Hitachi Digital Supply Chain/Design for Achieving Globally Collaborative Design

The globally developing manufacturing industry is increasingly localizing design to enable manufacturers to rapidly provide products that suit the varying customer needs of different countries and regions. The growth of trends such as design work done by suppliers working in coordination with engineering service providers and other partners is also demonstrating a greater demand for globally collaborative design work in which design data is shared and coordinated throughout the entire value chain. Hitachi provides a cloud environment called Hitachi Digital Supply Chain/Design for promoting globally collaborative design. This article discusses the design platform, design process management, and design tool set used in this solution.

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1. Introduction

The manufacturing industry does business on a global scale to provide products such as vehicles. Tailoring products to reflect the characteristic needs of the local market (the country or region), is becoming a mandatory requirement for staying competitive in this industry. To give the market what it wants, manufacturers also need to respond promptly when those local needs change. Design work is the foundation of manufacturing. While it was previously mostly done by domestic offices, recently manufacturers have been creating and upgrading overseas offices and using multiple offices to collaborate on design work. Mergers and acquisitions (M&A) are also adding new overseas offices, and design work is increasingly being done in coordination with overseas customers, suppliers, engineering service providers, and other partners.

These developments will make globally collaborative design increasingly important as a way to exchange design data globally in connection with the entire value chain, facilitating design work while collaborating.

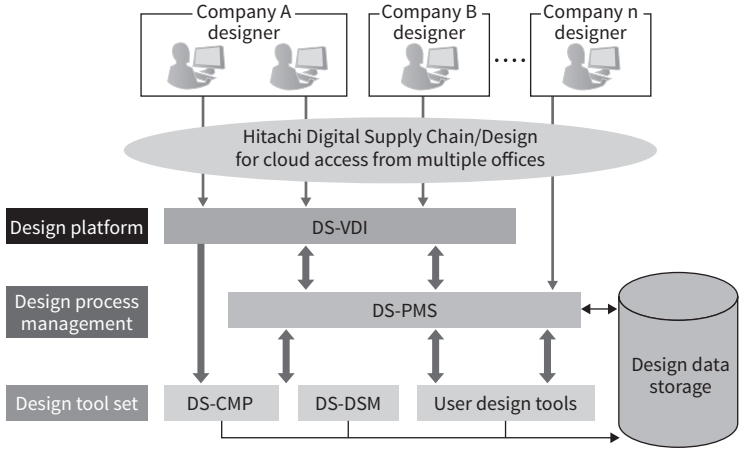
This article discusses some of the challenges involved in this globally collaborative design and their solutions.

2. Challenges to Achieving Globally Collaborative Design

The following challenges need to be solved to collaborate and facilitate design work among multiple offices around the world.

(1) Sharing of design data

The use of three-dimensional (3D) computer-aided design (CAD) and computer-aided engineering (CAE) software for design work has become common. Collaborative design requires an environment that enables multiple offices to securely share large volumes of 3D data that designers can use without stress.



VDI: virtual desktop infrastructure PMS: process management system CMP: CAE modeling platform
DSM: design-development schedule management CAE: computer-aided engineering

Figure 1 — Overview of Hitachi Digital Supply Chain/Design (DSC/DS)

DSC/DS provides the functions needed for design work spanning multiple companies or organizations in the cloud. It is composed of DS-VDI, a design platform; DS-PMS, used to manage design processes; and a set of design tools.

(2) Standardization of design processes and rules

When design processes and rules differ for each office, variations in factors such as design quality and work schedules can result, increasing the likelihood of quality, cost, and delivery (QCD) targets being missed when design work is spread among multiple offices.

Preventing this problem requires standardization of design processes, rules, and knowledge, along with a system to guide workers on how to properly apply and comply with these standards in work activities.

(3) Uniformity of design environments/tools

When design work is coordinated among multiple offices that use different environments or tools, problems such as data incompatibility among tools, etc. can cause significant loss of work efficiency due to the need to convert data formats. Unifying the design environments and tools used by all the offices, not only makes data sharing easier, but also makes it easier to transfer designer skills and knowledge. Therefore, improvements in work quality can be expected also.

3. Hitachi Digital Supply Chain/Design

Hitachi, Ltd. has developed and provides Hitachi Digital Supply Chain/Design (DSC/DS) as a solution to facilitate globally collaborative design while solving the challenges mentioned above (see **Figure 1**).

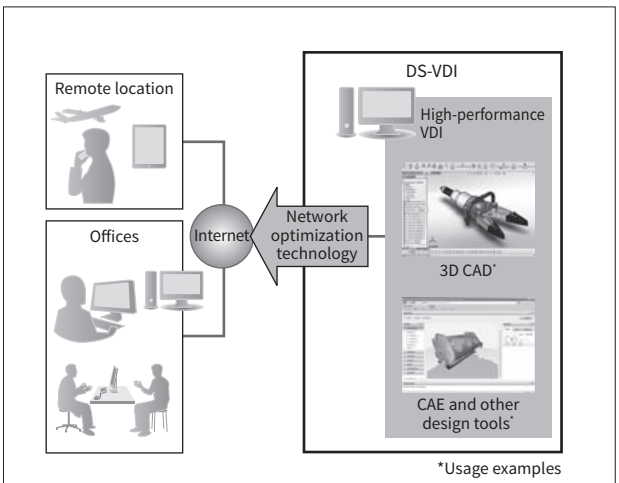
DSC/DS consists of services such as Virtual Desktop Infrastructure (DS-VDI) and Process Management System (DS-PMS) that designers in different offices can use to coordinate design work with other offices.

3. 1 Utilizing DS-VDI to Share Design Data

Recent advances in virtualization technology such as graphics processing units (GPUs) that process graphics have made it possible to assign GPUs to virtual operating systems. DS-VDI uses this technology to provide a virtual desktop service that implements high-performance graphics processing (see **Figure 2**). Designers can manipulate 3D data shared on the cloud using 3D CAD or CAE tools from any terminal or office.

Figure 2 — Block Diagram of DS-VDI

DS-VDI provides a high-performance design environment that is always available from multiple offices and mobile devices.



CAD: computer-aided design

But when the cloud server's data center is physically remote, drops in operation responsiveness due to network distance delays can be a problem.

Hitachi has used proprietary network optimization technology[1] to improve operation responsiveness and ensure stress-free operability by making effective use of unused network bandwidth.

One customer used to share 3D data by transferring large files among multiple offices located large distances apart. The introduction of DS-VDI has now made the huge transfer times unnecessary and improved work efficiency.

DS-VDI's centralized management of design data makes it easy to control access authorization and to manage acquisition histories, greatly reducing the risk of information leaks.

3. 2
Standardizing Design Processes and Rules Using DS-PMS

DS-PMS is a solution that can improve the transparency of the design process, enabling designers in different offices to use the same design processes and rules when working[2] (see **Figure 3**).

DS-PMS can divide design processes into multiple tasks that are defined and shared so they are not omitted or missed. Therefore, designers can proceed with their work simply by following each task displayed to them in the form of a work breakdown structure (WBS).

To perform each task, designers need to have the 'output' of the previous process (task), 'instructions,' and 'reference information' as documentation. All of that information is managed in association with each task, so designers can obtain the required work information in a unified manner. The 'output' of the previous process (task) is the input data needed for performing the next process (task); the 'instructions' are the task-specific work instructions; and the 'reference information' consists of the standards required to perform the task, such as the design rules, applicable regulations, and tools to use.

DS-PMS can also associate past output and notes of insight with each task as knowledge. The notes of insight consist of information written down in note form containing the knowledge and skills of expert designers. Past output and notes of insight can be referenced together for use in teaching knowledge to young designers.

Applying DS-PMS to design work has made it possible to reduce the amount of rework significantly by ensuring the proper use of documents and knowledge and eliminating the omission and forgetting of procedures.

3. 3
Design Environment/Tool Uniformity

DSC/DS is provides the various design tools needed for design in the cloud (see **Figure 4**). Utilizing these tools makes it possible to create a uniform design environment and set of tools across multiple offices.

The CAE Modeling Platform (DS-CMP)[3] is a tool that enables the efficient creation of analysis models used in CAE. DS-CAE is an analysis

Figure 3 — Block diagram of DS-PMS

DS-PMS is a solution that improves the transparency of the design process. Individual tasks can be managed in the form of a work breakdown structure (WBS) and correlated with outputs and reference information.

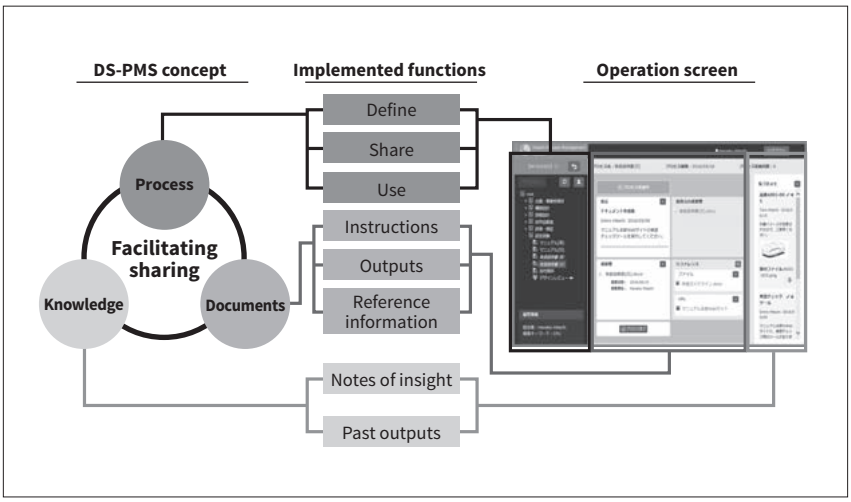
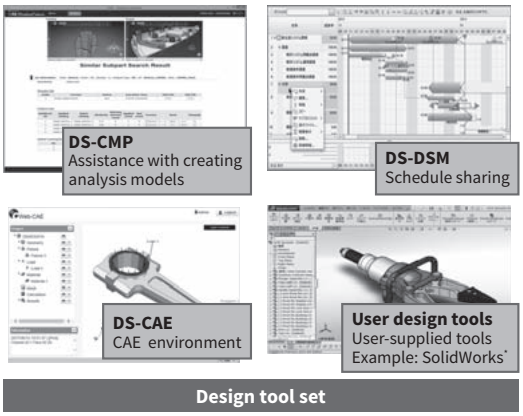


Figure 4 — DSC/DS Design Tool Set

DSC/DS's design tool set consists of several design tools that provide functions such as schedule sharing and assistance with creating analysis models.



*SolidWorks is a registered trademark of Dassault Systèmes SolidWorks Corporation.

tool for designers. Design-development Schedule Management (DS-DSM) is a tool that enables multiple users to manage and share project schedules.

For analysis design tools, etc. that are not provided by DSC/DS, DSC/DS allows users to register and use tools that they supply separately as user design tools. However, there are some usage restrictions on these tools that users should be aware of that are specified in the service agreement.

DSC/DS enables designers to use the same design environment across multiple offices, preventing the sort of design rework and data discrepancies previously caused by design tool differences. Furthermore, the cost of maintaining and operating the design environment can be expected to decline as computation resources and licenses are managed in a globally centralized manner in tandem with the services used.

4. Conclusions

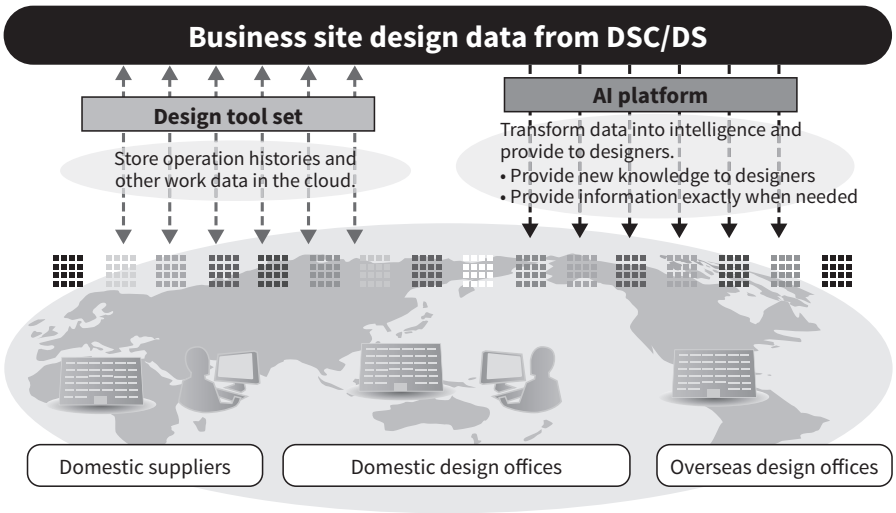
This article has described how DSC/DS enables faster development of products suited to market needs by connecting design work and design data across the value chain, thereby enabling globally collaborative design.

In the future, Hitachi plans to augment its design tool set with additions such as a design insights support system[(4)]. This system will make designer training and work processes more efficient by automatically checking for places where 3D CAD design rules are violated, and presenting the reasons for the violations to the designer.

The plan is to provide designers with even more valuable information by using artificial intelligence (AI) platforms to analyze design work data stored in

Figure 5 — Future Development of the DSC/DS Solution

Business site design data collected using the design tool set will be analyzed using AI platforms to provide new value to designers.



AI: artificial intelligence

the cloud (see **Figure 5**). This work data could include information such as operation histories and design changes accumulated while using the design tool set. Using AI platforms to analyze this data should enable benefits such as improving design quality by showing documents and knowledge to designers at times determined in accordance with their individual needs.

Hitachi intends to continue contributing to the development of even better products by utilizing AIs connected to the value chain.

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