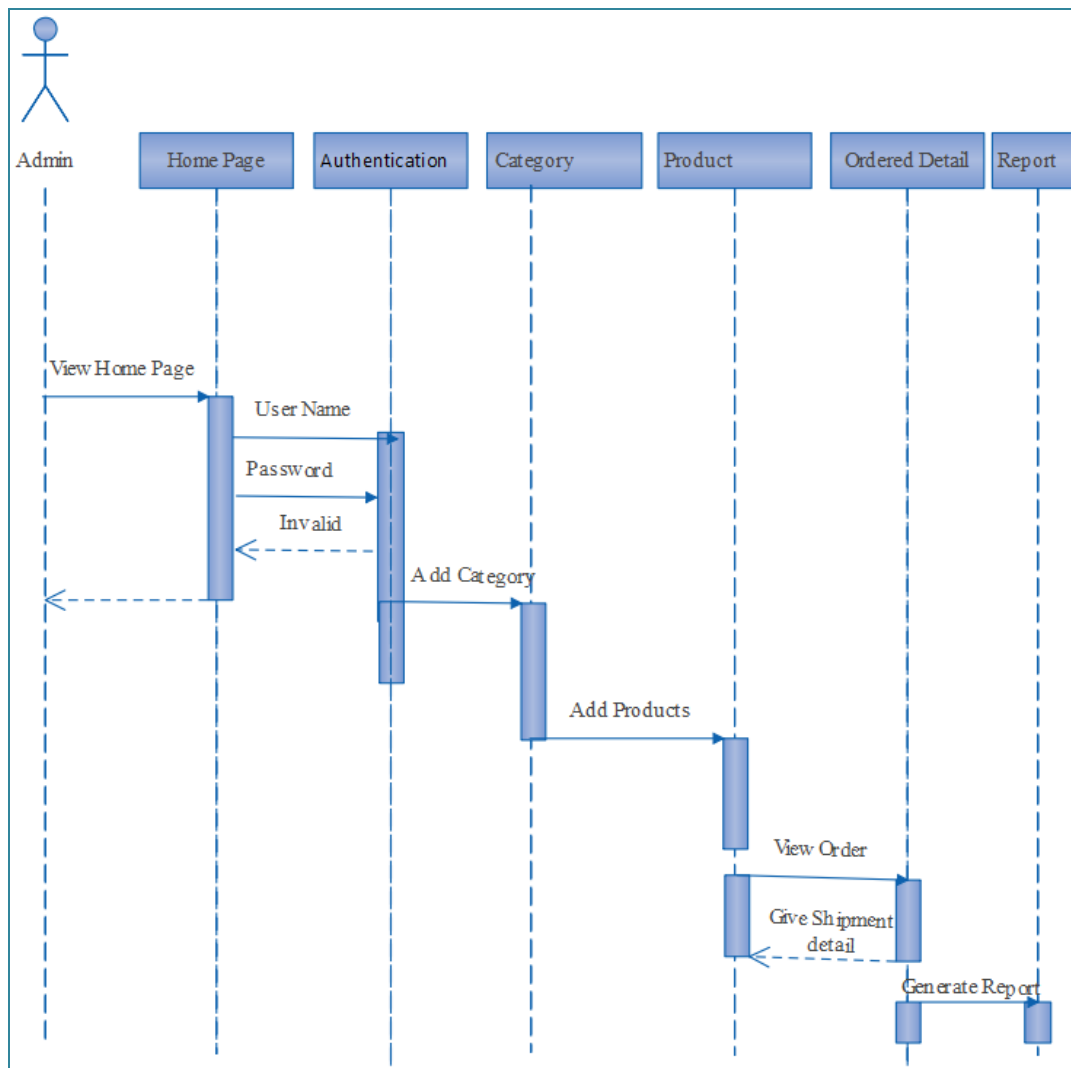


Figure 5-9: Sequence diagram of Administrator

5.2.4.3. Process View

This section lists the activity diagram which is one part of process view it describes the flow of activates in the system. A detailed description is given in figure 5-10. The figure provides the overview of the activity of online shopping application.

The flow begins when the user first runs the application home screen online shopping application that appears in the web browser. The user can browse through the available list of categories and can choose either to select a category or to directly view the cart. In the category, a user can select view more information about a particular items before deciding to add it to the shopping cart by clicking on the cart icon next to the item. The user can then decide to either continue

shopping by clicking the order button or can remove item from cart by clicking on the remove button. If there are no items in the cart, then the user does not have an option to click order button instead it display empty cart. The user can pay for the select product cost after doing the user authentication by logging in with the username and password. Once the user successfully logins/ registers, the order form, where the user can put the correct information to place the order appears. If the user includes incorrect or incomplete information, then placing the order is not allowed. After the user successfully inputs the correct information, placing order is successfully, and the users can see the success message. The additional flow step for the administrators is that they can view the user's information, the user's payment methods, and the product details by using the database after the user successfully places an order.

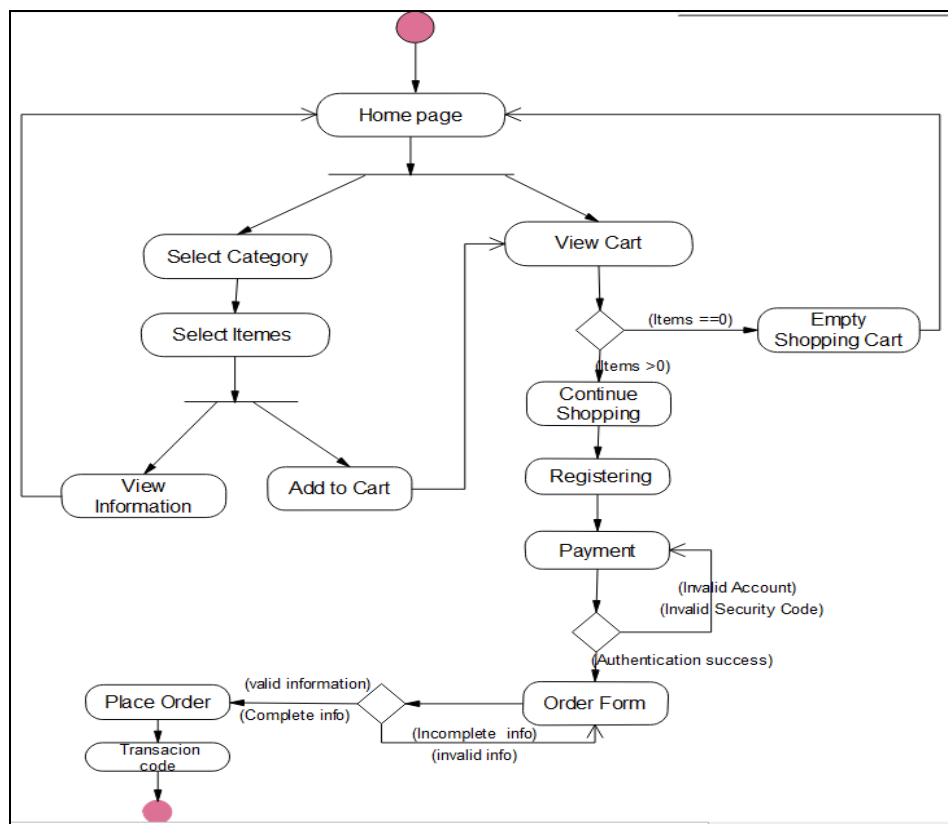


Figure 5-10: Activity diagram of online shopping application

5.2.4.4. Data Model View

Each customer has unique id and is linked to exactly in each own account. Account owns shopping cart and orders. Customer could register to be able to buy items online. Customer is required to be a bank user because purchases could also be made by internet bank it also possible

to by using cash payment, internet payment and mobile payment methods. A customer can select and order products by using this online shopping application.

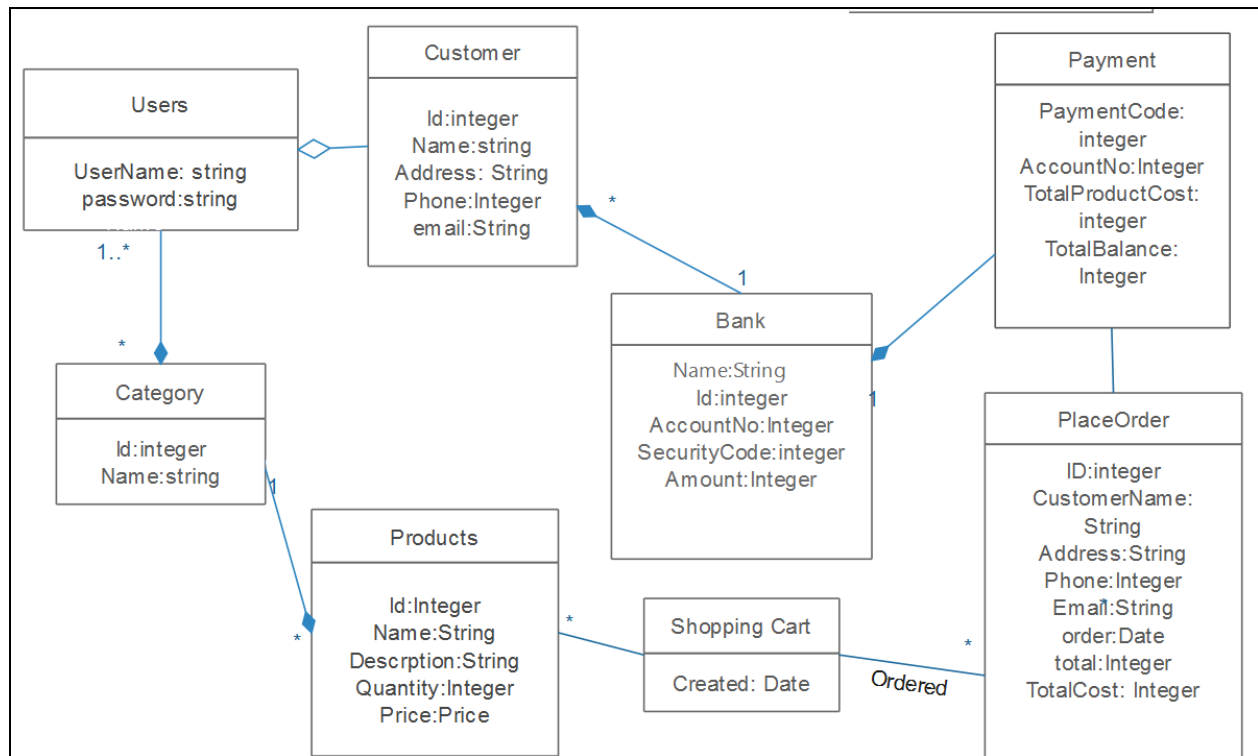


Figure 5-11: Data Model

5.3. Implementation Overview

The cloud based online shopping service is implemented a user friendly web shopping environment and more accessible. The application is deployed on cloud computing providers which is Microsoft azure and it is easy to order products, uploaded products, and user friendly and accessible by computer and mobile devices. To do this system different tools were used some of them are ASP.NET for the front-end, SQL2012 for the back-end and different tools were used for interface design. By using these tools the system was developed. At last, the system should be deployed on to Microsoft azure. This application is accessible by different devices because of the advancement of ICT in Ethiopia.

After completing developing the application there are a few steps to take in order to do an Azure deploy. First the code is tested and then the code is compiled, a package is created so it can be uploaded to the Azure platform. All applications are prepared for a release and published at some point in their lifecycle. We need to validate our Azure hosting environment first. Then, we need

to focus on the host, management and execution of our cloud application. After that, we purchase a subscription, and finally, we our deployment package to our staging or production environments [45]. In this case, it is possible to deploy in local machine in IIS(Internet Information System) because it is one of azure web role; A web role is designed for code that talks directly with web browsers or other HTTP clients i.e. it depends on IIS, Microsoft's webserver. Figure 5-12 shows the deployed online Shopping Application.

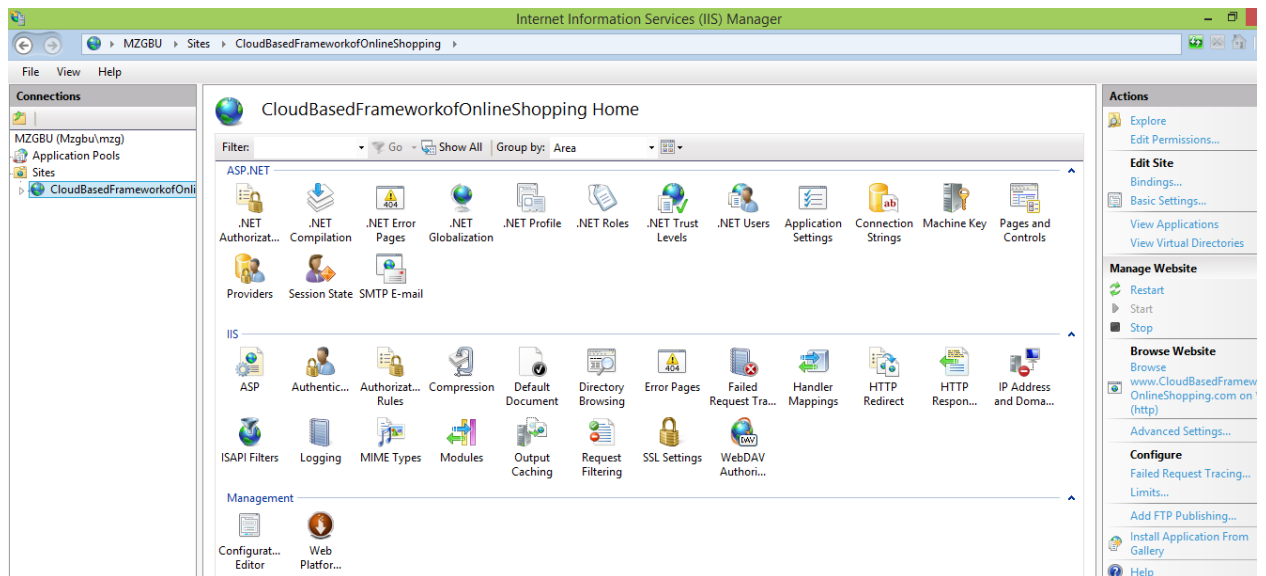


Figure 5-12: Deployment of Online Shopping in IIS



Cloud Based Framework of Online Shopping



[AddCategory](#) [AddProducts](#) [AllCategory](#) [AllProducts](#) [CustomerOrders](#) [ProductStock](#) [IncomeReport](#)

Add New Products

Product Name :

Product Category :

Product Description :

Product Image : No file selected.

Product Price :

Product Quantity :

© Mezgebu.com || [Home](#)

Figure 5-13: Admin Access Page of the developed Prototype

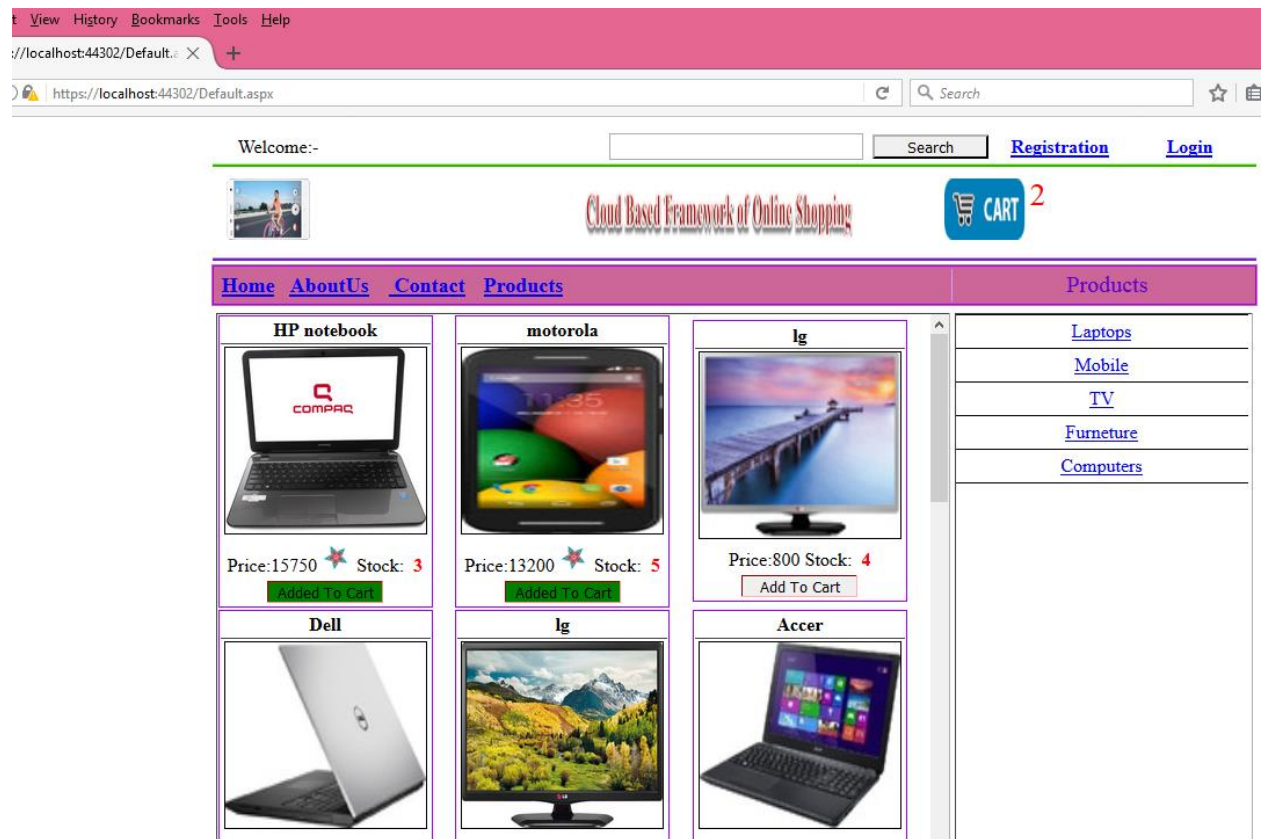


Figure 5-14: Home Page of the developed Prototype

Over view of the system works

During the ordering process the following algorithm are follow:

Buyers start the browser and open online shopping application

If selected category then

Go to items list of selected category

If selected item

Then show the details of selected item

If want to buy selected item

Selected item add to order form

Else remove the selected item

If selected item add to order form do add to cart

Go to cart form and fill required fields like name, address phone number,

Select payment mode

If want to select cash delivery

Continue shopping

Else select internet payment

Fill the account number and security code

If account number is equal to account number and security code is equal to security code

Continue shopping successfully

Users accessing and ordering, and buying product process shown

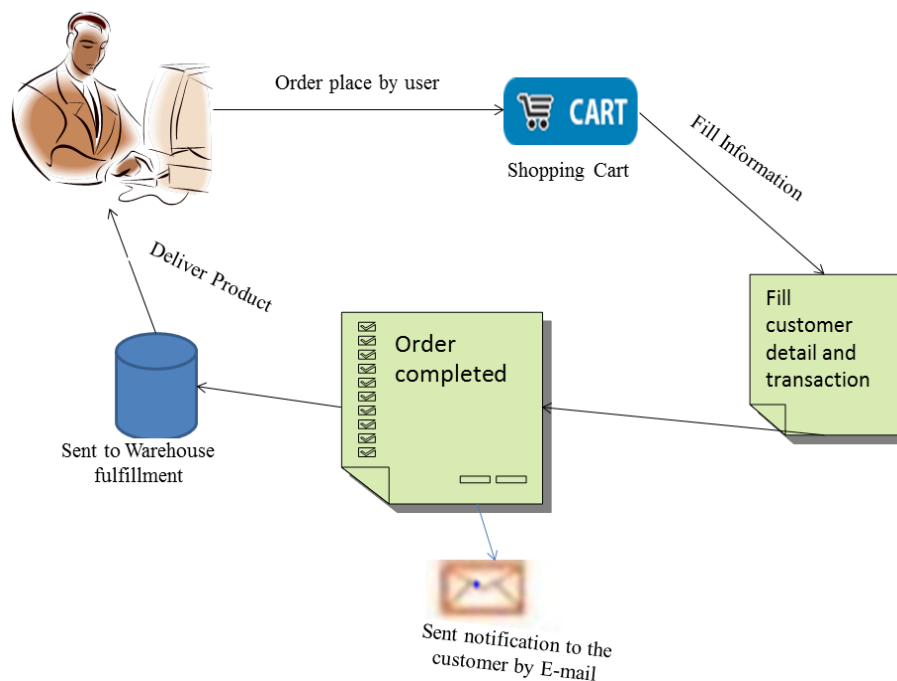


Figure 5-17: Users using the prototype

5.4. System Evaluation and Discussion

Cloud based framework of online shopping was evaluated by software experts who are working in software Development Company and the experts in the area of cloud computing, they check availability, functionality, usefulness, scalability, cost, performance. In case of cost, cloud computing important for minimize cost expenditure and increase profit because the cloud users do not worry about maintenance, installation, hardware and software cost in short users pay per use. These application is high performance, scalable and usable and available which accessed anywhere at any time. The application development is complete, development teams can move on to the quality assurance stage. Unit testing of the code is normally completed locally by the developer using different types of testing tools, such as automated unit tests and web tests in Microsoft azure. [45].

Here it is possible to show the details of how the prototype was testing, validating and evaluating the system. This Online shopping system was testing performed by using unit testing, integration testing and evaluation based on different criteria.

5.4.1. Unit Testing

During unit testing the system experts test each and every individual testing of the application and the usability and the functionality of online shopping system in cloud computing Software as a service. The system is deployed by using cloud computing tools which is Microsoft Azure testing the deployment of the application. Each cloud based online shopping interface is tested one by one of the overall function of system.

Table 5-2: Unit Testing

<i>Test Case No.</i>	<i>Test-Case Short Description</i>	<i>Output</i>
TC1	To test the Login authentication interface for the admin and user	Login in to their privilege.
TC2	To test, users can view the items they add in the shopping cart	Users view all the items in the home page and easily add the item in their carts.
TC3	To test, Admin can upload new/revised Categories.	Admin upload the category successfully.
TC4	To test, Admin can upload new/ revised items.	Products added by admin in each category correctly.
TC5	To test, Admin can view all the users registered in the system.	Admin view all registered users.
TC6	To test, Admin can view the information about all the users who successfully placed an order.	All the order and users information viewed by Admin.
TC7	To test that users are cannot order with an empty shopping cart.	Check the system if the user orders empty shopping car.
TC8	To test that users are not able to submit an order form if the information in any of the fields is not valid.	The system checks each record valid other wises return back to fill correctly.
TC9	To test that users are not able to submit an order form if the information in any of the fields is left blank.	The users cannot order item without filling the required information.

5.4.2. Integration Testing

Here, testing done on the integrated modules because integration is a combination of unit test. We also test interactions with different parts of the system. During integration testing the testers tries to find out the defects in interaction points and system functions and usually done the modules integrated properly.

Table 5-3: Integration Testing

Test Case No.	Test-Case Short Description	Output
TC1	Test user login it link with users access page by entering correct username and Password	It Got the ordered page
TC2	Test Admin login and access the admin page	It redirect to category add page
TC3	Check the link between category with products	Products are organized by its category
TC3	Check a report Daily, Monthly and yearly from different pages	Generate Product order with detailed customer information and calculate the sum of all products sold with its total cost.

5.4.3. System Evaluation

The proposed system should be validated or evaluated by different IT professionals. Due to this reason, the researcher requested around 14 ICT professionals from online display sites, software developers and banks regarding the security, payment system, user interface and the overall framework. Here are the evaluation criteria during prototype evaluation:

Q1: Is the security system of the prototype is enhanced for creating trust on the customer?

Q2: Is the cloud based framework of online shopping payment system is functional?

Q3: Do you think that the overall system which is like user interface interactive, performance, accessible of different device and cost effectiveness of cloud based online shopping is improved?

Table 5-4: Evaluation

SN	Respondents	Security				Payment System				Overall System			
		Very Good	Good	Fair	Poor	Very Good	Good	Fair	Poor	Very Good	Good	Fair	Poor
1	Software Developers	3	1	1	0	3	2	0	0	4	1	0	0
2	Banks	2	1	0	0	1	1	1	0	3	0	0	0
3	Online Display Sites	5	1	0	0	5	1	0	0	6	0	0	0
Total		10	3	1	0	9	4	1	0	13	1	0	0
Percentage		71.43	21.43	7.14	0.00	64.29	28.57	7.14	0.00	92.86	7.14	0.00	0.00

With regard to security 71.43% or the respondents' rate very good followed by 21.43% and 7.14%, good and fair respectively. The researcher also validated the payment system significant number of respondents relied very good (64.29.83%), good (35.71%) and fair (7.14%). To sum up, the overall system development was rated significantly very good (92.86%) and good accounts about 7.14%.

Chapter Six

6. Conclusion and Recommendation

6.1 Summary of Findings

The proposed cloud framework of online shopping and the implemented prototype bring benefits such as: cost effective product promotion, timely and consistent information, better customer service and relationships, customizations of products, competitive advantages and convenience, decrease the physical communication, minimizing extra costs, building trust, creating better life standards and accessing every products at anytime and anywhere. The study undertook different data collection and analysis mechanisms. The major findings are:-

- From the interview the researcher found that the traditional shopping system is not comfortable and economical. They were responded as the traditional shopping system has various problems like time consuming, lose money, create congestion, etc.
- Significant number of the respondents were didn't have awareness about cloud computing and online shopping. This awareness problem is not limited to the public at large but also few ICT professionals didn't have knowledge about cloud computing and its major functions.
- Since Ethiopia is one of the developing countries and the level of awareness about cloud computing is lagging behind. Therefore, the major challenges for the implementation of online shopping are lack of trust, security and payment system via internet which needs an intervention.
- Regarding cloud computing providers the researcher selected Microsoft Azure for Ethiopia by considering the major advantages. When we undertake cost benefit analysis cloud computing provides incomparable advantage for online shopping than ICT.
- A cloud based online shopping has tremendous advantages to improve the living standard of the citizens and make shopping more effective and efficient.

6.2 Conclusion

In light of the analysis and findings described above, it is clear that online shopping has significant role for the development of a nation and more importantly the trade sector. The major problems identified for the implementation of cloud computing in Ethiopia are awareness, trust, payment system, perception of the public at large and insufficient internet infrastructure. The concerned officials should work in an integrated manner to reduce these problems and promote online shopping here in our country to reduce the major challenges and problems of our traditional shopping system.

To sum up, Ethiopia has around 100 million populations and is a developing country which demands a lot to have an advanced marketing system. Cloud based framework of online shopping is cost feasible and simple and easy to use that enhances the living standard of the individuals. Generally, there are various problems of traditional shopping system here in our country that need to be averted. The problem will be worse with time and population growth unless immediate action is taking place in the provision of new technology which is cloud computing with online shopping in parallel with other development activities. In this research paper the researcher develop the prototype by using cloud tool which is Microsoft azure and shows a Hybrid cloud deployment model would be the main form of cloud adoption for online shopping. The paper enhance the services and make the country livable, detail strategies, rules and regulations should be developed by the concerned officials.

The resulting framework facilitates online shopping business sector, quality of services and assist customers in to the market. The different components of the proposed framework offer powerful capabilities to address products, services and resources management. This will provide enhanced degrees of scalability, flexibility, and simplicity for management and delivery of services and products in the clouds. Cloud computing is low cost for start online shopping investment because it does not need installation, maintenance, hardware and software costs simply used resource which provides by the cloud providers. Thus the proposed framework in this study used as a blue print for implementing actual cloud-based services in online shopping that can ensure secure services among online shopping and cloud service providers.

6.3 Recommendation

As the experience of other countries show, the recent technological advancement brought a good lesson for our traditional shopping system that raises the living standard of the individuals. But online shopping is not available here in our country.

- To implement or put in to practice the developed framework awareness creation campaign should be conducted at large scale. The mass media (radio and television) and telecommunication (by sending promotion messages to every mobile via phone) should play a great role for promoting online shopping by describing the major benefits to create awareness for the public at large.
- Ministry of Trade should give trade license for those who are interested to open online shops.
- Telecommunication should provide internet service without interruption to make online shopping more functional.
- The banks need to be integrated to have the same payment system via internet like the developed countries.

6.4 Future work

This research is carried out with a delimited time scope and budget. Hence, various challenges inhibited the quality. Therefore to make the research more fulfilled the following future work should be addressed.

- Security platform are not well resolved in practice this further research and exploration.
- Location based product delivery system by using GPS
- Different payment mechanisms should be embodied by considering the technological advancement.

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Appendix

Appendix I

Interview Question

These questions will be interview a selected ICT director, cloud computing professional and employees in online shopping company.

1. What are the challenges and problems of existing shopping system in Ethiopia?
2. What do you know about cloud computing?
3. What is the role cloud in online shopping service?
4. What are the existing challenges for the adoption of cloud computing in Ethiopia?
5. Is the infrastructure enough to support cloud computing?
6. What are the requirements of online shopping toward cloud computing?
7. Are there any online shopping sites Ethiopia?
8. Is payment via internet possible in Ethiopia?

Questionnaire

1. Does your organization have an internet connection?
☐ Yes ☐ No
2. Have you heard of the term cloud computing before?
☐ Yes ☐ No
3. What do think about the benefits of cloud computing in Ethiopia? (Select one)
☐ Fundamental change for accessibility, availability and security
☐ It increases the profit of cloud user organizations.
☐ So as to make competent in the world
☐ No idea
4. Does your company host any applications in the Cloud? (If you select **No**, go to question number 7)
☐ Yes ☐ No
5. Which layer of Cloud applications is currently being used by your company?
☐ Software as a Service (SaaS).
☐ Complete operating system and software package available via Cloud services (PaaS).

☐ Just infrastructure services such as storage, network capacity, etc – Infrastructure as a Service (IaaS).

☐ Other (Please specify).....

6. Which cloud deployment model is suitable to host your application?

☐ Public cloud

☐ Private Cloud

☐ Hybrid cloud

☐ Other (Please specify).....

7. Do think cloud computing is important to implement online shopping service in Ethiopia?

☐ Yes ☐ No

Specify

8. Did you believe that cloud computing has important to enhancing the delivery of services and good online?

☐ Yes ☐ No

Specify.....

9. Factors affecting adopting of cloud computing in your organization as well as in Ethiopia. please put the rate which is strong agree, agree not sure, disagree and strong Disagree

No	Parameters	Please tick the most appropriate answers				
		strong agree	agree	not sure	disagree	strong Disagree
1	Insufficient internet bandwidth					
2	Lack of clear strategy on cloud computing					
3	Insufficient internet bandwidth					
4	Lack of security					
5	Cost of deployment					
6	Lack of control and ownership					

Appendix II

Sample Codes

Login Code

```
namespace satr.Admin
{
    public partial class Login : System.Web.UI.Page
    {
        protected void Page_Load(object sender, EventArgs e)
        {
            txtLoginId.Focus();
        }

        protected void btnLogin_Click(object sender, EventArgs e)
        {
            if (txtLoginId.Text == "" || txtPassword.Text == "")
            {
                lblAlert.Text = "Enetr User Name and password";
            }
            else
            {
                BusinessLayer.ShoppingCart sho = new BusinessLayer.ShoppingCart();
                sho.UserName = txtLoginId.Text;
                sho.Password = txtPassword.Text;
                GridView1.DataSource = null;
                GridView1.DataSource = sho.GetAvailableStock58585();
                GridView1.DataBind();
                if (GridView1.Rows.Count != 0)
                {
                    if (GridView1.Rows[0].Cells[8].Text == "Admin")
                    {
                        Session["ShoppingAdmin"] = "ShoppingAdmin";
                        Response.Redirect("~/Admin/AddNewProduct.aspx");
                    }
                    else
                    {
                        Session["ShoppingAdmin"] = "ShoppingAdmin";
                        Response.Redirect("~/Default.aspx");
                    }
                }
            }
        }
    }
}
```

Adding Categories

```
namespace satr.Admin
{
    public partial class AddEditCategory : System.Web.UI.Page
    {
        protected void Page_Load(object sender, EventArgs e)
        {
        }

        protected void btnSubmit_Click(object sender, EventArgs e)
        {
        }
    }
}
```

```

        ShoppingCart k = new ShoppingCart
        {
            CategoryName = txtCategoryName.Text
        };
        k.AddNewCategory();
        txtCategoryName.Text = string.Empty;
        Response.Redirect("~/Admin/AddNewProduct.aspx");
    }
}

```

Adding Products

```

namespace satr.Admin
{
    public partial class AddNewProduct : System.Web.UI.Page
    {
        protected void Page_Load(object sender, EventArgs e)
        {
            if (!IsPostBack)
            {
                GetCategories();
                AddSubmitEvent();

                if (Request.QueryString["alert"] == "Success")
                {
                    Response.Write("<Script> alert ('Record Saved Successfully.');

```

```

ShoppingCart k = new ShoppingCart()
{
    ProductName = txtProductName.Text,
    ImageUrl = "~/Images/" + uploadProductPhoto.FileName,
    ProductPrice = txtProductPrice.Text,
    ProductDescription = txtProductDescription.Text,
    CategoryID = Convert.ToInt32(ddCategory.SelectedValue),
    TotalProducts = Convert.ToInt32(txtProductQuantity.Text)
};
k.AddNewProduct();
Alert.show("Record Saved Successfully");
ClearText();
}
else
{
    Response.Write("<Script> alert ('Please Upload Photo ');</Script>");
}
}

private void ClearText()
{
    txtProductName.Text = string.Empty;
    txtProductPrice.Text = string.Empty;
    txtProductDescription.Text = string.Empty;
}
private void SaveProductPhoto()
{
    if (uploadProductPhoto.PostedFile != null)
    {
        string filename = uploadProductPhoto.PostedFile.FileName.ToString();
        string fileExt =
System.IO.Path.GetExtension(uploadProductPhoto.FileName);
        if (filename.Length > 96)
        {
            Alert. Show("Image Name should Not exceed 96 character !");
        }
        else if (fileExt != ".jpeg" && fileExt != ".jpg" && fileExt != ".png" &&
fileExt != ".bmp")
        {
            Alert. Show("the Image Not Supported the system");
        }
        else if (uploadProductPhoto.PostedFile.ContentLength > 4000000)
        {
            Alert. Show("Image Size Not More than 4MB");
        }
        //Save Images Into Image Folder
        else
        {
            uploadProductPhoto.SaveAs(Server.MapPath("~/Images/" + filename));
        }
    }
}
}
}
}

```