CHAPTER 1
INTRODUCTION

Cloud computing is the embryonic paradigm with changing definitions but for this research work, we can define in the term of a virtual infrastructure which will provide shared information and communication technology services, via an internet “cloud,” for “multiple external users” by the use of the Internet or “large-scale private networks.”[1] A computer user access can be provided to Information Technology services i.e., applications, servers, data storage, there is no need to understand the technology or also ownership of the infrastructure. An analogy to an electricity computing grid is to be useful for comprehend cloud computing. A power company maintains and owns the infrastructure, a distribution company disseminates the electricity, and the consumers merely use the resources without the ownership or operational responsibilities. [2]. It is a subscription-based service where networked storage space and computer resources can be obtained. One way to think of cloud computing is to be considered our experience with email. Our email clients, let it be Yahoo!, Gmail, Hotmail, and so on are taken care of housing all of the hardware and software necessary to support our personal email account. When if we want to access our email we should open our web browser and go to the email client and log in. The internet access is the most important part of the equation. Our physical computer does not house our email. It is accessed through an internet connection anywhere by us our email can be checked everywhere let it be at work on a trip or down the street getting coffee, as long as we have access to the internet. [3] Our email and software which is installed on our computer both are different, such as a word processing program. When a document is created using word processing software, that document remain on the device. It is used to make it unless we physically move it. An email client is similar to how cloud computing works. Except instead of accessing just our email, we can choose what information. We have access to within the cloud. Similarly, a user’s cloud computing access enables “shared resources, software, and information on-
demand, [4] on a fee-for-service basis. The National Institute of Standards and Technology made a serve on cloud computing exhibits several characteristics:

1.1 Characteristics

Following are the main characteristics of cloud computing:

- **Agility:**
  Agility is improved with users' ability to re-provision technological infrastructure resources. [5]

- **Application programming interface (API):**
  Accessibility to software it is enables machines to interact with cloud software in the same manner the user interface facilitates interaction between men and computers. Cloud computing system is typically used REST-based APIs. [6]

- **Cost:**
  The cost can be reduced and in a public cloud delivery model capital expenditure can convert to operational expenditure. It is purported to lower barrier to entry, a person typically provides infrastructure and does not need to purchase for one-time or infrequent intensive computing tasks. Pricing on a utility computing basis is fine-grained with usage-based options and some IT skill is required for implementation (in-house). The e-FISCAL project's state of the art repository contains several articles looking into cost aspects in detail, most of them resulting that costs savings are depended on the type of activities supported and the type of infrastructure are available in-house. [7]

- **Tool and location autonomy:**
  It make users to access systems can be used a web browser in malice of their domains or which device will be used (e.g., PC, mobile phone). Infrastructure and accessed can be provided to a person via the Internet, users can be connected from anywhere. [8]

- **Virtualization:**
The technology can be permitted to server to storage and tool can be shared and utilization will be increased. Applications will be easily migrated from one server to another server. [9]

- **Multi tenancy:**
  A large pool of users can be enabled to share given below thus allowing for:
  - Centralization of communications in domains with minimum costs.
  - Highest-load capacity increases.
  - Utilization, capacity and efficiency improvements for systems which are often only 10–20% utilized.

- **Reliability:**
  Reliability can be improved when multiple redundant sites are used, that makes well-designed cloud computing will be suitable for business continuity and disaster recovery. [10]

- **Scalability and softness:**
  The scalability and softness can be improved via dynamic provisioning of resources on a fine-grained, self-service basis near real-time will be done, that is, there is no use of users to have engineer for High loads. [11]

- **Performance:**
  Performance can be monitored and consistent and loosely coupled architectures will be constructed to use web services. [12]

- **Security:**
  The centralization of data improves security, but concerns will be persisted about loss of certain data, and the deficient in security. Security is always being good and better than other conventional systems, in part because providers will be able to give over resources to solve security issues which cannot be afforded by many of. On the other hand, the complexity of security will be increased when data gets disturbance, unrelated users can use greater number of devices and multi tenant system, and above that user access to security audit logs will be difficult. Private
cloud installations can be part motivated by users' desire of control over the communications and stay away from losing control of in order security. [13]

- **Maintenance:**
  Maintenance of cloud computing becomes easier, because there is no need to be installed on each user's computer it can be accessed from anywhere. [14]

- **On-demand and self-service:**
  Users can be automatically request and obtain provisions of “server time and network storage.” Unilateral provisioning of such computing resources as: server, time, storage or network bandwidth, without requiring human interaction with service providers. [15]

- **Ubiquitous network access:**
  It provides ubiquitous network access to the system of user location or device (PC, mobile phone, tablet, etc.) [16]

- **Resource pooling:**
  Resource pooling is the Multi-tenancy which enables sharing of pooled resources and costs across a number of users that contain the different physical resources dynamically can be assigned and reassigned according to user demand. [17]

- **Rapid elasticity:**
  Quick scale up or scale down of resources through elastic provisioning or the release of capabilities in near real time. [18]

- **Pay per use:**
  Pay per use is the capabilities that are charged to be using a metered and the fee-for-service or advertising-based billing model to promote optimization of resource use. One pays only for the time when the resource is used. [19]

- **Broad network access:**
It can be accessed to network is available through multiple platforms, A technology which is called cloud computing will be used the internet and central remote servers so data and applications can be maintained. Cloud computing can be allowed consumers and businesses to use applications and there is no need of installation and access their personal files. The technology will be allowed for much well-organized computing by centralizing data storage. [20] Yahoo email, Gmail, or Hotmail are the common example of it. The server and email management software can work on the cloud internet and it can totally be managed by the cloud service provider Yahoo, Google etc. The software will be used alone and the benefits can be enjoyed by the consumer.[21] The analogy is , 'If we need milk , would we buy a cow ?' All the users or consumers should get the benefits of using the software or hardware of the computer. To get this benefit why should a consumer buy a software /hardware? Cloud computing can be conked out down into three segments: "application" "storage" and "connectivity." all segment will serve a diverse reason and offers different goods for businesses and persons around the world. In June 2011, Version conducted a research in it they found that 91% of senior IT professionals actually don't know what cloud computing is and two-thirds of senior finance professionals are clear by the concept, highlighting the wing nature of the technology. In Sept 2011, an Aberdeen Group made a survey in it they found that disciplined companies are achieving on average a 68% increase in their IT expenditure because cloud computing and only a 10% decrease in data center power costs. Cloud computing, according to name is a style of computing where dynamically scalable and visualized resources can be provided as a service for the internet. [22] These services are consumed by any user in a standard HTTP. There is no need of knowledge, expertise, or control over the technology infrastructure in the "cloud" which supports them. The symbol we use to represent the internet flow charts and diagrams inspired the name cloud computing. The clouds denote the abstraction of the complex infrastructure it conceals.

1.2 Layout of Cloud Computing
The layout of cloud computing can be understand with the diagram below displays the basic high-level of cloud computing, where the provider would create their solution
(software, infrastructure, or platform) on the internet and one or more users can consume that service “on demand”. Following is the mode to enabling convenient. [23]

Figure 1. Basic High Level layout of Cloud Computing

1.3 Combination of basic platforms.
Cloud Computing is the combination of various platforms. The major platforms are following:

- **Software as a Service:**
  It is referred to a service delivery model in that remote component can be used business services are accessible through a software interface and is combined to create new business services delivered via flexible networks. [24]
• **Platform as a Service:**
An additional abstraction level can be offered by cloud system: instead of supplying a virtualized infrastructure, it provides the software platform where we can run on system. [25] The sizing of the hardware resources can be demanded by the execution of the services can be made in a transparent manner. In other words PaaS is the delivery of a computing platform and solution stack as a service.

• **Infrastructure as a Service:**
Infrastructure Providers manage a large set of computing resources, such as storing and processing capacity. Through Virtualization, they are able to split, assign and dynamically re-size these resources to build ad-hoc systems as demanded by customers. They deploy the software stacks that run their services. [26]

1.4 Benefits of Cloud Computing:
With any new technology there are lots of expectations and possible applications and Cloud promises much more than technological applications. It promises a new paradigm and a new understanding of what IT is. In order to be accepted by the market it needs a list of good drivers for innovation.[27] All these drivers represent the sum of characteristics that differentiate Cloud computing from other technologies and promote it as the competitive solution in an accelerated business environment. In short, following are the main benefits of cloud computing:

1. **Infrastructure cost reduction:**
Due to the fact that the physical computing components are provided by the Cloud, the main infrastructure costs remain the networking and connectivity of the network devices. [28]

2. **Increase speed to market:**
Because the infrastructure exists in place, any investor can spin up a business much faster, without worrying about the computational needs. [29]

3. **New business models:**
Cloud computing brings flexibility and a whole new market niche, so new business models are to be developed for the Cloud users and the providers alike. [30]

4. **Expand existing products:**
Existing products can be moved to the Cloud and by doing so can benefit of more interoperability, flexibility, higher performance and integrate new interactivity features that the Cloud provides.

5. **Mobile and social capabilities:**
The web offers to any application a limitless scale of mobility and accessibility from anywhere, platform independent. [31] Also it offers social interaction facilities to existing applications, therefore making them more clients oriented and providing access that our virtual replicas provide.

6. **Application remediation:**
Existing applications can be moved to the Cloud and enriched with new features. [32]

7. **Collaboration and identity:**
The Cloud allows businesses to collaborate with each other easy and to identify themselves in the market perspective. This is one of the major business drivers. [33]

8. **Elasticity and scalability:**
New hardware and software can be used at a click of a button. This eliminates any concerns about infrastructure and furthermore everything is scalable, so no matter how many resources are needed the demand will always be met by the supply. [34]

9. **Higher performance computing:**
The pool of resources gives the impression of limitless and so the computing performance can be increase using as much resources as needed in order to perform a task in as little time as possible. [35]

10. **Data distribution:**
Cloud paradigm is focused on data and its security. The data is distributed in different centers, with multiple backups, so the users will not have to lose data due to any malfunction. [36]

Thus, we can say that: Cloud computing is the use of computing resources of hardware and software which can be delivered as a service over a network typically the Internet. The name has taken from the use of a cloud-shaped symbol as an abstraction for the complex infrastructure which contains in system diagrams. Cloud computing entrusts remote services with a user's data, software and computation.

1.5 Cloud Computing kinds Based on potential and Access:
There are various types of cloud computing based on the potential and ability to access them. In which public cloud is very prominent. There are many types of public cloud computing. Following represent various cloud computing types, which are based on capability and access.

- Infrastructure as a service (IaaS),
- Platform as a service (PaaS),
- Software as a service (SaaS)
- Storage as a service (STaaS)
- Security as a service (SECaaS)
- Data as a service (DaaS)
- Business process as a service (BPaaS)
- Test environment as a service (TEaaS)
- Desktop as a service (DaaaS)
- API as a service (APIaaS)

The major classification of cloud computing can be better under-stable the following diagram:
1.5.1 **Software-as-a-Service’ (SaaS):**
We can call first type of cloud computing capability, ‘Software-as-a-Service’ (SaaS). It is focused on providing users with business-specific capabilities. [37] In SaaS, third person can use the business specific capabilities in the cloud.” Some examples of SaaS providers are

- **Google Apps:** web-based office tools are provided like e-mail, calendar, and document management
- **salesforce.com:** A full customer relationship management application will be provided by it.
- **zoho.com:** Large suite of web-based applications will be provided, mostly for enterprise use.

1.5.2 **Infrastructure-as-a-Service (IaaS):**
Another kind of cloud computing capability will be called as Infrastructure-as-a-Service (IaaS). Computational infrastructure available over the internet will be supported by it.[37] organizations and developers will be allowed to make bigger their IT infrastructure on an on-demand basis.
Some examples of IaaS providers are given below

- **Amazon Elastic Compute Cloud (EC2):** users with a special effective machine will be provided (AMI) it can organize and run on the EC2 infra-structure [38]

- **Amazon Simple Storage Solution (S3):** users with access to energetically scalable storage resources will be provided [39]

- **GoGrid:** users with access to energetically scalable computing and storage resources will be provided. [40]

- **IBM Computing on Demand (CoD):** user with access to highly configurable servers plus value-added services will be provided. [40]

- **Microsoft Live Mesh:** user is provided a distributed file system can be accessed; for individual use [41]

- **Rack space Cloud:** user is provided with access to energetically scalable computing and storage resources will be provided, cloud applications and tools.

The final type of cloud computing capability is Platform-as-a-Service (PaaS).[42], it is kind where users are allowed to application growth platforms to influence the capital of traditional organizations to generate and swarm applications of a better scale or small business will be able to handle. Some PaaS examples include

- **Akamai EdgePlatform:** a large dispersed computing display place is provided on which organizations will be deployed their web applications; has a great center on analysis and monitoring [43]

- **Force.com:** from salesforce.com (an SaaS provider), user is provided with a platform to construct and sprint applications and machinery are bought from AppExchange6 or routine applications [44]
• **Google App Engine:** user is provided with a complete growth heap and it is permitted them to lope their applications on Google’s infrastructure [45]

• **Microsoft Azure Services Platform:** user is provided with on-demand compute and storage room services as same a growth platform based on Windows Azure[46]

• **Yahoo! Open policy (Y!OS):** user is provided with a means of increasing web applications on top of the obtainable Yahoo! platform and in doing it is leveraging a important piece of the Yahoo! resources [47]

**1.5.3 Type of Cloud Computing Based on Access Resources**

The two aspect of cloud computing will be based on who will be accessed resources will be characterized as public and private.[48] In public clouds, a person can offer capital as a overhaul, usually over an internet connection, for a pay-per-usage fee. Their use can be scaled by user and there is no need to acquire hardware to use the service. The communications and pool resources are provided by public cloud into the ability required by its users. In private clouds, capital are deployed inside a firewall and managed by the user group.[49] It is owned by the user association that owns the software and hardware communications and the cloud and controls right of entry are managed to its capital. Naturally, those resources and services cannot be shared outside the association. [50]

The National Institute of Standards and Technology it is defined by NTST that two additional types of cloud consumption models:

(1) Community clouds can be shared by numerous organizations and keep up exact needs and concerns of a community.

(2) Hybrid clouds which is the amalgamation of two or more public, private, and community clouds. Like, both clouds are specialties of public and private clouds.

**1.6 Implementation of Cloud Computing**
Cloud Computing is implemented on various attributes, we will see eight attributes of cloud computing as drivers for the acceptance of cloud computing. The attributes are ease of use, teamwork, suppleness, lower communications costs, mobility, risk decrease, scalability, and virtualization. [51]

Implementation of cloud computing can be described by table one, which describes how these attributes can dish up as drivers for cloud computing adoption.

<table>
<thead>
<tr>
<th><strong>Availability</strong></th>
<th>Any time a user can access is capital from side to side a normal internet connection.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Collaboration</strong></td>
<td>Users can see the cloud like a way to work at the same time on common in order &amp; data.</td>
</tr>
<tr>
<td><strong>Elasticity</strong></td>
<td>User’s resources are managed visibly by the provider utilization based on energetically altering requirements.</td>
</tr>
<tr>
<td><strong>Lower Infrastructure Costs</strong></td>
<td>The pay-per-usage models will be allowed an association for paying the resources they need with fundamentally without venture in the corporeal resources available in the cloud. No infra-structure preservation or upgrade costs.</td>
</tr>
<tr>
<td><strong>Mobility</strong></td>
<td>Users can access data and applications from approximately the world.</td>
</tr>
<tr>
<td><strong>Risk Reduction</strong></td>
<td>The cloud can be used by group to experiment ideas and concepts before making major funds in technology.</td>
</tr>
<tr>
<td><strong>Scalability</strong></td>
<td>Large quantity of capital can be accessed by users that balance based on their demand.</td>
</tr>
<tr>
<td><strong>Virtualization</strong></td>
<td>Each and every user has a single view of the available resources, independently of how they can be arranged in terms of physical devices. So, it has potential from a provider perspective to serve a greater number of users with fewer physical resources.</td>
</tr>
</tbody>
</table>

Table 1: Cloud Computing Drivers Attribute
Apart from above stated cloud computing drivers attribute we have the following table no. 2, which describes the Cloud Computing Barriers Concern

<table>
<thead>
<tr>
<th>Interoperability</th>
<th>No one could define a worldwide set of normal yet, ensuing in a vital risk of seller lock-in.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latency</td>
<td>All access to the cloud will be done by the internet, introducing latency into each message which takes place between the user and the supplier.</td>
</tr>
<tr>
<td>Platform or Language Constraints</td>
<td>Exact display place can be supported by some cloud providers.</td>
</tr>
<tr>
<td>Concern</td>
<td>Why It is Acted as a blockade to Cloud Computing acceptance</td>
</tr>
<tr>
<td>Regulations</td>
<td>There are concerns in the cloud computing community over jurisdiction, data protection, fair information practices, and international data transfer mainly for organizations that manage sensitive data.</td>
</tr>
<tr>
<td>Reliability</td>
<td>Many obtainable cloud infrastructures will be unsuccessful anytime.</td>
</tr>
<tr>
<td>Resource Control</td>
<td>The quantity of manage varies on state that the user has over the cloud supplier and its resources varies greatly between providers.</td>
</tr>
<tr>
<td>Security</td>
<td>The main concern is data privacy: no one have knowledge where is his data stored.</td>
</tr>
</tbody>
</table>

Table 2: Cloud Computing Barriers Concern

1.7 Cloud Computing and Grid Computing
Cloud Computing is much related to the grid computing also. As we know “A grid is a system that uses open, general-purpose protocols to federate distributed resources and to deliver better-than-best-effort qualities of service.”[52] Even if the difference with cloud computing is not lucid, one differentiator is that network computing relates wholly to communications services. A grid infrastructure provides a locate of
abstractions and interfaces for access to, and organization of, shared resources. The (ITaaS), is used by in-house, enterprise IT organizations that offer any or all of the above services. Using software as a service, users also rent application software and databases. The cloud providers manage the infrastructure and platforms on which the applications run. End users access cloud-based applications through a web browser or a light-weight desktop or mobile app while the business software and user's data are stored on servers at a remote location. It is claimed by proponents that enterprises will be allowed to get their applications awake and run organization faster, with enhanced manageability and less protection, and enables IT to more quickly adjust resources to meet fluctuating and unpredictable business demand. Cloud computing relies on sharing of resources to achieve coherence and economies of scale similar to a utility (like the electricity grid) over a network. At the foundation of cloud computing is the broader concept of converged infrastructure and shared services. IT organizations will be presented with a fundamentally dissimilar model of process, one that takes benefit of the prime of life of web applications and networks and the rising interoperability of computing systems to IT services should be provided. Specialize in meticulous applications and services can be provided, and this know-how it will be allowed to them to professionally manage upgrade and preservation, backups, tragedy recuperation, and failover functions. As a consequence, consumers of cloud services will be seen greater than before dependability, even as expenses turn down due to economies of scale and other manufacture factors, current needs will be monitored and make on-the-fly adjustments to boost or diminish ability, willing to help spikes in demand without paying for vacant aptitude throughout slower times. Aside from the potential to lesser expenditure, colleges and universities will gain the elasticity of being able to act in response rapidly to needs for new services by purchasing them from the cloud. IT organizations and providers can increase standardization of protocols and processes so that the many pieces of the cloud computing model will be interoperable correctly and professionally. Cloud computing scalability is an additional solution advantage to higher education, predominantly for explore projects that necessitate enormous amounts of storage space or dispensation ability for a incomplete time. Some data centers will be made near sources of renewable energy, such as wind farms and hydroelectric facilities, and cloud computing affords access to these providers of
“green IT.” [57] Finally, college and university will be allowed to make IT costs transparent and consequently match consumption of IT services to those who pay for such services.

1.8 IaaS:
According to the online reference Wikipedia, Infrastructure-as-a-Service (IaaS) is being delivered of computer infrastructure (typically a platform virtualization environment) being a service.[58] IaaS leverages significant technology, services, and data center investments are to be delivered IT like a service to customers. like traditional outsourcing, that requires extensive due diligence, negotiations, and complex, lengthy contract vehicles, It is centered by a model of service which is delivered that make a provisions a predefined, standardized infrastructure specifically optimized for the customer’s applications. Simplified statements of work and à la carte service-level choice it is made easy to tailor a solution to requirements as per customer. IaaS the transition and hosting of selected applications on their infrastructure is managed by providers. Management of their application(s) is managed by customer and provider manages off-loading hosting operations and infrastructure management to the IaaS. Provider-owned implementations typically include the following components: [59]

- Computer hardware (typically set up as a grid for massive horizontal scalability)
- Computer network (including routers, firewalls, load balancing, etc.)
- Internet connectivity (often on OC 192 backbones)
- Platform virtualization environment for running client-specified virtual machines
- Service-level agreements
- Utility computing billing

In-spite of purchasing data center space, servers, software, network equipment, etc., IaaS customers essentially those resources are rented like fully outsourced service.
Usually, the service is billed as monthly basis. [60] The customer can be charged only for resources consumed. The main profit of using this type of outsourced service includes these things. The Information Technology Infrastructure Library [ITIL] is a customized framework of best practices designed to promote quality computing services in the IT sector.) Following are the way we use the latest technology for infrastructure equipment

- Secured, “sand-boxed” (protected and insulated) computing platforms which can be security monitored for breaches

- Risk is reduced to have off-site resources maintained by third parties

- It can manage service-demand peaks and valleys

- Lower cost can be allowed expensing service costs instead of making capital investments

The privacy, security, data integrity, intellectual property management, audit trails, and other issues will be introduced by it[61] Because superior education will be subject to institutional policies and to a wide range of state and central regulations, these issues will be multifaceted and will be more hard in the context of inter-institutional cloud initiatives. Because of the manage that clients of cloud services cede to providers, successful initiatives will be rely on trust between a college or university and a contractor, including assurance in the provider’s long-term feasibility. The materialization of cloud computing as a feasible option for a increasing number of IT services speaks to a level of Internet diffusion and communications prime of life that did not exist just a few years ago, it is believed by some IT that cloud computing programs on site increase significantly in the coming years, and institutions can be more agreeable to transferring a larger number of services to the cloud [62] on the other hand, a violate of belief through a cloud provider it can be leave institutions uneasy about cloud services. Even if the profit of cloud computing will be more tangible, significant policy and technology issues will be sorted out for its potential. Yet as “public” clouds can be developed, a new class of “private” clouds will take outline, relatively undifferentiated services will be offered
to public cloud providers, private clouds parallel economies of scale will be followed but do so while the ability can be preserved to modify applications and services for clients. As superior numbers of campuses consider cloud computing, services which will have institutional identification or mixing needs will be less to be the cloud, and a varied mix of service still others developed in-house or purchased and customized will be characterize in most institutional. [63]

Cloud computing will come into spotlight only when it will be thought about what will be needed by IT, a way to increase ability or add capabilities on the fly without investing in new communications, preparation new workers, or licensing new software. Cloud computing encompasses any subscription-based or pay-per-use service can be used.[64] Cloud computing is a new concept, with a miscellaneous crew of providers large and small delivering a slide of cloud-based services, from developed applications to luggage compartment services to spam filtering, utility-style communications providers will be the part of the mix, but SaaS providers such as Salesforce.com. Today, IT will plug into cloud-based services separately, but cloud computing aggregators and integrators are already emerging which are Based on those deliberations, here's a rough stop working of what cloud computing is all about:

1.9 SaaS:
It is a solo application, can be delivered by this type of cloud computing from beginning to end the browser to thousands of customers by them a multitenant architecture will be used. If we talk about client, it means there is no upfront venture in servers or software licensing, with one app can be uphold, costs become low compared to predictable hosting.[65] Salesforce.com became best-known example among enterprise applications, but SaaS will also be common for HR apps and worked its way up the food chain to ERP, with players like Workday. And who will have been predicted the sudden rise of SaaS "desktop" applications, such as Google Apps and Zoho Office.

Utility Computing, which is not new, but this form of cloud computing will get new life from Amazon.com, Sun, IBM, and others by that now storage and virtual servers
are being offered, on demand IT will be accessed. Early venture adopters mainly use utility computing will be used for supplemental, but one day, parts of the datacenter will be replaced. Other providers offer solutions will be offered which will help IT to create fundamental datacenters from commodity servers, such as 3Tera's App Logic and Cohesive Flexible Technologies' Elastic Server on Demand. Liquid Computing Liquid Q offers parallel capabilities, enabling IT to stitch together memory, I/O, storage, and computational ability as a virtualized supply pool available over the network. [66]

Software as a Service (SaaS) became a software allocation model in that applications can be hosted by a vendor and it made ease of use to customers to a network, classically the Internet. SaaS is an more and more common delivery model like underlying technologies which can be supported Web services and service-oriented architecture will be supported mature and new developmental approaches, like Ajax, will be popular. Thus, broadband service will became increasingly available to support user access from all over world. [67]

There is close relation with SaaS and ASP and on demand computing software delivery of models will be done. Two in the direction of some level different delivery models are identified by IDC for SaaS. ASP is as like the hosted application management model: software will be hosted by provider to clients and delivers it over the Web. In the software on demand model, clients are given network-based access to a single copy of an application can be shaped exclusively for SaaS distribution by provider.

1.9.1 Benefits of SaaS model:

SaaS Model provide following benefits:

- Becomes easy administration
- Regular updates and patch management
- Compatibility which provides users will have the same version of software.
- Collaboration becomes easy for the same reason
- Accessibility all over the world

The traditional model of software distribution, in that software can be purchased for and installed on personal computers, sometimes it is referred as software as a product. SaaS is based on a "one-to-many" model; it is an application that can be shared across numerous customers. The correct description of software as a service (SaaS) is open to argue, when we ask dissimilar people we would get some special definitions. It is believed that SaaS has a major bang on the software trade, because software as a service can modify the technique that how people construct, sell, buy, and use software.[75] For it this software vendors need capital and in sequence about rising SaaS applications productively. at a standstill, most experts can be probably approved on a few original rules which discriminate SaaS from customary packaged software on the one hand, and straightforward websites on the other, software as a service is characterized as "Software deployed as a hosted service and accessed over the Internet".

SaaS becomes a way to convey applications to the Internet for service, as an alternative of installing and maintaining software, It should be accessed through the Internet, to make us free from multifaceted software and hardware administration. SaaS applications would be called Web-based software, on-demand software, or hosted software. Whatever it is called does not matter but SaaS applications can run on a SaaS provider's servers.[76] The provider manages can be accessed to the application, including safety, accessibility, and presentation. SaaS there no require purchasing any hardware or software, set up, keeps, or update. It is easy to access application: an Internet connection is needed only. A solo application is delivered by this sort of cloud computing through the browser to thousands of clients who will use a multi-tenant structural design. If we talk about client, it means there is no open savings in servers or software licensing; If we talk about supplier, with just one app to preserve, costs become low compared to straight hosting.
Salesforce.com is through distant the best-known copy among venture applications that provides CRM solutions as SaaS, but it is also ordinary for HR apps, and has worked to way up the groceries chain to ERP, with troupe like Workday. Besides all these, a number of the desktop applications such as Google Apps and Zogo Office contain made their stain in the market. [77]

1.9.2 SaaS Concept:

It’s important to know these four SaaS concepts:

- **Multi-tenancy**: Lets the system deliver an application to multiple client organizations from a single instance of software.

- **Provisioning**: The automated process that managed computing, resources, configurations, and processes and optimizes availability.

- **Scalability**: Lets the system scale storage needs up and down) which reduces user costs and complexity for the storage provider.

1.9.3 Categories in SaaS:

Now we should take a profound glance at the essential principles of SaaS, i.e., software deployed as a hosted service and it can be accessed over the Internet.[78] Two major categories can be read of SaaS:

1. **Line-of-business services**: It will be offered to organizations of all sizes. Because Line-of-business services are huge, customizable business has aim to facilitating trade processes like funds, supply-chain management, and client relations. One can sell these services to clients on a subscription-basis.

2. **Client-oriented services**: 
It will be offered to the common public. Client-oriented services also can be sold on a subscription-basis, but it over and over again provides to clients devoid of any cost, and is supported by promotion. When a big shot move from on-premise software to submission software as a service it is mandatory that software vendors should move their thinking in three consistent areas: in the business model, in the application structural design, and in the equipped structure.

1.9.4 SaaS Implementation Issues:
Many types of software components and applications frameworks are employed in the development of SaaS applications. When we use new technology it is found in these modern components and application frameworks can be drastically reduced the time to market and cost of converting a traditional on-premises product into a SaaS solution.[79] According to Microsoft,14 SaaS architectures can be top covert into one of four adulthood levels whose key each one level is illustrious in the preceding one by the adding of one of these three attributes. The levels described by Microsoft are given below.

➢ SaaS Architectural Maturity Level 1—Ad-Hoc/Custom.
The first level of prime of life is recognized as no maturity. Each customer has a only one of its kind, customized account of the hosted application. The application is run its own instance on the host’s servers. Migrating a traditional networked or client-server application at this level of SaaS maturity is typically required the least development effort and it is reduced operating costs by consolidating server hardware and administration.[80]

➢ SaaS Architectural Maturity Level 2—Configurability.
The greater program flexibility is provided by second level through configuration metadata. At this level, separate instances of the same application can be used by customer. It is allowed to a vendor to meet the varying needs of each customer for it he can use detailed configuration options. It is also allowed the vendor to ease the maintenance burden through a common code base.[81]

➢ SaaS Architectural Maturity Level 3—Multitenant Efficiency.
The third maturity level adds multitenancy to the second level. It has the capability to serve all of the vendor’s customers. This approach enables more efficient use of server resources without any apparent distinction to the end user, but eventually this level is limited in its ability to scale massively.[82]

- **SaaS Architectural Maturity Level 4—Scalable.**
  In the fourth SaaS maturity level, scalability can be added by using multitier architecture. This architecture becomes proficient to support a load-balanced farm of identical application instances which is running on a variable number of servers, sometimes in the hundreds or even thousands. System capacity dynamically increases or decreases to match and load demands by adding or removing servers, there is no need for further alteration of application software architecture. [83]

1.9.5 Key Characteristics of SaaS
Deploying applications in a service-oriented architecture can be more complex problem than encountered in traditional models of software deployment. As a result, SaaS applications can generally be priced based on the number of users which can be access to the service. Often we have to pay additional fees for the use of help desk services, extra bandwidth, and storage. SaaS can be revenue streams to the vendor who are usually lower initially than traditional software license fees.[84] so, the trade-off for lower license fees can be monthly recurring revenue stream, that can be viewed by most corporate CFOs as a more predictable determine of how the business is growing. These monthly recurring charges can be viewed much maintenance fees for licensed software. The key characteristics of SaaS software are the given below:

- Network-based management and access to commercially will be available software from central locations rather than at each customer’s site, enabling customers to access applications remotely.
- Application can be delivered from a one-to-many model (single-instance, multitenant architecture), opposed a traditional one-to-one model.
- Centralized enhancement and patch updating which is obviates any need for downloading and installing by a user.
SaaS uses in conjunction with a larger network of communications and collaboration software, sometimes it is used as a plug-in to a PaaS architecture.

All type of software continues to be sold in the equal method it has been sold for decades. The permit is bought to use the software, and installs it on hardware that of the client or which is or else under the clients manage, with the merchant support provided and as heading for by the conditions of the license or a support settlement. As per serve above-board software deal, the notion of a "license" seems like incredible of a trifle: legally, the correct to use a copy can be purchased by client of the software, but for realistic purposes, it as work as the client "owns" the software and it can be used as often and for as extended as it requirements.[85] SaaS
A new perception is brought which defines, i.e., instead of "owning" significant software absolute, clients have been told that they are pay for a contribution to software running on an important person else's servers, software which can go left if they want to stop subscribing. We have to glance at it from a dissimilar point of view. Fundamentally there are three types of mechanism to an IT infrastructure in a company:

1. Software

2. Hardware

3. Professional service

Out of these, from an association perspective, the most significant feature of it is software, as software is the main module which helps them absolute the purpose of the society. While, hardware and trained service allow the software to purpose and manufacture the result preferred by the institute. In other words, an organization can be contented to attach new software or functionality to presented software, if offered hardware is allow the new software/functionality will not run sufficiently, but any institute would not insert a new hardware till there is no expected require of a new software. But now a days, preponderance of the budget is life form expenditure on the hardware and the software specialized to run the software.[86] alternative of the
budget is formed for software that will most straight involve in information administration, which can be the eventual purpose of any IT organization. In divergent to that, if the institute consumes these software from a isolated place, SaaS vendor is administration by third party, and they are in the way of disburse only contribution of that software, then a enormous pitch of their budget is saved from hardware and expert services, since because the third party is managing by SaaS vendor. This would allow them to expend preponderance of the budget on software services, which has direct bang on meeting the objective of their institute. besides, applications can be delivered over the Web or elegant clients place extensively less demand on a desktop computer than fixed, locally-installed applications, which is enables expand the desktop skill life-cycle significantly.[87] by a SaaS provider standpoint, for SaaS applications which are built to scale first-rate, As more clients cost will be concentrated. As multi-tenancy can be developed by provider as a core proficiency, foremost to higher-quality contributions expenditure can be lower. consequently accounting for the hardware and professional services expenditure is incurred by SaaS vendors, clients will gain considerably greater pure software functionality for the same IT budget. , It is not a elf tale, as the donation for the software service will also contain the management of the server and the expert service? There is magic at the back it "Economy of Scale". A SaaS vendor with x number of clients subscribing to a single, centrally-hosted software service and the vendor cannot be competent to serve all of its clients in a consolidated surroundings. For instance, a line-of-business SaaS application can be installed in a load-balanced ranch of five servers can be able to hold up 50 medium-sized clients, means each client will only be accountable for a tenth of the expenditure of a server. A parallel application can be installed locally might need each client should be devoted an whole server to the application - maybe more than one, if weight balancing and high availability are concerns. [88] There are a lot of profits for both the client and the providers. Some of the center points can be consolidated as given below:
Profit of SaaS is necessary shifts in thoughts on the part of the provider and the client, and it depends on the provider how he assists the client to make it.

1.9.6 Application Architecture:
Application Architecture is good enough to provide the facility to make the application using the cloud computing. We can able to develop the application also, so that the utmost profit can be made out of it. Much like any other software, Software as a Service benefit also can be taken of Service leaning structural design to allow software applications to converse with each other. Every software service is acted as a service provider, revealing its functionality to other applications with the help of public brokers, and is also acted as a service requester, incorporating data and functionality from other services. It is essential to know that the SaaS line of attack requires system structural design capable to hold up peak usage and demands and the aptitude to progression large numbers of dealings in secure and reliable surroundings. The software should be need to met certain criteria to work on a replica such as
The application be obliged to need to be well intended to sustain and provide scalability and the ease of use of conventional desktop applications.

Three key points can distinguish a successful SaaS application from a failed SaaS application:

- **Scalability:**
  Scaling the application is generation to maximizing concurrency and by means of application capital with more competently; for example, optimizing locking period, statelessness, distribution pooled resources such as clothes and system connections, caching reference data, and partitioning large databases.

- **Multi-tenant efficient:**
  Multi-tenancy would be the most of note prototype shift that an designer adapted to designing isolated, single-tenant applications has to make. For example, when it is used in corporation accesses client information by using a CRM application service, the application example which the user connects to be cooperative users from dozens, or even hundreds, of other companies - all wholly inattentive to any of the users. It is necessary when architecture maximizes the distribution of resources across tenants, but it will not be still able to distinguish data belonging to different clients.

- **Configurable:**
  Provision on its own application illustration on a single server than it should be accommodated from numerous dissimilar companies at once. It cannot be in black and white tradition code to customize the end-user experience - anything is to be done to customize the application for one client it will modify the application for other clients also. in its position of customizing the application in the habitual sense, then, each and every client can use meta data to configure the technique the application is appeared and perform of users. The confront for the SaaS, architect it is ensured that the task of configuring applications becomes straightforward and simple for the clients, lacking extra expansion or costs.
There are four techniques of hosting an application on the SaaS structural design.[90] These are also called as the prime of life models of SaaS:

- **Ad hoc/Custom:**
  It is alike to the customary application service provider (ASP) representation of software delivery, dating back to the 1990s. Each and every client has his have possession of customized version to swarm the application, and runs his own illustration of the application on the host's servers.

- **Configurable:**
  It is the illustration of the application that is hosted by hawker for each client. Each instance is individually customized for the tenant; at this level, all instances are used the same code implementation, and when clients get together by vendor they require to provide detailed pattern options so client can be allowed to modify how the application looks and behaves to its users. in spite of being the same to one an additional at the regulations level, each and every example will stay behind wholly inaccessible.

- **Configurable, multi-tenant-efficient:**
  A single illustration is used by a vendor with the intention of is served to every client, with configurable meta data which provides a marital user experience and quality set for each and everyone. It is ensured by approval and safety policies that each client data should be reserved divide from that of other clients. There is no hint that someone is giving out application example among multiple tenants. This approach eliminates the need to make available server space for as many instances as the vendor has clients, allowing for a much more efficient use of computing resources than the second level, which translates in a straight line to lower costs. An important drawback of this move toward is that the scalability of the application is limited.

- **Scalable, configurable, multi-tenant-efficient:**
  Multiple clients is hosted on a load-balanced farm of identical instances, with each and every clients information can be reserved divide, and with configurable
meta data provides a exclusive user experience and characteristic set for each and every client.

![High Level Architecture](image)

**Figure 4 High Level Architecture**

The key which is at the back the financial benefit for SaaS is an structural design it is used "customization from end to end configuration" and brilliant data is partitioned. No require of these two rudiments, we almost certainly cannot be talented to move past the first adulthood level (Ad hoc/Custom) and it can know the efficiencies of multi-tenancy.[91]

1.9.7 **Service Oriented Architecture (SOA)**

The fundamental structural design of SaaS is as equal to any SOA (Service Oriented Architecture) based application.

1. **Meta-data Services:**

   The Meta information service is provided to clientele with the most important means of customizing and configuring the application. naturally, this is categorized in wide areas: user border and branding, work flow and trade rules, additional room to figures model access manage.

2. **Security Services:**
Chapter 1

Introduction

The SaaS contributor naturally is delegated to each and every tenant the liability to create and preserve its user accounts, a method is known as delegated management. A circumstance is formed in which the client is responsible to generate individual user accounts, but the vendor should make them endorse. Every one role gets one or more consent that enable users can assigned to the role execute actions in agreement with any pertinent business rules.

Significant venture software can be proposed to be used by hundreds of community. If anyone has knowledge building venture applications of this sort, we should come to be acquainted with first the challenges to create a scalable structural design.[92] For a SaaS application, scalability becomes more significant: we should hold up the standard user base of a on its own client, which is multiplied by the full amount number of clients. Applications should be scaled up by poignant the application to a larger, more commanding server. A hardly any of the ordinary best practices for scheming SaaS applications are given below:

- The application is supposed to be intended to run in a stateless fashion, with user and meeting information that is stored moreover on the client side, or in a distributed store that's easy to get to to any application example. Statelessness means that each deal should be handled by one example. A consumer may be transacted with dozens of dissimilar example throughout a single session.

- The application be supposed to be intended to perform I/O operations asynchronously, so that the request can be performed helpful work while to come for participation and productivity to complete.

- Group resources turn out to be threads, network relations, and database relations; it helps make the most of our computing resources, and our aptitude to predict resource usage can be better.

Based on the prime of life model selected for the SaaS execution, the database plan would be at variance to be reserved contract in mind, the folder plan should be:
Cloud Computing and SaaS is absolutely will make a enormous contact to our present method of working. intense and revealing all software services over the HTTP network be supposed to be allow the association IT communications is fully depend on the Internet medium. There will be criticisms and counter-criticisms for dependency.[93] If SaaS is fully functioned, it can explain one of the most important concerns of the software production, which is making the application expansion companies lose billions of dollars each year.

1.10 PaaS:
Let’s assume we want to build an application but building and running on-premise applications has always been complex, expensive, and risky. Our application required hardware, an operating system, a database, middleware, Web servers, and other software. Once we assembled this stack, we need a team of developers to navigate complex programming models like J2EE or .NET. We also need a team of network, database, and system management experts to keep everything up and running. Inevitably, a business requirement would require a change to our application, which would then kick off a lengthy development, test, and redeployment cycle.[94] Cloud computing has evolved to include platforms for building and running custom applications, a concept known as Platform-as-a-Service. To develop software, we
once had to buy databases, servers, networks, and a host of development tools. And then we needed the staff to install, optimize, and maintain it all. With PaaS, we can avoid those investments and focus on developing applications instead. There are a number of PaaS providers available today. **AppEngine** from Google based on Python and Java. **Force.com** from SalesForce based on the SalesForce SaaS infrastructure and Apex language. **Bungee Connect** provides a Visual Development Studio based on Java. **WaveMaker** is also a Visual Development Studio based on Java and hosted on Amazon EC2. **Amazon Web Services (AWS)**, a set of services can be delivered which can be together form a reliable, scalable, and inexpensive computing platform “in the cloud”. Platform as a Service (PaaS) provides infrastructure on which software developers should build new applications or extend existing applications do not need to purchase development, QA, or production server infrastructure.[95] Salesforce.com’s Force.com, Google’s App Engine, and Microsoft’s Azure are examples of PaaS. These Platform features can create custom applications, but it is also allowed to Independent Software Vendors and to create solutions for vertical niches. For CIOs or business executives considering Cloud Computing, or one of these “flavors” of Cloud Computing, it is advised would be to follow the standard process.

- First, it should be started with a business case. We should Calculate the net financial impact that an investment or change will happen to our business.
- When considering Cloud Computing, it should be considered with our network bandwidth requirements, and understand how much data will be needed to move across the network and requirements for the particular service.
- Security is another big factor, so our security requirements should be known by us and how our internal capabilities can compare to those of the Cloud provider.
- With any development or change, a risk perspective should be thought. We should research a solution and run a pilot before making a larger commitment or investment.
- If the business service for which it is being looked to leverage the Cloud is mission critical production, it is sure to look closely at the Cloud service provider,
its organization, and its business sustainability. For example, how are they profitable, how are they growing, and how do they have a strong balance sheet?

As we talk about terms of leveraging the Cloud for Supply Chain Management and EDI functions specifically, one of the first things a company will look at is the size of the providers overall network. A large network is being provided scale and quality that is easily leveraged to provide faster and higher quality implementations.[96] The same value can be provided by the scale when adding pre-wired connections to Trading Partners to accommodate business growth and change. We should look at the implementation process and organization for our Supply Chain service. Their service should be evaluated by delivery model, their overall capacity, and their track record also be recorded to get businesses up and running on their service. Finally, one of the most important things should be done that how it is looking at the ongoing service and support around the application. For example, most SaaS applications can be sold under a subscription model, that is great for the customer because it means the provider will provide ongoing value and support to all of us. The subscription can not be just about access to a set of technology but just as importantly access to a set of people of people who are provided customer support, change management, and overall business value every day, every week, every month. As a Supply Chain Cloud customer, another item it should also be examined how it will become the provider benchmarks and scorecards themselves in meeting with their customers’ service level agreements. It is done by Many Cloud providers at a global level but it is equally or even more important to do benchmarking and scorecarding for individual customers. This is determined that our Cloud provider can meet with our particular SLA objectives around items like uptime, processing speeds, and responding to support inquiries. This is especially critical for mission-critical systems in insuring the Cloud provider can have meeting with its commitments to the requirements business.[97]

1.10.1 Key characteristics:
Services to develop, test, deploy, host and maintain applications in the same integrated development environment can be done. Different PaaS offers different combinations of services to support the application development. Comprehensive
PaaS can provide us all service options in an integrated development environment with source code control, version control, dynamic (interactive) multiple user testing, roll out and roll back with the ability to audit and track which can make what changes should be happens when to accomplish [98]

1. **Web based user interface creation tools**
   PaaS offers typically and it is provided to some level of support to ease the creation of user interfaces because it is based on standards such as HTML and JavaScript or other Rich Internet Application as Adobe Flex, Flash and AIR. Rich, interactive, multi-user environments and scenarios are to be defined, tried out by real people (non-programmers), with tools which can make it easy to log/single out features that can annoy or frustrate to novices or experts. Creation tools can allow interfaces to define for different user profiles by function or expertise. PaaS offers improved user experience by incorporating channels for real people feedback by creation, design, development, testing, roll-out, product [99]

2. **Multi-tenant architecture**
   PaaS it is offered by it typically attempt to support use of the application by providing concurrency management, scalability, fail-over and security. The architecture dose not define the "trust relationship" between users in security, access, distribution of source code, navigation history, user people and device profiles, interaction history, and application usage.

3. **Integration with web services and databases**
   Support for SOAP and REST interfaces should be allowed PaaS it is offered by it to create compositions of multiple web services, it is known as” mashups” Access databases and re-use services should be maintained inside private networks.[100] Support to keep the user/relationships (if multiple users) device context and profile by the mashup across web services, databases and networks.

4. **Support for development team collaboration**
   The ability to form and share code with ad-hoc or pre-defined or distributed teams greatly enhanced by the productivity of PaaS which is offered. Schedules, objectives,
teams, action items, owners of different areas of responsibilities, roles (designers, developers, tester, QC) are defined, updated and tracked based on access rights.

5. Utility-grade instrumentation

PaaS it is offered to provide developers insight into the inner workings of their applications. Some PaaS are offerings the uses information about user behavior to enable pay-per-use billing. Historical/usage evidence helps to determine it.

- It can compare the value of different services. And it provides Track activity based costs and revenues.

- Visualization tools could have shown usage of patterns, exposing functional or correlational relationships between: services and/or user interactions, the value to the user or users, and the cost of alternative service paths such as web and cell phones

1.11 Public, Private, Community and Hybrid Cloud

- Public Cloud:
A public cloud is available over the internet to everyone. The cloud provider manages and owns everything from operations and facilities to computing resources. Popular public clouds are Amazon EC2, Google App Engine and Microsoft Azure. A public cloud is established where several organizations have similar requirements and seek to share infrastructure so as to appliance. In addition, it can be economically attractive as the resources storage, workstations utilized and shared in the community are already exploited.[101] This is the cloud computing model where service providers make their computing resources available online for the public. It allows the users to access various important resources on cloud, such as: Software, Applications or Stored data. On of the prime benefits of using public cloud is that the users are emancipated from performing certain important tasks on their computing machines that they cannot get away with otherwise, these include: Installation of resources, their configuration; and Storage.
• **Advantages of Public Cloud:**

Public cloud is bound to offer a multitude of benefits for its users, which can be sensed by its ubiquitous demand. Some of the most important ones are mentioned here:

1. Efficient storage and computing services

2. Inexpensive, since all the virtual resources whether application, hardware or data are covered by the service provider.

3. Allow for easy connectivity to servers and information sharing.

4. Assures appropriate use of resources as the users are required to pay only for the services they require.

5. Highly reliable and redundant.


7. Sets the business people free from the hassles of buying, managing and maintaining all the virtual resources at their own end, the cloud server does it all.

8. Public cloud, in today’s advanced workplace, empowers employees and enables them to become productive even when outside the office. The SaaS model ensures that corporations save on IT expenditures while delivering the flexibility of productivity software on the cloud.[102]

• **Private Cloud:**

A private cloud is available only to trusted users of an organization or group. Everything in a private cloud can be managed either by the organization or the cloud provider. iCylanAPP enables us to remote access the sensitive applications of enterprises by Smartphone’s or tablet device anywhere and anytime. The cloud-based
resources are delivered to one platform, which providing high performance, security, and user experience. We can access the desktop, run applications, change settings, and access data exactly as we are sitting in front of the local PC, using its keyboard and mouse. iCylanAPP has three versions, such as Standard Edition, Advanced Edition, Enterprise Edition, which providing proven security of different class. It can connect to any Windows applications running a iCylanAPP Client on smartphones or tablets devices. Nowadays, it supports the current systems, such as google, Android, Mac iOS, windows Phone 7 or BlackBerry. [103]

- **Community Cloud:**
  A community cloud is accessible to the members of a larger community comprised of different organizations or groups, and where partner organizations and the cloud provider co-manage everything from operations to facilities.

- **Hybrid Cloud:**
  A hybrid cloud is a mix of multiple public and private clouds and it addresses the challenges of a pure public or private cloud environment.

### 1.12 Internet Software Evolutions

The Internet name is given after the Internet Protocol, the standard communications protocol used by every computer on the Internet. The conceptual foundation for creation of the Internet was being developed by three individuals. The first, Vannevar Bush, who wrote a visionary description of the potential uses of information technology with his description of an automated library system named MEMEX. Bush introduced the concept of the MEMEX in the 1930s as a microfilm-based “device in which an individual stores all his books, records, and communications, and which is mechanized so that it may be consulted with exceeding speed and flexibility.”[113]

A buzz word is called cloud computing now- a- days in the air. It will be started when we ask what cloud is computing. A glance should be taken at how work is done and how is that going to make bang to our current working surroundings. SaaS. But we
should appreciate the basic concepts of cloud computing. It can be categorized into three groups:

1. Platform as a Service (PaaS)
2. Infrastructure as a Service (IaaS)
3. Software as a Service (SaaS)

A private or public both kind of cloud may be found. A public cloud services can be sold to on the Internet. A private cloud is known as proprietary network, which will supplies hosted services to a inadequate number of people. When public cloud resources will be used as service to create its private cloud, the answer is known a practical private cloud. Private or public, the aim of cloud computing is to give easy, scalable access to computing resources and IT services. [68] Some of the most well-known code-based frameworks are:

1. Java Google Web Toolkit (Google App Engine).
2. Python Django (Google App Engine)
3. Ruby on Rails
4. Microsoft .NET (Azure Service Platform)

1.12.1 The Emergence of Cloud Computing
Cloud computing provides new concept of the utility computing, which is defined as the provision of computational and storage resources like as a metered service, alike to those provided by a traditional public utility company [69]. This type of computing is getting popularity, however, as companies have begun to broaden the model to a cloud computing paradigm providing virtual servers which, It can be accessed by IT departments and users on demand. Early enterprise adopters can use utility computing mainly for non-mission-critical needs, but it is quickly changing as faith and trustworthiness issues are resolved. It is thought that cloud computing is the next big thing in the world of IT by some people. It is believed that just another variation of the utility computing model which has been repackaged in this decade as something new and fresh. On the other hand, it is not just the buzzword “cloud computing” which is cause of making confuse among the masses. at present, with so few cloud computing vendors[70] actually practicing this type of technology and also approximately every analyst from every research organization in the country defining
the term differently, the meaning of the term become very nebulous. yet among those who think that they know it, definitions vary, and most of those definitions are foggy at best.

1.13 Security:
The information housed on the cloud is often seen as valuable to individuals with malicious intent. There is a lot of personal information and potentially secure data that people store on their computers, and this information is now being transferred to the cloud. This makes it critical for us to understand the security measures that our cloud provider has in place, and it is equally important to take personal precautions to secure our data. [104]
The first thing we must look into is the security measures that our cloud provider already has in place. These vary from provider to provider and among the various types of clouds. What encryption methods do the providers have in place? What methods of protection do they have in place for the actual hardware that our data will be stored on? Will they have backups of my data? Do they have firewalls set up? If we have a community cloud, what barriers are in place to keep our information separate from other companies? Many cloud providers have standard terms and conditions that may answer these questions, but the home user will probably have little negotiation room in their cloud contract. A small business user may have slightly more room to discuss the terms of their contract with the provider and will be able to ask these questions during that time. There are many questions that we can ask, but it is important to choose a cloud provider that considers the security of our data as a major concern. No matter how careful we are with our personal data, by subscribing to the cloud we will be giving up some control to an external source. This distance between us and the physical location of our data creates a barrier. It may also create more space for a third party to access our information. However, to take advantage of the benefits of the cloud, we will have to knowingly give up direct control of our data. On the converse, keep in mind that most cloud providers will have a great deal of knowledge on how to keep our data safe. A provider likely has more resources and expertise than the average user to secure their computers and networks.[105] Now we should understand the evolution of computing in order to get an appreciation that
how can we got into the cloud environment. If we look at the evolution of the computing hardware it from the first generation to the present generation of computers, shows how it can be got from there to here. The hardware, however; evolutionary process is only part of it. As hardware evolved, as well as software. As networking evolved, As well as the rules for how to computers communicate. The development of rule also helps to drive the evolution of Internet software. If a common protocol is established for the Internet led directly to rapid growth in the number of users online. This has been driven by technologists to make more changes in current protocols and to create new ones. Today, it should be talk about the use of IPv6 (Internet Protocol version 6) to mitigate addressing concerns and for improving the methods that is used to communicate over the Internet. We have ability to build a common interface to the Internet which has been evolved with the improvements in hardware and software. Using technologies such as server virtualization, parallel processing, vector processing, symmetric multiprocessing, and massively parallel processing has fueled radical change. Now we should take a look at how it cab be done so it becomes easy to understand more about the cloud. It will be important to place the development of computational technology in a historical context. When we look at the Internet cloud’s evolutionary development, and the problems that are encountered along the way, some key reference points are provided to help us to understand the challenges that overcomes to develop the Internet and the World Wide Web (WWW) today. These challenges can be fallen into two primary areas, hardware and software. First at the hardware side should be taken care,[106]

1.14 Legal Issues in Cloud Models:
Recently some efforts have been done to create and unify the legal environment specific to the cloud. For example, the United States–European Union Safe Harbor Act provides a seven-point framework of requirements for U.S. companies which can use data from other parts of the world, namely, the European Union.[71] This framework sets forth that how companies can take part and certify their compliance and It is also defined in detail on the U.S. Department of Commerce and Federal Trade Commission web sites. In summary, It is allowed by agreement that most U.S. corporations is ready to certify that they have joined a self-regulatory organization
which adheres to the following seven Safe Harbor Principles or has implemented its own privacy policies that can conform by following principles:

1. Notify individuals where information is collected and used.

2. Give individuals the choice to disclosing information to a third party.

3. Ensure that if we want to transfers personal information to a third party, that third party will also provide the same level of privacy protection.

4. Individuals access is allowed to their personal information.

5. Reasonable security should be taken to protect collected data from loss, misuse, or disclosure.

6. Reasonable steps should be taken to ensure the integrity of the data collected.

7. It has in place an adequate enforcement mechanism.

Major Service providers like Amazon Web Services cater to a global marketplace, typically the United States, Japan, and the European Union, by deploying local infrastructure at those locales who are allowing customers to select availability zones. Although, It is concerned about security and privacy at both the individual and governmental levels, But major concern is the USA PATRIOT Act and the Electronic Communications Privacy Act’s Stored Communications Act.[72] The USA PATRIOT Act, is more commonly known as the Patriot Act, It is a controversial Act of Congress which was U.S. President George W. Bush signed into law on October 26, 2001. The contrived acronym stands for “Uniting and Strengthening America by Providing Appropriate Tools Required to Intercept and Obstruct Terrorism Act of 2001” (Public Law P.L. 107-56). The Act expanded the definition of terrorism to include domestic terrorism, so it is enlarging the number of activities to which the USA PATRIOT Act’s law enforcement powers will be applied. It helps to law enforcement agencies’ ability to surveil telephone, email communications, medical,
financial, and other records and increases the range of discretion of law enforcement and immigration authorities it works in detaining and deporting immigrants suspected of terrorism-related acts. It pointed the restrictions on foreign intelligence gathering within the United States. It also expands the Secretary of the Treasury’s authority to regulate financial transaction.[73]

The Electronic Communications Privacy Act’s Stored Communications Act defines in the U.S. Code, Title 18, Part I, Chapter 121, § 2701, Unlawful Access to Stored Communications. Offenses included in it are intentional access without authorization to a facility by which an electronic communication service can be provided or intentionally exceeding an authorization to access that which facility can be obtained, alter, or prevent authorized access to a wire or electronic communication while it is in electronic storage in such a system. Persons who is convicted under this Act can be punished if the offense is committed for purposes of commercial advantage, malicious destruction or damage, or private commercial gain, or in furtherance of any criminal or tortious act in violation of the Constitution or laws of the United States or any state by a fine or imprisonment or both for till five years at first offense. For a second or subsequent offense, the penalties stiffen to fine or imprisonment for 10 years, or both.[74]

1.15 Cloud Computing in Real Time Banking System
Real time banking is the term implemented in modern era. The banking done using information technology tools is called real time banking. Real time has the power to improve customer experience, increase back office efficiency, and boost analytics capabilities at a time when real insight is at a premium. Real time Systems are used in real time banking. These systems are based on time management. A real time system is used when a fixed time requirements have been placed on the operation of a processor or the flow of a data. Thus, it is often used as a control device in a dedicated application. Sensors bring data to the computer. The computer must analyze the data and possibly adjust controls to modify the sensors input. Many banks are implementing the concept of real time banking which includes call centers, websites, ATM’s and many more functional areas. The concept of cloud computing purely
provide clear cut example of ATM’s. An ATM machine is used by providing us the information about the transactions done.

1.15.1 Advantages of using cloud computing in banks:
Following are the advantage of using cloud computing in banking system:

- **Cost Savings and Usage-based Billing**
  With cloud computing, financial institutions can turn a large up-front capital expenditure into a smaller, ongoing operational cost. There is no need for heavy investments in new hardware and software. In addition, the unique nature of cloud computing allows financial institutions to pick and choose the services required on a pay-as-we-go basis.

- **Business Continuity**
  With cloud computing, the provider is responsible for managing the technology. Financial firms can gain a higher level of data protection, fault tolerance, and disaster recovery. Cloud computing also provides a high level of redundancy and back-up at lower price than traditional managed solutions.

- **Business Agility and Focus**
  The flexibility of cloud-based operating models lets financial institutions experience shorter development cycles for new products. This supports a faster and more efficient response to the needs of banking customers. Since the cloud is available on-demand, less infrastructure investments are required, saving initial set-up time. Cloud computing also allows new product development to move forward without capital investment. Cloud computing also allows businesses to move non-critical services to the cloud, including software patches, maintenance, and other computing issues. As a result, firms can focus more on the business of financial services, not IT.

- **Green IT**
  Organizations can use cloud computing to transfer their services to a virtual environment that reduces the energy consumption and carbon footprint that comes
from setting up a physical infrastructure. It also leads to more efficient utilization of computing power and less idle time.

1.15.2 Security issue regarding cloud computing in Banking:
Cloud computing is being complete inroads into the banking division for good cause; safety and data solitude becomes prime concerns for cloud implementers in the banking division. Banking cream of the crop have fear of having its data “in the cloud” is the single most hurdle which be obliged to conquer to build belief and gain the reimbursement of cloud computing. Especially it gives the cloud factual “multitenant” surroundings, CIOs are worried that someone can filch their data or can be compromised by hackers, mixed with data from their cloud providers.

- **Measures taken by banks to handle security issue:**

- Personal clouds can be completed by bank which is their primary main concern in moving to a cloud-based application and information access replica. The personal cloud works in the bank’s inner network.

- The confidential cloud can offer security and control is likely to petition to banks looking for a more gainful way to their center applications can be accessed, like expenditure or market data.

- Financial Services firms be capable of naturally leverage Hybrid Cloud structural design to understand profit includes cost, speed, and competence which makes balance across a variety of business functions. The profit of cloud computing can be reaped by it while also the safety and privacy of their information are maintained.

- There are many definite challenges in areas of safety and information privacy in banks. Their obtainable IT establishment has highly disjointed IT landscapes of safety and data seclusion is approached and policies are in use crossways dissimilar functions or business lines. It includes lot of danger and price. Using
the move to cloud computing to drive more constancy and computerization in security and data privacy is in point of fact provided a catalyst for driving better security.

- There are dissimilar levels of sympathy, from little level to ultra safe. In the same way, banks contain to plan their cloud to have parallel and suitable safety built for both personal and community clouds.

**1.15.3 Fundamentals of traditional commercial banks:**

In the future, traditional commercial banks will need to master two fundamental changes which are to given below:

1. The conversion of their product offerings, channels and customer service to reflect the demands of the “changing consumer”—connected, impatient, empowered, and demanding of services that can full fill their individual and social needs.

2. Core banking operations should be reshaping and reinvention to enable a more competitive, customer-centric, efficient and sustainable business model.

A failure to achieve either of these imperatives will expose banks to disintermediation by nimble, low-cost online and mobile providers of personal financial management should be maintained and payments services resulting in loss of relevance to customers and, therefore, their prominence in the financial services value chain could be maintained.

**1.15.4 Reason of cloud computing in banks**

There are a lot of reasons to move to the cloud, first reason is to probable be applications. New technologies have always been the assets spending wanted for new communications. Banks only have to budget for ready operating cost and pay for the services which are used. It becomes simple and cost efficient to test new applications on the cloud against current customary infrastructures.
• **Cloud based services**
All the business necessities cannot be full filled by only cloud computing service for every bank. An application collection be supposed to be built-up and maintained to consisting of together cloud and on-premise applications. While savings in inheritance systems will be predictable to continue, cloud based services turn out to be perfect for newer business areas. Cloud-based services are able to be predictable to provide the benefit of both lower savings in implementing business strategies and faster rotate time for manufactured goods and service contributions, particularly those can be deliver over mobile devices and the Internet.

Four types of earnings can be got in beneath vicinity.

1. client analytics

2. client relationship management (CRM)

3. Browser-based technologies such as venture content organization

4. IT expansion and application communications.

These functions are able to be out sourced; cost of savings is able to be achieved from side to side the cloud. So, previous to making the shift to the cloud, Banks be obliged to consider following rules:

• **ROI for cloud-based projects**
Banks will contain too careful about making important savings in acquiring IT communications as this will ultimately lead to aggregation of servers, which may potentially stay behind idle. The banks will not be permitted to put away on CAPEX and attention cost which derives important cost efficiencies by provisioning resources on-demand. Cloud solutions become supple and scalable - ability and indulgence power is upgraded for hit the highest point times and downsized for quieter periods. As a primary step, cloud providers be supposed to
give details the outlay and implications of migrating existing banking applications and communications to the cloud.

- **Choose service providers with proven expertise in cloud services management**
  most excellent direct cloud services release programs must be managed while using Service providers who have invested in pilot projects will encompass real-world knowledge and business cases for cloud computing initiatives. Banks should start small with applications such as CRM and then shift on to core business applications.

- **Understand data confidentiality and regulatory requirements**
  Banks be supposed to remain responsive data within firewalls to make client confidentiality supplies. So, it is a better first choice than public or cross clouds. As community clouds will gain trust and confidence among customers, it can be slowly transited to these models. Initiatives such as the Cloud safety Alliance are looking at these concerns.

  ➢ **Banks to overcome distribution and marketing challenges**
  Now a day banks need to successfully overcome specific distribution and marketing challenges in the following three ways:

  1. **Restore customer trust and engagement**
     There is lack of transparency and fairness and increasing demand for social responsibility;

  2. **Hold their ground with their payments business**
     The market will be made witness to progressive disintermediation where “banking without banks” and a rapid rise of ecosystems will be created a new market paradigm; and

  3. **Avoid communization**
Going forward, banks need to differentiate the customer experience, products and services.

**Smart Banks**

Customer behavior is being changed through the use of web, mobile and social connectivity and “smart banks” are being motivated to re-examine and re-engineer their business models. Accenture sees at least three unique business models emerging among smart banks:

1. The “analytical multichannel” bank
2. The “socially engaging” bank
3. The “digital ecosystem” bank

**1. Analytical multichannel:**

The “analytical multichannel” is a function which offers personal preferences and is underscored by:

- Advanced multichannel integration can be focused on digital channels and integrated Architecture;

- Pervasive analytics based on effective customer data collection and micro Segmentation will define new products and pricing; real-time interaction management (i.e., predictive modeling and real time events management);

- A product offering based on micro segments and optimized by channels.

**2. Socially engaging:**

The “socially engaging” customers who spend their time leveraging information provided via social media are contacted by banks. It depends on:

- Customer feedback and preferences.

- Social digital marketing to engage the customer with the proper content; and
- a product offering defined by social CRM and enriched customer data through social media tools.

3. Digital ecosystem:
The “digital ecosystem” banks are offered extended services by leveraging a dynamic network of partners. It is distinguished by:

- An enriched proposition through mobile commerce, geolocalization and hot deals;

- The active use of mobile payments based on near-field communication (NFC) or mobile wallet; and alliances and partnerships with nonbanking operators.

It should be achieved by banks these attributes the new technology should be adapted landscape outlined in the Accenture Technology Vision 2012. For banks, this new world can be characterized by three main technology trends:

a.) Distributed IT will be the new normal
Data can be dispersed across more locations—in-house, outsourcing vendors, cloud computing providers, including branch versus corporate, business versus IT, one business unit versus another. Analytics can intersect the distributed data and become distributed.

b.) Distribution requires decoupling
The decoupling and disaggregation of banks’ business process flows, applications and infrastructure can be enabled to improve business agility, including faster and lower-cost geographic expansion, and easier adoption of new technologies such as mobility and social media.

c.) Exploding volume of metadata yielding greater insight
The rapid digitization of banking channels and services cannot be able to track and analysis of everything from keystrokes to consumer behavior to social identities.
More opportunities can be brought for more sophisticated customer intelligence, enabling banks to migrate to “social enterprises” and maintain their relationships with customers.

- **Smart cloud-based bundling puts the customer in control:**
  Traditions become the chief obstacle to succeed in the social and mobile surroundings. Today nobody be able to own the client and online public financial providers have grasped this actuality. New applicant Bank easy, recognized today as only simple, serves as a display place for its online clients to access mobile and web-based financial services banks have coloration with a lot of other entities to make available wide range of service because now clients vision is must. Then innovate to deliver beside that view. The key to this novelty is bundling. Core banking products such as checking financial records are more and more undifferentiated. The real separation may possibly be seen in the pricing and bundling for clients. position their product engine be able to be located in a cloud, while retaining a unique and stylish bundling potential works jointly and combines cloud-based mechanism in receptive, specific clients are related with all above. It depends on market, and will be further than financial products. For instance, banks in France are bundling individual home be concerned services such as gardening. Further opportunities will survive when clients with digital storage “safes” in the cloud, bundled with value-added services like tax, economic and wealth administration recommendation. Cloud-enabled digital wallets carrying a range of different services on smart phones are another high potential area. In the absence of such agreements, telcos might start providing these services themselves—without the banks.

- **Cloud-based offers leverage social and mobile media to transform the banking experience and relationships for customers:**
  Banking services be able to be obtainable to disaggregate, and moving information, guidance and money in a quicker, more approachable and more modified way, these new entrants contain a aim to make the “front office” for customers’ banking requirements, leveraging the social and movable experiences that is found complicated to clients. While cloud-based applications such as peer-to-peer lending and mob sourcing of loans (often microloans) are in advance momentum. And banks’
role in payments—including in the up-and-coming area of m-commerce and mobile wallets—is being challenged by online heavyweights PayPal, Google and Facebook.

1.15.5 Cloud Computing Threats
Supply and demand depends on it. On the supply side, it is enabling new entrants into the market, lower cost platforms are made by it. On the demand side, it is enabling customers to make direct relation with banks. For banks, to talk with customer is not time wasting because customer needs personal attention. If banks fail to reinvent their services the customer can go to new service provider who understand and harness the new paradigm more effectively. This would ultimately relegate banks to a back-office usefulness running bank financial records at the back these third-party cloud-based front-ends, to dole out just as narrow gatekeepers for behavior such as anti-money laundering (AML). Banks contain been opposite these intimidation for long to their obtainable model at a time when savings in client service are tightly forced and the financial disaster can damage a belief of client. Also, dogmatic, market and client pressures on their attention based profits (e.g., loans) mean banks be supposed to make balance in attention earning revenues and towards revenues from services. These service revenues are precisely the ones that are most threatened by third-party social financial sites like wesabe.com and P2P lending sites such as yes-secure.com. This competition makes some formal relations with bank and customers, thus compounding the impact on revenues. The tools and capabilities will be offered to refuse to accept disintermediation by leveraging social/mobile networking and differentiated bundling capabilities for the altering customer outline. Many banks are responsibility it.

- Banks reaching out in the cloud:
Various social media strategies have been implemented to communicate better with its customers, including a blog that actively seeks questions and comments from customers, a We Tube channel, and a service that will be allowed to customers to talk to bank staff through Twitter or other social media. Bank of America uses Twitter as a customer service and advice tool, and reports that customers find it a faster and more effective way of getting the help they need.
- **Private clouds come to dominate core banking:**
  Customary behavior is being challenged of premarital slating their business necessities into IT solutions. The role of the IT purpose is set and also requiring a new supremacy replica, new skills, new behaviors, and new ways of sourcing IT communications and service, outstanding to changing client demands banks be supposed to center on their key differentiators and change their operations by adopting a lower-cost, more elastic and more scalable in service model, and by moving to a service leaning state of mind. Assist is done by enabling banks to crack down obtainable silos, decouple corporeal from effective IT, and divide manufacture from sharing.

- **Data security drives choices**
  The relevance of cloud solutions for executing these changes are appreciated by banks. Many are reluctant to entrust their sensitive customer and financial data to public cloud services run. Data privacy and security regulations are prohibited to storage and processing of customer data outside national borders. Banks are also wary of the potentially disastrous impact of a serious breach of security or privacy, or a brief outage in areas like ATM operations, fraud monitoring or credit card processing. Many banks, therefore, take the view that core banking should be kept in processes under complete control in their own data center so they know where the data is at all times. For example, banks together with Metro Bank in the UK and Sofol Tepeyac in Mexico are by means of Temenos’ T24, the primary production-grade core banking scheme that runs in the cloud. The Varolii cloud-based right to be heard dialers are used in a lot of banks of US because it saves time and money for instance it saved between $8 and $25 per call, and cut first expense defaults by additional than 60 percent.

- **Public cloud will dominate non-core and non-differentiated banking activities**
  It is provided to banks with new lower cost operating models thanks to virtualization, greater automation, and the ability to push more activities offshore. There are many benefits so banks will change their system towards cloud computing system it will integrate into the legacy environment.
For banks it is too hard to choose and pursue the right business case because technology has become critical. For example, if a bank makes a concerted move into BPaaS or SaaS, it will need certainty over the continued availability, reliability and utility of the cloud platforms underpinning them. Not all banking activities will move onto the cloud in the next five years. Implementation of cloud models normally has maximum shock in areas of the worth chain with the most unpredictability. Banks that administer higher business volumes with slight difference might find the best monetary option is to balance offshore labor arbitrage with the use of cloud computing. at the same time as safety concerns mean many banks are unwilling to use public cloud services in core banking, community cloud has a huge role to play in banks’ straight and back office process not directly connecting responsive client data. For banks, those enterprise processes that are best suited to public cloud include procurement, HR and customer relationship management (CRM). Salesforce’s CRM cloud has gained strong ground among banks in the past couple of years, and Spanish banking group BBVA recently announced that its whole workforce can be migrated to the cloud-based

1.15.6 The future of cloud computing in banking
As Competition, Collaboration and Convergence are taking part in banking sector all over the world therefore the future of the cloud computing in banking system is very bright. Following are the seven ways in which cloud computing can impact future banking products, services and technologies.

1. Customer relationships will be redefined
The overreaching and most disruptive impact of cloud computing will be how it redefines the relationship between consumers and their providers of banking products and services These services can be made more convenient, more accessible, easier to use, and more personalized by cloud computing to the individual’s needs and lifestyle. This is both a threat and an opportunity.

2. Cloud computing will steadily progress at all levels of the stack
As confidence is growing and more banking cloud products and services are being emerged, usage of cloud models will be continued to advance at all levels of the IT
stack. Currently, IaaS and/or SaaS are being focused by many banks, having virtualized their infrastructure and started to use SaaS for undifferentiated activities. There is also sporadic adoption of SaaS among banks that have yet to virtualize their infrastructure, enabling them to pursue IaaS in parallel with SaaS. While adoption can be continued, the pace will vary by bank and geography due to regulation, the status of their legacy systems and the levels of flexibility among their employees. With cloud-based BPaaS, there are similarities with the way endusers will scale up or down their space usage on the cloud today by provisioning or removing capacity. The same approach can be taken by banks with their own systems and processes. Scale of IT infrastructure can also influence cloud computing adoption. Newer and smaller banks built on client/server architectures have less overlapping legacy systems and infrastructure, and will therefore be quicker to adopt cloud technology higher up the stack. Larger banks currently tend to focus on virtualization, and may be culturally more resistant to expanding their adoption at the higher levels.

3. **Non-banking cloud-based competitors will keep up the pressure**
   The up-and-coming cohort of cloud-based, socially-driven money administration apparatus are client services and knowledge innovators. Banks will try to make more and more customer and also will try to get customer from additional banks. So, banks be supposed to be sustained to respond to these spirited pressures in order to avoid disintermediation-by investing in capabilities around public media, analytics, and beleaguered product and service bundling.

4. **Collaborative cloud-based shared services will emerge between banks**
   In a parallel way to Telco’s sharing network communications, “banks must start to work together to pool non-differentiated behavior into joint ventures using private clouds within a closed assembly of banks,” the authors forecast. These joint cloud-based ventures will make available joint services because it will create free banks from the load of schedule communication.”

5. **Cloud-enabled collaborative bundling will expand across and beyond financial service**
Banks possibly will also apply their cloud skills and assets to even shift into non-bank services it be able to be practical by banks. As we know cloud is blurring the appearance between IT providers and clients. Sardet and Viale tip out that a bank could potentially operate as “an integrator and aggregator of a varied array of products, by means of its differentiated cloud-based bundling ability as the stick. To join this ecological unit, third-party specialists inside and outside economic services—from accuse cards to concierge services to amusement and sports—will move around their offerings to the cloud so banks be able to integrate them extra easily.”

6. Emerging market banks will lead cloud-based innovation

Emerging market banks have less systems and infrastructure legacy than their counterparts in markets. Faster economic growth and distinctive social needs are affecting banking market. Witness the success of M-PESA in Kenya and other emerging countries, and the provision of online and mobile market information for farmers in India and Bangladesh. A consortium to leverage a shared can be chosen in a cloud based core banking infrastructure. In this case, if they could collaborate to build and share a new core system that will allow them to be more flexible and create more products for their customers. In a number of Latin American markets, the largest two or three banks might be able to invest millions of dollars on their infrastructure but they would be the exception. In Panama, for example, there are nearly 50 banks that have assets of fewer than $5 million. [73]

1.16 Objectives of Research

After deep discussion in above stated sections about the cloud computing, security and banking sector, our thrust of research towards secured and scalable operational model in real time banking system using cloud computing has augmented. We have divided our objectives of research in two broad categories i.e. main objectives and general objectives, which are interrelated to each other. Following are the main and general objectives of our research
1.16.1 Main Objectives:

The principle of this research is to fulfill the following main objectives of the research. The main objectives of our research are:

1. **Develop an Model:**

   The main and of utmost significance of this research is to develop an model for cloud computing which could able to provide the secure and scalable operational in real time banking system

2. **Develop an Algorithm:**

   To explain the step by step working of the model our next main objective is to develop the algorithm for secured and scalable operational model in real time banking system using cloud computing.

3. **Justification of Model and Algorithm:**

   To justify that the developed model provide the solution for cloud computing which is able to provide the secure and scalable operation in real time banking system is our final main objective of this research.

1.16.2 General Objectives:

Beside main objectives of research following are the general objectives of the research:

1. Identification of security challenges in adoption of cloud computing in Banking Sector.

2. Comparative analysis of existing security system in legacy system and cloud based system.
3. Devise a feasible solution for security and scalability in banking sector for adoption in cloud computing.

4. Design and Develop a real time security mechanism for banking information system over cloud computing.

Thus in this chapter we have introduce about characteristics of the cloud computing, the layout of cloud computing, combination of basic platforms, benefits of cloud computing, cloud computing types based on capability and access, Implementation of cloud computing, cloud computing and grid computing. Apart from this we have also discuss about the IaaS, SaaS and Paas. We have especially focused on the benefits, concept, categories and implementation issues of cloud computing. We have also discussed about the Public, Private, Community and Hybrid Cloud, Hardware evolution, security, legal issues in cloud models, cloud computing in real time banking system, Advantage of using cloud computing in Banking, Security issue regarding cloud computing in Banking, Fundamentals of traditional commercial banks, Reason of cloud computing in banks, Cloud computing threats, the future of cloud computing in banking and objective of this research.