Computer Professional English Report

Topic: Cloud Computing

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Date: 2020-1

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1. **Background**
   1. Definition of Cloud Computing

The National Institute of Standards and Technology (NIST) has given the official definition: cloud computing is a pay-per-use model that provides usable, convenient, and on-demand network access and access to configurable computing resources Shared pool (resources include networks, servers, storage, application software, and services). These resources can be provided quickly with little management effort or little interaction with service providers.

Essentially, cloud computing is a service provision model that believes that "use is more important than ownership". This model uses a large number of network-connected computing, storage resources and applications for unified management and scheduling, forming a resource pool to provide users with on-demand services. This resource pool is the "cloud", which can realize dynamic allocation and adjustment, Flexible switching and division between users will eventually simplify the user terminal into a simple input and output device, and enjoy the powerful computing power of the "cloud" on demand. Generally speaking, all IT services that meet these characteristics can be called cloud computing services.

* 1. The origin of cloud computing

The development of cloud computing has gradually matured after going through the power plant model, utility computing, grid computing and other stages. Strictly speaking, each stage does not reflect an obvious iterative relationship at the theoretical level. The use of low-cost and high-efficiency computing resources has always been the core demand of all sectors of society. The origin and evolution of cloud computing is more embodied in the process of integrating various technological innovations on the basis of extending the core concept, gradually exploring feasible solutions, and gradually meeting the needs of use.

Power plant model stage: The core of the power plant model is a concept of using scale advantages to reduce individual use costs. That is to say, all computing resources are concentrated in a public cloud computing center, and they comply with open agreements, similar to 220v/110v for electricity and No. 7 signaling for communication, which can be easily used by enterprises and individuals. This model has obvious advantages in scale, which reduces its operating costs, but there is only one form of public cloud in this concept. The power plant model is the initial form of cloud computing. The core concept is to reduce costs through scale effects and provide convenient services through leases. This idea continues to the cloud computing stage.

Utility calculation stage: In 1961, McKinsey, the father of artificial intelligence, put forward the concept of "utility calculation" at a conference. Its core borrowed from the power plant model, but different from the power plant model's concept of highlighting scale effects, "utility" emphasizes The way to charge for actual occupation of resources, not just charge based on duration or rate. The specific goal is to integrate distributed servers, storage systems, and applications to share with multiple users, allowing users to use computer resources as if plugging a light bulb into a lamp holder, and pay according to the amount used.

Grid computing stage: The purpose of grid computing is to provide unlimited computing power through any computer, access vast amounts of information, use their systems most effectively, and reduce ownership and management of computing on the basis of meeting user needs The cost of resources. In terms of implementation, grid computing hopes to realize the connection of computing power between different organizations to solve the problem of computing task distribution and result merging. That is to study how to split a problem that requires high computing power, allocate the split parts to many low-performance computers for processing, and finally combine these calculation results to overcome the big problem. However, due to the lack of business model, technology and security of grid computing, it has not achieved the expected success in engineering and business circles.

Cloud computing stage: Cloud computing is a combination of resource integration (virtualization) + IT interaction methods (SaaS, PaaS, IaaS). Its concepts are similar to power plant models, utility computing and grid computing, and their goals are basically the same. That is, it is hoped that IT technology can be as convenient as using electricity and at low cost. But the difference is that the technical strength of the cloud computing era is more mature, fully realizing the virtualization and elastic scalability of computing resources. More importantly, cloud computing relies on the flexibility of IT resource supply, which has revolutionized the business model of the IT industry and spawned a series of new high-value-added businesses. Nowadays, cloud computing has developed into a software and hardware integrated technology resource platform that provides various cloud services and components, and is a comprehensive carrier with a clear business model.

1. **Application situation**

Simpler cloud computing technology has been widely used in today's Internet services, and the most common ones are web search engines and web mailboxes. Search engines are most familiar to everyone than Google and Baidu. At any time, as long as you have used a mobile terminal, you can search for any resources you want on the search engine, and share data resources through the cloud. The same is true for web mailboxes. In the past, sending an email was a cumbersome and slow process. Driven by cloud computing technology and network technology, email mailboxes have become a part of social life. , As long as in the network environment, real-time mail can be sent. In fact, cloud computing technology has been integrated into today's social life.

* 1. Storage cloud

Storage cloud is a new storage technology developed on cloud computing technology. Cloud storage is a cloud computing system with data storage and management as its core. Users can upload local resources to the cloud, and connect to the Internet from anywhere to obtain resources on the cloud. The well-known large Internet companies such as Google and Microsoft have cloud storage services. In China, Baidu Cloud and Weiyun are the storage clouds with the largest market share. Storage Cloud provides users with storage container services, backup services, archiving services, record management services, etc., which greatly facilitates the management of resources for users.

* 1. Medical cloud

Medical cloud refers to new technologies such as cloud computing, mobile technology, multimedia, 4G communications, big data, and the Internet of Things, combined with medical technology, using "cloud computing" to create a cloud platform for medical and health services, realizing medical resources The sharing of medical services and the expansion of medical coverage. Because of the integration of cloud computing technology, medical cloud improves the efficiency of medical institutions and facilitates residents' medical treatment. For example, appointments in hospitals, electronic medical records, medical insurance, etc. are all products of the combination of cloud computing and the medical field. Medical cloud also has the advantages of data security, information sharing, dynamic expansion, and a national layout.

* 1. Financial cloud

Financial cloud refers to the use of cloud computing models to disperse information, finance, and service functions into the Internet "cloud" composed of huge branches. It aims to provide Internet processing and operation services for financial institutions such as banks, insurance, and funds. At the same time sharing Internet resources, so as to solve existing problems and achieve the goal of high efficiency and low cost. On November 27, 2013, Alibaba Cloud integrated Alibaba's resources and launched Alibaba Financial Cloud services. In fact, this is the fast payment that is basically popular now. Because of the combination of finance and cloud computing, you can now complete bank deposits, purchase insurance and fund transactions with simple operations on your mobile phone. Now, not only Alibaba has launched financial cloud services, but companies such as Suning Finance and Tencent have launched their own financial cloud services.

* 1. Education Cloud

Education cloud essentially refers to the development of education informatization. Specifically, the Education Cloud can virtualize any educational hardware resources needed, and then transfer them to the Internet to provide a convenient and efficient platform for educational institutions and students and teachers. The popular MOOC is an application of Education Cloud. MOOC refers to a large-scale open online course. At this stage, the three excellent platforms for MOOCs are Coursera, edX and Udacity. In China, MOOC of Chinese universities is also a very good platform. On October 10, 2013, Tsinghua University launched the MOOC platform-Xuetang Online. Many universities have now opened some courses of MOOC online using Xuetang.

1. **Cloud computing services**
   1. Concept

Any company that provides its services on the Internet can be called a cloud computing company. In fact, cloud computing is divided into several layers: infrastructure as-a-service, platform as-a-service and software as-a-service. Infrastructure is at the bottom, platforms are in the middle, and software is at the top. Other "soft" layers can be added on top of them.

* 1. IaaS (infrastructure services)

The first layer is called IAAs, sometimes called hardware-as-a-service. A few years ago, if you wanted to run some enterprise applications on the office or the company's website, you needed to buy servers or other expensive hardware to control local applications and make your business run.But now with IAAs, you can outsource your hardware to other places. IAAs will provide off-site servers, storage and network hardware that you can rent. With reduced maintenance costs and office space, companies can use these hardware to run their applications at any time.

Some big IAAs companies include Amazon, Microsoft, VMware, Rackspace and red hat. However, these companies also have their own expertise. For example, Amazon and Microsoft provide you with not only IAAs, they also rent their computing power to you to host your website.

* 1. PaaS (platform and service)

The second layer is called PAAS, sometimes called middleware. All of your company's development can be carried out in this layer, saving time and resources.

PAAS offers solutions for developing and distributing applications on the Internet, such as virtual servers and operating systems. This saves you money on hardware and makes it easier to work with distributed studios. Web application management, application design, application virtual host, storage, security and application development collaboration tools.

Some big PAAS providers include Google App Engine, Microsoft azure, Force.com ,Heroku，Engine Yard。 Recently, there are some companies, such as foddix and clouding

* 1. SaaS (software and services)

The third layer is called SaaS. This layer is a daily contact layer with your life, mostly through web browser access. Any application on a remote server can run through the network, which is SaaS.

The services you consume are entirely from web pages like Netflix, MOG, Google Apps, Box.net Drop box or Apple's icloud. Although these web services are used for business and entertainment, or both, they are part of the cloud.

Some SaaS applications for business include gotomeeting of Citrix, WebEx of Cisco, CRM of salesforce, ADP, workday and successfactors.

* 1. relationship among the three models

The relationship between them can be analyzed from two aspects: one is user experience. From this perspective, the relationship between them is independent, because they face different types of users. The other is technology. From this perspective, they are not simple inheritance relationships (SaaS is based on PAAS, while PAAS is based on IAAs). First, SaaS can be based on PAAS or directly deployed on IAAs. Secondly, PAAS can be built on IAAs or directly on physical resources.

1. **Core technology**
   1. virtualization technology

Virtualization is one of the most important core technologies of cloud computing. It provides infrastructure support for cloud computing services, and is the main driving force for ICT services to rapidly move to cloud computing. It can be said that without virtualization technology, there will be no cloud computing service landing and success. With the continuous heating of cloud computing applications, the industry's attention to virtualization technology has also been mentioned to a new height. At the same time, our survey found that many people have misunderstandings about cloud computing and virtualization, believing that cloud computing is virtualization. In fact, this is not the case. Virtualization is an important part of cloud computing, but not all of it.

Technically speaking, virtualization is a kind of computing form that simulates computer hardware in software and provides services for users with virtual resources. The purpose of this paper is to allocate computer resources reasonably and to provide services more efficiently. It breaks the physical partition between the hardware of the application system, so as to realize the dynamic architecture and realize the centralized management and use of physical resources. The biggest advantage of virtualization is to enhance the flexibility and flexibility of the system, reduce costs, improve services, and improve the efficiency of resource utilization.

From the form of expression, virtualization can be divided into two application modes. One is to virtualize a powerful server into several independent small servers to serve different users. Second, virtual multiple servers into a powerful server to complete specific functions. The core of these two modes is unified management, dynamic allocation of resources and improvement of resource utilization. In cloud computing, these two modes have more applications.

* 1. distributed data storage technology

Another advantage of cloud computing is that it can process massive data quickly and efficiently. In today's data explosion, this is crucial. In order to ensure the high reliability of data, cloud computing usually uses distributed storage technology to store data in different physical devices. This mode not only gets rid of the limitation of hardware equipment, but also has better expansibility and can quickly respond to the changes of user requirements.

Distributed storage is not exactly the same as traditional network storage. Traditional network storage system uses centralized storage server to store all data. Storage server becomes the bottleneck of system performance and can not meet the needs of large-scale storage applications. Distributed network storage system adopts scalable system structure, uses multiple storage servers to share the storage load, and uses location server to locate storage information. It not only improves the reliability, availability and access efficiency of the system, but also is easy to expand.

In the current cloud computing field, Google's GFS and Hadoop's open source system HDFS are two popular cloud computing distributed storage systems.

GFS (Google File System) technology: Google's non open source GFS (Google File System) cloud computing platform meets the needs of a large number of users and provides services for a large number of users in parallel. The data storage technology of cloud computing has the characteristics of high throughput and high transmission rate.

HDFS (Hadoop distributed file system) technology: most ICT manufacturers, including Yahoo and Intel's "cloud" plan, adopt HDFS data storage technology. The future development will focus on large-scale data storage, data encryption and security assurance, and continue to improve the I / O rate.

* 1. programming mode

In essence, cloud computing is a multi-user, multi task, concurrent processing system. Efficient, simple and fast is its core concept. It aims to easily distribute powerful server computing resources to end users through the network, while ensuring low cost and good user experience. In this process, the choice of programming mode is very important. Distributed parallel programming mode will be widely used in cloud computing projects.

The original intention of distributed parallel programming mode is to make use of software and hardware resources more efficiently and make users use applications or services more quickly and simply. In the distributed parallel programming mode, the complex task processing and resource scheduling in the background is transparent to users, so the user experience can be greatly improved. MapReduce is one of the mainstream parallel programming modes in cloud computing. In MapReduce mode, tasks are automatically divided into multiple subtasks, and the height and allocation of tasks in large-scale computing nodes are realized through two steps of map and reduce.

MapReduce is a Java, python, C + + programming model developed by Google, which is mainly used for parallel operation of large-scale data sets (larger than 1TB). The idea of MapReduce mode is to decompose the problem to be executed into map (mapping) and reduce (simplification). Firstly, the data is cut into unrelated blocks by map program, and then distributed (scheduled) to a large number of computers for processing, so as to achieve the effect of distributed operation, and then the results are aggregated and output through the reduce program.

* 1. large scale data management

Processing massive data is an advantage of cloud computing. So how to deal with it involves many aspects, so the efficient data processing technology is also one of the indispensable core technologies of cloud computing. For cloud computing, data management faces great challenges. Cloud computing should not only ensure the storage and access of data, but also be able to carry out specific retrieval and analysis of massive data. Because cloud computing needs to process and analyze massive distributed data, data management technology must be able to manage a large number of data efficiently.

Google's BT (BigTable) data management technology and open source data management module HBase developed by Hadoop team are typical large-scale data management technologies in the industry.

BT (BigTable) data management technology: BigTable is a non relational database, is a distributed, persistent storage of multi-dimensional sorting Map.BigTable It is based on GFS, scheduler, lockservice and MapReduce. Unlike traditional relational databases, it treats all data as objects, forming a huge table for distributed storage of large-scale structured data. BigTable is designed to handle Pb level data reliably and can be deployed to thousands of machines.

Open source data management module HBase:HBase It is a sub project of Apache's Hadoop project, which is located in a distributed, column oriented open source database. HBase is different from the general relational database. It is suitable for unstructured data storage. Another difference is that HBase is column based rather than row based. As a high reliability distributed storage system, HBase has good performance in performance and scalability. Large scale structured storage cluster can be built on cheap PC server by using HBase technology.

* 1. Distributed resource management

Cloud computing uses distributed storage technology to store data, so it is natural to introduce distributed resource management technology. In the multi node concurrent execution environment, the state of each node needs to be synchronized, and when a single node fails, the system needs an effective mechanism to ensure that other nodes are not affected. Distributed resource management system is just such a technology, it is the key to ensure the state of the system.

In addition, the resources processed by cloud computing systems are often very large, ranging from a few hundred servers to tens of thousands, and may span multiple regions at the same time. And there are thousands of applications running in the cloud platform. How to effectively manage these resources and ensure their normal service delivery needs strong technical support. Therefore, the importance of distributed resource management technology can be imagined.

The major cloud computing solutions / service providers all over the world are actively carrying out the research and development of relevant technologies. Among them, Borg technology used internally by Google is highly praised in the industry. In addition, Microsoft, IBM, Oracle / sun and other cloud computing giants have proposed corresponding solutions.

* 1. information security investigation

Data show that security has become one of the most important reasons to hinder the development of cloud computing. According to the data, 32% of the organizations that have already used cloud computing and 45% of the organizations that have not yet used cloud computing regard cloud security as the biggest obstacle to further cloud deployment. Therefore, in order to ensure the long-term stable and rapid development of cloud computing, security is the primary problem to be solved.

In fact, cloud computing security is not a new problem. The traditional Internet has the same problem. Only after the emergence of cloud computing, security issues become more prominent. In the cloud computing system, security involves many aspects, including network security, server security, software security, system security and so on. Therefore, some analysts believe that the development of cloud security industry will bring the traditional security technology to a new stage.

Now, both software security vendors and hardware security vendors are actively developing cloud computing security products and solutions. Security providers at all levels, including traditional antivirus software vendors, hardware and software firewall vendors, IDS / IPS vendors, have joined the cloud security field. I believe that in the near future, cloud security issues will be well solved.

* 1. cloud computing platform management

The scale of cloud computing resources is huge, the number of servers is numerous and distributed in different locations, and hundreds of applications are running at the same time. The platform management technology of cloud computing system needs to have the ability to allocate a large number of server resources efficiently to make it work better. Among them, it is the key of cloud computing platform management technology to easily deploy and open new services, quickly discover and recover system failures, and realize reliable operation of large-scale systems through automation and intelligent means.

For providers, cloud computing can have three deployment modes: public cloud, private cloud and hybrid cloud. The three modes have different requirements for platform management. For users, due to the different control of ICT resource sharing, system efficiency requirements and ICT cost budget, enterprises need different cloud computing system scale and manageable performance. Therefore, the cloud computing platform management scheme should consider more customization requirements to meet the application requirements of different scenarios.

Many manufacturers, including Google, IBM, Microsoft, Oracle / sun, etc., have launched cloud computing platform management solutions. These solutions can help enterprises to achieve infrastructure integration, achieve unified management, unified distribution, unified deployment, unified monitoring and unified backup of enterprise hardware and software resources, break the monopoly of application on resources, and give full play to the value of enterprise cloud computing platform.

* 1. green energy saving technology

Energy saving and environmental protection is the major theme of the whole global era. Cloud computing is also known for its low cost and high efficiency. Cloud computing has huge scale economic benefits, which can improve resource utilization efficiency and save a lot of energy. Green energy-saving technology has become an essential technology of cloud computing. In the future, more and more energy-saving technologies will be introduced into cloud computing.

The Carbon Disclosure Project (CDP) recently released a research report on how cloud computing can help reduce carbon emissions. According to the report, U.S. companies that migrate to the cloud can reduce their carbon emissions by 85.7 million tons per year, equivalent to the total carbon emissions of 200 million barrels of oil.

In short, cloud computing service providers need to continue to improve their technology to make cloud computing greener.

1. **The development prospects of cloud computing**

With the development of cloud computing, the function of the Internet is becoming more and more powerful. Users can process huge data and obtain required information on the Internet through cloud computing. From the perspective of the development status of cloud computing, the development of cloud computing in the future will be towards the direction of building large-scale underlying infrastructure that can be closely integrated with applications.

In addition, continuously creating new cloud computing applications and providing more and more perfect Internet services for users can also be regarded as a development direction of cloud computing.

In terms of trends in cloud computing, Google believes that the application of cloud computing means the future of data following the user. If you buy a new computer, you don't have to worry about copying data or installing new applications. All you need is a browser and you have all the environment, content and information you need. And it's not just on the computer. In the future, mobile phones, televisions, video phones and other devices will be able to access such information. In the future, all applications will be ported to the cloud, and all online content will be available through the browser, as well as the content needed for today's applications. Now, some of the software Google makes doesn't have to worry about missing storage, because it's stored on cloud servers.

Microsoft sees the next step in cloud computing as connecting these users more closely over the Internet and providing them with cloud computing services. Microsoft is creating a user experience that moves away from generic device storage to a mode where storage can be stored at any time. From a strategic perspective, Microsoft has determined its future cloud computing development direction as three routes:

Complete the transformation of enterprise software portfolio to network service, release the network version of PC software and continue to build the data center network.

According to Sun's "black box" plan, which was launched in 2006 based on cloud computing theory, the planned future data centers will not be confined to crowded, stuffy computer rooms, but mobile data centers. It can serve large companies with tens of thousands of employees as well as small and medium-sized enterprises. The best location for such a data centre could technically be a field outside the city, but preferably near a power station, which would minimise costs.

As for the future of cloud computing, researchers believe it is likely to revolutionize the way users use their computers, moving from desktop-centric applications to Web-centric activities.

It is also possible that the computer will degenerate into a simple terminal that will no longer require the installation and upgrading of software that it now requires. And Web data integration, personal data space management, data outsourcing services, research on mobile networks, and privacy issues will all be important components of future cloud computing research. Cloud computing is a higher level technology than grid computing, and its industrialization will bring about the adjustment of related products and software development methods and ideas. First of all, "cloud computing" technology needs to establish a "cloud" that can provide rich application services, rich information resources, privacy and security assurance of user information. Second, "cloud computing" technology also requires "thin" client devices that are efficient, secure and easy to use. Thirdly, "cloud computing" technology is based on high-speed, stable, low-cost and app-based network, which requires network product manufacturers to provide relevant products with high speed and stability based on application service guarantee and application choice of transmission path.

At present, although the development prospects of cloud computing are very good, but its future development challenges are not to be ignored.