

# Fusion of Space Technologies and IT/Network Technologies

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## Abstract

NEC set up the project “NEC Space System Business Vision and Space System Business Roadmap” in 2010. As a part of this undertaking, NEC is able to offer “Comprehensive Space Usage Systems” by fusing space technologies and IT/Network technologies. The “Comprehensive Space Usage Systems” are to provide solutions for our users to solve issues not only by providing products of space technologies but also by providing technologies that are capable of fusing space technologies and other technologies.

This paper introduces trends in the next generation platforms, such as cloud systems and also describes strategies for space system usages based on cloud systems, as well as for related issues that are yet to be solved.

## Keywords

space utilization, cloud, service model, remote sensing, satellite data utilization

## 1. Introduction

Technology development has hitherto been the main business domain in the space industry in Japan. However, the enactment of the Basic Law for Space Activities in 2008 signaled a major shift in the policy of Japan's space industry away from “development” and towards the “utilization” of space. Along with the progress of space related technologies, people are beginning to show an increased interest in space topics. The space industry has now undergone significant changes in becoming an industry that contributes significantly to improving society.

Against this background, in the summer of 2010 NEC formulated the “NEC Space Business Vision” and “Space Business Roadmap.” This vision and the related road map stated that NEC is committed to advance from being a domestic R&D-leaning satellite manufacturer and to reinvent itself as a solutions company capable of providing “global space related solutions.” Offering a portfolio of technologies from satellite developments that have been honed to a cutting edge over the years, we are advancing solutions that fuse IT and network technologies with the aim of providing a “comprehensive space utilization system.” The NEC “comprehensive space utilization system” outlined in **Fig. 1** aims to provide information services that can provide “any” user with “any” information that they need “anytime” and “anywhere” by processing, formatting and storing both the observation/survey data ac-

quired from space systems and the various kinds of sensor data collected from terrestrial sources.

Our “comprehensive space utilization system” does not provide space technologies via products but aims to provide them with solutions to solve the issues that users are facing.

The latter part of this paper will introduce an outline of how NEC intends to promote the fusion of space technologies with our IT and network technologies with the aim of building a “comprehensive space utilization system.”

## 2. Recent Trends in IT and Network Technology

### 2.1 NEC's Cloud Systems

As you can see the shift from internet to the NGN (Next Generation Network) telecommunications infrastructures have recently been advancing rapidly. At the same time, cloud computing, which allows users to access IT services; including hardware, software, data, information, systems development environments, etc., at any time they need to via the network, has been attracting more and more attention.

This trend shows that the market has entered the stage of the “4th Wave” in other words the “era of cloud computing” as illustrated in **Fig. 2**. The information system configuration has been transformed from mainframes to PCs, Open systems, and then to cloud computing services.

With cloud computing, users do not have to possess their

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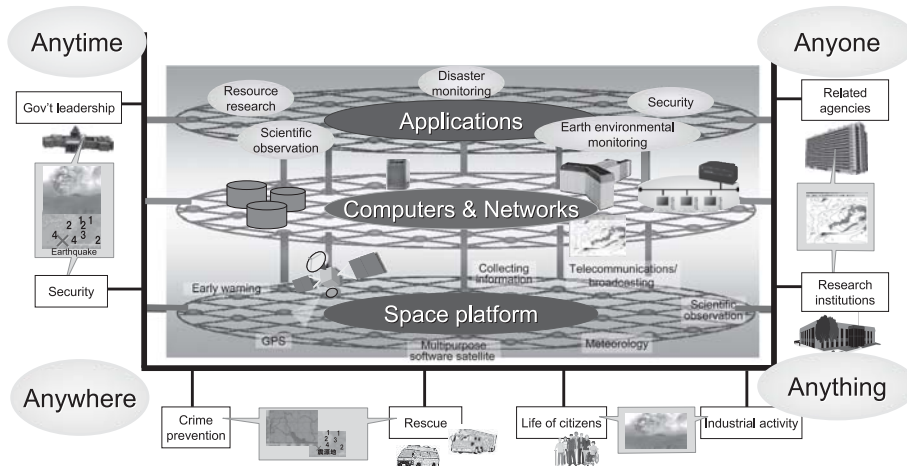


Fig. 1 Comprehensive space utilization systems.

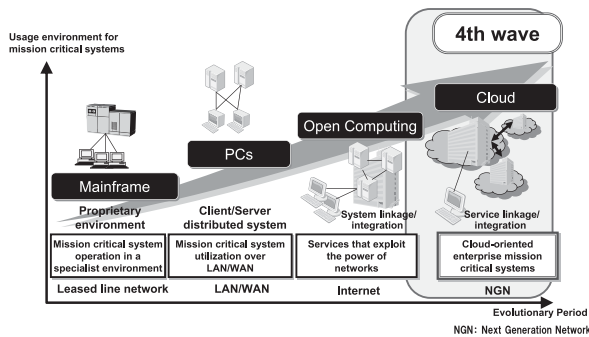


Fig. 2 Trend of mission critical system usage environment.

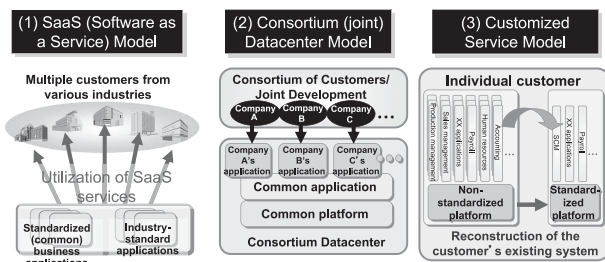


Fig. 3 NEC's three service models.

own IT or information systems as they did in the past. What users do now is to acquire the necessary services via cloud computing systems and to build their own information systems while gaining the advantages provided by the cloud computing services such as speed, flexibility, convenience,

productivity increase and cost reduction. To achieve this, NEC has prepared three types of service models as shown in Fig. 3, so that usage can configure the cloud computing environment that suits their situation or needs while allowing them to choose the most appropriate service models. Our cloud computing architecture is the new system model that fuses IT and network technologies.

### 2.2 Expansion of the Market Segment of Space Utilization

When viewed from the perspective of the space utilization market sector, satellite communications and broadcast systems, car navigation systems and other products aimed at the general consumer account for over 95% of the market. However, the relatively young market of remote sensing is the focus of increasing attention.

As shown in Fig. 4, remote sensing technology can be applied to various market sectors such as agriculture, environment, disaster prevention, resource exploitation and security assurance, etc.

In the past, various services based on the information acquired from ground-based sensors or sensors mounted on aircraft have been developed and have then been applied to these markets. However, adequate results could not be achieved from this information alone, and users also found it burdensome to spend a lot of time and expenses in acquiring the information they sought. Innovative space utilization technologies are useful measures for solving these issues because the information required can be readily acquired via satellites whereas conventional sensors were incapable of providing it.

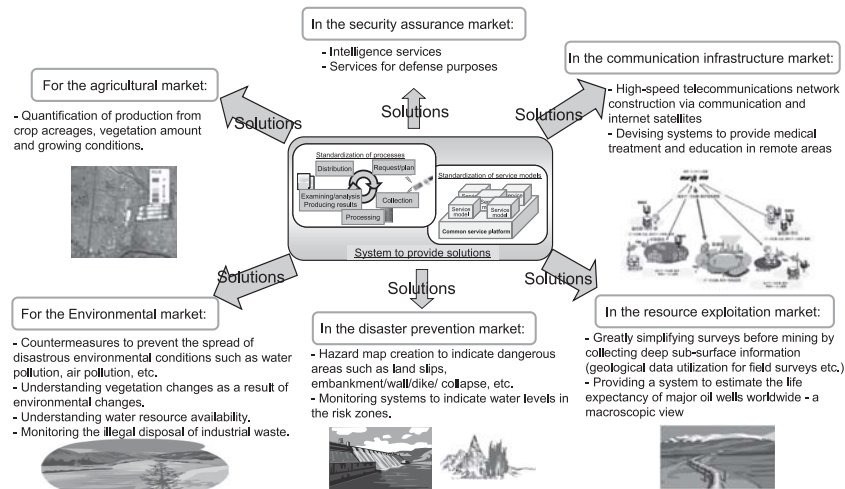


Fig. 4 Possibilities of space utilization in various market sectors.

Such market scenarios for space utilization may be expected not only in Japan but also in overseas countries, including in the developing countries and even more ambitious scenarios can be expected. Especially, countries with large land areas but without sufficient terrestrial network infrastructures may demand systems that enable the combination of information acquired from space with that from the ground in order to compensate for the inadequacy of their current information.

Such possibilities of advances in space utilization will tend to change conventional market strategies that is technology-centered activities targeting individual customers. In order to cope with such changes, NEC will process, format and store the observation/survey data acquired from space systems as well as the various sensor data collected from terrestrial sources. Moreover, it is essential to prepare a “comprehensive space utilization system” to provide information services that can offer “any” user with “any” information that they may need “anytime” and “anywhere” while at the same time listening to expert opinion and thereby add more value to available services.

### 3. Changes in Space Utilization that Cloud Computing will Introduce

The possibilities of space utilization have been increasing, however, users who actually use space technologies and services are still limited to researchers and engineers with specialized knowledge or to those who work in a specific

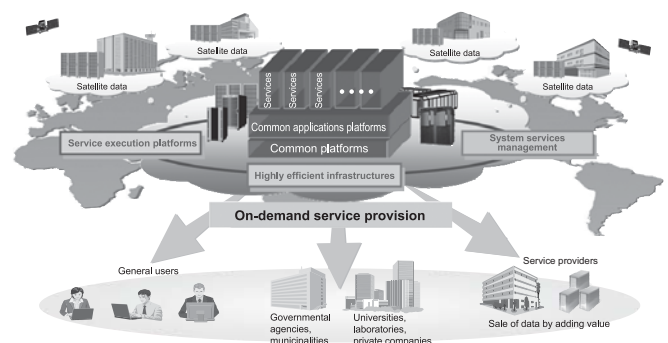


Fig. 5 Cloud computing systems that NEC is pursuing.

environment. General users are not able to use such technologies or services conveniently. For example, observed data acquired from a climate satellite is processed via a ground-based system, which is then evaluated by a weather forecaster or a specialist after combining the data acquired from the satellite with other information (terrestrial sensor data, etc.). Finally, a weather forecast is reported via TV and other media together with comments to make the report more understandable for ordinary people. People may then use the weather information to help them to decide on which clothes to wear or what plans to carry out on the day.

In the case of utilization of a weather forecast, users may not have any idea that they are using information from space. They only use the weather forecast as an information resource to help them decide on carrying out their plans. The basic idea of the integrated space utilization system is to provide users with re-

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quired information and services at different levels according to their needs so that they can achieve their objectives. The cloud computing system that NEC is engaged in is shown in **Fig. 5**. It corresponds to users' needs by providing various space utilization services via an on-demand platform, so that users can select a required service or combine multiple services to achieve their planned objectives.

### 4. Issues in Promoting Space Utilization

As described above, space utilization possibilities exist in various market sectors. However, there are also issues to be considered before promoting these possibilities.

#### 1) Issues in satellite data utilization

In Japan, most satellites excluding broadcasting and communications satellites are launched by the governmental agencies. This means that the governmental agencies manage these satellites and control the data acquired from these satellites. Therefore, for a private company to develop a business using such satellite data, it has to acquire permission from the relevant government department. It is therefore necessary to establish a standard procedure for this process.

#### 2) Standardization issues

Specifications and formatting of data acquired from satellites are different for each satellite. Although movement toward standardization has been accelerating in the international market, such a course of action has only recently been started by the government of Japan.

#### 3) Issues of secondary use

Before using satellite data, it is necessary to process it at the primary processing stage and then at the secondary processing stage (physical quantity conversion or image processing). Products produced from these processes are currently classified as primary use products. However, when the utilization of satellite data is expanded, such products produced from primary processed data or information have specialist knowledge added to them and they will be modified into products with "added-value information." Such products are classified as secondary use products and how to handle and provide them is currently under discussion.

The preceding issues have to be solved before starting business deployment of either domestic or overseas commercial satellites. Governmental agencies are therefore requested to prepare suitable mechanisms and rules to support their adoption. These issues are under discussion by governmental agen-

cies and clear guidelines are expected to be established to promote the imminent commercial use of satellite data.

### 5. Conclusion

The advancement of space technology offers great hope and expectations for the people of Japan. Space, which used to be a childhood dream is not a far away world any more but is now within our grasp. Space technologies will be used as efficient measures in our commercial ventures and also to enhance our every day lives. NEC will deal with space utilization as an opportunity to create new businesses. There are so many issues to be solved, but NEC will challenge these issues and solve them in achieving our aim of integration into a powerful "One NEC."

### Author's Profile

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