

Information & Telecommunication Systems

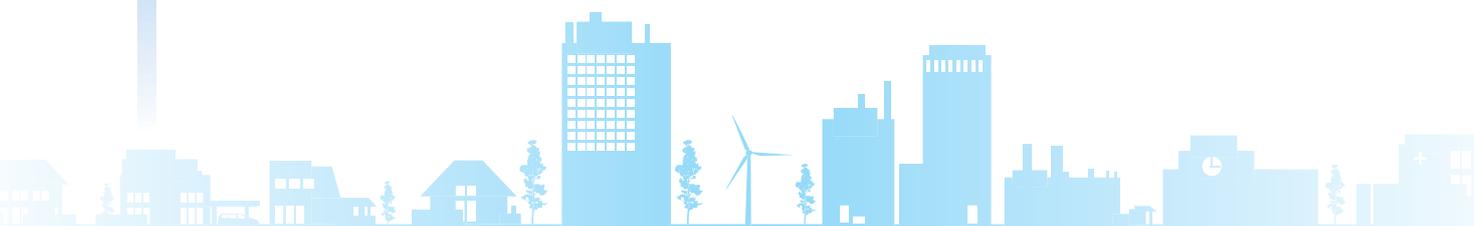
IT Platform

Cloud Computing

IT Solutions and Services

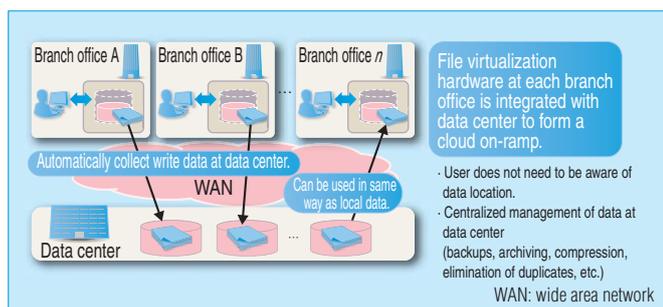
Network Systems

System LSIs



Content Cloud Supporting Use of Big Data to Generate New Value

Currently, there is growing demand to put "Big Data" to work in areas like improving corporate competitiveness or solving social problems. Here, Big Data refers to the large quantities of information that companies and other organizations progressively collect and accumulate from their field operations and devices. In response, Hitachi has released a "content cloud" that can act as an IT platform for realizing this ambition. In this article, some of the people involved comment on the benefits and possibilities opened up by the content cloud.



Automatic collection of data at data center using file virtualization

Time to Utilize Big Data in Corporate Strategy

The key focus in past use of information technology (IT) has been on taking data collected for particular purposes and subjecting it to specific types of processing in order to improve business efficiency. In recent years, however, the explosive growth in the amount of data collected from sensors and other sources, along with increasing volumes of unstructured content data such as e-mail, images, and business documents, have led to calls for IT to generate new value from this huge amount of information that has come to be referred to as Big Data.

A common example from consumer businesses is to conduct detailed analyses of data on customer purchasing activity and then use the results to provide a recommendation function. In other words, finding ways to make use of this rapidly growing quantity of data and utilizing it in business innovation will form an essential part of company growth strategies in the future.

Use of Content Cloud for Integrated Management of Different Types of Data

Hitachi uses the term "One Platform for All Data" for the future form of new IT platforms that use Big Data to improve knowledge productivity. To achieve this, Hitachi supplies an "infrastructure cloud" that provides efficient processing of Big Data using storage virtualization and middleware for automating administration, as well as a "content cloud" that provides integrated management of different types of data. Hitachi seeks to combine these two platforms organically. An additional feature is the cloud on-ramp solution, which forms part of the content cloud and has earned a positive reputation for the unique ideas it embodies.

In place of conventional devices such as file servers or network-attached storage (NAS), this solution uses file virtualization hardware installed at different company sites to act as a cloud

on-ramp and automatically collect and integrate the continually growing quantities of data on large file storage devices at a data center. Because data can be accessed transparently when needed, the user does not need to be concerned with the data's actual location, nor spend time making backups. Because the data center provides support for data duplication, the solution can also be seen as playing a valuable role in business continuity plans (BCPs).

Implementation of Information Cloud Using Combination of Technologies

Hitachi intends to use a range of different technologies to generate new value from Big Data that has been collected and integrated in this way. Among examples from Japan, work is in progress on use of parallel distributed processing for Hadoop*, highly reliable grid batch systems, stream data processing whereby continuous streams of data are processed in memory at high speed, and an ultra-high-speed database engine being developed jointly with The University of Tokyo.

In addition to implementing these technologies on the content cloud in the future, Hitachi intends to combine these with its extensive practical know-how to create an "information cloud" that can provide customer businesses and other parts of society with new value and innovation in an optimal form.

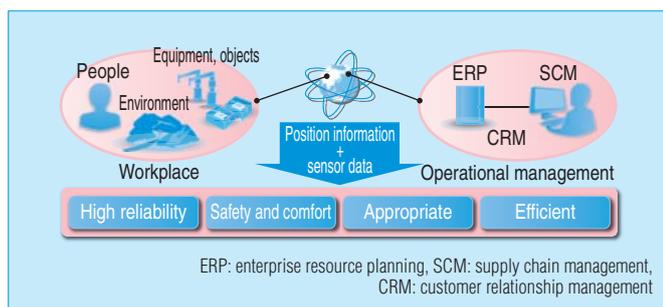
* See "Trademarks" on page 91.



Yasushi Kuba (left), Director, Software Strategy and Planning, Platform Business Planning, IT Platform Business Management Division; Takashi Oeda (middle), General Manager, Integrated Platform Systems Development Operation, IT Platform R & D Management Division, IT Platform Division Group, Information & Telecommunication Systems Company, Hitachi, Ltd.; Michael Hay (right), Chief Engineer, Platform Business Planning, Storage Strategy and Planning, IT Platform Business Management Division, IT Platform Division Group, Information & Telecommunication Systems Company, Hitachi, Ltd. and Vice President, Hitachi Data Systems Corporation

Smart Sensornet Solution Entering Widespread Use

Recent years have seen growing demand for the ability to determine the location and status of people and objects for purposes such as energy efficiency or security. Hitachi already supplies visibility solutions that use wireless networks to provide access to information on position, temperature, humidity, acceleration, pulse, and other parameters. These services are now being consolidated into smart sensornet solutions. This article interviewed the people responsible for these services, which are being considered for use at a range of different sites, including factories, warehouses, and data centers.



Ongoing Expansion in Scope of Application

Hitachi business activities that deal with the use of wireless networks can be broadly divided into indoor position information and sensor network systems. These activities involve the supply of systems for determining the position and status of people and other objects. Specific products include a series of wireless local area network (LAN) position detection systems and a series of sensornet information systems, which have been on sale since 2004 and 2005 respectively. For example, detecting the position and status of goods in a warehouse in realtime and making this information available allows for the provision of services with high added value, including managing goods appropriately and making major improvements in operational efficiency.

Hitachi has continued to expand its business by finding new markets for these products since they were first developed and they are starting to be adopted in a wide range of different sites for purposes such as the management of people and other objects, security, and energy efficiency. Accordingly, Hitachi has now consolidated the services into what it calls its "smart sensornet solution."

Wireless LAN Position Detection Systems and Sensornet Information Systems

Wireless LAN (WLAN) position detection systems are data communication systems that use receivers to detect the locations of wireless nodes in indoor environments. They are capable of detecting positions to a high degree of accuracy (1 to 3 m*) based on wireless LAN reception strength and signal propagation time, and can use wireless LAN nodes as position detectors without needing to perform any customization.

Sensornet information systems can acquire data such as temperature, humidity, and acceleration in realtime. A feature of

the systems is their use of the ZigBee** wireless communication standard to support multihop communications (in which signals are relayed from node to node,) which makes it simple to collect sensor data on a server. They can also be customized in a variety of ways including use with wristband sensors that capture parameters like pulse, acceleration, and skin temperature, and connection to power meters, power supply taps, and other locations to collect electric power usage information.

Smart Sensornet Solution

While products for acquiring position information and products for acquiring sensor information are currently available from a number of suppliers, Hitachi has succeeded in integrating these into smart sensornet solutions. In the case of systems for detecting when something has fallen over, for example, existing systems have been able to detect that a fall has occurred but not where it occurred. When the smart sensornet solution is used, the sensornet information system detects when a fall occurs and the wireless LAN position detection system obtains the position information. The result is a solution with more added value.

Beyond this example application, smart sensornet systems can also be used to provide solutions from a number of different approaches, including security, goods management, safety, and comfort. In the future, Hitachi intends to expand the scope of smart sensornets by accelerating the fusion of wireless LAN position detection systems and sensornet information systems.

*1 Quoted performance may not be achieved in some environments.

** See "Trademarks" on page 91.



Kohei Ueno, Sales Promotion Center, WirelessInfo Division, Information & Telecommunication Systems Company, Hitachi, Ltd.

Job Management Partner 1 –Control of Security Measures

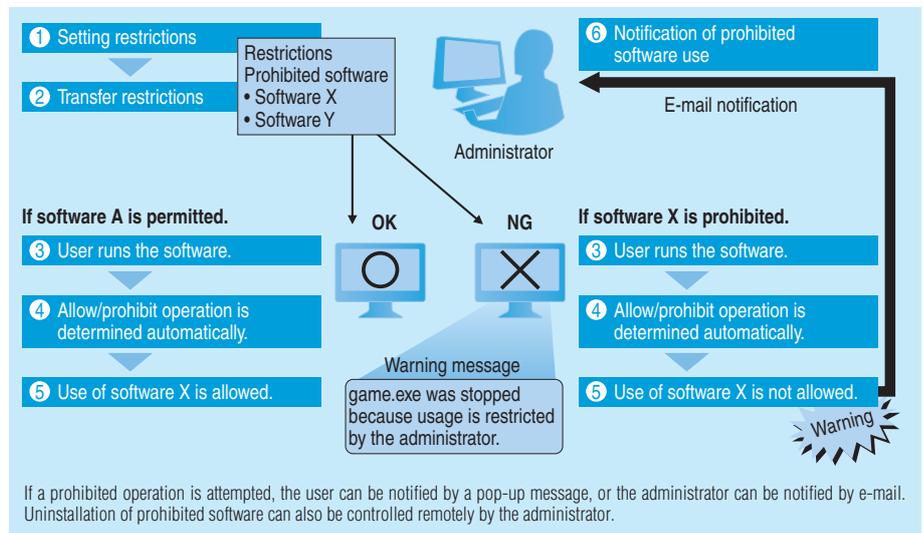
Managing the enterprise information systems of today poses a multitude of challenges, such as how to maintain policy compliance and how to reinforce security measures against increasingly complex risks.

Job Management Partner 1 delivers integrated management of information technology (IT) assets, enforcement of compliance policies, and enhanced system security.

In Job Management Partner 1, security policies can be created to prohibit certain operations, maintain operational usage logs, and keep software versions up to date for products such as antivirus software. Policies can be applied either to individual personal computers (PCs) or at a group level to ensure security measures are uniform. It can also show the effectiveness of the applied security measures (security trends), and changes can be implemented simply by updating the defined policies.

[Main content of security policies]

- (1) Determination of program updates
- (2) Determination of anti-virus software



Example security policy (specifying prohibited operations)

- (3) Determination of operating software
- (4) Determination of security settings for services
- (5) Setting of prohibited operations
- (6) Determination of security settings for operating system (OS)
- (7) Setting of operation logs

A Large-volume Data Processing Platform for the Information Explosion Era

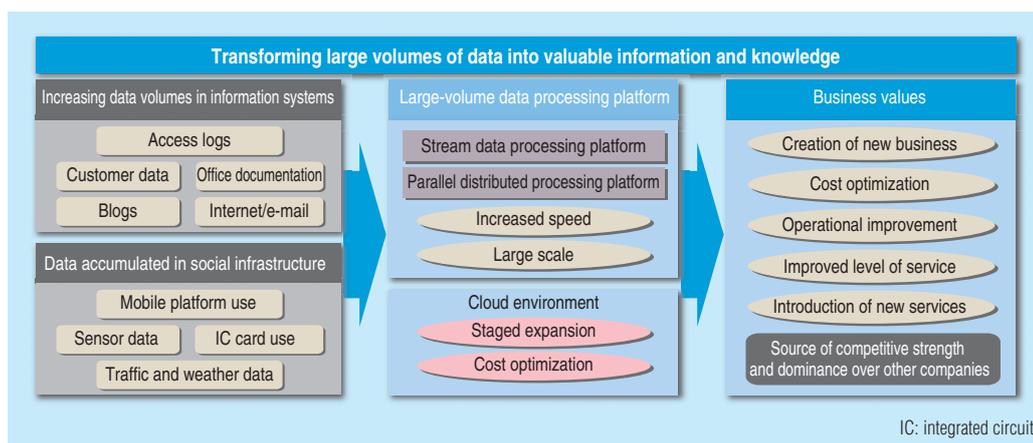
With the arrival of an era of information explosion, there is a growing trend toward using large-volume data from extensive access logs and sensor data in order to improve business and assist in managerial decisions, as well as to improve the quality of customer service and the introduction of new products and services.

The large-volume data processing platform offers data

processing capabilities suited to a range of data application needs. Consisting of both stream data processing platform and parallel distributed processing platform products, the large-volume data processing platform performs realtime processing of large volumes of data, as well as large-scale batch processing. In-memory processing is used together with distributed parallel processing to cope with increased data volumes, offering better processing speed

and larger sizes. Additionally, by supporting the construction of systems in a cloud-platform environment, the large-volume data processing platform allows staged system expansion and optimization of running costs through system growth that is in step with the size of the business.

Hitachi will continue the evolution of both functionality and performance, thus anticipating changes in the increase of data volumes and in usage needs.



Positioning of the large-volume data processing platform

Hitachi Compute Blade Series

Hitachi Compute Blade is an information technology (IT) platform that links storage, networks, and middleware to provide a converged data center solution. This platform brings Hitachi's development resources and know-how to pivotal technologies for next-generation platforms, such as system virtualization, integrated control, and energy-efficient operation. It is flexible enough to handle the various applications that will be necessary in the coming IT era, including Big Data processing, business analytics, the moving of operations to the cloud, and use in high-level social infrastructure.

(1) Hitachi Compute Blade 2000—a platform supporting highly reliable IT environments

The Hitachi Compute Blade 2000 is the high-end model of the series. It is a highly reliable, high-performance blade server that features technologies that Hitachi has acquired through its development of mainframe computers. Although it is a blade server, the Compute Blade 2000 supports large memory capacity and input/output (I/O) slot expansion units, and offers the performance necessary for server virtualization and large scale systems. Furthermore, Hitachi offers long-term hardware maintenance, supporting the highly reliable IT environments needed for core systems and social infrastructure platforms.

(2) Hitachi Compute Blade 500—a blade server optimized for virtualization / cloud platforms

The Hitachi Compute Blade 500 is optimized for systems that use Big Data, virtualization, and cloud platforms. It supports the use of high performance processors and large memory capacity to

raise the consolidation ratio of virtual machines. Additionally, the Compute Blade 500 provides the flexible, highly expandable networks needed for cloud platforms, and is equipped with functions to simplify the building and operation of the large-scale, complex systems made necessary by the increase in cloud-platform use-cases.

(3) Hitachi Compute Blade 320—a blade server intended to reduce energy and space requirements

The Hitachi Compute Blade 320 is a blade server that utilizes advanced cooling techniques and lightweight, precise mounting technology to achieve high consolidation ratios. This model is also compatible with energy-efficient use, such as the use of high-efficiency power supplies and performance optimized for power supply conversion efficiency, and use with power capping functions that keep power consumption by users at or below a set limit.

(4) Hitachi Compute Blade logical partitioning feature—high-performance, highly reliable virtualization equipment

The server logical partitioning feature in the Hitachi Compute Blade utilizes hardware-assisting mechanisms and logical partitioning of all resources based on unique Hitachi technology, providing a logical server partitioning environment for servers with low overheads, and high reliability and security. The logical partitioning manager (LPM) navigator, a graphical user interface (GUI)-based building and operational support tool, makes logically partitioned resources much easier to use, enhancing usability.



Hitachi Compute Blade 2000 & IO Expansion Unit (a), Hitachi Compute Blade 500 (b), and Hitachi Compute Blade 320 (c)

Hitachi Compute Rack, Hitachi Compute Tower

The Hitachi Compute Rack and Hitachi Compute Tower are servers with a rack or tower configuration, equipped with advanced processors including the Intel® Xeon® processors, and offering superb expandability in terms of memory, input/output (I/O), and storage. Featuring a broad lineup, the Hitachi Compute Rack and Hitachi Compute Tower series have the flexibility to cater to a diverse range of workloads and needs from a small office or department server to a medium or large-scale database server. The rack configuration allows high levels of consolidation to be achieved within the limited confines of a rack cabinet by using high density mounting, while the tower configuration is intended to deliver quietness and compactness suitable for a range of installation environment needs.

In addition to excellent processing performance, the Hitachi Compute Rack and Hitachi Compute Tower support internal redundant array of inexpensive disks (RAID) arrays for improved fault tolerance with regard to storage, as well as redundant power supplies and fans, to support stable operation. Further, this series also allow the efficient use of resources through virtualization using

Hyper-V* or VMware*, and use energy-efficient components such as low-voltage processors and 80 PLUS* certified power supplies. They also provide support for power management functions like power capping in order to facilitate the creation of energy-efficient systems.

* See "Trademarks" on page 91.



Hitachi Compute Rack (left) and Hitachi Compute Tower (right)

Hitachi Compute Blade 10 Entry-level Blade Server for High-density and Energy-efficient Data Centers

In recent years, with the swift growing of different end-user devices, the amount of data generated by business and social activities has increased dramatically. Accompanying this rapid increase, initiatives employed by businesses and utility services

that obtain information from the analysis of the data generated have seen growth in a variety of areas. As a part of such expansion there is growing interest in distributed processing systems that use Hadoop* and multiple servers in parallel to perform large-scale data processing efficiently.

The Hitachi Compute Blade 10 entry-level blade server was developed in response to the burgeoning need for the installation of many servers with low levels of power consumption in restricted amounts of space, which has been brought about by growth in the volume of data handled at data centers. The Hitachi Compute Blade 10 is suited to the diverse needs of customers such as data centers and content distributors who want to construct systems consisting of multiple servers housed together in a physically dense configuration. Additionally, it is suitable for use as a distributed data processing system platform utilizing Hadoop, and also supports the use of large volumes of data in a variety of fields in business.

* Hadoop: A software framework developed and distributed by the Apache Software Foundation that allows efficient distributed processing of large volumes of data.



Hitachi Compute Blade 10

Strengthening of the Hitachi Virtual Storage Platform

In recent years, storage virtualization has gained attention as a response to the rapid increase in data volumes and usage of the cloud. In the enterprise storage domain, virtualized devices

offering consolidated control of previously discrete storage media have been brought to reality, as has virtualization that allows the consolidation of internal volumes in a consolidated volume.

The Hitachi Virtual Storage Platform now offers the virtualization of storage levels, and in particular, makes it possible to automatically allocate data to levels with differing characteristics, including for example, solid state drive (SSD), serial attached small computer system interface (SAS), and serial advanced technology attachment (SATA) that are appropriate to the frequency with which the data will be accessed. In April 2011, Hitachi began offering support for external storage devices from Hitachi and other companies that have been connected externally as new layers using virtualization. Saving data that has not been accessed for long periods automatically to externally-connected storage allows better cost-performance than was previously possible.

Additionally, Hitachi moved ahead of other companies in August 2011 by offering virtualization of volumes for mainframes, thus allowing virtualization technologies with a proven track record in open architecture to be used in a mainframe environment.



Hitachi Virtual Storage Platform

Hitachi Unified Storage 100 Series

Hitachi has released the Hitachi Unified Storage 100 Series of storage systems that enable the timely utilization of Big Data by storing a wide range of different data in the same system.

The Hitachi Unified Storage 100 Series supports both block and file access protocols to allow applications that handle different types of data to share access to a single system. In addition to facilitating cross-system processing of the data produced by different business systems and allowing for prompt and effective use of Big Data, this also reduces both initial hardware investment and administration and running costs. The Hitachi Device Manager storage hardware management software is also included as a standard feature. It reduces the day-to-day workload imposed on administrators by providing unified operational management, including capacity allocation and capacity and usage checking for both block and file storage.



Hitachi Unified Storage 150

Hitachi Data Ingestor—Reducing Costs while Simplifying Cloud Adoption

Hitachi Data Ingestor (HDI) is a bottomless, backup-free cloud on-ramp and filer, which helps organizations simplify and accelerate cloud adoption.

Acting as a caching device, HDI provides users and applications with seemingly endless storage and new capabilities for cloud and distributed information technology (IT) environments, including:

(1) Content sharing—enabling “edge-dispersion” of data across a network of HDI systems

Multiple HDI systems can read from a single Hitachi Content Platform (HCP) namespace, giving an HDI system access to other HDI systems. Also, users can deploy wide-area content distribution frameworks.

(2) File restore

Users can retrieve previous versions of a file, as well as deleted files, maintaining file and directory access control.

(3) NAS migration

Enables transparent migration of data from network attached storage (NAS) and Windows* Servers to HDI, and supports automated throttling and continuous migration of data into HDI. Benefits of the new version of HDI include:

(1) Reduced cost

(a) Eliminates backups at the edge by providing a highly available on-ramp into a centralized storage solution, and takes advantage of robust storage management capabilities.

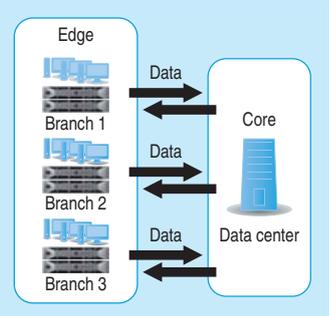
(b) Improves efficiency and utilization by consolidating distributed silos.

(2) Simplifies IT

(a) Reduces islands of storage and infrastructure.

(b) Increases efficiencies through bottomless storage at the edge

- An integrated edge-to-core solution: greatly reduces the cost and complexity of providing IT services to distributed consumers
 - Remote or branch offices
 - Cloud storage consumers
- Hitachi Data Ingestor: a low-footprint appliance that sends data from the edge to core infrastructure
 - Seemingly bottomless and backup-free
- Hitachi Content Platform: a massively scalable, multi-tenant distributed object store
 - Delivers advanced storage and data management capabilities.



Hitachi Data Ingestor and Hitachi Content Platform

with intelligent management capabilities.

(3) Reduced risk

(a) Supports compliance and retention capabilities.

(b) Supports full integration with Active Directory* and light-weight directory access protocol (LDAP).

(4) Streamlined cloud deployments and adoption

(a) Supports multi-tenant, multi-namespace environments.

Working in conjunction with HCP, a virtualized object store with advanced storage and data management capabilities, HDI is deployed as a minimal-footprint or virtual appliance that sends data from the edge to core infrastructure, to easily and cost effectively help customers move data to the cloud at their own pace.

* See “Trademarks” on page 91.

Hitachi Command Suite 7 Storage Management

Hitachi Command Suite 7 strengthens support for improving storage operations management efficiency and for the effective use of storage resources.

Adapting to changing operations management and expanding virtual environments efficiently requires the labor-saving benefits offered by provisioning in a virtual server environment. Hitachi

Improved storage management efficiency (reduced OPEX)

Automatic data store generation function (vCenter Plug-in) allows efficient provisioning management in virtual server environments.

VM creation procedure	Before improvement	After improvement
(1) Resource group allocation	Storage administrator	Storage administrator
(2) Volume creation	Storage administrator	vCenter Plug-in
(3) Volume assignment	Storage administrator	Server administrator
(4) Volume mounting	Virtual server management tool	Server administrator
(5) Data store creation	Server administrator	Automatic data store generation
(6) VM creation	Server administrator	Server administrator

Steps (2) to (5) can be run automatically just by specifying the data store name and capacity (vCenter Plug-in).

- Reduced workload for server administrators (simple deployment of the necessary volumes when needed)
- Minimization of cooperative work required between server administrators and storage managers

Efficient use of storage resources (CAPEX reduction)

Provides a control screen (dash board) for optimizing the layout of storage layers to meet operational requirements.

Dashboard logical group*1 screen

Worst 10 logical group response times

Worst 10 unused logical group volumes

Specify logical groups with slow response times.

Specify logical groups that have little remaining free space.

Specify pool**2 for logical groups that may have problems.

Evaluate drive (tier) / volumes for addition or migration from the pool details screen (separate from the dashboard).

*1 A grouping of devices assigned in operational units, comprised of hosts and volumes
 **2 A cluster of storage-tier areas assigned to volume data
 OPEX: operational expenditure, VM: virtual machine, CAPEX: capital expenditure

Features of Hitachi Command Suite 7

Command Suite 7 offers the VMware vCenter* Plug-in, which aims to reduce the workload of server administrators by automating the process from storage volume creation to data store creation, so that administrators only have to specify a data store name and capacity.

The rapid increase in workloads means that it is important to always assign the optimal storage tier to an operation task in order to maintain service levels. To that end, Hitachi Command Suite 7 provides strengthened control through virtual environments in storage tiers on the Hitachi Virtual Storage Platform. This platform offers control screens for evaluating operational factors such as how many of the various drives to assign and when to assign them, and which volume it would be appropriate to migrate, supporting the efficient use of storage resources.

* See “Trademarks” on page 91.

Virtualized RAM Cloud: Private Cloud Solution for Financial Institutions

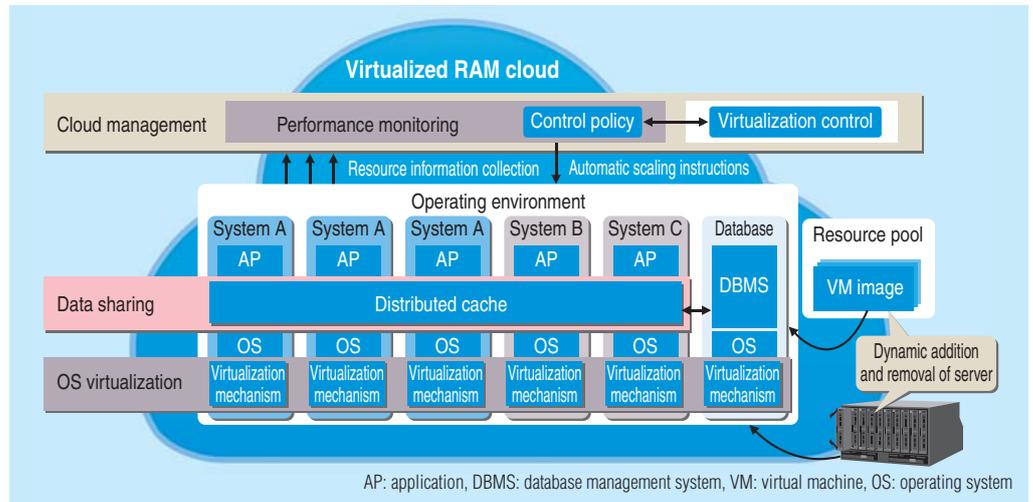
A virtualized random access memory (RAM) cloud is a solution jointly developed by VMware, Inc. and Hitachi, Ltd.

The core technology is its use of distributed in-memory processing whereby large quantities of data are spread across memory in multiple computers and can be accessed at high speed using unique keys. The computer resources can be adjusted without disruption by varying the level of processing concentration to allow resource sharing among multiple applications. The technology can distribute consolidation of database access and be used

for the downsizing or speed enhancement of systems such as Internet banking and on-line trading.

Because of its suitability for parallel processing, virtualized RAM cloud can be used to increase the speed of the high-volume batch processing undertaken by financial institutions, achieving 100 times* the performance of previous systems in some cases.

Furthermore, because data can be rapidly replicated across



Example virtualized RAM cloud configuration

different computers, the technology has applications in disaster recovery and global data sharing.

Further development of this technology is planned for the future in response to anticipated growth in demand for high-volume, high-speed cloud processing from financial institutions.

* Based on testing by Hitachi

Telematics Service for Commercial Vehicles

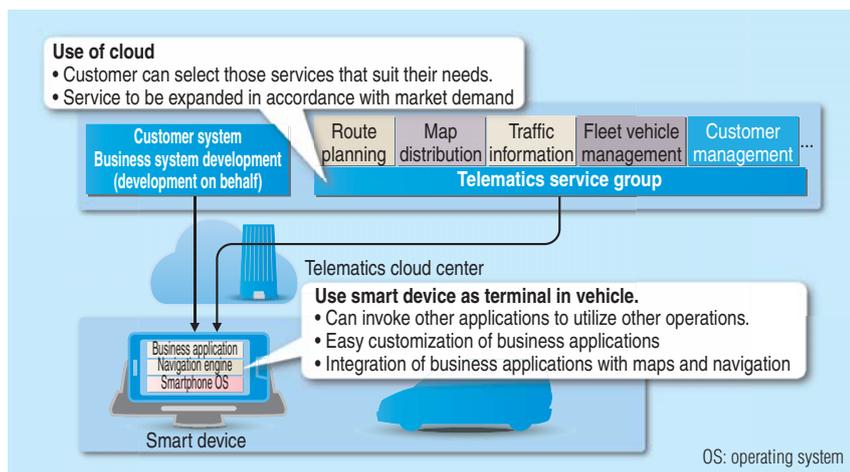
In recent years, the emphasis in telematics services for commercial vehicles has shifted from "operational management and administrative efficiency" to "safety and comfort, environmental performance, and the efficiency of sales activity." The market is estimated to reach one million vehicles and 100 billion yen by 2025

(based on forecasts by Yano Research Institute Ltd.).

The telematics service for commercial vehicles uses a car navigation system that runs on smart devices. These devices have proliferated rapidly in recent times. With the addition of services that provide strong support for sales support applications such as customer relationship management (CRM), the scope of the product extends to business operations that use sales vehicles and maintenance service vehicles, not limiting delivery operation.

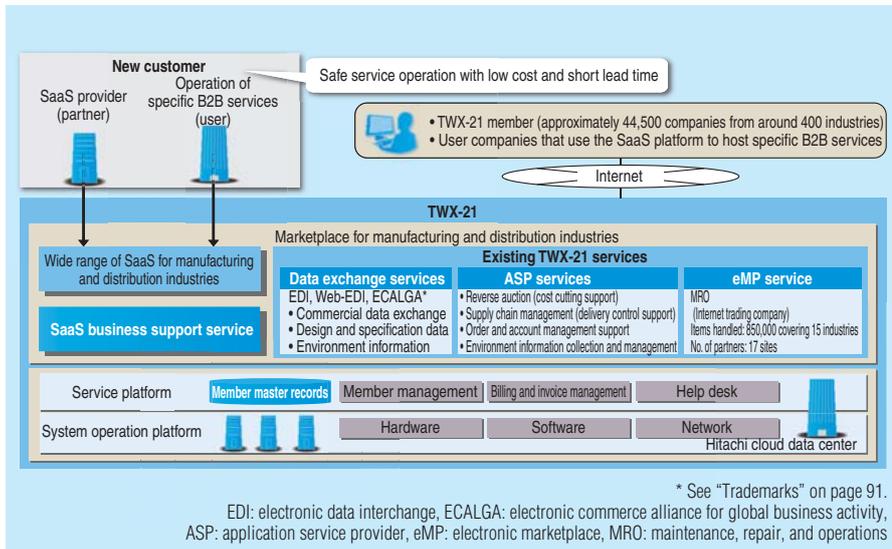
The three key features of the product are that it is available in the form of a software-as-a-service (SaaS) cloud service for a low monthly fee, that the latest map data and traffic information (which incorporates probe data) are provided in the form of differential updates, and that the required business applications can be downloaded for use from the cloud, easily and as required, by using the navigation functions of smart devices as the terminal units.

Future plans include expanding the range of business applications and deploying the system in other parts of the world, starting with China. (Hitachi Solutions, Ltd.)



Telematics cloud service

TWX-21 SaaS Business Support Service



TWX-21 service diagram (SaaS business service as the new service and existing services)

TWX-21* [business to business (B2B) business media service] is Hitachi's brand name for software as a service (SaaS) styled services for business tasks available via a cloud platform. Hitachi supplies these services to approximately 44,500 companies globally, offering secure and high-quality services for implementing various customer business tasks.

In July 2011, TWX-21 launched the SaaS business support

service for enterprise software vendors offering new global services.

This service helps vendors achieve rapid service deployment and supports effective business operations that can respond quickly to increased demand from customers in manufacturing and distribution industries that operate globally.

In particular, the service draws on TWX-21's experience in the SaaS business, which has been built up by responding to customer needs. This includes planning, service development, operation, monitoring, maintenance, version upgrades, promotion, and user support.

The service also allows these vendors to focus on developing services that satisfy customer needs, and service offerings that use the SaaS business support service to provide customers with safety and high quality.

Hitachi also plans to develop TWX-21 into a cloud computing marketplace, making it one of the major services in Hitachi cloud solutions, and will continue to support the global business operations of companies in the manufacturing and distribution industries.

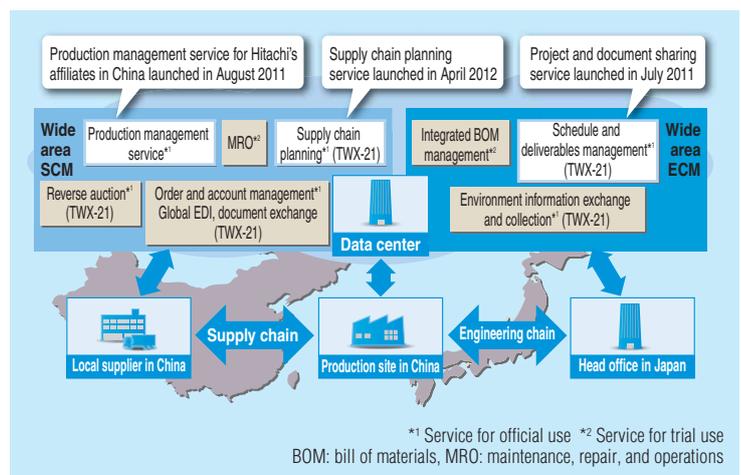
* TWX-21 is a trademark of Hitachi, Ltd.

Offering Global SCM and ECM Support as Cloud Services

In Japan, the focus in enterprise information systems is shifting away from the building of in-house systems and toward the deployment of external services. Demand is increasing for cloud services that can support global business tasks and operations.

Hitachi's response has been to establish its China supply chain management (SCM) Project. While many Japanese manufacturers have expanded their activities in China in recent years, issues involving SCM and engineering chain management (ECM) often remain a challenge. This project conducts evaluation and verification of Hitachi's role in assisting enterprise software vendors to launch software as a service (SaaS) styled services by utilizing the TWX-21 cloud platform and TWX-21 SaaS business support service. It also seeks to improve the usability of services that support global SCM and ECM.

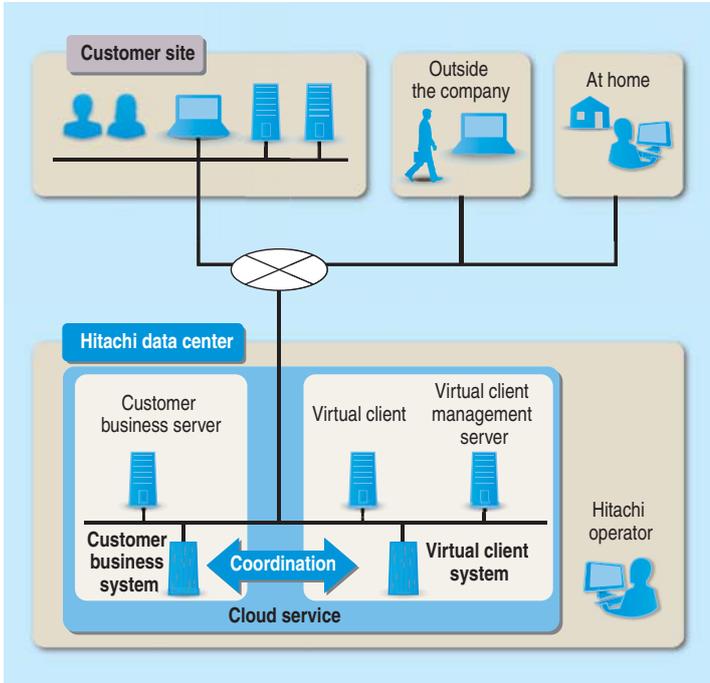
The project's initial offering comprised some TWX-21 services: the web-electronic data interchange (Web-EDI) service, the document exchange service, the quotation evaluation service, and the environment information exchange service and other. Further, the project launched three more services: the project and documents sharing service in July 2011, the production management service for Hitachi's affiliates in China in August 2011, and the supply chain planning service in April 2012.



Services for trial or official use offered by the China SCM Project

Along with evaluating and verifying new services, through this project, Hitachi will continue enhancing its offerings and launching new services for Japanese manufacturers active in China and Southeast Asia.

Platform Service for Virtual Clients



Example virtual client system

Virtual clients are a rapidly growing segment of cloud services. Consolidating clients at a robust data center allows users to access the clients from anywhere while also reducing client administration overheads and strengthening security. Furthermore, securing data at the center means it can be recovered quickly in the event of a disaster, allowing business operations to continue.

In response, Hitachi can offer data centers that are among the most robust in Japan. These data centers can provide reliable, high-quality client services by drawing on know-how in areas like sizing and stable operation obtained through extensive experience in system configuration and the operation of in-house systems with tens of thousands of users. If customers also run their business servers in the cloud, they can coordinate the operation of their business servers and clients to operate their entire business system as a cloud.

In the future, Hitachi intends to further expand its services for client operation and to supply client services in accordance with customer requirements, including the building of a disaster-resistant environment operating over multiple data centers.

Business Continuity Support from Cloud-based Storage Service

The importance of maintaining business continuity following the consequences of the Great East Japan Earthquake is behind growing demand for the provision via the cloud of remote backup sites that ensure availability. In response, Hitachi supplies a storage service that incorporates the following two types of operational management as part of its promotion of a cloud-based approach through Hitachi Cloud Computing Solutions.

(1) Contents managed service

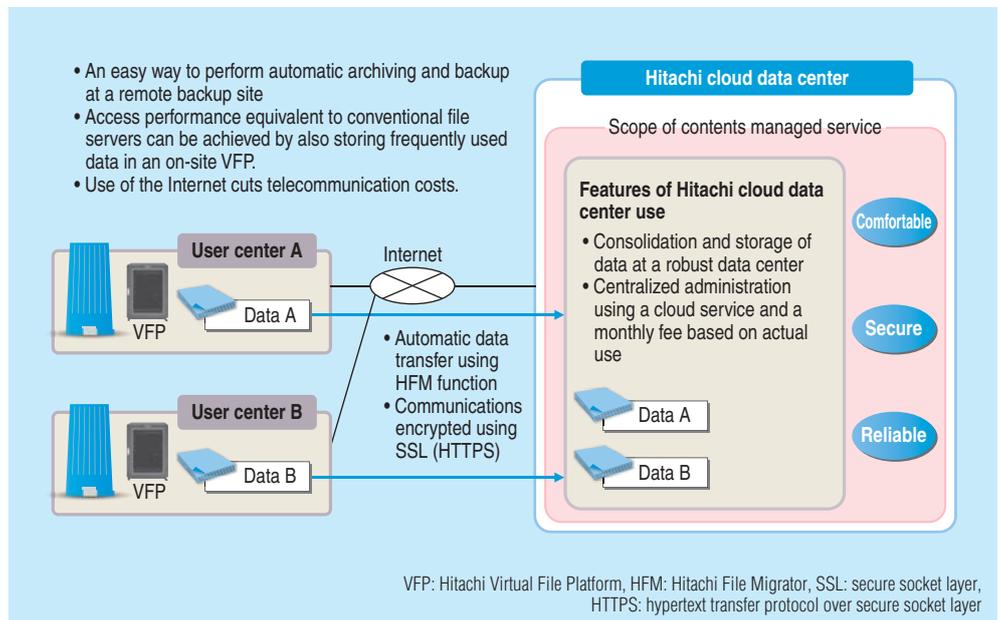
This service for images and other content data provides easy-to-use automatic archiving and backup at a remote Hitachi cloud data center (a data center used to supply Hitachi Cloud Computing Solutions) for content data spread across multiple sites.

(2) Data managed service

A highly reliable block storage service for handling mission-critical system data. It uses a remote copy function for storage that transfers data remotely from user centers to storage at a robust

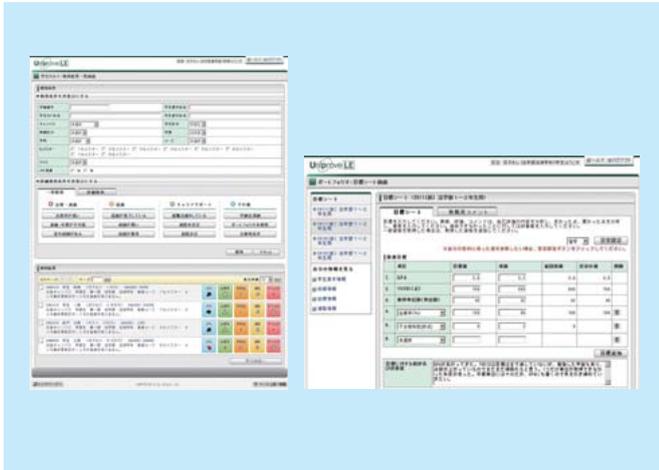
Hitachi cloud data center.

Hitachi intends to continue expanding its storage services to achieve data management with a high degree of added value.



Provision of remote archiving and backup at a Hitachi cloud data center by managed service for content

Study Design Support System for Universities



Screenshot example of student records and portfolio screens from study design support system for universities

In order to make students more employable in ways that will encourage self-sufficiency in social and employment contexts, universities have, in recent times, needed to create an environment in which students can self-manage their goals in areas like study and personal growth.

In response, Hitachi has developed a study design support system for universities by combining a student records function and portfolio function. The student records function supports this objective by centrally managing a wide range of student information including their academic results and desired career paths, while the portfolio function does so by allowing students to set their own goals and handle areas for improvement autonomously. The support system acts as a front end for a variety of different campus systems within Hitachi's information technology (IT) solution for campuses. This package system is designed to optimize information systems, including use of a service-oriented architecture (SOA) for campus systems to support centralized management of data and realtime performance.

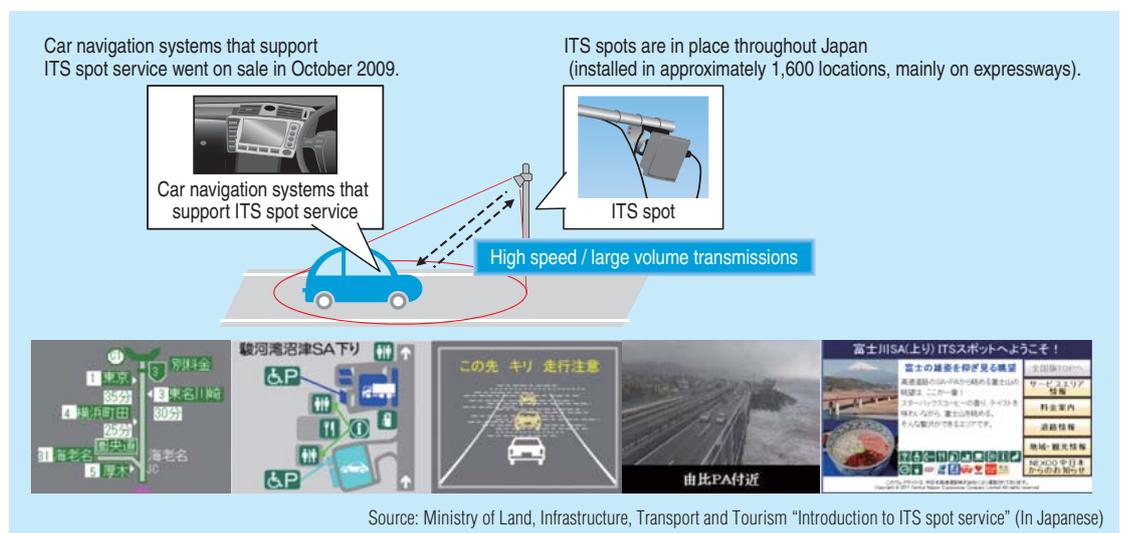
Creating an ITS Spot Service and its Future Development

The spread of systems such as vehicle information and communication system (VICS) and electronic toll collection system (ETC), allow Japan's intelligent transport systems (ITS) to offer convenient services to many drivers. To make traffic information more precise, dedicated short range communication (DSRC) technology has been used since August 2011 to collate driving histories for vehicles. ITS spot services that supply road traffic information through sound and images have also been put into operation throughout Japan, mainly on expressways. Hitachi has built a centralized system to provide road traffic information for major expressways and motorways. Additionally, beginning in April 2012, this system has started providing road traffic information for a new expressway opened at the foot of Mt. Fuji.

ITS spot services provide road traffic information such as dynamic route guidance (traffic congestion, barriers, regulations and travel times on multiple routes up to 1,000 km away, and provision of information on service areas through simple diagrams and voice guidance), support for safe driving (provision of alerts regarding the locations of accidents

and objects that have fallen on the road, and information on earthquakes through simple diagrams and voice guidance, and the use of images to provide information on weather such as snow, fog, and waves), and Internet connections (provision of information regarding tourism and facilities in the region at the rest areas and roadside stations).

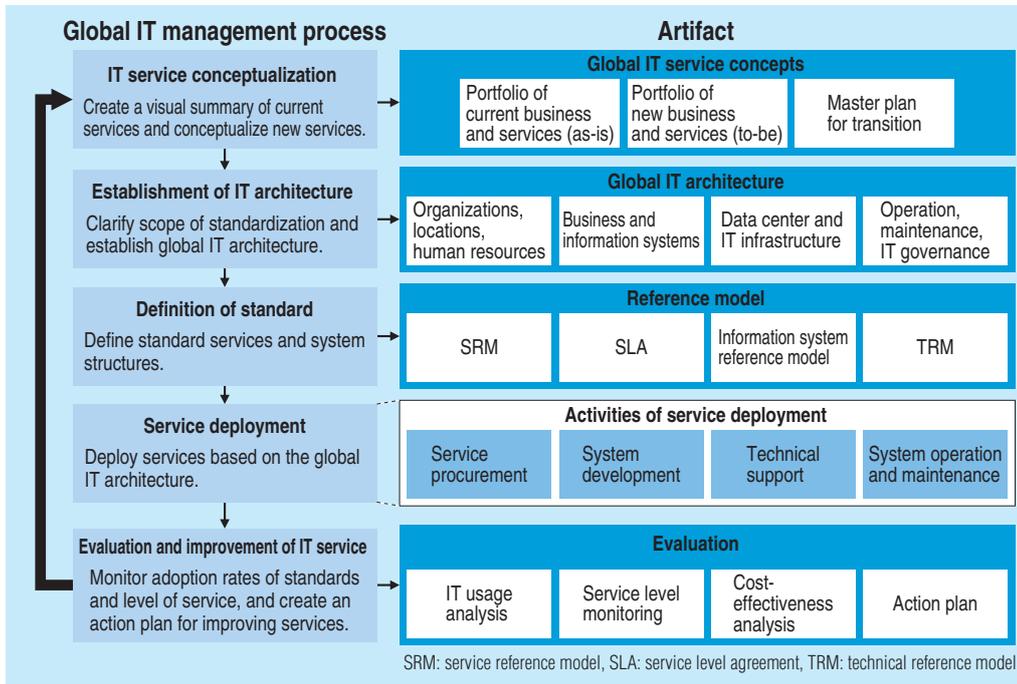
This ITS spot service is currently only available as a service through road operators, but future expansion into private services is planned to bring the provision of logistics and payment information, and a range of service contents to one part of the DSRC wireless data. Hitachi plans to be actively involved in work towards expanding private services.



Source: Ministry of Land, Infrastructure, Transport and Tourism "Introduction to ITS spot service" (In Japanese)

ITS spot service system

Global IT Management Consulting



Global IT management process

(1) Establishment of global IT architecture

Create a visual summary of the portfolio of business and services and clarify the concepts of new IT services so that a global IT architecture for realizing them can be established. The global IT architecture should include IT organizational structures, location of IT services, human resources, global common functions, and region-specific functions.

(2) Standardization of IT services

Select suitable IT services that can be deployed globally and define them in a service reference model. Providing globally-standardized services allows businesses to be started promptly, and lets services adapt in response to changing business environ-

To succeed in global business, it is necessary to start businesses in a timely manner in targeted geographical areas, and to make changes for improvement continuously where needed by analyzing management information collected in realtime.

In addition, specific countries and regions need the deployment of information technology (IT) services tailored to their particular business and IT environments.

There are three important factors for IT management that allow a global business to succeed:

ments.

(3) Optimization of IT investment

Evaluate services through analysis of IT usage, monitoring of service levels, and cost-effectiveness analysis. Create action plans for improving services and optimizing IT investment based on this evaluation.

Global IT management consulting aids the performance of the measures described above, and helps global business to succeed. (Hitachi Consulting Co., Ltd.)

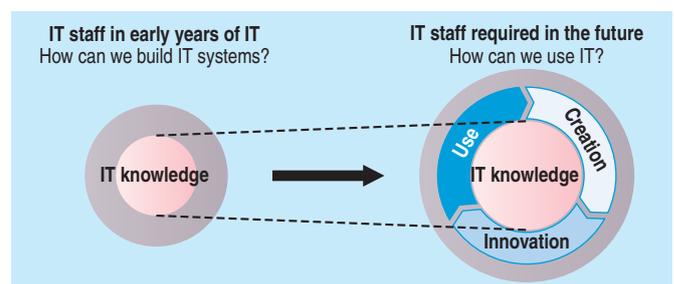
IT Human Resource Development Solution

Advances in information technology (IT) and its wider use are transforming IT from a business support tool into an integral feature of business strategy. Meanwhile, the staff who work in IT are increasingly being asked not only to develop IT systems, but also to take on decision making roles in relation to how IT can be used to increase business value. As a result, a level of competency and awareness that goes beyond IT knowledge and skills is becoming an important requirement for IT staff.

This competency and awareness derives from actions and a sense of purpose that include business innovation, creation of value in collaboration with customers, and an ability to make use of IT in which IT knowledge and skills have a core role. Fostering these requires more than just the acquisition of knowledge and skills. In response, Hitachi intends to supply an IT human resource development solution that contributes to the value creation demanded by business and other parts of society through a curriculum that includes "Drucker Curriculum" licensed by The Drucker Institute, Claremont Graduate University (released in

October 2011) as well as the acquisition of IT knowledge and skills. The "Drucker Curriculum" is for the study of the concepts and theories of P. F. Drucker who has huge influence on business and management minds.

(Hitachi Information Academy Co., Ltd.)



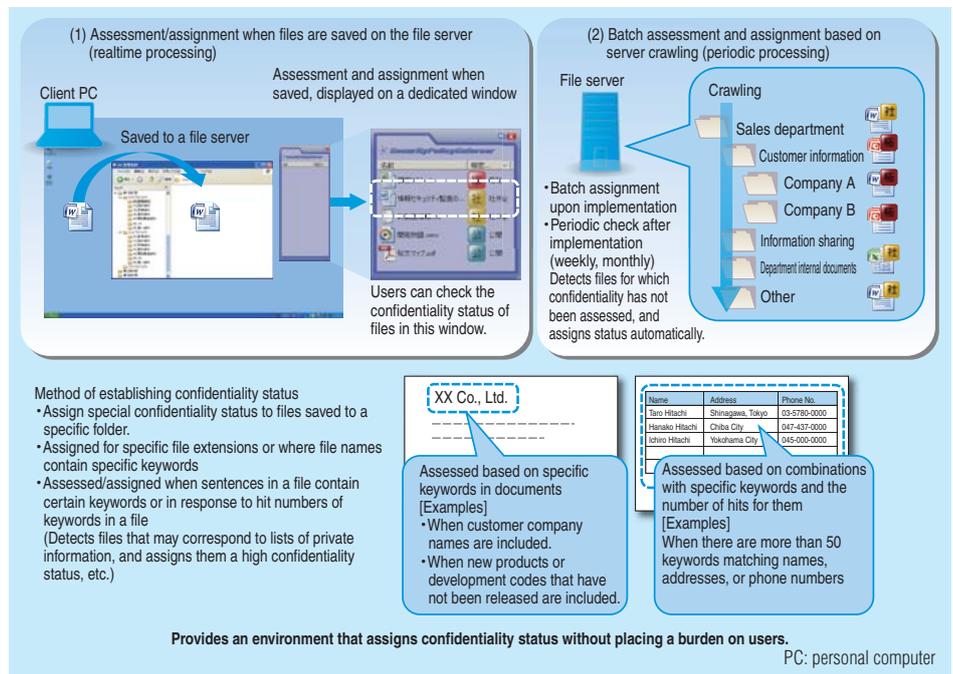
Competency and awareness demanded of future IT staff

The Use of "Hibun" Information Disclosure Prevention Solutions as Countermeasures against Targeted Cyber Attacks

Recently there have been incidents of targeted cyber attacks, or illegal intrusions into government and corporate information systems to steal information. Currently, effective measures against these targeted cyber thefts utilize access policies to prevent intrusion, and check-out policies to prevent the obtaining of information by fraud. One method that is gaining particular attention as a check-out policy is data loss prevention (DLP).

The "Hibun*" information disclosure prevention solutions offer a DLP function that provides total support, from management to access control of confidential information. These solutions automatically assess the files on the server and assign confidentiality status for them (strictly confidential, for internal only, for public release, etc.), displaying the status to users and offering information on the ownership status. Additionally, they place restrictions on checking-out of the files to the external media, sending them by mail, and accessing via the web, in accordance with security status.

Sending information with a high level of confidentiality outside the company can be completely blocked by the systems' gateways. This provides an effective means of preventing information



Automatic assessment and assignment of confidentiality status

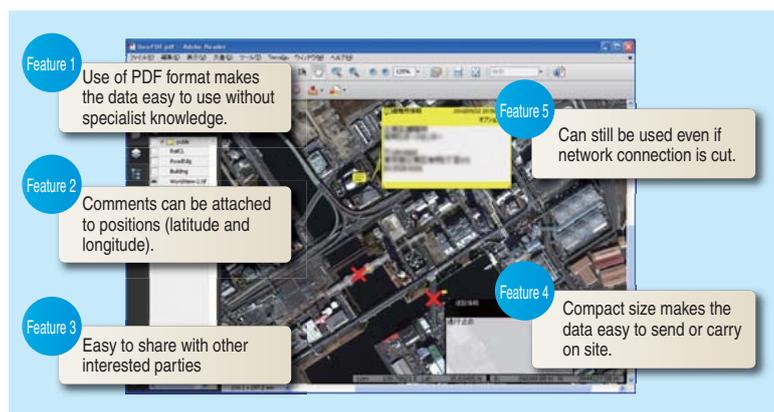
leakage through cyber attacks. (Hitachi Solutions, Ltd.)

* Hibun is a trademark of Hitachi Solutions, Ltd.

GeoPDF Solution

While use of position information is growing in a wide range of different fields, including disaster contingencies, risk management, distribution management, and marketing, it often requires the use of special-purpose systems that are difficult to operate.

To solve this problem, Hitachi released the GeoPDF* solution



Features of GeoPDF

in July 2010 to give access to position information when and where it is needed, and in an easy-to-use way. The solution uses GeoPDF, an extended format that allows the use of position information in PDF format. It allows the distribution of position information, collection of information in the field, and the sharing of collected information to be done using the commonly used PDF format. The solution has already been adopted by more than 900 organizations in the USA, as well as by government agencies and others in Japan. For the Great East Japan Earthquake, GeoPDF data that overlays satellite images taken after the disaster on top of residential map data collected before the disaster has been supplied to the Japanese government, as well as to the local governments in the affected areas for uses such as the issuing of disaster victim certificates.

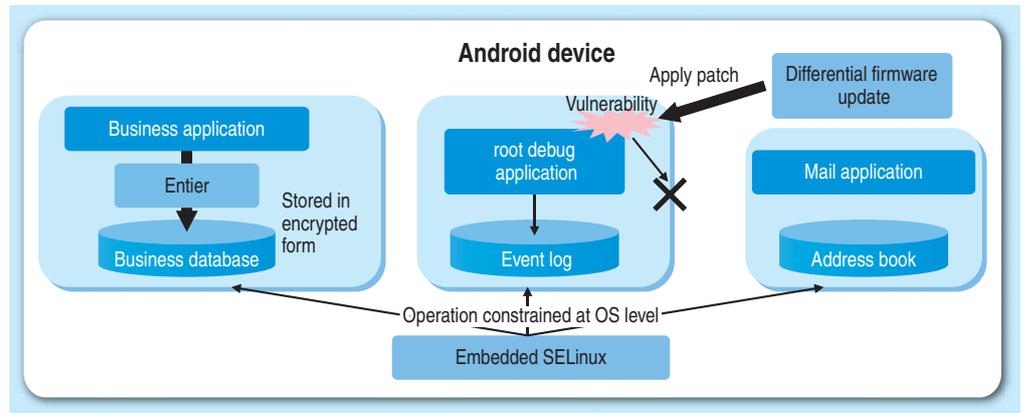
While the product is mainly sold as a package at the current time, Hitachi is also working on supplying it as a service in the future to satisfy customer requirements. (Hitachi Solutions, Ltd.)

* See "Trademarks" on page 91.

Security Enhancement Technology for Android

The key security issues with the Android*¹ operating system (OS) for portable devices include the potential for information to be leaked if the device is lost or stolen, or for a virus infection or other unauthorized modification to be made by exploitation of some vulnerability in the device.

To prevent theft of data if a lost or stolen device is acquired by a third party, Hitachi has developed technology that uses the Entier*² database management system for embedded systems to store important information in an encrypted database. The new technology consists of a differential firmware update technique for fixing security vulnerabilities and an embedded version of Security-Enhanced Linux*¹ (SELinux) that minimizes potential damage in the event of a vulnerability being exploited. The differential firmware update reduces the load on the server by comparing the old and new versions of the firmware to identify differences and apply patches. As Android includes unrestricted root privileges, there is the potential for unlimited damage to be done if this vulnerability



Countermeasures against loss, theft, and security vulnerabilities provided by security enhancement technology for Android

can be exploited. On embedded SELinux, in contrast, exploiting this vulnerability has been made much more difficult because the operation of root applications is restricted at the OS level.

In the future, Hitachi plans to combine these technologies to supply solutions that support the development of secure devices. (Hitachi Solutions, Ltd.)

*¹ See "Trademarks" on page 91.

*² Entier is a trademark of Hitachi, Ltd.

Hitachi WAN Accelerator

The Hitachi WAN accelerator is a high-speed device that allows the bandwidth of a wide area network (WAN) connection to be used to its maximum capacity. It utilizes a unique Hitachi algorithm that minimizes the effect of round-trip delay time and packet loss occurring over WAN connections, significantly reducing the time required to transmit large amounts of data.

This accelerates access to the latest data and allows Big Data to be updated and shared quickly in financial industries such as

banks as well as manufacturing industries such as the vehicle, iron and steel, and semiconductor businesses, contributing to rapid improvements in production efficiency.

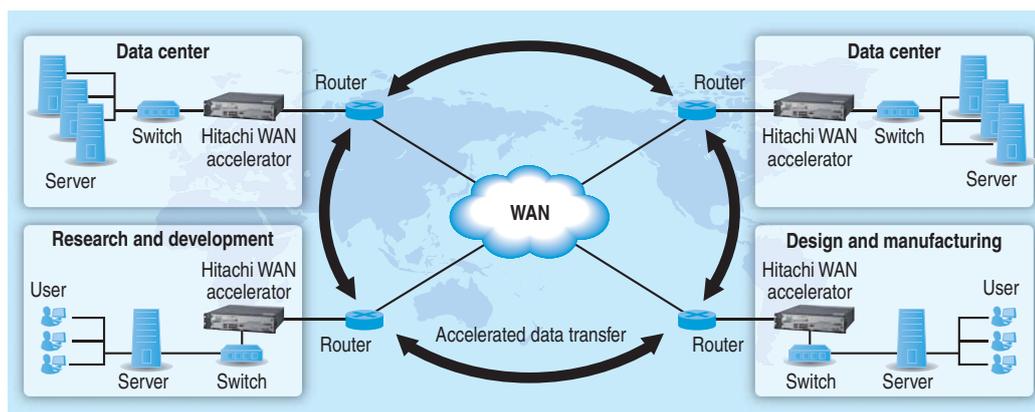
[Key features]

(1) Accelerates transmission control protocol (TCP) transmission, using a method other than caching. This reduces performance loss in long-distance transmissions when round-trip delay times are long, resulting in efficient data transmission.

(2) Measures available bandwidth over a WAN connection and controls data transmission volumes. Accelerates transmission without significant loss of speed when packet loss occurs.

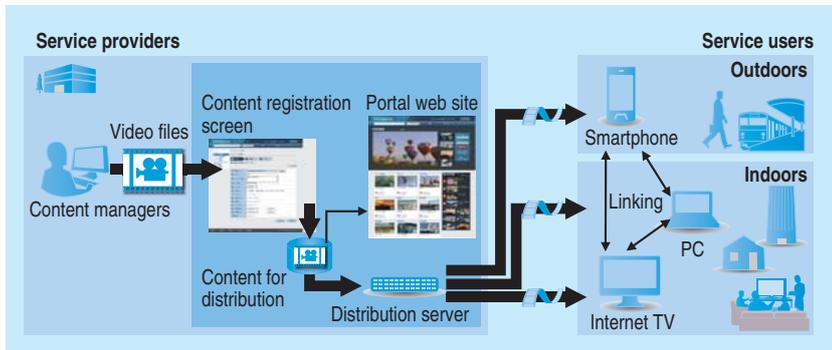
(3) Can be installed without additional changes to existing system environments.

Hitachi will continue to expand its lineup of products that respond to line bandwidth while improving peak session performance.



Sample system configuration suitable for internal company networks

Multi-screen Video Delivery Solution "Hitachi VOD Server Series"



Overview of the multi-screen video delivery solution

As smartphones and Internet-enabled televisions become more common, Internet-based video delivery services are now a normal part of our everyday lives at work as well as at home.

Hitachi's multi-screen video delivery solution, Hitachi video-on-demand (VOD) Server Series, makes it easy to implement a video delivery service tailored to the needs of specific service-providers.

(1) Provide supreme quality video for multi-screen display.

Deliver video-on-demand (VOD) over network to smartphones,

Internet-enabled televisions (TVs), personal computers (PCs), and other devices. Hitachi VOD Server Series supports high-definition video for Internet-enabled TVs and PCs, and employs delivery control technology that enables smooth transition between scenes when using fast-forward or replay features. Moreover, the system provides a quick response and beautiful picture even on smartphones.

(2) Share bookmarks with and continue watching videos on various terminals.

Portal pages and bookmarks can be accessed from smartphones, Internet-enabled TVs, PCs, and other terminals. Users can also start watching a video on one device—a TV for example—and continue watching it on a PC or other device. This seamless integration creates new freedom for users to integrate video watching into their lifestyles.

(3) Quickly, easily implement multi-screen video delivery.

Portal page creation and video delivery is achieved quickly and easily via a web browser. Additionally, video format and delivery bandwidth is adjusted automatically to suit the viewing device.

There are several service packages available to suit a range of user applications, contributing to timely, low-cost implementation.

LTE Core Network System Enhancement

At a time when data volumes are growing as smartphones gain popularity, Long Term Evolution (LTE) is seen as the most potent solution for mobile infrastructure where processing power is limited. Since LTE core networks are expected to play a key role in data processing in LTE systems, Hitachi has enhanced various functions for starting LTE business services, including linking with existing Code Division Multiple Access (CDMA) -1x/1x Evolution Data Only (EV-DO) networks.

The main features of LTE are as follows:

(1) Home Agent (HA) function

Hitachi has created software that packages the HA functions used in Packet Data Network Gateway (P-GW) hardware for providing LTE functionality, and began commercial use of this software in the current 1x/1x EV-DO services prior to starting its LTE business services. At the same time, a configuration has been implemented that provides P-GW and HA functionality on the same hardware when starting LTE commercial services.

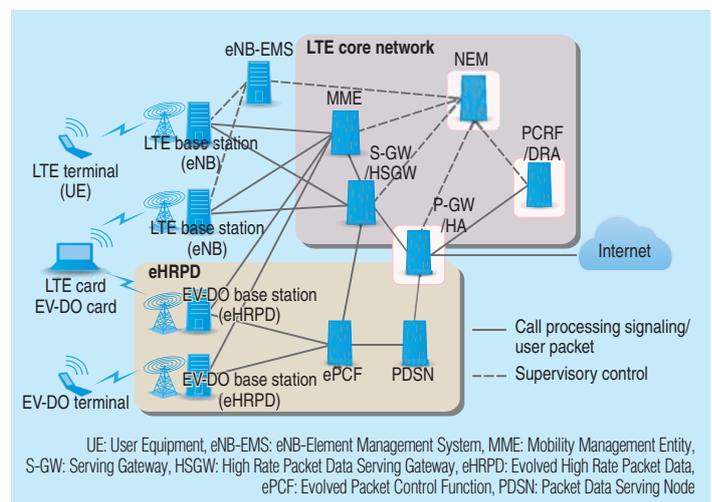
(2) Diameter Routing Agent (DRA) function

A DRA function is developed for distributing the load placed on Policy and Charging Rules Function (PCRF) device that controls Quality of Service (QoS) policies for each member, and which is equipped with a routing function that directs signals from other equipment to the appropriate PCRF device. The introduction of DRA allows a single Access Point Name (APN) to be stored on multiple PCRF devices, enhancing scalability.

(3) Evolved Node B (eNB) supervisory control function

A multi-vendor interface is implemented for supervision of some of the LTE base stations in Network Enhanced Management System (NEM) that controls LTE core systems, to achieve integrated supervision of LTE systems.

Hitachi will continue to develop hardware that offers more data processing capacity, as well as Voice over LTE (VoLTE) functions for voice services as well as mobile data.



LTE core network system enhancement

Packet Optical Transport Systems

The increase in the volume of mobile data traffic that has accompanied the spread of smartphones, along with the growth in data traffic to data centers caused by expanding use of the cloud, has brought about a steadily increase in the need to transmit large

volumes of data.

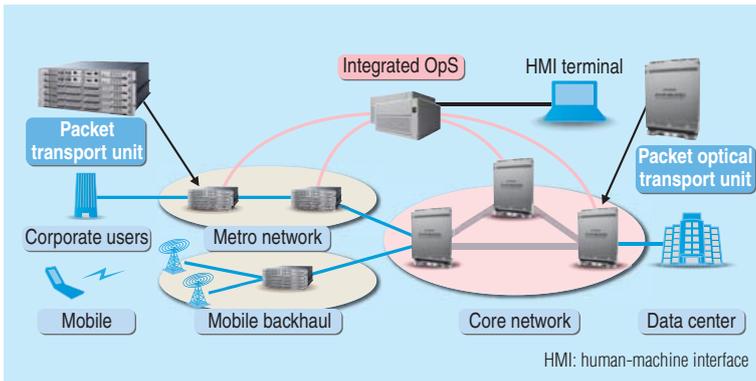
To meet this requirement, Hitachi is currently developing a packet optical transport system comprising of a packet transport unit and a packet optical transport unit, which are equipped with multi-protocol label switching-transport profile (MPLS-TP) technology, and the integrated operation system (OpS).

The primary features of these systems are as follows:

- (1) Transmission quality control using MPLS paths and large volume data transmission at 100 Gbit/s using optical paths.
- (2) Improved reliability and quality of packet networks through operation, administration, and maintenance (OAM) functions.
- (3) Reduced network operation costs achieved through integrated OpS that can control metro/core networks in a consolidated manner.

Hitachi will expand these functions and develop them globally.

(Planned release: July 2012)



Packet optical transport system

Next-generation Optical Access Network System 10G-EPON

The 10-Gbit Ethernet passive optical network (10G-EPON) system operates at 10/1 Gbit/s downstream and 10/1 Gbit/s upstream with upstream using technology for time division multiplexing (TDM), and downstream using technology for wavelength division multiplexing (WDM). Broadband television (TV) and cloud computing will become popular over the next few years, which is why Hitachi should utilize 10G-EPON technology with optical access lines to build a broadband network.

Hitachi is currently in the process of developing the 10G-EPON optical line terminal (OLT) and optical network unit (ONU). This 10G-EPON system has the following three characteristics:

(1) High split ratio (1:128)

OLT utilizes both high launch power and a high sensitivity receiver to offer a high split ratio (1:128) to produce a system that combines devices with low power consumption. Hitachi's OLT also incorporates existing 1G ONU to provide an integrated 1G/10G system.

(2) Implement MPLS-TP functions.

OLT utilizes MPLS-TP functions to provide flexible control (path management, committed bandwidth guarantee, protection) for each service.

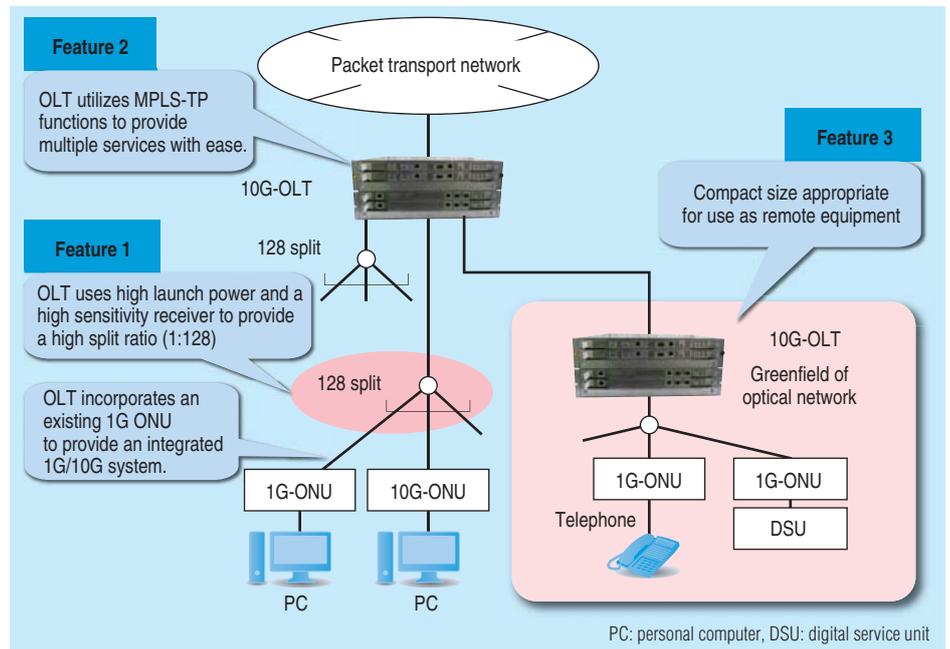
(3) Compact size appropriate for use as remote equipment

OLT is 19-inch rack wide and 4U*

high, allowing it to be installed as remote equipment and utilized for renewing legacy equipment in greenfield of optical network.

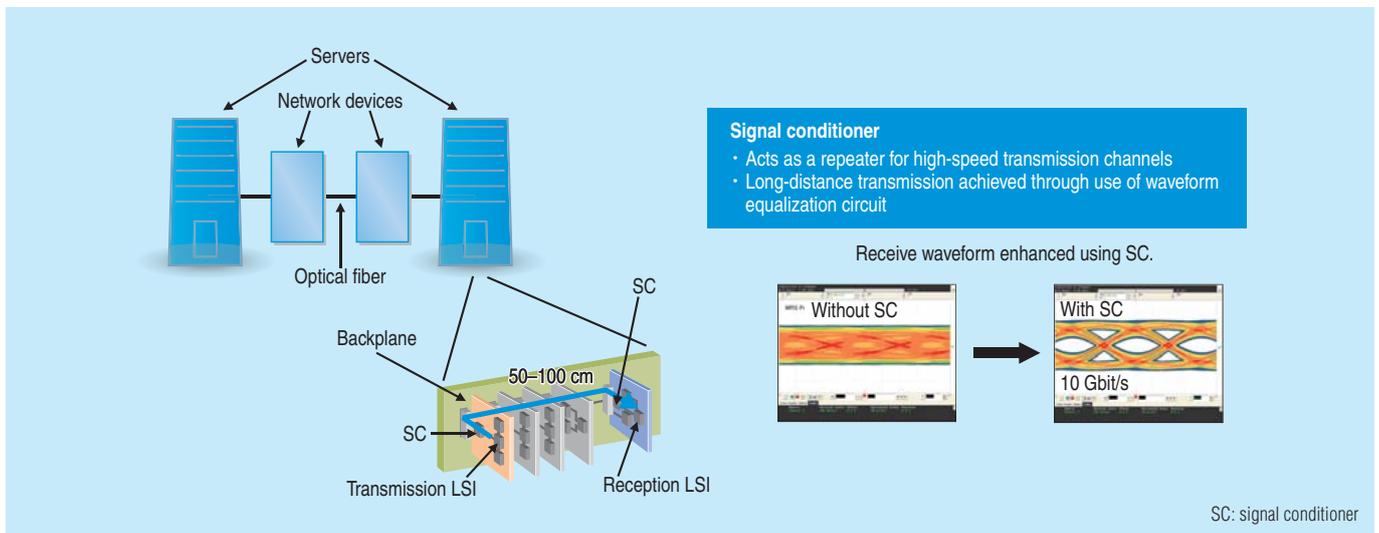
(Scheduled to be commercialized in 2012)

* 1U = 1.75 inch = 44.45 mm



10G-EPON network

Tera Bit-per-second Wideband Hardware Technology for Information and Telecommunication Systems



Signal transmission technology for information and telecommunication systems

Demand for data throughput in information and telecommunication systems such as high-end servers and network routers is growing at such a rate that it roughly doubles every two years. Satisfying this demand requires improvements in transmission speed both inside and outside information and telecommunication systems.

Remarkable improvements have been made to the transmission speed of backplanes and cables used in information and communication systems, with signal lane transmission speeds roughly doubling every three years. Recent information and telecommunication systems have required transmission speeds per lane of 8 to 10 Gbit/s or faster to achieve data throughputs of 1 Tbit/s or more. Faster speeds make signal transmission more difficult due to degradation of signal quality caused by higher transmission loss and greater interference between symbols.

To solve these problems, Hitachi has developed a signal conditioner that significantly improves signal quality in 10 Gbit/s. It is implemented as a large-scale integrated circuit (LSI) using complementary metal oxide semiconductor (CMOS) technology with 40-nm nodes. The signal conditioner LSI has the following features:

- (1) Flexible and stable high-speed signal transmission that does not depend on the combination of transmission and reception LSIs.
- (2) Lower system cost made possible by the ability to achieve high-speed signal transmission using cheap backplane materials.
- (3) Smaller circuit board size achieved by integrating four duplex

lanes or eight simplex lanes on each LSI.

- (4) Lower circuit board component count achieved by use of an integrated power supply regulator.

Hitachi also intends to develop enhanced signal conditioner LSIs with clock data recovery (CDR) mode to improve signal quality. The new LSIs will support a range of standards (including PCI Express* 3.0, Fibre Channel, and Ethernet) and faster transmission speeds.

Optical fiber is currently used for communications between information and telecommunication systems, and 100G Ethernet has also been adopted recently. The transmission rate of 100 Gbit/s is achieved by multiplexing four 25-Gbit/s optical signals, each using a different wavelength of light. However, this requires analog integrated circuits (ICs) to convert the 25-Gbit/s optical signals back into an electrical signal. Hitachi has developed a transimpedance amplifier IC that supports 25-Gbit/s transmission using 0.18- μm node silicon germanium (SiGe) bipolar transistor technology with a cut-off frequency of 210 GHz. This transistor technology achieves a low noise figure (NF) and ultra-high speed by using an SiGe epitaxial growth technique when forming the thin base layer of the bipolar transistor to reduce $1/f$ noise and base resistance (r_{bb}). To increase speeds further, Hitachi is also developing technology for SiGe bipolar transistors with a cut-off frequency of 300 GHz.

* See "Trademarks" on page 91.