ReadCache System

44 Tanaka-monzen , Sakyo , Kyoto 606-8225 , Japan   Tel +81-75-703-0740   Fax +81-75-703-0738

Introducing ReadCache System 4.5

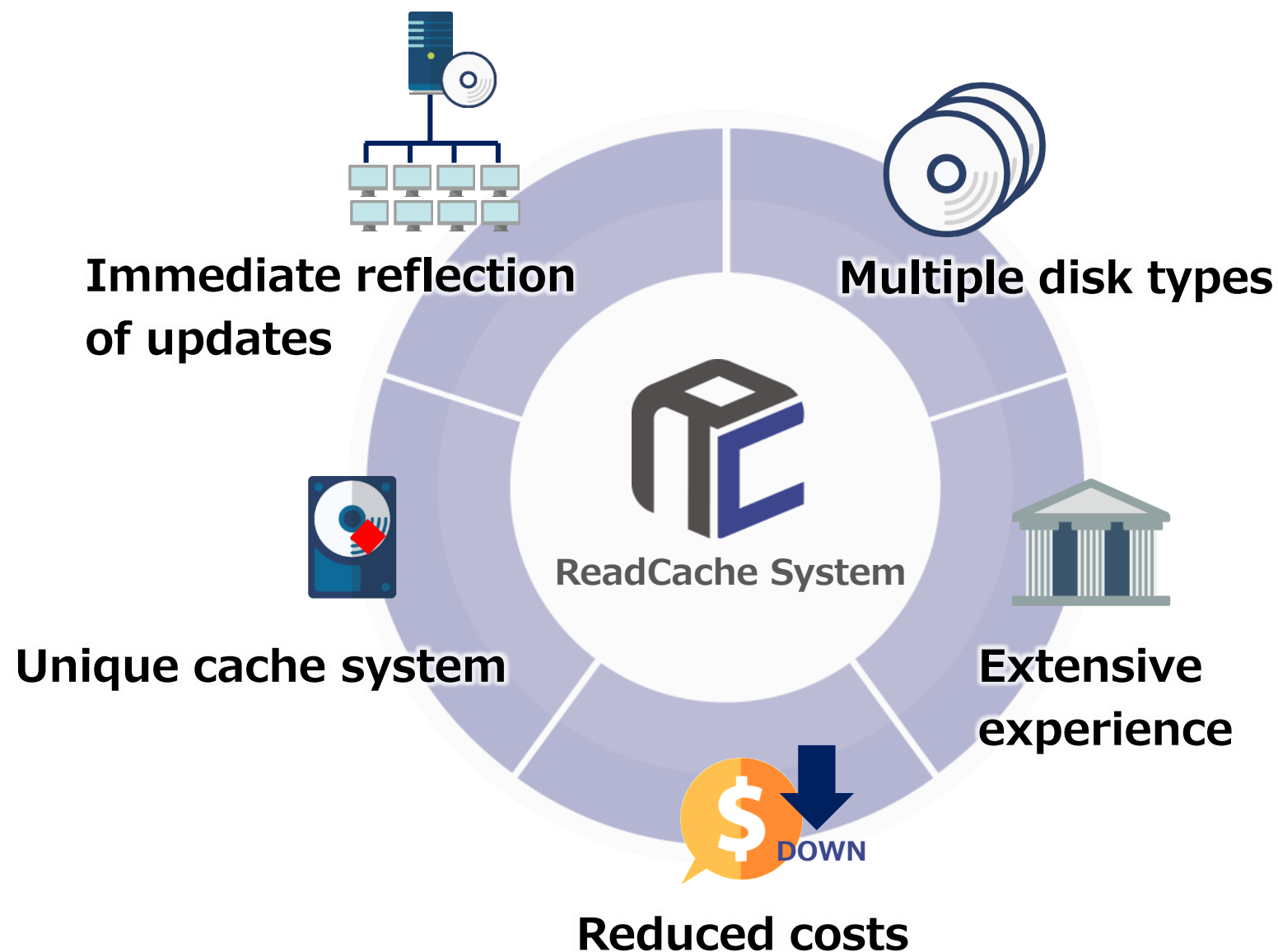CO-CONV, Corp.

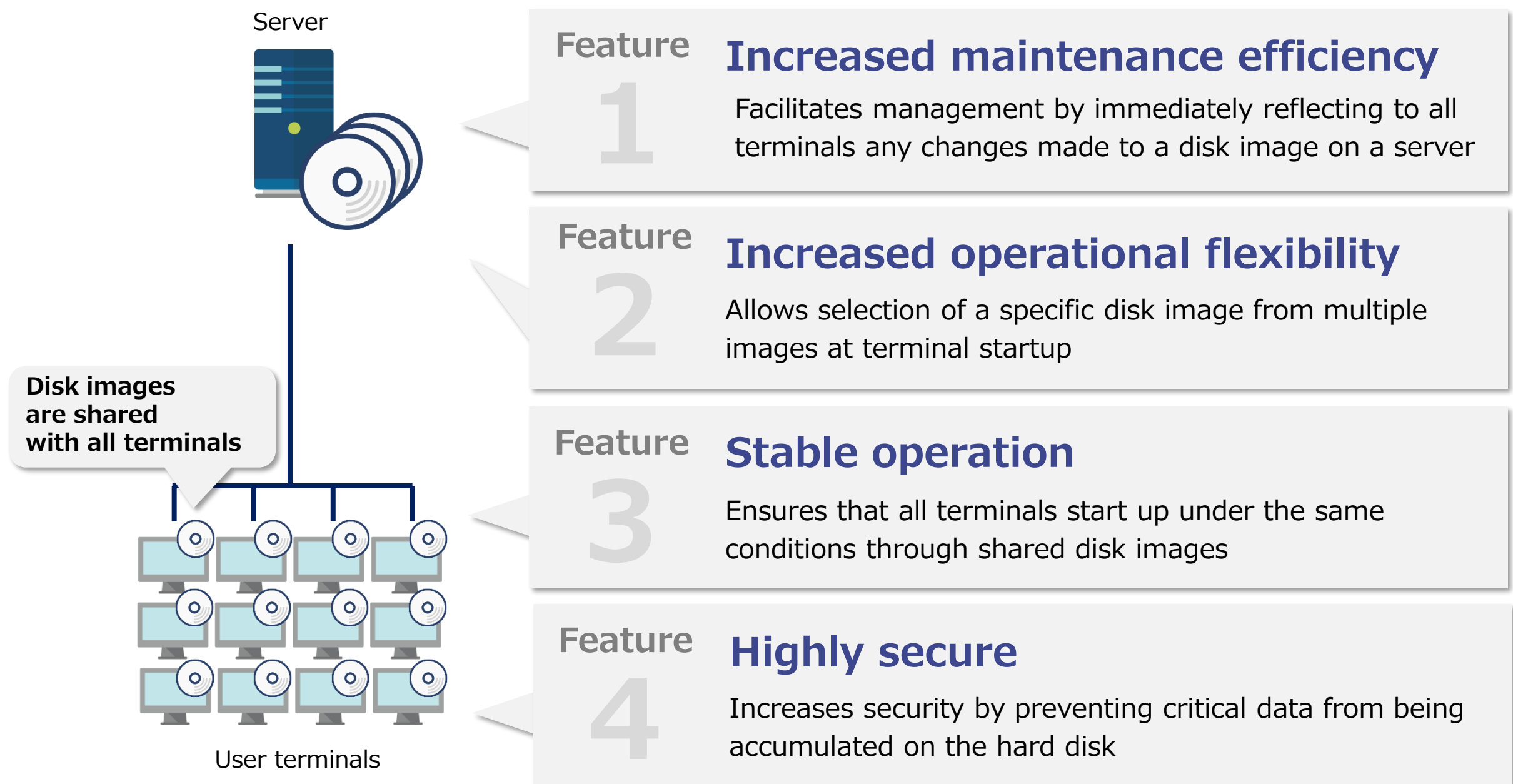Representative Director: Shin Maruyama

CONV

2016/09/13

CONV

Designed for educational institution systems, the ReadCache System software dramatically increases the efficiency of optimal network boot-type thin clients and greatly reduces installation and operating costs while remarkably improving the agility of the overall system. ReadCache is the perfect product for systems where a large number of people share a common environment, not only in educational institutions but public terminal and office terminal systems.

Immediate reflection of updates

Multiple disk types

ReadCache System

Unique cache system

Extensive experience

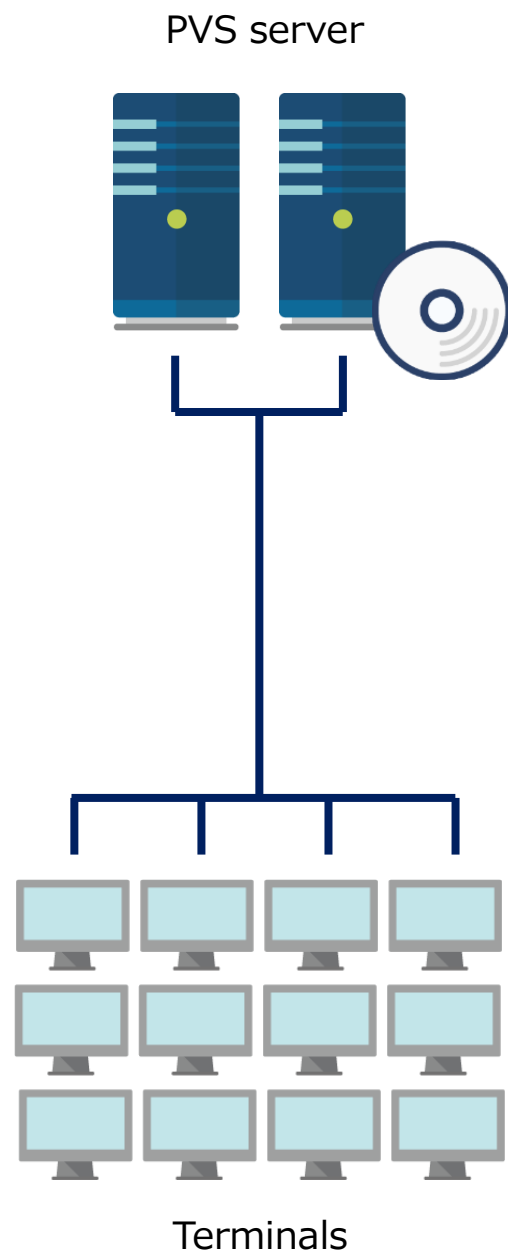$ DOWN

Reduced costs

2

2016/09/13

2. Network Booting Technology Overview

Network booting is a technology that allows hard disks that would be used for starting up individual terminals to be consolidated on a server as disk images. Network booting offers the following features.

Server

Disk images are shared with all terminals

User terminals

Feature 1
Increased maintenance efficiency
Facilitates management by immediately reflecting to all terminals any changes made to a disk image on a server

Feature 2
Increased operational flexibility
Allows selection of a specific disk image from multiple images at terminal startup

Feature 3
Stable operation
Ensures that all terminals start up under the same conditions through shared disk images

Feature 4
Highly secure
Increases security by preventing critical data from being accumulated on the hard disk

The ReadCache System consists of the following elements.

CITRIX® PVS

PVS (Citrix Provisioning Services) is used as the core system behind our network booting. **PVS is the most venerable and trusted disk distribution solution products** on the market.

(The related product **CO-Store** is the recommended disk management tool.)

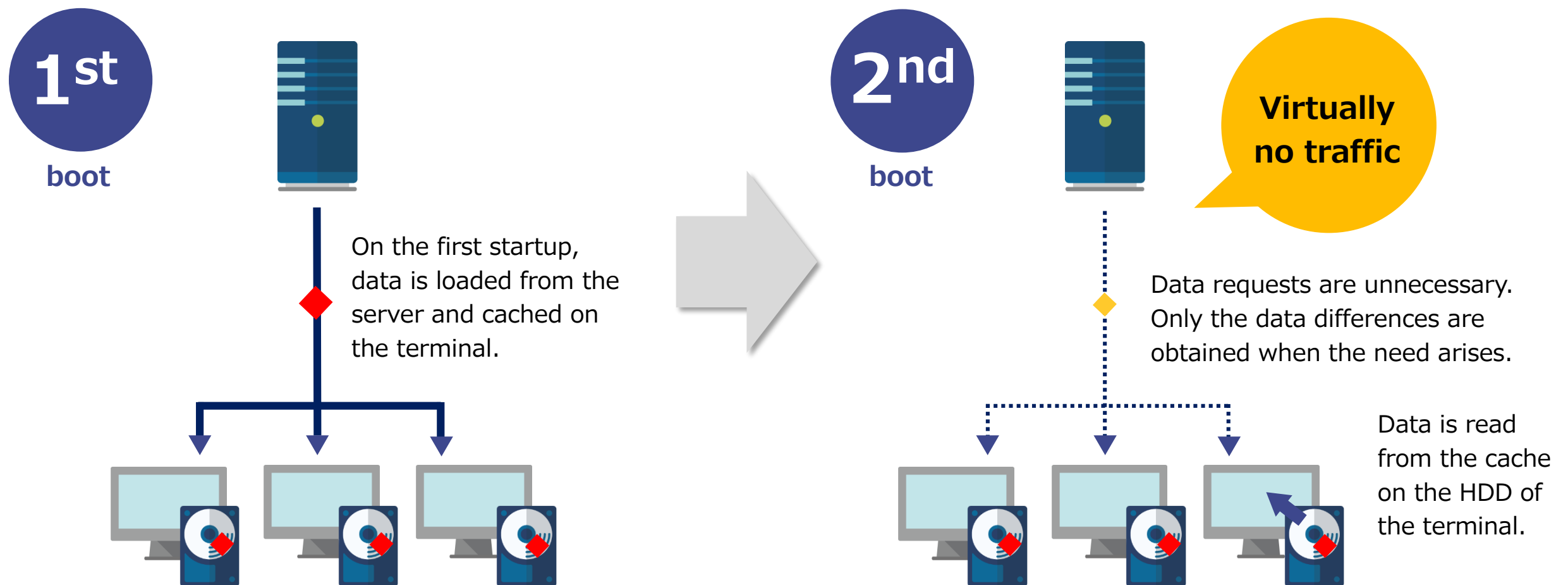CO-CONV, Corp. is a certified Citrix Solution Adviser.

ReadCache System

The ReadCache System provides **cache functionality*** to a network booting system in order to facilitate integrated management of large-scale systems and to allow for a lightweight system by, for example, speeding up terminal startup speeds.

* This cache system utilizes only the smallest amount of disk space required on the terminal **without impairing inherent network booting advantages,** including **instant reflection of any disk image changes to terminals** and the ability to **use multiple disk images with the ability to switch images at any time**.

Terminals

4

4. Operating Principles

Data read from the server is cached on the terminal's HDD, eliminating the need to request the data again after initial startup.

This not only dramatically reduces traffic but also resolves server and networking load concentration problems that have been a weak point of thin clients.

1st boot

On the first startup, data is loaded from the server and cached on the terminal.

2nd boot

Virtually no traffic

Data requests are unnecessary. Only the data differences are obtained when the need arises.

Data is read from the cache on the HDD of the terminal.

Tips

Read Cache
The idea behind ReadCache System arose out of noticing that even when data used by the OS or an application is updated, essentially the same data was being updated every time. This system is a unique patented technology that makes use of advanced regions possible with thin clients, a task that had long been considered impossible. (Japanese Patent No. 4,808,275)
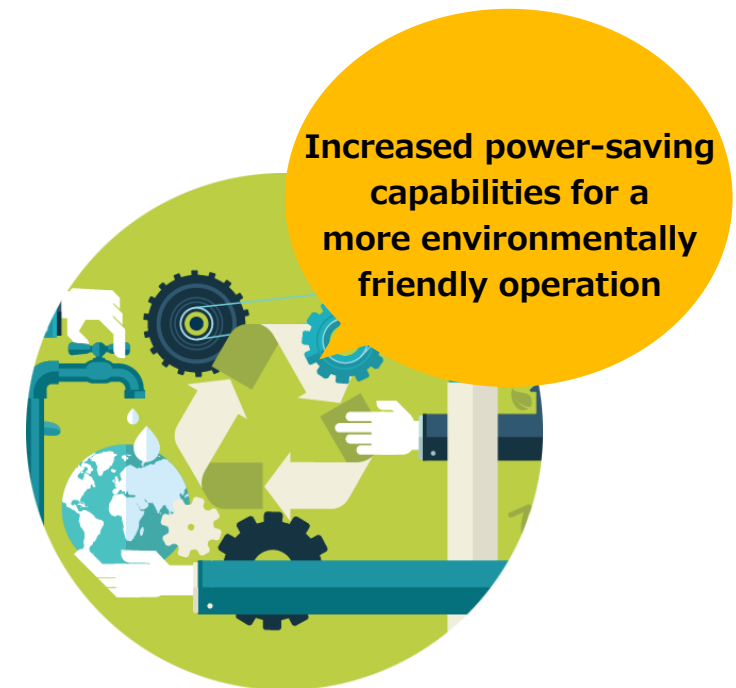
Advancements in server consolidation are rewriting the book on network booting.

Centralized management from a single location makes it possible to drastically reduce purchasing costs and operating costs.
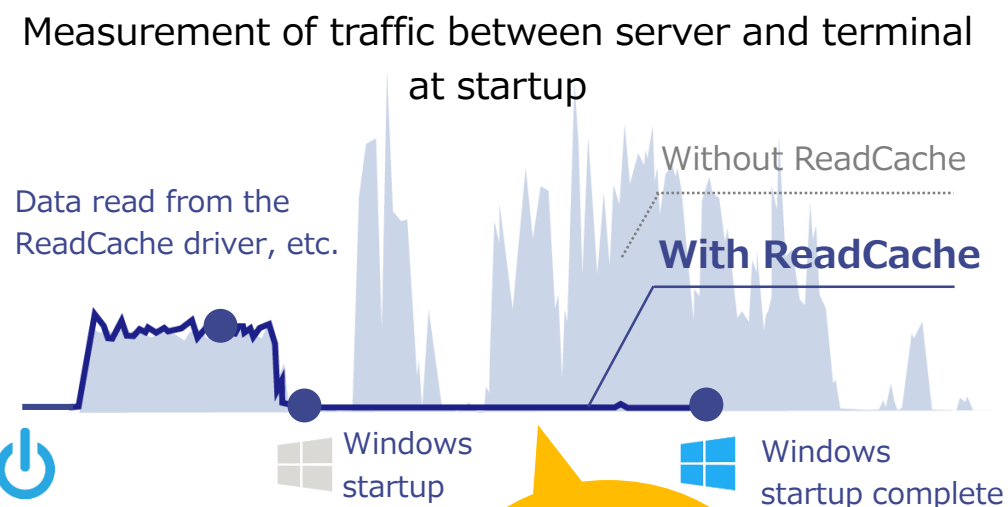
Reduced purchasing costs

More than 500 terminals on 1 server

500 terminals
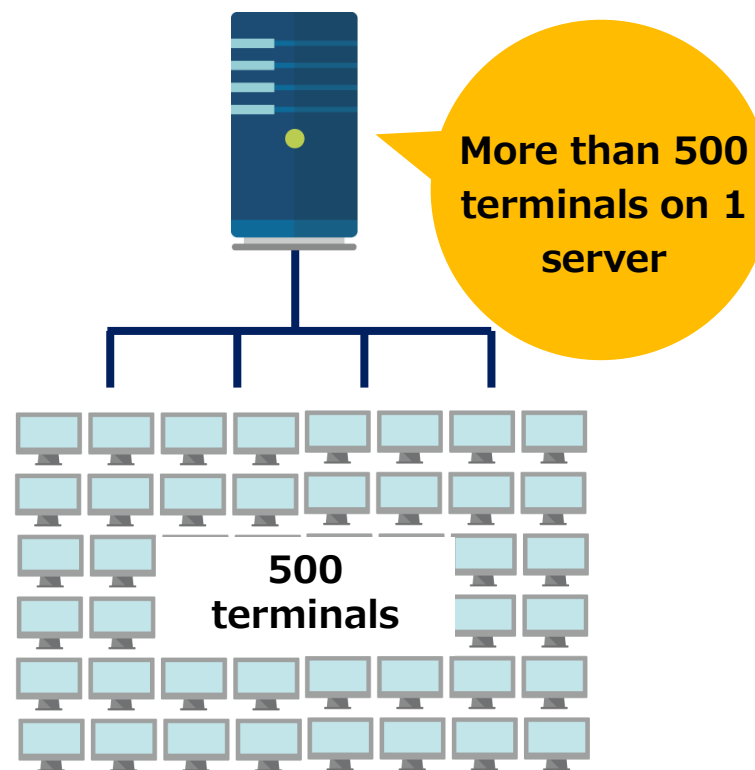
Reduced operating costs

Increased power-saving capabilities for a more environmentally friendly operation

Tips

- General server performance specifications are sufficient with no need for excessive capabilities.
- Adopting CO-CONV products has allowed Hiroshima University to reduce its power consumption by two-thirds.
- Regardless of virtual disk size, terminal cache sizes are kept to a minimum.
  (A large number of cases feature a 128 GB SSD, with HDD configurations also possible.)
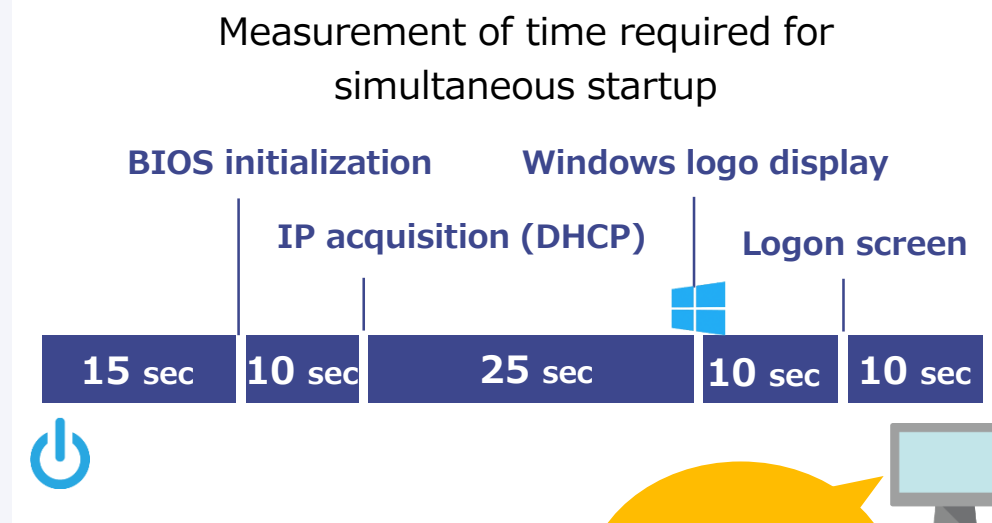
Thanks to vastly reduced traffic between the server and the terminal, there is almost no impact on startup times. Starting up hundreds of terminals at once is also no slower than starting up a stand-alone machine. No extra time spent waiting for the terminal to start up means more time that can be spent on teaching or other tasks.

Reduced traffic

Measurement of traffic between server and terminal at startup

Data read from the ReadCache driver, etc.

Without ReadCache

With ReadCache

Windows startup

Windows startup complete

Cache use virtually eliminates traffic

Reliable simultaneous startup

Measurement of time required for simultaneous startup

BIOS initialization

IP acquisition (DHCP)

Windows logo display

Logon screen

| 15 sec | 10 sec | 25 sec | 10 sec | 10 sec |

* These startup times are measured values from the actual operation environment of a specific customer.
* Startup times will vary depending on the environment.

70 seconds to startup!

Tips

Startup behavior and the Prefetch Function

For even shorter startup times, the ReadCache System features a Prefetch function that pre-loads data from memory. This function temporarily moves cached data from the slow HDD to faster memory for startup, allowing for startup times that are not plagued by the overhead generally associated with thin clients.

CO-CONV systems are developed to be able to utilize the cache at any time. This makes it possible to perform daily maintenance easily without stopping system operation.

When security is a top priority, daily updates can also be carried out with no effect on performance.
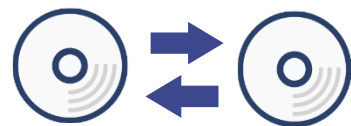
Always-available cache system
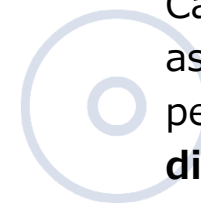
When restarting

Directly after updating

When switching disks

When rolling back

Cache characteristics

Caches can be as large as is permitted by **disk capacity**

Caches can be **as compact as 20 GB** per disk image

Caches can be created for **up to 10 disk images**

Caches will be available no matter which disk image is used for startup

Precise sector management maximizes cache efficiency and minimizes server access

Tips

Always-Available Cache System
Even if changes are made to the server disk, only the changed area (usually negligible in size) is erased, with other areas being left untouched. (Japanese Patent No. 5,290,287)
This allows for a low-cost design by assuming a low load because the cache is always available.

Thorough Security

The Image Recovery function, an essential function for a shared terminal, erases all traces of use from the terminal. To protect security and confidentiality, this function makes sure the terminal uses the same framework data from the server at every startup to ensure no user data remains on the terminal.

Image recovery

Initialization of terminal usage history when restarting

System protection with no data left on the terminal

Complete environment unification for terminal groups

Disk management tool

The related product **CO-Store** is the recommended disk management tool.

Image data can be immediately applied to a terminal for **rapid and easy security management.**

The disk management tool has been designed to make the most of the advantages associated with network booting.

Tips

- CO-Store is a disk management tool with the main feature of allowing changes to be made to an image easily and by anyone. By reducing update wait times for changes to an image to virtually zero, the tool makes it possible to perform updates quickly and easily. The ability to apply Windows updates with no delays thanks to the Automatic Disk Image Update function greatly enhances system safety.

The ReadCache System includes useful tools for understanding ReadCache operating conditions and for managing terminals.

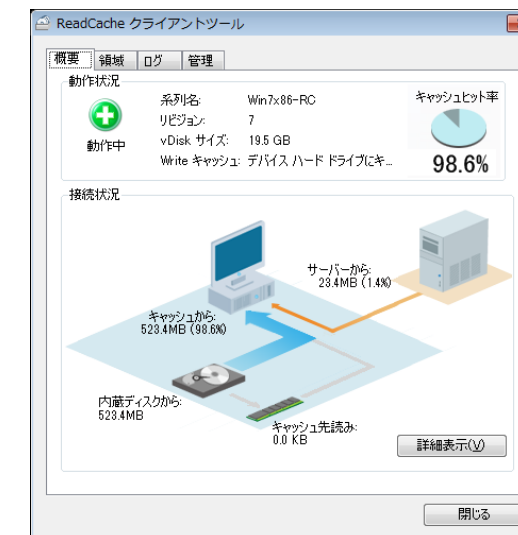## Server-side management tool

ReadCache system monitor

The server-side tool can be used from the server to obtain operating statuses and logs from client terminals installed with ReadCache all at once and to **list operating statuses for ReadCache, for terminals, or for provisioning services (PVS)**.
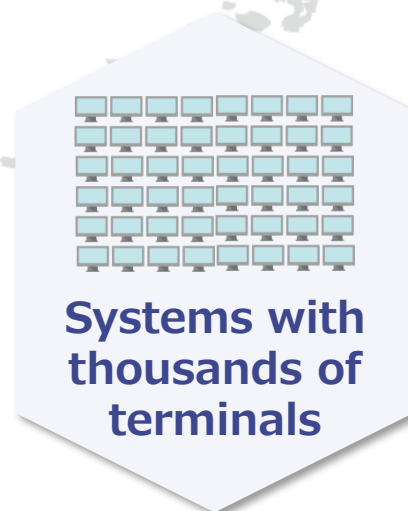
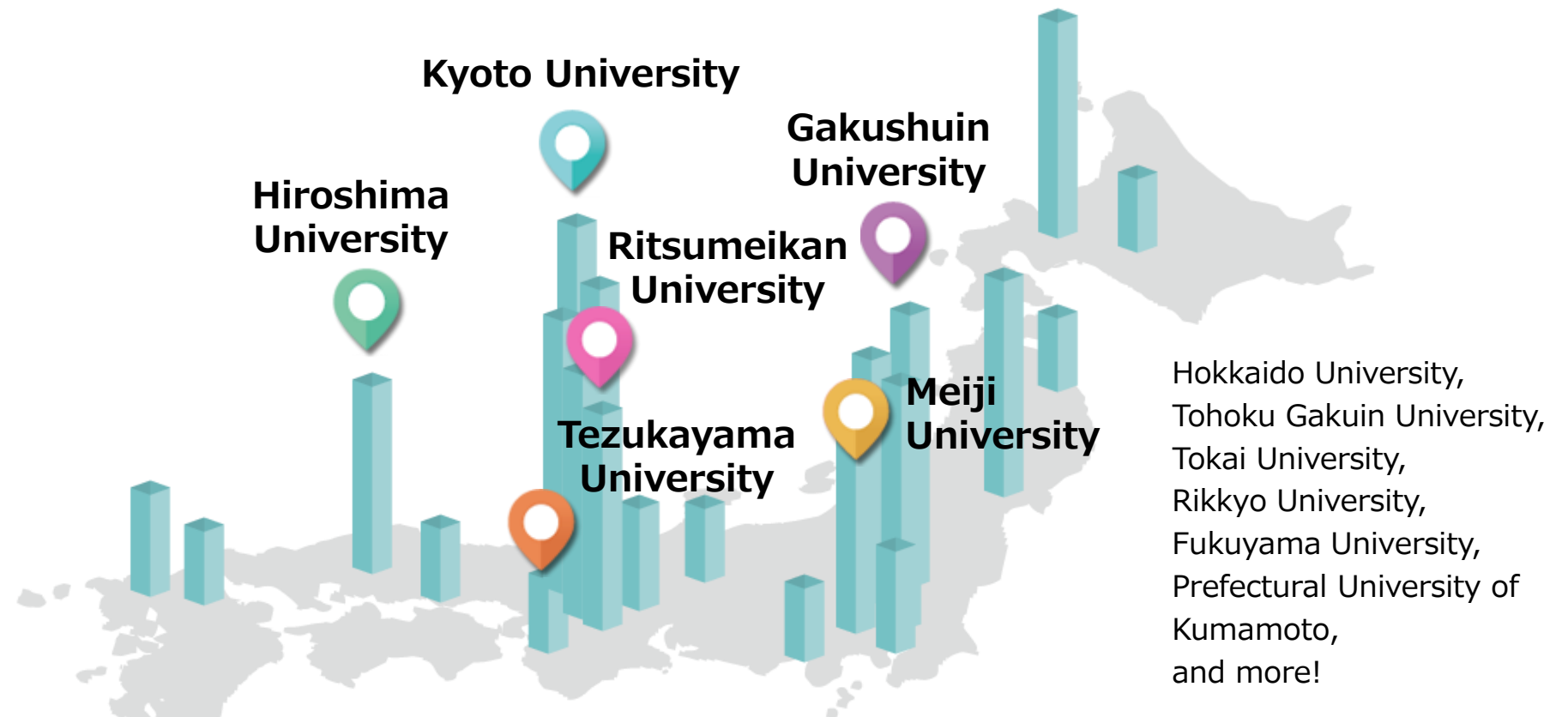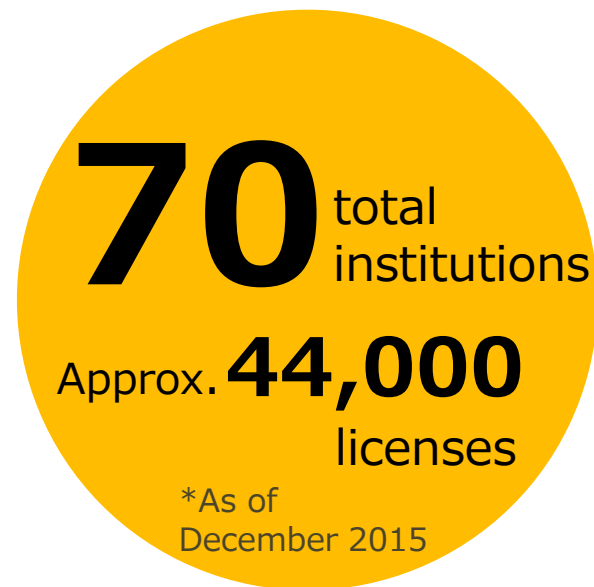## Terminal-side management tool

ReadCache client tool

This graphical tool allows administrators to **check and control the operation status of ReadCache** on client terminals.
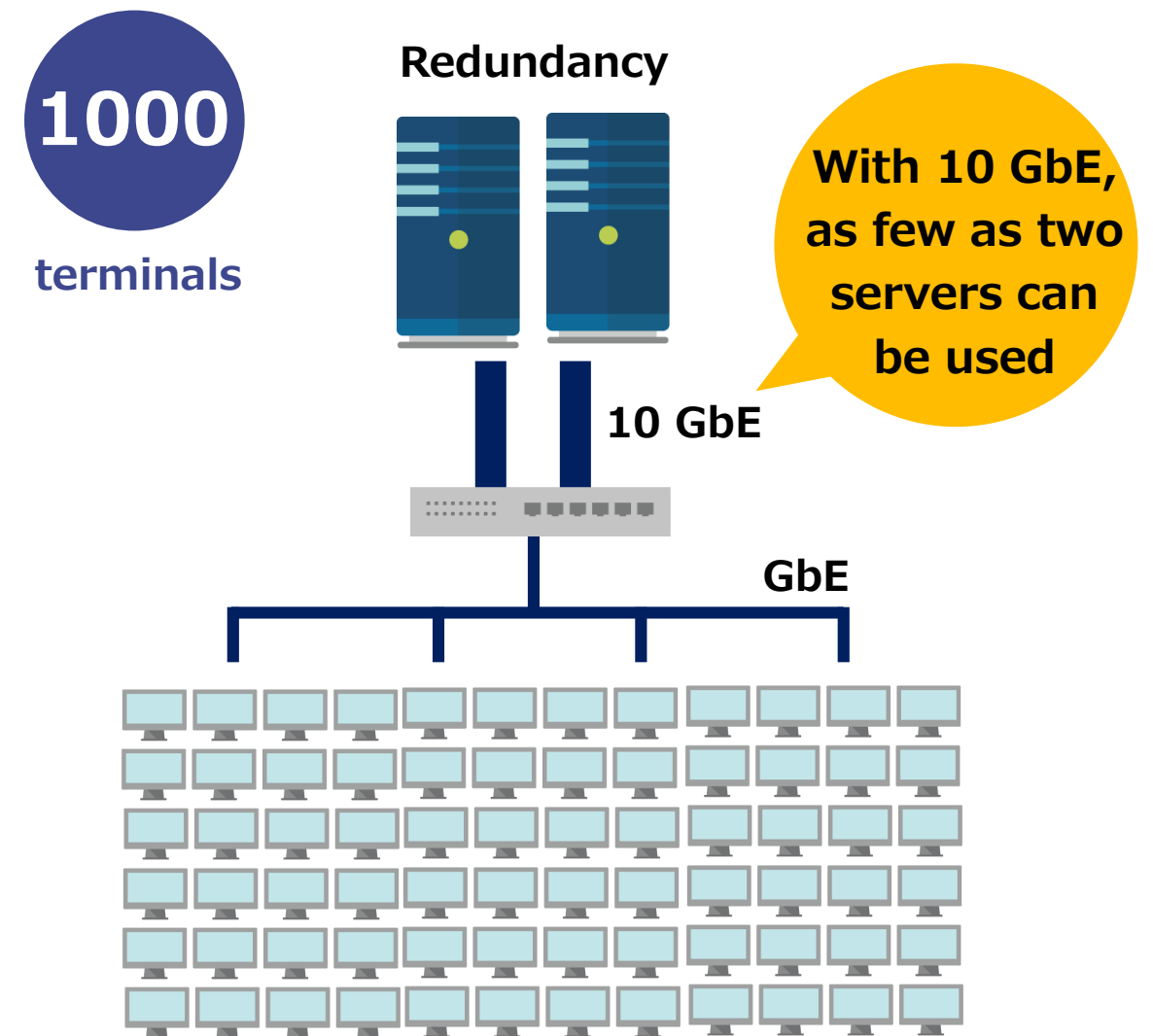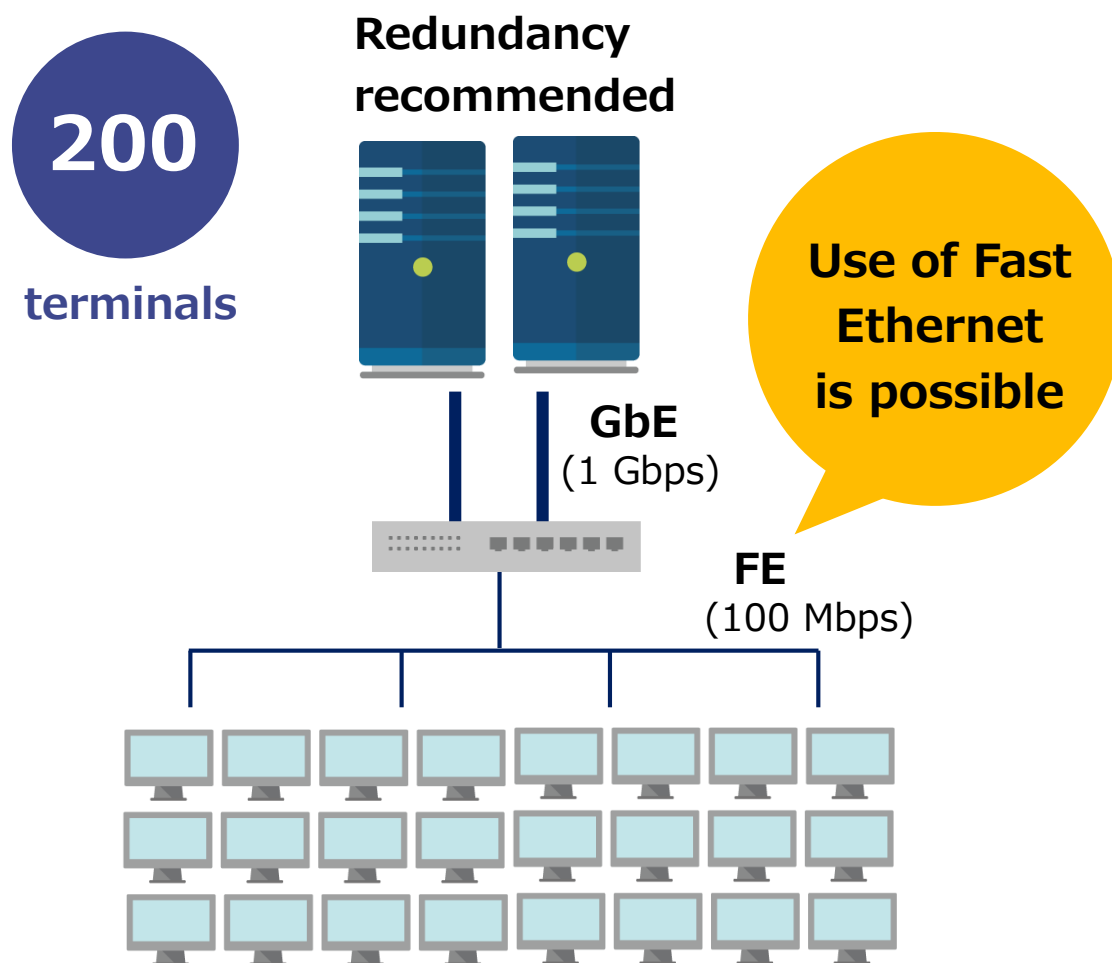
Tips

The ReadCache System has been put to use in both large and small educational institutes all over Japan. The number of institutes that have adopted the system is a testimony to the capability, quality, and reliability of the ReadCache System.

70 total institutions

Approx. **44,000** licenses

*As of December 2015

Kyoto University

Hiroshima University

Gakushuin University

Ritsumeikan University

Tezukayama University

Meiji University

Hokkaido University,
Tohoku Gakuin University,
Tokai University,
Rikkyo University,
Fukuyama University,
Prefectural University of Kumamoto,
and more!

State-of-the-art systems

Systems with thousands of terminals

Language systems

Professional training

Integrated management of remote campuses

11

6. Configuration Examples

Because there is virtually no traffic between the server and the terminal, even older Ethernet networks can be used.

200
terminals

Redundancy recommended

GbE
(1 Gbps)

Use of Fast Ethernet is possible

FE
(100 Mbps)

1000
terminals

Redundancy

10 GbE

With 10 GbE, as few as two servers can be used

GbE

Tips

• A bandwidth of at least 1 Gbps or so per 100 unit terminals is recommended for the uplink in each classroom.

7. Actual Introduction Examples

The ReadCache System has been extensively adopted by many institutions across Japan, mainly universities.

Kyoto University

6 servers   **1400** terminals

Introducing the **CO-Store** and **CO-Client Operation** related products simultaneously **enables both centralized management and flexible configuration of large-scale systems.**

Gakushuin University
(2 campuses)

4 servers   **1900** terminals

By constructing a network booting system with **four consolidated servers** and a large number of terminals, Gakushuin University was able to **minimize both installation and operating costs**. Using cache technology, startup times are kept at **less than 90 seconds**.

Small-scale projects

Numerous small-scale projects with **50 terminals** have been introduced. These projects offer the **same benefits** as large-scale institutions, including **reduced installation and operation costs**, and **lightweight startup**.

Kyoto University

Gakushuin University

Fukuyama University,
Prefectural University of Kumamoto,
and more!

8. Specifications (Operating Environment)

CONV

Operating Environment

Server

Windows Server 2008 R2
Windows Server 2012
Windows Server 2012 R2

- The operating requirements for the server OS are the same as for Citrix XenDesktop.
- Operation verification has been performed using Windows Server 2008 R2 SP1 and Windows Server 2012 R2 (both Standard Edition).

User terminal

Windows 7
Windows 8
Windows 8.1
Windows 10

- Both 32- and 64-bit systems are supported.
- The operating requirements for the user terminal OS are the same as for Citrix XenDesktop.
- A dedicated ReadCache partition must be created on the HDD.
  The size of the partition where the cache will be saved can be specified as desired, but at least 20 GB is recommended for each disk image.
- Operation verification has been performed using Windows 7 Enterprise (32-bit/64-bit) SP1 and Windows 8.1 Enterprise (32-bit/64-bit).
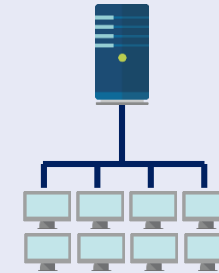
Network booting environment

Citrix Provisioning Services 7.0
Citrix Provisioning Services 7.1
Citrix Provisioning Services 7.6
Citrix Provisioning Services 7.7
Citrix Provisioning Services 7.8
Citrix Provisioning Services 7.9

- Citrix Provisioning Services is provided as a function of Citrix XenDesktop.

8. Specifications (Functions and Restrictions)

Functions

Basic functions	• The content of a disk image on the server is cached on the terminal's HDD. • The terminal uses this cache for operation, allowing for reduced server access and thus reduced server load. • Terminals with insufficient hard disk space can also operate without using the cache function. • Up to 10 disk images can be cached on a terminal. • Startup times are reduced through cache pre-loading when starting up the terminal. • The terminal uses this cache even when updating a disk image, allowing for reduced server access and thus reduced server load. • When updating a disk image, the terminal uses the always-available cache system rather than completely erasing the cache on the terminal. • When rolling back to a previous version, the terminal uses the always-available cache system rather than completely erasing the cache on the terminal. • Maximum terminal cache sizes can be specified. • Virtual disks on the server can be changed without needing to clear the terminal cache. • Both MBR and GPT format terminal hard disks are supported.
Management functions	• A tool for displaying the cache operating status is included with both server-side and terminal-side systems. • Notifications can be sent to administrators via e-mail or HTTP request in the event a terminal is operated without using the cache.

Restrictions   The following restrictions are present in the Citrix Provisioning Services settings.

VHD format	Fixed and Dynamic supported
vDisk access mode	No restrictions
Cache types (Cache write destination)	Support for device hard drive, device RAM, and server caches. (However, persistent caching settings are not supported.)
Other restrictions	Automatic vDisk updating (image updating using hypervisor) is not supported by PVS. When no server filter function is used, use of vDisk mounting is limited.

15

9. Inquiries

Product Inquiries

Exclusive sales distributor

ReadCache System Group, 1st Government and Public Solutions Division, NEC Corporation
mosimosi@elsd.jp.nec.com

Technical Inquiries

Developer

CO-CONV, Corp.
mosimosi@elsd.jp.nec.com

Making PC management enjoyable.