Features, Characteristic and Packet Drop Causal Factors in Cloud Computing Network

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ABSTRACT

Data Computing Centres provide resources for a broad range of services such as Web search, email, websites, etc each with different delay requirement, for example, web search should cater to users request quickly while data backup has no special requirement on completion time. Different applications also introduce flows with very different properties, (e.g. size and duration) [3]. Without the standard interconnect protocols and nature of assembling data, of data computing centre technologies, cloud computing would not become a reality [4]. Cloud computing is TCP/IP based, high development and integrations of computer technologies, such as fast microprocessors, huge memory, high speed network and reliable system architecture. There are more than 21 definitions of cloud computing that seem to only focus on certain aspects of this technology [4,9]. This, is enough confusion, this paper uses the features and characteristics of cloud computing to elucidate the computing parlance "cloud computing" and furtheringly, proposed the causal factors in data packet drop in cloud computing environment.

Keyword:, Computers, Communication, Characteristics, Packet Drops, Caursal Factors, networks & Cloud Computing

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1. INTRODUCTION

The term "Cloud Computing" become popular from 2007 when IBM and google announced collaboration in computing. The IBM and google collaboration was a direct experience inbibed from computing data centres' service as an infrastructure for providing essential resources to host a broad range of applications from Web search, email, advertisment to data mining of user behaviour and system log analysis of the Amazon Elastic Compute cloud (EC2), to Google App Engine (GAE). These experiences largely represent a promissing conceptual foundation of cloud computing services [4,6]. Cloud computing can be divided into five layers including infrastruture, applications, clients, platform and servers. These layers subsume three categories of services, namely, infrasture-as a- service platform as- a- service, and software –as –a- service [5,6]. Due to the high operational cost, Cloud Data Computing resources are shared and multiplexed by these different job services. Thus how cloud network resources are shared has a crucial impact on the job delivery, performance, throughput, and the ability to meet various latency. Requirements.

Making the undertanding of cloud computing more clearer and interesting, the features of cloud computing can be put as: Broad network access, measured service, on demand self-service, resource pooling, rapid elasticity and multi tenacity. These, coupled with the exhibiting characteristics of cloud computing would explain in clearer term, such networks and services that can be classified as "Cloud Computing". The paper also discuss the causal factors in Data Packet droping inspite of the robustness, agility and fast speed of cloud computing network. The paper is divided into the following sections. Section 1 is the introduction, Section 2 is the basic features of cloud computing, Section 3 is the characteristics of cloud computing; Section 4 examine the factors that cause data packet drops in cloud networks and Section 5, concludes the paper.

2. FEATURES OF CLOUD COMPUTING

An ever growing features of cloud computing exist according to the level of complexities and types in use. Succintly put [1,10],the features of most cloud computing techniques can be summarised as:

(i) Resource Pooling: The provider's computing resources are pooled together to serve multiple users using multiple tenant model, with different physical and virtual resources dynamically assigned and reasigned according to consummer demand. The resources include among others, storage, processing, memory, network bandwidth, virtual machines and email services. The pooling together of the resource builds economic of scale.

(ii) Measured Service: Cloud computing resource usage can be measured, controlled, and reported providing transparency for both the provider and the consumer of the utilised service. Cloud computing services use a metering capability which enables control and optimise resource use. This implies that just like airtime, electricity or municipality water, IT services are charged per usage metrics-Pay-per-use. The more the consumer utilise, the higher the bill. I.T services such as network security management, data centre hosting or even departmental billing can now be easily delivered as a contracted service.
(iii) Broad Network Access: cloud capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms such as Mobile Phones, Laptops and PDAs.
(iv) On Demand Self-Services: Computer Services such as email, applications, network or server service can be provided without requiring human interaction with each service provider. Cloud service providers providing on demand self-services include Amazon Web Services (AWS), Microsoft, Google, IBM and Salesforce.com, New York times and NASDAQ are examples of companies using AWS (NIST).
(v) Rapid Elsticity: Cloud Services can be rapidly and elastically provisioned, in some cases automatically, to qickly scale out and rapidly released to quickly scale in to the consumer, the capacities available for provisioning appear to be unlimited and can be purchased in any quantity at any time.
(vi) Multi Tenancity: This Characteristic of cloud computing was advocated by the cloud Security Alliance. It refers to the need for policy-driven enforcement, service level and chargedback/billing models for different consumer constituencies. Consumers might utilize a public cloud providers service offerings or actually be from the same organization, such as different business units rather than distinct organizational entities, but would still share infrastructure.

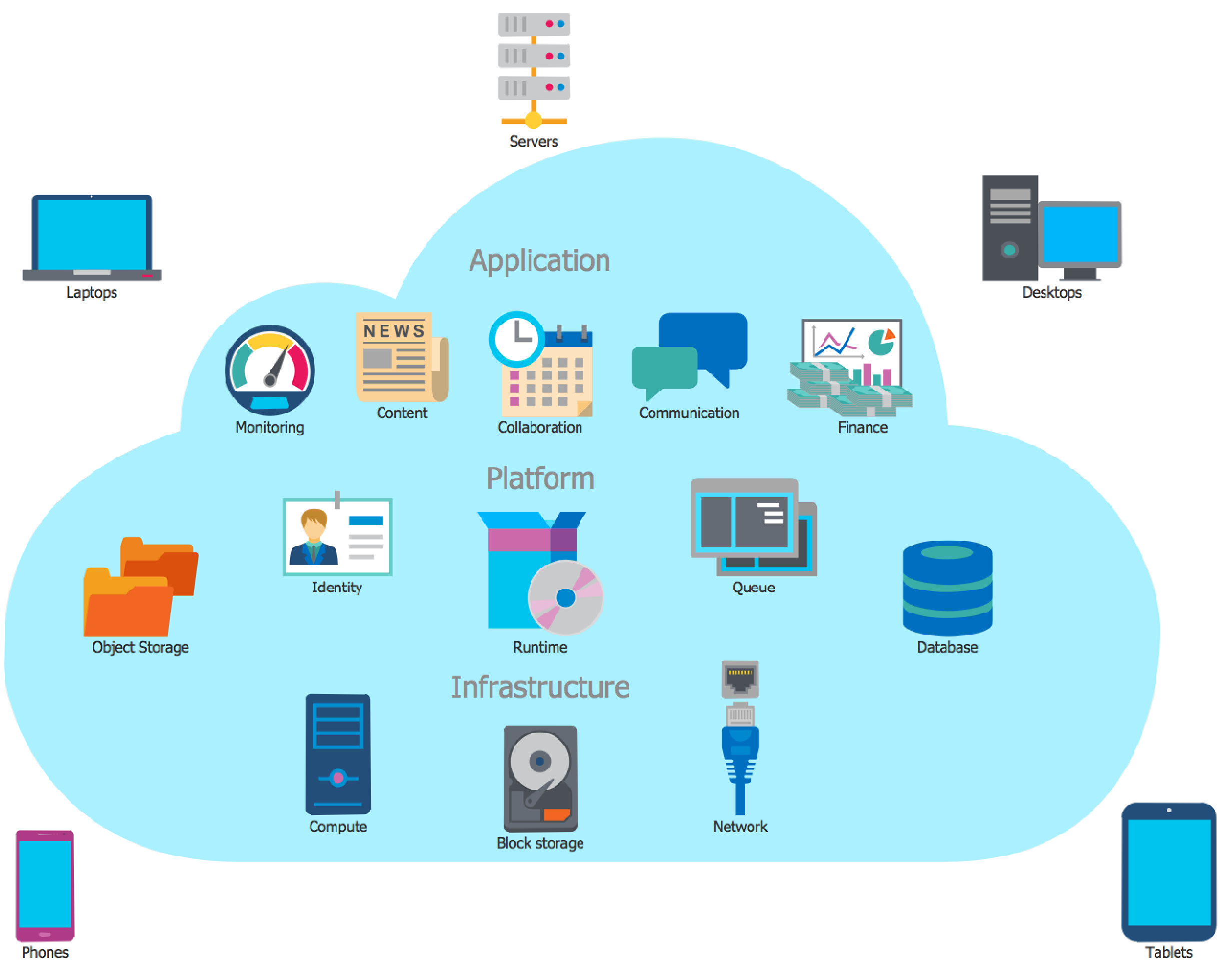

Fig. 1: Cloud Computing Architecture

3. BASIC CHARACTERISTICS OF CLOUD COMPUTING

The essential primary characteristics of cloud computing can be grouped into six [4,8,7], based on metrics deduced from the operational feature.

1. Technical Characteristics further splitted into two(2)
(a) Loose Coupling
The Loose Coupling is the basic principle of cloud computing application interaction. Through the visualization or other technologies, the infrastructure are separated in logic physic. The behaviour of one part hardly affects other parts. For example, the platform is an abstract layer which can isolate different applications running on it. Importantly, the whole cloud computing run in a client-server model. The cloud users connect loosely with servers or cloud providers. All the users have almost no data or control dependence.

(b) Strong fault tolerance:
There are many fault tolerant methods in parallel computing. At low-level, there always exist some fault correction mechanisms with specific. At high level, many specific applications are studied with methods aiming at algorithms. Checking point is one of the most effective methods at middle-level. In large scale parallel computing systems, the interval of two failures may be shorter than application execution time. For example, some scientific computing applications run for weeks or even longer but there may be several trivial or fatal errors during the whole runtime. The fault tolerant technology becomes critical in this condition. Otherwise it has only less chance to complete the time consuming computing tasks. Because a minimum error is unacceptable and redoing costs too much time in many scientific applications, so the whole computations slates which are saved periodically on stable storage will roll back to a special checking point if an error occurs. It is important to keep the whole states of cloud computing systems. There is almost no dependence between two transmission. The failure of one transactions does not affect the other one and partly failure of the system will not cause chain reaction. There are mainly four places where faults may occur in cloud computing: Provider-inner, provider-access, provider-user and user-access. If a fault occurs in provider, the backup or redundancy of provider will sustitute for the failed part. Stop services and restart are another common method if the services are not on time or urgent. The loose compling nature of provider e.g. data centre makes this kind of faults not hard to deal with. If a fault occurs among providers, the provider-across transaction will be cancelled and return with an error hint. Redirecting to other providers is a univrsal method which involves load balance of the whole cloud computing system. Fortunately, there are only fewer transactions, which are caused by background management in the main, involving more than one provider. It needs only to run background management one time per day or even per week.

There are too many reasons such as network congestion, browser collapse, request time out, provider busy, and hacker attack that can casuse faults between provider and user. If not invoving some key elements, these faults are omitted and user can try next time. If involving key element which cause real lost to user such as money in the personal account, additional operations are needed to ensure the security of transaction. At the same time, the system log and credit of provider can deal with accidents. And corresponding laws are supposed to solve all these at last. User does not only connect with provider but also with other users. Many users attempt activities and share several critical resources. On this condition unsafe accessing critical resources, and this can cause choas in cloud computing systems. There exist hard ware level operating systems level and software level methods to protect critical resources. The provider will sit on the fence to arbitrate dispute among users. If all these are not enough, the law will stand in the end. So it is not terrible when a fault occur as both the nature of technology and security guarantee the strong fault tolerant characteristic of cloud computing.

2. Conceptual Characteristic: Service Oriented
Abstraction and accessibility are two keys to achieve the service oriented concept. Through virtualization and other technologies, the underlying architecture is abstracted without allowing the user to learn the detail of cloud architecture and the threshold of application development. At the same time, the key elements underlying the architecture can simply be accessed by cloud user.
Cloud user can consume all the capacity easily by exploring system parameters such as processing, performance and storage capacity. In general, according to the type of provided capacity, the services of cloud computing are broadly divided into three categories.

Infrastructure-as-a-service (iaas), platform-as-a-service (paas) and software-as-a-service (saas) [2,5]. Infrastructure-as-aservice is the delivery of huge computing resources such as the capacity of processing, storage and network. Taking storage as an example, when a user use the storage service of cloud computing part without buying any disks or even knowing nothing about the location of the data he stores. Sometimes the iaas is also called Hardware-as-a-service (Haas). Platform-as-a-service generally abstracts the infrastructures and supports a set of application program interface to cloud applications. It is the middle bridge between hardware and application. Because of the importance of platform, big companies want to grasp the chance of predominating the platform of cloud computing as Microsoft does in personal computer time. The well known examples are Google App Engine and Microsoft's Azure services platform[11,12].

Software-as-a-service aims at replacing the applications running on Pc. There is no need to install and run the special software on your computer if you use the saas. Instead of buying the software at a relative higher price, you just follow the pay-as-you-use pattern which can reduce your total cost. The concept of saas is attractive and some software runs well as cloud computing, but the delay of network is fatal to real time or half real time applications such as 3D online game.

There exist also many cloud resources that cannot rank among Infrastructure, Platform or Software, Apple' App store is a creative and famous cloud computing in wireless area environment. The software services are sold in pay-per-use style, but running on terminals such as 3G phone instead of huge data centres, and is different from Saas. In online game area, powerful game servers supply the interactions of millions of game players. Game players use the capability of cloud computing without waking up to this technology. The e-books resources of the British Broadcasting Corporation (BBC), Amazon, etc are also services in cloud computing. These services scarely have substitution and building another is much more easier than owning so many e-resources. All these services are as important as Iaas, Paas, and Saas, and should be understood fully.

3. User Experience Characteristic-Easy Use

User experience which belongs to the subject of human computer interaction is a vitat criterion when evaluating whether an application is successful or not in the cloud computing, user experience improves alot than its ancestor like grid computing. The cloud service is design towards the end of providing a good experience for cloud user. The valuable services should be easily accessed by cloud users. The core user's experience s achieving easy use. Three reasons are advanced [4] why cloud computing should be of easy use.

First, most cloud providers offer internet-based interfaces (API). These interfaces are simple and elegant enough to hide the business processing behind. The interfaces can stay the same, ignoring whether the business processing has changed or not. Secondly, user experience of web applications is fully studied, so the user interfaces are independent of content. The development of web application has a full suit of flow which can be divided into three stages including user need analysis, function design and program implementation. In top-down method, the user experience design is the fundamental of the whole function design. The facets of the user experience are useful, useable, valuable, desirable, flexable, credible and accessible. Thirdly, the web 2.0 increases the interactions between web users and providers. Web was originally design to transport hypertext. As the rapid and rich development of increasingly sophisticated contents are appearing, web is usually used as a remote software interface. The web 2.0 is supposed to be continunm of user expeience and blurs the line between software and the internet. The emerging AJAX technology makes web applications and services becoming more software-like. All these, reduce information technology overload for the end user. Search in the internet is very simple, presenting a web page with an input text and a confirm button.

4. Economic Characteristic-Business Model

The business model is the key characteristic of the cloud computing option. Cloud computing is mainly supported by gigantic IT companies. They plan that all investments on cloud computing should get return on investment (ROI) in the near future or bet market competitors in the long run. There are many business models especially "how-to-pay model in cloud computing. Pay-per-use may be the favorite one in many cases. This is almost the same as the concept of utility computing. The capacity of processing, storage and network in cloud computing is utility services and can be available whenever the user requires them at anytime in modern human society. Users pay service providers based on their usage of these utility services. There are two categories of cloud users: end and median user. Cloud services are ends in themselves for end user. End user consumed cloud computing services for self use. Median user consumes cloud services and cost effectivily supplies professional services to others. End user sometimes does not pay for cloud services directly. For example, online game players pay for special game according to how long they stay online. And part charge is defrayed to maintain the running of cloud system.
This process is opacity to end user. Median user usually pays for consumed cloud services directly. For medium user, no need to manage complex hardware and software but they learn how to use tools and gain experience with cloud computing technology.
But the business of cloud computing is far beyond these. There are many free to serach with Google, send email with hotmail and find new friends with facebook, and chat on WAPS APP. These conditions merely appear in using other social utility services.

5. Other Characteristics

There are other important characteristics such as TCP/IP based vitualization and high security. TCP/IP gives reliable delivery, a connection-oriented service between remote applications. TCP/IP is widely used in cloud computing. Although the network protocols may be private in the back end of data centre, most cloud users connect to providers through TCP/IP. The HTTP protocol over TCP/IP or internet inspires the user experience characteristics. Cloud resources are offered virtualization as a service over the internet. Up to the present day, many cloud computing infrastructures consist of data centres.data centre uses virtualization technologies which abstract the commonness of infrastructure in different levels. High securtity of cloud computing is achieved manly through three ways. First, the loose coupling makes cloud compuring system run well when part of it is destroyed. Second, the abstraction and virtualization of cloud provider avoid exposing the details of corresponding implementations. Third, technology cooperating with law is the guard of cloud computing.

4. PACKET DROP CAUSAL FACTORS IN CLOUD COMPUTING.

Cloud computing is connection oriented based on two basic transimission protocols. The transmission control protocol (TCP) and the Internet Protocol. As a TCP based connection oriented network, it is suceptible to many fault triggered issues and provider-user caused drop issues [7,8,9]. Accordingly, reasons exist also [7] for packet lost, such as delay in packet transmission from sender to receiver, heavy loading, packet arriving too late at the receiver end, congestion of routers and gateways and the variation in packet after arrival time. The diiferent between when the packet is expected and when it is actually received is called Jilter.

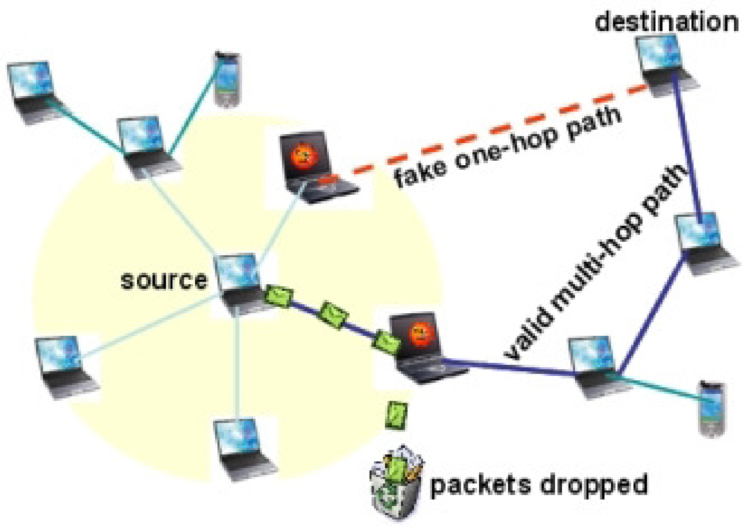

Fig 2: A Packet Drop Scenario

Packet drop causal factor can be [8] categorized as:

1. Node-side failures which are further classified into (A1) Node failures and (A2) PC-end failures.
2. Corruptions which are further classified into (B1) in-Network corruption and (B2) corruptions at the link node.
3. Overflow drops which are further classified into: (C1) Loop induced overflow drops and (C2) Non-loop overflow drops
4. No-ack drops which are further classified into: (D1) environmental induced no-ack drops and (D2) interference induced no-ack drops which can be induced by node rebot or routing loops. Both node rebot and routing loops will cause a very high drop rate.
5. Node rebot can directly cause queued packets of the downstream nodes to be dropped. It is also important to note that a single trigger factor may have different impacts. For example, a rebot may cause the queued packet to be dropped directly or caused interference to all neighbouring nodes, resulting in no-ack drops at those nodes. A routing loop may cause overflow drops directly or cause interference to all neighbouring nodes, resulting in no-ack drops. Simply put, packet drop in cloud computing network can be grouped into four[7,11].

4.1 Link Congestion

Data Packet travel through multiple devices and links during its trip across the network. If one of these links is at full capacity when the send data arrives, the packet must wait its turn before being sent across the net. This is queuing. If a cloud computing node or device is falling very far behind, it will not have room for the new data packet to queue, so, it does the only thing it can, which is to discard the data packet and the pack is said to dropped.

4.2 Device (Router/Switch/etc.) Performance.

If the bandwidth is adequate, user can still face an issue with the router or switch or firewall when they are not able to keep up with the transmission traffic. For example, a link upgrade from 8Gb to 17Gb made on traffic reports that a link node was at full capacity during peak hours of the day after the upgrade, the charts show that the bandwidth goes up to 3.5Gb but the problem is still there, the cause factor could be that the device is not able to keep up with the volume of transmission traffic, and you have hit the maximum throughput the hardware can provide. The traffic is reaching the device, but the device’s CPU or memory is maxed out and not able to handle extract traffic, this results to packet drops.

4.3 Cloud Computing Software Issue
Most of the software written for network devices are time bound. Some of these software are extremely complex, and it is a matter of time before the errors (bugs) show up. These bugs can cause new features not to work at all when deployed or can go undetected for a while before performance issues come up. Fauty Hardware or Cabling: Most parts of cloud computing is connection based. A physical component that is malfunction can lead to a Data packet drops. Error messages maybe seen on the console of the device or within system logs when hardware device is working improperly or when there is link issue. This type of issue is common with both copper wire cabling and fiber optic [11].

5. CONCLUSION

In this paper, we discuss a technical area as complex as cloud computing in a way that ease the understanding of this emerging technology. To make the understanding of cloud computing more clearer, we identify its fundamental features and characteristics relating it to how these features and characteristics may contribute to data packet drops. The loose coupling, strong fault tolerant is the main technical characteristics, the ease use user experience and its business model characteristic, help cloud computing being widely accepted by non computer experts.We also believe that as this paper in its merit exposed and identified the vital features and concepts of cloud computing, it does not solve all the issues with the technology. As part of the future research work, we had like to get detail of technical connectivity, underlining principles of the technology and the various deployment platform.

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