OVERVIEW: New enterprise information system is requested to be flexible and efficient in order to cope with rapidly changing business environments and advancement of services. For this reason, the Internet technology has been applied to the enterprise information system, and new information technologies such as distributed object technology, Java*1 and ActiveX*2 are beginning to be introduced. There also exist many properties in enterprise information systems, such as the application programs or legacy data, which have been developed for a long time. In order to unite these properties with new information technologies, legacy system integration technology using distributed object technology was developed. With this technology, processes and data such as on-line processing, batch processing, and databases on the existing mainframe systems including VOS3 can be utilized from the distributed object environment. Development of new applications utilizing the existing property and construction of new and flexible value-added systems integrated with the commercial software of a distributed object base thereby become possible.

INTRODUCTION
NEW enterprise information systems need to be flexible and efficient in order to cope with rapidly changing business environments and progress in services. For this reason, Internet technology is being applied to enterprise information systems, and new information technologies, such as distributed object technology, Java and ActiveX are beginning to be introduced. It has become important to unite the properties built into existing application programs with new information technology, and develop more flexible and extensible enterprise information systems.

The legacy system integration technology assists in this unification. It enables the existing property freely utilized from the new environment through flexible connections with the distributed object technology. Using this technology, the existing programs and data can be used independent of the distributed object environment, without any significant change. Value-added services by integration with other systems can thereby be provided quickly and easily, employing existing property to the maximum efficiency. This report discusses the positioning of legacy system integration technology, its architecture, and VOS3 (Virtual-Storage Operating System 3) wrapping products.

SYSTEM INTEGRATION IN NETWORK OBJECTPLAZA
Network Objectplaza*1 is the architecture for the next-generation information system constructed on the basis of the distributed object environment which Hitachi advocates. As a distributed object base, Network Objectplaza consists of TPBroker containing ORB (Object Request Broker), CORBA (Common Object Request Broker Architecture)*3 services, a system integration base, a development environment, an operation management, and application frameworks. Here, the system integration base enables the construction of systems, in which not only C++ and Java applications but also various existing applications or commercial packages can be accessed.

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*1: Java and all Java-based trademarks and logos are trademarks or registered trademarks of Sun Microsystems, Inc. in the United States and other countries.
*2: ActiveX is a trademark of Microsoft Corp. in the U.S. and other countries.
*3: CORBA is a standard for distributed objects being developed by the Object Management Group (OMG).
freely from clients, such as a web browser, Java, ActiveX, etc. (Fig. 1). One reason that Network Objectplaza is built on the CORBA environment is that CORBA provides interoperability for achieving a variety of system integrations. The most notable one now is the integration of an on-line program or a batch program on VOS3.

Moreover, for the system integration in heterogeneous environment, the tools for making various systems and applications cooperate flexibly, utilization technology and SI (system integration) technology are also important.

**ARCHITECTURE OF LEGACY SYSTEM INTEGRATION**

Wrapping

Wrapping is the technology that provides a new interface using a conversion program (wrapper), without changing the interface of the existing software. The system, conventionally used only in a specific environment, can in this way be used in a new environment. Specifically, we call this use in a new environment “Legacy System Wrapping,” in which the existing mainframe system is wrapped.

If we use this wrapping technology in a distributed object environment, the program and data of the existing system can be treated as an object, and can be cooperated with other objects easily (Fig. 2).

**Classification of Wrapping Methods**

The objects of wrapping are on-line systems, batch processing, and database systems on a mainframe. Although the interface of each legacy system differs, the wrapper will absorb the difference, and show those properties as objects with the unified interface as a distributed object (Fig. 3).

In the case of on-line system wrapping, there are several methods for connection with a legacy system. The simplest method is to use a wrapper which carries out the same operation as a terminal (screen wrapper in Fig. 3). By this method, the configuration of the mainframe does not need to be changed at all.
Conversely, when changing a legacy system for maintenance, for example, the position of the input domain in a screen is moved 1 line, and a corresponding correction is also needed for the wrapper side. This is because a screen wrapper recognizes the data by the coordinates on the display screen.

The “logic interface wrapper” wraps the input-output data of an on-line system using the more logical connection than the screen wrapper. Since it does not use a screen interface, efficiency is better and is not influenced by the layout of a screen. Although the form of the input-output data differs for each application, since definition data describing this form usually exists, the wrapper can create definition data for wrapping using this definition.

Furthermore, the “business logic wrapper” takes the interface structure for each application into consideration. The concrete method of wrapping depends on each application. For example, the business logic wrapper can automatically manage legacy input-
output data which use two or more screens to be acquired only by 1 call from a client.

Batch processing can be performed using a remote batch interface, and the result can also be acquired by the file transmission. Although it is not as real-time as an on-line operation, it can be used in a way like start first when required and see the result after taking for a while.

Moreover, a database can also be directly controlled by the wrapping using a database access interface such as ODBC. It will be fit for a simple operation like reference.

**Architecture of On-Line Wrapping**

Since originally an on-line system is connected and used by terminals, it is premised on the architecture peculiar to terminals, such as specific communication sessions. For this reason, a wrapper needs to have a functionality to control these interfaces.

The architecture of on-line wrapping using the business logic wrapper is shown in Fig. 4. Here, the definition file holds, for example, a parameter peculiar to applications, such as the name of the data item or the name of the screen. Session management manages the communication session with a legacy system, and provides the function of maintaining the session virtually. This is because, when a client uses the WWW (World Wide Web), although communication with a browser will be disconnected by every screen, a legacy system usually holds session, while continuing the operation.

Scenario execution provides a function which automatically performs and controls accesses to two or more screens. State surveillance is needed in order to understand the state change of a legacy system correctly. In the case of a transition to an unexpected state, an error handling function tries to recover from that state. In addition, cooperation with the two phase commit or the recovery service, for example, is also needed in some applications.

**INTEGRATION WITH VOS3 SYSTEM**

The function for treating the resource and process on VOS3 as an object in a distributed object environment is called the “VOS3 wrapping function.” Using this function, the VOS3 system can cooperate with an open system easily, without greatly changing the environments on VOS3. By integrating VOS3 and a distributed object environment, we can obtain advanced value-added services quickly and easily, employing the existing property with the maximum efficiency.

**Functional Outline of VOS3 Wrapping**

The VOS3 wrapping function includes (1) on-line wrapping, (2) batch wrapping, and (3) database wrapping.

The VOS3 wrapping function has a file which defines its operation. The support tool to create this definition file is also provided.

By using the VOS3 wrapping function, we can access the resources on VOS3 through the application object on servers, such as UNIX*4 or Windows NT*5, from the client of Windows 95*5, for example. When using a WWW browser, “web page generator (web page generation function)” can be used. The web page generator calls the CORBA object from HTML (hypertext markup language), and sticks the results on a web page. It can create a web page easily from the results from VOS3 access.

**On-Line Wrapping**

The on-line wrapping is a function to treat a transaction with the on-line system on VOS3 as an object. “XDM/DCCM3 wrapping” and “TMS-4V/SP wrapping” are first among the on-line wrappings.

Using these functions, we can change the user interface from a dumb-terminal basis to a WWW

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*4: UNIX is a registered trademark in the United States and other countries, licensed exclusively through X/Open Company Limited.
*5: Windows and Windows NT are registered trademarks of Microsoft Corp. in the U. S. and other countries.
browser, or building a new system by cooperating each work which had no relation before has become possible. At this time, the existing application on VOS3 needs to be changed only a little.

In the definition file for on-line wrapping, the screen layout information and the screen transition information are described in scripts.

(1) XDM/DCCM3 wrapping

XDM/DCCM3 wrapping is the function of wrapping DCCM3 applications using the terminal screen interface, a logic interface, and message communication. As a support function of DCCM3 wrapping, there is an XMAP analysis support tool which creates wrapping definition file information automatically from the XMAP file which defines a terminal screen.

(2) TMS-4V/SP wrapping

TMS-4V/SP wrapping is the function of wrapping TMS-4V/SP applications using a logic interface.

(3) Wrapping of other on-line systems

The wrapping function of other systems, such as the on-line system on VOS1, will also be provided in the same manner.

Batch Wrapping

Batch wrapping is the function which enables the starting and execution surveillance of batch jobs from a distributed object environment. After a job is performed, the execution result is returned to the application on the distributed object side.

By batch wrapping, extensive data can be processed asynchronously in a lump. It can be used when dealing with extensive data on VOS3 collectively. An outline of VOS3 on-line wrapping and a batch wrapping is shown in Fig. 5.

Database Wrapping

Database wrapping is a function for accessing abundant data on VOS3 from a distributed object environment. This function is a database access tool in distributed object environment, and the distributed object applications created using APPGALLERY or Visual Basic will be able to access various kinds of database, such as XDM (Extensible Data Manager), HiRDB (Highly Scalable Relational Database), Sybase SQL Anywhere, and ORACLE.

The database wrapper is attaining performance improvement by parallel processing using multi-thread. Moreover, since it also corresponds to DCOM (distributed component object model), a flexible enterprise information system can be constructed. An outline of a database wrapping is shown in Fig. 6.

FUTURE DEVELOPMENT

(1) Expansion for integration target

In the legacy information system of an enterprise, various systems of many vendors are connected by mainframe to personal-computer server. Hitachi had produced wrapping technology of the VOS3 system

*6: Visual Basic is a registered trademark of Microsoft Corp. in the U.S. and other countries.
*7: Sybase SQL Anywhere is a product name of Sybase, Inc.
*8: ORACLE is a registered trademark of Oracle Corporation.
first. In order to provide synthetic solutions to a customer, the target of wrapping to other mainframe systems, to conventional client server systems, and also to packaged software.

(2) Correspondence to toolkit-integration

Toolkit-Integration is a library which defines the common interface for heterogeneous system integration, and enables clients to access applications and data of a variety of systems using the unified interface. The wrapping products will also correspond to this toolkit-integration, in order to achieve integration with more systems. CORBA security service can be used in toolkit-integration. We can thereby achieve fundamental services such as encryption of communication data, access control, and obtaining the access log, and the unified login capability.

(3) Expansion of system integration technology

If we use the properties of the conventional system effectively, and cooperating with the system inside and outside, we can turn a new enterprise information system into a global system. Therefore, in the system integration or the system consolidation, the “integration technology” has become very important for building a highly value-added system which meets each business situation combining the various kinds of systems.
of technology.

From now on, we intend to provide and expand the technology and environments much further so that different systems can be integrated more freely by combining the wrapper and integrating the systems and packages of components (Fig. 7).

CONCLUSIONS

This report explains the legacy wrapping technology that utilizes existing system properties using the distributed object technology which is becoming the core technology of future enterprise information systems.

We consider that the open standardization and open system/network connectivity of an enterprise information system will be increasingly accelerated with the development of information technology. On the other hand, the programs and the data property which have been built thus far have also been increasing with the expansion of business. Hitachi intends to support construction of flexible and highly value-added systems which integrate new information technology and conventional system properties.

REFERENCES