NEC's Core Technologies for the Cloud Computing of Telecommunication Carriers

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Abstract

The era of cloud computing has begun, and telecommunication carriers, which are important customers of NEC Group, are looking for opportunities to enter the cloud computing business in order to secure new income sources. Advanced telecommunication carriers, such as Telefonica, have already begun to offer these services. For such carriers, NEC is the only vendor which can offer both IT and network solutions while understanding the differences and synergies of both technologies. NEC is also a business partner that can provide comprehensive consulting solutions in order to contribute to the success of telecommunication carriers who move their business to the cloud.

Keywords

cloud computing, carrier, Cloud Platform Suite, NetCracker, VPCC, MDS, Femto, WiMAX, LTE, OpenFlow

1. Introduction

In recent years, "cloud computing" has attracted attention as a new method for utilizing IT systems. In "Cloud Computing Era," distributed IT resources are connected accross high-speed access lines and backbone networks to form data centers that exist entirely in the cloud of the network.

As of 2010, majority of IT companies around the world have stated how they will move into the area of clouds, how it relates to their strategies and what cloud services they will offer. NEC as a leading IT vendor has led this move to cloud computing services in the IT sphere. Moreover, NEC's telecommunication carriers have shown a great deal of interest in providing cloud computing services to pursue new business opportunities. Telefonica, a Spanish firm, has already begun to provide cloud computing services to end users utilizing NEC's SaaS infrastructure.

2. Business Opportunities for Telecommunication Carriers

It is forecast that communication traffic will greatly increase both in wireless and fixed networks. The ratio of data traffic is especially rapidly increasing in developed countries. On the other hand, ARPU (average revenue per user) growth is sluggish due to increasing competition between telecommunication carriers, the introduction of fixed-rate communication services, etc.

In the current situation of industrial and economic depression in recent years, it is common for telecommunication carriers around the world to reduce CAPEX (capital expenditure) and OPEX (operating expenses) and to develop new revenue streams in order to increase sales (**Fig. 1**).

Cloud computing services have been initiated by Google, Yahoo and Amazon. It is essential for telecommunication carriers to leverage the advantages that they possess in order to differentiate their services from the services provided by companies like Google:

1) Guaranteed communication quality, the key factor for cloud computing services.
2) Secure and reliable communications.
3) Stable operating infrastructure.
4) Competitive on price in the field of cloud computing (ratio of communications expenses).

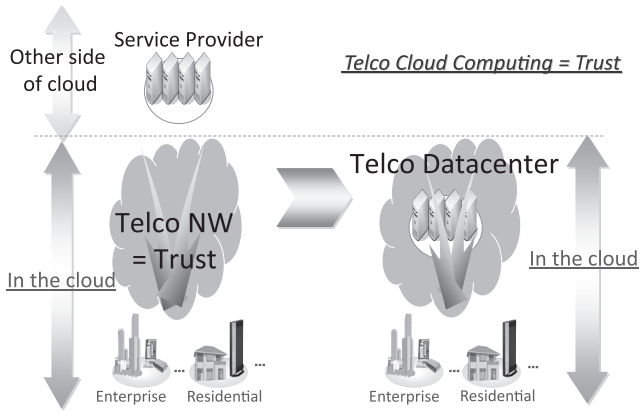

Fig. 1 Cloud computing for telecommunication carriers.

5) Adequate offices and operation systems for commercial services.

3. Advantages of NEC

NEC proposed the C&C (Computers and Communications) concept in 1977 and since then has been providing the bespoke solutions for customers in both the IT and networking fields.

In the IT field, in step with the evolution in form of use (i.e., from general-purpose computers to clients and servers, web computing and mobile computing), NEC has developed OMCS (Open Mission Critical System) to support the infrastructures of business and society. On the other hand, in the networking fields, NEC has been providing highly reliable products and services to telecommunication carriers in step with the evolution to low cost, high performance, high capacity and high speed systems (i.e., from analog to digital, FTTH, VoIP and 4G). NEC has been providing highly reliable products and services, which are highly evaluated as "carrier grade."

There is a need to provide cloud services which are unique to telecommunication carriers and to transform telephone exchange stations into data centers. However, IT technologies alone are not sufficient to respond to these needs. It is indispensable to understand network infrastructure in order to make comprehensive proposals regarding network infrastructure (e.g. adjusting the infrastructure to the services provided, or providing broadband infrastructure and terminals such as LTE and WiMAX). In this sense, NEC is dominant over other companies in providing real C&C solutions.

In other words, successful cloud computing for telecommunication carriers means combining NEC's products and services, such as IT technologies, network technologies and terminal technologies, to suit the aforementioned needs of telecommunication carriers.

4. Description and Characteristics of Cloud Computing for Teleommunication Carriers

NEC is responding to the needs for IT and network products through a platform solution for cloud computing services. **Fig. 2** shows a description of cloud services for communication carriers.

4.1 IT Infrastructure of Cloud Computing for Telecommunication Carriers

Telecommunication carriers have as their bases many switching centers with extensive floor space. Since the 1990s, telephone switches have been digitized and downsized, and the installation spaces needed for switches have been greatly reduced. As a result, at present, many switching centers have

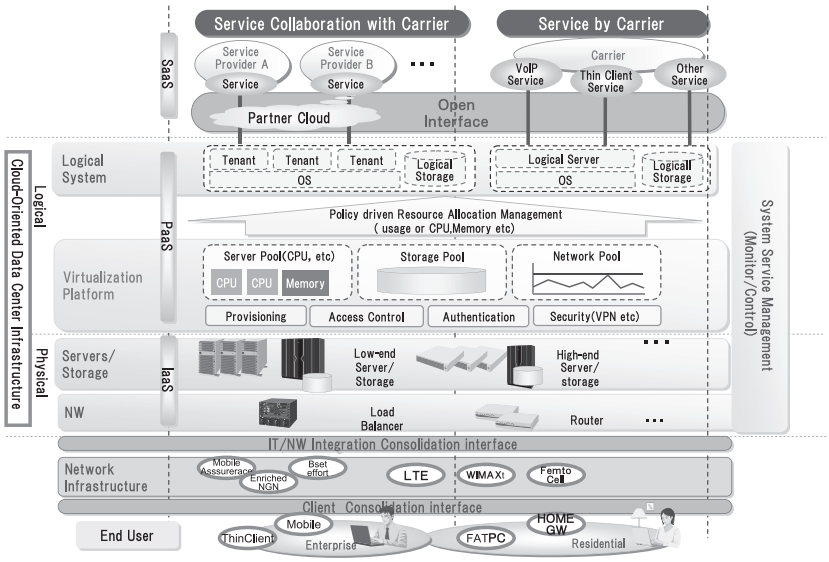

Fig. 2 NEC's the cloud computing Solutions for telecommunication carriers.

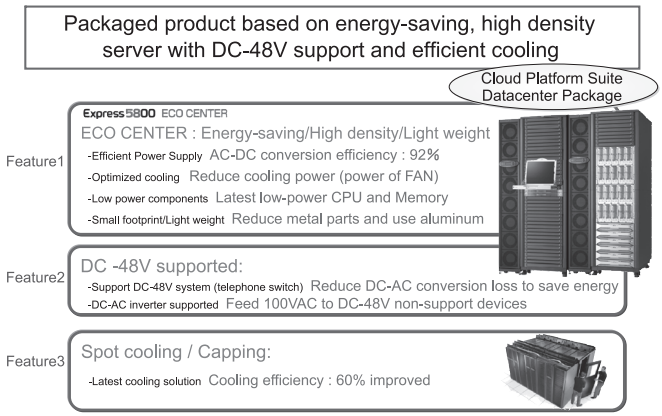

Fig. 3 IT platform for the cloud computing of telecommunication carriers.

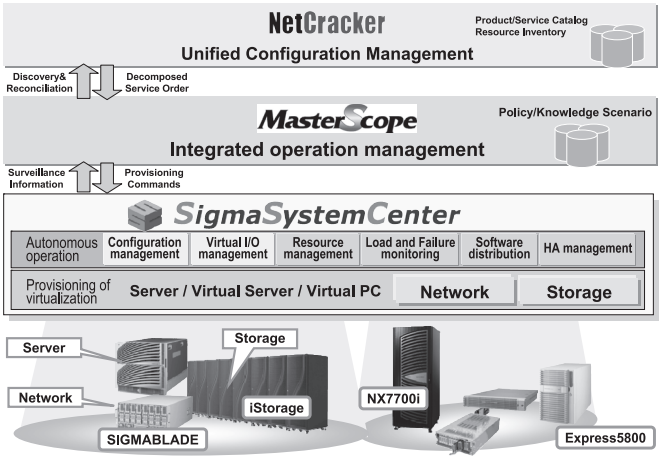

Fig. 4 System services management.

unused floor space. It is possible to reduce the overall investment needed for cloud computing by effectively utilizing these vacant spaces.

NEC's "Cloud Platform Suite," is an integrated IT and network platform product for telecommunication carriers. The product has been designed by carefully considering the circumstances of switching centers, such as power feeding (DC -48V is generally used for switchboards), load heaviness and cooling systems (**Fig. 3**).

4.2 Software to Support the Operation of Cloud Computing

In order to provide cloud computing services, it is necessary for telecommunication carriers to effectively operate virtualized servers and storage. In addition, for the operation of cloud computing services, it is necessary to have functions to support the operations needed to provide services such as customers' service orders (e.g. new enrollment and addition of new service contracts) and system monitoring systems (e.g. optimum placement of resources) and the reliability of these services.

(1) SigmaSystemCenter

This software manages and monitors virtualized resources (i.e. servers, storage and networks). It also features an auto-recovery function, and it can optimize resource configuration in accordance with load status.

(2) WebSAM (know as MasterScope overseas)

MasterScope performs integrated operation and management for a whole IT system. It also monitors the operation of virtualized systems. This software is integrated with NEC's Sigma System Center to support system operation.

In addition, the software pre-detects failures using invariant analysis technology and realizes a high level of service.

(3) NetCracker

NetCracker offers solutions to support telecommunication carriers' service provision. It manages and monitors facilities unique to telecommunication carriers (e.g. management of massive amount of nodes and terminals) and provides functions to support the operation of telecommunication carriers to effectively configure facilities when users join or withdraw (**Fig. 4**).

5. Network Technologies Supporting Cloud Computing Services

In order to realize better cloud computing services, higher access speed and larger bandwidth are indispensable. However, in the global market, it is not necessarily the case that a broadband infrastructure (e.g. Japan's FTTH) has been established. Therefore, the role of wireless broadband access technology gains importance, since it is possible to establish networks in accordance with the circumstances of telecommunication carriers in each country. In the following, the wireless broadband access technologies of NEC are introduced (**Fig. 5**).

5.1 Femtocell Technology

A femtocell (Access point base station) is an extremely compact base station installed in the home or office. The unit

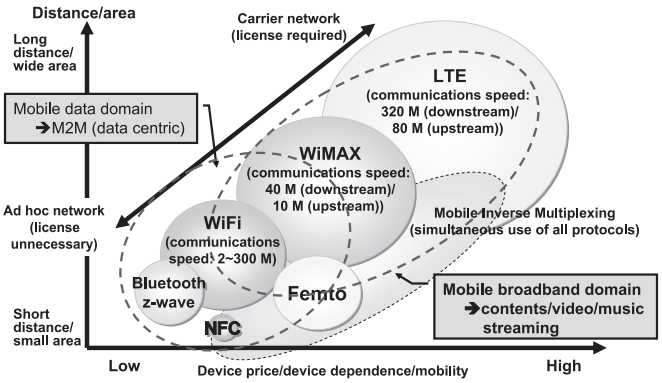

Fig. 5 Wireless broadband technologies supporting cloud computing for telecommunication carriers.

consists of a gateway connecting to a core network plus a maintenance system. The base station is connected to the internet via a broadband line and provides broadband access to existing 3G terminals.

NEC has already begun to deliver a commercial femtocell system to telecommunication carriers in Europe and Asia. The features of the system include a Traffic Offload function to reduce telecommunication carriers' network investment and simple base station operation with Plug & Play and other functions unique to NEC and beneficial for telecommunication carriers, such as billing management, positional information. In March 2009, NEC was commended by the industry organization FemtoForum for its achievement in promoting commercial usage of femtocell technology.

5.2 WiMAX Technology

Like the Wi-Fi system, WiMAX is a wide-area wireless broadband access system developed based on the IEEE802.16 technical standard established by the IEEE802 standard-setting organization. It realizes broadband access with speeds over 50Mbps using technologies such as S-OFDMA, MIMO and BeamForming. The main application of these technologies is in mobile broadband access services; however, demand for fixed broadband access is also growing in developing countries.

In markets where telecommunication infrastructures are mature, such as Japan, Korea and the U.S.A., new services are being introduced by MVNO (mobile virtual network operator) models that use WiMAX. In addition, WiMAX is sometimes used in combination with Wi-Fi as one of the measures to respond to the rapid growth of 3G data traffic caused by the introduction of smart phones such as the iPhone.

NEC took these needs into account and developed PasoWings, a series of compact and light WiMAX products which can be easily installed and operated.

5.3 LTE Technology

LTE (Long Term Evolution) is the next mobile access technology developed by 3GPP to take over from W-CDMA and HSDPA. LTE standards require peak data rates of over 100Mbps for descent and over 50Mbps for ascent communications with less than 5ms of transmission delay in RAM. Moreover, it is possible to achieve a peak data rate of 300Mbps for descent with a bandwidth of 20MHz using technologies such as MIMO (multiple input multiple output) and 64 QAM (quadrature amplitude modulation). Leading mobile telecommunication carriers plan to employ LTE, and this technology is expected to be the mainstream of future mobile broadband systems.

NEC's LTE solution features a small and light unit, making the system easy to install. The technology also realizes world-class amplification efficiency, and is the solution which is suitable to the needs of telecommunication carriers wanting to reduce TCO (Total Cost of Ownership) by using the latest technologies such as SON (Self Organizing Network). NEC's LTE solution has been employed in trial by global telecommunication carriers such as Telefonica and SingTel.

5.4 Mobile Inverse Multiplexing Technology

NEC owns the patent for mobile inverse multiplexing technology, which makes it possible for multiple lines of different carriers to work as a single broadband connection. It is an immediate solution for realizing comfortable cloud computing services even in circumstances where broadband infrastructure has not yet been completed.

With Mobile Inverse Multiplexing, a single data stream is distributed over multiple mobile access paths (e.g. 2.5G, 3G, WiMAX), then the transmitted data streams are again restored as one data stream on the receiving side. For data communication between senders and receivers, a mobility overlay is provided to networks operated in different systems by encapsulating the data in Mobile IP. In addition, Sprit TCP and intelligent retransmission systems are provided to handle multiple physical lines working as a single broadband connection.

It is also possible to integrate multiple service areas using different wireless systems and network circumstances currently employed by telecommunication carriers in different countries. In other words, it is possible to immediately establish a single overlay network at low cost.

6. Examples of Cloud Computing Services Provided by NEC

6.1 MDS (Managed Desktop Service)

NEC is promoting MDS as the model case of cloud computing services for telecommunication carriers. MDS has become a promising theme for telecommunication carriers, because for these clients MDS is a "virtual PC," in which the operating system, applications and user data can be intensively managed at the telecommunication carriers' data centers. This means that it is possible to perform operating system updates, etc. collectively at data centers, and it is also possible to greatly reduce the required man-hours and management and operation costs (**Fig. 6**).

NEC can respond to cases in which line speed between data centers (virtual PCs) and thin clients is not high enough (e.g. in the access environment of countries lacking sufficient broadband infrastructure). Even in such cases, it is possible to realize trouble-free operation, and it is also possible to take measures to respond to the needs caused by low speed WAN using integrated IT and networking technologies.

(1) Playing Video on a Virtual PC

Since many virtual PC systems usually employ a "screen transmission system," it can be difficult to play video smoothly. In order to achieve this mission-usually-impossible and smoothly play back video, NEC has implemented MMA, a technology on our MDS solution.

In the case of MMA, when playing back video in WMV (Windows Media Video) or FLV (Flash Video) format, the video contents are converted into the MPEG 2 format on the virtual PC before the data is transmitted to thin client terminals. This eliminates the need to implement multiple codecs on terminals. Since MPEG 2 video usually has higher bitrates than WMV or FLV video, MPEG 2 video requires the network to have larger bandwidth.

Therefore, MMA technology features functions to convert video into the MPEG 2 format at designated bitrates, and video is played back on the virtual PC in accordance with the bandwidth of the ADSL network in order to realize smooth playback via low speed lines. This cannot be achieved by the systems of other companies.

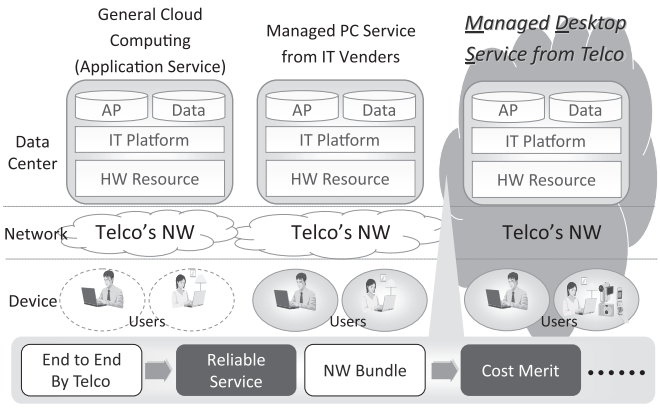

Fig. 6 Outline of MDS service.

(2) Upload

When uploading large files from the USB memory connected to a thin client terminal via ADSL, the transfer takes over the thin ascent line, and it might cause trouble for regular operations (e.g. the use of a mouse or keyboard).

Taking such dangers into account, NEC has provided thin clients with a function to specify the bitrate of data at the time of file upload, and has given virtual PCs an interface for specifying the bitrate in order to realize data transfer in accordance with a low speed network connection. This is the advantage of NEC, which is providing solutions for both platforms and thin clients.

(3) Multitenancy

In multitenant environments using commercial access networks, it is necessary to fulfill a variety of factors from the viewpoint of users by considering such conditions as "do not modify existing assets (network circumstances) as much as possible" and "do not install special facilities." The factors to be taken care of include the maintenance of security for each tenant and the connections to existing resources in tenants from the virtual PC. These factors usually require a reasonably complex network configuration, which means high costs for network facilities and extensive man-hours for management.

NEC has tried to simplify the configuration as much as possible by implementing virtual NICs in both virtual PC and thin client in order to "build a tunnel" from the virtual PC to the thin client. This system can realize a highly secure and reliable environment. It makes it possible to clearly see the local network of a tenant from the side of a virtual PC, and

to connect to existing assets without any inhibition.

6.2 SaaS for Telecommunications Carriers

SaaS (Software as a Service) is gaining popularity as a measure for service providers to provide end users with business applications over the Internet. As previously explained, telecommunication carriers are the most suitable organizations to perform this service, thanks to their network assets, high reliability and high security level.

In order to make a strong showing in the SaaS business, it is important for telecommunication carriers to add third-party applications (e.g. CRM, ERP) to their product lineups, to build IT and network environments that suit their end users, and to prepare platforms which can quickly provide applications, rather than forcing users to provide applications themselves.

NEC's SaaS solution includes a function to integrate and manage NEC's applications and applications provided by third parties. In addition, NEC has established a business model to provide telecommunication carriers with the NEC SaaS platform to quickly begin SaaS business.

7. OpenFlow, the Network Infrastructure for Cloud Computing in the Future

Like the transformation of switching centers in the past, data centers in the future are likely to be layered into mega data centers, satellite data centers and edge data centers by streamlining telecommunications and appropriately allocating data. In the case of existing technologies, it is necessary to consider the maximum transmission traffic when configuring networks for traffic management between data centers, which requires a high cost. Also, when building additional data centers, it is essential to re-examine the configuration of the whole network.

OpenFlow is the network technology of the next generation designed to solve such problems. With existing technologies, networks are managed principally by the routing of IP addresses; however, in the case of OpenFlow, a series of communications determined by a combination of MAC addresses, IP addresses and port numbers are defined as a "flow," and communication routes are controlled by units of "flow." Virtualization and multitenancy of data centers are progressing, and the OpenFlow technology will make it possible to control the server traffic of data centers at an arbitrary level of virtualization.

NEC is proposing to realize more effective operation by employing this technology as the network platform infrastructure for the cloud computing of telecommunication carriers (**Fig. 7**).

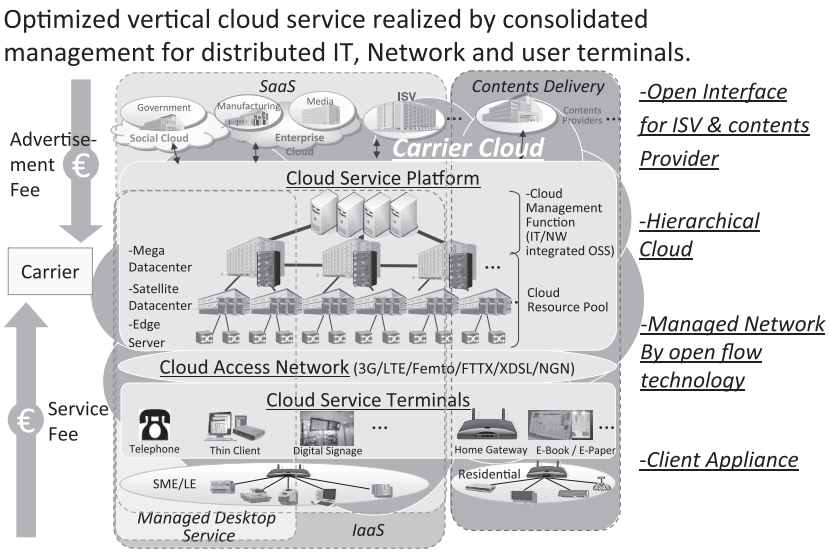

Fig. 7 Image of cloud computing for telecommunication carriers in the future.

8. Conclusion

In the past, NEC has been providing IT services to customers wanting IT services, and network services to customers wanting network services. However, for cloud computing services, it is necessary to change this custom. It is necessary to make the most of NEC's assets (i.e. IT and network services) and to propose business models and system models to solve customers' problems.

At MWC 2010 (Mobile World Congress 2010), held in February, NEC proposed cloud computing services for telecommunication carriers in a scale and scope that went beyond that of any other telecom vendor. Above all, NEC has proposed that telecommunication carriers include SaaS and MDS (DaaS) into their cloud computing services. NEC's proposed solutions have attracted a high level of customer interest.

Telecommunication carriers rely on NEC as a "business partner" to promote cloud computing services and as the "provider" of comprehensive services ranging from IT technology to network technology and terminal technology. NEC is making efforts to respond to the confidence of customers in a concrete way. It is also important to make more competitive integrated IT and network solutions and technologies for platform products. NEC is enhancing its business to realize C&C cloud computing strategies, contributing to expanding the business of global telecommunication carriers.

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