

# Contributing to Business Efficiency with Multi-cloud Utilization and Migration Technology

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## Abstract

The needs for cloud computing is not seen merely from the viewpoint of leveling the operating costs simply by its introduction. It recently targets a greater contribution to customers' businesses such as improving the value of their businesses and works, increasing productivity, etc. To achieve such targets, NEC must not merely provide its own corporate services. What is important now is to build multi-cloud environments optimally by combining on-premise and private cloud environments with the public cloud environments such as Amazon.com Inc. and Salesforce.com, Inc. in order to optimize the situation of each customer. This paper discusses the multi-cloud utilization method that can contribute to customers' businesses, and the key points and technologies of systems and data migrations.

## Keywords



multi-cloud, service, integration, data utilization, marketing, loose coupling, system migration, data migration

## 1. Introduction

It is almost five years since the word "cloud" began to be regarded as an important keyword in the market and in discussions with our customers.

Our customers of around 2010 studied the use of cloud computing from the viewpoint of "what can be placed in the cloud?" But, from around 2014, it has been changing to the viewpoint of "cloud-first," for example "what cannot be placed in the cloud?"

This change in customers' viewpoints is backed up by shifting the investment domain toward front-office jobs and digital marketing jobs that are connected directly to the business. Such change has chanted the customers' viewpoints to the interests of how to increase business topline or the value of businesses. This is the reason that the viewpoint of reducing the costs by concentration into a single cloud environment has changed and is now focusing on the multi-cloud system that combines multiple cloud environments according to their features<sup>\*1</sup>.

Customers have demands to use the multiple-cloud environments optimally according to the purpose of each enterprise.

However, there are various issues such as migration from the existing system and the linkages between services.

NEC provides NEC Cloud IaaS, our core cloud service, and multi-cloud utilization to fulfill customers' needs.

This paper describes NEC's approach of transforming existing system to multi-cloud environment with three viewpoints which are "Transformation (Modernization & Innovation)," "Integration (Combination & Circulation)," and "Transition (Migrations & Transfer)" in aspects of utilization methodology and technology.

## 2. Transformation (Modernization & Innovation)

In deliberations with customers to decide on which domain to be invested and whether or not multi-cloud systems are to be used for business enhancement, we found that customers tend to focus on three major domains, as shown in **Fig. 1**.

### 2.1 (1) IT in the Business Field

This refers to the front-office job domain for value improve-

\*1 "Multi-cloud" assumes the combination of three or more cloud services. For example, on-premise/private cloud/public cloud environments, IaaS/PaaS/SaaS, etc.

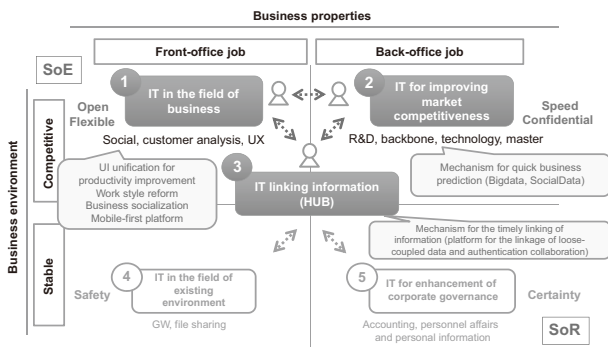


Fig. 1 Investment domains of multi-cloud utilization.

ment of business departments. IT activates jobs directly connected to the business by UI standardization and continuous use of leading edge technologies with cloud, workstyle innovation (improve UX), business socialization (corporate SNS and SFA enforcement), and mobile first (work from external and multi-device environment).

In this domain, NEC is required to accurately complement and utilize domain-specific public cloud such as those provided by Amazon.com, Inc., SalesForce.com, Inc. and Microsoft Corporation.

### 2.2 (2) IT for Improving Market Competitiveness

This refers to the data marketing domain. We need a perspective of how to gather information from customers' core business, R&D and marketing, and convert into useful information and then deliver to the appropriate business field. This strategy enables to step up the customers' businesses to a new stage by utilizing the currently held data, Enterprise Resource Planning (ERP) system and call center data, as well as previously unused data such as social data (Facebook, Twitter, etc.) and open data (population statistics, weather etc.).

The key point in this domain is that the secure data management and analysis are implemented using NEC's original platform, while big data from devices and edge locations are managed using low-cost public cloud.

### 2.3 (3) IT for Linking Information

This domain refers to the authentication and the data linkage platform (Integration-PaaS) for the seamless connection of environments of (1) and (2) above. Customers' actual need is the minimum modification of the existing systems whenever possible (as total modification increases the cost). Therefore, the key point is to create a mechanism that facilitates additions and removals of systems in order to continuously use the latest technologies of cloud services. To make this possible, loosely-coupled architecture is required.

NEC implements integration environment on NEC's original platform to secure flexibility and provide an environment that can always benefit from the latest technologies.

In the domains (1) to (3) above, the value of NEC lies in managing the entire lifecycle of each customer, from consultation to operations, maintenance and delivery, by making extensive use of NEC's latest technologies, know-how of combining cloud services, and partner resources.

## 3. Integration (Combination & Circulation)

To implement the multi-cloud environment, it is required to select the optimum cloud service for each business and to connect the distributed cloud locations. The architecture in Fig.2 is necessary to implement integration and information circulation relevant to the business value chain.

### 3.1 NEC's Core Competence

NEC establishes its core competence within complex multi-cloud environment. NEC has integration know-how to combine various leading edge technologies in Integration-PaaS domain, architecture know-how to achieve optimum DB allocation and economical service cost, and delivery capability including both system and business.

What is essential to maximize the NEC value with its core competence is the data-oriented concept. Functions such as generation, collection, synchronization, storage and delivery of data are coordinated according to the situation and environment of each customer. NEC implements loosely coupled architecture with data linkage using ETL or ESB, general purpose API using ODATA or SOAP, and a single sign-on using SAML or OPENID.

In the manufacturing industry in particular, the trends of enhancing existing businesses using information on "things" such as the M2M (Machine to Machine) and IoT (Internet of Things) and of planning new businesses using information on

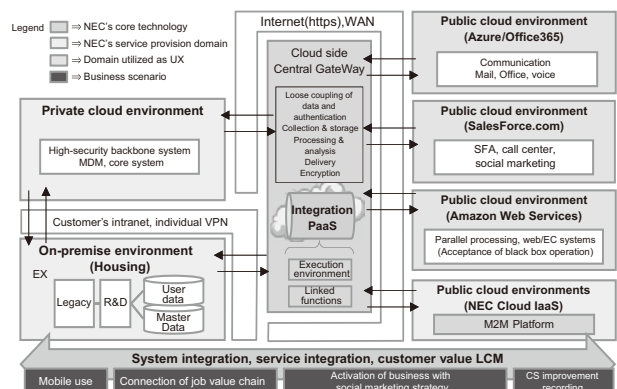


Fig. 2 Example of multi-cloud architecture.

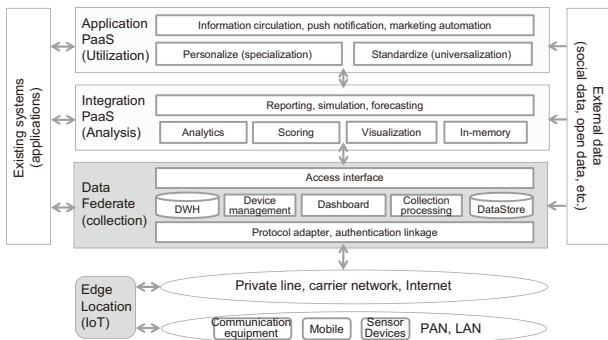


Fig. 3 Structure of data utilization architecture.

“human-beings” such as open social data, are currently becoming more noticeable than hitherto. In order to make use of the various data sources, it is necessary to improve business value and productivity by making full use of the cloud and mobile technologies. At the same time we must remain conscious of the four architecture layers that are comprised of IoT, collection, analysis, and utilization as shown in Fig. 3.

What should be especially noted is that, in the utilization layer, the drastic workstyle innovation is currently attracting attention with functions to select information to be delivered according to the properties of each “human-being,” and to automatically facilitate the circulation of information (Personalize, Marketing Automation, etc.).

#### 4. Transition (Migration & Transfer)

Transition from the existing environment toward a multi-cloud environment needs four steps including migration planning, migration preparation, migration execution, and post-migration operations as shown in Fig. 4. Of these, the migration planning is the key step.

Transfer is performed by executing operation (re)design, operation implementation, and operation test concurrently with the above.

##### 4.1 The Key Technology elements for Migration

The key points and technology elements for the migration planning are as follows.

In the system migration, it is important to perform evaluation of overall migration source systems and servers and assess system dependencies, to group all systems into the migration units, and plan the migration method per unit. From this perspective, the technologies elements required to support the cloud migration are shown in Fig. 5.

For machine migration, except in the case of machine reconstruction, consider P2V (Fig. 5-A) when the migration source uses physical servers and V2V (Fig. 5-B) when the migration

Migration planning	Migration preparation	Migration execution	Operations
<ul style="list-style-type: none"> <li>Evaluation of migration source server/system</li> <li>Identification of above dependence relations</li> <li>Breakdown of restrictions and conditions, study of applicable range</li> <li>Study of migration units</li> <li>Study of migration plan</li> <li>Study of migration steps/schedule</li> <li>Study of customization</li> </ul>	<ul style="list-style-type: none"> <li>Preparation of migration destination environment</li> <li>Study/establishment of fallback method</li> <li>Execution of customization</li> <li>Operation checking and test execution at the migration destination</li> </ul>	<ul style="list-style-type: none"> <li>Migration test (server, data, etc.)</li> <li>Backup acquisition before migration</li> <li>Migration</li> </ul>	<ul style="list-style-type: none"> <li>Functioning check after migration</li> <li>Support and improvement of actual operations</li> <li>Countermeasures for malfunctions and problems</li> <li>Isolation of issues and countermeasures</li> </ul>
Operation design	Operation building	Operation testing	
<ul style="list-style-type: none"> <li>Identification of operation changes in the migration destination cloud system, their countermeasures</li> <li>Selection of operation tools</li> <li>Study of the operation scheme</li> </ul>	<ul style="list-style-type: none"> <li>Operation packaging at the migration destination cloud system</li> <li>Preparation and setup of operation tools</li> <li>creating an operational scheme</li> </ul>	<ul style="list-style-type: none"> <li>Operational testing (normal system, abnormal system, monitoring, etc.)</li> <li>Handover/acceptance for actual operation</li> </ul>	

Fig. 4 Cloud migration study steps.

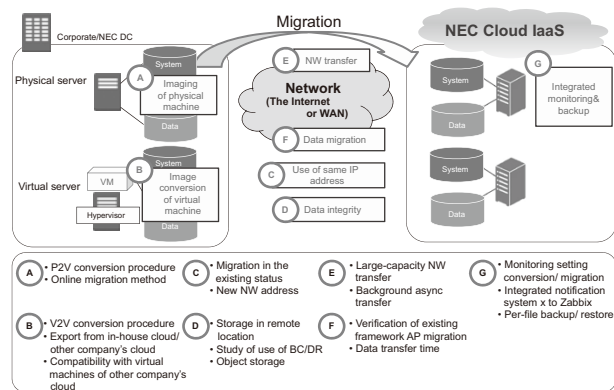


Fig. 5 Technology elements of cloud migration.

source uses virtual servers. The output file format should be compliant to the specifications of the migration destination cloud environment.

For the network, consider new network segments in the migration destination environment. If the same network segments as the migration source is required, for example when NEC Cloud IaaS is used, migration without an IP address change is considered by means of the L2 connection of the inter-DC NW service of a specific NEC data center (DC) (Fig. 5-C).

For data integrity, consider requirements such as remote location storage, BC/DR, etc. as a disaster countermeasure, and positively use standard cloud functions to minimize costs. (Fig. 5-D).

For data migration, select the NW transfer tool (Fig. 5-E) and migration tools (Fig. 5-F) according to requirements.

For integrated monitoring tools for operation, use cloud functions and OSS (Open Source Software) (Zabbix, etc.). If the monitoring requirements are unfulfilled, consider using the monitoring tools used in migration source environment.

For the backup, use of the cloud function is the first choice. It should be noted that the purpose of snapshot and D2D type backup are countermeasures against disk device failure so backup/restore is performed per drive. Consider using OS function (copy function) and the utility function of the products (export/import functions of the database products) accord-

ing to the purpose of the backup (Fig. 5-G).

From the perspective of the utilization of new functions and cost, it is recommended to use the functions of the cloud environment whenever possible, instead of migrating the migration source functions directly to the migration destination environment.

#### 4.2 Key Points in Cloud Selection and Migration

The key points of cloud selection are the degree of operation black box/white box, security measures, and individual requirements. When the cloud environment employs a black box operation, there will be issues such as the impossibility of individual operations to avoid system down and deficiencies of the audit and trail measures.

The first step for solving these issues is to review and decide system requirements with questions such as are the current operations remains necessary?, is it permissible to change the operations in the cloud environment?, and are there any advantages for that ? There are cases in which the combination of the cloud and housing environments are necessary from the viewpoints of specifications, performances and system affinities. Therefore, it is also required to select services in which two environments can coexist without difficulty.

The key for successful migration is not to stick to 100% migration of the existing environment. Actually, there are many cases in which the OS version and system properties do not match the cloud service. It is important to make a premise of rebuilding the system environments and migrate data and APs as they are.

### 5. Conclusion

As described above, NEC endeavors to accumulate the technological components and expertise required for customers using multi-cloud environments in multiple aspects.

Utilization of the multi-cloud environment is an attractive IT platform concept to enterprises, yet it possesses some difficulties, such as choosing and coordinating between existing environment and cloud environment.

NEC is advancing in studies of the cloud utilization strategy including customers' existing environments. This strategy proposes an effective support for multi-cloud utilization and IT platform implementation and maintenance from the planning phase specific for each customer environment.

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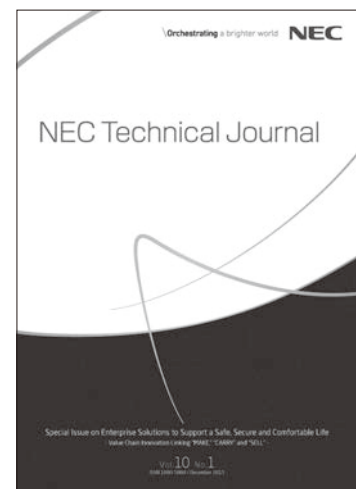
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