



WHITE PAPER

Improving the Reliability of New Platforms with Clustering Solutions: An Analysis of Best Practices for the Cloud and in Emerging Economies

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IDC OPINION

Companies and organizations consider improving the availability of the IT systems that support their businesses and services to be a crucial task that they must undertake. The use of clustering solutions that employ availability and clustering software is one of the most effective measures for increasing system up-time. NEC intends to provide a high degree of reliability to companies and organizations through the promotion of clustering solutions that use its EXPRESSCLUSTER products (called CLUSTERPRO in the Japan market).

The major points of this white paper are as follows:

- In the Asia-Pacific region (APAC), the market for availability and clustering software has continued to experience strong growth, and there is growing demand relating to high-availability. In 2013, NEC retained its position as the number one vendor in terms of revenue share for the fifth year in a row; the company first having achieved that distinction in 2009.
- Availability and clustering software is being increasingly installed on x86 server platforms running Linux and Windows. NEC has firmly established its position as the leader in this niche in the APAC marketplace – for both Linux and Windows systems. The company's lead in 2013, in terms of revenue share among vendors, from Linux systems in particular was considerable, with NEC taking 35.2% of the market segment.
- Going forward, improving availability for IT systems built on new platforms such as virtualization and the cloud will be a crucial problem to solve. NEC has already undertaken this task and has achieved a balance between cost reductions and improved reliability with its cloud-based clustering solutions – which combines public cloud services with availability and clustering software.
- NEC is accelerating its global strategy. The company is focusing in particular on offering clustering solutions in newly emerging countries that are adopting IT at a rapid pace. This report analyses three NEC business cases: improving the reliability for enterprise resource planning (ERP) systems in the manufacturing industry in India and implementing disaster recovery (DR) solutions for both banks in Nepal and insurance firms in Saudi Arabia.
- NEC's strategy for the EXPRESSCLUSTER line is succeeding in expanding the horizon of possibilities for clustering solutions, largely through three major moves: quickly supporting a variety of platforms; improving reliability by upgrading core functions; and expanding the scope of application for systems like EXPRESSCLUSTER to more areas, including DR and the cloud.

- To foster more trust among their customers, partners, and employees, companies and organizations must make adequate investments to ensure the high-availability of their IT systems. Furthermore, IDC believes that such companies and organizations would do well to select vendors that can flexibly support their needs and that have highly reliable clustering solutions.

IMPROVING IT SYSTEM AVAILABILITY – A CRITICAL TASK

IT plays a crucial role in a wide range of activities in which companies and organizations engage. Much work is underpinned by IT systems, and nowadays it is almost taken as given that service will be available 24 hours a day, 365 days a year – as well as across national and regional borders. In other words, companies and organizations are dependent on IT systems to the extent that they underpin operations. Consequently, the level of reliability demanded of IT systems increases with each passing day, and high availability for IT systems can be said to be one of the most critical problems within IT strategy.

The single thing on which IT managers must focus the most is unforeseen system downtime. Clearly, system outages can cause loss of business opportunities because companies may have to halt doing business or offering services. Furthermore, there are various unquantifiable effects, including loss of trust among stakeholders such as customers, business partners, and owners of company stock. In part to avoid such situations, IT managers must protect data and application resources that are critical to doing business and providing services from suddenly occurring faults in hardware, OSs, and applications, as well as from disasters, such as earthquakes and fires. It is particularly essential to ensure high availability for mission-critical systems, such as those required for companies' core business (financial accounting, sales management, etc.) and those for web services aimed at customers (electronic commerce sites, online transactions, etc.).

There are various means of increasing IT system availability. What is crucial, however, is the ability to transfer workloads to other hardware without stoppages to business or services when faults occur. This can be achieved through the use of clustering software. Such solutions are diversifying, including into failover solutions that transfer systems from operations servers to standby servers, as well as into data mirroring and DR. Moreover, virtualization and the cloud have quickly become fixtures of the IT world, and the improvement of availability for new platforms such as these will be an even more crucial task in the future.

IDC defines software that has features that increase system availability, including clustering software, as *availability and clustering software*. This white paper presents an overview of trends in the APAC availability and clustering software market and considers the future for NEC's strategy for using its clustering software EXPRESSCLUSTER in clustering solutions. Specific NEC user case examples will also be analyzed.

CURRENT CONDITIONS FOR CLUSTERING SOLUTIONS IN APAC

Trends in the APAC Availability and Clustering Software Market

In 2013, the size of the availability and clustering software market in APAC shrank at a rate of 10.2% year-over-year (YoY), falling to \$313.7 million. In the Japanese market, there was growth of over 5% on a Japanese yen-basis. However, from 2012 to 2013, the yen depreciated considerably.

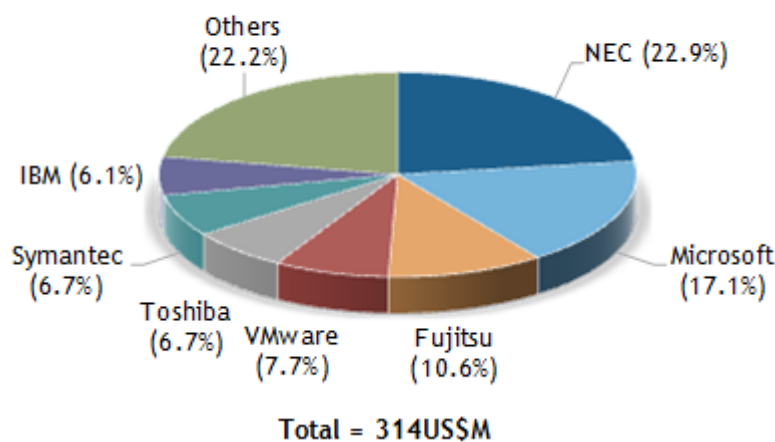
Therefore, it should be noted that negative growth on a dollar-basis was affected by exchange rates. The APAC market excluding Japan shrank only slightly.

Server virtualization has become common throughout the region, and there is an increasing trend of trying to achieve high availability for virtual infrastructure using availability and clustering software. Furthermore, those companies that are on the forefront of their industries have developed virtualization to move toward the use of private clouds, and there have been some cases of companies adopting availability and clustering software to improve the reliability of those clouds. APAC is also a region prone to disasters such as earthquakes, and there are an increasing number of companies making use of availability and clustering software to implement DR systems to ensure business continuity.

Revenue shares by vendor in the APAC availability and clustering software market in 2013 are shown in Figure 1. NEC, which developed and now sells EXPRESSCLUSTER, has the top share in the market, at 22.9%. This is the fifth year in a row (since 2009) that the company has held that position.

FIGURE 1

Revenue Shares by Vendor in the APAC Availability and Clustering Software Market, 2013



Note: APAC includes Australia, China (the People's Republic of China), Hong Kong, India, Indonesia, Japan, South Korea, Malaysia, New Zealand, the Philippines, Singapore, Taiwan, Vietnam, Thailand, and others.

Source: IDC Asia Pacific, January 2015

Clustering Solutions in the Major APAC Countries

Figure 2 presents forecasts for the compound annual growth rates (CAGRs) of the markets for availability and clustering software from 2013 to 2018 in the APAC economies of Japan, China, India, economically advanced areas of Asia and Oceania (South Korea, Hong Kong, Taiwan, Australia, and New Zealand), the five major ASEAN nations (Indonesia, Malaysia, the Philippines,

Singapore, and Thailand), and newly emerging and other APAC countries (Vietnam, Myanmar, Nepal, Laos, Cambodia, Bangladesh, Sri Lanka, and others). Forecasted CAGRs are: 2.4% in Japan, 5.9% in China, 9.0% in India, 3.7% in economically advanced areas of Asia (excluding Japan), 1.4% in the five major ASEAN countries, and 5.4% in newly emerging Asian countries and the rest of APAC. The following sections describe market trends in different countries.

Japan

In 2013, the size of the market was \$218.4 million. Japan makes up approximately 70% of the entire APAC market. Because more companies are implementing mission-critical systems, including databases and ERP in virtual environments, high-availability solutions for virtualized environments that use availability and clustering software are the subject of much interest. Furthermore, Japan is a country with a high frequency of natural disasters, and as a result there has been an increasing number of cases of companies using availability and clustering software in DR solutions.

China

The size of the market in China in 2013 was \$17.2 million, making the country the third largest market in APAC, after Japan and Australia. Major companies – including banks and firms in the securities, communications, and manufacturing industries – have continued to implement large-scale mission-critical systems. Demand for high-availability solutions that use availability and clustering software is thus increasing. In addition, a large number of companies have made progress in datacenter virtualization and the implementation of private clouds, adding to the number of projects undertaken to achieve high availability for mission-critical applications in virtual environments. IDC believes that these trends will continue into the future and forecasts a CAGR of 5.9% for 2013 to 2018.

India

The size of the market in India in 2013 was \$15.4 million – quite close to the scale of the market in China. The sectors driving the market are finance, communications, government, and IT services. In India, there are frequent power outages due to insufficient supplies of electricity, so high availability has become essential for IT systems. Windows-based servers are a mainstream in India, but in recent years, there has been increased adoption of Linux-based servers, particularly among small and medium-sized businesses (SMBs). Because of this, clustering solutions for Linux systems are now receiving considerable attention. India is somewhat behind other major countries in terms of implementing virtualization, but it is expected that virtualization will accelerate in the near future. Therefore, IDC believes that demand for high availability in virtual environments will increase. IDC forecasts a CAGR of 9.0% in India for 2013 to 2018. This is the highest rate among the major APAC countries; considerable market growth is predicted.

Advanced Economies of Asia and Oceania

In 2013, the size of the market in the advanced economies of Asia and Oceania (Australia, Hong Kong, South Korea, New Zealand, and Taiwan) was \$46.1 million. Virtualization has become extremely widespread in Australia – which is the second-largest market in APAC, after Japan – and there is increasing demand for high-availability solutions for virtual environments. In South Korea, where the Internet content industry is growing rapidly, high-availability solutions have been increasingly implemented as a result of datacenter expansion. Growth in the market reached 4.3%

in 2013. In the advanced economies of Asia and Oceania, IDC forecasts a CAGR of 3.7% for 2013 to 2018 and thus predicts strong growth.

Five Major ASEAN Countries

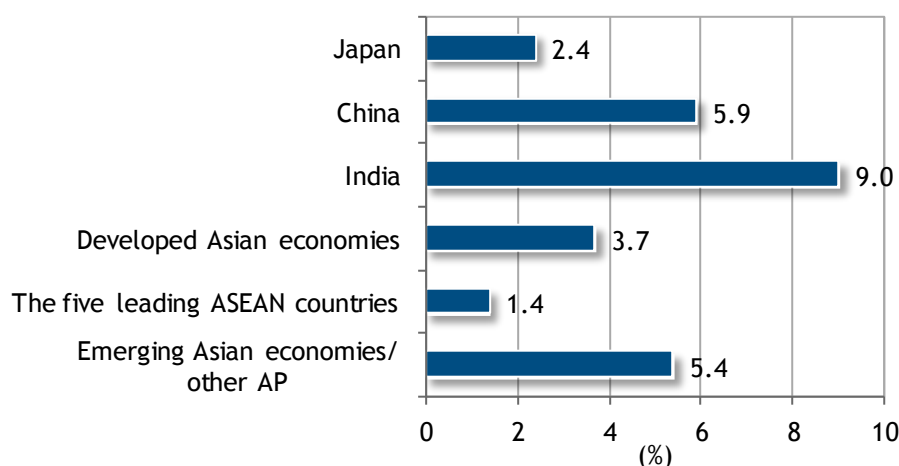
In 2013, the size of the market in the five major ASEAN countries was \$15.7 million. Singapore, with a share of 62%, was the main driver of the market in the ASEAN Big Five. Numerous global firms have a presence in Singapore, and many datacenters have been constructed there. In particular, there are now more datacenters oriented toward the cloud. Awareness of high availability is extremely high, and the need for clustering solutions has been growing rapidly. In the Philippines – where numerous major firms have a presence – more companies are striving to implement DR measures; 2013 growth was 2.4%.

Newly Emerging Countries in Asia/Other Countries in APAC

The newly emerging countries of Asia include Myanmar – which more major manufacturers are entering – and Laos – which has had impressive economic growth. There are high expectations that these nations will be new growth countries within the APAC market in the future. The current size of the availability and clustering software market is still small, but high growth at a CAGR of 5.4% is expected for 2013 to 2018. IT is being implemented in these countries at an extremely rapid pace, and as a result, demand for high availability in IT systems should grow.

FIGURE 2

Forecasted 2013-2018 Compound Annual Growth Rates in the APAC Availability and Clustering Software Market



Notes:

- "Developed Asian economies" refers to Korea, Hong Kong, Taiwan, Australia, and New Zealand.
- "The five leading ASEAN countries" refers to Indonesia, Malaysia, the Philippines, Singapore, and Thailand.
- "Emerging Asian economies/other AP" refers to Vietnam, Myanmar, Nepal, Laos, Cambodia, Bangladesh, Sri Lanka, and others.

Source: IDC, January 2015

Clustering Solutions for x86 Server Platforms: Increased Demand for Linux and Windows

In 2013, the size of the market for availability and clustering software for Linux in APAC was \$118.0 million. The market for Linux-based software constitutes 37.6% of the availability and clustering software market. The market for software that runs on Linux has grown because Linux is taking over the role formerly played by UNIX in mission-critical systems that require high availability. For example, the New York, London, and Tokyo stock exchanges have all adopted Linux as the platform for their trading systems. These are the examples that are most famous globally, but companies and organizations in general are increasingly adopting Linux for mission-critical systems, and availability and clustering software solutions have been developed that, when deployed on these systems, increase availability.

In 2013, the size of the market for availability and clustering software for Windows was \$133.66 million. Virtualization is increasingly being used on x86 servers, and many of these servers run Windows and applications via hypervisors. High availability has become a requirement for such systems, and there are increasing opportunities to use availability and clustering software that runs on Windows.

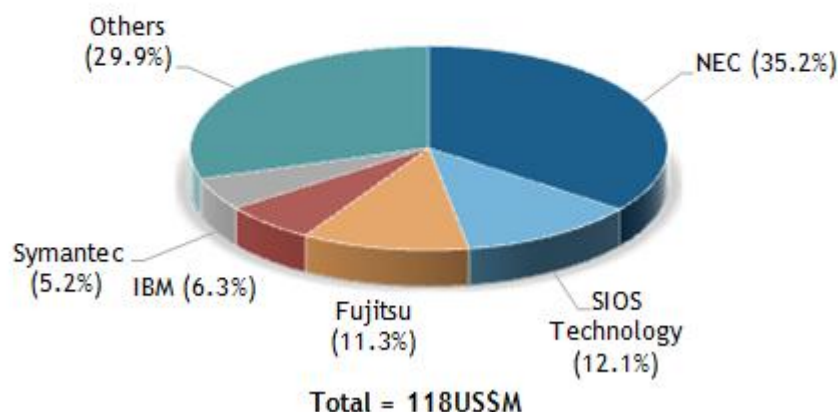
The growth of the market for availability and clustering software for Windows and Linux combined can be understood as the result of increasing needs for high availability on x86 servers. Servers with x86 architecture continue to be used more and more for systems for which downtime is unacceptable – including companies' mission-critical systems, online systems for financial and ecommerce (EC) sites, and platforms for social networking services. Thus high availability is now required in more cases, and demand for availability and clustering software will increase to an even greater extent than before.

Shares of the Market for Linux-based Availability and Clustering Software

Figure 3 presents 2013 revenue shares by vendor in the APAC market for Linux-based availability and clustering software. NEC, which has the highest share of the overall market – which includes non-Linux-based software – captured a 35.2%-share of the Linux segment to become the market leader. The company turned its attention to the growth potential of the Linux market at an early stage and strove to launch and then enhance products that run on Linux before other vendors, such as by making efforts to support a variety of Linux distributions. NEC has gained a diverse customer base that includes communications companies, government agencies, and manufacturers, as well as financial firms – which have increasingly adopted Linux for mission-critical systems and for which NEC has performed large-scale implementations with 100 nodes or more. In addition to holding the top share for Linux-based solutions, NEC had the second-highest revenue share among vendors of Windows-based availability and clustering software in APAC, capturing 22.7% of the market. Thus NEC has established itself as the leader of the market in APAC for availability and clustering software for use on x86 server platforms.

FIGURE 3

Revenue Shares by Vendor in the APAC Linux-based Availability and Clustering Software Market, 2013



Note: APAC includes Australia, China (the People's Republic of China), Hong Kong, India, Indonesia, Japan, South Korea, Malaysia, New Zealand, the Philippines, Singapore, Taiwan, Vietnam, Thailand, and others.

Source: IDC, January 2015

DEMAND FOR HIGH AVAILABILITY ON NEW PLATFORMS

The Importance of High Availability in Virtualized Server Environments

Server virtualization that uses virtual machine software – notably hypervisors – is currently becoming more prevalent at a rapid pace. Behind the rapid rise in deployments of virtualized servers is the benefit of greatly reducing the costs of hardware, operations, and maintenance that can be gained by consolidating physical servers. However, there is a corresponding rise in the level of risk associated with any given system because multiple applications are consolidated onto a single physical server. For instance, when a physical server goes down, so do all the virtual machines running on it. The risk increases in step with the degree of server virtualization, which means that high availability will be sought after to an even greater extent than previously.

Virtualization software packages that include hypervisors and modules with features for managing virtual environments sometimes also come with modules with features intended to provide high availability. However, there are many aspects in which such packages are inadequate in terms of high-availability features: among other defects, they may have insufficient features for dealing with sudden failures, and they may be unable to monitor applications running on guest OSs. Therefore, it is crucial to use third-party availability and clustering software to ensure high availability at every layer from the physical machine to the virtual machine and the application.

There are currently multiple options for hypervisors including VMware vSphere, Windows Server 2008 Hyper-V, and Windows Server 2012 Hyper-V, as well as open-source software such as Xen

and KVM. Each option differs from its competitors in such terms as functionality, performance, and price. Users are beginning to adopt different hypervisors based on the intended use of the system or on other criteria, so mixed-hypervisor environments are likely to become more common. If that happens, then vendors will need to contemplate ways of comprehensively managing the availability of virtualized environments that are deployed using different hypervisors.

Improving Reliability for IT Systems in the Cloud Is Essential

There has been a notable increase in the use of public cloud services in recent years. According to IDC, the global public cloud service market grew by 24% YoY in 2013. Growth in newly emerging regions was particularly striking: the APAC region excluding Japan grew by 30%. An area in which there is rapidly increasing use of public cloud services is infrastructure as a service (IaaS), in which server and storage resources are provided as services. Notable examples of IaaS include Amazon Web Services, Microsoft Azure, and Google Cloud Platform.

Overall use of IaaS has increased because there has been an accelerating trend toward building corporate IT systems on IaaS. Benefits of IaaS from companies' perspectives are that they can build IT systems while only paying for the IT resources that they actually use – rather than paying to own these resources in-house – and that there is greater freedom to run different applications relative to software as a service (SaaS) – in which the service provided is the direct use of specific applications. There are increasing numbers of cases of companies building and running mission-critical systems, such as ERP systems, on top of IaaS.

With IaaS, the level of service is guaranteed for the infrastructure but not for the applications running on it. That is, users must take personal responsibility to respond to faults or problems that occur in applications. Furthermore, virtual machines and OSs running on IaaS also sometimes have problems, depending on the resource usage environment. To handle such situations, it is necessary to improve the availability of software run on IaaS. The adoption of availability and clustering software that improves the reliability of IT systems on IaaS is one of the leading solutions for achieving this.

It is necessary to pay attention to the IaaS platforms on which a given piece of availability and clustering software is guaranteed to work. There are still few availability and clustering software packages that are explicitly guaranteed to work with IaaS, so it is necessary to confirm the available software options when selecting cloud services.

The public cloud service market will continue to grow into the future. IDC predicts that the 2013-2018 CAGR in the Japanese market will be 23.5%, while that in the rest of APAC, excluding Japan, will be 28.1%. Both these growth rates exceed that forecasted for the market globally, which is 22.8%. Given those conditions, it is likely that demand for clustering solutions will increase as a large number of mission-critical IT systems are built on IaaS.

DR Delivered at Low Cost

As the 2011 Great East Japan Earthquake demonstrated, major disasters always have at least some chance of occurring anywhere in APAC – and in any other region worldwide. When companies are doing business, they must be aware of the many risks they face simultaneously, including earthquakes and other natural disasters, terrorism, riots, and wars. Asia is a region that is especially prone to earthquakes. It is necessary to consider both the primary risk of buildings collapsing and the risk of secondary damage, such as the disruption of the electrical grid or other

essential infrastructure. To mitigate risks from disasters of all kinds, companies' information systems departments must build DR systems at their datacenters.

The most important task when implementing DR systems is to minimize downtime during disasters. This is because it is pointless to prevent data loss by transferring data and applications to other datacenters via backups or other means if it takes time to restore systems to the point where business as usual is again possible; lost opportunities during the time before systems are restored cannot be regained. Means of continuing operations at other datacenters without any downtime are required.

High availability solutions that use availability and clustering software can be used to build such DR mechanisms. It is possible to build production environments that are run at primary datacenters by implementing clustering systems that use remotely located datacenters and failover capabilities. There are various solutions for DR, but this method is a solution that delivers a high degree of reliability at a low cost; an increasing number of companies are implementing it.

NEC'S CLUSTERING SOLUTIONS

The Leading Company for Availability and Clustering Software

NEC boasts the top share of the Japanese x86 server market. According to a May 2014 IDC report, NEC had the number-one share of x86 server unit shipments in Japan: 23.5%.¹

As mentioned previously, NEC – the developer and vendor of EXPRESSCLUSTER clustering software – had the largest 2013 revenue share in APAC of any vendor in the availability and clustering software market. The company has an especially strong track record in Japan, having captured tops shares domestically for both Windows-based systems and for Linux-based systems, as well as in the market overall.²

- ¹Japan Server 2014-2018 Forecast and 2013 Analysis (IDC #JP1573103X, June 2014)
- ²Japan System Software 2014-2018 Forecast and 2013 Analysis (IDC #JP1677103X, August 2014)

EXPRESSCLUSTER: The Core of NEC's Clustering Solutions

As NEC plays out its clustering solution strategy globally, it is developing its core product EXPRESSCLUSTER primarily in the following three directions:

- **Expanding the number of supported platforms in anticipation of mixed OS and virtual infrastructure environments.** It is likely that companies' and organizations' IT systems will increasingly consist of mixes of different types of OS – such as Linux and Windows – or mixes of different OS versions – such as the 2003, 2008, and 2012 releases of Windows Server. Another reason that the management of IT systems may grow more complex is that virtual environments could be implemented using different hypervisors. To meet the needs of platform environments in which there are complex mixes of OSs and virtual infrastructure, NEC is expanding the number of platforms that EXPRESSCLUSTER supports. It is currently unclear which cloud computing platform will become predominate, but NEC will be able to support any option that its customers might choose.

- **Improving reliability in mission-critical areas.** There are a wide variety of causes of system failures. It is crucial to monitor every part of the system to determine if any failure that might occur originates from a hardware, an OS, or an application problem and to ensure that failures are detected in the first place. It is not possible to maintain system availability until failover capabilities that work both reliably and swiftly in the event of a failure have been implemented. With EXPRESSCLUSTER MC (HA Series), NEC offers a highly reliable clustering solution for mission-critical Windows- and Linux-based systems that require high availability – such systems having become more common in recent years. The solution dramatically reduces downtime and improves reliability to the maximal extent by predicting, detecting, and preventing failures.
- **Expanding the areas in which clustering is used.** NEC aims to develop high-value-added, software-based clustering solutions. In particular, the company is focusing on DR. EXPRESSCLUSTER comes with features for creating clusters that contain sites located far away from the primary site and for restoring both data and applications after a disaster has struck. Furthermore, it has become much more common in recent years for companies to use cloud services such as IaaS, and NEC has made it possible to offer EXPRESSCLUSTER-based clustering solutions for systems built in the cloud. NEC is continuously developing new products and technologies aimed at increasing the scope of usage for clustering. It strives to supply clustering solutions with even more value added than it does now.

New Improvements to Products

NEC is continuously attempting to add to the EXPRESSCLUSTER lineup and to upgrade the series' features. Below are the major components of NEC's new lineup:

- **EXPRESSCLUSTER MC (HA Series).** This product can predict, detect, and prevent failures on mission-critical systems that require extremely high availability – such as core business systems and social infrastructure – and increase system availability to the maximal extent possible. NEC offers separate products for various uses, so its customers can choose solutions that match the particular characteristics of their systems in terms of databases, business applications, disks, and OSs.
- **Fault Tolerance for FileMaker Server.** NEC has added to its lineup a version of EXPRESSCLUSTER dedicated for use with FileMaker Server – a database system famous for being easy for users to develop with. The standard EXPRESSCLUSTER features – including failover – provide high availability for FileMaker Server systems.

Global Strategy

NEC is expanding its offering of clustering solutions by releasing products under the EXPRESSCLUSTER brand name in North America, Europe, and in other regions around the world. The company is able to achieve this because of its existing track record within Japan. Recently, NEC has considered APAC to be one of its areas of focus and has had growing sales results in the region, particularly in the large-scale markets of China and India. The company also does sales in newly emerging Asian countries – including Nepal and Myanmar – from which NEC has begun to see results. In addition, NEC has established a menu of implementation support services for English-speaking markets using an India-based support team, helping to improve the company's worldwide support network. NEC also makes use of its global network to support Japanese firms entering overseas markets in regions around the world. Descriptions of NEC's strategies in major countries and regions are provided below.

Asia-Pacific Region

- **China.** NEC has developed clustering solutions primarily for communications carriers, financial firms, government, the medical industry, and education. It has racked up considerable results from these areas. The company has also started to have good results among retailers and other types of business. NEC has established a 24-hour support system, offered packages designed for SMBs, and increased the number of regions within the country in which it does business and offers support. These attempts are improving NEC's already strong business structure in China. NEC is also focusing on joint ventures with local partners in the vast country that is China. The company is striving to bolster existing partnerships with local solutions vendors – including hardware vendors, software vendors, and systems integrators – as well as to establish a larger number of new partnerships.
- **India.** NEC has established a 24-hour maintenance system with an India-based support team that serves EXPRESSCLUSTER users throughout the English-speaking world. Sales in this market are made through NEC's local sales company, but NEC is able to offer its Indian customers cohesive solutions that include everything from sales to support in a manner that is tailored to the Indian market because of the partnership between the sales company and the support team. In addition, NEC has developed solutions for the Indian market that pair EXPRESSCLUSTER with products from independent software vendors (ISVs) and local partners. NEC has already successfully completed proof-of-concept of EXPRESSCLUSTER X with Zimbra Collaboration through local partner (Logix InfoSecurity Pvt. Ltd).
- **Newly emerging Asian countries.** NEC has joined with ISV partners with strong presences in local industries to develop solutions for the newly emerging Asian countries that have recently experienced remarkable growth and are rapidly implementing IT. One example of this is NEC's work in the Nepalese banking industry, which will be explained in more detail in a later section. NEC also supplies low-cost appliances with EXPRESSCLUSTER installed for configuring clusters in Bangladesh and Sri Lanka. Otherwise, NEC has launched EXPRESSCLUSTER in various newly emerging Asian countries, including Myanmar, Laos, Cambodia, and Mongolia.

Europe/Mid-East Region

- **Europe.** In Europe, NEC is aggressively marketing a total solution called Smart Enterprise to enterprise customers. With this solution, NEC is, among other efforts, putting its energies into ensuring availability, as well as into the EXPRESSCLUSTER software itself.
- **Mid-East.** NEC is proceeding with expansion into the Mid-East region with a focus on Saudi Arabia. The company will improve particularly its DR solution offerings because the Saudi government has mandated the implementation of measures to handle climate change-related disasters – such as flooding – that the country is not used to dealing with and against which it is unprepared. A user case will be provided in a later section.

The Americas

- **North America.** NEC is strengthening its ties with local ISV partners in North America. For example, NEC has developed DR solutions that combine EXPRESSCLUSTER with applications provided by physical security vendors. These solutions are often delivered to customers requesting high availability. Based on the solution developed in partnership with FileMaker in Japan, NEC has also released a solution that pairs FileMaker Server with EXPRESSCLUSTER in the North American market. In fact, NEC has received the first

overseas order with FileMaker from a resource recovery and recycling company, Close the Loop. Further expansions of the business with this product continue to be expected.

USER CASE STUDIES

This section presents case studies of user companies that have implemented clustering solutions that employ NEC's EXPRESSCLUSTER.

Successfully Improving the Reliability of its Production Line while Taking Advantage of the Benefits of FileMaker Server: Ushio Inc. (Japan)

Ushio Inc. deals globally in products that employ optics, including industrial light sources, based on the company's core activity of developing new light sources and optical technologies. Many of Ushio's products in the areas of optical equipment and discharge lamps have the largest shares worldwide.

Problem: Improved Efficiency with a Database System Comes with Concerns About 24-hour Operations

Ushio's Third Manufacturing Division implemented a manufacturing process management support system for its specialized industrial lamp production line using FileMaker Server. This allowed the division to check instructions and diagrams using tablets and improved efficiency. The fact that a system meeting the actual conditions on the ground could be built – even by those outside the IT department who were not particularly well-versed in such a system at a specialist level – was very well received in the division generally. The IT department, however, grew concerned because, as the system came to be used more frequently, the risks of a system halt grew more severe. Without adequate mitigation measures, it was feared that the effects of a stoppage might spread to other production lines. In response, the IT department noted that the system needed to be made redundant.

The Best Choice for Increasing Availability While Still Enjoying Ease-of-Use

Systems implemented using FileMaker Server are easy to use and provide the benefit that they can be rapidly updated to reflect requests for improvements from the people whom the system manages. However, because someone with little specialist IT knowledge was in charge of developing the system, it had the drawback of possible low reliability. The production line operated 24 hours per day in three shifts. Therefore, there was a considerable risk that, if the system went down early in the morning or in the middle of the night, production would remain halted until the person in charge of the system could run in to fix it. Because of this risk, Ushio turned its attention to EXPRESSCLUSTER, which is partner-certified to work with FileMaker Server. EXPRESSCLUSTER was the best choice for Ushio because it allowed the company to duplicate its FileMaker Server system at low cost and enabled automatic recovery – all while still leaving Ushio to enjoy the benefits of FileMaker Server in terms of ease-of-use.

Solution: Continue Work without Stopping the Production Line When Faults Have Occurred

Ushio duplicated its FileMaker Server-based manufacturing process management support system using EXPRESSCLUSTER and two NEC Express5800 x86 servers. During normal operations, one

server is active while the other is on standby. EXPRESSCLUSTER automatically detects when a fault has occurred in the server, network, or OS – as well as when FileMaker Server has thrown an exception or the system has halted. Using the solution's failover feature, the standby server is able to take over processing and data when EXPRESSCLUSTER has detected one of these issues. Thus the company was able to continue work without stopping the production line, and the reliability of the overall system was increased significantly.

Effects of Implementation: Workers on the Line and the IT Department Relieved and Scope of System Implementation Expanded

Because EXPRESSCLUSTER reduced the risks associated with 24-hour operations, Ushio was able to roll out the same manufacturing process management support system to multiple other production lines. Currently, the system has been expanded to cover more than 70% of processes at the Third Manufacturing Division. In addition, previously the production department managed the FileMaker Server system, but, with the installation of EXPRESSCLUSTER, the IT department now handles server administration. This has reduced the management burden on the ground. Furthermore, multiple people – including the person in charge from the IT department – are now always able to monitor the system, increasing reliability. A person responsible for the Ushio production line commented, "We have been freed from our worries about the system going down, and we can now go on to implement the same system on more production lines, including in other departments." This solution pairing EXPRESSCLUSTER and FileMaker Server delivered an easy-to-use system that reassures both those on the ground and those in the IT department without harming productivity.

Increased Availability for Mission-Critical Systems Built in the Cloud: Ride On Express Co., Ltd. (Japan)

Ride On Express Co., Ltd. (REX) has launched a variety of catering businesses that deliver meals to customers' homes, including the sushi delivery chain Gin no Sara – which has more than 350 locations throughout Japan – and Kamatora – whose over 150 locations deliver *gozen*, or upscale, traditional Japanese meals.

Problem: Extensibility and Reliability Must Be Improved

In the delivery business, future marketing strategies that companies adopt are strongly influenced by trends in daily revenue and in customer data. Therefore, REX needed to analyze and to utilize large volumes of data and aimed to upgrade to a database system that would let the company understand its customers more easily. REX had launched numerous types of food delivery chains – offering fried pork cutlets, curry, and other types of cuisine – in addition to its sushi and gozen chains. As a result, REX's business systems were highly complex and intricate, and it was not an easy task to add new systems when launching more types of delivery service. Thus REX required a system that combined, on one hand, flexibility and extensibility so that new systems could be added easily, and, on the other, a level of reliability that could ensure that the system would operate 24 hours per day, 365 days per year without stopping – an essential requirement in the home delivery business.

Making Use of the Cloud and Open-Source Software

REX considered using an IaaS cloud service as a new platform that would provide extensibility, and the company eventually decided to use IDC Frontier's NOAH Platform Service. Building the

system in the cloud was intended to rein in costs, so REX opted for an open-source software (OSS)-based system with Linux as the OS and MySQL as the database.

Solution: Build a System with Something as Essential and as Unobtrusive as Oxygen

To achieve its other goal of high reliability, REX adopted a clustering solution that used EXPRESSCLUSTER. REX was drawn to EXPRESSCLUSTER because of its proven track record of being run with OSS, such as Linux and MySQL, and being verified to work with numerous cloud environments. Furthermore, REX could not shut down its systems during the busy seasons when there were influxes of orders – including around New Year's – so NEC's 24-hour support system was another major reason why REX went with EXPRESSCLUSTER. There were concerns that the switchover from the clustering functions of Oracle Database, which REX was using at the time, to clustering based on a combination of MySQL and EXPRESSCLUSTER would complicate operations. In the event, however, operability was dramatically improved. A person involved in the development of REX's system, which was done by Universal Solution Systems Inc., commented, "EXPRESSCLUSTER is as essential to developing clustering solutions as oxygen is to life – and just as unobtrusive."

Effects of Implementation: Combination of the Cloud and EXPRESSCLUSTER Highly Effective

Compared to the cost of building REX's previous clustering system with Oracle Database on UNIX, the EXPRESSCLUSTER-based system was about one-tenth as expensive. By using the cloud, REX was able to cut hardware costs, including those for storage, considerably. In addition, EXPRESSCLUSTER made it possible to change the settings for all virtual machines in the cloud at once. Moreover, the software has features for importing and exporting settings files, so REX was able to save multiple different settings and switch among them at will. Implementing a combination of the cloud and EXPRESSCLUSTER provided significant positive effects in terms of both cost and operational management.

Cloud-Based DR Solution for the Banking Industry: Mercantile (Nepal)

Mercantile Group does all kinds of business in Nepal – notably IT but also housing, finance, media, publishing, environmental engineering, and others. The group's oldest business, Mercantile Office Systems Pvt. Ltd. (MOS), offers the application solution Pumori for banking.

DR Mandated in the Banking Industry

Nepalese companies have been rapidly adopting IT in recent years. The banking industry, in particular, is heavily reliant on IT systems for managing operations and data. Because of this dependency, there are considerable risks if IT systems stop because of system faults, natural disasters, or other contingencies. Despite the risks, using IT systems for data and applications is particularly crucial for banks. Furthermore, banks require availability 24 hours per day, 365 days per year, so the Nepal Rastra Bank (the country's central bank) has mandated that all Nepalese banks implement adequate DR solutions.

Problem: Banks Must Break Free from Old DR Methods

The majority of Nepalese banks used simple measures such as traditional backups as their DR method, backed up data being stored in the banks' vaults. However, server failures often continue

for hours or days, so the methods the banks were using at the time were barely effective at all. Nepalese banks were thus unable to fully comply with the mandate, and improving this situation was an extremely critical task for the banks to undertake.

Solution: Offer DR via the Cloud with a Datacenter 300 Kilometers Away

Mercantile, which was the IT solutions vendor with the majority of Nepal's banks as its customers, was in search of a superior DR solution to offer to banks. After evaluating multiple DR products, Mercantile opted to use NEC's EXPRESSCLUSTER. With EXPRESSCLUSTER, Mercantile could provide its customers failover capabilities that would rapidly switch operations over to cloud-based systems located in a Mercantile datacenter 300 kilometers away in the event of a system failure. Furthermore, the software made operations extremely seamless and allowed Mercantile to improve the operational efficiency of its cloud. Thus Mercantile could offer its customers a cloud solution that allowed them to run banking applications 24 hours per day, 365 days per year.

Effects of Implementation: Availability of Banking Services Maximized

Mercantile implemented highly reliable banking cloud solutions for several banks using EXPRESSCLUSTER and MOS's banking applications. ACE Development Bank aimed to maximize the availability of its services – that is, wanted to minimize the length of service outages. This cloud solution allowed ACE to reach that goal. During the blackouts that cause the bank's systems to stop, the cloud hosted in Mercantile's datacenter located 300 kilometers away now takes over the system's tasks. Pradip Nepal, who is in charge of IT at ACE Development Bank, commented, "Server failures are inevitable for us. But we can recoup all of our investments because EXPRESSCLUSTER prevents business losses." The IT manager at NMB Bank, which implemented the same solution, offered a positive evaluation: "EXPRESSCLUSTER is extremely effective as a DR product. Moreover, it is easy to use despite its high functionality, and it can be implemented in a short amount of time." Finally, a developer at Mercantile commented, "It would be a good DR solution for banks of any kind," demonstrating considerable expectations.

DR for an Insurance System that Cannot Have Downtime: United Cooperative Assurance Company (Saudi Arabia)

United Cooperative Assurance Company (UCA) is a leading Saudi Arabian insurance company that is listed on the Saudi Stock Exchange (Tadawul). Since UCA's establishment in 1974, it has offered a variety of insurance services, including asset, damage, liability, cargo, hull, aviation, life, health, and credit insurance.

Problem: Trying to Achieve Zero Downtime

Because of the particularities of the insurance business in which UCA is involved, it cannot stop operations in any situation; indeed, the primary role that insurance plays comes to the fore when disasters have occurred. Furthermore, the various personal information and data that UCA retains regarding its customers must be treated carefully – loss of data is unacceptable. To achieve zero downtime for UCA's system – which was implemented using Oracle applications and which supports the firm's approximately 200 insurance dealers – UCA needed to find a clustering solution that came with DR features. That solution also needed to provide the high availability that the Saudi government demanded while still making operational management simple at both the primary site and the secondary site (the site for recovery).

Solution: Implement a Clustering Solution Equipped with DR

UCA was about to upgrade to new versions of Oracle Database, which it was using as its main database, and of Windows, and it looked into deploying a clustering solution at the same time that it migrated to the new server. In response, NEC teamed up with its local partner, NajTech, and combined EXPRESSCLUSTER with a fault-tolerant server (no-downtime server) to propose a robust and low-cost clustering solution that was simple to manage. UCA was very pleased with this proposal and also evaluated NajTech's support highly, so UCA accepted NEC's proposal. The system was set up in just three months with the help of four of NajTech's NEC-certified engineers and two of NEC's engineers in charge of the Middle East region. UCA was able to successfully complete the project with only three of its own staff members, an IT department manager and two senior engineers.

A fault-tolerant server equipped with EXPRESSCLUSTER and storage in the form of SAN was used to implement the insurance system. A branch of the company located 30 kilometers away from the head office was used for the DR site, and both sites were connected via the corporate WAN. Failover would be conducted in the event of a problem at the working site, and operations could be resumed within 20 minutes. The DR site was also used for other purposes, including as a file server, for email, as a database, and for backup.

Effects of Implementation: Effectiveness of NEC's Clustering Solution Proven by Flood

UCA gained the following benefits by adopting NEC's DR-ready clustering solution:

- A 15% increase in the productivity of operating staff
- A 90% reduction in downtime for the main database
- A 20% increase in user satisfaction

When Jeddah, a city that is a major center of commerce in Saudi Arabia, was hit by a flood in 2011, the company was able to switch back over to online mode via the DR site in a matter of minutes. Labib Assaf, manager of UCA's IT department, stated, "It was really a wise decision to select NEC and NajTech as technology partners. Our choice proved to be right even given the sad occurrence of the Jeddah floods of 2011."

Improving the Reliability of the ERP Underpinning a Manufacturer's Business: Nipman Fastener Industries Pvt (India)

Nipman Fastener Industries Pvt (Nipman) is a manufacturer headquartered in India that develops fastening parts (bolts, lock nuts, screws, etc.) for automobiles. Nipman possesses world-class technologies and best practices and is rapidly growing within the automotive industry.

Problem: Reliability for Highly Risky ERP Must Be Improved

Nipman's ERP manages customer orders, so it is accessed from the company's four manufacturing plants in India. Because of this, any downtime for the ERP system would mean serious risks, as it would cause delays in transactions, affect customers significantly, and harm Nipman in terms of both revenue and corporate trust. Thus, to continue to provide its customers high-quality service, Nipman looked ahead to the future and sought a high-availability solution for ERP and related databases.

An Easy-to-Use Interface and Automatic Failover for Databases

To improve business continuity for its core applications, Nipman opted for EXPRESSCLUSTER, a solution that fulfilled the requirements of the company's IT department. Nipman was impressed by the fact that EXPRESSCLUSTER came with an easy-to-use interface for operational management, as well as that it could offer rapid, automatic failover and recovery of the various data the company stored in its databases – including those for sales, customers, and orders – during any failure in the hardware, OS, or application. Another aspect of the solution that was well-received by Nipman was that it could minimize downtime not just after faults but also during IT infrastructure maintenance.

Solution: Provide Recovery within Two Minutes at the DR Site

NEC delivered a DR solution using EXPRESSCLUSTER for both the Microsoft Dynamics ERP system and Microsoft SQL Server database software at the main site, which were accessed by users at Nipman's manufacturing plants. Microsoft Dynamics is an ERP application produced by Microsoft that is rapidly growing in popularity worldwide. With the new system implemented, Nipman could rest assured that, when a fault occurred, its ERP and databases would automatically failover via WAN to the DR site located 25 km away. Furthermore, it became possible to recover within two minutes from the server going down. Nipman's data were also replicated, providing business continuity 24 hours per day, 365 days per year.

Effects of Implementation: Service Level of 99.99% for Mission-Critical Systems Achieved at Low Cost

Now that Nipman had installed EXPRESSCLUSTER, it could run its ERP and databases – for which it had worried about downtime – at peak capacity. In addition, downtime after failures was dramatically reduced, regardless of whether the fault was in the server, the application, the database, or the network. Nipman's IT department successfully achieved a service level of 99.99% for the company's mission-critical systems at an extremely low cost.

FUTURE OUTLOOK

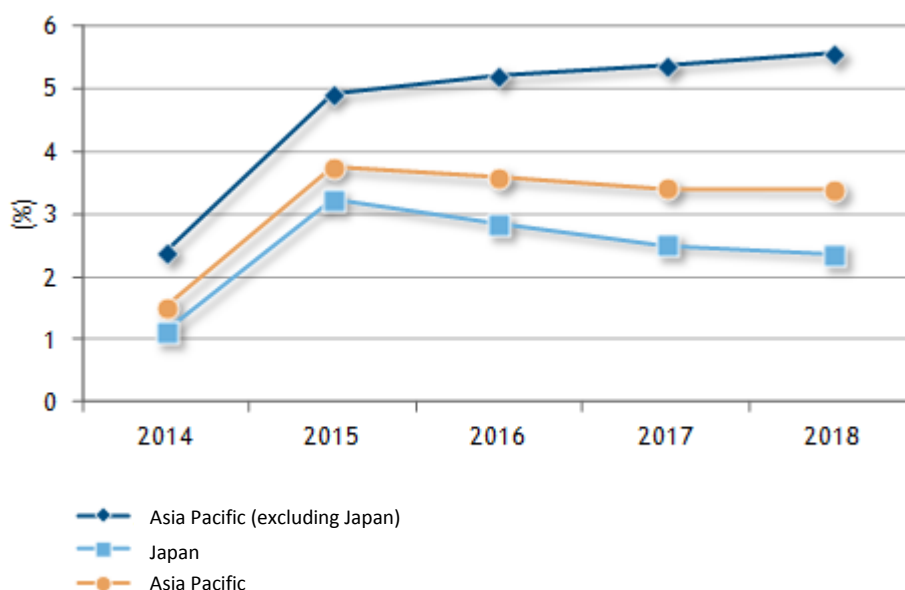
Availability and Clustering Software Market Forecast

IDC forecasts that the APAC availability and clustering software market will expand at a CAGR of 3.1% over 2013 to 2018. Figure 4 shows the forecasts for YoY revenue growth from 2014 to 2018. The figure displays separate forecasts for Japan and for APAC excluding Japan.

The APAC region excluding Japan looks set to continue to grow at a high rate. IDC forecasts that growth will continue between 5% and 6% from 2016 onward and that the overall CAGR for 2013 to 2018 will be 4.7%. Demand for high availability for IT systems through the use of availability and clustering software is high, and an accelerating number of implementations are expected in China, India, and emerging Asian economies. This region is prone to natural disasters, so use in DR systems is also likely to increase. In Japan, where the market is mature, growth looks set to continue at a robust pace; IDC forecasts a CAGR of 2.4%. IDC believes that the market for x86 server-based Linux and Windows platforms will continue to register high growth, in general, throughout APAC.

FIGURE 4

APAC Availability and Clustering Software Market YoY Revenue Growth Forecast, 2014-2018



Source: IDC, January 2015

The Future of Clustering Solutions

Growing Possibilities for Clustering Solutions

Unscheduled system downtime due to hardware and software failures, natural disasters, terrorism, and other such unexpected events is an ever-present challenge faced by enterprises and organizations. It is no exaggeration to say that the reliability of IT systems that serve as service infrastructure to cater to customers, business partners, and employees is now a performance indicator for enterprises and organizations. In this context, high-availability solutions based on availability and clustering software will play an even more important role in the future.

The greatest advantage of availability and clustering software is that it can be used flexibly to implement diverse clustering solutions. This software is able to meet diverse needs, from one-to-one failover to DR via a remote site. It is able to offer many options for solutions tailored to varied user budgets, system configurations, uses, operations to be conducted after deployment, and other criteria. It can guarantee high reliability in addition to providing flexibility.

Availability and Clustering Software That Supports Mission-Critical Systems

This report presented best practices in two manufacturing businesses located one each in Japan and India. Both companies succeeded in improving the reliability of the mission-critical systems underpinning their manufacturing business by using availability and clustering software. Supply chains continue to globalize, and manufacturers' business systems are now required to operate 24 hours per day, 365 days per year. For such systems, high availability is essential.

The two user case studies of DR in the financial services industries of Nepal and Saudi Arabia proved that high levels of reliability can be achieved with availability and clustering software. Finance requires higher degrees of availability for its IT systems than do other industries, so best practices here can surely be applied in many other fields.

Availability and clustering software offers a flexible means of addressing increasingly diverse needs for high availability and is expected to play a significant role in improving availability and providing DR for IT systems in countries and regions with vastly disparate geographies, cultures, and business practices.

Improving the Reliability of Virtual Environments

The environments in which IT systems operate are undergoing continuous changes as technology evolves. Virtualization plays a significant role in this and is greatly changing the nature of platforms. As a result, improving availability in virtual environments is now an important challenge that organizations must undertake. Virtualization has begun to be introduced into mission-critical domains, as well, and this is increasing the importance of improving availability in virtual environments.

Increased mixing of virtualization infrastructure, such as hypervisors, as well of guest OSs, would continue to make management of availability more complex. If this happens, then the use of only the functions built into the OS or virtualization software will often not result in sufficient reliability or efficiency. IDC believes that this would further serve to highlight the value of third-party availability and clustering software compatible with cross-platform environments.

Improving Reliability in a Wide Range of Cloud Environments

Cloud services are making rapid inroads in the corporate world. According to an IDC study, the global public cloud service market was worth \$42.1 billion in 2013 and has a forecasted CAGR of 21.6% for 2013 to 2018, which should result in a size of over \$100 billion in 2018. High levels of growth are expected for all regions, with particularly significant expansion in emerging economies, such as those of Asia and South America.

In such an environment, a growing number of companies are turning to cloud service platforms for their core corporate systems, as the REX case demonstrated. There will likely be more such cases as use of cloud services expands. One of the most important challenges will be ensuring the availability of applications running in the cloud, including on IaaS. Although, to be sure, minimum levels of availability are guaranteed by cloud services, it is important for users themselves to increase availability in order to enhance reliability.

The case of REX demonstrates the best practice of combining public cloud services with availability and clustering software to cut costs and improve reliability simultaneously, even if these two goals might seem in opposition to one another. Increasing availability also has a large role to play in private clouds implemented in corporate datacenters. Finally, in the future, clustering solutions will likely be an essential component of a wide array of hybrid cloud environments, including those consisting of different public clouds or of both public clouds and private clouds.

CONCLUSION

To conclude this whitepaper, we will summarize NEC's market opportunities and challenges in the clustering solutions business and provide recommendations for users.

NEC's Market Opportunities and Challenges

Market Opportunities

- NEC is already entrenched as the leader of the APAC market for availability and clustering software for Windows and Linux – a market set to grow even more in the future – and NEC's clustering solutions business is expected to continue growing. NEC's clustering solutions, which are based on the abundant experience and know-how it has gained in Japan – where availability requirements are high – appear able to gain the trust of countless customers around the globe.
- This would by no means be limited to developed countries. In many emerging economies, including those in Asia and in South America, users are actively pursuing increased availability for their IT systems and are just as busy working to improve business continuity. Demand for DR is on the rise, particularly in countries prone to natural disasters. NEC's DR offerings, which are low-cost and easy to implement, should prove to be attractive solutions for many clients.
- There has been a rapid increase in the use of virtualization and the cloud in countries around the world, and system environments will be increasingly cross-platform (combinations of various environments). NEC develops clustering solutions for the cloud and a wide range of other platforms, and these solutions should offer significant positive effects for clients.

Challenges

- High availability features added to OSs and virtualization software packages, as well as clustering solutions integrated into cloud services, could pose threats to third-party availability and clustering software. NEC will need to offer users higher-value clustering solutions by supplementing or linking with these features.

Recommendations to Users

- **Invest in reliability.** The level of availability required of IT systems depends on the industry of the enterprise, its size, business tasks, and services. In systems requiring a high level of availability, users must not, under any circumstances, compromise on high availability. A small compromise can often lead to a large loss. To increase reliability, it is imperative to invest sufficiently in high availability, including by investing in availability and clustering software.
- **Make effective use of diversifying clustering solutions.** No one knows when they might occur: Users must always be prepared for all sorts of unexpected events. The scope of application for availability and clustering software is expanding, including into DR. Various possibilities should be explored and tried, as there are many clustering solutions available that can be implemented at low cost and without decreasing reliability as compared with other methods.
- **Improve reliability in virtualized and cloud environments.** Applications running in virtual environments or in the cloud are exposed to very significant risks in terms of reliability. Going forward, it will be necessary to adequately consider high availability in virtualized and cloud environments when future platforms are being planned out. Among the key questions to be addressed are the kinds of applications to which virtualization should be extended and the kinds of systems that should be implemented using cloud services.

Vendor Shares of the Global Availability and Clustering Software Market

TABLE 1

Global Availability and Clustering Software Market Vendor Revenue Results, 2012-2013

| | 2012 (US\$ M) | 2013 (US\$ M) | 2013 Revenue Share (%) | 2012–2013 YoY Growth Rate (%) |
|------------------|---------------|---------------|------------------------|-------------------------------|
| Microsoft | 493 | 535 | 26.9 | 8.5 |
| IBM | 268 | 271 | 13.7 | 1.4 |
| Symantec | 217 | 220 | 11.1 | 1.6 |
| VMware | 158 | 194 | 9.8 | 23.3 |
| HP | 180 | 149 | 7.5 | -17.2 |
| NEC | 86 | 75 | 3.8 | -12.8 |
| Vision Solutions | 137 | 72 | 3.6 | -47.5 |
| EMC | 49 | 47 | 2.3 | -4.4 |
| Fujitsu | 43 | 39 | 2.0 | -9.3 |
| Red Hat | 34 | 29 | 1.5 | -14.3 |
| Others | 389 | 355 | 17.9 | -8.9 |
| Total | 2,053 | 1,986 | 100.0 | -3.2 |

Notes:

- Based on data from IDC Worldwide Semiannual Software Tracker
- When calculating statistics for the global market, IDC converts all local currencies into US dollars. The difference between the Japanese yen-to-US dollar exchange rates in 2012 and 2013 was ¥17.8/\$1 (the yen depreciated in 2013). Because of this, Japanese companies, including NEC and Fujitsu, experienced negative growth on a US dollar-basis despite having positive growth on a Japanese yen-basis

Source: IDC, January 2015

About IDC

International Data Corporation (IDC) is the premier global provider of market intelligence, advisory services, and events for the information technology, telecommunications and consumer technology markets. IDC helps IT professionals, business executives, and the investment community make fact-based decisions on technology purchases and business strategy. More than 1,100 IDC analysts provide global, regional, and local expertise on technology and industry opportunities and trends in over 110 countries worldwide. For 50 years, IDC has provided strategic insights to help our clients achieve their key business objectives. IDC is a subsidiary of IDG, the world's leading technology media, research, and events company.

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