SaaS and PaaS of Engineering Cloud

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Fujitsu will provide Desktop as a Service (DaaS) (offers remote access from a thin client) as a cloud service that is specialized for engineering work. This service will allow engineers to manage and operate engineering data on the cloud. In addition, it will let them conduct 2D and 3D modeling and simulations using digital mock-up tools and help engineers that are geographically distant to communicate. It will offer these benefits for a fixed monthly fee. These services will greatly improve the efficiency of global engineering, in ways including improving the linkage between our customers' global bases. At the same time, it is a solution that will help prevent information leaks when sharing data with collaborative partners. It will make it possible to start collaborative work faster.

1. Introduction

In recent manufacturing, various issues have appeared that need to be resolved such as reducing the period from product planning to provision and lowering product development costs. Resolving these issues will enable organizations to quickly respond to increasingly diverse product specifications and changes in market needs due to globalization.

In these circumstances, Japanese manufacturing enterprises are globalizing their engineering operations, collaborating and dividing labor with partner companies and using an original design manufacturer (ODM) system more than ever.

With these trends in the background, there are increasing risks such as information leakage and rework caused by miscommunication between designers. Up to now, they took measures such as centralized management of engineering data, remote access from remote locations (overseas) and CAD application service provider (ASP) to address these risks. With the conventional remote access technology, however, it was not realistic to interactively operate massive engineering data from remote locations.

This paper presents the cloud computing infrastructure technology, which achieved remote access to massive engineering data, and various services offered based on it. It describes the trends and issues in manufacturing styles, past approach, infrastructure technology that realized the ideal cloud solution, values offered by Engineering Cloud and future approaches.

2. Trends and issues in manufacturing styles

Figure 1 shows changes in the number of Japanese overseas subsidiaries (in the manufacturing industry). The number of such subsidiaries in Asia is increasing year by year and reached 5865 in 2008 (1.9% increase from the previous year). In China, in particular, the number almost doubled in seven years (from 1393 in 2001 to 2917 in 2008). Since the Great East Japan Earthquake and the nuclear power plant problem that occurred in March 2011, it seems likely that Japanese enterprises will
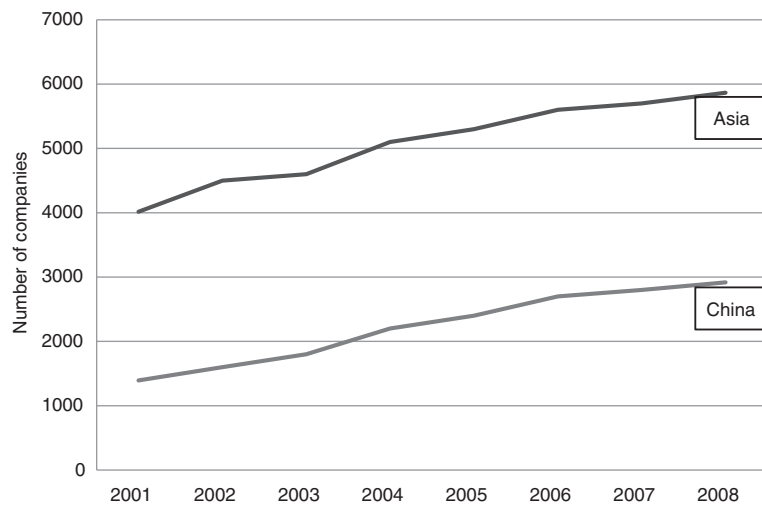
Source: Summary of the 40th Survey on Overseas Business Activities - Results for FY 2009, METI

Figure 1
Changes in number of Japanese overseas subsidiaries (manufacturing industry).

relocate overseas at increasing speed.[1]

The progress of industrial globalization is not only caused by the trend toward manufacturing in low-wage ASEAN countries in pursuit of cheap labor. In recent years, to more responsively incorporate local preferences in huge markets such as China and India, organizations have been increasingly conducting product and exterior design work locally. In addition, more and more enterprises are striving for selection and concentration to make the most of their resources by contracting with partner companies with advanced technology in specific areas to outsource the specific portions of products from the partner companies.

Under these circumstances, more enterprises have been recently adopting the ODM system, which is outsourcing including design and manufacture. As a result, however, some issues have emerged.

The first issue is security. In order to collaborate with overseas bases or partner companies, design data that form the basis of products are disclosed so as to outsource design and manufacture. This is said to cause a risk of design data leakage.[2] The state of damage from information leakage accidents indicates that internal crimes cause the most serious damage. **Figure 2** shows the number of victims of information leakage per case classified by the cause.

Second, communication takes time and effort. When design and manufacture of specific optional products or localized models are outsourced to local partner companies, for example, Japanese designers and product development managers need to review the design with local designers. Since they are geographically far apart, they are obliged to exchange information by video conference or e-mail. However, engineering data such as 3D CAD data are large in size and those means are not sufficient to allow smooth information exchange. As a result, people often deliver data themselves.

Third, even if a collaboration contract is concluded with an ODM, it takes time before actual design can be started. In engineering work, there are no industrial standards such as accounting principles and individual companies often own unique standards and tools as their know-how. In that case, building in the ODM a design environment compliant with the design standards of the assembly manufacturer is time-
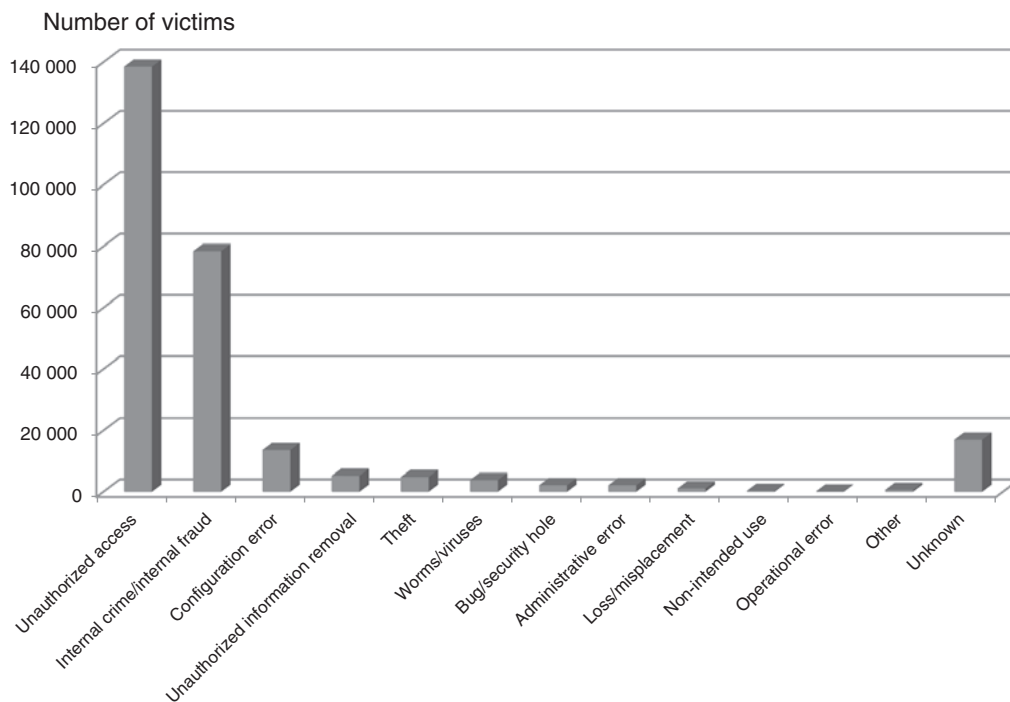
Number of victims

Source: NPO Japan Network Security Association 2010 Information Security Incident Survey Report

Figure 2
Number of victims of information leakage per case classified by cause.

consuming in the first place.

In this way, numerous issues to be resolved exist in a new manufacturing style.

3. Past approach

As an approach to solving the issues described in the previous section, IT vendors used CAD ASP to consolidate and access engineering data. It is described below.

1) CAD environment and CAD data reflecting the design standards of the assembly manufacturer were consolidated in a data center.
2) Overseas bases and partner companies access them by CAD ASP to conduct design work.

This system does not require design data to be given to overseas bases or partner companies and reduces the risk of information leakage. It also allows ensured adherence to the design standards without spending extra time by having the design environment incorporating the design

standards of the assembly manufacture used via remote access.

In reality, however, no remote access tool existed that allowed interactive access to big 3D CAD data exceeding tens of Mbytes and ODM by this system did not become widespread.

4. Infrastructure technology that realized ideal cloud environment

Fujitsu has developed Remote Virtual Environment Computing (RVEC), a technology for high-speed display in a virtual desktop environment. It provides remote access to massive 3D CAD data as mentioned in the previous section.

Traditionally, a network bandwidth of 40 to 60 Mb/s was believed to be necessary for stress-free operation of 3D CAD from a remote location, and this is now possible with a bandwidth of 1 to 2 Mb/s by using RVEC.

We have also developed a cloud access management tool (Engineering Cloud Manager)

capable of allocating virtual environments in a cloud to Engineering Cloud users and controlling viewing access to information according to the individual user's rights.

These approaches have enabled users to migrate existing applications and CAD tools as they are to a cloud without modifying them into Web-accessible forms and use them by the same operation as before via Engineering Cloud Manager.

Again, these advanced technological breakthroughs have made it possible for assembly manufacturers to centralize engineering data and provide overseas bases and partner companies with remote access to 3D CAD.

What could not be realized with CAD ASP has at last come true in the form of Desktop as a Service (DaaS) cloud services.

5. Values offered by Engineering Cloud

This section presents cases where

Engineering Cloud has actually been used and the values offered by them.

5.1 Efficient global ODM linkage

- Assumed user: manufacturer cooperating with ODMs
- Needs: i) prevention of design information leakage
  ii) fast start of collaborative work
- Solution: PaaS (infrastructure technology)

In the case above, a PaaS environment of Engineering Cloud can be used as work space for global ODMs, as shown in **Figure 3**.

In many cases, assembly manufacturers outsource specific optional products and special advanced technologies to ODMs that are strong in those fields. They do this rather than designing all functions in-house for respective product development projects, so that they can reduce commercialization costs and development periods. However, such collaborative work is often based on short-term contracts and there
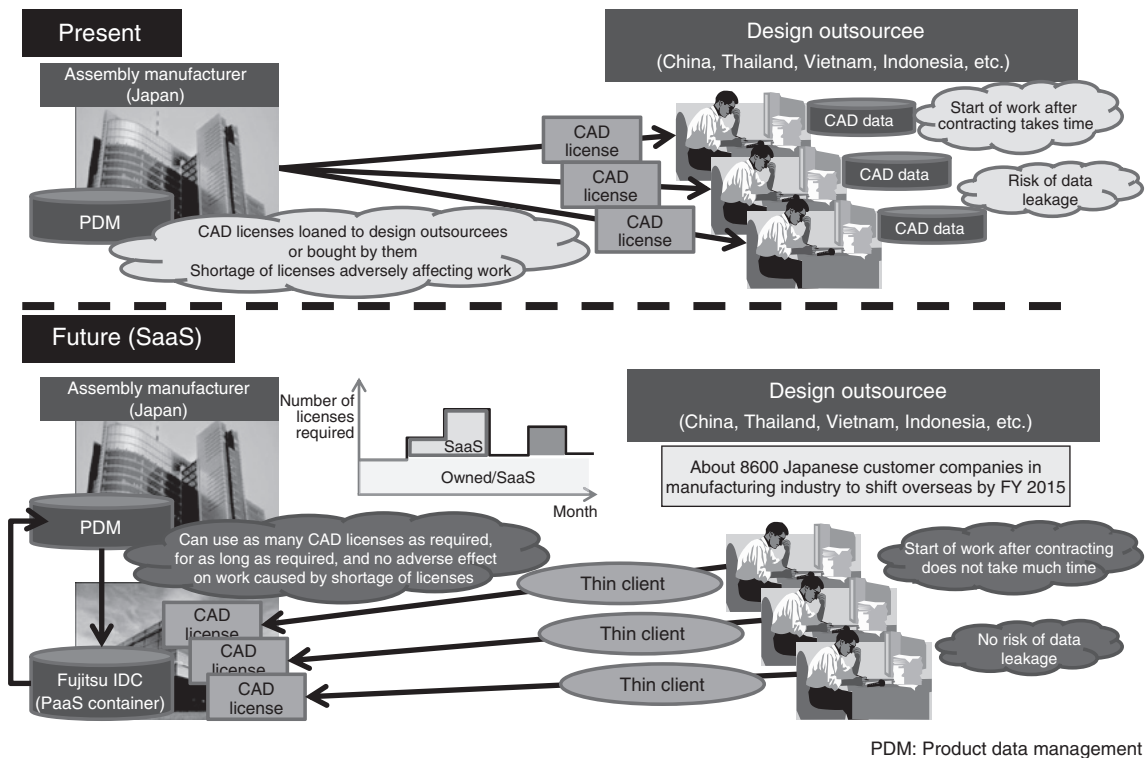

Figure 3
Global ODM linkage.

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is a need to build a collaborative environment securely and in a short time.

To meet this need, a PaaS environment of Engineering Cloud can be used as work environment for ODMs. In this way, manufacturers can put in place a secure design environment in a short time according to the volume of the outsourced work and period of outsourcing.

5.2 More efficient communication between designers

- Assumed user: manufacturer that shares design work
- Needs: i) greater communication efficiency
      ii) accumulation and reuse of know-how
- Solution: SaaS

By taking the case shown above as an example, the following describes the factors that hinder communication between designers and shows how to solve the problem.

1) Access to and operation of CAD data by multiple people

Manufacturers need to be able to communicate between bases while operating the actual CAD data, but ordinary conferencing tools cannot handle big data such as 3D CAD data.

To meet this challenge, Engineering Cloud makes it possible for multiple people to access and operate one set of CAD data on a cloud. This allows them to have discussions including design reviews while operating the actual data.

2) Conversion of voice of video conferences to text data

Video conferencing systems are used for meetings between bases, and this makes it difficult to verify the content of conversations or indicated points, possibly leading to misunderstanding at a later date.

To solve this problem, Engineering Cloud has a function to convert the voice of video conferences into text data. This not only prevents misunderstanding but also allows efficient

accumulation and reuse of indicated points.

3) Translation of text-converted data

Overseas conferences involve a language barrier. Engineering work, in particular, uses many technical terms and not so many people are able to interpret them appropriately.

Therefore, Engineering Cloud has a function to simultaneously translate the text-converted data mentioned in 2) above into the language of the other party and display it on the video conference screen.

In this way, Engineering Cloud offers services that help designers work more efficiently as well as design tools including CAD.

6. Future approaches

For Engineering Cloud, the private cloud system is used at present to securely manage data of specific customers, and independent environments for respective customers are put in place.

In the future, we intend to prepare the following to offer more effective services to local enterprise associations and enterprise groups with common purposes.

1) Provision of public cloud environment for sharing cloud server resources and CAD license between specific group companies

2) Provision of common component DB and know-how DB

In addition, cooperation with independent software vendors (ISVs) must be strengthened so as to expand the line-up of applications to be offered on Engineering Cloud.

7. Conclusion

Engineering data have come to be used in supply chain management (SCM) in areas such as marketing, sales, logistics and maintenance as well as in product lifecycle management (PLM) in areas including design and manufacturing.

For cloud computing in the engineering field in the future, Fujitsu is committed to supporting operations in a wider area and planning and

providing the linkage services required.

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2) NPO Japan Network Security Association: 2010 Survey Report of Information Security Incident. (in Japanese).
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