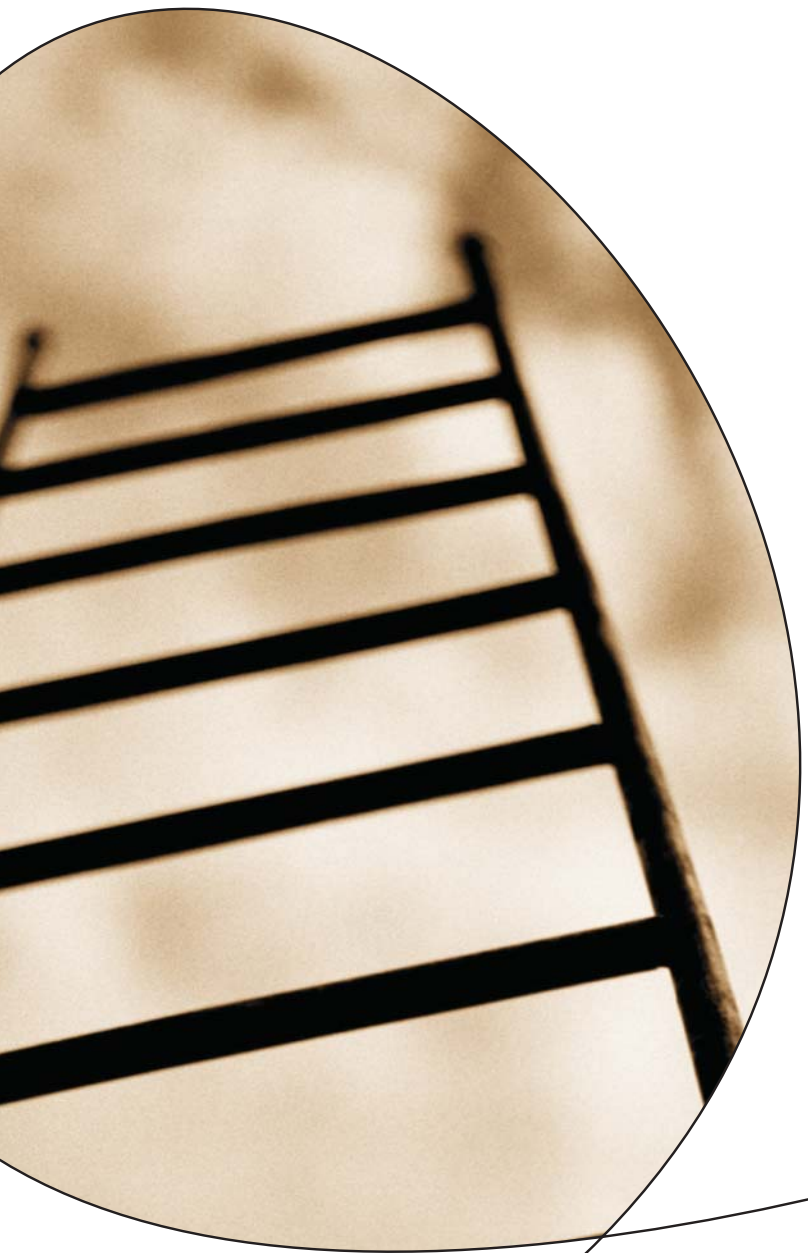
HITACHI
DATA SYSTEMS

Business Continuity

Business Brief

Partner Beyond Technology



Executive Summary

The extent to which information technology is woven through the fabric of your operation and the always-on nature of business today make fast and continuous access to your company's information essential to your continued success. Hitachi Data Systems business continuity solutions are designed to protect your business from a variety of causes that might prevent you from accessing that data for an unacceptable period of time. Foremost in most people's minds is site disaster. Indeed, the risk of site disaster deserves your attention; even though it comprises only three percent of unscheduled downtime, its impact can be devastating to a business. Other causes—including system malfunction, hacker attacks, and human error—are also countered effectively by the business continuity solutions described in this Business Brief. Some of the solutions even eliminate downtime associated with system upgrades and scheduled maintenance. In general, advanced approaches to disaster recovery preparedness provide more than just an insurance policy—they can take your business to the next level by providing secondary access to data without impacting regular production workloads.

The Hitachi Data Systems Business Continuity Business Brief is a primer to help you understand the key technologies, processes, and benefits associated with business continuity solutions.

It describes the business environment and issues leading organizations to build highly available IT infrastructures that are resilient in the face of outages of any origin. It notes that you must assess the extent of risk based on the importance of the particular data and associated business processes. It then explains how Hitachi Data Systems can help you implement the appropriate level of solution derived from the full range of possible approaches. This Business Brief also touches on the ancillary benefits of these approaches, which can improve the ROI of your business continuity project by going beyond risk analysis to include more immediate and tangible payback from productivity improvement.

Hitachi Data Systems is recognized as the leading provider of high-availability storage solutions, and its systems tend to be deployed in support of an organization's most critical operations. Thus, this Business Continuity Business Brief is focused where Hitachi Data Systems' experience and capabilities are most often called on—at the high end of business continuity via remote data replication. But the Business Brief also covers the full range of business continuity solutions offered by Hitachi Data Systems, based on Hitachi hardware and software, plus the best-of-breed offerings of its partners under the solution umbrella of Hitachi Data Systems Global Solution Services.

Introduction

Natural disasters, such as earthquakes, floods or tornados, or acts of terror can bring a business to a grinding halt. In today's highly competitive business environment—a 24/7 world of just-in-time delivery, global supply chains, around-the-clock customer demand, and competition that is just a mouse click away—a business cannot take days to resume IT operations after an unexpected disruption.

Businesses must be able to restart operations fast. Most would prefer to resume at the point in time at which operations ceased, while preserving the last transaction or business process step completed before that point. To do this, the most current data must be available and ready to go on a moment's notice at a location safely removed from the disaster site. Of course, there's a tradeoff: the shorter the delay before a business is back up and the less data lost, the higher the cost of the solution.

Clearly, cost of solution must be weighed. But because technology is woven so tightly into the fabric of a business today, most companies cannot tolerate more than a few hours, or even a few minutes, of downtime without serious bottom-line impact. Meta Group estimates lost revenue from downtime at an average of US$1 million/hour. Contingency Planning Research says losses go as high as US$6.45 million/hour for retail brokerages. Beyond the loss of revenue, there are adverse headlines and the potential impact on company valuation to consider, not to mention lower employee productivity caused by sporadic outages. It adds up to this: Your data really *is* your business.

In addition, governments are getting into the act with mandates to protect that data. For example, United States regulations on data protection now apply to health care (HIPAA), financial services (SEC 17a-4), corporate accountability (Sarbanes-Oxley Act), life sciences (21 CFR Part 11), and government (DoD 5015.2-STD). Elsewhere in the world the story is similar, from the New Basel Capital Accord (Basel II) globally to RIPA and FAS in the UK and to COB in France. Beyond government regulators, investors and even insurers are insisting that businesses put in place feasible disaster recovery/business continuity plans to protect critical information.

Business continuity solutions to these challenges are constructed from a palette of interrelated capabilities that divide between local-site solutions and implementations that transport or replicate data to a remote site, as shown in Figure 1. The capabilities applicable within a single site increase the availability of data in a number of ways, including: allowing nondisruptive backup; eliminating single points of failure; and providing automation for business continuity procedures to ease the process of replication and backup and to speed data restoration when such a task is required.

Replication approaches also vary. Your business can survive a site disaster or data outage from other causes by using a service that removes tapes to a remote tape vault. Most older business continuity plans depend on this approach, meaning their data recovery processes involve multistep manual tape procedures that can take several days to complete.

Hitachi Data Systems provides a full range of backup and rapid recovery solutions to minimize recovery time and alleviate other negatives associated with tape while preserving the cost advantages of this media.

Solutions from Hitachi Data Systems and its partners range from enhancing backup through local mirroring (to eliminate the backup window and lessen the backup's impact on server performance) to solutions that transmit backup data to an offsite tape-vaulting facility.

For full resiliency and faster recovery, even in the face of a site disaster that either disables a site's systems or takes out the site's power and other data communication infrastructure, additional capabilities must be brought to bear on the problem. Two basic variations on remote disk replication can be used (asynchronous and synchronous), often in conjunction with a solution that extends server clustering to a remote site.

Hitachi Data Systems Business Continuity Framework

Centralized, Automated, Policy-based Management

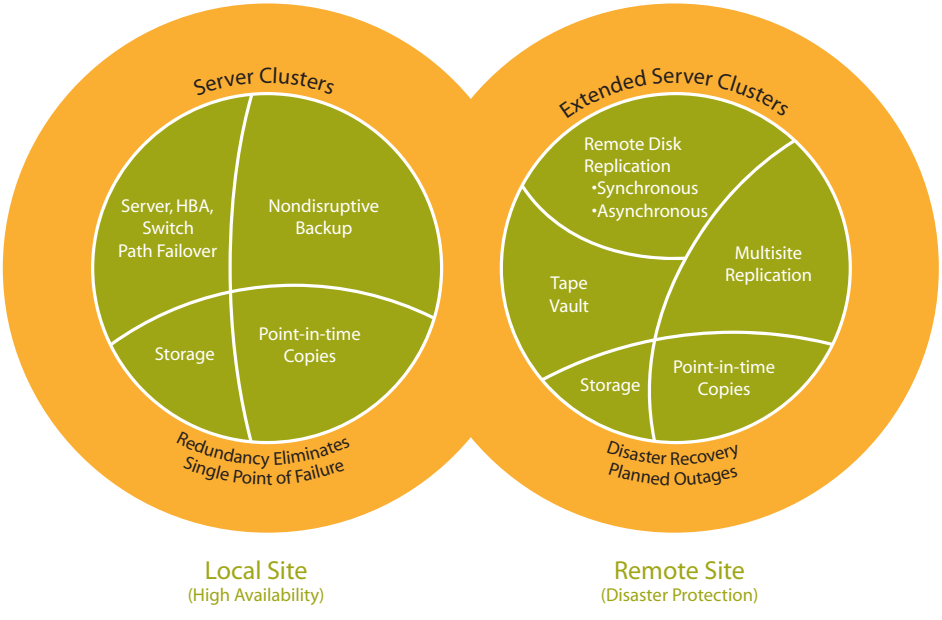


Figure 1: Business Continuity Services range from enabling high availability at a single site to full failover capabilities involving a distant secondary site.

Remote Replication Boosts Productivity While Averting Risk

The infrastructure for replicating data between sites provides productivity benefits beyond the ability to recover quickly from outages. Besides the fact that you will no longer need a service to transport tape backups offsite, some organizations use their remote data sites for a variety of productive, although noncritical, tasks. These tasks include application testing, data mining, decision support, trend analysis, and more. Of course, such tasks can be immediately halted in the event of a disaster that requires the remote site to assume primary mission-critical operations.

Similarly, the remote replication site can take over primary operations on a planned basis to allow for periodic maintenance of the primary systems.

In today's nonstop business environment, some organizations may find themselves putting off important upgrades because of the natural reluctance to go off-line for any period of time. With remote replication in place, shutting down the primary systems for maintenance has no business impact. Such an exercise is an opportunity to verify your disaster recovery procedures and hone the skills of your staff, which improves business confidence.

Analyze the Business Problem

The selection process starts with an assessment of the potential risks and their probability for your particular enterprise. Next comes a Business Impact Analysis (BIA). The BIA helps determine which applications require the most protection based on value of the data and the business impact of downtime as well as other economic factors.

The overriding goals of a business continuity plan must be to survive a disaster and resume operations as quickly as possible. The best recovery plan to achieve those goals depends on how an organization chooses to balance three factors—recovery speed, data value, and cost.

Determining the recovery-time objective (RTO) and the recovery-point objective (RPO) will define how fast an enterprise needs to recover in order to survive and how much data loss can be tolerated.

RTO defines the time frame in which specific business operations must be restored. It answers the question: How long can a business afford to be down?

RPO defines the point in time to which to recover. It answers the question: How much data can the business afford to lose?

The specific RTO and RPO determine which data replication and recovery option a business needs and how much it will cost.

Evaluate the Solutions

The next step is to find the solution that satisfies your RTO and RPO values, which in effect matches the value of data to the cost of the solution.

Figure 2 shows the spectrum of the common techniques for data replication to protect a business from disasters. There is no one method that fits every application.

The increasing value of data has caused more and more businesses to turn to remote, disk-based data replication to ensure that their organizations can pick up operations rapidly and with minimal data loss and corruption in the event of a wide area disaster. Important data is not usually a good match to the pickup truck access method (PTAM) of driving to a remote storage site to pick up the backup tapes and then spending several hours or even days restoring the tapes at the recovery site. Remote tape vaulting eliminates this driving time, but time to recovery can still be measured in hours or even days, depending on how much data must be restored. And that presumes your tape backup and recovery process is error free—an assumption that must be tested regularly despite the difficulty of the task.

Companies have a number of options for replicating data, and they generally fall into one of two categories: synchronous or asynchronous replication. Business managers must consider distance of replication versus application performance. They also must evaluate the critical replication issues posed by rolling disasters, including data consistency and sequence fidelity. Using the results of this analysis, business managers can move toward the right business continuity and recovery solution for their organization's needs.

Synchronous and Asynchronous Replication

Synchronous replication ensures that a remote copy of the data identical to the primary copy is created at the same time the primary copy is updated. In synchronous replication, an I/O update operation is not considered done until completion is confirmed at both the primary and mirrored sites. An incomplete operation is rolled back at both locations, ensuring that the remote copy is always an exact mirror image of the primary.

One benefit of synchronous replication is that data can be recovered quickly. Operations at the remote, mirrored site can begin immediately where the primary site stopped, should operations at the primary site be disrupted. Only the few operations in process at the instant of disruption may be lost. Because neither the primary nor remote site will have a record of those transactions, the database rolls back to the last confirmed state.

The drawback to synchronous replication is its distance limitation. Fibre Channel, the primary enterprise storage transport protocol, can theoretically extend as far as 200 kilometers. But latency quickly becomes a problem as propagation delays lengthen with increased distance. Propagation delays can significantly slow down a system by forcing it to wait for confirmation of each storage operation. This means the practical distance for synchronous replication for a busy system is about 20 miles (about 35 kilometers), depending on the application response time tolerance and other factors—not far enough to be clear of a wide-area disaster zone.

Asynchronous replication provides a way to mirror sites across any distance, and usually involves IP networks. With asynchronous replication, the primary write operation is disconnected from the remote write operation. The application writes the data to primary storage and continues with the next operation. There is no confirmation step as with synchronous replication.

The benefit of asynchronous replication, therefore, is that it can span any distance without impact from propagation delay. Remote sites can be as far as hundreds or even thousands of miles from the primary site, ensuring that the stored data is safely outside the disaster zone.

The Rolling Disaster Challenge

The rolling disaster challenge relates to unplanned events that occur over a span of time, anywhere from minutes to hours. They are called rolling disasters because not all systems, storage, or network connections fail at precisely the same moment.

During such a disaster, components will fail independently, resulting in corrupted and unusable data that often requires difficult and very lengthy recovery. Disasters like the events of September 11, 2001, earthquakes, tornados, and floods all represent rolling disasters.

write-sequence fidelity. For accurate database recovery, the data must be recovered in the proper sequence because of data dependencies. If, for example, a credit-debit sequence occurs in reverse order, it could have serious ramifications for that particular account. In a rolling disaster, the correct write sequence can very easily be disrupted as packets are lost or delayed. In even the best circumstances, packets typically arrive out of sequence.

Hitachi Data Systems deploys asynchronous replication with caching, sequence numbering, time stamps, and other techniques to automatically preserve write-sequence fidelity at the remote site during asynchronous replication.

Synchronous replication allows quicker data recovery; asynchronous replication works across any distance, making sure your data is safely outside a disaster zone.

One drawback to asynchronous replication, however, is a slight time lag between data being stored at the primary and remote sites. This can result in an I/O inconsistency between the two locations and possible loss of data. The remote database may not be able to pick up operations instantly at the point the primary site failed. However, while some transactions or operations may have to be recreated, most will likely be consistent between the two sites.

In terms of potential data corruption, synchronous replication has the advantage of achieving consistency between the primary and mirrored site. But the distance limitation of synchronous may mean that both reside within the disaster zone. If the mirrored site goes down along with the primary site, you have effectively eliminated any chance of quick recovery. Thus, rolling disasters mostly affect remote asynchronous replication. There likely will be inconsistency between the primary site and the remote site caused by partially committed transactions. Although such inconsistency can be managed and resolved, problems may occur with database

The choice to implement asynchronous replication should not be based on sending changed tracks to the secondary system. Because changed-track updates may not preserve the original sequence of writes, they should not be used for real-time disaster recovery.

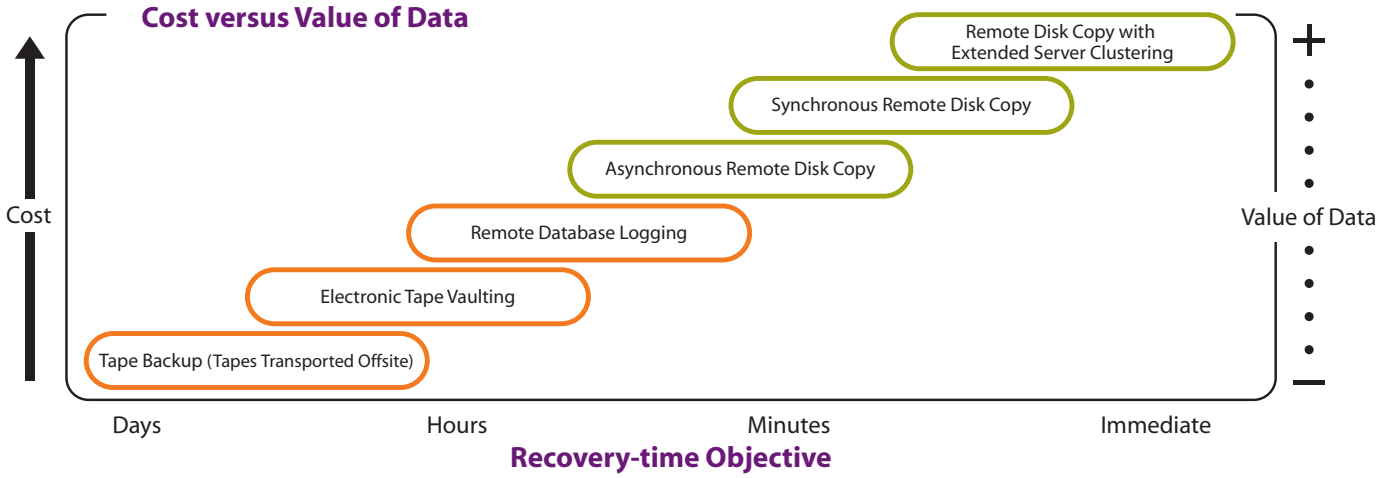


Figure 2: Recovery-time objective combined with a recovery-point objective, based on the value of particular data, map to a range of technical approaches, costs, and degrees of data protection.

Weigh the Options

If the business cannot tolerate any data loss and operations must be resumed quickly, then synchronous replication would seem to be the answer. Of course, that depends on how far the data has to be replicated to clear the likely disaster zone and how much degradation of the specific application's performance can be tolerated. On the flip side, the organization that can tolerate being down until it can reconstruct the last few transactions, or that cannot tolerate the performance impact of synchronous propagation delays, might opt for a less costly asynchronous solution.

A third option is a three data center (3DC) model. Synchronous replication is employed between the primary data center and a nearby hot site, and then the data is replicated to a geographically remote site using asynchronous replication. In the event of a local disaster, customers have the option of recovering to the intermediate site immediately with no data loss. In the event of a disaster geographically broad enough to impact the primary and intermediate sites, recovery is still possible by failing over to the remote site with some delay and some data loss. Thus, a 3DC configuration provides the best combination of protection against disaster with minimal data loss and downtime, but at a significantly higher cost. Clearly, the decision is a complex one and calls for engaging individuals with a great deal of experience in replication implementations.

The decision of which business continuity strategy to adopt is a complex one, based on the value of data, how long your business can be down, and how much data you can afford to lose.

Business Case for Solving the Problem

Adopting a sound business continuity/disaster recovery strategy produces clear business benefits.

- **Simplify disaster recovery:** Achieve rapid restart/recovery over virtually any distance with minimal impact on application response time; eliminate inefficient and resource intensive tape-based replication/retrieval systems
- **Minimize downtime, gain better ROI:** Provide continuous access to business information and eliminate or minimize both planned and unplanned downtime; improve business confidence by enabling more frequent and nondisruptive testing and disaster recovery scenarios with current production data; provide immediate remote access to time-critical information for other data mining and decision support systems with no impact on production systems
- **Protect valuable information assets:** Prevent loss of business information from site disasters, viruses, human error, and system failures by providing alternate remote and local copies of data and enabling rapid restart and recovery
- **Use resources and personnel efficiently:** Offload processing and data to alternate systems and locations; use advanced software tools to minimize the labor-intensive nature of backup and recovery procedures
- **Standardize IT practices on fewer storage platforms:** Gain improved performance and greater scalability and availability; reduce burdens on IT staff
- **Gain the efficiency of consolidation:** Reap the benefits of standardized IT practices on fewer platforms by consolidating resources (requires greater data protection and disaster resilience)

Next Steps

This Hitachi Data Systems Business Continuity Business Brief has started you on the road to understanding the extent of your business continuity exposure and making a business case for solving it. Having read this Business Brief, you have a basic understanding of what is involved in implementing the best business continuity solution for your organization and what kind of engagement will equip you to choose from among the available software and services to simplify disaster recovery, minimize downtime, speed recovery, and pro-

tect your information assets while maximizing the use of resources and personnel.

As a next step, you can get more detail about Hitachi Data Systems synchronous or asynchronous data replication solutions that tackle the site disaster issue in our related Solution Blueprints. These Solution Blueprints detail the core of the solution, including an associated customer case study that offers a typical example of the particular business problem and technical solution. Clearly, each company's business continuity/disaster recovery requirements are unique, but the Solution Blueprints are designed to reduce uncertainty by describing pre-tested configurations to a class of specific storage problems. The Solutions Blueprints related to this Business Brief are:

- *Business Continuity Solution Blueprint: Synchronous Data Replication*
- *Business Continuity Solution Blueprint: Asynchronous Long-distance Data Replication*

Although reading is a good first step, Hitachi Data Systems strongly recommends that you engage our Global Solution Services group before you seriously undertake a business continuity plan. Global Solution Services can help you:

- Identify and analyze your business goals in terms of the length of time your business can afford to be down and how much data the business can afford to lose
- Identify your technical goals, based on which replication strategy makes sense, the nature of your existing infrastructure, the topologies of your storage layout and placement, and traffic patterns by application and host
- Create a migration plan to a new solution that includes test and verification components
- Document the design and create a detailed implementation and test plan
- Manage the implementation and execution phase of the plan

Pertinent offerings from Global Solution Services include:

- *Business Continuity Readiness Evaluation Service*
- *Risk Analysis Workshop*
- *Business Continuity Strategic Planning Service*

To learn more about how Hitachi Data Systems can help you with your business continuity plans and to read the aforementioned publications, please visit www.hds.com/bc. Or, call Hitachi Data Systems at (888) 234-5601, ext. 950, to explore an engagement that will result in the optimal solution for your business continuity needs.

A Breakthrough Worthy of Mention: Universal Replicator

Hitachi Universal Replicator software provides advanced, storage system based replication among all of the storage systems certified for attachment to Hitachi TagmaStore™ Universal Storage Platform.

Universal Replicator uses disk-based journaling to lower communication costs while improving data protection. It also pulls the data to the remote site, instead of pushing it from the primary site, which reduces resource consumption on the primary storage system and improves production application performance. Finally, instead of the single-product line limitation of previous generations of storage system-based replication software, Universal Replicator manages replication in heterogeneous storage environments. With only one set of procedures, tools, and skills to be mastered, regular and comprehensive disaster recovery testing of complex heterogeneous environments becomes more feasible and affordable.

In the same way, Universal Storage Platform handles three data center (3DC) configurations with less complexity, scripting, and overhead than previous solutions, making the 3DC solutions affordable for a broader range of enterprises and applications. For a more detailed discussion of the advanced business continuity capabilities of Universal Storage Platform, see the Hitachi Data Systems white paper, "Business Continuity and the Universal Storage Platform."

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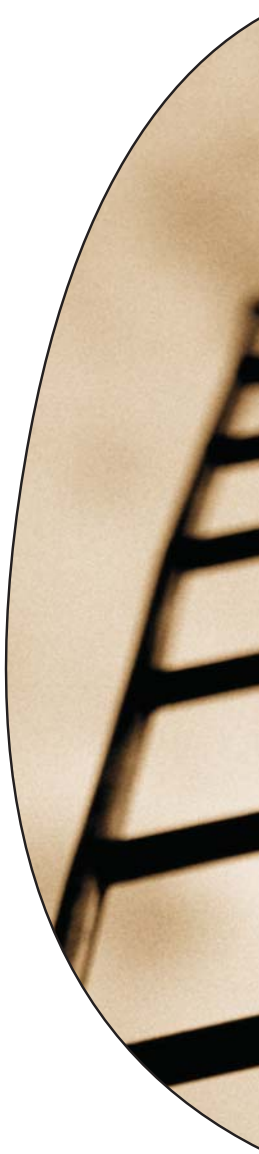

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