



Information & Telecommunication Systems

 IT Solutions and Services

 IT Platform

 Network Systems

 System LSIs

Storage Solution for Cloud Era Featuring Advanced Virtualization Technology

Storage systems have a close relationship with business strategy and, with both the volume of data stored by companies and the cost of its administration continuing to grow rapidly, there is a demand for solutions that can help provide more flexible operation and lower costs. Hitachi has developed cloud-oriented platforms with high added value featuring advanced virtualization technologies for both block storage and file storage. Hitachi is providing strong support for reducing companies' TCO by pursuing solutions that incorporate administration and other functions.



Yoshihiro Asaka (left), Senior Vice President, Hitachi Data Systems Corporation (General Manager, Storage Systems Development, Disk Array Systems Division, Information & Telecommunication Systems Company, Hitachi, Ltd. at the time of this interview); Michael Hay (right), Chief Engineer, Products Planning Department, Disk Array Systems Division, Information & Telecommunication Systems Company, Hitachi, Ltd. and Vice President, Hitachi Data Systems Corporation

Implementing Storage Tier Virtualization

A high level of expectation is being placed on storage virtualization as a way of taking us into the era of true cloud computing with benefits that include making effective use of resources and reducing operational workloads. Block storage typically uses an FC (fibre channel) interface and Hitachi has already developed and supplied advanced solutions in the form of storage device virtualization (the virtual integration of different types of storage) in 2004 and volume capacity virtualization (the ability to define volumes freely regardless of physical capacity) in 2007. Subsequently, Hitachi has made further efforts to reduce user TCO (total cost of ownership) through simplified and automated management and, in 2010, added storage tier virtualization which dynamically transfers data between different types of storage media with different costs, such as SSD (solid state drive) and SATA (serial advanced technology attachment), based on the frequency of data use.

Operational Flexibility Provided by 3D Scaling

The latest enterprise storage product incorporating all three of these virtualization technologies is Hitachi Virtual Storage Platform (VSP). VSP features a 2.3-fold improvement in system performance compared to the previous model together with "3D (three-dimensional) scalability" ("scale-up," "scale-out," and "scale-deep") which provides for flexible expansion of performance and capacity by making the various components such as ports and processors more independent to enhance expandability and by adopting a new architecture that allows interoperation between controllers. The VSP also makes a major contribution to space saving and energy efficiency at data centers with features such as high-density mounting using 2.5-inch drives and improved cooling efficiency through the use of a front-inflow/rear-outflow design.

New Horizon in File Storage

Hitachi has also developed a new product called Hitachi Data Ingestor (known as Virtual File Platform in Japan) for file storage applications which takes maximum advantage of these virtualization technologies and know-how. This cloud-oriented solution uses Hitachi Data Ingestors installed at company branch offices and departments as "cloud on-ramps" and frees site administrators from cumbersome tasks such as backing up and archiving by automatically collecting and managing the large and ever-increasing volumes of data in data-center-based object stores Hitachi Content Platform. This provides sites with transparent access to data in the data center through a file virtualization function and means that users do not need to worry about where files are stored. The file system capacity can be expanded up to an industry-leading 1 Pbyte and the integration of file systems reduces the work associated with system design and administration. Because of the large predefined virtual capacity of the file system, the file system's capacity virtualization function allows for effective use of storage capacity as physical capacity can be added as it becomes needed.

In this way, Hitachi intends to continue providing businesses with strong support for the era of cloud computing through virtualization, not only of the storage system, but also of the overall data center including administration, and by working on solutions for producing valuable information from huge volumes of data.

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

The markets for content distribution and hosting services are expanding rapidly together with increased Internet use, while demand for large-scale data analysis also continues to grow. In response, Hitachi has released the Hitachi Compute Blade 10: the blade server which is designed for cost-performance and to have the highest levels of density and energy efficiency. The entry-level model supports SSD, iSCSI, and flexible scale out, and is suitable for distributed parallel processing and data center with a number of servers.



Azusa Fujita (left), Project Manager, Business Marketing Department; Mutsuki Tsukayama (right), Project Manager, Development Department I, Client Operation, Enterprise Server Division, Information & Telecommunication Systems Company, Hitachi, Ltd.

Compact and Energy-efficient Design Ideal for Data Centers

Use of network information services accessible from a range of different end-user devices is growing. Therefore, the servers that play a key role in the telecommunications infrastructure require new forms of value including the flexibility to respond to changes in the scale of the information service, superior cost-performance, the ability to install more servers in limited space, and consideration for the environment. The Hitachi Compute Blade 10 was developed as an entry-level model to satisfy these needs. During development, we consulted with customers from a wide range of industries and did our best to incorporate their requests. Two areas given particular emphasis were the need for high density and energy efficiency in data centers. We took advantage of our high-density technology to produce 5 U-high base unit able to install up to 40 blades (1 U = 44.45 mm). Because the lightweight design (approximately 1 kg per blade) also features a high level of cooling performance, a 42-U rack is able to install a maximum of 320 blades.

Regarding energy efficiency, the servers draw on technologies from notebook PCs (personal computers) to achieve power consumption of only 35 W per blade under normal operating conditions. In addition to 80 PLUS*¹ Gold*² certification for the base unit's power supply module, the energy efficiency of the overall system is also improved through fine-grained control of parameters such as cooling fan speeds and how many power supply modules to use based on blade usage.

Design for Superior Cost-performance

The servers use Intel*¹ Core*¹ i-Series processors to deliver superior

cost-performance, an important criterion for an entry-level model. In addition to support for the Red Hat*¹ Enterprise Linux*¹ OS (operating system), the ability to run CentOS, Fedora*¹ and other non-commercial versions of Linux has also been verified. Meanwhile, features like support for OSS (open source software) tools help reduce installation and running costs.

The Windows*¹ OS is also supported. So too is Secure Client Solution, a thin client solution from Hitachi that provides an efficient thin client environment with high density.

Parallel Distributed Processing for Large-scale Data Analysis and Similar Applications

The Hitachi Compute Blade 10 is well regarded as a front-end web server. One reason for this is the ease with which systems can be scaled out by adding server blades, a consequence of it being developed with parallel distributed processing in mind (in which a single system is configured from a number of servers housed together physically).

To allow the servers to be used in applications such as high-speed content distribution, the product range includes models with SSD (solid state drive) internal storage for high-speed access as well as HDD (hard disk drive) models. Meanwhile, not only does iSCSI (Internet small computer system interface) support allow use of network storage for better protection of data, the product range also includes easy-to-use models that are solely for iSCSI boot systems.

Because parallel distributed processing is also suitable for tasks such as analysis of large amounts of data, Hitachi offers Hadoop consulting as well as a Hadoop configuration service for the Hitachi Compute Blade 10. Hadoop is a platform that has become known for its use in the batch processing of large amounts of data up to the Pbyte range.

Naturally, the design of the Hitachi Compute Blade 10 emphasizes its reliability as a server. Heavily used components such as the power supply and fan have a redundant configuration and hot plugging allows modules to be replaced in the event of a fault without interrupting operation. Similarly, users can install the servers with confidence as operation is supported by system management software which provides centralized administration of faults and other operating status information. To help customers configure optimum server environments, we intend to continue improving the Hitachi Compute Blade 10 to contribute toward achieving even more advanced utilization of data centers.

*¹ See "Trademarks" on page 83.

*² Certification awarded to products that demonstrate a power supply efficiency of 80% or better based on the 80 PLUS Program of the Electric Power Research Institute, Inc. (EPRI) in the USA.

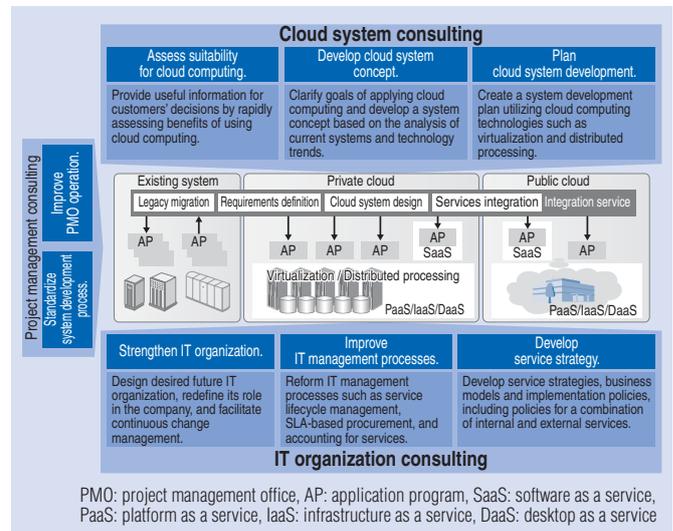
Consulting Services that Realize Benefits of Cloud Computing

Making greater use of cloud computing allows companies to procure IT (information technology) infrastructure as an external service in a way that allows system capabilities to be changed rapidly and elastically. Other companies meanwhile are seeking to optimize their IT costs by applying virtualization or distributed processing technologies to their existing systems.

There is a growing need to handle changes in the business environment with flexibility and to implement business strategies rapidly. This requires an organic combination of internal and external services that can introduce new services quickly. It also involves the IT organization changing its role to that of a service provider. For instance, it will be expected to develop global service strategy for the corporate group, establish SLA (service level agreement)-based procurement schemes, and regularly evaluate services.

Hitachi helps customers make decisions about these drastic changes as follows.

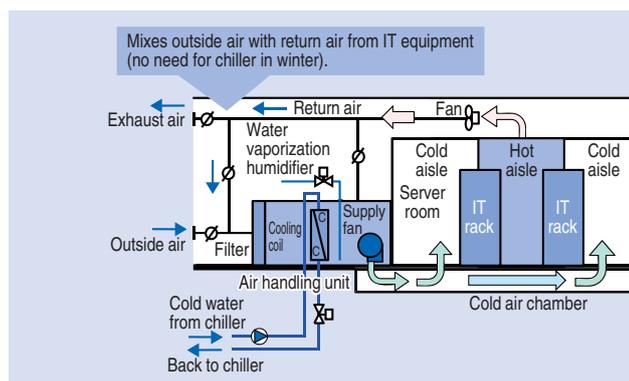
- (1) Rapid assessment of benefits of cloud computing
- (2) Development of service strategies, business models and implementation policies
- (3) Strengthening of IT organization and improvement of IT management processes
- (4) Development of a cloud system concept based on the analysis of current systems and technology trends



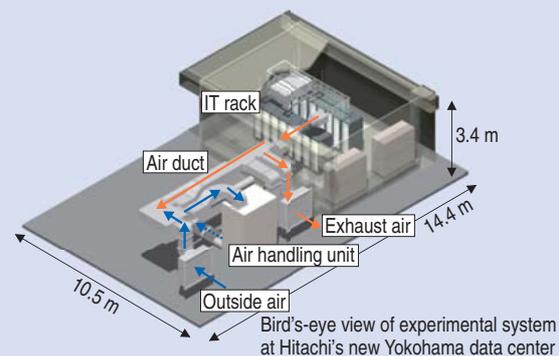
Establishment of continuous change management by combining a cloud system with IT organization consulting

Hitachi offers total services that assist continuous change management for IT organizations as well as for cloud systems. (Hitachi Consulting Co., Ltd.)

Air-side Free Cooling Technologies for Data Centers



Air-side free cooling system for data centers



The need has grown in recent times for the IT (information technology) industry to obtain a competitive advantage in IT services and establish long-term partnerships with customers, particularly in the field of cloud computing which involves the management of large IT clusters in data centers. However, the effective management of large volumes of data also consumes a large amount of energy both for the IT equipment itself and for cooling and other utilities. This has created a growing need to lower the power consumption associated with data center air conditioning. Air-side free cooling systems represent one way of minimizing air conditioning energy consumption. This energy-efficient cooling technology uses the outside air when the outdoor enthalpy (total

thermodynamic energy) is less than that of the return air from the IT systems. In winter, for example, the air needed to cool IT equipment can be produced by mixing outside air with return air and then humidifying the resulting mixture. This reduces running costs because chillers do not need to operate.

Hitachi has been testing this technology at its new data center in Yokohama since October 2010. The system monitors the temperature and humidity of the outside air supply and return air and selects the air conditioning operation mode automatically. Sensors are also used to evaluate the potential for corrosion of LSI (large scale integration) boards in the IT hardware due to cooling by outside air.

Applications of Finger Vein Authentication Technology

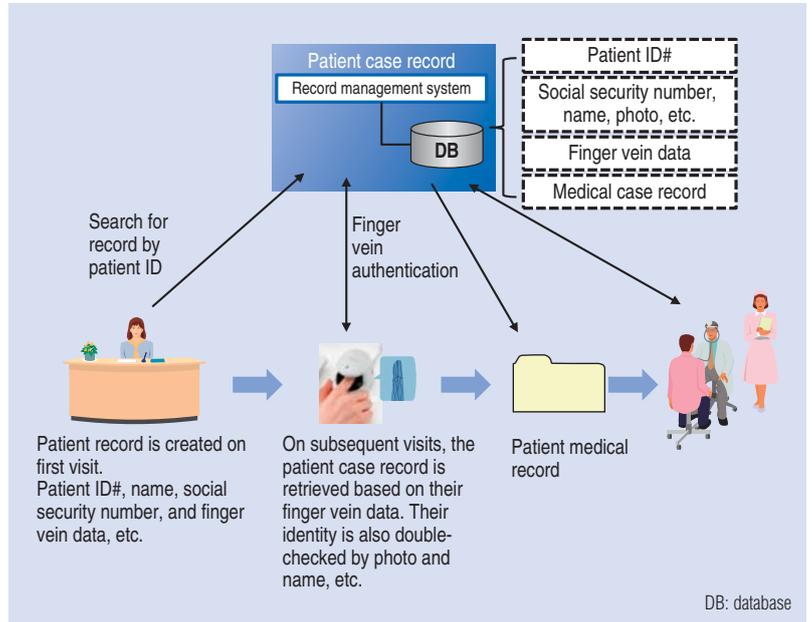
Hitachi's finger vein authentication technology is used on most ATMs (automated teller machines) in Japan to provide more reliable personal authentication. In recent years, the technology has also been adopted for a range of other applications globally based on its successful use in the banking industry. In the USA, the finger vein technology is used for patient authentication at medical institutions. This helps prevent fraudulent medical billing and patient mix-ups.

In Australia, the finger vein technology is used in an employee time and attendance management system. In addition to being simple and accurate for employees to use, the system prevents employees from using another person's ID (identification).

Other areas in which the finger vein technology is used include:

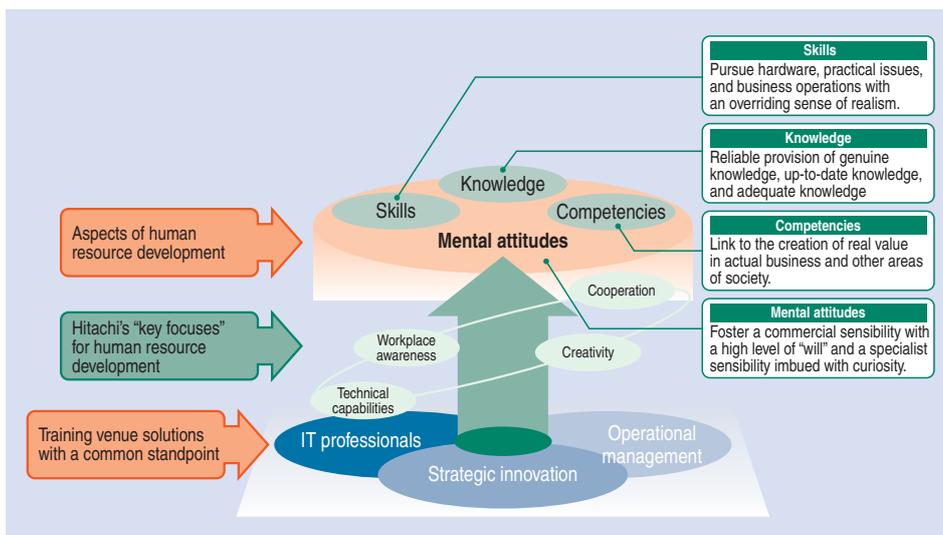
- (1) User authentication in e-learning applications, especially systems such as those that issue licenses or qualifications which require reliable authentication
- (2) Computer access control including login to personal computers that store confidential information
- (3) Physical access control for entry to restricted areas

Hitachi intends to work with Japanese and global partners to help make society safer and more secure by using finger vein authentication technology achieving convenience and stronger security in various sectors.



Finger vein authentication deployed at medical institutions

Crescendo Learning Concept for Developing IT-capable Human Resources that Contribute to the Society's Future



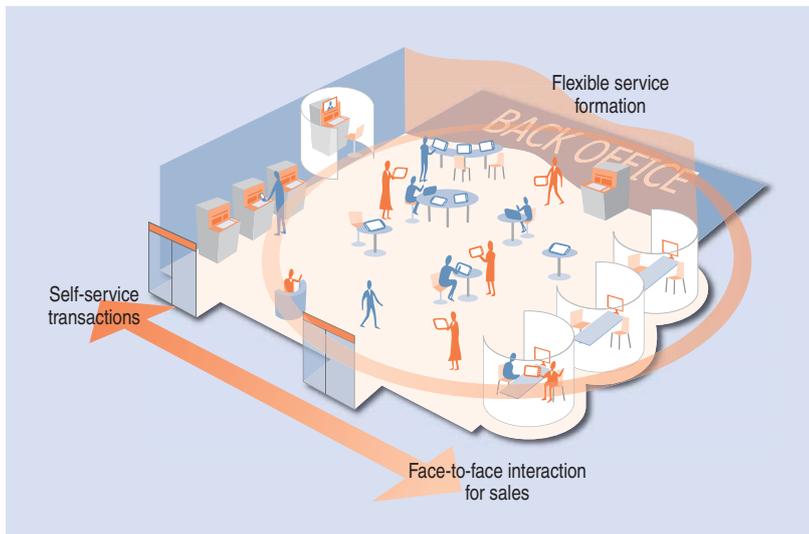
Crescendo learning concept

Society is becoming more complex and is going through rapid changes including greater globalization, reduced impact on the environment, and more diverse lifestyles. Amid all of this, companies need to sustain unrelenting growth and continue to deliver value to their customers and other parts of society. In particular,

"creativity," and "cooperation," Hitachi intends to help its customers create optimum IT human resource capabilities by supplying the IT human resource development solutions that are essential for a modern corporation.

(Hitachi Information Academy Co., Ltd.)

Next-generation Channel Solution for Financial Institutions



Next-generation branch concept

In order to transform bank branches into genuine sales offices, Hitachi has been working on creating an environment that allows staff to focus on selling through measures such as reducing the burden on staff by using image processing to make administration more efficient.

Meanwhile, staff continue to face a growing administrative workload due to the greater diversity of financial products they are handling and other tasks such as compliance work imposed by regulations.

To meet these challenges, Hitachi is working on enhancing its integrated channel solution based on the concept of encouraging self-service for transactions and face-to-face contact for sales. The branch system reduces the counter and back office workload by handling self-service and face-to-face interaction separately depending on the task being performed and the type of customer being dealt with. ATMs (automated teller machines) are the most frequent point of contact between a bank and its customers and, in addition to their current role as cash dispensers, they are also being given features that help create opportunities for financial instrument sales. With the aim of increasing users, the screen designs used in Internet banking

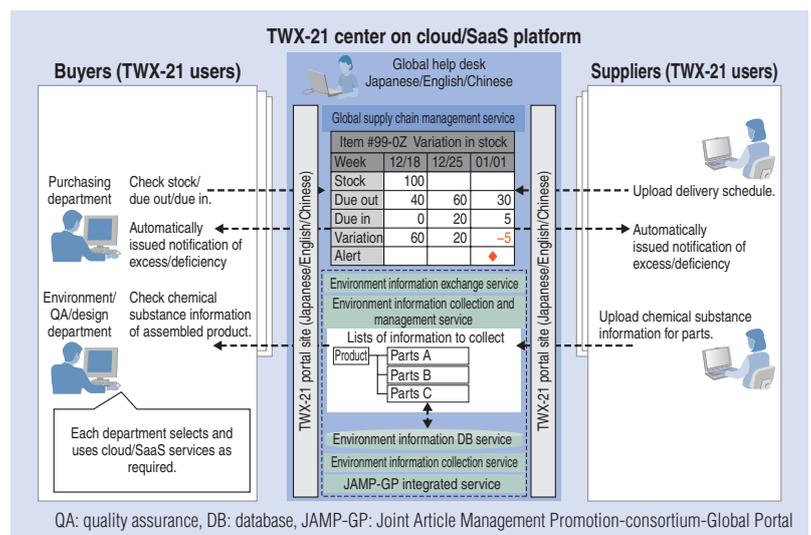
are being renewed to make them easier to use.

Hitachi is contributing to the channel strategies of financial institutions by utilizing the strengths of these three different channel solutions (branch systems, ATMs, and Internet banking) and by integrating and coordinating their operation.

Global Supply Chain Management Service and Environment Information Exchange Service (Extended Version) Available via TWX-21 as Cloud/SaaS Platform

TWX-21 (enterprises business media services) is Hitachi's brand for core enterprise system services delivered using a cloud/SaaS (software as a service) platform. Hitachi introduced two new TWX-21-based services called the "global supply chain management service" and the "environment information exchange service (extended version)" in July 2010. The global supply chain management service was introduced to meet complex global SCM (supply chain management) needs. The environment information exchange service (extended version) helps customers comply with REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals) and other global chemical substance management regulations. This extended version has management functions for collecting chemical substance information for assembled products. All functions and help desks are available in Japanese, English, and Chinese.

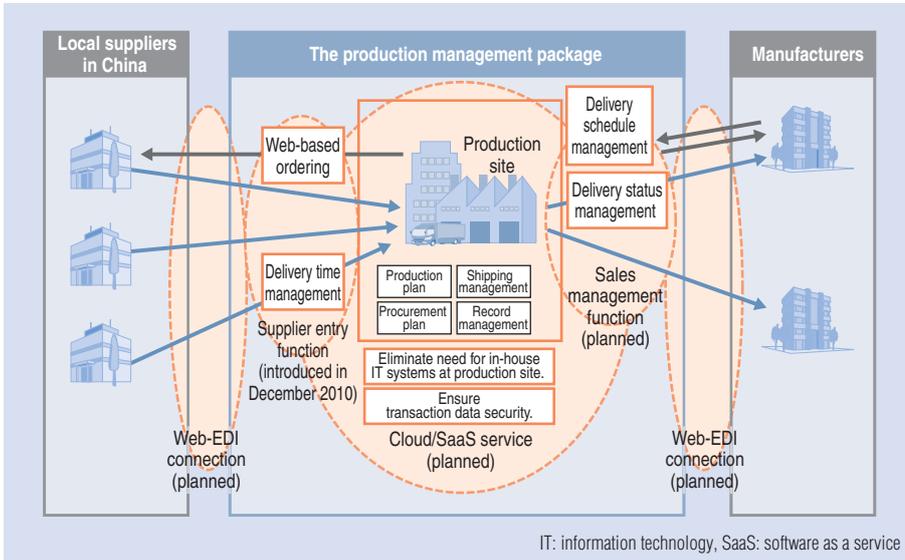
The global supply chain management service simplifies the process of controlling deliveries between production sites and suppliers domestically and overseas. The service also enables users to reduce excess inventories. The environment information exchange service (extended version) helps improve the efficiency of chemical substance information exchange between companies.



Overview of TWX-21 global services delivered using cloud/SaaS platform

TWX-21 is used by over 42,000 companies in approximately 400 industries. Based on customer needs, Hitachi intends to continue developing new SaaS services in partnership with other companies and supporting customers in the global marketplace with TWX-21.

Next-generation Supply Chain Management Solution



Functional enhancements to the production management package for customers who operate manufacturing businesses in China

lated experience. Key concepts are ease of use, fast implementation, and flexibility. The package was first introduced in October 2003 and as of July 2010 was in use at 23 companies in Japan and 28 companies outside Japan.

To provide better support for customers with manufacturing businesses in China, Hitachi has added a new supplier entry function to the package and has also released a simplified version of the package for easy deployment. Hitachi also plans to add a web-EDI (electronic data interchange) connection function to the package in the future.

Instead of its current configuration as a proprietary package in which operation is restricted to specific sites, Hitachi's plan for the future is to transform the package into an open production package that can be used from anywhere by incorporating management functions for suppliers and

Hitachi offers the production management package that has been developed based on years of its technical expertise and accumu-

lated experience and by providing information sharing for design, environmental considerations, and other processes.

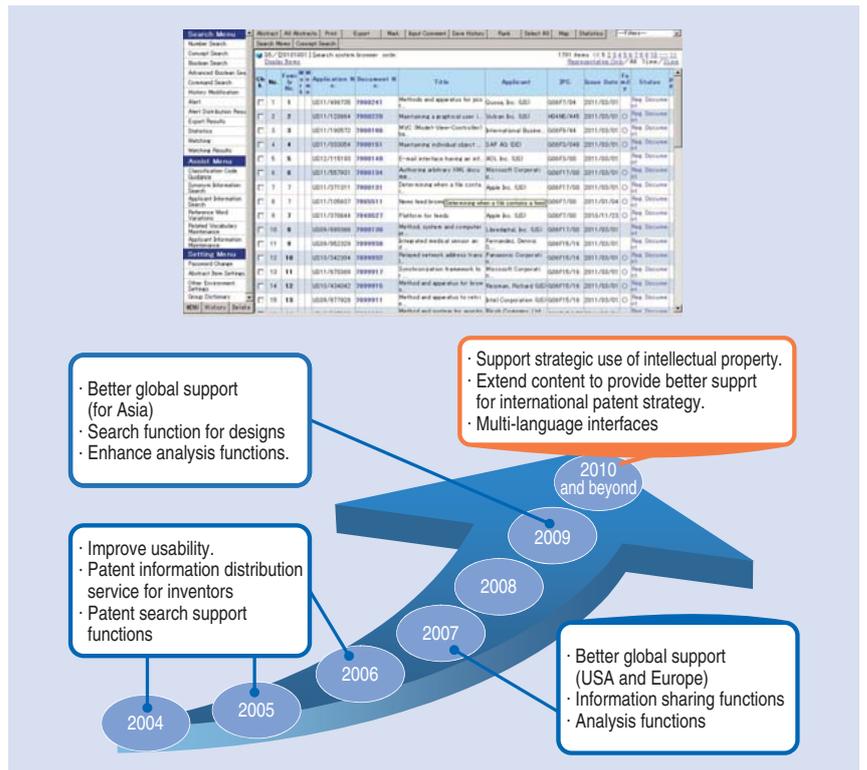
Patent Information Service with Prospects for Overseas Applications

Hitachi's patent information service provides the ability to search and research patent gazette data from Japan and other countries and has the leading market share in Japan* for such services targeted at the private sector.

As globalization proceeds in the world, intellectual property strategy has come to play an important role in corporate business strategy. For this reason, Hitachi has undertaken the following upgrades to its service to prepare it for deployment in markets outside Japan.

- (1) Addition of English and Chinese user interfaces
- (2) Extension of coverage to patent-related contents from jurisdictions outside Japan
- (3) Addition of a function for US patent data that searches for similar patents based on entered text (concept search). This function is in addition to the existing keyword search function.

There has been a dramatic increase in patent submissions in recent times. A target of mid-2011 has been set for introducing the service in China where a future increase in demand for patent information services is expected.



* Share among top 300 patent submitting companies

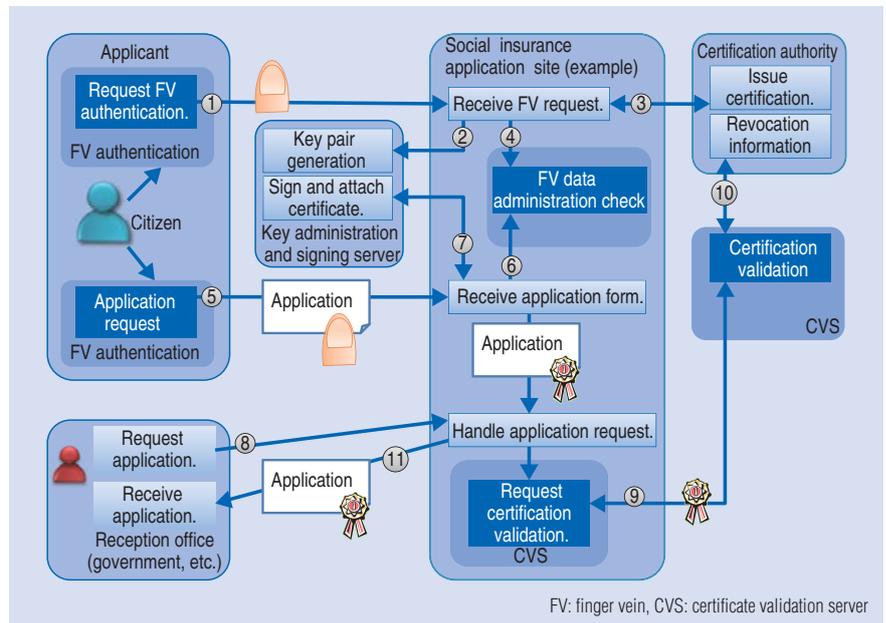
Hitachi's patent information service

Polish Demonstration of Hitachi's Finger Vein Authentication and Certificate Validation Server System

In Europe, Hitachi is working on the development of an innovative new IT (information technology) security solution called the biometric signature solution which combines Hitachi's finger vein technology and certificate validation server system. Finger vein technology is an advanced Hitachi security solution that is widely used in banking and for PC (personal computer) and application login. Certificate validation server is also a security solution and is widely used in PKI (public key infrastructure) systems in Japan. The biometric signature solution provides commercial, administrative, and government end users with more convenient and safe IT environments.

The biometric signature solution is suitable for various businesses that require a secure IT environment. Examples from government include taxation and social insurance while commercial applications include use in education, banking, and medical records management.

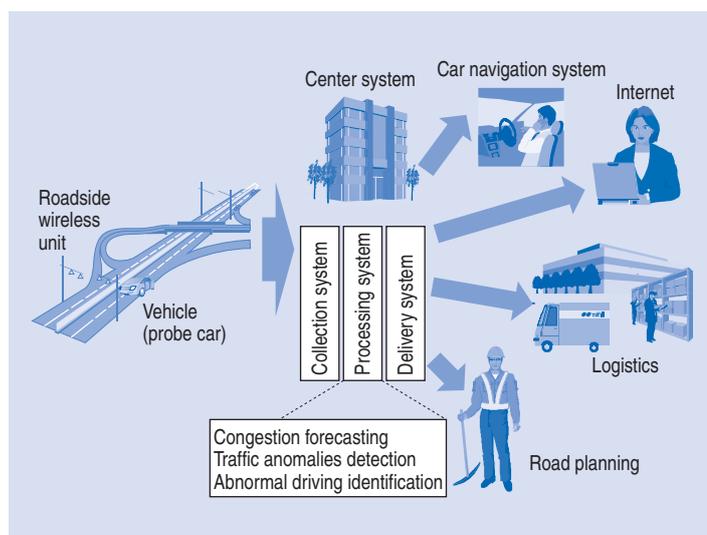
In Poland, Hitachi Europe Ltd. has since 2010 been working with a local IT company on the introduction of the biometric signature solution at several commercial and non-profit organizations with



Example flow chart for social insurance application

strong support from local government institutions. Hitachi Europe and this local company now plan to expand the demonstration to other sectors and other countries.

Probe-car-based Congestion Information Collection and Dissemination System



Probe-car-based congestion information collection and dissemination system

Smoothing traffic flows by alleviating congestion is important not only because of the economic benefits of shorter travel times but also because of the role it has had in recent years in facilitating environmental measures and road safety. One measure aimed at achieving this in Japan was the commencement in 2010 of work

on infrastructure for collecting data from on-road probe cars*¹ to measure traffic conditions, primarily on expressway. This system uses ITS (intelligent transport system) car navigation system*² installed in probe cars to acquire vehicle movement and behavior history data which is then collected using DSRC (dedicated short range communication) radio systems when the cars pass under roadside wireless units. The center system uses the vehicle movement history data to calculate the travel time for each stretch of road which can then be used to measure traffic conditions. Similarly, the vehicle behavior history data can be used to determine when driving is abnormal and identify hazard locations.

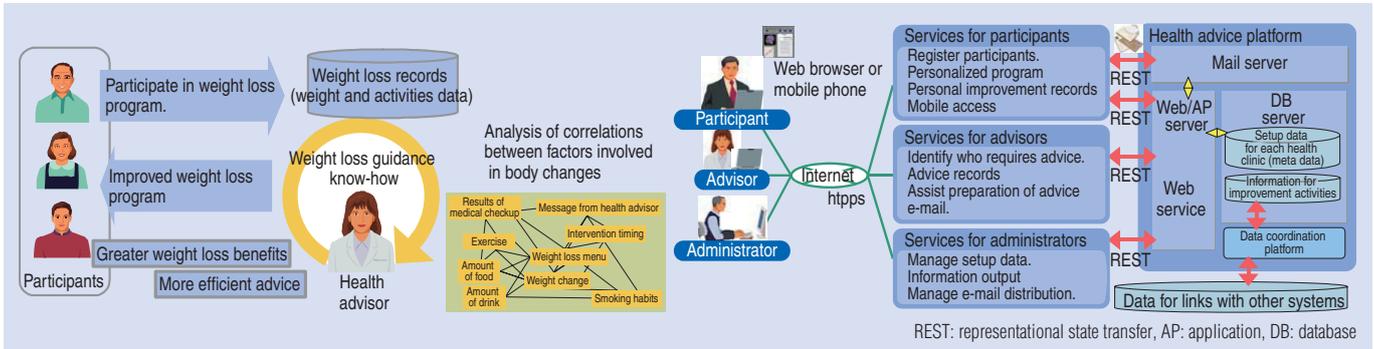
Installation of more roadside wireless units along highway is planned and the intention is to use the information produced by the system not just for road planning but also to make it available to a wide range of users through various information dissemination channels such as car navigation systems and the Internet.

The deployment of this newly developed technology into growing markets will help make road transport safer, less stressful, and more comfortable.

*¹ A function for collecting vehicle movement history data (speed, position, etc.), or a vehicle equipped with such a function

*² A vehicle-mounted unit that supports next-generation services and ETC (electronic toll collection)

Hitachi's New ASP Business for Health Sector —Weight Loss Program Support Service for Metabolic Syndrome



Use of weight loss records to improve weight loss program (left) and system block diagram (right)

Hitachi has developed a new weight loss program for metabolic syndrome. This body fat reduction program aimed at managing the health of Hitachi staff was devised and is being run by Dr. Nakagawa, a doctor of industrial medicine at the Hitachi Health Care Center. More than 1,000 employees per year are enrolled in the program. Overcoming lifestyle diseases has become an important challenge for advanced nations around the world and the idea behind the introduction of this new service is to promote good health in the wider community by making this approach better known outside Hitachi.

A unique feature of the service is the way in which its method of providing advice is integrated with the use of IT (information

technology). It was originally conceived as an effective way for the Hitachi Health Care Center to provide health advice to a large number of employees spread over a wide area with limited resources and it has become an efficient way to deliver a high level of benefits without relying on the skill levels of individual health advisors. The service is also able to continue growing by progressively accumulating further health advice know-how.

By managing the service's various functions in the form of meta-data, the systems form a loosely coupled collection of web services implemented on a "data coordination platform." Further expansion of the service is planned for the future to keep up with market growth.

More Flexible and Scalable IT Strategy in Age of Change —Job Management Partner 1

In this age of change, companies need to continuously evolve their strategies in response to the demands of business. As a result, companies vigorously review their IT (information technology) infrastructure to address this ongoing change.

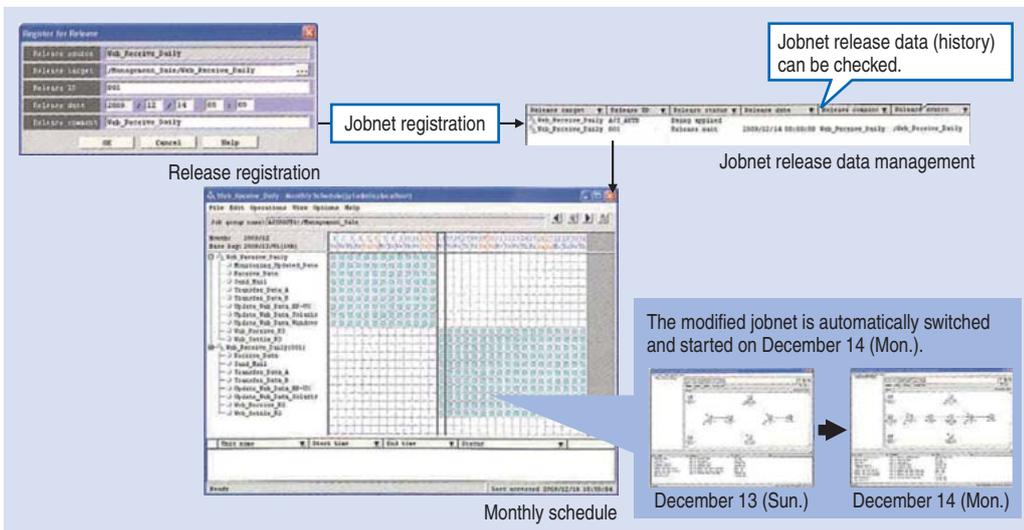
To help companies build IT infrastructure able to cope with

this age of change, Job Management Partner 1, an integrated system management suite, has added enhanced automatic operations. It makes companies' information infrastructure more flexible and improves business operation.

When a lot of jobnets have to be changed, jobnets can be added into

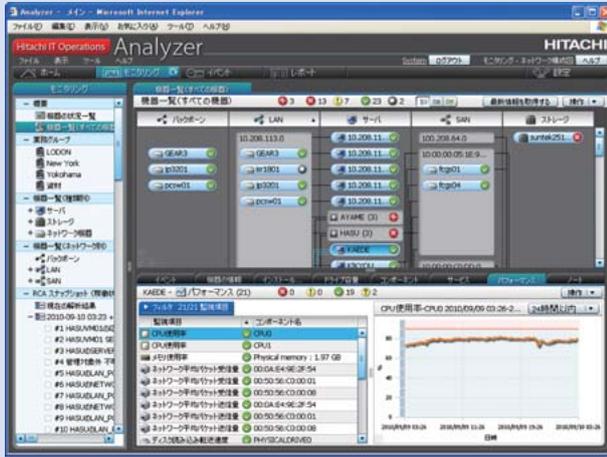
the workflow, modified, or switched according to planned operations without interrupting job operation. If a jobnet is modified and registered in advance via the release register function, the jobnet is automatically switched on at the specified date without changes to the conventional operating schedule. The release data (history) of jobnet changes can also be checked in the release data list. Job Management Partner 1 version 9 provides trouble free and automatic planning of jobnet switching.

(Web site: <http://www.hitachi.co.jp/jp1-e/>)



Jobnet release data management

Simple Systems Management Package Software for Small- and Medium-sized Businesses



Hitachi IT Operations Analyzer monitoring screen (left) and Hitachi IT Operations Director screen (right)

Hitachi IT (information technology) Operations Analyzer, availability and performance monitoring software and Hitachi IT Operations Director, IT lifecycle management software are systems management package software marketed to small- and medium-sized businesses throughout the world, including Japan. Both packages allow users to get started quickly without needing to install agent software on each device. They are also simple to use thanks to their intuitive and easy-to-understand interfaces. Hitachi IT Operations Analyzer handles stable operation of IT devices by providing comprehensive performance monitoring across servers, network, and storage devices in a server room, including any faults. As performance monitoring uses predefined

threshold values, problems can be preempted before they occur. When a fault occurs, Hitachi IT Operations Analyzer automatically identifies the root cause devices and factors to help achieve a rapid response. Hitachi IT Operations Director assists ensuring observance of corporate compliance by performing centralized administration of PCs (personal computers) in an office and prompting security measures. In addition to asset management, Hitachi IT Operations Director helps achieve a rapid response for security management by providing customizable dashboard screens that show the status of security measures including virus infections, prohibited operations, and information leaks.

Hitachi PC Servers

Hitachi's PC (personal computer) servers use the Intel Xeon* Processor and are available in rack-mounted and tower configurations that have superb capabilities for memory and I/O (input/output) expansions. They have a wide range of uses in corporate IT (information technology) systems extending from file servers and mail servers to application servers and database servers. The rack-mounted PC servers are also available either in a slim (1U size: 44.45 mm) design that allows for high-density mounting or in a design that allows a large number of HDDs (hard disk drives) and backup devices to be included. The tower PC servers meanwhile feature very small size (footprints) and quiet operation to suit installation in office environments. The servers are also suitable for use as virtualization platforms running software such as Hyper-V* or VMware* vSphere* to facilitate flexible and efficient system operation. In consideration of the environment, the servers support energy saving functions such



Rack-mounted PC server

as power capping and use energy-efficient components including low power-consumption processors, memory, SSDs (solid-state drives), and a highly efficient power supply with 80 PLUS certification.

* See "Trademarks" on page 83.

Enterprise Blade Server “Hitachi Compute Blade”



(a)



(b)

Hitachi Compute Blade 2000 (a) and Hitachi Compute Blade 320 (b)

Hitachi Compute Blade is a next-generation IT (information technology) platform with high performance, high scalability, high availability and a lower TCO (total cost of ownership). By bundling blade servers, storage, networking, an OS (operating system), and system management software to provide integrated administration of the overall system, it delivers an IT system that can respond promptly to changes in the business environment.

The Hitachi Compute Blade 2000 is a high-end blade server that draws on technology Hitachi built up through mainframe development to combine high performance with reliability. In addition to being a blade server, features include large memory capacity and support for I/O (input/output) slot expansion units together with the ability, essential for a cloud platform, to configure server virtualization. A highly reliable high-performance server virtualization mechanism that is proprietary to Hitachi is also available and supports high-reliability virtualization environments suitable for social infrastructure platforms and core systems.

The Hitachi Compute Blade 320 blade server model is designed for small size and high-density installation which it achieves through superior cooling technology along with other technolo-

gies for light weight and high-density mounting. It also features energy-efficient operation including a power capping function which controls the processor clock frequency to limit server power consumption to a user-specified maximum and an efficient power supply with functions that optimize the power supply conversion efficiency. Its small size and energy efficiency reduce maintenance and administration costs and help boost the cost-performance of cloud systems.

With the growth of the cloud, server virtualization which in the past has been used primarily to make effective use of hardware resources also needs to combine a high level of security and reliability with performance and ease-of-operation. Because the logical partitioning feature included in Hitachi Compute Blade provides a virtualization environment with low overhead, high security, and high reliability through the logical division of resources and the use of a hardware assist mechanism based on proprietary Hitachi technology, it is suitable for applications such as mission-critical systems and highly reliable cloud platforms. Further enhancements are planned including the provision of GUI (graphical user interface)-based configuration and operation tools that will make the use of virtualized resources even easier.

Hitachi Virtual Storage Platform

It is anticipated that virtual storage technology will play a significant role in implementing cloud computing, a field that has attracted considerable attention due to the major changes in the business environment in recent years. In the field of enterprise storage, device virtualization and volume capacity virtualization have already made possible the integrated management of multiple storage units and eliminated the need for design of volume capacity and performance. Hitachi Virtual Storage Platform has now become the first such system in the world* to offer storage tier virtualization. Storage technologies such as SSD (solid-state drive), SAS [serial attached SCSI (small computer system interface)], and SATA (serial advanced technology attachment) have different characteristics and storage tier virtualization automatically allocates data to these different storage levels in an optimum way based on the frequency of access to improve cost-performance beyond what was possible in the past. Also, the advanced architecture provides the ability to expand performance and capacity flexibly. Components such as ports, caches, and processors can be added independently as required and, by interconnecting the controllers, the configuration can be expanded by twice as much as was possible using previous models.



Hitachi Virtual Storage Platform

This allows the configuration of cloud systems that can respond rapidly to changing business needs.

* As of September 2010

Enhanced Cloud Support on Hitachi Adaptable Modular Storage 2000 Series



Hitachi Adaptable Modular Storage 2000 Series with enhanced cloud support

Storage virtualization, or more specifically the use of volume capacity virtualization to maximize the efficiency of capacity usage on disk arrays, is one of the core technologies for cloud

computing, a field that is currently attracting considerable attention.

To enhance its support for cloud computing, the Hitachi Adaptable Modular Storage (AMS) 2000 Series of mid-range disk arrays includes the Hitachi Dynamic Provisioning (HDP) volume capacity virtualization function as a standard feature. Meanwhile, flexibility has been improved by extending the type of disks supported (with SAS [serial attached SCSI (small computer system interface)] hard disk drives) that can be mounted in high-density expansion enclosures which allow a high density of drives to be installed, and connectivity to servers has been improved by increasing the number of FC (fibre channel) interfaces (on the AMS2100/2300 model), as well as providing both FC and iSCSI (Internet SCSI) interfaces. The product range has also been extended by the release of the new AMS2010* model for small- to medium-sized systems which offers lower up-front installation costs and includes

HDP as a standard feature for cloud support.

* Being sold by partners in countries except Japan.

Hitachi Data Ingestor—Lower Cost and Complexity at Edge and Simpler Cloud Deployment—

Hitachi Data Ingestor (HDI) is a dedicated on-ramp optimized for the Hitachi Content Platform (HCP), an intelligent object store.

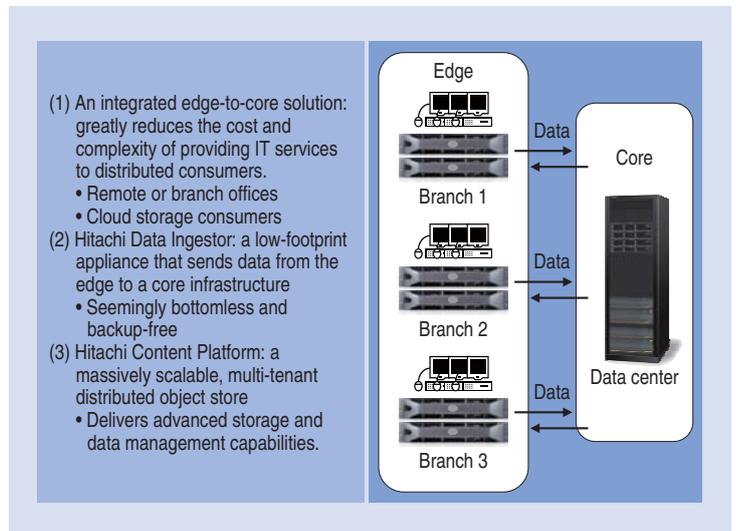
HDI appears to users and applications as a bottomless storage device by automatically moving content out of its internal cache and into the HCP to provide expanded storage capacity for new content. With HDI, users no longer need to back up their edge devices.

HDI can be supplied as a highly available two-node cluster with external storage, a single node with internal storage, or a software-only configuration running on VMware vSphere Hypervisor.

In all configurations, HDI acts as a tiering solution, moving its resident files to HCP and providing links to those files for on-demand recall.

HDI's features include:

- (1) Local and remote access to an HCP for clients over CIFS (common Internet file system) and NFS (network file system)
- (2) Seemingly bottomless storage capacity back-ended by HCP
- (3) Migrates content to a central HCP while maintaining local links to migrated content.
- (4) Active Directory and LDAP (lightweight directory access protocol) authentication support for HCP clients
- (5) Support for HCP tenant and namespace features over CIFS and NFS
- (6) Built-in file-level WORM (write-once, read-many) functionality



Hitachi Data Ingestor and Hitachi Content Platform

- (7) Scales to 400 million files per HDI system
- (8) Intelligent local cache for accelerated access to HCP content over CIFS and NFS
- (9) Speeds cloud adoption by eliminating the need to rewrite applications or change user behavior.

The solution allows organizations to greatly reduce the cost and complexity of providing IT (information technology) services to geographically dispersed locations or cloud consumers.

Hitachi Command Suite 7 Storage Management Software



Hitachi Command Suite 7 featuring lower total storage system costs

The 2010 upgrade of Hitachi Command Suite 7 features storage management capability for use in private cloud environments which are becoming increasingly common.

Hitachi Command Suite provides better usability incorporating task-oriented operation approaches that allow users to make the

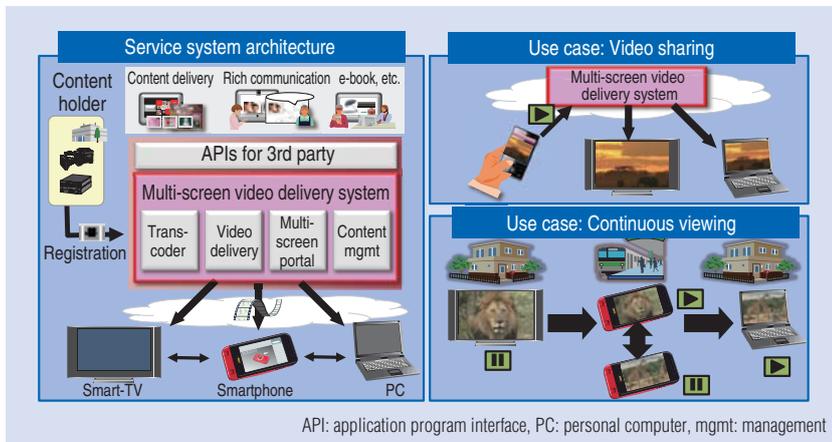
configuration changes associated with the addition or expansion of application systems on their own. Users can select the operation they want to perform (such as allocating storage to a host) from a menu and use a wizard to perform the series of steps in an intuitive way, entering only the minimum of information needed to complete the task.

Hitachi Command Suite also supports Hitachi Virtual Storage Platform which comes with the latest virtualization functions. It allows for centralized management of heterogeneous storage devices and supports automated tiered storage manage-

ment that moves data to the most appropriate storage media depending on the requirement of applications.

Hitachi intends to continue supplying software that reduces administration costs and storage costs at sites ranging from corporate server rooms to large data centers.

Multi-screen Video Delivery Solution for New User Experiences



Service system architecture and use cases

The environment of video delivery service is undergoing major changes including advances in networking such as high-speed mobile access and next-generation networks, smartphones, the growing sophistication of Internet-capable devices such as Smart-TVs (televisions), the emergence of new media such as SNSs (social networking services) and CGM (consumer-generated media), and the expansion of cloud services. These changes are leading to greater diversity in the way users view content and are

creating a demand for video services available anywhere and anytime.

The aims of the multi-screen video delivery solution are to give users access to high-quality video anytime and anywhere and to provide a way for sharing videos among family and friends. The functions provided by the solution include high-quality video distribution, copy-right management, transcoding, and a portal that supports multi-screen viewing. The solution has the following three features.

(1) High-quality and scalable video delivery to multiple screens including smartphones, smart-TV, and PCs (personal computers).

(2) Sophisticated terminal-linkage applications that support multiple screens. These include continuous viewing, video sharing, and remote

control.

(3) Secure content management using DRM (digital rights management) technology with support for multi-screen viewing.

Hitachi is working with carriers, service operators, device suppliers, and other stakeholders to offer new ways of enjoying videos such as continuous viewing and video sharing and is extending its multi-screen video delivery solution for the era of cloud computing.

Sensor Network Information System

Energy efficiency and security management are two fields where there is a recognized need to make visible what is happening in business workplaces. Implementing these applications requires the collection of environmental information (such as temperature, humidity, lighting, and power consumption) and staff location data (such as movement history and access control) through the use of IT (information technology) at factories and distribution sites. Hitachi supplies a sensor network information system that can be used to collect environmental and position data using highly reliable wireless technology.

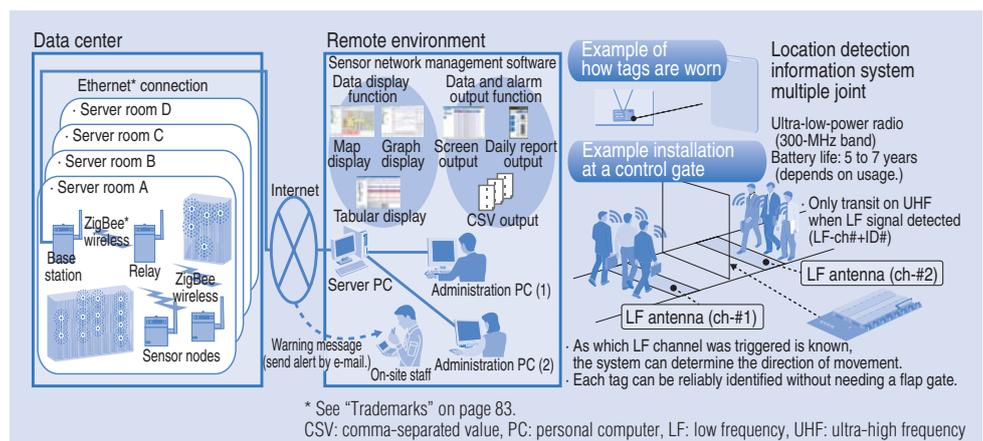
[Main products]

(1) Sensor network information system series

These systems use small wireless sensors to collect environmental information. System applications have included hygiene management at food processing plants and warehouses and energy efficiency and heat management at data centers.

(2) Location detection information system series

These systems attach wireless tags to people and objects for appli-



Sensor network information system (left) and location detection information system multiple joint (right)

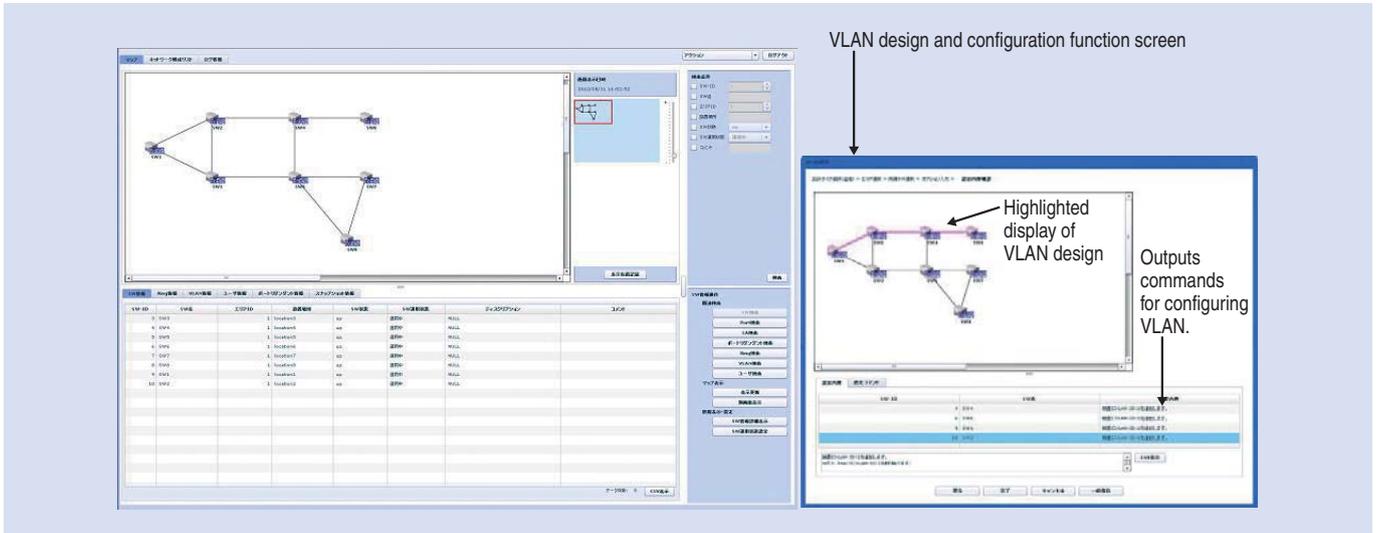
* See "Trademarks" on page 83.

CSV: comma-separated value, PC: personal computer, LF: low frequency, UHF: ultra-high frequency

cations such as collecting position information and hands-free detection of travel paths. System applications have included access security at factories and offices, materials management at warehouses, and measurement of forklift trajectories.

The aim is to deploy large numbers of sensors in social infrastructure such as the electricity system, railways, and roads where they can help implement functions such as equipment management and preventive maintenance and be used in conjunction with cloud technology to perform advanced and efficient data analysis.

Logical Network Operating System



Example screens for VLAN design and configuration function of virtual network operating system

A variety of virtualization technologies are used in the data centers that are the foundation of the cloud computing with the network used in these systems being implemented as a VLAN (virtual local area network).

Hitachi's logical network operating system product was conceived and developed to support the aspects of network management and operation that require human investigation and analysis and is based on the concept of providing "visual tools that support management and operation of layer 2 network via a user-friendly GUI (graphical user interface)." One of its features is that it provides a visual representation of the VLAN.

[Key features]

- (1) Supports network administration through functions such as displaying the assumed VLAN route information in the event of a fault.
 - (2) Incorporates functions for VLAN design and configuration to reduce the workload associated with administration. Hitachi also intends to strengthen the provisioning function through future enhancements such as functions for entering settings automatically.
- This product is currently only available in Japan.

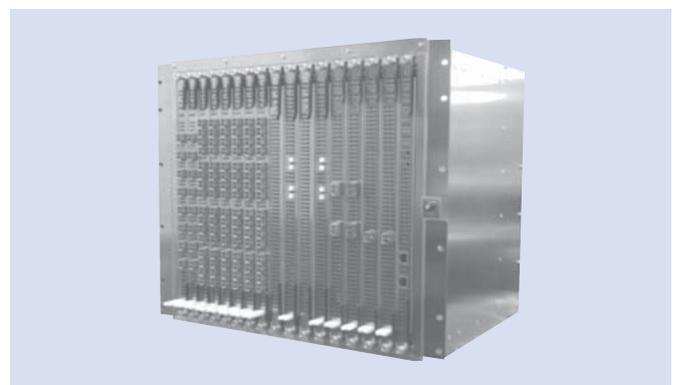
MSPP Packet Transport System

With data traffic having come to predominate in communication carrier networks, there is a progressive shift from past networks used principally for telephony services toward IP (Internet protocol) networks designed to handle data services. Meanwhile, the growth of cloud computing is expected to increase demand further for highly reliable networks.

In response to this transformative period for carrier networks, Hitachi has released a packet transport system based on an MSPP (multi-service provisioning platform) incorporating packet switches that can handle everything from the provision of highly reliable data services to telephony services using MPLS-TP (multi-protocol label switching—transport profile) technology.

[Key features]

- (1) Economical switching
Highly efficient housing due to the use of packet switches
- (2) Improved reliability of IP network
End-to-end path management together with fault and quality management using OAM (operation, administration, and maintenance)
- (3) Ensures quality of telephony service.



AMN5500 packet transport system

- Low delay, clock transmission function support
- (4) Enhanced network reliability
Provision of highly reliable virtual paths using LSPs (label-switched paths) and support of ring, dual ring, and linear topologies

Next-generation Packet Optical Transport System

Even greater increases in IP (Internet protocol) traffic are anticipated to result from the future growth of the cloud computing along with video distribution. The AMN6400 next-generation POTS (packet optical transport system) integrates a high-capacity WDM (wavelength division multiplexing) transmission function with highly reliable electrical multiplexing and packet switching functions. The integration of these functions reduces network equipment and the space requirements as well as operating costs.

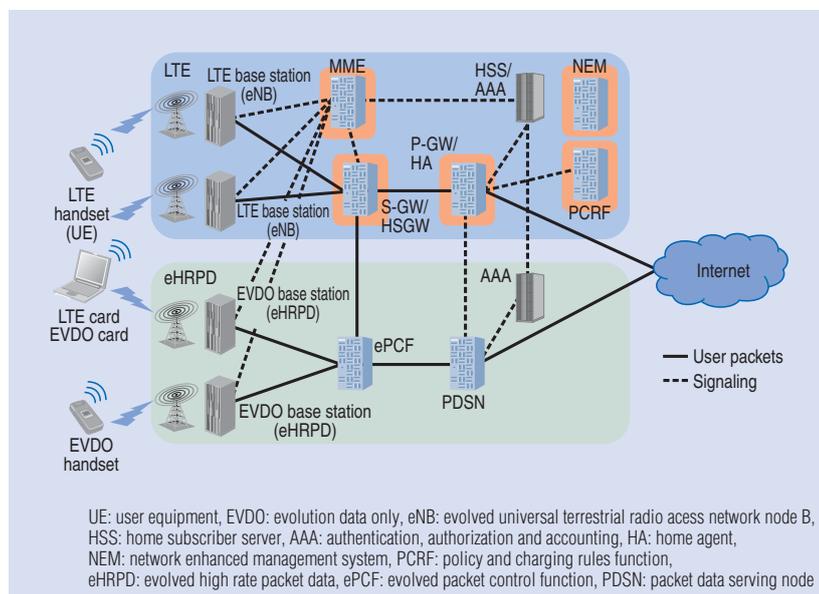
[Key features]

- (1) High reliability and unified resource management due to the application of alarm forwarding and fault monitoring functions using OAM (operation, administration, and maintenance) to the packet network
- (2) High-capacity transmission (100 Gbit/s × 88 wavelengths) with support for different network topologies (linear, ring, and mesh)
- (3) Lower latency, faster service introduction times, and easier fault identification through multi-layer path management extending from WDM transmission to LSPs (label switched paths)



AMN6400 packet optical transport system

Core Network Products for LTE Systems



Core network products for LTE systems

Because the rise of smartphones in recent years, primarily in developed economies, has placed stress on the existing 3G (third generation) mobile infrastructure, it is anticipated that 3.9G (3.9th generation) mobile infrastructure will be widely deployed to help improve the situation. The solution is LTE (long term evolution), an international standard which provides for data communication services with speeds that are an order of magnitude faster than current 3G mobile, delivering downstream speeds of more than 100 Mbit/s and upstream speeds of more than 50 Mbit/s.

It is against this background that Hitachi has developed core network equipment for LTE systems.

[Key features]

(1) High-speed packet transmission capability
S-GWs (serving gateways) and P-GWs (packet data network gateways) handle upper layer processing for layer 4 and above and each rack is capable of high-speed packet transmission processing at several tens of Gbit/s. While upper layer processing is performed in software, high throughput is achieved by adopting a configuration that does not use an OS (operating system) and therefore does not suffer from the associated overheads.

(2) Can handle large numbers of subscribers and support base stations efficiently.

The MME (mobility management entity) that handles location registration, paging for mobile handset, base station handoff, and other mobility management operations can support several million subscribers per rack and the S-GW that handles relaying of user data can support over ten million subscribers per rack. Similarly, the MME can support several tens of thousands of base stations per rack and the lower incidence of handoff between MMEs means end users experience lower latency.

(3) Combined S-GW/HSGW function

The HSGW (high-rate packet data serving gateway) used for inter-connection with the 3G network can be implemented on the same hardware as the S-GW providing a smooth migration from existing 3G networks to LTE.

(Commercial service is scheduled to start from December 2012)

LSI Technology for Safe and Comfortable Society

In addition to advanced functions and high performance, the ultra-high-speed LSIs (large-scale integrated circuits) that perform digital processing in the information processing and telecommunication equipment used to provide the information infrastructure of society require high quality. Enhancements to LSI functions and performance are largely achieved through techniques for higher transistor integration density and better circuit design. These have resulted in LSIs with up to several hundred million transistors that can run with clock frequencies in the GHz range. Hitachi has developed an LSI test system for delivery testing of these LSIs that features high speed and quality. To achieve the high quality and low cost required by LSIs used in social infrastructure, this system incorporates techniques for detecting short circuits between the tightly integrated transistors together with high-speed testing technologies and the use of test data compression to reduce the volume of test data by a factor of more than 1,000. These techniques are applied to CMOS (complementary metal-oxide semiconductor) ASIC (application-specific integrated circuit) designed in 90-nm technology and beyond. Hitachi has also established an LSI design consulting service that utilizes LSI design technologies including this LSI test system and circuit design techniques.

For use in analog LSIs designed for optical communications in telecommunications infrastructure, Hitachi has also developed SiGe BiCMOS (silicon germanium bipolar complementary metal-oxide semiconductor) LSI technology which allows the same LSI to combine both the excellent high-speed performance of bipolar transistors and the high level of integration possible with CMOS transistors. By adopting an epitaxial growth technique, a feature

of this technology is that it can integrate CMOS logic on the same chip that also provides the 210-GHz ultra-high-speed response performance of a high-value compound semiconductor. Applications include microwave, optical communications, and high-precision measurement instruments.

Meanwhile, industrial and medical equipment also requires greater integration of their electronic components into ICs (integrated circuits) to achieve higher performance, smaller size, lower power consumption, lower cost, and higher reliability. In response to these requirements, Hitachi has also developed a medium- to high-voltage platform technology for devices such as driver ICs and power supply control ICs. Features include:

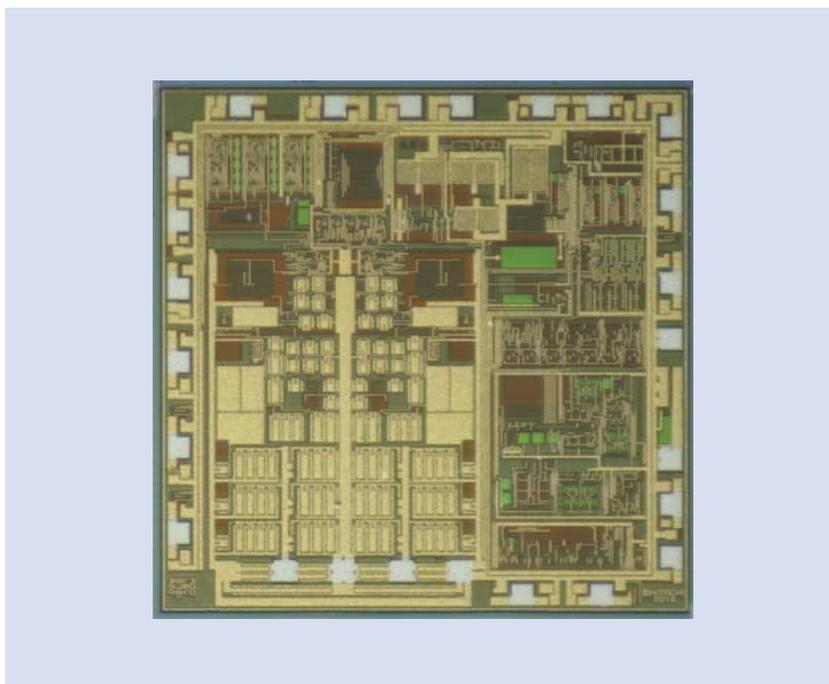
(1) The provision of devices optimized for specific applications with power supply voltages ranging from 35 V to 285 V

(2) Use of a 0.35- μm process, 0.25- μm SOI (silicon on insulator) process, and high-drive/low-resistance LDMOS (laterally diffused metal-oxide semiconductor) to achieve a high level of integration and high reliability.

The LSIs that use these technologies include:

(1) A piezo driver IC incorporating a linear amplifier with a high output voltage (200 V differential), low power consumption (128 mW), and low distortion (-54 dB) suitable for a wide range of applications including touch panel drivers and print head drivers

(2) An ultrasound pulser IC for medical ultrasound systems that features ± 100 -V positive and negative output waveforms with excellent symmetry and a high level of integration including internal T/R (transfer/receiver) switches and eight channels. Through these technologies and products, Hitachi is helping make society safe and comfortable.



Piezo driver IC