CHAPTER 1

INTRODUCTION

In the past decades, the growth of high-speed networks boosts millions of internet-based queries in the cloud as well as massive transactions of concurrent queries of e-commerce which creates an alarming situation in the domain of data handling and processing. The large-scale data centers would act over hundreds and thousands of servers for consolidation to minimize the ever-increased demand with infrastructures such as network systems, cooling methods, and storage. Based on pay-as-you-go utility computing is delivered this commercialization of these developments is defined currently as Cloud computing.

Traditionally, business organizations accustomed acquisition and maintenance of machine resources invest a large quantity of capital and time.Provision of on-demand access to these ascendable infrastructures and services due to the emergence of Cloud Computing rapidly changes this ownership-based approach to a subscription-oriented approach. Within the cloud users, they will access, store, and share a random quantity of knowledge in the Cloud. That is, buying, configuring, administering, and maintaining their computing infrastructure ought not to worry concerned a little or medium by enterprises/organizations.

They can specialize in on-demand computing resources, quicker and inexpensive software system development skills, and abilities at low-value exploitation sharpen their core competencies. Moreover, a tremendous quantity of information is generated nearly a day that

an organization needs to be processed which will provide reasoning power can jointly offered by Cloud computing. For example, money firms have to be compelled to maintain a day the dynamic data regarding their many shoppers, and genetics analysis should manage large volumes of gene sequencing knowledge.

The locus of the computation will move once more with the current drift, through the internet capacities information is moving outward from the data centers. It shows a return to the time-sharing-based computing by the unused administration, in the event that as it were since there's no center. User or client on the Web can communicate with a number of servers simultaneously, some of which may moreover be trading data among them. In any case, indeed in the event that there is no return to the design of time-sharing frameworks, the sudden stunning quality of the cloud worldview marks the inversion of an established slant. In this situation end-users or clients and corporate IT supervisors once quarreled over ownership of computing assets, both sides are presently ready to yield an expansive degree of control to third-party benefit suppliers.

1.1. Information Activity Scenario

A later IDC thinks about claims that by 2025, around the world information activity will have developed by 61 percent to 175 zetta bytes, with generally 75 percent of the populace having at slightest one information interaction every 18 seconds. As worldwide web entrance rates proceed to develop and associated advances enter the standard, it's clear that the number of information centers around the world is progressing to keep on expanding [2].

"The European Code of Conduct for Information Middle Vitality Effectiveness program – a deliberate activity made in reaction to expanding vitality utilization within the division– dates back to 2008," de Rul notes. "Yet there's unquestionably a recharged center on the subject, as the ever-increasing request for information has made a parallel request for vitality."

"By building up proactive maintainability and proficiency measures at beginning, leveraging the most recent innovation these companies can guarantee that the office can be worked, kept up, repaired and restored effortlessly, moving into a more circular utilize of materials and more astute, cleaner way of devouring vitality and water."

A manufactured insight is additionally being sent in a few information centers to decrease control utilization. AI can dissect information yield, mugginess, temperature, and other critical measurements in arrange to discover a way to progress effectiveness, drive down costs, and decrease add up to control utilization.

1.2. Problem Statement

With the above scenario, we interpreted that a lot of people using internet shares their data through many web application, mobile application and desktop application, these applications for permanent data storage using cloud storage, all people data stored on the cloud and when people share, update, delete and add data event get generated to execute the request, here a lot of people generating the same event again and again which is called a duplicate event, due to this processor have to work more and more, it increases the load on servers which results in power consumption, excess heat generation, needs more air conditioner solutions to cool the server, needs more network bandwidth to handle a huge number of event.

1.3. Objective

- In this work, we have studied & analyzed the effect of the increase of computational load in cloud computing.
- To address the above, we have developed a model which reduces these increased events due to tasks from a large cloud user community.
- To reduce these events main task is identification, grouping, and redundant and duplicate events in the cloud.

Study & Analyze the effect of an increase of computational load in cloud computing:
Study and analysis of the effect of an increase in service-related events to complete tasks generated by cloud users from various platforms. Environmental impact of these increased events in the context of more and more energy requirements and consumption for a cloud server to complete tasks, as well as to maintain external real-world conditions favorable cloud computing, like the need for more cooling and air conditioning solutions. A methodical analysis of the Cloud is required to design such solutions for their optimum and efficient power utilization.

Model for efficient and effective Event reducing approach: To address the over said challenges, we have created a productive and successful event reducing approach for Cloud Computing that leads to a reply to the past challenges. We have created event-reducing approaches, like event clustering, grouping, and reducing, to decrease the duplicate and redundant events from the task of cloud users.

Identification, grouping, and reducing redundant and duplicate events in the cloud: Development of a mechanism to handle issues related to event identification and processing with the help of event identification methods and processes them as input to our developed model which takes these events and optimizes them to develop a more energy-efficient model.

1.4. Significance of the Work

The production and consumption of data and communication technology products and services still grow worldwide. This trend is amid a corresponding increase in electricity use, still as direct environmental impacts of the technology. However, an additional difficult image of effects is rising. Positive indirect effects on an environmental property may be seen in substitution and improvement (enabling effects), and negative indirect effects may be seen in further demand thanks to potency enhancements (rebound effects)

Concurring to Pranav Prakash, the presales expert at Photon, the information center carbon impression is discernable:

"Data centers are responsible for 17% of overall carbon emission because of technology. The power needed to operate these data centers in the form of electricity is almost thirty billion watts. Ninety percent of the electricity in the form of energy with respect to the total energy consumed by these servers is waste because servers are not run all the time at their full capacity"

For an information middle to stay utilitarian, it either has to have been built in a nation with an actual cold climate or to be housed in a temperature-controlled environment that must be kept up circular the clock. Agreeing to studies, around 40 percent of the whole vitality that information centers expend goes to cool IT hardware [2]. The developing request

of Cloud foundation has definitely expanded the vitality utilization of information centers, which has ended up a basic issue. Tall vitality utilization not as it were deciphering to tall operational fetched, which decreases the profit of Cloud vendors, moreover leads to moreover lead to a large number of carbon emanations that aren't naturally inviting so there is a need of energy-efficient approach in cloud computing.

With the quick expansion of cloud administrations, the information center servers are encountering expanding computational stack each year. The electrical control devoured by IT gear is changed over into warm. A rise to the sum of control is required to evacuate that warmth in arrange to preserve an appropriate working environment through a cooling instrument. The cooling component works by blowing the cold discuss through empty floor tiles towards server racks. As a normal handle, the temperature of cold discusses blown from the floor vents gets to be more than the set temperature close the beat of the racks. In expansion to that, the hot discuss blown out from the discussed cooled servers from the back of the racks rises and gets blended with the cold discuss close the best of the racks. This distribution of warm increments the cold discusses temperature as well. In this way, the best-mounted rack servers ended up the casualties of gulf temperature increase.

For the person, add up to control comes at a cost. The Computer program must be introduced and arranged, at that point overhauled with each modern discharge. The computational framework of working frameworks and low-level services and functions must be kept up. Each renovation in the working framework starts a cascade of consequent corrections in other different programs. Outsourcing of computations to an online benefit dispenses with all these issues. Cloud computing moreover provides end-users or client's points of interest in form of versatility, association, and cooperation.

Application software traders are motivated to shift their commercial activities into the cloud because of the forcing power of clients who compares the services of the cloud with other platforms. Sale or authorization of application software as a product for user devices must be capable to handle an outstanding multidisciplinary working environment. In other words, application software can be created, tried, and run on a computing platform of the vendor's choice. Renovation and bug fixing is performed and conveyed in a short duration. But the

difficulty of connecting server-side application software with client multidisciplinary working environment is still a challenging job.

Although for inefficient use of web computing, the main driving factor is its centralized nature of computing. But it still has the property of centralizing and decentralized computation. The main objective is to centralization of the execution and storage of application programs to which all other executing nodes are connected with a high-speed network and this connected functional networked system is monitored carefully. Since nodes of this functional networked system are the end-users or clients who generate a request for services and in response to their request, they receive services of their requirement.

1.5. Organization of the Thesis

This thesis proposes a model that will be efficient enough for event-driven dynamic composition methods to provide state and notification management during the execution of cloud processes for better environmental effects. An outline of this thesis is shown as follows:

Chapter 2 provides an overview of concepts of Service-oriented computing, standards, and specifications related to Web services, Event-driven Architecture, Component-Based Architecture, and Cloud computing.

Chapter 3 discusses the various research work that has been taken before in respect to event-driven cloud computing and the work done for the better environmental impact in the field of computing.

Chapter 4 describes the concepts and implementation of our approach for events, clustering, Cloud computing. It presents the usage of log data of cloud servers to achieve the required middleware support for the execution of the workflow and to achieve the best state during the execution of a cloud process. It also discusses the implementation of the prototype system and the development of the model using existing standards, protocols, and tools.

Chapter 5 summarizes our work and discusses the future direction of this research work

The chapter had discussed the present scenario of the information blast in the world with relevance to the distributed environment computing, how the information propagates from one place to another. We have discussed the problem which may turn out in the adverse of the environment arranging in the problem statement. We have discussed & overviewed the various objectives of the research work, tracing out the significance of the work with the present scenario. In the last, we summarized the content of the thesis with the organization of the thesis.

CHAPTER 2

BACKGROUND & BASIC CONCEPTS

To overcome the challenges of SOA Cloud Computing could be a most promising and rising worldview. Gartners's best 10 key advances list, Cloud Computing holds to begin [1]. With the current necessities of the deployed application, the procured and discharged assets like computing capacity and capacity or administrations like databases or informing frameworks will be guaranteed. Like virtualization and ideas like benefit arranged in engineering may be a combination Premise of cloud computing. [3]. the stage and type of application can be portrayed by Cloud computing. The arrangements design reconfigures and de-provision servers powerfully staged in cloud computing. Physical machines or virtual machines act as Servers within the cloud. Other security devices, storage area networks (SAN), network equipment, firewalls are the advanced resources typically included in a cloud[5]. Have a notion for Cloud and network usage in it.

2.1. Service Oriented Architecture (SOA)

Service-oriented architecture is a structural fashion for utilizing dispersed capabilities and organizing them that will be beneath the distinctive proprietorship spaces control and executed utilizing different innovation stacks. In a Benefit Driven approach, an Enterprise's design is created for benefit arranged designs (SOA), where their independent benefit. The client objectives and/or organization's trade objectives forms bolster freely with the coupled administrated are organized into commerce [8].

A client without having consolidation of the code conjuring many of the fair components of the reusable code, in respect to the running program for benefit. A benefit by definition is reusable and replaceable, that's, the benefit is reused once more and once more by other administrations for the usefulness it gives, and benefits supplier usage can be supplanted by another provider's usage.
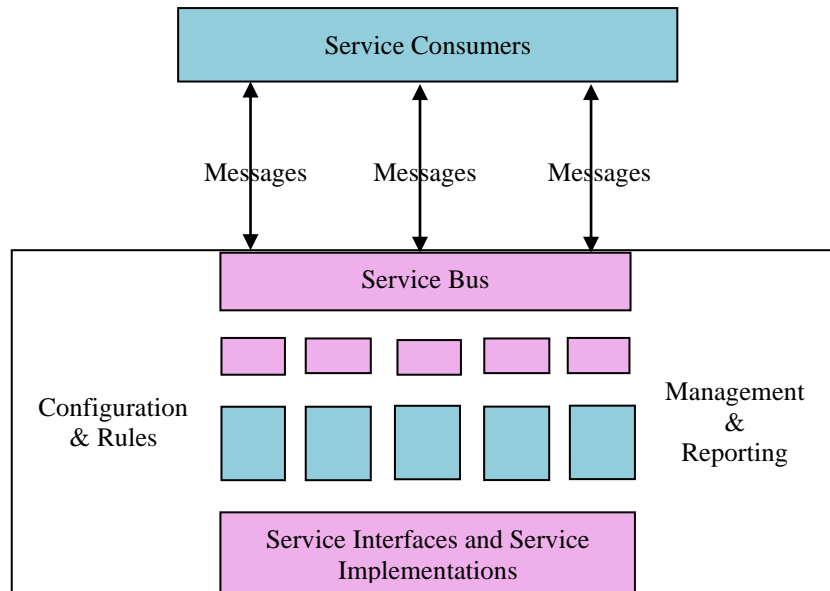

Figure 2.1: Service-Oriented Architecture

Within the SOA administrations can be categorized into basic/foundation administrations, security administrations, commerce administrations, entrance administrations, etc. It ought to moreover be famous that a benefit is advertising particular usefulness for a Venture and rises above ventures; the benefit is as it were actualized once in undertaking design and can be reused over ventures that bargain with conveying a substance, multi-media,administrations, etc. Within the SOA the communication stream was closed to unused unexpected inputs as the communication stream has begun, i.e., they are regularly well-characterized and boundaries were well set. [7] The utilization of SOA has different complexities that are, the administrations ought to be total, promptly accessible, and cannot be changed once it has been utilized. To overcome these issues Service-oriented architecture was presented. Since occasions were colossal, non-concurring, & eccentric.

2.1.1. Principles of Service-oriented Architecture

- Loose coupling
- Platform independence
- Discoverability
- Flexible configuration
- Reusability

2.1.2. Challenges in SOA

Cloud computing may be a prominent & rising worldview to overcome the challenges of SOA. Gartners's beat 10 vital innovations list Cloud Computing holds to begin with[1]. It guarantees that assets like capacity of computing and capacity of architecture like databases or informing frameworks can quickly be procured and discharged based on the current necessity s of sent application.

The Premise of cloud computing may be a combination of a few well-known advances like virtualization and ideas like benefit situated engineering [8]. Cloud computing portrays both a stage as well as a sort of application. Cloud computing offers a platform that actively schedules designs, reconfigures, and de-provision servers as required. Servers within the cloud can be physical or virtual machines. Progressed cloud ordinarily incorporates other computing assets such as storage area network (SAN); organize types of gear, firewalls, and other security gadgets [10]. Cloud applications can be open through the web.

It misuses expansive capable servers and data centers and that have web administrations and web applications. Anybody can get utilize a cloud application by appropriate web association and a standard web browser [10].

2.2. Event-Driven Architecture (EDA)

EDA rises to make an effective & dexterous application, it grasps components for planning the callers and needs of the suppliers for benefit, developers and customers of information, sensors, and responders of program architecture with diversifying level of communication coupling, with a variable range of message relationship and with variable alternatives to provide quality of benefit. EDA incites to arrange that tunes in to thousands of approaching

events from diverse sources, wherein complex events preparing comes about in planning framework reaction [4].

EDA bolsters energetic, parallel, off beat streams of messages and thus responds to the outside response that can be having eccentric nature. An EDA can behave synchronous or non-concurrent between program end-points and conceivably give both synchronous and offbeat get to between the member's same property. In EDA, execution of synchronous streams can run freely for each other to fulfill a client request for framework duty, regularly an event carried serves as a stage to oversee the integration and/or choreograph bigger prospects [4].
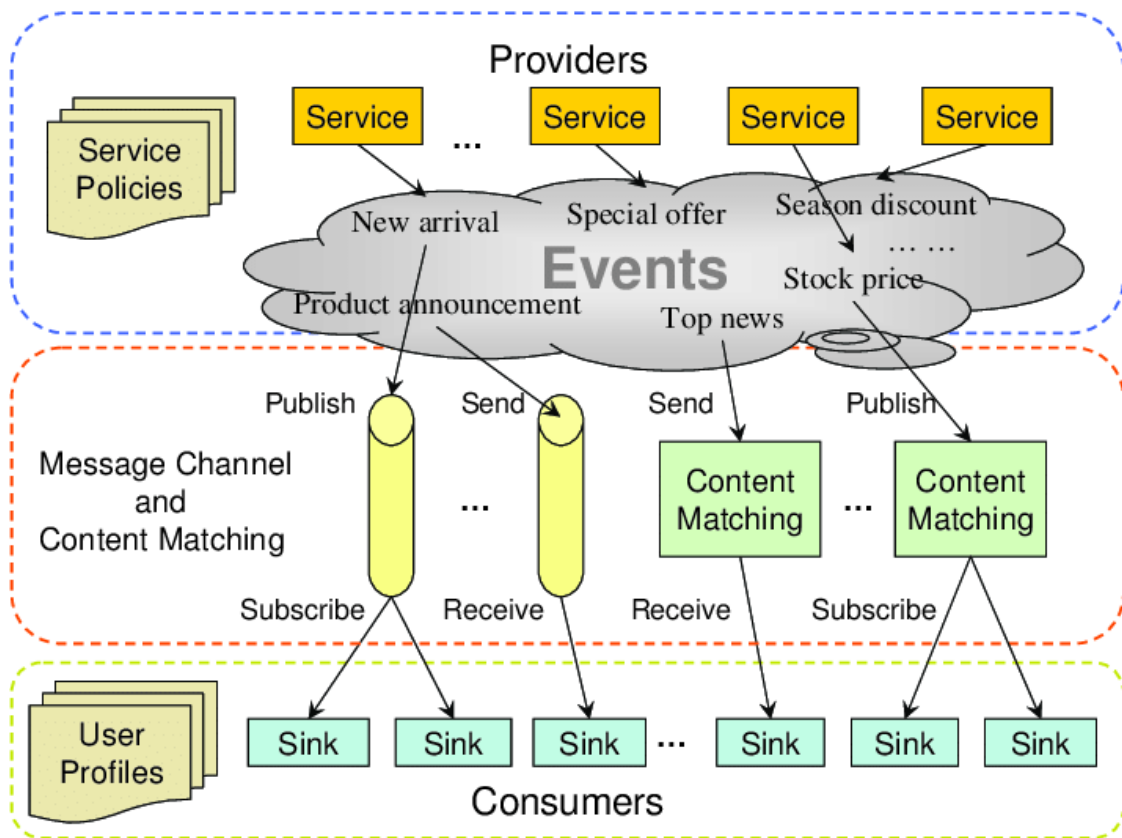
Figure 2.2: Message-based-event-driven-architecture

In EDA an occasion is really benefited ask and is utilized to control the independent components which act, and decoupled completely. The stage of event handling will be the events that are sent through the middleware application to all the clients who will work for it.

The other components choose themselves which sort of occasion they will subscribe to or on which they will react [8]. They utilize SOA in building EAs was collected to illuminate the issues for reliance & software complexity. Administrations are the driving constrain for way better events codes.

Integration gets to be a really basic errand with getting to usefulness promptly accessible. Subsequently, applications may convey considerable benefits by leveraging prepared administration devices and within application code. Where the sum of information to be exchanged is generally little and clients are willing to hold up a moment or two for a reaction the web services, work exceptionally better within the disseminated atmosphere of the Web, and where administrations have clear work and reason. Utilizing administrations in EAs is much more complex and presents challenges for designers [6]. Components are utilized to overcome these challenges of SOA. Component-based computer program improvement gives an assortment of points of interest; it oversees complexity more successfully, diminishes advancement time, produces way better quality programs, and increments reusability.

Event-Driven Architecture (EDA) mainly uses events to complete tasks in the cloud. In cloud computing, several events are generated from cloud users. Further for completion of these tasks, various services on the cloud need to invoke several services which need to be combined. The Combining of these services is called service orchestration. The service orchestration process uses the huge number of events generated for orchestrations of services.Many of these events generated for service orchestration are duplicates and redundant. These duplicate events are overhead for cloud servers.

2.3. Component-BasedArchitecture (CBA)

The stage for conveyed component-based design which ties components and methods for creating coarse components that's environment/container mindful, which breaks down a benefit, into numerous pluggable and distributable parts related with introduction rationale, commerce rationale, asset get to rationale, integration rationale, arrange occasion rationale, security rationale and more [5].

Component-based approach evolves are object-oriented design principles whose basis is as follows:

- Encapsulation

- Polymorphism

- Inheritance

The premise for disseminated component design which ties instruments and methods for creating environment/container mindful coarse components, which breaks down a benefit, into numerous distributable parts & pluggable related with introduction rationale, trade rationale, asset get to rationale, integration rationale, arrange occasion rationale, security rationale and more. [5].
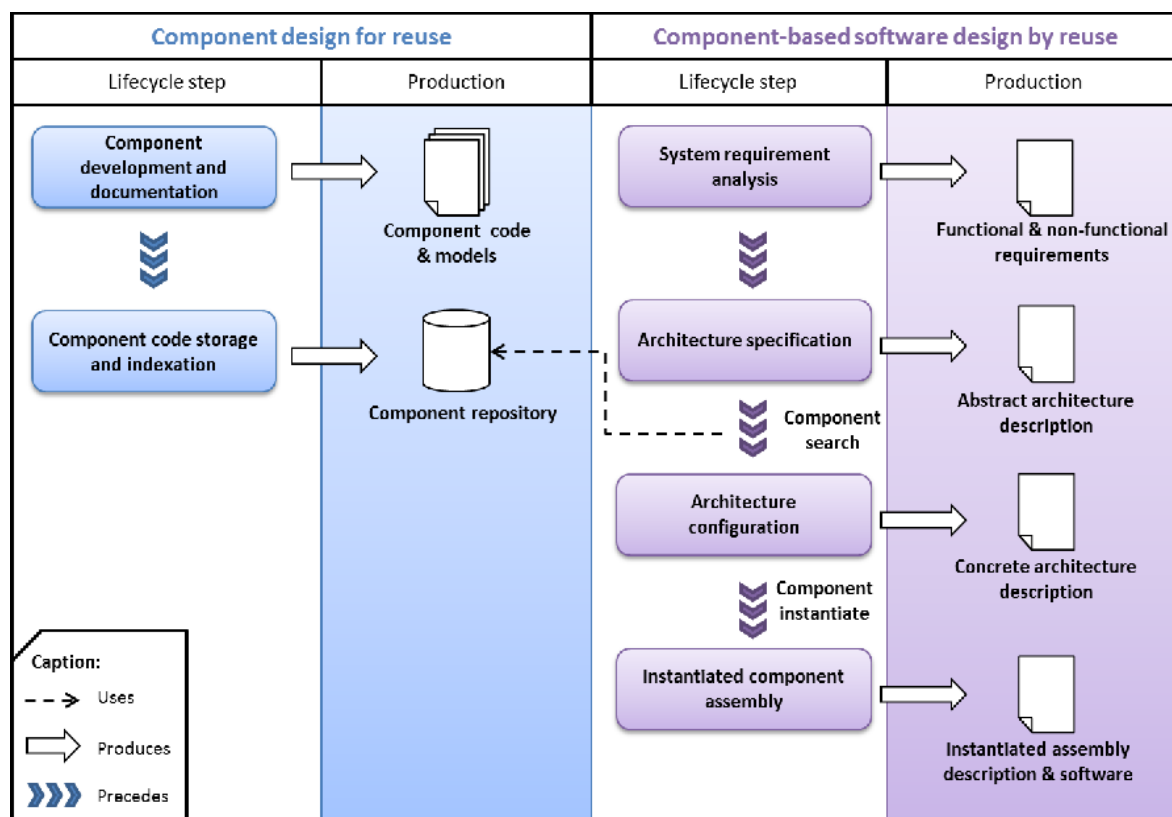

Figure 2.3: Component-based Architecture

2.4. Evolution of Cloud Computing

When individual computers come into existence around the 1980'sthere was a need for the guarantee of "freeing" programs and information to become the physical centrally computing

center. People were free to govern the claim computing environment, selecting computer programs to suit the needs and customize frameworks to the tastes [1].

But Personal Computers in segregation have a self-evident shortcoming: In a large number of cases traces in which the sneaker-net was the essential implies of sharing & collaboration. The client-server demonstration presented within the 1980s advertised the centralized store for shared information whereas individual computers & workstations supplanted end points, permitting people to run programs locally.

Whether it's called on-demand computing or cloud computing, computer program as a benefit, or Web as a stage, the common component may be a shift within the geology of computation. After they make a spreadsheet with the Google Docs benefit, major segments of computer programs dwell on inconspicuous computer machines, whereabout obscure, conceivably scattered over physical distances.

The migration from locally introduced programs to cloud computing is fair enough to take beneath way to the effectiveness. The Reuse and destroy program is still overwhelming to popularized and isn't easily finished, but the center of advancement without a doubt appears to be rising into the clouds. A few considerable divisions of computing action will relocate absent from the desk computers and the server room at the cooperating level. Alter would influence each & every level of the existing system at the computational level, from general user client to computer program designer, IT chief, indeed equipment producer.

What we are seeing presently assume at this moment coming from cloud computing. Nearly fifties, a long time back a comparable which will arrive due to the need of agencies for the time-sharing framework is centralized computing. Star network provided a common platform for time-sharing benefits. Instar a network, multiple clients connect to centralize computing resource which is called a server. Clients at terminals communicated over the network with a centrally located server machine where the processing of computing tasks was done.

2.5.   Cloud Computing

The National Institute of Standards and Technology (NIST) characterize cloud computing as "a

demonstration for client comfort, on-demand arrange get to contributes the computing assets (e.g., organize, capacity, application, servers & administrations) that can be actively realized by the negligible exertion of administration or benefit obstructions supplier" [3].

A cloud would be seen as a virtualized computer assets pool that can be [1]:

- Employments and intelligently client confronting applications to host an assortment of distinctive workloads counting bunch fashion back-conclusion.

- Through the quick provisioning of virtual machines or physical machines, it allows workloads to be conveyed and scaled out rapidly.

- Support repetitive self-recovering, exceedingly versatile programming models that permit workloads to recoup from much unavoidable hardware/software disappointment.

- To empower rebalancing of assignments when required Monitor asset utilizes in genuine time.

A cloud is considered a set of computer assets. A cloud gives a way to oversee the various assets; administration incorporates provisioning, alter ask, workload rebalancing, de-provisioning, and observing [9].

2.5.1. Foundation Stones of Cloud Computing
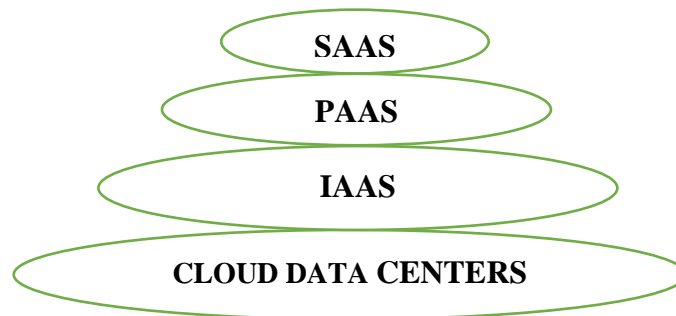
Figure 2.4: Foundation Stones of Cloud Computing

Cloud computing grants numerous clients get to a single server to perform a few operations on their information without acquiring any permit for different applications [3]. Cloud computing gives tall speed administrations at exceptionally moo fetched. Cloud computing makes modern issues and challenges execution issues. For handling request processes made by clients, there are no existing techniques available to deal with this problem. Cloud information capacity alludes to a dispersed framework. In cloud information capacity clients

routinely overhaul put away information, files[4]. He may perform a few operations counting addition, cancellation, alteration, reordering on putting away information. Cloud information capacity has a few highlights like adaptability, taken a toll administration, unwavering quality, support, area autonomy.

Cloud computing could be a common term for anything that includes facilitated administrations over the Web. These administrations are broadly partitioned into three categories:[1]

2.5.2. Infrastructure as a Service (IaaS): In IaaS shows computer assets such as capacity, computing capabilities are made accessible to the client on request. Its fetched sparing demonstrates. This demonstrates the client as it paid to utilize IT foundation as required [1]. E.g.: Amazon Web-Services, Virtual machines, servers, storage, load balancers, network.

Multi-Cloud Infrastructure   Data Centres (Servers)

Service Provider

Application Clients (End Users) & Applications
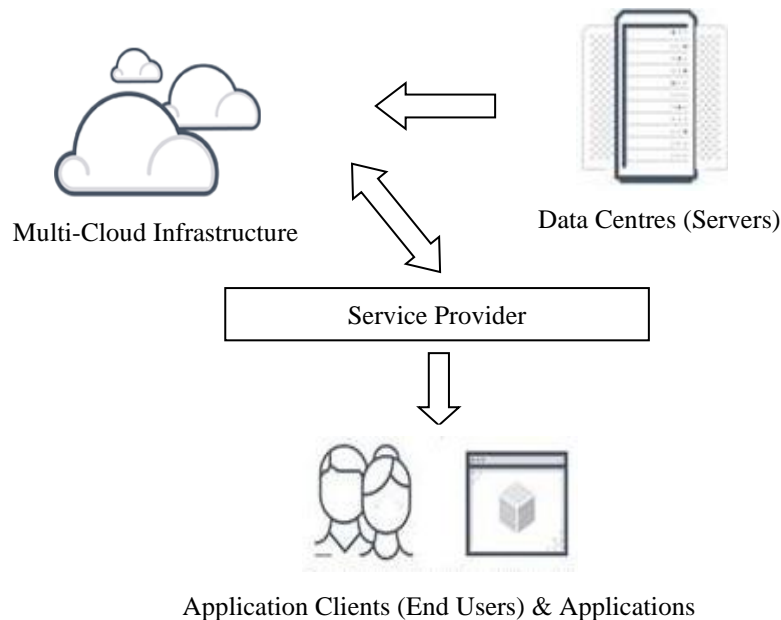
Figure 2.5: Infrastructure as a Service

2.5.3. Platform as a Service (PaaS): Within the PaaS show an improvement environment is advertised to the client who is overseen by the supplier. On which clients can create and run their applications without building and overseeing complex frameworks[1].

E.g.: Google Application Engine, Execution runtime, database, Web-server, Development tools.

Software & Operating System

Cloud Services

Data Centres (Servers)

Service Provider (Platform)

Application Clients (End Users) & Applications
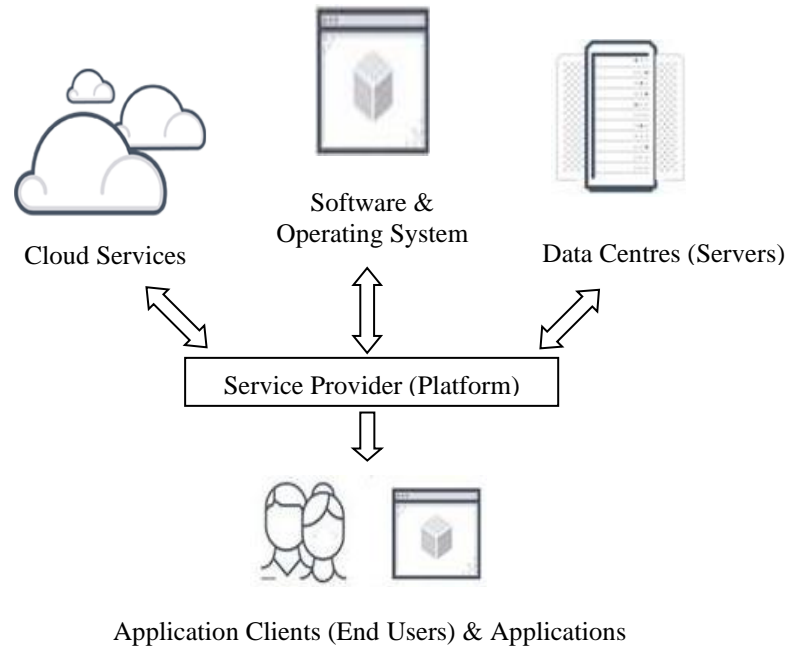
Figure 2.6: Platform as a Service (PaaS)

2.5.4. Software as a Service (SaaS): Within the SaaS show an application is advertised to the client by the cloud benefit supplier. In which application is facilitated by the supplier at their framework and dispersed over the organization as a benefit on request [1].

E.g.: Online word processing and spreadsheet tools, Microsoft Office, Email, Communication, Games.
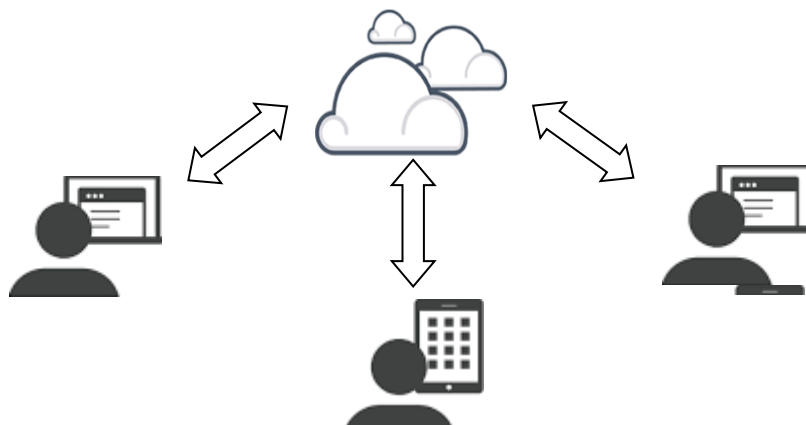
User can access SaaS application on any devices

Figure 2.7: Software as a Service (SaaS)

2.5.5. Classification of Cloud: Cloud computing is classified into four categories-

Public Cloud: Open cloud is the openly accessible cloud that is managed by untouchables. All clients share a normal system pool with an obliged setup. The cloud provider is in charge of the creation and persistent upkeep of the open cloud [1].

Private Cloud: Private cloud is open as it were by an organization conjointly overseen by the organization. Private cloud empowers an organization to utilize cloud computing by implies centralizing get to IT assets from diverse geological areas[1].
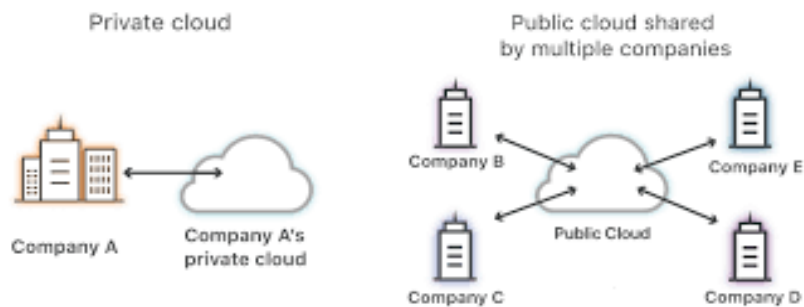
Figure 2.8: Public & Private Cloud

Hybrid Cloud: Hybrid cloud joins both Private and Public cloud models. With Half breed, cloud affiliation can utilize untouchable cloud provider organisation in a full or midway way. Consequently, half breed cloud extends the flexibility of computing [1].
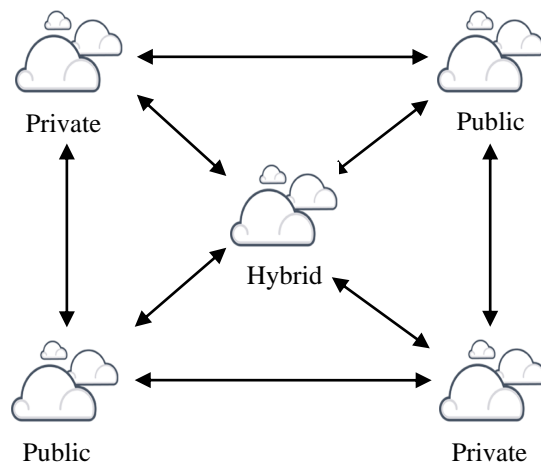
Figure 2.9: Multi-cloud, Hybrid Cloud

Community Cloud: A Community cloud may be a multi-inhabitant framework that is shared among several affiliations. Too, it is supervised, managed, and confirmed by all the taking an interest affiliation. These affiliations have comparable cloud necessities and their authoritative objective is to achieve commerce objectives. It is valuable to fetched savings.
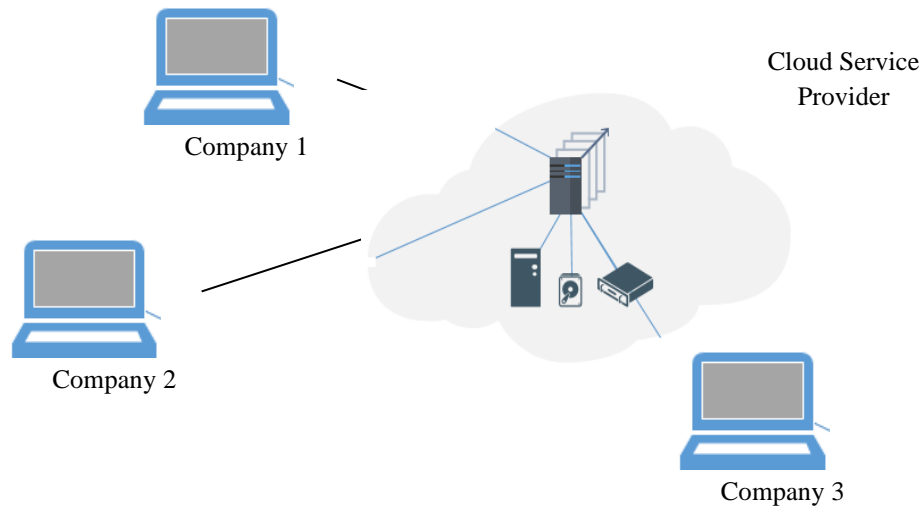
Figure 2.10: Community Cloud

2.5.6. Cloud computing Characteristics

- **Ultra-large-scale:** In ultra-large-scale handling, the estimate of cloud is broad union [5]. More than one million servers in a surge of Google had. For occurrence, Yahoo, IBM, Microsoft, Rediff, Amazon all have more than a few thousand servers. There are numerous servers in a wander control get to.

- **Virtualization:** Disseminated computing makes clients induce to advantage all over, through a terminal. All that you just can wrap up the method through a web get to by utilizing a note cushion PC or a progressed cell or a Tablet. Clients can fulfill or share it securely through a direct way, at whatever point, wherever. Clients can wrap up a task that can't be wrapped up in a singular PC.

- **High reliability:** Cloud applies data multi transcript fault-tolerant, the calculation center isomorphism conversely in this way as to enhance the high immovable quality

of the cloud advantage. By utilizing conveyed computing is significantly reliable than neighborhood PC prepare association.

- **Versatility:** Dispersed computing can make a couple of sorts of employments maintained by cloud organizations and the single cloud can keep up different applications running meanwhile.

- **High extendibility:** The measure of cloud can uncommonly extend out or continuously need to meet the growing need of cloud organizations.

- **On-demand service:** Cloud could be a pool of huge resources, which is available if you will pay as per your pre-requisite. Cloud is same as piped drinking water supply, electricity supply, and piped gas supply which are chargeable as they utilized

- **Extremely inexpensive**: The centered on the board of cloud makes the endeavor needn't grasp the organization fetched of the server cultivate that extension speed of the organization. The adaptability can upgrade the rate of utilization for the accessible resources differentiated and ordinary systems, appropriately clients can completely appreciate the cloud organization and negligible exertion as favorable position or to a incredible degree unassuming.
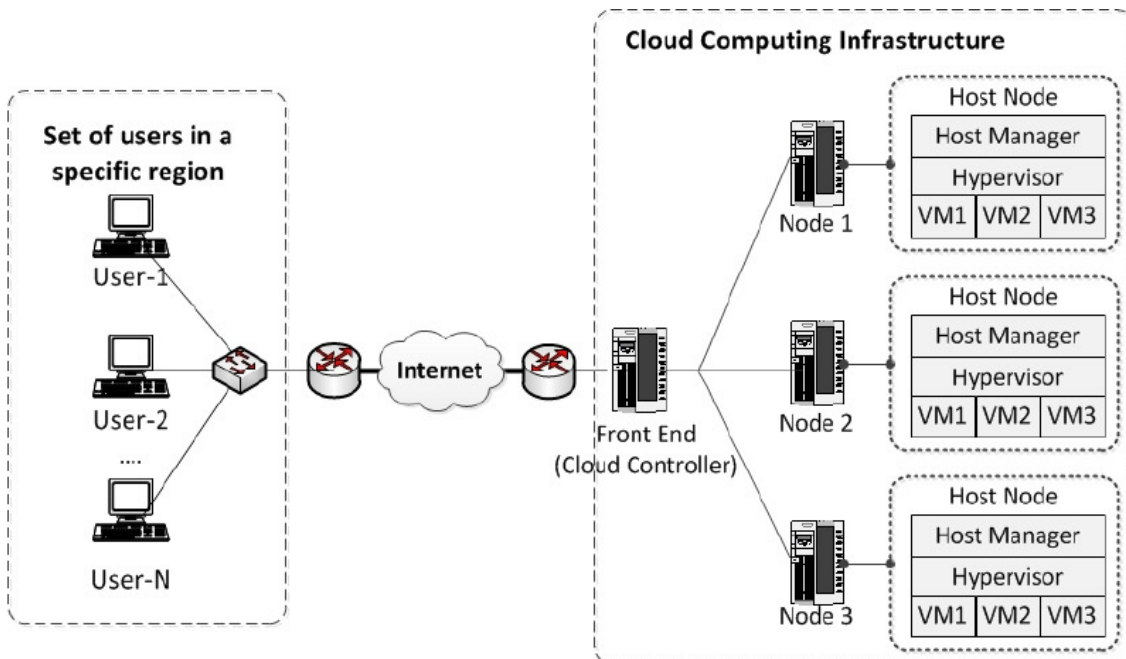
Figure 2.11: Architecture Model of Public Cloud Computing Usage

2.5.7. Cloud Future

The future of cloud computing does not varyclear, but some of the applications of the cloud are as follows [1]:

Web-based WordStar. The sorts of efficiency applications that to begin with pulled in individuals to individual computers 30 a long time back are presently showing up as program administrations.The Inclusion of a word processor, a spreadsheet, and power point applications in Google Docs application is an example of office capabilities. Another example of theseweb-based word processors is Adobe Framework in 2007 and for image manipulation application is Photoshop Express.

Cloud for Enterprise Computing. The Computer program for most of the e-commerce applications (such as client back, deals, and showcasing) has for the most part been operating on commercial or corporate servers, but a few organizations presently give benefits of on-demand services. The primary was Salesforce.com, established in 1999, advertising a suite of online programs for client relationship administration and other business-oriented assignments; the company's motto is "No program!"

Infrastructureas Cloud. To outsource the jobof an organization and keeping up an information center is exceptionally good, but somebody must still supply that framework. Amazon.com has moved into this specialty of the Web biological system. Amazon Web Administrations offers information capacity estimated by the gigabyte-month and computing capacity by the CPU-hour. Both sorts of assets grow and contract concurring to require. IBM has reported plans for the "Blue Cloud" foundation. And Google is testing the App Motor, which gives facilitating on Google server ranches and a programming environment centered on the Python programming dialect and the Enormous table disseminated capacity framework.

The Cloud OS. Majority of applications for the cloud there is a single-window interface in the web browser for all clients. There are few interfaces or activity points that give commercially valuable client requests for services. There is an approach that misuses cloud computing globally to supply all the offices of working framework interior in the browser. The eye OS framework, for illustration, duplicates the recognizable desktop metaphor—with

symbols for files, folders, and applications—all living in a browser window. Another arrangement would bypass the Internet browser, substituting a more-capable computer code that runs as a partitioned application on the client computer and communicates straightforwardly with servers within the cloud. This can be the thought behind Discuss (once in the past Apollo) being tried by Adobe Frameworks. Open-Laszlo, an open-source venture, works in a similar way.

2.5.8. Cloud Issues & Challenges

Adaptability: For those conveying programs out within the cloud adaptability may be a major issue- they have to be arranged and organize assets in such a manner that a program precedes running easily even though the number of clients grows rapidly. It is a challenge for a server to be responsive and reactive to the massive number of demands at any moment. There is also a challenge for the framework to facilitate data received from different sources which are not centrally controlled by a single organization instead of from different and distributed organizations. Its design principle for communication is based on many- to- many in which each server communicating and serving with many clients and every client is interacting and getting services on numerous servers.

***Browser-Based Client Interface*:** Browser-based client interface is another type of challenge for cloud computing transactions. The current menu-based window interface is familiar and in practice for the client of the window-based system over decades. Imitating this value within a web browser is a challenging task. There is a need to stay in a comparatively crushed enhancement environment. To design a program for desktop applications for windows or one of the UNIX variants selections can be made from a large collection of programming languages, code libraries, and application systems. Most of the parts of the client interface can be amassed by pre-built reusable components. For net-based cloud computing programs, designtakesa much more primitive approach.

Work Environment: To move applications to the cloud is one of the majorchallenges. It needs a different and distinctive approach to cloud development. In various cloud applications a back-end handle depends on a geographically and socially distributed database, so group code is embedded in SQL or other query languages. Programs on the

client side are executed in embedded JavaScript in HTML documents.Server applications provideinteractions between distributed databases and cloud clients programmed in a scripting language (Such as PHP, Java, and python).The exchange of information between the diverse layers is likely to be encoded in the combination of an XML document.

Security and Reliability: At the final stage, cloud computing raises questions around assurance, security, and reliability—a major subject of discourse at a workshop held last January at the Center for Information-Development Course of action at Princeton College. Allowing a third-party advantage to require guardianship of person reports raises awkward questions nearly control and proprietorship: In case you move to a competing advantage provider, can you take your data with you? Will you lose get to your files in the event that you come up brief to pay your charge? Do you have the control to cancel records that are not required?

The issues of security and security are so also confounding. In one routinely cited circumstance, a government office presents a subpoena or seesa warrant to the third party that has proprietorship of your data. Within the occasion merely had held physical care, you might still have been compelled to abdicate the information, but at scarcest you'd have been able to select for yourself whether or not to challenge the organize. The third-party advantage is less likely to go to court on your purpose. In many circumstances, you might not in fact be taught that your reports have been released. It shows up likely that much of the world's computerized information will be living inside the clouds long a few times as of late such questions are settled.

Undoubtedly in show disdain toward the truth that the advanced appear of more distant computing shows up to turn around the 1980s "flexibility" improvement that gave individual clients care over programs and data, the move does not in a general sense reestablish control to bosses inside the corporate IT division.

To the degree that cloud computing succeeds; it talks to a self-evident competitive challenge to vendors of the shrink-wrap computer program. Out of the blue, the open-source improvement appears to have an extraordinary time altering to the unused computing appear. It's one thing to create and scatters an open-source word processor competing with Microsoft

Word; not so self-evident is how a consortium of volunteers would make a Web advantage to compete with Google Docs.

2.6. Events

An event in Event-driven Service-oriented Architecture (EDSOA) is where services have thecapabilities to react to events [8].

Events can be in the form of:

- Start or end of service execution.
- Changes by assignment in value of critical variables.
- Exceptions are generated at the run time.
- The state change of service.
- Beginning or end of the activity.

In Event-Driven Architecture (EDA) events are the primary entities thatdepend on time and location. In cloud computing processes are event-driven and requires the execution of task set to achieve the goal. Achieve the goal requires the composition and execution of different services required and invoked by events. Events are capable responsible to change the state of a process. Events and the state of the process in the cloud can be modeled. EDSOA defines an event-driven cloud process model by representing cloud processes as conceptual process flow.

The handle is spoken to as a set of administrations and completion of each benefit as an occasion that is capable to trigger another benefit. Each benefit taking portion within the execution of a handle may be a state-full benefit and underpins occasion and notice. To screen the occasion on administrations, properties and life cycle of administrations ought to be characterized.

Property portrays the parameter and state and it is capable for state move of a prepare. The life cycle is mindful to characterize in the beginning, conclusion, and end time of a benefit, which is required to preserve and control the execution of a preparation.

A cloud is more than a collection of computer resources since a cloud gives an instrument to supervise these resources, the organization joins provisioning, change inquire, workload rebalancing, de-provisioning, and watching.
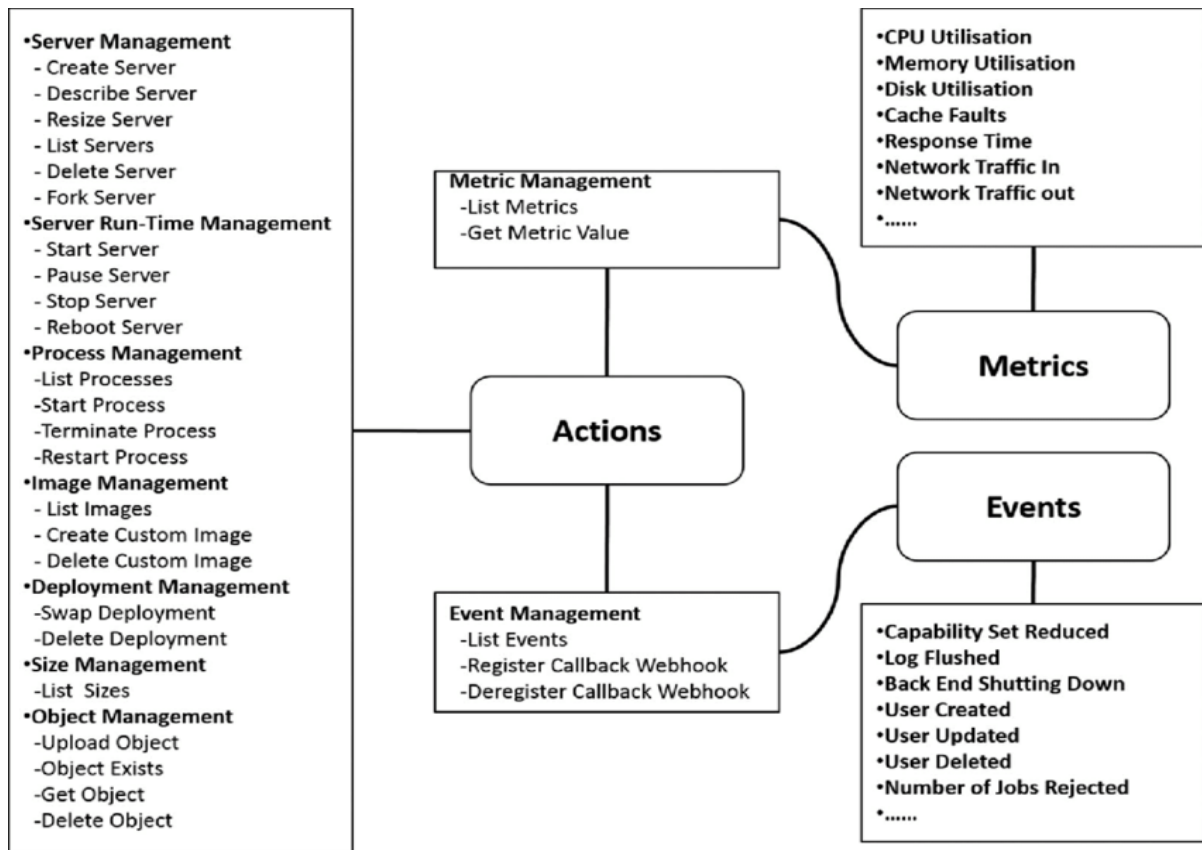
Figure 2.12: List of probable events in a cloud process and its management

2.6.1. Life Cycle of Event-driven Service-oriented Architecture

Business processes are represented as a composition of services. Business processes are dynamic in nature due to changes in policies, rules, partners, and events. There is a need for a formal framework and event-driven service-oriented architecture to model, compose, and execute the dynamic business processes [8].

The event-driven business process developed using EDSOA follows the following EDSO development lifecycle.

Model: The model stage incorporates investigation and plan of commerce forms, administrations, occasions, and messages. In demonstrate stage, genuine administrations are modeled which can perform single commerce work and take portion in composition. Metaphysics ought to be characterized to supply common space lexicon, information, and business service layouts, which can use amid the Model stage.

Compose: Within the composition stage, one should create or reuse existing administrations and combine it to make composite services. Business rules, commerce arrangement, and commerce metadata ought to be characterized at the composition stage. It'll depict the control and information stream, mapping input, a yield of administrations, which are required for creating an energetic composition pattern.

Deploy: The deployment stage includes exercises like making an environment for arrangement, enlisting endpoints, conveying the commerce administrations, provisioning commerce administrations to organizations and endorsers. Components and administrations are to be sent in a coordinated's way so they can take an interest and get executed in an appropriate arrangement at the time of execution of a composite trade handle.

Execution and Monitoring: The execution and observing stage includes managing, entitlements, and memberships of the trade administrations to organizations and clients. Occasion and state give trade setting perceive ability for composite administrations. For illustration, you'll be able to determine how a commerce benefit is utilized on different channels for diverse buyers, as well as determining how diverse endpoints are performing for particular commerce setting along with which administrations are in execution and in which state.
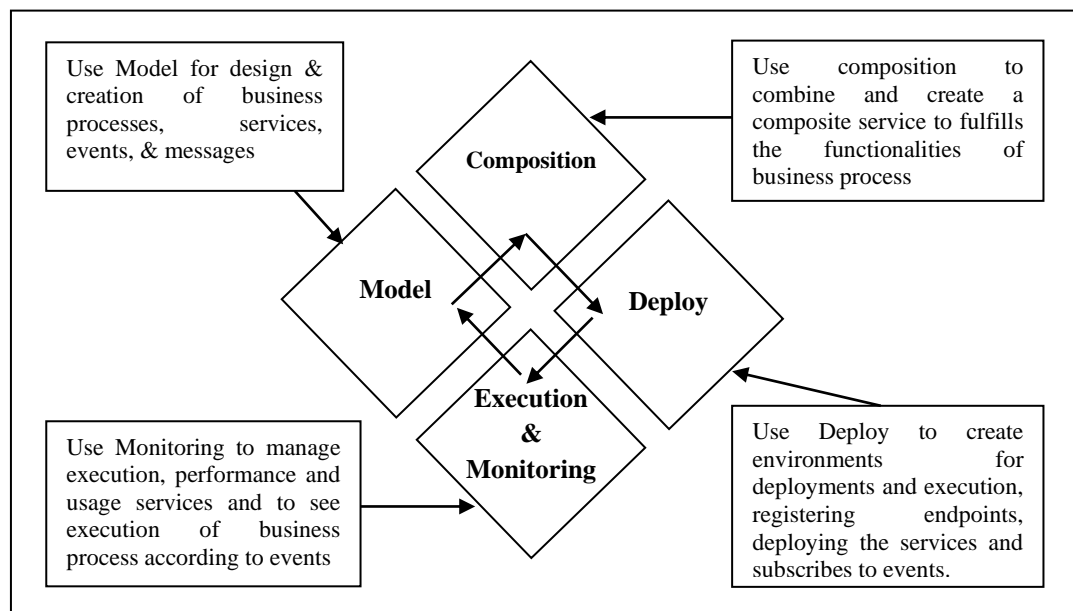
Figure 2.13: Event-driven Service-oriented Architecture Lifecycle

2.7.   Environmental Impact of Cloud Computing

With the ever-expanding utilization of IT foundations around the globe, the increment in vitality utilization and carbon emanation could be a troubling circumstance for everybody since of its coordinated impact on the environment. The environment is being hazardously affected by the Data Innovation foundation's broad utilize and its squander. Cloud computing has developed as one step assist arrangement to send all virtualized IT assets as per require on a self-service premise as a rental strategy for the clients. Diverse cloud arrangement strategies have been developed agreeing to the requirement of clients, teach and communities. In the final decade, virtualization has been a point of reference in empowering the ideal utilization of data innovation assets. Cloud computing has given a stage for sending everything as a Benefit in IT, which has changed the financial matters of IT-based trade and organizations from Capital Use to Operational Use. For empowering Cloud administrations, we, to begin with, got to get it our existing framework. In the moment step, we ought to be able to virtualize it for ideal usage. Then with the assistance of existing cloud applications able to provide and convey data innovation as an asset at different levels such as foundation, stage, and computer program [2].

The cost included in support and administration of those assets is colossal which can be spared due to centralized administration of private cloud foundations. We make private cloud keeping in intellect.

- Availability and performance requirements for the cloud
- Infrastructure sizing, performance, and continual availability requirements
- The need for data security or isolation
- The appropriate user interface

Mechanical Systems	IT Systems	Services
Hot & Cold Alsle Topology	Enterprise Core	Web services Portals, web-based warehouses
Air Conditioning Systems	Multi-tier Networking Infrastructure (aggregators, switches routers)	Application Service Enterprise Resource Planning
ChilledWaterSystems	Computer Infrastructure (Server pools)	Core Service-DNS, DHCP, NTP, FTP
In-row Cooling Systems	Storage Infrastructure (RAID, SAN)	Database Service MS SQL, Oracle, Sybase
Electrical Systems	**Connectivity & Topology**	Security Layer ad Safe Fallover Services
Power Distribution Systems	Racks, tray, cabinets, pods, rooms	Load Balancing, Power/ Thermal Management
Uninterruptible Power Supply (UPS) Systems	Rack-to-rack Infrastructure	Middleware Enterprise Application Integration,
Standby Power Systems	Fiber uplinks, 1Gb, 10Gb, 40Gb Ethernet links	

Figure 2.14: High-level components comprising cloud computing environment

The Cloud computing environment comprises thousands to tens of thousands of server machines, working to render administrations to the clients. Model servers are distant from vitality consistency. Servers expend 80% of the top control indeed at 20% utilization. The vitality non-uniformity server may be a key source of vitality wastefulness in the cloud computing environment. Servers are regularly utilized with between 10% to 50% of their crest stack and server involvement visits sit still times. This implies that servers are not working at their ideal power-performance tradeoff focuses for the most part, and sit still the mode of servers devours an enormous parcel of general control [2].

The chapter basic concept and background comprises the various building concept which is used for the development of the cloud computing environment, we have talked about the service-oriented architecture their pros and cons, and their working model in this sequence we have also elaborate event-driven architecture, component-based architecture. Based on these basic concepts we have discussed in detail cloud computing services, types, challenges & issues in cloud computing, and its prospects. As the research work is around cloud computing events and their management the basic definition of events, their lifecycle, and their implementation model were discussed. At the end of the chapter, we have discussed the environmental impact of cloud computing in both positive and negative scenarios.

CHAPTER 3

LITERATURE REVIEW

In the previous chapter, we have discussed in detail Cloud Computing how joins or links together distributed server resources on user or client demand for the fulfillment of their needs. To fulfill user demand cloud club together web organizations and requested resources. Cloud administrators request Cloud Service Providers for utilization of their web organization to fulfill the demands of users or clients.

To access web services through Internet ISP's offer users or clients to upgrade for speedy broadband services. Cloud Service Providers (CSPs) and Internet Service Providers (ISP's) jointly create a web organization.

Cloud Suppliers generally offer three types of services i.e. Software as service (SaaS), Platform as a service (PaaS), and Internet as a service (IaaS). There are many reasons to move on the Cloud Computing environment as users pay for resources uses on the cloud, any one or any organization can offer their services on cloud, services always available on-demand in the cloud.

Web administration is platform-independent, low-cost, performing, and may be most vital is rectify interfacing for people, permits complex application workflows communicating with

web administration. Web applications must be platform-independent. In contrast tothe source code level of centralized computing, web applications are advancement to theoretical and platform-independent models of computing. It empowers quick prototyping, programmed code & documentation, and model level suitability and correctness checking.

3.1 Review of Literature

Cloud computing manages a collection of systems as an entity. It also describes applications that are extended to be available using the internet.

Oleg Y. Nickolayev et.al, Proposed that detailed event traces generate the expected interaction detail. Systems that consist of hundreds of processors, generate the the large volume of performance data by event tracing that may lead to unexpected system behavior and complicated data analysis.[6]

Muhammad Arifand and Tariq Mahmood addressed a few issues like vitality utilization, an emanation of nursery gas, etc. carbon impressions, and with the assistance of distinctive software techniques, they attempted to play down these issues. Among the other methods, virtualization is an imperative method that is critical to diminish the natural impact-related issue of cloud computing. Due to the tall volume of distinctive sorts of information, the estimate of information centers is getting to be excessively expensive and unmanageable due to colossal estimates of information, tall power bills, and administration of assets and gadgets [7].

Karina Hauserand et.al, Proposed an arrangement that handles messages in an offbeat fashion based on trade occasions as they happen. Subsequently, the design isn't designed around the greatest number of messages in a pre-defined reaction period, but or maybe over a much longer time, a few minutes versus seconds. The proposed architecture combines the preferences of component-based program improvement, event-driven engineering, and SOA [8].

Rajrup Ghosh and Yogesh Simmhan proposed a system that offers a unique in sight on the compute, organize, and vitality execution of edge gadgets and Cloud VMs for person occasion preparing inquiries. The multiple applications with several query types and event

rates present a set of execution disseminations that are profitable to assess other asset stages for event investigation. [9]

James R. Hipp and Christopher J. Young created a fully automated strategy for recognizing clusters in huge occasion sets. The strategy of employments to decide the clusters and beginning participation and application of an iterative K-medoid optimization is utilized to refine enrollment within the clusters till solidness is accomplished. The proposed strategy carries on as strong and computationally effective, with execution enhancement over standard K-medoid optimization [10].

Stella Gatziu Grivas et.al, created a concept that gives a profoundly energetic, adaptable engineering that permits the handling of a gigantic sum of data from distinctive fluctuating sources. It moreover gives a dynamic, occasion-based, strategy for the supposition mining and estimation examination that has competent to supply the fast comes about than other information gathering and preparing approaches [11].

Jeffrey Dean and Sanjay Ghemawat proposed Map-Reduce programming demonstrates has been effectively utilized at Google for numerous distinctive purposes. The show is simple to utilize, indeed for software engineers because it unique the subtle elements of parallelization, fault-tolerance, region optimization, and stack adjusting diverse issues can be spoken to as Map-Reduce computations. The usage of Map-Reduce scales to huge clusters of machines comprising different overlaps of machines [12].

Awada Uchechukwu et.al, formulates and provides a solution for green cloud situations to play down its natural affect and vitality utilization beneath unused models by considering inactive and energetic parcels of cloud components. They proposed a strategy to capture cloud computing information centers and present a nonexclusive demonstration for them. For this in-depth information of vitality utilization designs in the cloud environment is required. They analyzed vitality utilization designs and appear that by applying appropriate optimization arrangements coordinated through given vitality utilization models, it is conceivable to spare 20% of vitality utilization in cloud information centers. Investigate comes about can be coordinates into cloud computing frameworks to screen vitality utilization and back inactive and energetic framework level-optimization. [13]

U Wajid et.al, Vitality effectiveness and CO_2 awareness are globally important issues in cloud computing. With expanding consideration being paid to the natural effect of cloud computing there are concerns around the supportability of cloud computing demonstrates as its take-up increments. In this regard, we consider it valuable to supply a preview of the necessities for vitality proficient and CO_2 aware cloud computing to permit the conception and advancement of modern strategies and approaches in this region. In advance, we display a case consider approach for vitality effective cloud sourcing that points to construct on these necessities. [14]

T. Mahmood et.al, Cloud computing is giving fundamental level of computing office to meet the day by day needs of common or open community. In this paper, we have chosen the subject of cloud computing and its natural impacts. Worldwide warming, nursery effect, increasing temperature of the complete environment are major concerns regarding rise in temperature and contamination of the environment of the entire world. No question cloud computing is giving the fundamental office of computing to the common community but at the same time, it is playing a major part in expanding the temperature of the complete world and getting to be the source of contamination for the environment. In this paper distinctive procedures have been embraced to control this issue. Virtualization strategy is being utilized to control the issue of vitality utilization and emanation of carbon dioxide gas. So numerous methods with respect to virtualization like the live movement of VM, Energetic Asset Allotment of distinctive assets, virtualization of organize assets like switches, directing conventions, virtualization of equipment assets like server, capacity, memory, and other gadgets. An exertion is being worked out to decrease the issue of carbon outflow and vitality utilization of cloud computing to an expansive degree. [15]

Y. G. Patil et.al, Mobile Cloud Computing (MCC) has revolutionized the way in which portable endorsers over the globe control administrations on the go. The portable gadgets have advanced from simple gadgets that empowered voice calls as it were some a long time back to shrewd gadgets that empower the client to get to esteem included administrations anytime, anyplace. MCC coordinating cloud computing into the versatile environment and overcomes impediments related to execution (e.g. battery life, capacity, and transfer speed),

environment (e.g. heterogeneity, versatility, accessibility), and security (e.g. unwavering quality and protection). [16]

M. K. Saggi et.al, Mobile Cloud Computing (MCC) could be a combination of portable computing and cloud computing. It has become one of the Major Investigate issues within the industry. In spite of the fact that there are so, numerous inquire about thinks about portable computing and cloud computing, the merging of these two regions give encourage scholastic endeavors towards prospering MCC. With this point, this paper presents an audit on the foundation and rule of MCC, characteristics, later investigate work, and future investigate patterns. It at that point investigations the highlights and framework of portable cloud computing. The rest of the paper investigations the challenges of versatile cloud computing, outline a few inquire about ventures related to this range, and focuses on promising future inquire about bearings. [17]

M. Gattulli et.al, Vitality utilization in media transmission systems keep developing quickly, basically due to the rise of modern Cloud Computing (CC) administrations that got to be bolstered by expansive information centers that devour a tremendous sum of vitality and, in turn, cause the emanation of the colossal amount of CO_2. Given the diminishing accessibility of fossil fuels and the rising concern approximately worldwide warming, inquire about is presently centering on novel "low-carbon" telecom arrangements. E.g., based on nowadays telecom advances, information centers can be found close to renewable vitality plants, and information can at that point be viably exchanged to these areas through reconfigurable optical systems, based on the guideline that information can be moved more productively than power. This paper centers on how to powerfully course on-demand optical circuits that are set up to exchange energy-intensive information preparing towards information centers fueled with renewable vitality. Our primary commitment comprises concocting two steering calculations for associations supporting CC administrations, pointed at minimizing the CO_2 emanations of information centers by taking after the current accessibility of renewable vitality (Sun and Wind). The trade-off with vitality utilization for the transport supplies is additionally considered. The comes about to appear that important diminishments, up to approximately 30% in CO_2 outflows can be accomplished utilizing our approaches

compared to pattern shortest-path-based directing methodologies, paying off as it were a minimal increment in terms of arranging blocking likelihood [18].

Malathy et.al, Cloud computing may be a computing world view in which the different assignments are rolled out to a combination of associations, computer programs, and administrations that can be gotten to over the arrangement. The computing assets and administrations can be productively conveyed and utilized, making the vision of computing utility realizable. In different applications, execution of services with more number of errands should perform with least associate errand communication. The applications are more likely to display distinctive designs and levels and the disseminated assets organize into different topologies for information and inquiry spread. In a conveyed framework the asset disclosure could be a noteworthy handle for finding suitable hubs. The prior asset revelation component in the cloud framework depends on the later perceptions. In this ponder, asset utilization dispersion for a gather of hubs with indistinguishable asset utilizations designs is recognized and kept as a cluster and is named as asset clustering approach. The asset clustering approach is modeled utilizing CloudSIM, a toolkit for modeling and reenacting cloud computing situations, and the assessment progresses the execution of the framework within the utilization of the assets. Come about appear that resource clusters can supply tall exactness for asset disclosure [19].

Sarkar et.al, Cloud computing is the most recent innovation that conveys computing assets as a benefit such as foundation, capacity, application improvement stages, computer program, etc. Cloud computing is picking up ubiquity and nowadays it is on the boom. The colossal sum of information is put away within the cloud which should be recovered productively. The recovery of data from the cloud takes a parcel of time as the information isn't put away in an organized way. Information mining is hence vital in cloud computing. Able to coordinate information mining and cloud computing (Integrated Information Mining and Cloud Computing– IDMCC) which is able to provide dexterity and speedy get to the innovation. The integration ought to be so solid that it'll be able to bargain with the increasing generation of information and will offer assistance in the productive mining of a gigantic sum of information. In this paper, we offer a brief portrayal of cloud computing and clustering procedures. At that point, it moreover depicts almost cloud information mining.

This paper proposes a show that applies various leveled clustering calculations within the information capacity cloud to cluster the information based on the sort of information being transferred by different conclusion clients [20].

Hao Song et.al, this paper ponders the issue of point cloud disentanglement by looking for a subset of the first input information set agreeing to an indicated information diminishment proportion (craved number of focuses). The kind include of the proposed approach is that it points at minimizing the geometric deviation between the input and disentangled information sets. The fundamental rearrangements guideline is based on clustering of the input information set. The cluster representation allotments the input information set into a settled number of point clusters and each cluster are spoken to by a single agent point. The set of the agents is at that point considered as the disentangled information set and the coming about geometric deviation is assessed against the input information set on a cluster-by-cluster premise. Due to the reality that the alter to an agent choice as it influenced the arrangement of some neighboring clusters, a proficient plot is utilized to overhaul the by and large geometric deviation amid the look handle. The look includes two interrelated steps. It to begin with centers on a good format of the clusters and after that on fine-tuning the neighborhood composition of each cluster. The viability and execution of the proposed approach are approved and outlined through case considers utilizing manufactured as well as commonsense information sets. [21]

Arash Deldari et.al, one of the most highlights of Tall Throughput Computing frameworks is the accessibility of tall control handling assets. Cloud Computing frameworks can offer these highlights through concepts like Pay-Per-Use and Quality of Service (QoS) over the Web. Numerous applications in Cloud computing are spoken to by workflows. Quality of Service is one of the foremost imperative challenges within the setting of planning logical workflows. On the other hand, the surprising development of the multicore processor innovation has driven the utilization of these processors by benefit suppliers as building squares of their framework. Hence, planning logical workflows on the Cloud requires particular consideration to the multicore processor foundation which includes more challenges to the issue. On the other hand, in expansion to these challenges' users' QoS imperatives like execution time and fetched ought to be respected. The most objective of this

inquire is planning workflows on the Cloud, considering a multicore-based foundation. An unused calculation is proposed which finds clusters of the workflow that can be executed in parallel whereas having huge information communications. These kinds of clusters may be suitable candidates to be executed on a multicore processor. In differentiate; there are other clusters that ought to be executed in serial. This calculation examines whether the serial execution of these clusters is conceivable or not. The exploratory comes about to appear that the calculation incorporates a positive impact on execution time and fetched of the workflow execution. [22]

Kun Qin et.al, Clustering is a very important technique of data mining. Using the approach of clustering to research the relationship between satellite cloud images and precipitation has been increasingly attracted the attention of corresponding scholars. Hong et al. developed an idea to combine FCM, GA with FSC mutually, and use them to cluster the high-dimensional features of GMS-5 images. Then, calculate the remove between these tests and clustering centers to decide their classifications. The sorts of the pixels in unique cloud pictures can be found out which bunch in high-dimensional include spaces the pixels have a place to. So that it can make beyond any doubt its climate region to achieve the programmed classifications of the climate range (Hong et al., 2006). The paper proposes a method of weather classification based on cloud models and hierarchical clustering. According to weather sampling data from FY-2C image, cluster the brightness values of five wave groups by the method of cloud model-based hierarchical clustering, and generate the clusters of image features under the condition of different rainy weather types which composed the precipitation weather judgment model of cloud images. Then compute the membership degree of each pixel within the genuine time cloud pictures of FY-2C to each cloud show through the forward cloud generator. At long last, determinate the precipitation climate sorts of comparing climate stations. The precipitation weather type of the corresponding site belongs to can be ensured, and the real-time precipitation weather judgment can be realized.[23]

Alaa Eldin Abdelaa et.al, Event-based control has picked up critical intrigued from the inquire about community in later a long time since it permits superior asset utilization in organized control frameworks. In this proposition, we propose engineering for advertising

event-based control as a benefit from the cloud, which not as it progressed asset utilization but moreover diminishes the fetched and setup time of large-scale mechanical robotization frameworks. Giving event-based control from the cloud is that as it may, postures numerous investigate challenges. We address two of the most challenges, which are relieving long and variable organize delays and taking care of controller disappointments presented since of moving the controller distant absent from the plant. We propose novel strategies to fathom the delay and disappointment issues and we appear that these strategies keep up the steadiness and execution of the control framework. We actualized the proposed strategies and sent them on the Amazon cloud. It comes about to appear that our delay relief strategy can handle huge communication delays up to a few seconds with practically zero impact on most execution measurements of the framework. In addition, the proposed blame resistance approach can straightforwardly handle controller disappointments indeed on the off chance that the controlled framework is thousands of miles absent from its cloud controllers. [24]

L. Ardissono et.al, In this paper, we portray the Individual Cloud Stage (PCP): typically, an open stage for the administration of benefit clouds advertising an organized and coordinated see of the user's exercises and collaborations. The PCP incorporates a center set of program components supporting the definition of collaboration bunches and an all-encompassing administration of the workspace mindfulness, concerning all the coordinates' applications. Particularly, the PCP underpins the introduction of the mindfulness data to the clients, appropriately organized on the premise of the collaborations to which it has a place. In addition, we are expanding the PCP in arrange to customize the mindfulness bolster, depending on the user's notice inclinations. As the PCP is based on open engineering, the undertaking client can coordinate outside applications, in arrange to supply the cloud clients with particular capacities. This paper too portrays a model individual cloud, based on the PCP, which we created by coordination a few broadly utilized trade applications supporting report sharing and calendar administration. [25]

Abhijit Sarkar et.al, focus on the study of data mining and Cloud computing. They identified the role of data mining in the field of business intelligence by extraction of patterns and future prediction. The role of Cloud computing is in the provision of computing resources in the form of services to the cloud users in the distributed computing environment.

They combine data mining and Cloud computing for knowledge discovery with help services provided by the cloud computing environment. For their work, they have reviewed different models like MapReduce, Apache Hadoop. They have developed an approach that incorporates a Linked list-based FP tree, SEARUM, sector/Sphere, Parallel data mining, various clustering, and classification algorithms. In their study and review, they observed the issue of security in combining data mining and Cloud computing because all the user data is easily accessible in a cloud environment [26].

Soumitra (Ronnie) Sarkar et.al, Cloud-based offerings such as Infrastructure-as-a-service (IaaS), Platform-as-a-Service (PaaS), and Software-as-a-Service (SaaS), are being conveyed by different sellers at profoundly competitive costs to empower a worldview move to utility computing. To optimize the operational costs of overseeing an IBM Cloud-based PaaS advertising, a two-pronged approach has been received: rearrangements of enterprise-class information center administration forms as of now utilized in IBM's Worldwide Administrations Vital Outsourcing accounts, and robotization of the disentangled forms. This paper describes a framework that the authors have developed to deliver integrated monitoring and event correlation system, and an event-driven Automated Incident Management System, for IBM's Smart Business Dev/Test Cloud offering.[27]

Tal Dayan et.al, show innovation relates to cloud computing frameworks and dealing with occasions that happen within the cloud. A relationship framework gets and analyzes different occasions to get comprehensive data of almost the behavior of the cloud. An occasion store gets and keeps up time-stamped occasions, which may be gotten from the cloud itself or outside Sources detailing on the cloud. A query engine is utilized to choose, channel, and total occasions from the occasion store. The inquiry motor may take into consideration metadata that portrays connections between distinctive parts of the cloud. Comes about from the inquiry motor may be displayed on a show or something else detailed. Utilizing such data, the framework may settle known issues or alter certain parameters to move forward the cloud computing handle. [28]

Soumya Ray et.al, Explain the concept of load balancing in the cloud computing environment. Nowadays Cloud computing considerably changed parallel and distributed

computing environments. Cloud computing supports different types of users from different computing domains to access cloud services that are distributed across the web. Users can access these services over the Internet. To distribute workloads across the multiple nodes for efficiency and optimality they propose the methodology of load balancing. According to them, load balancing in cloud computing is the main area of focus. To attain maximum benefit load balancing algorithms can utilize resources efficiently. In their work, they give a review of the load balancing algorithms of cloud computing. In their study, they focus on the principle on which load-balancing algorithm works. They proposed a dynamic balancing algorithm. [29]

Ashish Bhushan Khare et.al, in their work, proposed a framework of the e-Governance model for cloud environment. They focus their work on the study of availability infrastructure for e-Governance in the urban and rural parts of the country. In their research, they find that in the urban part there is sufficient awareness in citizens and adequate infrastructure available for e-Governance. But in small towns and rural parts of the country, they find inadequate awareness and infrastructure for e-Governance. For the solution to the above problem, they proposed a framework to identify the resemblance between generic government processes & services and service-oriented cloud computing models. They also discussed key issues in implementing a cloud computing-based service-oriented grid for various government bodies. so they proposed a model-based framework for implementing cloud computing-based services for e-Governance for the rural part of the country. [30]

Arash Deldar et.al, in this work, addresses the problem of workflow scheduling in cloud computing. Workflows are a very effective and strong modeling technique to represent the distributed and loosely coupled tasks of Cloud computing. In a commercial Cloud computing scenario, where users avail the services of the cloud on the basis of pay-as-you-go, quality of service (QoS) requirements are very high. Fast processing capabilities due to multicore processing technology also give challenges to workflow scheduling to complete the tasks within time and cost constraints. To address these challenges they proposed a workflow scheduling algorithm to minimize processing cost within the user-defined time-constrained. To achieve this in their algorithm they divide workflow into clusters. For generation clusters algorithm uses a scoring method for the selection of the best cluster. [31]

Muhammad Sheraz Mehmood et.al, this work is related to the development of simple and strong encryption techniques for computing. A Cloud computing environment needs very strong data encryption. Producers and consumers of the data of the cloud are various networked devices that are connected by the network on basis of unique IP addresses. These devices produce a huge quantity of data which is called Big Data. In Cloud computing, this data is available to the requester through web services available in the public cloud. This data on the cloud is at high risk, therefore, needs a very strong encryption technology for its safety. Devices connected through Cloud have low computing capability and are slow. Available data encryption technique like advance encryption standard (AES) and data encryption standard (DES) are uses complex algorithms. Therefore, needs high-performance machines. The objective of their work is to study and survey for the less resource-consuming data encryption algorithm. [32]

Frederico Durao et.al, for navigation and searching of resources there is a need for tags. These tags are generally generated by the popularity of tags. In this approach of tagging, they found some problems such as some tags are not so popular but pint to the important and useful resource for users. Some tags are not utilized due to the default number of tags already available in the tag cloud.to overcome these problems which impose a limitation on tag cloud they describe an approach to generate a tag that improves the current state of the tag cloud. Their approach is based on the similarity of tags by which they are related. The result from the similarity calculation provides information to the spectral clustering algorithm to identify the cluster of tags. These clusters represent the proximity of tags. Tags of the same cluster are strongly related to that cluster and loosely related to the other clusters. So above categorization of tags provides users with web resources of their interest. [33]

3.2 Research Gap

The cloud computing platform encompasses novel computing models where assets like web-based applications, computing control, capacity and arrange assets can be shared as administrations through the web. The broadly usable utility arranged computing demonstrates executed by most cloud computing suppliers is the viable highlight for clients whose request for virtual assets changes with time. The wide-scale potential of online applications leads to workloads of great range and vast scale. The computing and information processing capacity of several organizations has been increasing speedily. Such a rapid increasein computing resources requires a scalable and efficient information technology

infrastructure including servers, electrical grids, physical infrastructure, storage, network bandwidth, personnel, and huge capital expenditure and operational cost. Cloud datacenters are the strength of today's demanding IT infrastructure, there is a crucial need to improve its efficiency.

Energy consumption is the key concern in substance dissemination framework and most dispersed frameworks (Cloud frameworks). These request an amassing of organized computing assets from one or different suppliers on datacenters amplifying over the world. This utilization is a limited plan parameter in the advanced information center and cloud computing frameworks. The control and vitality expended by the computing machine and the associated cooling framework may be a primary constituent of this vitality taken a toll and tall carbon outflow.

Finally, minimizing this vitality utilization can result to conceal taken a toll diminishment. Separated from the colossal vitality fetched, warm discharged increments with higher control utilization, hence increments the likelihood of equipment framework disappointments. Minimizing the vitality utilization includes a pivotal result on the overall efficiency, unwavering quality, and accessibility of the framework. Hence, minimizing this vitality utilization does not as it were diminishing the colossal fetched and moves forward framework unwavering quality, but too makes a difference in ensuring our natural environment. In this way, decreasing the vitality utilization of cloud computing frameworks and information centers could be a challenge since information and computing application are developing in a fast state that progressively disks and bigger servers are required to prepare them quickly inside the specified period.

Various research gaps identified by referring to multiple research papers that can be enlisted as follows:
- High resource consumption and effectiveness.
- Reduction of unnecessary computations of cloud servers due to duplicate events of users and clouds.
- Reduced vitality utilization by up to 95 % with the assistance of virtualization.
- Reduced wastage of energy due to utilization of computational control as a benefit.

- Reduced ecological impact by minimizing the effect of greenhouse gases generated by the cooling requirement of cloud computing servers.

The chapter covers the various research works precise which have already been completed in the concerned field. We have created the reviews of the basic concept involved in cloud computing, and their working model in this sequence we have also elaborated the basic and the work done in the event-driven architecture, component-based architecture. As the research work is around cloud computing events and their management the implementation model for these in the various services which already exist was discussed. At the end of the chapter, we have discussed the research gap in events and their management of cloud computing in both positive and negative scenarios.

CHAPTER 4

EVENT REDUCING MODEL FOR BETTER ENVIRONMENTAL EFFECT

This chapter focuses on the development of a model to address the challenges of handling and management of a large number of cloud users and cloud system events. In this chapter, we created an efficient and optimal event reduction mechanism for Cloud Computing which gives an answer to the past challenges related to event duplicity. We have constructed a model for the reduction of duplicate events. To achieve the goal of work we have developed a mechanism for event clustering, grouping and reducing, to decrease the duplicate events generated from the tasks of cloud users and the cloud itself.

4.1. Events in cloud architecture

Current cloud-oriented systems are planned and developed based on service-oriented systems. These service-oriented systems are planned and developed based on the event-centric system. Respond to massive cloud events, cloud base systems become more and more interconnected they are designed to publish and receive a large number of cloud events. Events are generated from various services invoked in the cloud by users for the fulfillment of their tasks. Each of these services might then publish another event to invoke other services and so on until the task of cloud users is not fulfilled. This service and event-based user interaction are notably different from the traditional command-and-control styles.

At present in cloud architecture users from the public cloud invoke services to complete their tasks, further with the help of events generated from these services, invoke other services, and so on. This invocation of services generates a large number of events. An event log receives and maintains these time-stamped events, which are obtained from the external explicit events from cloud users or cloud it. A query system is employed to select, identify, and aggregate events in the event log. Results from the query system return to the cloud users. This system of event management processes a large number of events in which some events are duplicate. In the next section, we will address these issues related to the management of duplicate events by presenting a model to overcome the duplicity and redundancy of events in cloud architecture.

4.2. Event Reducing Model for Event Optimization

We have developed a model, which is called **Event Reducing Model for Event Optimization (ERMEO).** In **ERMEO** we have used the clustering of events, Mapping & Reducing mechanisms to reduce the duplicate events coming from cloud users and the cloud. [36]

- From the user interface of this model, users from a private cloud or hybrid cloud interact with the cloud system by various means like web application, mobile application or desktop application, and some other means of interactions to the cloud from different physical locations.

- These interactions with the cloud environment further need invocation of various services which in turn generate various users as well as cloud generated events in the system from private cloud to public cloud.

- In our developed model these events are forwarded from the private cloud to Event Cluster Station. Event Cluster Station is designed to reduce the duplicate events generated in the cloud.

- This Event Cluster Stationforwards these reduced user and cloud events to the Event Orchestration System. Which is responsible for finding locations of services in the public cloud and provide these services at the user level by user interfaces?
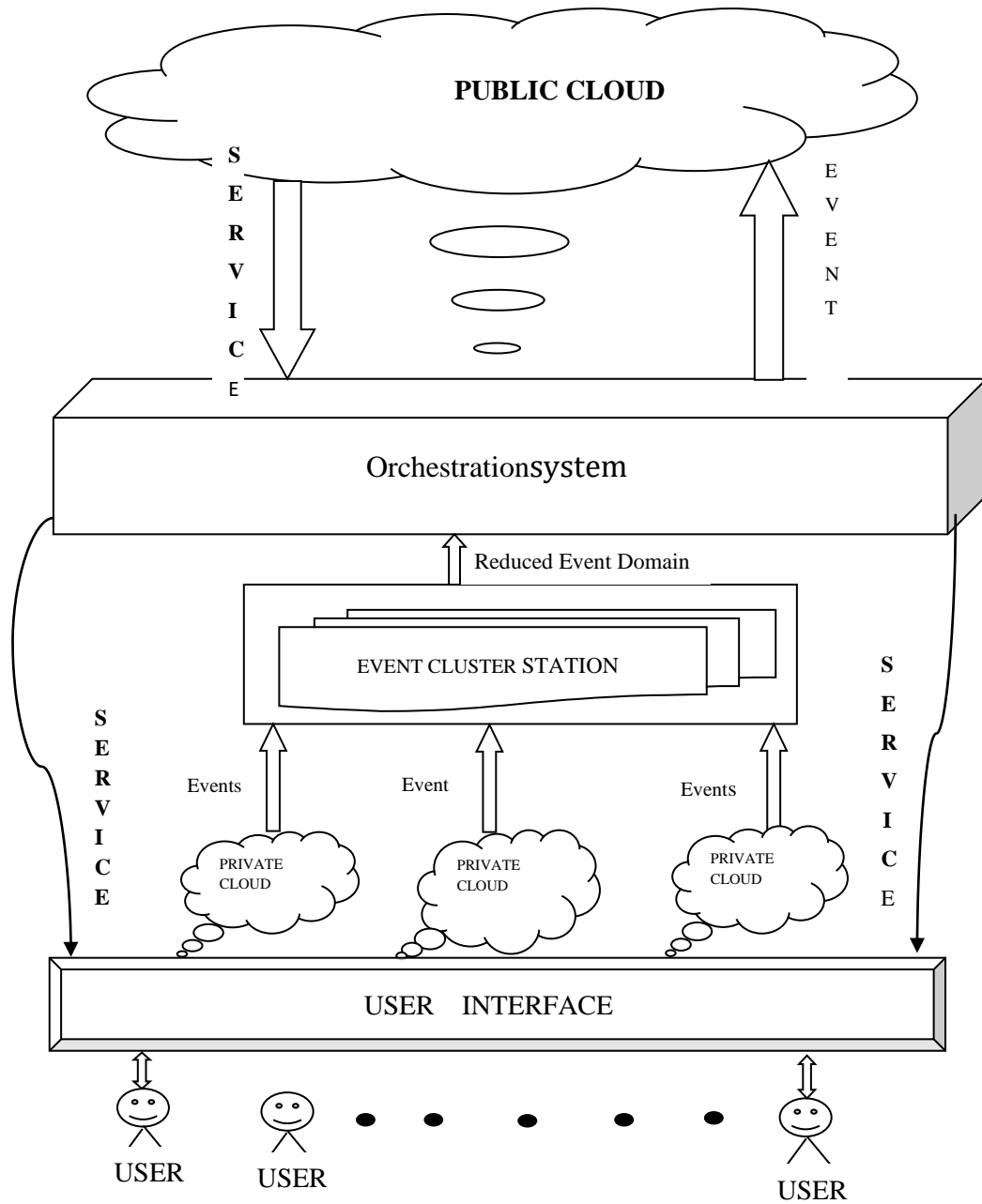
Figure 4.1: Event Reducing Model for Event Optimization (ERMEO)

In the above figure, we have designed a process flow diagram that elaborate the how the events get transferred from the client user to the various layer of the public, private cloud services. In this figure, it is also depicted that how the event instances are stored.

4.2.1. User Interface

Cloud computing users can interact with the cloud computing environment by user interfaces and get the results of their tasks or queries from the cloud environment. These interfaces of cloud computing are web applications, mobile applications or desktop applications, and some other means of interactions to the cloud from different physical locations. Mostly these interfaces are interacting with private cloud or hybrid cloud.

4.2.2. Private cloud

A private cloud is a dedicated cloud for a specific organization, purpose, or people. Administration and maintenance of the private cloud are done by the private system. Since private clouds are controlled by private systems so it provides the best security and control to the user minimum cost. In the model, we consider a private cloud as a manager of the following activities in a cloud environment-

- The private cloud generates and forwards user events and cloud events asynchronously in the cloud for invocation of services to accomplish the user task. Users of the cloud can interact with the private cloud for different purposes and goals.
- The private cloud provides a user-oriented environment. The purposes and goals of interactions of cloud users in the cloud are different. There are numerous purposes and goals of users like e-commerce, financial transactions, academics, and research & development, and so on.
- With help of web personalization services private cloud follows and remembers user interest. It helps cloud users in content searching of their interest. These users' interests may be related to commercial, academics, and casual surfing or searching activities.
- Users of the private cloud interact with the cloud for numerous reasons and objectives some users perform financial activity some users only search the contents of the cloud some users are doing e-commerce; some are displaying their information only and many more. So based on different goals and objectives of different users private cloud keeps user's data in a personalized manner.
- In order to complete different types of tasks and the nature of cloud users, private cloud initially generates events of various natures as required for service invocation and availability.

- Since most services reside in the public cloud and users mainly directly interact with private clouds. In turn for the fulfillment of user tasks, private clouds take the user events from different types of user interfaces and forward these user events to the event cluster station for event reduction.

- Since users interact with the private cloud with their specific and personalized purposes and goals, therefore, a great requirement to personalize local data storage. Private cloud doing this task by providing local data storage.

- Every user of the cloud is totally different from other cloud users and has its own personal purposes and goals of interaction with the cloud. So, the data of cloud users are visible to cloud users and platforms. Therefore, user data security is a big issue in the cloud. The private cloud is also responsible for the data security of cloud users.

4.2.3. Event Cluster Station (ECS)

The Event Cluster Station (ECS) is developed for event optimization. Optimal events are generated by the reduction of duplicate and redundant events of the cloud. To reduce the redundant Events, they are grouped into clusters to form event clusters. Event processing systems use these event clusters to reduce duplicate events. The event cluster station is used to optimize events by following steps -

- There is a large number of events in the cloud which are generated by cloud users or cloud systems. These events may be unique or duplicate. So, the identification of events is the primary and most important task for event optimization. Event Cluster Station (ECS) preliminary identify nature of events.

- Since in a large number of events generated in the cloud, some events may be unique and some may be a duplicate events. Duplicate events are the main overhead for cloud servers therefore for further processing for event optimization Event Cluster Station (ECS) groups these events in a cluster of time.

- From these groups of clusters to optimize events in cloud Event Cluster Station (ECS) reduces clusters by replacing duplicate occurrence of events in clusters.

- These reduced events are unique events of a cloud system. These events are very less in number. Event Cluster Station (ECS) finally reduces the event domain and hands over

these optimizes events to orchestration system for further invocation of services to fulfill the user task.

4.2.4. Orchestration system

Orchestration is an activity to define the location of the services, methods, and timings of service utilization, other executable services, and methods of data combination for services. The orchestration system invokes services and provides the context to these services. When the execution of these services is completed then the service context is again transferred back to the orchestration system that invokes and executes the services. The orchestration system is the main system for service invocation, execution, and control flow of services in cloud systems. The orchestration system is responsible for the following-

- When a user task needs services from the cloud, there must be information about the location of the services. The orchestration system gives permission for a definition of service locations.

- Definition of methods that contain detailed descriptions about consumption or utilization of services. Definition and description of time-based sequencing for services which describe when services are consumed.

- It also manages the information of other services that are required in the further execution of services. For the association between web services and resources with various states in a cloud system, it provides properties of cloud resources. It performs state management of cloud resources so cloud-based applications and services share changing information reliably. So, cloud-based applications and services can find, verify and communicate with the cloud resources of various states.

- It selects the best composite services to deploy the components and services, and configure the middleware for the execution. Services will be executed in the sequence as specified in the composition schema by passing messages and data from the output of service as an input to the next service. It defines the structure of the data and providing syntactic information about data to make it interchangeable but provides no meaningful information about the data. It is responsible for the integration of cloud services.

- The orchestration system invokes the cloud services and provides the context to the called service.

- After completion of execution of a cloud service, the context of invoked service is returned back to the orchestration system, which has invoked the cloud service.by this activity orchestration system monitor and administer the central flow of cloud services.

4.2.5. Public Cloud

Public cloud is an open platform distribute across the cloud environment, it supports distributed computing for a user of the cloud which are the organizations, user groups or single-user mostly interact from private or hybrid cloud. These organizations, user groups, or single-user invoke services via user events or cloud events to complete their tasks by the globally available resources provided by the fine-grained and self-benefitted cloud service providers by cloud-based mobile apps, web apps, and by some other means. This is an open general cloud whose services and resources are accessible over the Internet.

Since services mostly reside in the public cloud, therefore, the role of the public cloud seems a service repository. It is responsible for the following activities-

- It provides cloud services to cloud users through cloud computing platforms via the Internet. Since it is an open and general service provider for all, therefore, it supports a large number of cloud users from the public domain, data centers constructed and managed by public cloud providers.

- It provides services of three different natures. Most of these services are grouped in the following category-

    1. Infrastructure as a service. Amazon EC2 is an example of these services.
    2. Platform as a service. Google App Engine is an example of these services.
    3. Software as a service.Salesforce.com is an example of these services.

- Because it is available to all on the internet so it provides services of different nature to the users of other clouds like private cloud and hybrid cloud. Therefore, it supports request calls to other clouds.

- Public cloud supports a large number of cloud data and service providers with numerous numbers cloud servers and high-speed networks.

- The public cloud gives a solution in the form of services to the cloud users which are associated with the cloud customers having small organization and undefined infrastructure usage.

- The public cloud manages loads of cloud servers by applying an effective and efficient methodology of resource management and planning.

- With the feature of its multi-tenancy, the public cloud can expand on-demand and can give the demanded services to cloud users on a pay and use basis.

4.3. Mechanism Applied in ERMEO

In our approach, we have used Events as data items. To reduce the duplicate Events, they are grouped into clusters by forming event clusters. Event processing systems use these events clusters to reduce duplicate events. The functionality of the event processing system is made available to all cloud users by the cloud system. First of all this event processing system preprocess the large number of raw cloud events that are generated by various cloud sources. In the first stage, event processing system applies event clustering on these events and group them into event cluster. In the second stage with the help of the mapping & reducing technique, it reduces the duplicate events in event clusters. After completion of event reduction activity event cluster station forward these reduced event streams to the orchestration system of a cloud environment.

By above said the mechanism of event clustering and map & reduce a large number of raw cloud events are preprocessed and reduce the duplicate events, which are unusable. Therefore there is a tremendous reduction in cloud events is possible which further reduces the overhead of cloud servers to process these duplicate events.

So due to event clustering and map & reduce mechanism in event cluster station, the large number of duplicate events are tremendously reduced in cloud environment therefore overhead of processing these duplicate events by orchestration system is minimized. As a result, the processing overhead of cloud servers also minimizes. This results in low energy consumption by cloud servers and also reduces the demand for cooling of data centers and

cloud servers which further reduces the effect on the environment by greenhouse gases discharged by cooling plants.

In the next chapter, we are focusing on the design and implementation of the mechanism of event clustering and map & reduce. This is a key issue in Event Reducing Model for Event Optimization (ERMEO) which is developed & described in this chapter. In the next chapter, we also analyze the results which are generated by the implementation of a mechanism for event clustering and map & reduce on cloud event log in terms of load reduction of cloud servers by reduction of duplicate events.

CHAPTER 5

IMPLEMENTATION AND RESULTS

This chapter covers issues related to event identification and their processing with the help of event identification methods and processes them as input to our developed model which takes these events and optimizes them to develop a more energy-efficient model. We have used the window cloud event log.

In our approach, we have used Events as data items. To reduce the redundant Events, they are grouped into clusters to form event clusters. Event processing systems use these event clusters to reduce the redundant Events by map-reduce mechanism. After completion of this stage of processing on cloud events, these reduced events are forwarded to the orchestration system of a cloud environment.

5.1 Event Identification

For event identification and event processing, we have done the following data preprocessing on the event log

Step 1: Take the group of events from the event log for optimization.

Step 2: Find out the various events that took place within the group of events to complete, treat them as the tuple. An event is a tuple from the event log that takes the form: (Event ID, Date and Time, Source):

Event ID: an attribute that uniquely identifies the event.

Date and Time: the time when the event occurred.

Source: the origin of event occurrence.

Process the event log to create relational tuple table of the events as defined in step 2.
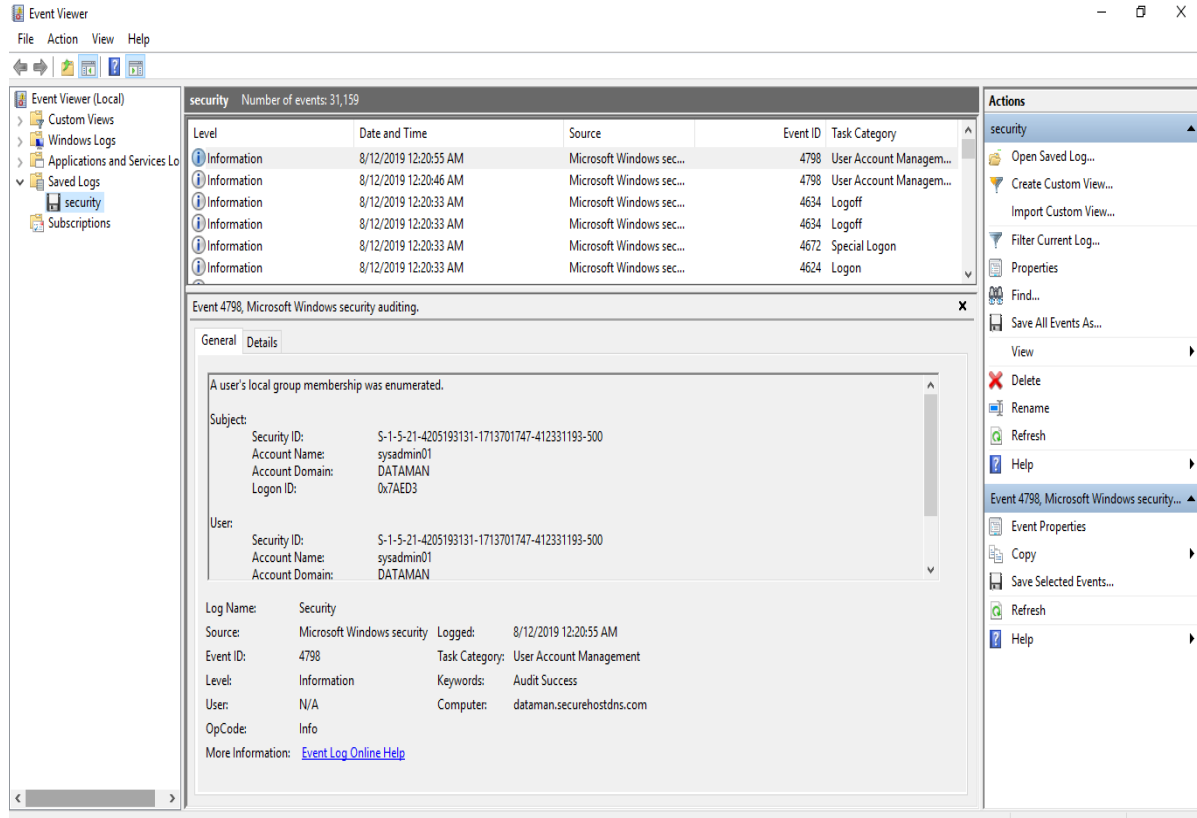
Figure 5.1: Windows Event Log

5.2. K-Medoid Clustering Algorithm

K-medoids clustering is based on the medoids values. These medoid values are the main representative of the cluster of K-medoids. Medoids are the member of the data set with the minimal average dissimilarity with other members of the data set. Medoid is always belongs to the data set. Medoid is the most centrally located item of data set. [35]

K- medoids clustering algorithm starts by selecting a finite number of data items as starting medoids to represent the finite number of clusters. All the rest of the items of the data set are attached in a cluster which at least medoid distance from them. Next, a new medoid is identified for a better representation of the cluster. All the rest of the data items are again

attached to the clusters with the least medoid distance from them. In each cycle, medoids change their places. This procedure is continuously minimizing the sum of distances betweeneach ofthe data items and their related conforming medoid. The procedure of minimization is repeated until the place change of medoid is not stopped. At this point,the algorithm stops and shows its cluster with a defined medoid.

5.3. Algorithm for Event Reduction

Step-1:

K-Medoids Clustering algorithm on event log provides cluster-wise events.

Step-2:

Cluster with least Medoid value is most suitable for implementation of Map-Reduce algorithm

Step-3:

The cluster with the least Medoid value is the cluster of the latest events.

Step-4:

Mapping & Reducing function reduces duplicate events of Cluster with least Medoid value.

Step-5:

Results in a group of dissimilar events represent the reduced set of events.

5.3.1. Event Clustering

Clustering is the method of formation of groups of similar data items. Clusters depict the boundaries from which instances or data items are drawn. It is a procedure that processes data items for finding out proximity to some other data items than they have to other remaining data items.

5.3.2. Proposed Event Clustering Algorithm

To implement the event reduction approach, the following clustering algorithm is used to find out the centrally located event for event cluster c_i.

1. From event domain E, randomly choose c representative events and select time domain of events for medoid value and clustering.
2. Set the rest of events in event domain as non-medoid events.

3. loop until medoids are stabilize or converge

      for complete medoid events e_s

           for complete non medoid events e_n

                compute the processing overhead cost of swapping TPCjsn;

           end;

      end;

    chooses_min & n_min such that $TPC_{s_min,n_min} = $ Minimum TPC_{jsn};

      if $TPC_{s\_min,n\_min} < 0$

           sets_min as non-medoid event and n_min as medoid event;

      end;

4. find k event clusters c_1……...c_k;

After completion of event clustering, all the key events are allocated to a specific event cluster by consideration of proximity to the medoid value of the event cluster.

5.3.3. Mapping and Reducing

Further to reduce redundant events following mapping reducing algorithm is used [37]. By **Mapping and Reducing function** similar events of cluster v_i are reduced and represented by a single event.

- **Map**- takes a Cluster v_i and a list of events as Event ID in that cluster and returns each Event ID and an associated count of occurrences of that Event ID.

- **Reduce** – takes Event ID and its count of occurrences in Cluster v_i and replace all similar Event ID with a Reduced Event ID on the basis of its count of occurrences.

  Map (Cluster v_i, Event ID)

    for each Event ID in Cluster v_i

        number of counts=number of occurrences of Event ID;

    return (Event ID, number of counts);

  Reduce (Event ID, number of counts)

for each value in number of counts

R_Event ID=Event ID;
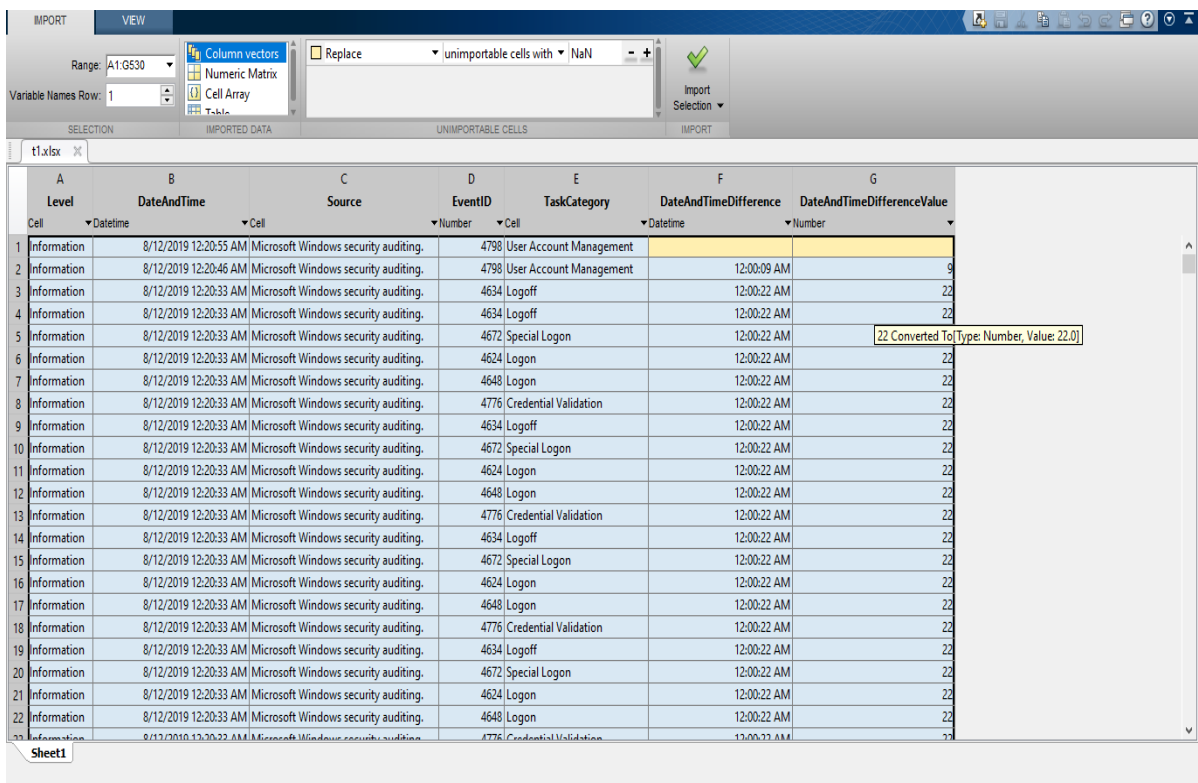
return (R_Event ID);

So, this mapping and reducing are created a group of dissimilar events which represent the reduced set of events.

5.4 Results

5.4.1 Event Log with the time difference value

We have processed the event log and obtain the event log in a time difference of events with respect to the latest event in the event log.

Figure 5.2: Event Log with the time difference value

5.4.2.   Event log after application of K-Medoids Clustering Algorithm.

We have implemented the k-Medoid algorithm on event log with time difference value and obtained event log with events which shows event with their respective cluster in the context of time-domain medoid values.

Figure5.3: Event log after application of K-Medoids Clustering Algorithm

In our analysis after implementation of K-Medoid on event log dataset, we obtained 4 clusters with 4 medoid values. These medoid values are given as below in Table

Cluster	Medoid value in seconds
Medoid value for cluster 1	624 sec.
Medoid value for cluster 2	**44 sec.**
Medoid value for cluster 3	403 sec.
Medoid value for cluster 4	224 sec.

Table 5.1: Event clusters with their Medoids value

5.4.3 Cluster Wise Event

Event Cluster1

Figure 5.4: Event Cluster1

Event Cluster2

Figure 5.5: Event Cluster 2

Event Cluster3

Figure 5.6: Event Cluster 3

Event Cluster4

Figure 5.7: Event Cluster 4

5.4.4 Graph of Clusters with respect to Medoid Values

We have plotted a graph between events of event log and time of events. It shows the events of the event log on the X-axis of the graph and the time of events on the Y-axis of the graph.
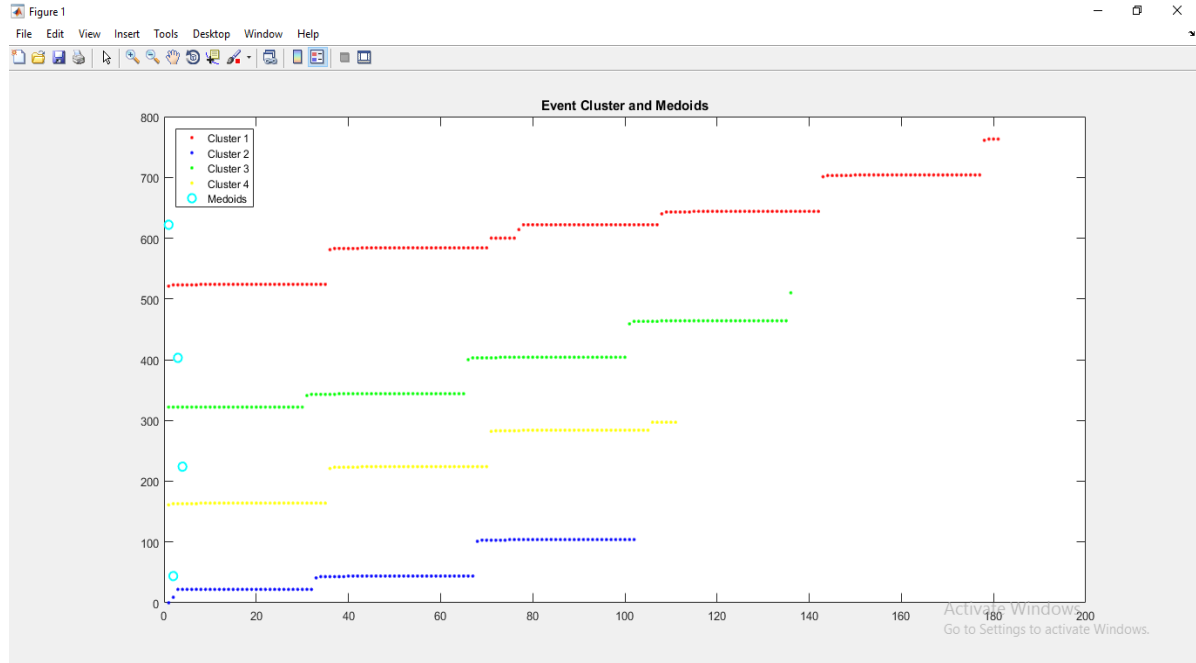

Figure 5.8: Graph between events of event log and time of events

5.4.5 Analysis of results and conclusion

In the graph plotted above events of event cluster1shows by red dots, event cluster2 shows by blue dots, cluster3 shows by green dots and event cluster4 shows by yellow dots. Medoids of event clusters are represented by circular rings. After the analysis of the plotted graph, we observe that events show by blue dots have the least medoid value which is 44 seconds. Event clusters 2 have a medoid value of 44 seconds.

So according to our algorithm for event reduction, medoid values of Cluster 2 have the least Medoid value. Therefore cluster 2 is the cluster of the latest events. So, we have applied the Mapping & reducing function on cluster 2.

After reduction of events of by application of Mapping &Reducing function on Cluster2, following unique events identified for further processing in Cloud Server

Reduced Cluster2
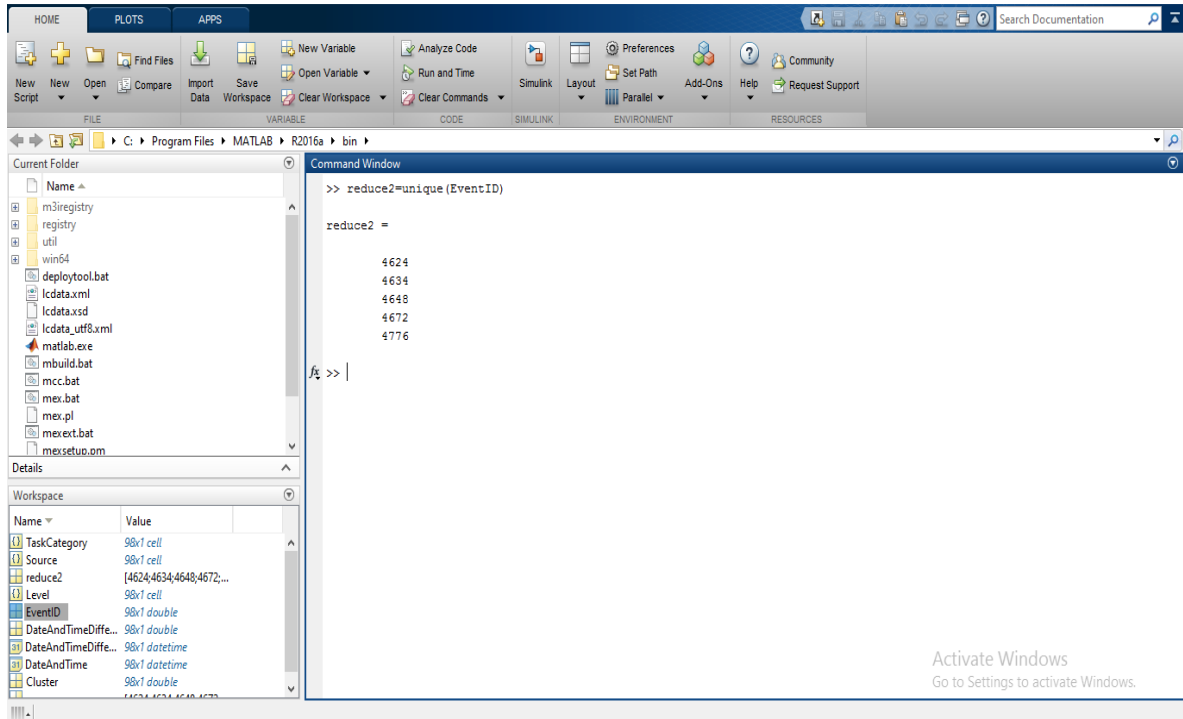
Figure 5.9: Reduced Event Cluster2

1. Event ID	4624
2. Event ID	4634
3. Event ID	4648
4. Event ID	4672
5. Event ID	4676

Table 5.2: Reduced events of Event cluster2

- **Total number of Events in cluster2=98**
- **Number of unique events after reduction=5**
- **% reduction in event processing =94.90%**

Chapter 6

CONCLUSION

Due to the continuous processing on servers, the heat is emitted which is allowed to reduce with the usage of air-conditioned server rooms, this one way or another result in an increase of carbon dioxide concentration in the environment. Therefore, to build a clean and green environment with cloud computing many duplicate events can be reduced or removed by applying various clustering techniques which may lead to lesser and lesser energy usage and waste.

6.1 Conclusion

In this work, we find that with the rapid development in cloud computing there is exponential growth in cloud users and cloud-based applications. So, there is a huge expansion of load on cloud servers. These servers are data centers or application servers or some other servers. The current development in cloud computing, demanding the request of cloud foundation has definitely expanded the large utilization of information centers, which has ended up with a basic issue of the high computing capacity of cloud servers.

To cope with a large number of users in the cloud community there is development in the hardware field. To meet the demand in the current cloud computing hardware industry is

advanced with high-performance machines to fulfill the needs of large performance demanding user groups in cloud computing. Challenges in cloud computing for high-performance machines lead to the development of machines with huge computing capacity.

With the development of high-performance machines, almost all computing tasks are now shifted to the cloud. Many cloud service providers are today offering different computing services like DTP work, word processing, image processing, financial processing services, etc. on demand to the cloud users. These cloud-based activities heavily depend on cloud services which are mostly residing in a public cloud. Demand by the large user community for cloud services lead, increase loads of cloud servers by generating huge computation task. These demanding tasks invoke a large number of web services. To invoke these services cloud user generates events. When a user of the cloud activates events for tasks then for completion of user task cloud environment generates a number of events to invoke services in the cloud. These large numbers of the event generated in cloud computing are the main cause of server loads and the main candidate for load reduction on servers. Of the large number of events generated in cloud computing, some events are duplicates and the main candidate for load reduction of servers.

In this thesis, we have developed an approach to reduce duplicate events in Cloud computing so that reduced events for cloud servers can be treated to minimize harmful impact on the environment. For this, we have developed a model and a mechanism to optimize the events in cloud computing to reduce the load on cloud servers. We have used k-medoid optimization and the Map-Reduce concept. K-medoid clustering associates a group of time-domain medoid points into a lesser number of clusters. Map-reduce is a framework for processing parallelizable problems across large datasets. This approach results in a massive reduction of events on cloud servers.

With the developed approach of Event Reduction on Event, stream reduces events in the cloud leads to low computational usage of cloud servers. The optimum utilization of cloud servers leads to low energy consumption and will allow lesser Carbon-dioxide emissions that can save the environment from heating up or more precisely 'global warming'. This developed approach for the cloud computing world provides us a better environmental effect.

6.2. Future Scope

The solution provided above has an indirect better impact on the environment in the vision of reducing the carbon-dioxide emissions. Besides this concept, this can have an extension to the better utilization of the devices in terms of handling more transactions and the process at a time; which leads to increasing the productivity of the enterprises. The optimized processing also leads to the cost effectiveness which in the long-term benefited the enterprises. An acute observation of the above concept will enhance the future service at third-party platforms. This will optimize and reduce the overhead for the both customer and the service provider in performing the transactions.