

On-Demand Virtual System Service

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Cloud computing, which enables information and communications technology (ICT) capacity to be used over the network, is entering a genuine expansion phase for enterprises as an effective means of reducing up-front investments and using ICT more effectively. One Cloud service, infrastructure as a service (IaaS), enables the use of virtual machines, virtual storage, and virtual networks on an as-needed, when-needed basis. IaaS can be used by many enterprises regardless of their type or scale of business and can be used in either a public, virtual-private, or private format. Fujitsu provides IaaS through its “on-demand virtual system service” with easy-configuration, on-demand, and self-service features designed for enterprise use. This service enables enterprises to use ICT resources in line with their business strategies and to free themselves from hardware lifecycles. However, enterprises must become familiar with application-development techniques applicable to virtualization and distributed processing. As enterprise ICT expands to include clients and customers, the use of Cloud services is becoming indispensable to business.

1. Introduction

In Cloud computing, information and communications technology (ICT) capacity anywhere on the network can be used as a service. Cloud computing provides a new way of using ICT compared with conventional owned ICT resources from both technical and business viewpoints and represents an evolved form of data center services. The spread of high-speed networks and advances in Web-related technologies have been accompanied by free or inexpensive convenient services like Web searching and E-mail and the widespread establishment of Cloud services in the world of ICT for personal use. The use of Cloud services in the corporate world is now entering a genuine phase of expansion.

Against this background, Fujitsu developed a prototype system for providing enterprise-oriented Cloud services and implemented it for

in-house use in 2009. After consolidating the development and operating experience gained from this prototype and collecting feedback from the departments having hands-on experience with the system, Fujitsu then planned and developed an “on-demand virtual system service.” This service began beta trials in May 2010 and expanded into a full-fledged commercial-grade service from October of the same year.

This paper describes the features and benefits of Fujitsu’s on-demand virtual system service and its enterprise usage patterns.

2. Change in enterprise use of ICT

In the corporate world, ICT began as data processing for core business systems, but its use later expanded to individual departments. The outlook from here on is for ICT to expand its scope

and role to include clients and customers. As a result, the flow of information and other forms of value is beginning to diversify. This flow was traditionally characterized by the transmission and provision of value from the center outwards. However, we have now entered an era that requires the creation of new value by enabling corporate management to make use of the huge amount of data generated by society and present on the network. In this regard, the provision of new services and the analysis of large quantities of data require many ICT resources.

Intrinsic business benefits of the Cloud include no up-front investment in infrastructure facilities, the ability to use only as many resources as needed when needed, and usage fees based on the amount of infrastructure used. For an enterprise, the use of Cloud services means both reduced risk in upfront investments and more effective use of ICT.

Cloud services include software as a service (SaaS), which provides business application functions as a service, platform as a service (PaaS), which provides an application

development and execution environment as a service, and infrastructure as a service (IaaS), which provides basic ICT resources like servers and storage systems as a service and can be used by many enterprises regardless of the type or scale of their business.

3. IaaS usage Cloud service patterns

IaaS usage Cloud services (hereafter, IaaS Cloud services) can be broadly classified into three patterns according to the means of connection and other characteristics (Figure 1).

1) Public Cloud services

Users can access and use ICT resources provided by a Cloud services provider over the Internet. This pattern exploits characteristic features of the Internet to enable users to access Cloud services from various types of environments including mobile and overseas terminals. It is ideal for systems that provide services to a wide range of end users including users not from one's own company and users located overseas.

2) Virtual-private Cloud services

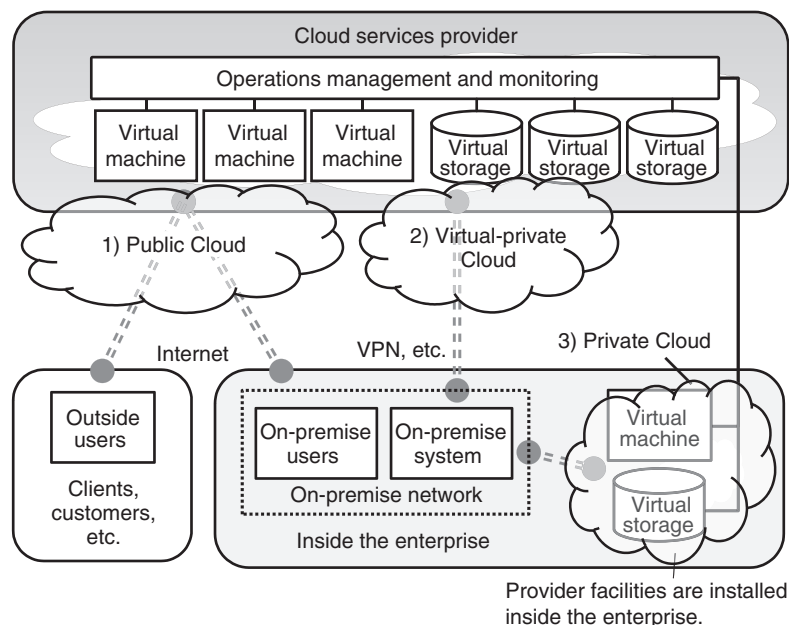


Figure 1
IaaS usage Cloud service patterns.

With a virtual-private Cloud, users connect to and use ICT resources provided by a Cloud services provider via a dedicated network from an on-premise company network. This network may be an ordinary virtual private network (VPN), but if the data center installing the enterprise system is providing Cloud services, it may also be a local area network. In this pattern, ICT resources can be accessed using the same private IP address range as used by existing servers within the company, and resources, which can freely increase or decrease, can be used from the on-premises network. This pattern is applicable to systems whose users are restricted to company personnel or to systems that prohibit communication over the Internet because of security risks. In particular, in the case of connection to a local area network, the existing system and Cloud ICT resources can be integrated in an environment having exceedingly small transmission delays, and Cloud services can be used flexibly with the existing system that transmits, receives, and shares large volumes of data.

Fujitsu provides an environment that enables virtual-private Cloud services to be used easily via VPN service or from a data center outsourcing environment.

3) Private Cloud services

In a private Cloud, a Cloud services provider installs ICT resources inside an enterprise and users make direct connections to those resources via an on-premise network.^{note)} In this case, the use of ICT resources can be monopolized by that enterprise, and all business communications and business data can be kept within the company. The operation center of the Cloud services provider connects to this private Cloud only via a management network to provide remote operations. Since ICT resources are not shared with other entities, the level of access isolation

note) A pattern in which an enterprise owns ICT resources is generally called a private Cloud.

and network security is high in this pattern.

However, the downside of physical ICT resource monopolization is that costs are somewhat higher than when resources are shared and pricing is usage-based. Accordingly, the private-Cloud pattern is advantageous for an enterprise that uses many virtual ICT resources around the clock. It must be kept in mind, though, that the machine rooms of individual enterprises may not incorporate the most advanced countermeasures to power outages and earthquakes and other disasters that can be found in the large-scale data centers of Cloud services providers.

A hybrid Cloud, which combines the above services as needed to match the type and scale of the enterprise business, is also a Cloud usage pattern for enterprises. Fujitsu's on-demand virtual system service will expand from the hybrid-Cloud and virtual-private-Cloud patterns.

4. ICT resources provided by IaaS

The IaaS Cloud service provides basic ICT resources like servers and storage systems in the form of virtual resources. Taking the resources available from Fujitsu's on-demand virtual system service as examples, I describe below how these virtual resources can be used.

4.1 Virtual machines

The on-demand virtual system service provides virtual machine functions to provide Web servers, application servers, etc. A business system can be constructed by loading virtual machines with packaged software or original business applications and interconnecting these virtual machines by a virtual network. The user can select the CPU capacity and memory capacity to be used and can modify these settings even after system operation has begun to better match actual processing loads.

4.2 Virtual storage

In this case, the on-demand virtual system

service provides external storage devices for the purpose of storing operating systems, applications, and business data. The user may create as many virtual volumes as needed in any size to serve the business in question without having to be concerned with the capacity of physical storage equipment and can use these virtual volumes by connecting them to virtual machines. Backup and restore functions for virtual volumes can also be used as services.

4.3 Virtual network security

Virtual machines can be interconnected by a dedicated virtual local area network (VLAN) so that communications between servers can be made secure. A firewall function can also be used to make connections to the Internet safe and to defend against attacks. This function enables the number of virtual machines that communicate with the Internet directly to be kept to a bare minimum. In this way, a network security configuration that supports Internet connections can be achieved on the Cloud.

5. Features of on-demand virtual system service

To make the best use of Cloud benefits in the enterprise use of ICT, Fujitsu's on-demand virtual system service provides the following features.

1) Easy configuration

For IaaS, all physical design and operations such as device rack positioning, LAN cable connections, and redundant configuration design are performed by the Cloud provider, which eliminates the need for the user to engage in design work related to physical devices and wiring. It is necessary, however, for the user to become involved in configuration design and logical-connections design using virtual machines and other virtual ICT resources. This configuration work requires commands to be issued or operations to be performed in ways that differ from one IaaS provider to another. In short,

users are required to acquire system construction skills unique to Cloud environments in contrast to conventional ICT physical-infrastructure design.

Fujitsu's extensive experience in system integration and outsourcing has produced many case studies and much know-how in relation to network and server configuration design and interconnectivity in a wide variety of enterprise systems. This know-how has been used as a basis for identifying a number of prototypical configurations that differ in business scale, type of business operations, and security level. The on-demand virtual system service provides system templates based on these prototypical configurations. A user only needs to select a system template and enter relevant information to create a virtual platform for a business system since the selected interconnections and performance parameters of the virtual ICT resources will be set automatically. The user can save a system created in this way as an original system template and can also make a clone of a similar system.

2) On-demand

Fujitsu began to provide an on-demand hosting service some years ago to enable the use of ICT resources in accordance with user needs. This service progressed to enable the use of resources on an "as-needed, when-needed" basis. In the past, the implementation and addition of ICT resources required paper-based applications and contracts to be drawn up in a process that could take several days. Moreover, the contract period was normally one year. In contrast, the on-demand virtual system service enables the procedure for using ICT resources to be completed within 30 minutes or so from the time that those resources are needed while allowing them to be used in one-hour units.

3) Self-service

Self-service and automation are essential to achieving a full on-demand service. Past procedures called for transferring, by forms

belonging to an application or by E-mail, information about what kinds of ICT resources are needed and from when. From the time that such documents were received to the time that the resources were finally set up, both the enterprise user and provider had to perform many manual tasks. Thus, by minimizing the amount of manual work in the process of identifying and providing ICT resources, we have made it possible to start using ICT resources quickly. The service portal shown in **Figure 2** provides users with a self-service window.

Users can use this service portal to apply one of the abovementioned system templates and specify the beginning (and optionally the end) of resource use. All subsequent processing is automatically controlled, enabling ICT resources to be provided without any time lag. This service portal was created with human operation in mind, but it is also possible to use a service application programming interface (API) so that the same functions specified via the service portal can be achieved from a program. Operations such as booting up or terminating virtual machines in response to increases or decreases in processing load according to a predefined schedule or the actual number of accesses, or tasks like periodic backup, can all be automated. Fujitsu aims for an open Cloud through standardization of service APIs.

Managing and controlling the virtual ICT

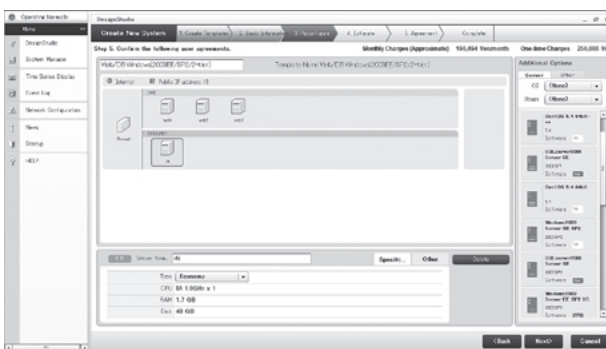


Figure 2
Service portal.

resources linked to the service portal requires the right combination and integrated control of state-of-the-art technologies such as advanced Web and security techniques and server, storage, and network virtualization, and the application of those technologies to services in a form that is easy to operate. This has been achieved through Fujitsu's next-generation Service Oriented Platform, which has been designed to provide Cloud services.

6. Benefits of on-demand virtual system service

An enterprise using Fujitsu's on-demand virtual system service can expect the following benefits.

1) Improved enterprise speed and flexibility

An ICT system that can support the launch of a new business is indispensable not only for enterprises that conduct business over the network but for all enterprises. A new business may require new applications or the cloning or modification of an existing system, which may require the installation of new servers and storage devices and the running of applications. It may also turn out that there is no need for new resources, which indicates that the enterprise had been saddled with an unnecessary excess of ICT resources all along. The Cloud allows the use of ICT resources for only as long as needed. It enables users to develop systems dynamically while expanding business strategies and to clone, integrate, and discontinue systems as strategies change. The use of Cloud services is an effective means of keeping the ICT infrastructure in line with the strategies of an alert and agile enterprise.

2) Release from hardware lifecycles enabling emphasis on applications

Device maintenance guarantees from hardware vendors usually last about five years, so periodic replacement of devices is necessary. There are many cases of on-premise enterprise systems being repeatedly upgraded and used

over the long term. With IaaS, the replacement or repair of devices due to hardware faults, which can occur at any time, and system migration in response to aging hardware are all performed as services. It is possible, for example, to move a system that had been running on IaaS for several years to new hardware without the enterprise user even knowing that such a change has taken place.

The migration of virtual machines between physical servers is also handled on the provider side by combining reboot timing with live migration in which a virtual machine is moved while it continues to operate. The business system continues to function without interruption during this migration. In short, the enterprise user has no need to worry about the operation or replacement of the ICT infrastructure and can therefore concentrate on applications that are directly tied to the user's business.

3) Easy system cloning enabling maintenance/test environments and large-scale expansion

Systems constructed on IaaS can be easily cloned thanks to virtualization. Fujitsu's on-demand virtual system service enables the use of system templates, which allow an entire system composed of virtual networks and machines to be deployed in one shot. The deployed system can then be loaded with the software required to conduct the target business and configured accordingly and patches can be applied to implement the enterprise user's security policies. The new state of the virtual machines configured in this way can now be saved as a user-defined system template, which means that a clone of the system in its latest state can be easily made by redeploying that template. A cloned environment can be used to test application revisions and evaluate the impact of new patches on the application. It is an invaluable tool for operating enterprise business systems, and the fact that it can be created and used only when needed is a great advantage.

In addition, it is not uncommon for various

organizations within a single enterprise to run the same system separately. A system template is an effective means of massively expanding the same system.

7. Future issues

Some problems with the provision of Cloud infrastructure services for enterprise use still remain.

1) Virtualization

In a virtualized environment consisting of virtual machines and other virtual devices, some software that performs hardware-dependent processing may not operate. Recognizing this problem, Fujitsu will offer a test environment for checking software operation and release the operation testing conditions.

2) Availability

A conventional high-availability cluster system that requires inter-system paths cannot operate as such in a virtual-machine environment. For systems running on a Cloud, a typical technique for raising the performance and availability of an entire system is to scale out by operating multiple virtual machines in parallel. However, it is not the case that all enterprise systems can be directly migrated to such a format. Fujitsu provides a failover function that responds to a hardware failure by automatically allocating other hardware and rebooting virtual machines. This enables downtime to be limited to a few minutes without the need to form a cluster system. Problem hardware is isolated from services and periodically repaired in a batch.

3) Performance

As described above, a scale-out system based on distributed processing suits a Cloud that allows a large quantity of virtual resources to be used as needed.¹⁾ An application running on a single ultrahigh-performance physical machine may not achieve the same performance in a virtual-machine environment. From here on, applications that support the scale-out approach based on new architectures for enterprise

systems such as MapReduce, Key-Value Store, and queuing services are expected to increase. The early provision of an environment that facilitates the development of such systems is an issue to be addressed.

8. Conclusion

An enterprise using a Cloud infrastructure can optimize service usage fees by using only as many ICT resources as needed when needed. A Cloud services provider, in turn, can reduce the cost of providing services by providing widely shared physical resources to enterprises whose peak characteristics differ. What makes all this possible is the virtualization of ICT resources and the use of automated self-service schemes.

Fujitsu's on-demand virtual system service aims to be a Cloud infrastructure service that can

be used effectively not only by emerging dot-com companies but by all kinds of enterprises from small- and medium-sized companies to large organizations. In addition to enabling existing middleware and applications to run, the plan is to provide a software architecture applicable to the Cloud in the form of services that can be used within an enterprise system.

For enterprises to expand their ICT services from their core businesses and internal departments to their clients and customers, Fujitsu believes that Cloud computing must become an essential part of their business.

Reference

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