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Emerging Trends of Cloud Computing

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Abstract:- Cloud computing is Internet based system development in which large number of computing resources are provided as a service over the internet to users. The concept of cloud computing incorporates infrastructure of web, software as a service (SaaS), Web 2.0 and other emerging technologies, and has attracted more and more attention from industry and research community. We describe about the construction of a cloud computing platform. Specifically, we design a GFS(Global Foundation Service) compatible file system with variable chunk size to facilitate massive data processing, and introduce some implementation enhancement on Map Reduce to improve the system throughput. We also discuss some practical issues for system implementation.

Keywords: *cloud, Internet, service, etc.*

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I. INTRODUCTION

Cloud computing is the deployment of computing as a service rather than a product, whereby shared resources, software, and information are provided to computers and other devices as a utility over a network like Internet.
Cloud computing services with a user's data, software and computation on a published application programming interface over a network. It has generally overlap with software as a service (SaaS).

The end users access cloud based applications through a web browser or mobile applications while the business software and data are stored on servers at a remote site. Cloud application providers strive to give the same or better service and performance than if the software programs were installed locally on user computers.

The foundation of cloud computing is the important concept of infrastructure convergence and shared services. This type of data centre environment allows enterprises to get their applications up and running faster, with easier manageability and least maintenance, and enables IT to more rapidly adjust IT resources to meet fluctuating and unpredictable business demand.

II. HISTORY OF CLOUD

The term "cloud" is used as a metaphor for the Internet, based on the cloud drawing used in the past to represent the telephone network, and later to depict the Internet in computer diagrams of network as an abstraction of the underlying infrastructure it represents.
After the ubiquitous availability of high capacity networks, low cost computers and storage devices as well as the acceptance of virtualization, service-oriented architecture, autonomic, and utility computing have led to a lot of growth in cloud computing. Details are abstracted from end-users, who have no need for expertise in, or control over, the technology infrastructure "in the cloud" that supports them.
The underlying concept of cloud computing dates back to the 1960s, when John McCarthy told that "computation may someday be organized as a public utility." Almost all the modern-day characteristics of cloud computing such as a utility, online, illusion of infinite supply, the comparison to the electricity industry and the use of public sector, private sector, government, and other community forms, were thoroughly explored in Douglas Parkhill's 1966 book, The Challenge of the Computer Utility.
The actual term "cloud" borrows from telephony in that telecommunications companies, who until the 1990s offered primarily invented peer-to-peer data circuits, began offering Virtual Private Network (VPN) services with comparable quality of service but at a much lower cost. By switching traffic to balance utilization as they observe to fit, they were able to utilize their overall network bandwidth more efficiently. The cloud symbol was used to denote the demarcation point between that which was the job of the provider and that which was the responsibility of the end user. Cloud computing extends this boundary to cover servers as well as the network infrastructure.

Then the dot-com bubble, amazon played a major role in the development of cloud computing by modernizing their data centers, by using most computer networks, were using as little as 10% of their potential at any one time and just to leave room for occasional spikes. Which found that the new cloud architecture resulted in significant internal efficiency improvements whereby small, fast-moving "two-pizza teams" could add new features faster and more easily.

Early 2008, Eucalyptus became the first open-source, AWS API-compatible platform for deploying private clouds. Open Nebula, introduced in the RESERVOIR European Commission-funded project, became the first open-source software for deploying private and hybrid clouds, and for the

federation of clouds in 2008. In the same year, efforts were focused on providing QoS guarantees to cloud-based infrastructures, in the framework of the IRMOS european commission-funded project and resulting to a real-time cloud environment. By mid-2008, Gartner saw an opportunity for cloud computing "to shape the relationship among consumers of IT services, those who use IT services and those who sell them" and observed that "organizations are switching from company-owned hardware and software assets to per-use service-based models" so that the "projected shift to cloud computing will result in major growth in IT products in some areas. The significant reductions in other areas."[2]

III. ARCHITECTURE OF CLOUD COMPUTING

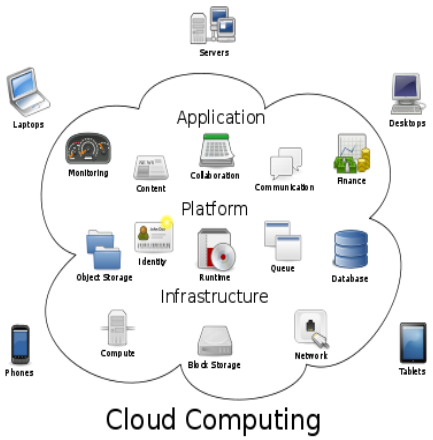

Figure a Architecture of cloud computing

IV. SERVICE MODELS

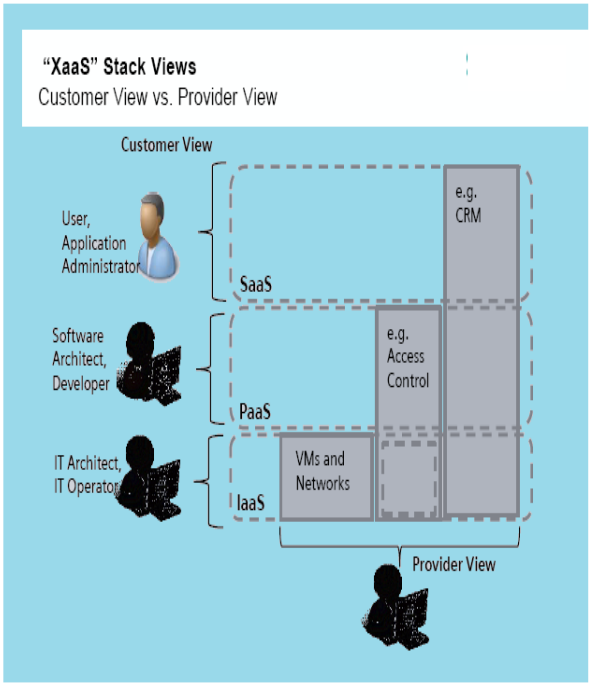

Figure b Service Models

Infrastructure as a Service (IaaS)

In this most basic cloud service model, cloud providers offer computers – as physical or more often as virtual machines such as raw storage, firewalls, networks, and load balancers. IaaS providers supply these resources on demand from their large pools installed in data centers. IP addresses are part of the offer in Local area networks. For the wide area connectivity, the Internet can be used or - in carrier clouds - dedicated virtual private networks can be configured.

For delivering their applications, cloud users then install operating system images on the machines as well as their application software. In this model, it is the cloud user who is responsible for maintaining and patching the operating systems and application software. Cloud providers typically bill IaaS services on a utility computing basis, that is, cost will reflect the amount of resources allocated and consumed.
Infrastructure as a Service (IaaS) is a way of delivering Cloud Computing infrastructure – servers, storage, network and operating systems – as an on-demand service. Instead of purchasing servers, software, datacenter space or network equipment, clients instead buy those resources as a fully outsourced service on demand.
In IaaS, there are some sub-categories that are worth noting. Generally IaaS can be obtained as public or private infrastructure or a combination of the two. In "Public cloud" the infrastructure that consists of shared resources, deployed on a self-service basis over the Internet.[3]

Characteristics of IaaS

SaaS and PaaS, IaaS is a fastly developing field. That said there are some core characteristics which describe what IaaS is. IaaS is generally accepted to comply with the following:

- Resources are distributed as a service
- It allows for dynamic scaling
- Has a variable cost, utility pricing model
- Generally includes multiple users on a single piece of hardware

Platform as a Service (PaaS)

In the PaaS model, cloud providers dispatch a computing platform and solution stack typically including operating system, programming language execution environment, database, and web server. Different application developers can develop and run their software solutions on a cloud platform without the cost and complexity of buying and managing the underlying hardware and software layers. PaaS offers, the underlying compute and storage resources scale automatically to match application demand such that the cloud user does not have to allocate resources manually.
Service (PaaS) Platform brings the benefits that SaaS bought for applications, but over to the software development world. PaaS can be defined as a computing platform that allows the creation of web designing applications quickly and easily and without the complexity of buying and maintaining the software and infrastructure underneath it.
PaaS is analogous to SaaS. Rather than being software delivered over the web, it is a platform for the creation of

software.

Characteristics of PaaS

There are some basic characteristics of PaaS described below:

•Different Services to develop, test, deploy, host and maintain applications in the similar integrated development environment.

•Different services needed to satisfy the application development process

•The web based user interface creation tools help to create, modify, test and deploy different user interfaces.

•Multiple concurrent users utilize the same development application in multi-tenant architecture

•Built in scalability of deployed software including load balancing and failover

Software as a Service (SaaS)

The cloud providers install and operate application software in the cloud and cloud users access the software from cloud clients in this model. The cloud users unable to manage the cloud infrastructure and platform on which the application is running. For doing maintenance and support this avoids the need to install and run the application on the cloud user's computers. What makes a cloud application different from other applications is its elasticity. By cloning tasks onto multiple virtual machines at run-time to meet the changing work demand this can be achieved. This distribute the work over the set of virtual machines by the load balancers. Only a single access point this process is transparent to the cloud user who sees. For accommodating a large number of cloud users, cloud applications can be multitenant, that is, any machine serves more than one cloud user organization. To refer the special types of cloud based application software with a similar naming convention: desktop as a service, business process as a service, Test Environment as a Service, communication as a service and software that is deployed over the internet. With SaaS, a provider licenses an application to customers either as a service on demand, through a subscription, in a pay-as-you-go model, without charge when there is opportunity to generate revenue from streams other than the user, such as from advertisement or user list sales.

Characteristics of SaaS

HE solutions sold as SaaS in fact comply with generally accepted definitions of Cloud Computing. The characteristics of SaaS include: •The Web access to commercial software. •A software is managed from a central location •Software delivered in a "one to many" model .•Users not required to operate software upgrades and patches

.•Application Programming Interfaces allow for integration between different pieces of software

V. CHARACTERISTICS OF CLOUD COMPUTING

Cloud computing explores the following key characteristics:

* **Empowerment** of end-users of computing resources by putting the provisioning of those resources in their own control, as opposed to the centralized IT service control.

* **Agility** improves with users' ability to re-provision technological infrastructural resources.

* **Application** programming interface accessibility to software that enables machines to interact with cloud software in the same way the user interface facilitates interaction between human being and PCs. REST based APIs typically used by Cloud computing systems

* **Cost** is claimed to be reduced and in a public cloud delivery model capital expenditure is converted to operational expenditure. This is typically provided by a third-party and does not need to be purchased for one-time or infrequent intensive computing tasks. The pricing on a utility computing basis is fine-grained with application based options and fewer SOFTWARE skills are required for implementation.

* **Device and location independence** enables end users to access systems using a web browser regardless of their location, what device they are using As infrastructure is off-site (typically provided by a third-party) and accessed via the Internet, users can connect from anywhere.

*The **virtualization technology** allows servers and mass storage devices to be shared. So utilization will be increased. The applications can be easily migrated from one physical server to another.

*The **Multi-tenancy** activates sharing of resources and costs across a large pool of users thus allowing for:

o **Centralization** of infrastructure in locations with lower costs such as electricity, etc.)

o **Peak-load** capacity increases users need for highest possible load-levels.

o **Utilization and efficiency** improvements for systems that are often only 10 to 30% utilized.

Reliability is improved if more redundant sites are used, which makes well-designed cloud computing suitable for business continuity and disaster recovery.

Scalability and Elasticity provides dynamic provisioning of resources on a fine-grained, self-service basis near real-time, without users having to engineer for maximum loads.

Performance is monitored, then consistent loosely coupled framework architectures were constructed using web services as the system interface.

Security could improve due to integrated centralization of data, increased security-focused resources, etc.

* **Maintenance** of cloud computing applications is easier, because they need not be installed on each user's computer and can be accessed from different places.

VI. COMPARISON

The Cloud computing shares characteristics with:

* Autonomic computing — Computer systems capable of self-management.

* Client–server model — Client–server computing uses for any distributed application. This differentiate between service

providers (servers) and service requesters (clients).
* Grid computing — A form of distributed and parallel computing, whereby a virtual computer is composed of a cluster of networked, loosely coupled computers acting in concert to perform very large tasks.
* Mainframe computer — The powerful computers used mainly by large organizations for complex applications, typically bulk data processing such as census, industry and consumer statistics, police and secret intelligence services, resource planning, and financial transaction processing.
* Utility computing gives the packaging of computing resources, such as computation and storage, as a metered service similar to a traditional public utility, such as electricity.
* Peer-to-peer provides distributed architecture without the need for central coordination, with participants being at the same time both suppliers and consumers of resources.

VII. DEPLOYMENT MODELS

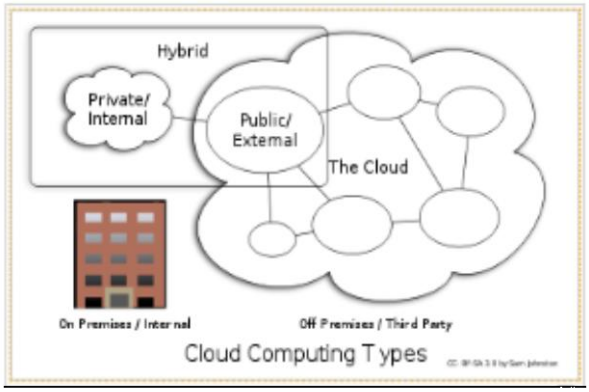

Figure c Types of cloud computing

Public cloud

The applications, storage, and other resources are made available to the general public by a service provider. Public cloud services may be free or offered on a pay-per-usage model. Microsoft, Google etc are service providers ,they owns all infrastructure at their Data Center and the access will be through Internet mode only. No direct connectivity proposed in Public Cloud Architecture.
The main benefits of using a public cloud service are:

- Easy and inexpensive set-up because hardware, application and bandwidth costs are covered by the provider.
- More scalability to meet needs.
- You pay for what you use so no wasted resources

A private cloud is managed by the organization it serves. A third model, the hybrid cloud, is maintained by both internal and external providers.

Community cloud

Community cloud shares infrastructure between several organizations from a specific community with common concerns like security, whether managed by a third party and hosted internally or externally. The costs are spread over fewer users than a public cloud, so only some cost savings potential of cloud computing are realized.

Hybrid cloud

Hybrid cloud is a combination of two or more clouds private, community or public, that remain unique entities but are bound together, offering the benefits of multiple deployment models.
A **hybrid cloud** is a cloud computing infrastructure composed of two or more clouds (private, community, or public) that remain unique entities but are tied together by standardized technology that enables data and application portability.

Private cloud

Private cloud is cloud infrastructure operated for a single organization, whether managed by a third-party and hosted internally or externally. Users still have to buy, build, and manage the so they have attracted criticism.[4]

VIII. CLOUD COMPUTING APPLICATIONS

There are lot of applications of cloud computing. With the right middleware, a cloud computing system could execute all the programs which a normal computer could run on it. Generic word processing software to customized computer programs designed for a specific company could work on a cloud computing system. We required the another computer system for running the programs and storing the data. Here are just a few reasons:

- Clients would be able to access their applications and data from anywhere at any time. Using any computer linked to the Internet they could access the cloud computing system. Data wouldn't be confined to a hard drive on one user's computer or even a corporation's internal network.
- It reduces the hardware costs. Also cloud computing systems would reduce the need for advanced hardware on the client side. You wouldn't need to buy the fastest computer with the most memory, because the cloud system would take care of those needs for you. We could buy an inexpensive computer terminal. The terminal could include a monitor, input devices like a keyboard and mouse and just enough processing power to run the middleware. And necessary to connect to the cloud system. You wouldn't need a large hard drive because you'd store all your information on a remote computer.
- The corporations that depends on computers have to make sure they have the right software in place to achieve goals. Cloud computing systems give these organizations company a wide access to computer applications. The companies don't have to buy a set of software or software licenses for every employee. Instead, the company could pay a metered fee to a cloud computing company.
- Many servers and digital storage devices take a lot of space. Some companies rent physical space to store servers and databases because they don't have it available on site. For storing data on someone else's hardware, removing the need for physical space on

the front end the cloud computing gives these companies the option for this work.

- Corporations might save money on IT support. They have fewer problems than a network of **heterogeneous** machines and operating systems.

IX. RESEARCH

In research different universities, vendors and government organizations are investing around the topic of cloud computing:

• The Academic Cloud Computing Initiative was announced as a multi university project designed to explore students' technical knowledge to address the challenges of cloud computing In October 2007,.

• In April 2009, UC Santa Barbara released the AppScale, first open source platform-as-a-service, which is capable of running Google App Engine applications at scale on a multitude of infrastructures.

• The St Andrews Cloud Computing Co-laboratory was launched in April 2009,, focusing on research in the important new area of cloud computing. Unique in the UK, StACC aims to become an international centre of excellence for research. This also teaching in cloud computing and will provide advice and information to businesses interested in using cloud-based services.

• The Trustworthy Clouds project was started in October 2010,, funded by the European Commission's 7th Framework Programme. The project's goal is to research and inspect the legal foundation and architectural design to build a resilient and trustworthy cloud of cloud infrastructure. The project also develops a prototype to demonstrate its results.

• The TrustCloud research project was started by HP Labs Singapore in December 2010, to address transparency and accountability of cloud computing via detective, data-centric approaches encapsulated in a five-layer TrustCloud Framework. The need for monitoring data life cycles and transfers in the cloud. This leading to the tackling of key cloud computing security issues such as cloud data leakages, cloud accountability and cross-national data transfers in transnational clouds identified by the team.

• The High Performance Computing Cloud (HPCCLoud) project was kicked-off in July 2011, aiming at finding out the possibilities of introducing performance on cloud environments while running the scientific applications - development of HPCCLoud Performance Analysis Toolkit which was funded by CIM-Returning Experts Programme - with the coordination of Prof. Dr. Shajulin Benedict.

• The Telecommunications Industry Association developed a Cloud Computing in June 2011.This analyzes the integration of challenges and opportunities between cloud services and traditional U.S. telecommunications standards.

• CLOUD 20 tries to attract researchers, practitioners, and industry business leaders in all the following areas to help define cloud computing, and its related modernization strategy and directions of the services industry. Following are the cloud research areas:

The Infrastructure Cloud

- The Software Cloud
- The Application Cloud
- The Business Cloud
- Service-Oriented Architecture in Cloud Computing
- Virtualization of Hardware Resources
- The virtualization of Software Resources
- Cloud Computing Consulting Methods
- Many design Tool for Cloud Computing
- Maintenance and Management of Cloud Computing
- Cloud Computing Architecture
- Cloud Applications in Vertical Industries

Advantages of cloud computing are:

- Lower Cost: Pay as you go, no hardware investments or software licenses.
- More performance: Processing time on demand, even HPC, if needed.
- Less maintenance: Someone else manages the servers and
- core software.
- More security: Easier maintenance enforcement of policies, centralized data.
- Unlimited storage capacity: Use it when you need it.[5]

Disadvantages of cloud computing are:

•Dependency on Internet connectivity: Requires a constant connection.

•Loss of control: The problem of someone else hosting hardware, software and data ,which results in security concerns.

•Unpredictable cost: Pay as you go means that the cost of computing will be different every month.[6]

Conclusion:

The Cloud computing is slowly moving toward is a blended computing model that will combine the best elements of public cloud services. Consolidating server environments and improving hardware utilization. Increasing service quality and performance, such as reducing downtime. Enabling disaster recovery and business continuity. It is more efficient to make use of a cloud computing service to provide backup and recovery. Investing in a ton of duplicate infrastructure makes no sense. The Software-as-a-Service (SaaS) is a form of cloud computing. It's a customer relationship management (CRM) system, there are times when delivering those applications as a service makes sense. Maximum IT organization can't afford to invest in supercomputer-class infrastructure. But the business could benefit from access to some pretty compute-intensive analytic applications.

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