Achieving a "Personal Cloud" Environment

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Abstract

This paper introduces NEC's challenging achievement "Personal Cloud", which is a strategic vision of BIGLOBE. We are promoting the development of "Cloud Device" that integrates various terminals, telecommunications and services, as well as the development of "Application/Contents Market" that collects various services on the Internet. The service platform to support them will be capable of flexibly handling the increasingly large amount of accesses. To achieve this, we have deployed an architecture with scale-out configuration using open source software for the platform.

Keywords

Personal Cloud, Android, virtualization, scale-out, open source

1. Introduction

The Internet, which makes our daily life convenient in various aspects, continues its advance. Terminals to access the Internet now feature greater variety, from PCs to mobile phones, TV sets and games machines. High-speed wireless network enabled broadband accesses outdoors at an equal level of convenience to indoor reception. Moreover, advancement of technologies in server virtualization and distribution has enabled an even more flexible "cloud" environment.

In such an environment, BIGLOBE declared in July, 2009 that it will evolve from being an "Internet Service Provider (ISP)" to become an "Internet Service Partner (ISP)". While an "Internet Service Provider" provides mainly internet access services, the "Internet Service Partner" will create new values in various aspects of everyday life via the Internet. We will promote this evolutionary advance under the strategic vision of the "Personal Cloud".

Under the slogan "Personal Cloud" this paper introduces the world that BIGLOBE is aiming at and the service platforms to support it.

2. Personal Cloud

Fig. 1 is a diagram of the planned BIGLOBE personal cloud. It aims to create an environment in which everyone can use cloud services without constraint at both indoor and outdoor locations, contributing thus to an agreeable lifestyle. In this section, "cloud device" and "application contents market" are explained as the main elements in achieving this environment.

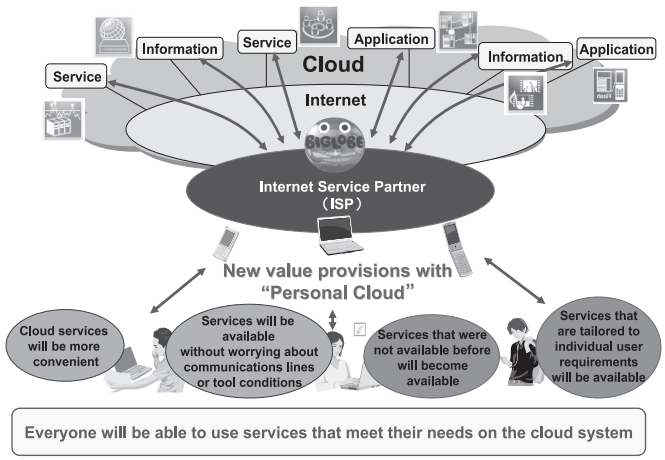

Fig. 1 Personal Cloud.

2.1 Cloud Device

As shown in **Fig. 2** , the "Cloud device" is a concept of a terminal that integrates communication functions and various services. Generally, PCs and mobile phones are used mainly as terminals to access the Internet and users must choose either one of them according to their usage situation. A desk-top PC fixes a user at home. Even a notebook PC is not perfectly suitable for carrying about. Also, users have to choose the most appropriate network access to suit their location. A mobile phone is a suitable terminal for carrying around. However, its screen is rather small so it is far from being the perfect tool for

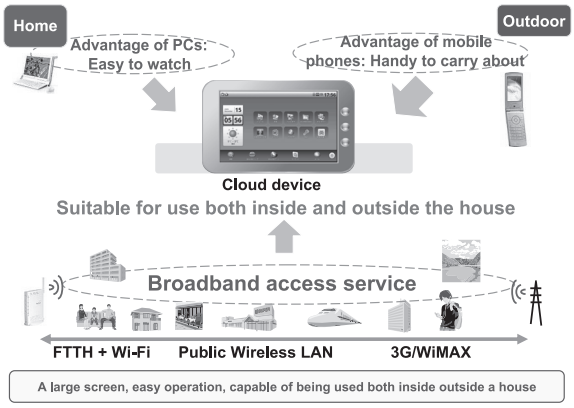

Fig. 2 Cloud devices.

unconditionally accessing all required information. To solve these issues, BIGLOBE is planning to provide a cloud platform that allows users to use terminals both at home and outdoors without issue. Its features are:

1) A touch panel screen of 7 to 10 inches, and an on-screen keyboard
2) Flexible switching over different communication systems
3) Expandability achieved by using open technologies

The size of the touch panel screen referred to in the feature 1) is a little smaller than that of a notebook PC and a little larger than that of a mobile phone. The on-screen keyboard is employed as an input device so that the user displays it only as necessary. The cloud device is designed to be used also as a photo frame at home by standing it on a user's desk, or as a mobile device when the user goes out.

Feature 2) realizes easy and automatic selection of various communication environments such as indoor wireless LAN, outdoor public wireless LAN, 3G network, WiMAX, etc. This function is provided by the "BIGLOBE Auto-connect Service". Users register their IDs to this service and they can access the most suitable network environment and also easily switch to a different network.

Feature 3) provides flexibility and expandability in the device so that services and applications added to the cloud system on a daily basis may be quickly installed on the user's cloud device. The open source application "Android", which is a software platform for mobile phones, is also employed.

The cloud device is planned to eventually accommodate various services on the Internet. However, the following services are considered as a start.

1) E-mails, blogs, twitter and a communication service such as photo sharing
2) Daily life information providing services such as news, weather forecasts, local events, etc.
3) Entertainment contents services such as comics, magazines, games, animations, etc.

When users use the cloud device by standing it on their desks like a digital photo frame, information such as news, weather forecasts, etc. will be provided automatically to their cloud device with a "Push type" service, so that they do not have to be concerned about operating the device in order to access and retrieve the latest information. Moreover, the screen which is larger than that of the mobile phone will provide an easy-to-read layout when displaying comics or electronic books.

Sample models of the cloud device were rented out to the consumers that participated in the monitoring research from February to May, 2010. This sample model was equipped with WebStation which is a terminal made by the Taiwanese company, Camangi Corp. and software developed by BIGLOBE which provides news and weather forecasts, etc. With the help of such research activities, opinions from users will be collected to develop even more convenient terminals.

2.2 Application/Contents Market

The "Application/Contents Market" is a web site market for software and is designed under the assumption that it is to be accessed via not only the BIGLOBE cloud device but also via various other terminals such as mobile phones, smart phones, etc. Especially users with terminals using Android as an operating system will be able to select and download desired services and contents among those that the various software developers and contents owners have registered to the "Application/Contents Market". Some of these services are free, and others are charged. In satisfying provision conditions, this web site will be a safe and convenient access place for users and also for developers and contents providers.

As shown in **Fig. 3** , a web site named "andronavi" (http://andronavi.com/) was launched on January 2010 to be eventually developed as "Application/Contents Market". It started as a web site to provide information related to the Android, and began to provide free application download services in February. A charged application download service will be started in the future and a web marketplace where worldwide registration and purchasing of applications and contents will be available is planned to be launched around October 2010. By providing such services, we expect that the cloud device expandability will be greatly improved.

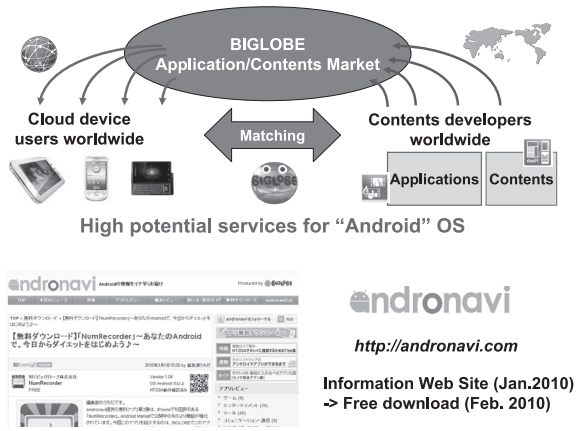

Fig. 3 Application contents market.

3. Cloud Service Platform

BIGLOBE platform supporting the services described in section 2 is a cloud-type platform with a capability of high expandability and security (**Fig. 4**). As of April 2010, more than 10,000 servers and storage devices with approximately 1 petabyte (one million times of one Gigabyte) are installed at the BIGLOBE data center in order to provide over 1,000 different types of services. These IT systems maintain high expandability and reliability by employing virtualization, automation and distribution technologies. Moreover, LED lighting, high-efficiency air-conditioning systems and fans are installed in the machine room of our data center to enable displays of temperature distributions (thermograph cameras and multipoint temperature sensors). Optimal air-conditioning system operations are thus achieved. This policy has also resulted in the Japan top level PUE (Power Usage Effectiveness: an index to show energy efficiency in a data center, etc.) achieving the score of 1.6 or less.

BIGLOBE is promoting the four architectures shown in **Fig. 5** to develop the "personal cloud" services.

1) The most unique feature of the cloud service platform is to employ a scale-out architecture. This architecture enables us to expand servers easily both for infrastructure systems and for applications in order to cope with the increasing traffic. BIGLOBE has realized and standardized this architecture by employing state-of-the-art OSS (Open Source Software) technology and flexibility and reliability are thus ensured for the cloud services.

2) While providing various information, cloud computing

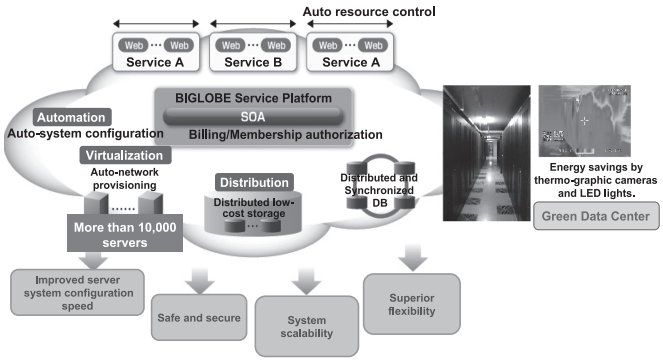

Fig. 4 BIGLOBE platform.

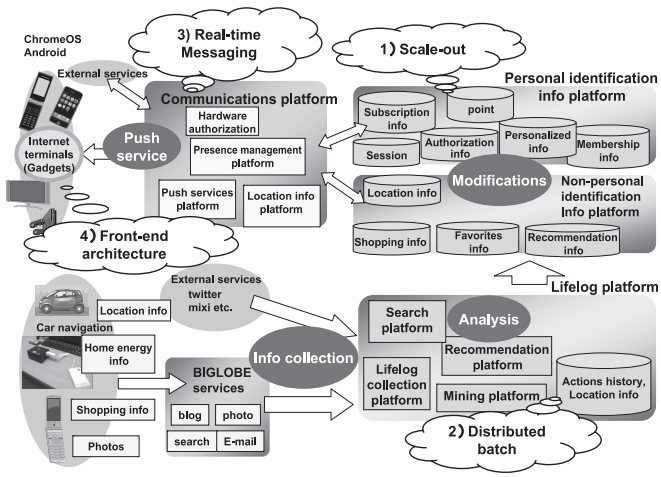

Fig. 5 Next generation service platform for "personal cloud".

still retains the issue that it must have the ability to analyze enormous amounts of data in real time using significant amounts of computer power [2] . An OSS distribution processing middleware, Hadoop (http://hadoop.apache.org/) is deployed for the economical general-purpose server. Key Value Store as a system that combines database management software is employed for the data storage system so that distributed batch architecture can perform real-time information analysis.

3) User devices and messaging systems are different to those of conventional cloud systems. A system model is employed in which center servers provide information to users instead of that by which users access the servers to get information. A technology called "Comet" materializes this system model. It allows servers to control http connections so that information timely to the appropriate user domains

can be distributed even when an enormous number of user devices access the cloud services.

4) As for the usage aspect, a front-end architecture that is employed for recent models of smart phones will be introduced to materialize the requisite superior operations capability that cannot be achieved by using conventional architectures. This means that advanced and dedicated technologies are required, not only for device functions but also for high-speed transmissions and high-speed screen display functions. Even when accessing rich content, the latest technologies provided on HTML5 boot the content without stress and materialize convenient usage scenes. BIGLOBE is always aiming to standardize the contents development environments by using the state-of-the-art technologies. Of the above four approaches to cloud platform technologies, the scale-out process architecture is shown in detail in **Fig. 6** .

Using the conventional router type architecture, the performance of the load balancer, that is the Internet connection point, depends on the limitations of its hardware capability. To solve this issue, DSR (Direct Server Return) type architecture is employed so that session management is carried out in the cache servers which are deployed subsequent to the Web servers.

Also, contents cache servers are located ahead of the Web servers so that static contents distribution scales can be scaled out without being limited by the performance of the storage devices.

Key Value type memory table servers are deployed ahead of them in order to avoid that the database server accesses such as referring to user domain information, etc. become a bottleneck in the system.

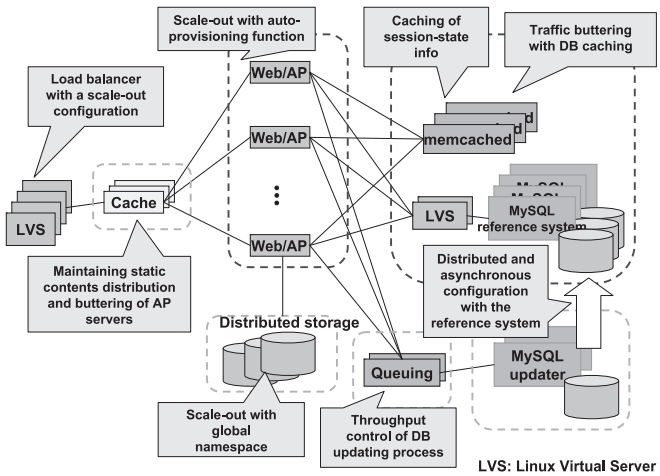

Fig. 6 Scale-out process architecture.

Moreover, with the scale-out process architecture configuration, the database is updated via queue control servers so that information will be updated in the database moderately. This enables the employment of a distribution scale-out type architecture for the database servers that results in realizing a countermeasure against sudden traffic increases and also in the reduction of the infrastructure cost.

Scale-out architectures were eventually employed for the BIGLOBE services in 2009, such as for the BIGLOBE web site home page, a blog service called "WebryBlog" and the "andronavi" service described in section 2 in this paper. For example, The BIGLOBE top page was renewed in October 2009 and deployed Key Value table servers. This achieved page information personalization according to the users' domains with over ten times the limiting performance compared to that of conventional architecture.

The rest of the three cloud architectures will be realized by the end of FY 2010, and they will be eventually adopted for other services of BIGLOBE. Also, the management know-how acquired from the use of these architectures will be developed as a cloud-type hosting service and will be provided mainly to service enterprises providing consumer services.

4. Conclusion

As described in the above paper, BIGLOBE is intended to provide services based on our strategic vision "Personal Cloud" so that users may enjoy our services even more pleasantly. The platform will become available by developing terminals, communication environments and services en suite. To achieve this aim, we will modify the conventional architecture and develop a cloud-type service platform by applying our innovative state-of-the-art technologies. We will also make the best use of our experience gained in the provision of services to our users over the last ten years.

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