

White Paper

Contributing to the Environment When Investing in ICT

Rapidly evolving technologies are sending extremely precise, high-level information into the marketplace 24 hours a day. In a number of industries, this information includes important data linked to future business opportunities. Increasingly, the key to applying data for success lies in how quickly data can be gathered, analyzed, stored and maximized in business planning. As ICT systems grow in scale to handle ever-increasing data volumes, companies must invest in security, reliability and high processing power, and manage system operation and maintenance costs comprehensively, including the facilities that house them. Highly efficient ICT environments also provide ecological benefits through energy and resource savings.

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The Three Challenges in ICT Investment

The challenges companies face in deciding ICT investments can be classified into three main areas:

- Reducing the Initial Investment

Optimizing for the future at low initial costs

- Reducing Operating Costs

Optimizing ongoing operations while maintaining low costs

- Ensuring Business Continuity

Ensuring the safest possible ICT environment in terms of maintaining the business, including Business Continuity Planning (BCP)

This white paper uses practical examples to introduce an approach to overcome the challenges faced by companies considering ICT investments.

1. Reducing the Initial Investment

Phased Expandability

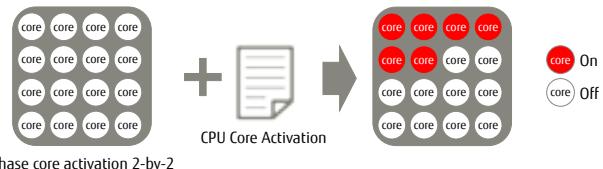
The key element in reducing and optimizing ICT equipment procurement costs is achieving systems that fill processing needs at the optimal cost (including processing capacity and installation). In other words:

- Products that promise high performance and storage efficiency
- System configurations optimized to the processing capacity currently required
- Equipment that can respond to future processing capacity requirements

For example, depending on system requirements, the Fujitsu M10 connects up to 16 4U rack-mounted servers of up to four sockets for use as a single server (Building Block Architecture, maximum 64 CPUs/1,024 cores, 32TB memory). Moreover, Fujitsu's Dynamic Reconfiguration allows the system to be expanded without service interruption, so customers can start small and build up to larger systems in phases matched to their real needs at any given time. In terms of the initial investment, reducing costs by configuring systems per Build Block required makes it possible spread investments out into the future.

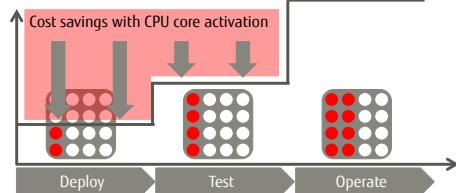
The Fujitsu M10 also uses CPU core activation to allow phased CPU capacity expansion without halting systems in operation. With CPU core activation, the machine comes installed with 16 cores per CPU and the ability to activate only the cores required in a matter of minutes. By minimizing the number of cores initially activated, capacity can be increased in line with future requirements. This architecture removes the need to pre-purchase CPUs to meet future demand, minimizing the initial investment.

Using CPU Core Activation



Purchase core activation 2-by-2
Turn on/off 1-by-1

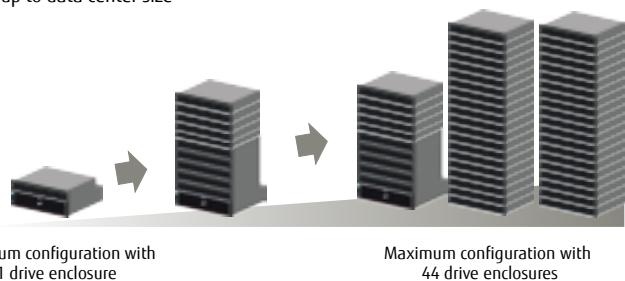
Benefits of CPU Core Activation



In addition, Fujitsu Storage ETERNUS DX500 S3/DX600 S3 disk storage systems can be purchased with minimal configurations, as small as 5U (about 22 cm), and then scaled up flexibly. Drives and drive enclosures can be expanded per unit without interrupting current operation. Existing volumes and RAID levels can be changed while the system is in commercial use for flexible data volume increases and operations expansion. Overall costs are optimized because investments for expansion can be made in stages.

Flexible Expansion in line with Operating Environment

- Small start from one drive enclosure
- Scale up to data center size



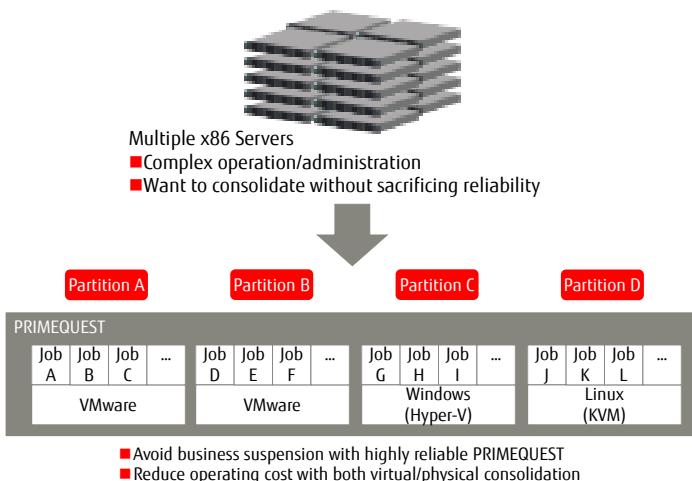
Minimum configuration with 1 drive enclosure

Maximum configuration with 44 drive enclosures

Consolidation of Diverse Systems

When preparing ICT systems to match increasing information volumes, ignoring equipment integration efficiency can lead to superfluous equipment costs later. For this reason, it is necessary to select ICT equipment that can be integrated efficiently in accordance with operational characteristics.

For example, in the Fujitsu Mission Critical x86 Server PRIMEQUEST, the hardware resource can be separated into multiple resources, each of which can operate as an independent system with a different operating system. Physical Partitioning (PPAR) is excellent for fault isolation between the systems. By combining it with virtualization software such as VMware, KVM and Hyper-V, multiple systems with different reliability and capacity requirements can be efficiently consolidated to optimize the ICT infrastructure.



The Fujitsu Server PRIMERGY also supports VMware and Hyper-V virtualization software being provided as functions of Windows OS. Multiple virtual servers (OS, applications, data) are constructed on a single physical server to raise operational efficiency.

Furthermore, the Fujitsu M10 comes standard with functionality of three different virtualization technologies: Oracle Solaris Zones, Oracle VM Server for SPARC and hardware partitioning. Hardware partitioning can create partitions per unit. Since each partition is completely independent, a failure in one partition has no impact on the other partitions, achieving high fault isolation.

The Fujitsu Storage ETERNUS DX S3 series adds an Ethernet interface card and cache memory and can be easily used as an NAS from the ETERNUS SF Web Console. Neither an NAS gateway device nor individual controllers are required, which saves space. Integrating SAN and NAS reduces initial procurements costs while raising operating and administration efficiency.

2. Reducing Operating Costs

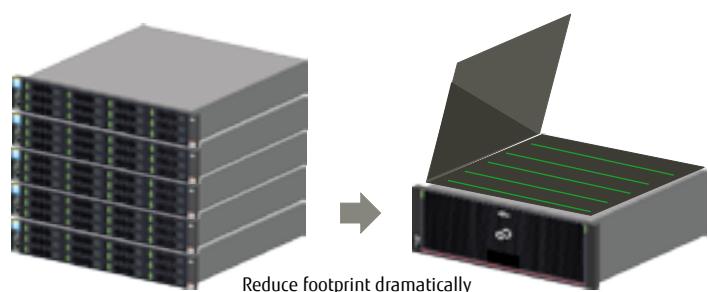
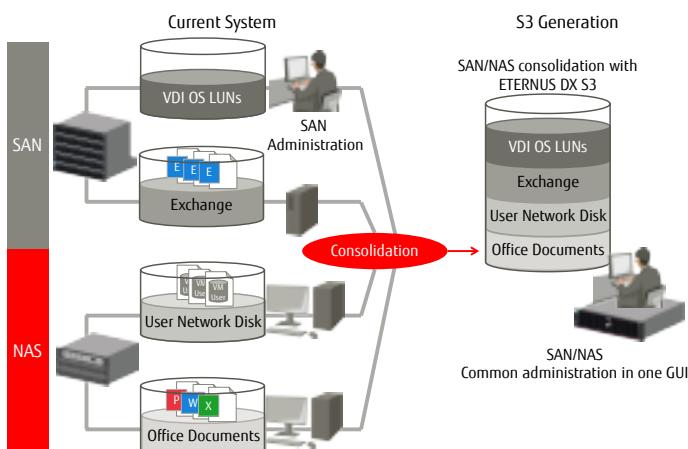
Visualization

As ICT system scale and data processing volumes increase, higher-level operating skills are required, increasing demand for highly skilled administrators. In other words, larger and more complex systems bring with them added labor and other related costs. Being able to "visualize" the status of systems, including current operations and load factor, would make it possible to consider plans to optimize operations.

Fujitsu's server products come equipped standard with a system monitoring tool that recognizes system operations, power consumption, intake air temperature and air exhaust. Since it can keeps track of main unit status with high precision, the burden on administrators is reduced, which leads to server management cost reductions. Operations can be scheduled to shut down systems at night and during holiday periods in line with actual hours of use. Synchronizing power plans also allows system control of multiple servers and I/O devices, such as storage that shares files between servers. The result is potential savings of operating costs such as power consumption.

In environments in which storage is shared for multiple operations, Fujitsu Storage ETERNUS DX S3 series products come with QoS (Quality of Service) to automatically tune bandwidth according to operations priorities and Automated Storage Tiering to automatically distribute data to high-performance SSDs (solid state drives) or lower-cost high-volume nearline disks in line with access frequency and priority policies. These automation features help reduce data management costs and reduce installation space requirements.

High-density drive enclosures, which can be installed in Fujitsu Storage ETERNUS DX S3 series products, improve disk drive storage capacity by as much as 2.5 times for HPC, archiving and other high-volume operations, and reduce required installation space by as much as 50%.



To further streamline operations, a mechanism to centrally manage the entire system is needed. By leveraging software to "visualize" and then optimize entire systems, customers can enjoy significant improvements in efficiency.

Using "Open" Databases

Today's ICT systems are closely linked with everyday life, as can be seen in changes in working styles brought about by the cloud and smart devices, as well as expanding usage of big data. People expect more, which expands the role and responsibilities of ICT. At the heart of these systems is the database, the requirements of which are growing hand-in-hand with rising demands on the systems themselves.

In addition, the Fujitsu Storage ETERNUS DX S3 series integrates a wide variety of operating systems. It supports Windows, Linux and UNIX, and can be connected to a multi-vendor server to support diverse interfaces. It is well-suited for virtualization platforms such as VMware and Hyper-V, making it ideal for highly integrated virtualization environments, and also supports OpenStack open source software to provide open cloud environments.

If information is to be applied rapidly and effectively in business situations, time is of the essence in system development. For this reason, demand is strong for "open" databases that link existing software and packages, both internally and externally, and make it possible to build new systems in a short time. Fujitsu Enterprise Postgres is fully equipped with a PostgreSQL open-source software interface that can be applied in a variety of environments. Packages, information systems, development tools and applications with PostgreSQL interfaces can be easily integrated, and the database also supports diverse development environments and scripting languages. Application development efficiency can be enhanced, and the scope of application within ecosystems can be radically improved. By adopting the PostgreSQL interface, Fujitsu has achieved high compatibility with databases from different companies. Making the transition to Fujitsu Enterprise Postgres is simple, requiring just 1/8th the migration processes of conventional database migration (based on internal testing).

Note

What is PostgreSQL?

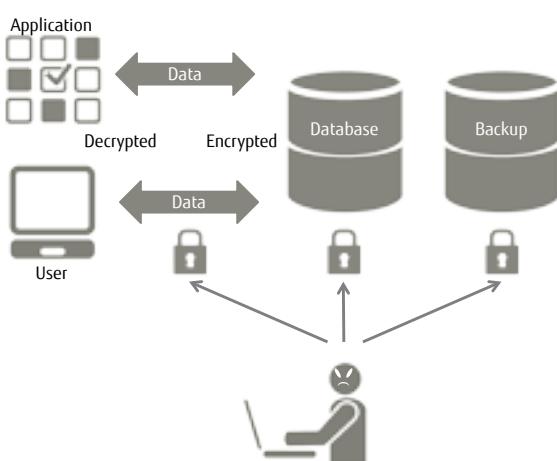
One of the world's most advanced databases, and a proven architecture that has earned a strong reputation for reliability, data integrity, and precision.



Database Management "Peace of Mind"

As applications diversify, we are entering an age in which engineers with limited database knowledge and experience are building and operating systems. Users require "peace of mind" where system operation is concerned.

In conventional PostgreSQL interfaces, data to be stored in the database is encrypted when it is written to the data file, and then decrypted when it is read out. Fujitsu Enterprise Postgres extends this capability, providing Transparent Data Encryption (TDE) to carry out the entire process automatically. Data encryption and decryption processing, and encryption key management become possible without requiring the attention of users or applications.



In addition, Fujitsu Enterprise Postgres conforms to PCI DSS (Payment Card Industry Data Security Standards) established by the credit card industry to safely handle member information. Encryption to prevent unauthorized access and network eavesdropping is a standard feature.

In business environments that change at a dizzying pace, Fujitsu Enterprise Postgres offers a variety of functions of the mission-critical database, inherited from the mainframe era, while actively supporting open functionality to respond to new business requirements.

Starting Small

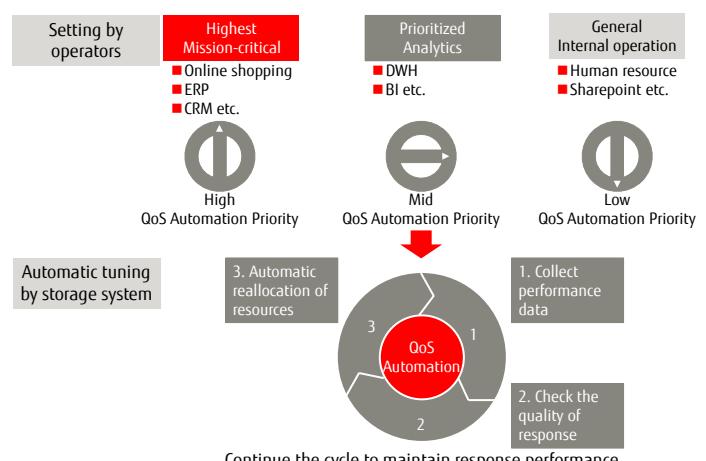
Progress has been made in recent years in the modernization of ICT infrastructures utilizing virtual server environments, and needs are growing for the ability to share multiple operations in a single virtual storage pool. Adopting virtual storage pool operation can curb initial installation costs while reducing operating costs and simplifying operation.

- Can implement small starts with only the capacity used being distributed to physical disks via capacity virtualization
- Capacity can be used with no waste and no partitions per RAID
- Can expand capacity by adding disks without interrupting operations
- Striping ensures constant leveling of disk loads

However, while operation is simplified, increased processes and excessive accesses to certain processes can present new challenges such as:

- (1) Lowered response on priority processes
- (2) Increases in data exposed to high-density access, which degrades overall performance
- (3) Increases in data that is not accessed, which runs up data storage costs

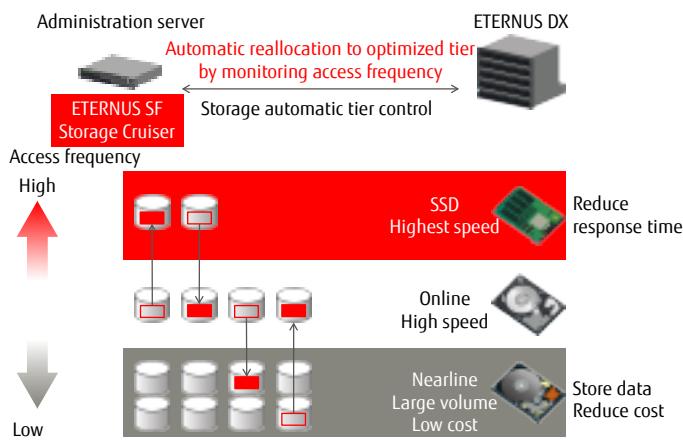
The Fujitsu Storage ETERNUS DX S3 series and ETERNUS SF Storage Cruiser storage management software use QoS Automation to tune the required bandwidth in line with process priority and Automated Storage Tiering to redistribute data in line with access frequency and priority policies. The result is a reduction of data storage costs, as well as significantly improved performance.



Note**What QOS Automation ensures?**

Response corresponding to the process priority to maintain a balance between processes while automatically adjusting bandwidth to achieve stable system operation.

With Automated Storage Tiering, data that is used less frequently is distributed to nearline disks to reduce storage costs. In addition, data that is frequently accessed is distributed to SSDs to shorten response time and enhance performance.



SSDs use semiconductor memory to store data, removing the need for moving parts to achieve not only high-speed access, but also considerable power savings. Dozens of hard disk drives can be replaced with a few SSDs to maintain the same performance with significantly reduced power consumption.

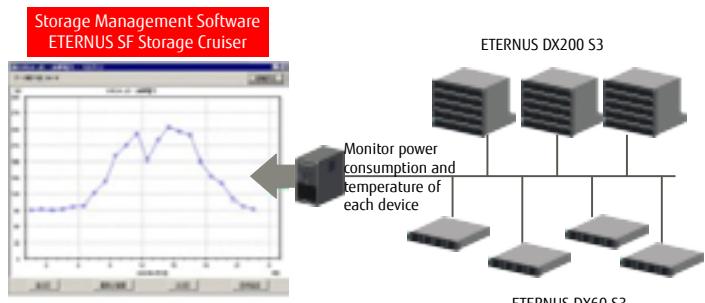
Eco Mode

Disk drives that can be mounted in Fujitsu Storage ETERNUS DX series products can take advantage of an Eco Mode applying MAID* technology so that disks are rotated only when needed. Disks that are only required at certain times are powered down to reduce energy consumption. For example, dedicated backup disks can be scheduled to rotate only during backup operations.

*MAID technology: Abbreviation of "Massive Array of Idle Disks" technology. By stopping the rotation of infrequently used disks, it is possible to reduce power consumption, prolonging the life of the disk drive.

Storage Visualization

Power consumption and temperature changes inside Fujitsu Storage ETERNUS DX series products can be viewed as graphs on the ETERNUS SF Storage Cruiser web console. Being able to monitor local temperature increases inside data centers makes it possible to improve cooling efficiency, for example by reviewing air-conditioning systems.

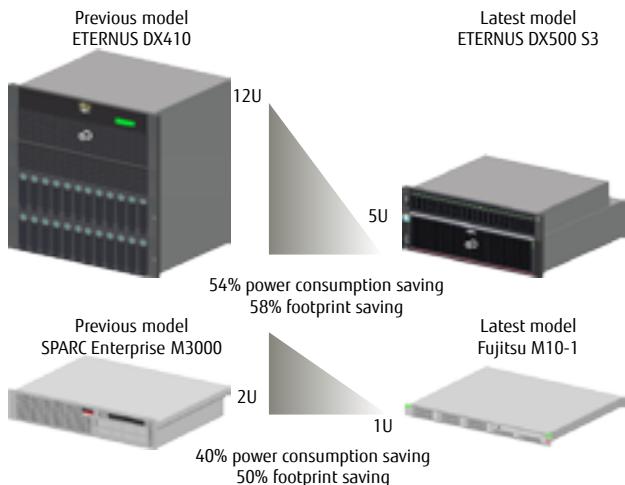
**Reducing Energy Consumption**

Facilities (space), power supplies and air conditioning equipment comprise a major portion of the investment in ICT systems, raising energy costs and environmental impact. Installing such equipment in-house, in particular, increases fixed assets, while renting facilities brings its own costs, as well as new power and air-conditioning expenses. In other words, expanding ICT systems requires investment not only in equipment, but also in system and facility maintenance. Comprehensive optimization is of vital importance.

Switching in the Latest Equipment

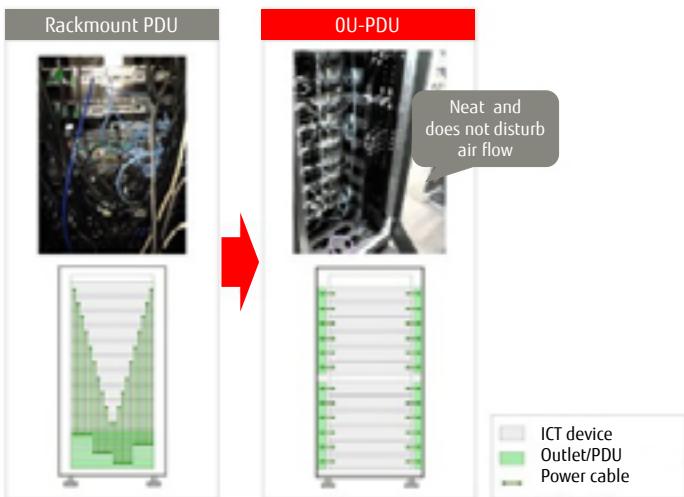
Great strides have been made in recent years in the development of technological countermeasures to deepening environmental concerns. For example, improvements in performance thanks to technological innovation are obvious when comparing today's ICT equipment with predecessors of five or even three years ago.

By replacing older equipment with the latest models, customers can realize not only power reduction of the products themselves, but also significant energy and space savings on air-conditioning and other equipment in data centers and offices.

Compact and Energy-saving Design**Improving Cooling Efficiency**

Packing equipment into server racks increases the number of power cables required. In the common case in which a PDU is installed on the bottom shelf of the rack and connected to a power supply, air exhaust from equipment is blocked by the power cable, drastically cutting cooling efficiency. This issue can be resolved by replacing AC200V cables with IEC-shaped plugs suited to confined spaces, installing them vertically on the side of a 19-inch rack, and then connecting the PDU and equipment with the shortest possible length of cable.





3. Ensuring Business Continuity

In considering effective ICT investments, ensuring business continuity is an important challenge. Customers need to select ICT equipment with wide scalability and easy scale-up and scale-out to achieve reliable systems providing flexible processing capacity with high quality and availability. The level of system safety and reliability, including BCP (business continuity plans), is also important.

Stable Operation

Fujitsu's servers and storage have inherited the achievements of more than 50 years of technology development. We tenaciously maximize reliability at the LSI level, the unit level (disks, power supplies, fans, etc.) and the system level (clusters, etc.). By building reliability at each level, we improve the availability of the system as a whole to support stable operation 24 hours a day, 365 days a year.

Furthermore, by switching to normal nodes using monitoring processors and asynchronous monitoring LANs, Fujitsu equipment excels at preventing data loss from faulty nodes and network address conflicts in cluster systems. This is a technology offered only by Fujitsu and is the reason we can realize high-availability systems.

Backup

Data loss in mission-critical systems not only interrupts a company's own business, but it also damages confidence in transactions with third parties. For this reason, reliable data backup is essential for ICT systems. However, backing up enormous amounts of data is prohibitively time-consuming, and a huge amount of free space is required on backup media. Ensuring data backup efficiency is an important consideration in planning ICT investments.

Tape backup has been reevaluated in recent years as a method to fulfill the cost balance requirements of data protection in terms of long-term storage, external storage, large capacity and low cost. Backup tapes offer huge data capacity at about one-third the cost of comparable disk media, and tape systems use less power, which also translates into cost savings.

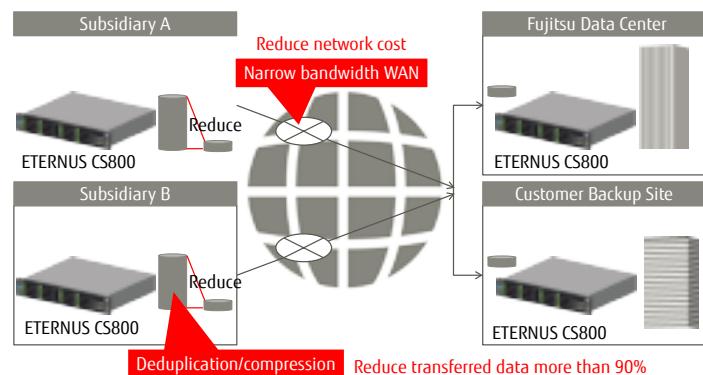
Fujitsu Storage ETERNUS tape devices are the result of many years of ongoing development related to magnetic tape products and have earned high praise from customers.

Fujitsu Storage ETERNUS DX S3 series products are also equipped with ETERNUS Advanced Copy Manager, which rapidly creates backup copies within the storage unit without using any server resources in operation. At specified intervals, process volume data is rapidly copied from one part to another part of the same disk storage system. This functionality contributes to the efficiency of backup resources by letting the user copy only data that has changed since the previous backup and copy data between different data generations.

The ETERNUS CS800 data protection appliance prevents data duplication and compresses backup data to realize a more than 90% reduction* in storage requirements for backup and further reductions of data backup costs.

* Based on typical enterprise data backed up fully once a week and daily for all data changed since the previous day

In addition, data can be copied between ETERNUS CS800 S5 units in remote locations, making it possible to build countermeasure backup systems against natural disasters. Because only block data that has been changed is transferred after compression, backups can take place over affordable low-bandwidth lines, removing the need for dedicated backup lines. Moreover, even customers who do not own a backup site can take advantage of Fujitsu's Remote Backup Service, which keeps backup data stored in a Fujitsu data center.



To optimize customers' ICT investments, it is important to have high-performance, high-reliability, and high-availability ICT equipment with a superb aggregate capacity. The system configuration must be optimized to the customer's processing volume, be easy to expand in the future, and reduce operating power and space consumption. In other words, comprehensive solutions are required.

Maximizing Data Center Efficiency

Customers can study the usage of data centers to improve the efficiency of ICT investments. Data centers contribute to comprehensive investment optimization, including ICT equipment, by saving overall installation and operating costs.

■ Reducing the Initial Investment

Select the optimal configuration for the processing capacity required and easy expandability in the future

■ Reducing Operating Costs

Remove facility-related costs to reduce total operating costs

■ Ensuring Business Continuity

Maintain the capability to continue and recover operations if unexpected events occur

1. Reducing the Initial Investment

As with ICT equipment, the vital considerations in using data centers are selection of the optimal configuration for the processing power required and easy scalability for the future.

With Fujitsu's Data Center Services, customers' operating systems are entrusted to Fujitsu data centers, where Fujitsu performs day-to-day processing on the customer's behalf. Applying our strengths as a comprehensive ICT equipment manufacturer, we provide a variety of data center services.

"Colocation" services are for customers looking to situate their existing ICT equipment in top-class Fujitsu data centers, where we provide space, power, air conditioning and all other facilities needed for stable operation. "Housing" adds Fujitsu management of the customer's systems. "Hosting" takes the service one step further, as Fujitsu provides the ICT equipment, as well. Service contents, such as operating scope and level, can be tailored to each customer's needs, contributing to initial investment optimization and flexibility of future process expansion.

Fujitsu maintains high-speed data networks for rapid data transmission inside and between buildings, and between data centers, so customers need not worry about new space to install added equipment when expanding their processing capacities.

Furthermore, in addition to conventional outsourcing services, in which the customer's operations are all concentrated in a single system, Fujitsu offers a variety of system configurations taking advantage of the cloud. For example, a customer might want to have a hybrid cloud system in which unique processes are housed in a private cloud environment, while common functions can use the public cloud environment. It is also possible to aggregate these diverse systems to create a single system that operates in an integrated manner.

2. Reducing Operating Costs

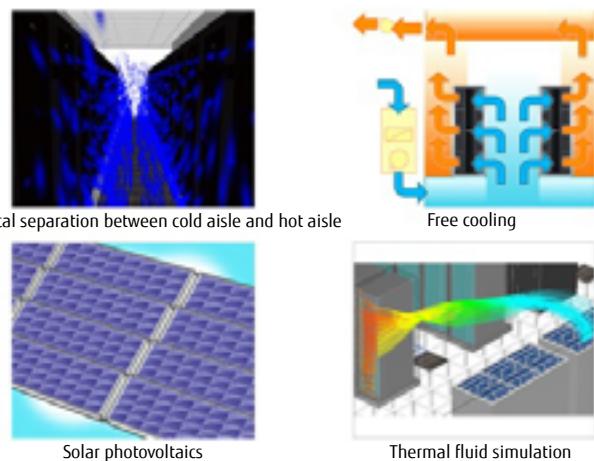
Data centers have the potential to comprehensively reduce ICT investments because they remove the need for labor costs related to system operation and administration, as well as space, power and other facility costs.

Fujitsu's Data Center Service engineers are highly experienced in outsourced ICT management and oversee customers' systems at all times, every day of the year. Thorough automation efforts further improve service quality while containing costs. We also maintain an organization of dedicated professionals to rapidly tackle any problems that might occur in our systems.

Customers maintaining their own ICT systems must allow for significant maintenance and security expenses. Outsourcing provides a viable cost-saving alternative. For customers who house or operate their own data centers and machine rooms, Fujitsu provides maintenance service packages under which veteran engineers monitor and manage customers' systems remotely. This wide range of service options helps our customers lower their ICT costs in each phase of operation.

Every Fujitsu data center proactively considers the burden on the natural environment. Without sacrificing value in the traditional form of stability and robustness, we study and apply technologies to reassure customers that outsourcing ICT system operation to Fujitsu is "a contribution to the earth's environment." In addition to basic measures such as visualizing air conditioning and power consumption status, separating heating and cooling in rack columns, and installing high-efficiency equipment, we are tying up with construction and facility vendors in the area of "air conditioning that takes full advantage of the outside air."

We take care not only during data center construction, but also after facilities start operations through ongoing reviews and analyses to fine tune and improve energy efficiency.



3. Ensuring Business Continuity

To prepare for the eventuality of natural disasters, accidents and other unforeseen circumstances, it is important to be able to rapidly deploy countermeasures and recover operations to continue providing the high performance and quality that customers demand of ICT systems.

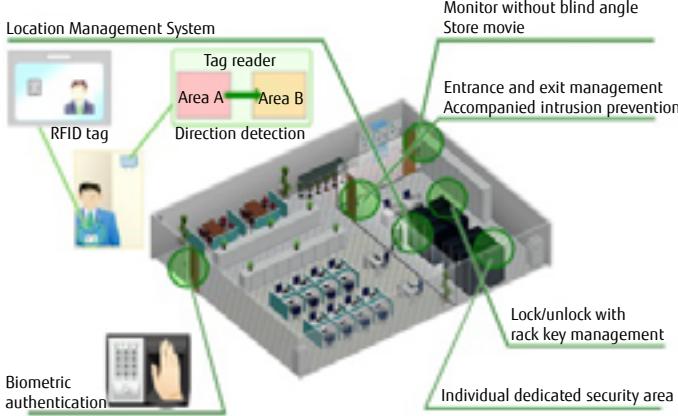
Stable Operation

Fujitsu's data centers are fully designed to maintain smooth customer operations and a high degree of business continuity even in the event of natural disasters such as earthquakes and torrential rains. We also continuously train data center engineers to improve their disaster response skills and apply a variety of automation and assistance tools in the pursuit of the highest quality possible.

Dedicated data center engineers are on duty at all times with access to any required maintenance part. Even if one system component breaks down, the time required to resolve the issue and restore full operation is minimized.

Security

Security forms the core of the value provided by data centers. At Fujitsu, we pursue the tightest possible security at all levels of data center operations. State-of-the-art security technologies guard against unauthorized physical access to systems and networks to prevent leaks of customers' data.



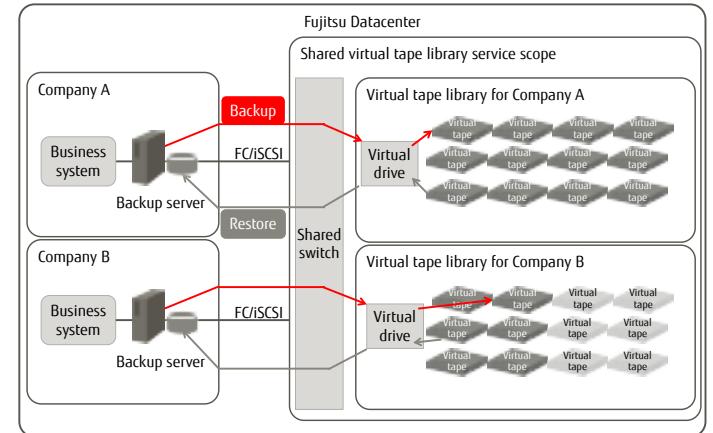
Physical Security: Biometric authentication, RFID equipment, antechambers, metal detectors and more

System Security: Protection against website intrusions such as hacking and data theft

Network security: Constant monitoring to detect intrusions and simulated attack testing to discover potential vulnerabilities

Backup

In its data centers, Fujitsu provides its Disaster Recovery Center Service to automatically back up system data and information in the event of a natural disaster. By turning a backup center into the main center when disaster strikes, we minimize customer system interruptions and data loss. A range of backup service packages are available to respond to each customer's needs and budget.



Moreover, Fujitsu's diverse selection of highly efficient ICT system services includes Internet-based services using the public cloud and the private cloud, or hybrid clouds combining the two.

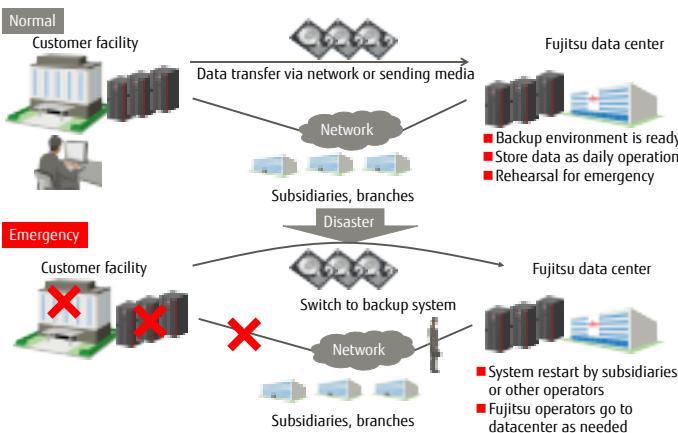
Our Data Center Service is a powerful partner, supporting customer business continuity through the effective combination of facilities, operating technologies and diverse services with high-quality products and systems.

Conclusion

Fujitsu is the only comprehensive ICT manufacturer that can, at a high level, resolve all the ICT system issues customers face. We offer products in all ICT categories, as well as operating, administrative and security software, maintenance plans, data center services and advanced solutions that help customers contribute to an abundant online world.

We safely and securely install all the components of each customer's ICT system in data centers, and then take full responsibility for their operation and administration to ensure a high level of business continuity in case unforeseen events occur.

Fujitsu also pays close attention to environmental preservation on behalf of its customers, providing efficient, waste-free ICT environments, and reducing power and resource consumption through optimal investments to manage the operation, maintenance and administration of diverse systems and installations.



Customers in Japan, for example, can use our low-cost, shared infrastructure services for virtual tape library at the Tatebayashi and Akashi Data Centers. These services are applied in the same way as conventional physical tape library devices. Here, too, we provide flexibility by letting customers increase their tape capacities in line with system expansion.

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