NEC's Approach to Orchestrating the Cloud Platform

In recent years, the employment of cloud services by ICT (Information Communications Technology) systems has been rapidly increasing. The development of ICT system-centric solutions that can exploit the convenience and flexible scalability of cloud services will be a critical piece of the answer to honing the future edge of corporate competitiveness and the creation of innovative value. We believe that the cloud platform that supports ICT systems can and should be a platform that contributes to a better society by enabling us to use them in the safe, secure, efficient and equal manner with reduced impact on the environment.
In this article, NEC will provide an overview of how we are tackling the development of cloud platform solutions.

HASHITANI Naoki
Vice President
Business Innovation Unit

1. Introduction

By tackling solutions that contribute to a better society by ensuring the safety, security, efficiency and equality, NEC aims at reinventing itself and becoming a company focused on social value creation.

Cloud platforms, SDN (Software-Defined Networking), Big Data and cyber security are examples of ICT that will play a vital role in supporting solutions for society that are advancing our social infrastructure.

The cloud platform covered in this special issue will play a vital role as a foundation to support such ICT. While the ongoing evolution of cloud and virtualization technologies is driving the expansion of IaaS/PaaS, as long as the cloud remains a platform to support ICT systems, the essential qualities of operational stability and security demanded of the cloud platform remain unchanged.

In addition, the current provision of a variety of cloud services by each carrier and their deployment by not only private individuals, but also by companies and other organizations, is accelerating, and the form these services take is truly diverse. The breadth of this diversity can encompass cloud services constructed within the company, utilization of outside cloud services, and installations in third-party data centers. There may also exist a need to manage hybrid environments that provide a bridge to legacy systems. In the future, we can envisage the development and deployment of cloud services of multifarious forms.

2. Cloud Platform Development Objectives

In order to ensure that our customers can rely on the safety and security of cloud services, NEC's efforts are premised on security and stable operation as essential qualities of the cloud platform. At the same time, we accelerate efficient administration of our various services, and also fair utilization in accordance with customer requirements, which are the fundamental axis of our development objectives.

Moreover, NEC is aiming at a cloud platform solution that boasts flexibility, scalability and extensibility that can keep pace with the future evolution of technology – a platform that can incorporate innovative products equipped with cutting-edge technology such as energy-saving micro modular server units that incorporate high-density integration capable of providing 736 servers in a single device, and that employ SDN technology which will enable the flexible reconfiguration of networks.

The fundamental qualities that NEC's envisaged cloud platform shall possess to achieve these objectives are defined in **Table 1** below.

Software, Hardware and Data Center Infrastructure Development Objectives

With the aim of paving the way for our envisaged cloud platform as defined above, NEC is pursuing the development of new functionality and strengthening the robustness of hardware, software and data center infrastructure.

Also with the aim of reducing the environmental burden of this infrastructure, NEC aims to build a cloud platform incorporating devices that are highly energy efficient and offer the benefits of a high-density design (more compact).

With these aims in mind, **Table 2** outlines the concerned development objectives.

3. Current Results of NEC Cloud Platform Development

Through the deployment of newly developed technologies and adoption of innovative approaches, NEC has observed the following results in the elements that configure the cloud plat-

Table 1 Essential qualities of NEC's cloud platform.

Item	Objective
① Orchestration	Unified management of the private cloud (on premise) and "housing" cloud (off premise).
	Integrated management with the public cloud.
② Scalability/Extensibility	Easy and rapid system scalability (increased memory, cores, etc.) in response to the state of usage.
③ Operability	Cost savings and enhanced operation quality through system virtualization and automation.
	Cost savings and enhanced operation quality through network virtualization and automation.
	Reduced costs and enhanced quality through automation of design, manufacture/construction, and assessment tasks.
④ Performance	Avoidance of response delay under high load conditions.
	Prevention of impact on performance by increases/decreases of utilization.
⑤ Availability	Uninterrupted operation when faults/failures occur.
	Uninterrupted operation during maintenance.
⑥ Energy efficiency	High-density integration packaging (ultra-large-scale integration) of IT devices/equipment.
	Improved energy efficiency of IT devices/equipment.
	Reduced energy consumption by cooling devices.
⑦ Security	Management and control of the confidentiality, integrity and availability of information.
⑧ Disaster-resistance	Operational continuity in the event of a large-scale, wide-area disaster.

Table 2 Software, hardware and data center infrastructure develop ment objectives.

Configuration Element		Item	Objective
Software	(1) Virtualization management platform software	① "Orchestration"	Reduction of operational costs by integrated operational management including cloud services on-premise, housed, and provided by other companies. [Cut current corresponding costs in half]
	(2) Network management software (3) Integrated operational management software	② Scalability/Extensibility	Accelerated scalability by automated provisioning/construction of resources (memory, processing cores, etc.) [Provisioning time: 5 minutes]
		③ Operability	Reduction of operational costs through automation of systems and networks by employing virtualization of systems and networks and resource pooling. [Cut current corresponding operational costs in half.]
			Operation cost reductions by automation of operational tasks (configuration management, revision/ID/access management, escalation). [Cut current corresponding operational cost to 1/5.]
			Elimination of closed "personalized" operational aspects through ITIL-base process standardization.
			Optimization of IT asset operation by generational management of IT assets.
			Cost reductions through automatic generation, scrapping, and reuse of development/test/operational environment through system modeling. [Cut current corresponding cost in half.]
		⑦ Security	Internal control by ID and access management.
Hardware	(4) High-energy-efficiency, high-density dedicated data center server	⑥ Energy efficiency	Reduce server installation footprint by high-density (compact) devices [Cut current corresponding installation space to 1/5.]
			Reduce electrical power consumption by adoption of energy efficient chips.[Cut current corresponding energy consumption to 1/4.]
			Reduce electric power cost by air-conditioning systems through adoption of energy-saving cooling methods. [Cut current corresponding electric power cost by 30%.]
	(5) High-reliability platform storage	④ Performance	Operational stability to prevent delays in online response and performance interruptions/degradation. [10 times the current processing capability.]
		⑤ Availability	Key component redundancy and online switching in the event of component failure.
	(6) Scale-out storage for backups and archiving	④ Performance	Operational stability to prevent delays in online response and performance interruptions/degradation. [Twice the current processing capability.]
Data Center Infrastructure	(7) Data Center	⑥ Energy efficiency	PUE1.4 or lower
		⑦ Security	ISMS (JISQ 27001)
			Privacy Mark (JISQ 15001)
			Internal control; Assurance level (SOC1・SOC2)
		⑧ Disaster resistance	Tier3 or higher*

* JDCC tier: Formulated by the Japan Data Center Council, this data center facility standard reflects the reliability requirements and Japan-specific elements demanded for data centers located in Japan.

form. These results are covered in more detail in other articles in this special issue.

(1) Virtualization management platform software

Centralizing ICT resources including servers, storage and networks and managing them in the resource pool made possible the visualization of the state of utilization of ICT resources (linking the physical configuration, logical configuration and end-users). In addition, the assignment of ICT resources from the resource pool and work flow functions to automate the cloud platform building process shrunk the provisioning time to as little as about 5 minutes.

(2) Network management software

For the provision of network services (Internet access, VPN, etc.), firewalls, and load balancing services, a wide variety of devices must be used; however, specifications, setting methods, access protocols and degree of multiprocessing differs greatly from device to device. In order to establish the uniform management and control of settings among the devices, NEC developed the necessary logic and APIs and then automated the process from network resource assignment to structuring the network. The result was roughly halving the expenditure for all data center ICT devices and their operational cost.

(3) Integrated operation management software

By combining system monitoring, configuration management and incident management functions, NEC established a system that centralizes multiple and different system environments such as hybrid environment that bundles servers with different service levels, housing, on-premise environment and even other cloud service system environment, and administrates them from a self-service portal.

This approach cut the operational costs of utilizing multiple system environments by about half.

In addition, conventional operator responsibilities such as configuration management and revision (floor, rack, devices, VM, licenses); ID and access management; and escalation/system health management were automated, which reduce corresponding operation-related costs to about 1/5.

The self-service portal adopts Web-MVC model-ready architecture. Establishment of an operation portal that integrates monitoring software, configuration management tools, and high quality operation that adopts ITIL-based standardization to eliminate "personalized" operational aspects has realized a powerful synergy of Open Source Software (OSS) and NEC products.

(4) High-energy-efficiency, high-density dedicated data center server

NEC newly developed a micro modular server that features both high-density performance and low energy consumption for data centers. By using ultra-high-density processors that enable 1 rack to deliver a maximum of 736 servers, installation space requirements are reduced to approximately 1/5 of a conventional solution. In addition, the adoption of a highly energy efficient chip has reduced energy consumption to 1/4 per core, and as a countermeasure against the heat generated by the ultra-dense server, the amount of electrical power used for cooling is minimized by the combination of a server equipped with a temperature control function and an energy-efficient cooling method (phase change cooling), resulting in approximately 30% reduction of the "per rack" electrical power cost for cooling compared to that of a conventional data center.

Highly evaluated both in Japan and abroad, NEC's innovative data center server solution has received numerous awards including the Grand Prix in the Data Center & Storage category of the "Best of Show" Award at Interop Tokyo 2014.

(5) High-reliability platform storage

By employing I/O flow control and multiple allocation of cache memory, NEC has limited occupancy of I/O bandwidth. This has secured stable performance of the virtualization environment, and eliminated the negative impact of additional tenants and increased data volume on the performance of in-process tasks. In addition, a function to optimize the allocation of data allocates the data to the device (SSD/SAS/NL-SAS) appropriate to its purpose according to the frequency of access to the data. This approach has improved task system response, and multiplied performance and capacity rates to approximately 10 times the conventional system.

Also the X4 (by four) architecture (quadruple redundancy of key parts) for the main frame storage significantly improves system resiliency and operational continuity in the event of multiple failures compared with conventional 2x redundancy. In addition, the capability to perform online replacement of key components while maintaining operational continuity further enhances service availability.

(6) Scale-out Storage for Backup and Archiving

Utilizing our proprietary deduplication technology (DataRedux) and physical compression, NEC has enhanced data compression efficiency and shrunk the physical disk capacity required for the data storage. Also our original grid architecture realizes dynamic scalability of performance and capacity. In addition, by specifying read/write bandwidth limits for each tenant, frequency bands are secured and a negative impact on other tenants is avoided. Through these efforts, capacity is now a maximum of 5 times that of the previous system and processing performance has almost doubled.

(7) Data Center

With a PUE (Power Usage Effectiveness) [*1] of 1.26, NEC's Kanagawa Data Center boasts a high energy efficiency rating. As a standard of comparison, it is said that data centers in Japan generally have a PUE of about 2.0.

Also in response to concerns about cloud services from a security perspective, NEC has reinforced its proprietary cloud security. We have received not only ISMS (JIS Q 27001) and Privacy Mark (JIS Q 15001) certifications, but also satisfied the FISC standard for security measures (facility standard). Moreover, we are in the process of securing compliance with the internal control assurance SOC2/Type 1 Report (approved) and Type 2 Report (to be approved in April 2015) which assists internal control audit processes.

4. NEC Cloud IaaS Overview

Our vision for NEC Cloud IaaS (Infrastructure as a Service) is shown in **Fig. 1**. In order to respond to the diversity of customers and ways they will use this infrastructure, we believe that the cloud platform should be an environment that anticipates hybrid utilization, and have prepared two types of services: "Standard (STD)" and "High Availability (HA)". STD achieves high cost-performance and HA does high-performance and high-reliability.

Also for linking with the customer's housing and on-premise services as well as other cloud services, NEC is providing a centralized user environment for integrated management that is accessed via a self-service portal.

As shown in **Fig. 2**, NEC Cloud IaaS offers an extensive menu that will respond to the many and varied needs and demands of a broad diversity of customers.

Especially, in step with the expanded utilization of an ICT environment that is increasingly defined by the open and shared advantages of cloud services, the demand for security including measures to counter external security threats that lie outside the on-premise environment and the response to compliance requirements.

In light of these circumstances, NEC has established an original cloud security standard. While constantly endeavoring to bolster and improve the security quality of NEC Cloud IaaS, we will provide an array of services to reinforce security and counter threats including services to counter cyber attacks, security monitoring, and ID & Access management as well as a menu to respond to internal control assurance reporting.

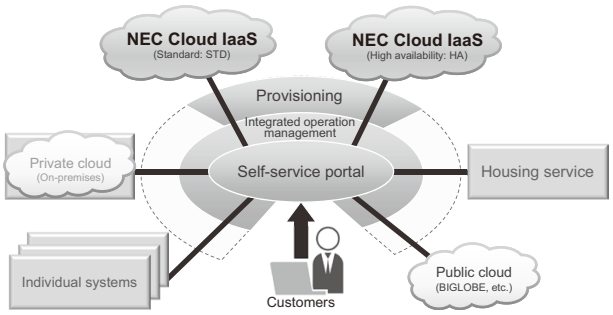

Fig. 1 NEC Cloud IaaS vision.

The Future of NEC Cloud IaaS

With the aim of making our vision of the cloud platform a re-

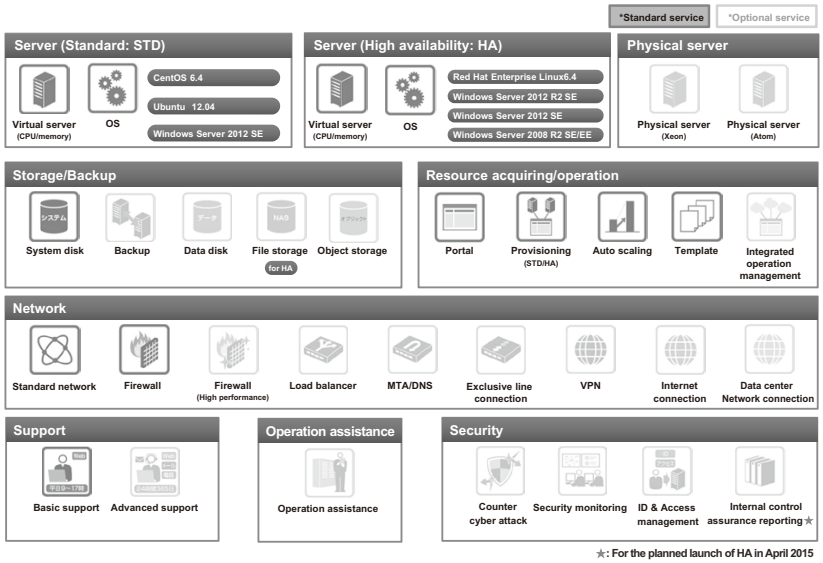

Fig. 2 NEC Cloud IaaS service menu.

*1 PUE (Power Usage Effectiveness) = Measurement of the energy efficiency of a data center expressed as a ratio calculated by dividing total energy consumption by the energy consumption of ICT devices in the data center. The closer the ratio is to 1.0, the higher the efficiency.

ality, NEC shall continue to tackle new approaches and technologies. We have systematically organized the cumulative knowledge gained in the design, development and operation of NEC Cloud IaaS into the "Cloud Reference," which will serve as a foundation for the establishment of the discipline of cloud-type SI engineering. Regional deployment will see the opening of the NEC Kobe Data Center (planned opening in April 2016), and as we move forward with global development with the expansion and fulfillment of overseas data centers, NEC shall exploit our cloud-type SI engineering expertise and deploy our cloud platform in the above data centers at the earliest stage possible.

And as we advance the development and fusion of next-generation technologies for the cloud platform, we shall also tackle the new, innovative services.

(1) Cloud-type SI Engineering

With the Cloud Reference as our base, we will utilize automation technology that leverages the advantages of the cloud to enhance efficiency and automate processes in every aspect of the platform from sizing and test environment configuration to the actual execution environment with the aim of halving the number of operational tasks.

(2) Regional and Global Development

NEC is putting SDN to work and virtualizing the network that connects data centers operated by NEC[*2], our customers and partners both in Japan and abroad. Through these measures, it will be possible to procure ICT resources among multiple data centers swiftly, at lower cost than previously, and with no consciousness of the physical location of the resources. Moreover, this network also supports data backup and system recovery, enhancing business continuity.

(3) Future Technological Contributions to the Cloud Platform

Technology that exploits the power of low-cost, high-efficiency and small footprint (compact) accelerators (many-core coprocessor/GPU, Field Programmable Gate Array) to process the huge amounts of data at the high speeds and low latency demanded of the cloud platform; software-driven dynamic configuration that provisions the needed devices at the needed time; and technology that facilitates "computing" in accordance with the needs at the time of usage – all the elements demanded of the cloud platform of tomorrow will be supported by infrastructure technologies. Through these and other advanced approaches, NEC will deliver performance improvements and tackle the creation of innovative services.

5. Conclusion

Positioned as our flagship data center facility, NEC's Kanagawa Data Center is a showcase of vision of cloud platform services. Here we are building a structure for the generational management of IT assets (hardware and software). By their deployment to other data centers as IT assets, for which verification of earlier versions has been completed, we aim to establish an environmentally friendly IT asset cycle that assures stable operation at a low cost.

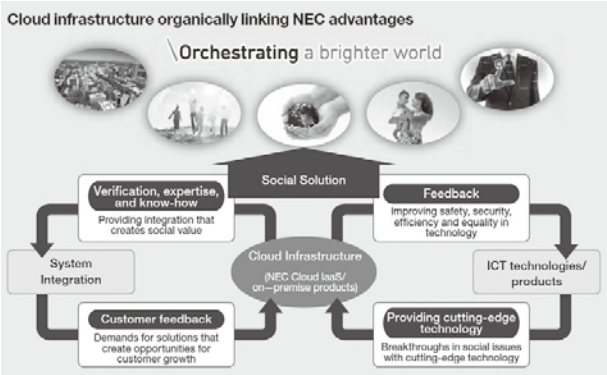

Fig. 3 Cloud platform and the creation of solutions for society.

NEC has positioned the cloud platform as a stage for innovation. Through the organic linkage of NEC's strengths in System Integration (SI) and ICT technology and products, we will create solutions for society and provide them to our customers and society via the cloud infrastructure (**Fig. 3**).

With eyes focused on our customers' growth opportunities and ears open to their voices, NEC is feeding back insights to our ICT technology and products divisions in the form of technology requirements that will pave the way for solutions for society, all conceived from the perspective of safety, security, efficiency and equality. By equipping our cloud platform with cutting-edge technology that will unlock breakthroughs to social issue solutions and by leveraging the experience and know-how gained through our efforts, and exploiting this knowledge in our next generation system integration, NEC is orchestrating a brighter world by contributing solutions for society.

[*2] NEC Group owns and operates data centers at 60 locations in Japan.

Information about the NEC Technical Journal

Thank you for reading the paper.
If you are interested in the NEC Technical Journal, you can also read other papers on our website.

Link to NEC Technical Journal website

Japanese

English

Vol.9 No.2 Special Issue on Future Cloud Platforms for ICT Systems

Vol.9 No.2
June, 2015

Special Issue TOP

NEC Information