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PEGASUS Domestic Sales and Production System

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Synopsis :

The authors have developed PEGASUS system (Plan & Entry operations by Grouping & Analyzing SUpport System) to support the planning of monthly domestic sales and production of steel. This system was reconstructed as a new wide-area network, whose hardware configuration is a three-tier client/server system consisting of a host computer, UNIX servers and personal computers. One of the most prominent feature of this system is that this system shares product inventory database of Kawasaki Steel with its trading companies. The application of PEGASUS system reduced the salesman's workload, the number of salesmen, and the amount of stock. Moreover, the system carried a reformation in the environment of sales division.

PEGASUS Domestic Sales and Production System*

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1 Introduction

The domestic sales and production system, which was the most important theme related to steel sales systems among the activities for improving job efficiency, has contributed greatly to the improvement of office work efficiency and productivity in the sales division and supported reform of the environment of the sales division. This system covers the monthly sales planning task that involves forming monthly plans based on the information on inquiries from trading companies, and system was developed to release the sales staff from work that has been performed manually by almost all members, especially at the beginning of each month, and to provide an environment in which the sales staff can perform their essential sales activities.

The features of the domestic sales and production system are as follows: the hardware configuration is a client/server system developed by the Head Office for the first time for mission critical tasks; the foundation for future system expansion was established by constructing a wide-area network and integrating the hardware and software for sales tasks; and the product inventory database is used as a corporate database.

This paper first describes the functions of the product inventory database and communication techniques supporting the information contained in the database, then

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presents an outline of the domestic sales and production system in which the product inventory database is used, and describes the features of this system in terms of system technology. The benefits and problems of this system are also discussed.

2 Product Inventory Database as Foundation

The mission critical tasks of the steel business division at Kawasaki Steel are order receiving, production, and distribution. The functions of this division are broadly classified into ① the function of the manufacturing department, translating orders from customers into products, and ② the function of the sales and distribution departments, supplying products and gathering information on subsequent customer requirements.[1] Many corporate databases, such as order, in-process product, and product databases, are conceivable. However, the product inventory database is the database which provides the point of contact between production and sales and distribution. Various benefits are expected from this database, and the domestic sales and production system is one of the many tasks in which the product inventory database is used.

The functions and features of the product inventory database are first described below, and the fundamental techniques that support the product inventory database are then described.

2.1 Outline of Product Inventory Database

In the product inventory database, information on the condition (warehousing, discharge from warehouses, etc.) of products in each place of shipment is gathered and the integrated information on products is controlled. This database has two functions, gathering information from data sources and supplying information related to the product inventory throughout the company in an integrated manner.

The function of information gathering will be described first. The information controlled in the product inventory database includes various kinds of results grasped by the shipment systems of works, such as warehousing, shipment orders, and loading in ships, and various kinds of results, such as warehousing, processing, and discharge from warehouses in each place of distribution (service center or coil center). A conceptual diagram of the product inventory database is shown in **Fig. 1.** The relationship between the contents of information and the database is shown in **Fig. 2.** Information is given and received basically by the sequential real-time method using KISS (Kawatetsu interconnection support system) between the Head Office and each works. Information is also gathered from each distribution base in a similar manner. In the product inventory database, information is accumulated as a database that can be finally controlled in an integrated manner by ensuring the compatibility between each shipment base

and distribution base using a unique function developed by this company.[2]

Another function is to supply information so that the information can be easily used in the tasks to which the product inventory database is applied. This function has the following features:

(1) The product inventory database itself is analyzed. Batchwise daily and monthly analyses are possible.
(2) The supply of interfaces to related systems was unified in the product inventory database in a company-wide manner by controlling the information on products from the works in an integrated manner.
(3) The order status control function is also provided by concentrating information in product inventory units for each order.

Next, the product inventory database has the following features:

(1) The structure of the product inventory database is such that information can be retrieved using the units and items (specialized terms) which customers, such as trading companies and users, use in controlling the results that occur in each shipment base.
(2) The structure of the product inventory database is such that it is possible to control product information within the scope of responsibility of Kawasaki Steel by concentrating such information for each contract No. and correlating it with order information.
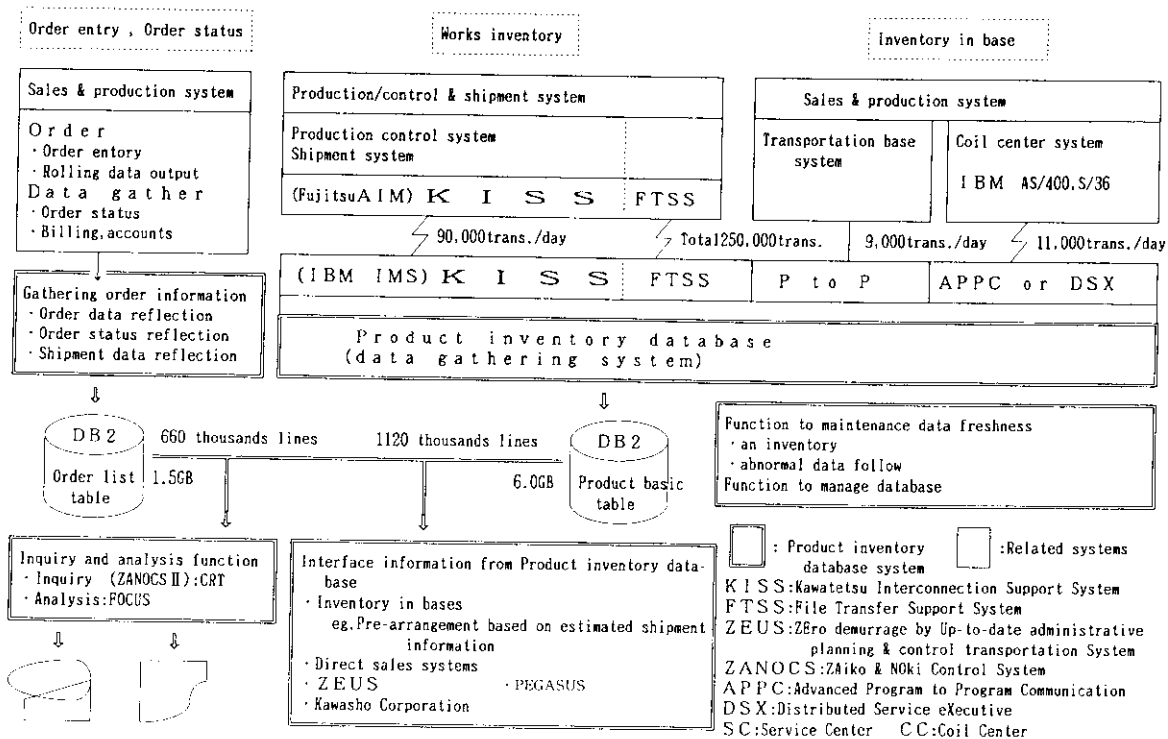(3) Because information is processed so as to ensure the same freshness as in the data sources, as well as con-

Fig. 1　Outline of product inventory database

O : Insert   △ : Update   — : Nochange

Distributed system	Phase	Order information		Results linked order information		Product inventory information						Coil Center
		Contract No. list	Specification	Progress status	Order status	Finishing line No.	Contract No. list	Basic item	Status date	Delivery	Position	Coil center inventory
Sales & production system	Order entry	O	O	—	—	/	/	/	/	/	/	/
Works production system	Product control	—	—	△	△	/	/	/	/	/	/	/
	Inventory	—	—	△	△	O	O	O	O	O	O	—
	Shipment	—	—	—	△		—	—	O	△	△	—
Transportation base system	Received	—	—	—	△	—	—	—	O	△	△	—
	Shipment	—	—	—	△	—	—	—	O	△	△	—
Coil center system	Received	—	—	—	△	—	—	—	O		△	—
	Shipment	—	—	—	△	—	—	·	O	—	—	O

Main table of product basic database	Order list table	Product basic item table	Coil center inventory table
	Error data table		

Fig. 2   Information of product inventory database

sistency, the stocktaking of information is periodically conducted to maintain the freshness of data.

(4) Because operation for 24 consecutive hours is a precondition, backup and interfaces in which importance is attached to dates are supplied.

2.2 Foundation Technique Supporting Product Inventory Database

The product inventory database has the above functions and features. The KISS support system for processing between different machines was developed as a foundation system to support the product inventory database.

At Kawasaki Steel, different types of host computers are used, that is, an IBM in the Head Office and Fujitsus at the works. The purpose of building this tool is to realize early interchange of information with a high degree of freshness among the application programs on the host systems connected through the network among such computers.

Techniques for communication between the applications among different types of systems may be obtained by the standardization of OSI (open system interconnection) and EDI (electronic data interchange) or the connection by IBM's LU 6.2. However, the establishment of processing of communications between applications by the company's own technique was realized in consideration of the expandability of communication protocols, independence of operation from operating conditions in

and outside the company, guarantee of data interchange, etc.

This KISS permitted the realization of a system for updating data at almost the same timing as real time among the host computers of different types in the Head Office and each works. At present, transactions totalling over two million lines a month gathered as the product inventory database are processed in the form of a real-time application.

3 Domestic Sales and Production System

3.1 Outline of System[3]

The domestic sales and production system PEGASUS (Plan & Entry operations by Grouping & Analyzing SUpport System) covers the task of forming monthly sales plans and of order entry and issuing of production instructions according to plans and gathering the results.

In the task of forming monthly production plans before the introduction of the information system, plans were made by each sales section in various ways, and the result information, which serves as the basic information for the information system, was gathered in an individual manner. In introducing the information system, these diverse methods for making plans were standardized and the methods for gathering result information were also standardized.
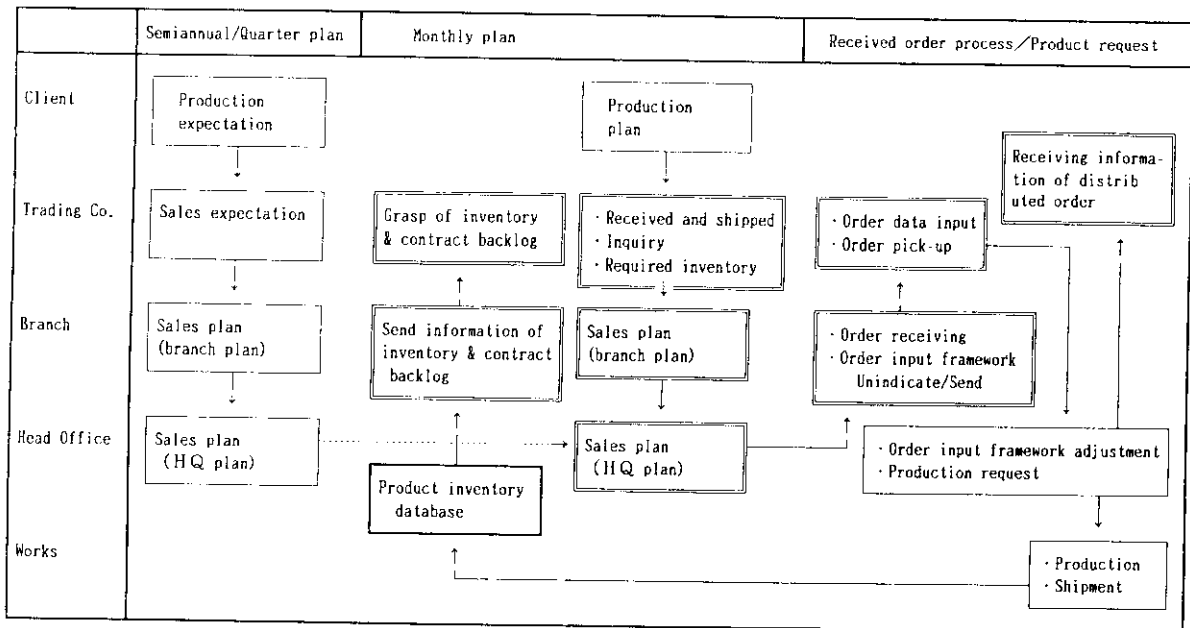
Fig. 3 Outline of PEGASUS

The main flow of the information system is shown in Fig. 3. At the beginning of each month, information on the monthly inventory and contract backlog is obtained from the product inventory database integrated in a company-wide manner and is then transmitted to trading companies. The trading companies estimate the amounts to be handled by conducting receiving and shipment while referring to this result information, and transmit the estimated amounts to the branches of Kawasaki Steel. Each branch examines the estimated amounts proposed by the trading companies, prepares branch plans for sales plans, and sends the plans to the general administrative department of the Head Office. The Head Office collects and analyzes the branch plans and determines the sales group plans as Head Office plans. The determined Head Office plans are taken into consideration in production planning, etc. However, because it is necessary to inform trading companies of the determined result, the Head Office distributes order quantities to each branch, which in turn distributes the order quantities to each trading company and transmits them to the trading companies. On the basis of this result, the trading companies conduct order entry and give production instructions.

In order to conduct these tasks by the information system, system requirements were separated out from task requirements and the system was designed to obtain the following configuration:

(1) All branches located across the country are included in a LAN (local area network), which is connected to each LAN of the Tokyo Head Office and Kobe host computers to form a nationwide wide area network.

(2) Because sales managers who have not acquainted with the operation of terminals also use this system, software with excellent GUI (graphical user interface) is applied to provide a screen design that permits further unified operation.

(3) UNIX is regarded as a database server in the domestic sales and production system, and one unit of UNIX is installed each in Tokyo and Osaka to distribute the load of processing.

(4) The hardware and software configurations are such that future technical trends are kept in sight and the system configuration also serves as the infrastructure of the whole sales business.

3.2 System Configuration and Fundamental Technology

3.2.1 Concept of hierarchy for realizing client/server system

In realizing the domestic sales and production system, a three-tier client/server system was adopted. The system is composed of a host tier of host computers controlling a large volume database, a UNIX server tier as database servers for mission critical task processing, and a client tier of personal computers with which users operate screens.

The host tier of host computers controls the function of outside connection to trading companies, etc., which has historically been controlled, the sales and production control system, which is an existing mission critical system, and large-scale foundation databases, such as the product inventory database. Independent data controlled

by a departmental mainframe, such as the domestic sales and production system, is accumulated in the tier of UNIX data servers, and the UNIX machines are used as departmental computers. In the client layer, the GUI can display its greatest effect, with main application programs for domestic sales and production tasks installed in a DOS/V machine with Windows.

When fax is the only means of contacting trading companies, which is an exception in terms of the system configuration of the domestic sales and production system, messages are transmitted very efficiently, like the output image of the soft-form-overlay method that is output by a large computer and, therefore, a fax server using the UNIX machine is exclusively used as an automatic fax function.

Furthermore, the design is so made that one personal computer can perform three functions in order to meet the following requirements from the sales persons who actually operate the system:

(1) Mission critical tasks of the domestic sales and production system, etc., and EUC (end user computing) must be possible.
(2) The conventional host computer functions are available without change.
(3) Personal computers must take full advantage of various kinds of software.

3.2.2 Hardware and software configurations

The RS/6000, which is a RISC machine manufactured by IBM Japan, was adopted as the UNIX server machine in consideration of stability and the design concept of ODL (open data link) of middle software (**Fig. 4**).

SYBASE was adopted as an RDBMS (relational database management system), because it can withstand the high transaction load during the peak operation at the beginning of each month, which is a feature of the monthly sales planning task, and advanced functions such as stored procedures have long been realized. Although disk mirroring (data duplication) was conducted in consideration of the occurrence of failures, the duplication of the UNIX machine is not conducted because recovery time is a necessary condition.

For the personal computers, the IBM Japan PS/55 series was adopted as hardware capable of using Windows and in consideration of compatibility with the LAN board and the degree of guarantee of the laser printer and I-3270 emulator.

Notebook computers were adopted to secure office space in the Tokyo Head Office, and desk-top computers with high resolution were adopted in the branches.

As shown in **Fig. 5**, IBM's ODL (open data link on the personal computer side and open data server on the UNIX side) was adopted as the middle software that links SYBASE of UNIX with spread sheet software for personal computers, such as EXCEL, in consideration of future possibilities. Furthermore, a soliton TCP was installed as the TCP/IP (transmission control protocol/internet protocol) on the personal computer side. As the software for personal computer development in the domestic sales and production system, EXCEL was adopted as the spread sheet program and Visual Basic was adopted for menus after various processes of trial and error.

Furthermore, COMPAQ DOS/V machines were equipped with NetWare to combine the print server
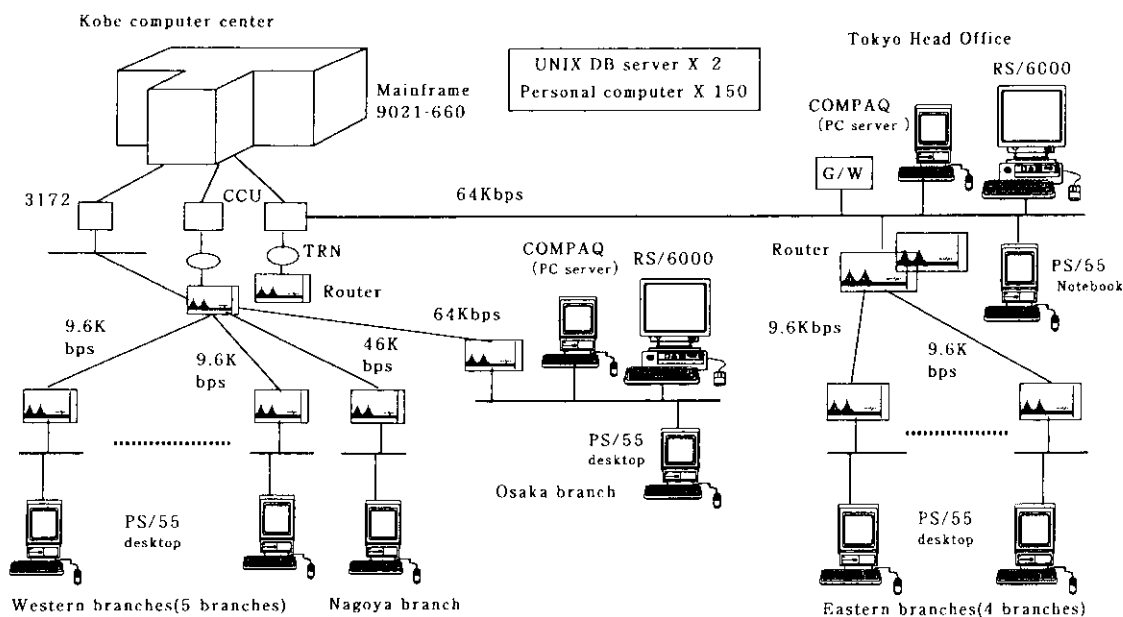

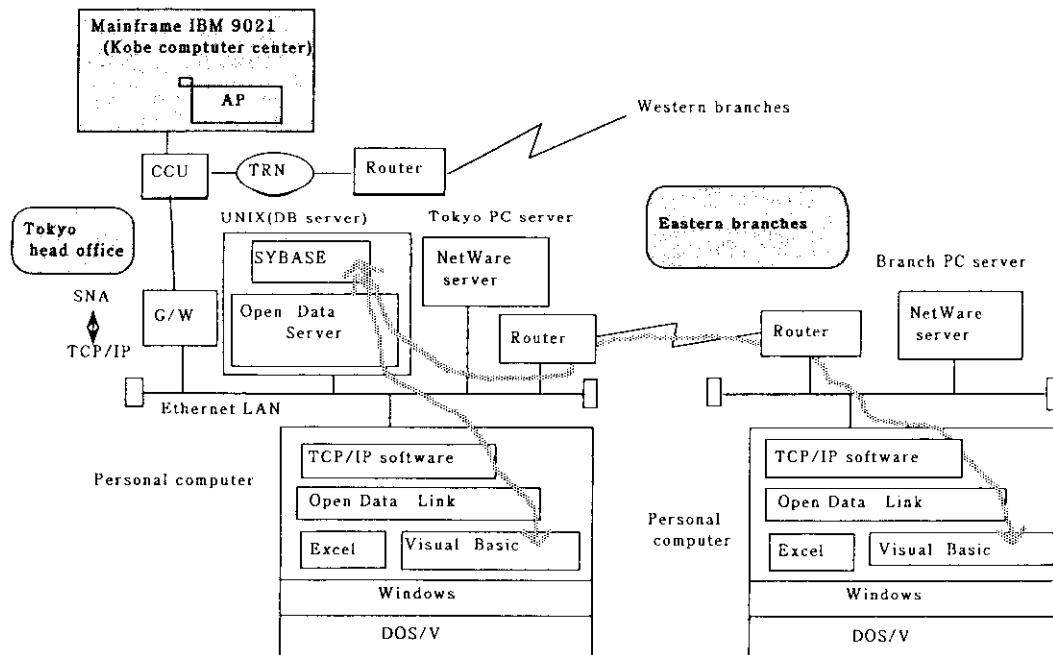Fig. 4 Hardware configuration of PEGASUS system

Fig. 5   Software configuration of PEGASUS system

function with the developed program distributing function by installing a NetWare server in each branch (here, the Tokyo Head Office is also regarded as a branch). As shown in **Fig. 6**, in order to reduce the load of the NetWare print server in allotting one laser printer to five personal computers, equipment exclusively for the print server was also connected to each laser printer.

3.2.3 Network configuration

With the client/server system serving as the basis for the domestic sales and production system and with TCP/IP serving as the basis between UNIX and the personal computers, a WAN (wide area network) was realized by installing Ethernet LAN/s, which provide the basis for open systems as future infrastructures in the Head Office and each branch (Fig. 4).

In branches where the amount of data and the number of terminal units are small, data compression and expansion devices were installed in sets in low-speed lines with great benefits (Fig. 6). A duplex system was adopted for important communication equipment, such as routers, and the above branch servers. Furthermore, Net View 6000 was adopted for the supervision of the whole network, and abnormalities in the network up to the intelligent HUB are monitored.

3.2.4 Solutions to technical problems for stable operation of system

A client/server system of UNIX and personal computers was examined by following the basic policy described below, and the following results were obtained:
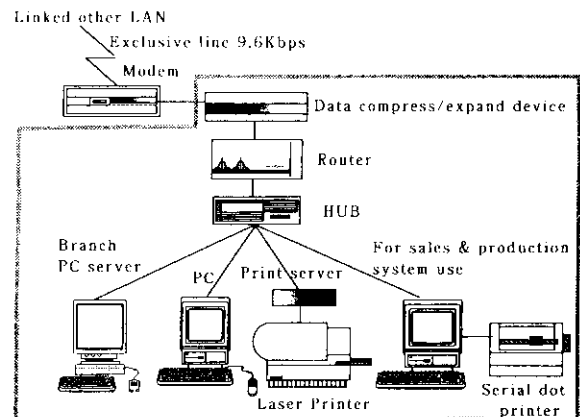

Fig. 6   Configuration of LAN environment

(1) Because there are still many technical problems related to the Head Office, the basic policy was formed in such a manner that the tools on UNIX accumulated at the works are transplanted as far as possible to the Head Office in a form suitable to the Head Office. The following are examples of transplants from the works or commercialization:
   (a) Batch operation control system in UNIX
   (b) Batch file transmission and receiving between the mainframe host computer and UNIX or between the two UNIX servers
(2) There have so far been few cases of program management by operation in a wide area network. However, such program management may constitute a bottleneck. Therefore, a decision was made to build tools

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unless packages, etc., became available by the time the production run is conducted. The prepared tools include:

(a) Tool for the automatic distribution of development application programs of personal computers and UNIX

(b) Tool for reserving the execution of batch processing from personal computers to UNIX

3.3 Effects and Problems

3.3.1 Effects of system

In the practical side of sales tasks, the office work load is greatly reduced by standardization. However, the effects of the present system were not limited to this, and what is more important, the system formed a foundation for contributing greatly to the concept that the customer-oriented inventory control is the core work function, and also to the enhancement of the sales planning function. Furthermore, the front-line sales persons who participated in the planning of the information system operate the system themselves, presenting an opportunity to eliminate their "allergy" to systems. At the same time, it might be said that this marked a step toward the future development to EUC (end user computing).

To build system infrastructures for the sales task, the nationwide network was reviewed and LANs were totally adopted in terms of environment; this created an environment in which horizontal distributed processing can be conducted. At the same time, GUIs were integrated by a Windows environment and new standard software was supplied by abolishing conventional standard software. The foundation was thus built by an integrated environment as a whole. The system is expected to contribute greatly to the future development of information literacy and EUC.

3.3.2 Future problems

The initially aimed functions of the domestic sales and production system were achieved and the system is operating smoothly. The following items should be examined as future problems:

(1) Measures to cope with upgrading the versions of various kinds of software related open systems

(2) Support in daily non-routine analysis tasks, system for supplying information to top management in association with basic tasks, and building a database that provides a foundation for this system

(3) Promotion of the application of groupware to take full advantage of the organizational capabilities of the sales division through integration of infrastructure equipment

4 Conclusions

The domestic sales and production system (PEGA-SUS) for forming monthly sales plans, which is the most important problem in improving the work efficiency of the sales division, was developed. The following results were obtained:

(1) The product inventory database was built on the basis of the Kawatetsu Interconnection Support System (KISS), which is a new communication technique.

(2) PEGASUS was designed with the configuration of a typical client/server system consisting mainly of UNIX database servers. SYBASE software was applied in the database and Visual Basic, Excel, etc., were adopted as development supporting tools.

(3) An increase in the office work efficiency in the sales division resulted in shortened office work schedules and improved productivity, which increased the sales planning capability.

(4) Because the people of sales division designed and operated the system for themselves, their "allergy" to systems was eliminated. This contributed greatly to the reform of the environment of sales division.

(5) Converting the networks for company branches located throughout Japan into LANs resulted in the construction of an infrastructure for the future building of client/server systems.

(6) Integrated database control was made possible by sharing information with trading companies using the product inventory database on a full-scale basis.

Although the development period including planning was about three years, this system covers almost all kinds of products made by Kawasaki Steel. The system was applied first to sheet products in June 1994 and then to the remaining products in December. The know-how obtained through the standardization of the system is expected to provide a basic model for the development and maintenance of future client/server systems.

We would like to extend our sincere thanks to the people of IBM Japan who afforded cooperation in the development of this system from planning to the production run.

References

1) S. Fujikawa, Y. Tsuchida, and Y. Michino: "On-Line Information System for Meeting Order Processing Services, "KOS-MOSII" Kawasaki Steel Giho, 20(1988)2, 102–107

2) T. Uemura: "The Foundation of Data Base," (1979), [Ohm]

3) Y. Watanabe: Nikkei Computer, 348(1994), 116–121