Storage migrations made simple.

Overcoming the challenges of technology refresh
Executive summary

Minimizing the impact of data migrations on business operations is a critical part of the data center manager’s job. Studies have shown that technology refresh—defined as replacing an older server or storage array with a new one—is the primary driver of data migration. Storage hardware and server replacement, as well as the expiration of storage equipment leases, means that storage managers have to move data on a regular basis. Moving data for technology refresh can be problematic, however, due to application availability requirements, incompatibilities between source and target systems, and time and budget constraints. While technology refresh projects are typically scheduled to be performed during off-hours, today’s 24x7 environment means that applications need to stay online, even during off-hours.

New software allows nondisruptive migration, meaning that applications remain online during migration, without significant performance delays. And reliable methodologies that help plan, migrate and validate data migrations can enable customization, speed the process and ensure data integrity—simplifying the technology refresh process.
The following table presents five key factors that show how data migration software can simplify technology refresh and how Softek™ Transparent Data Migration Facility (TDMF™) technology can meet these needs.

<table>
<thead>
<tr>
<th>Key factors</th>
<th>Description</th>
<th>Softek TDMF capability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance</td>
<td>Performance measurements must take into consideration how quickly data is copied from the source to target, and balanced against network bandwidth and system overhead.</td>
<td>TDMF software includes a throttling or pacing capability that can speed up or slow down data movement depending on system demands in order to easily balance migration.</td>
</tr>
<tr>
<td>Roll-back capability</td>
<td>If something goes wrong, the migration can be terminated and restarted or application processing can continue on the source data/device.</td>
<td>Roll back can easily be accomplished with TDMF software, although it can be problematic with some other technologies, such as volume managers.</td>
</tr>
<tr>
<td>Increase in volume size</td>
<td>In a recent survey, 40 percent of migrations involved an increase in volume size from the source to the target.</td>
<td>TDMF software can accommodate an increase in volume size.</td>
</tr>
<tr>
<td>Heterogeneous source and target hardware</td>
<td>While host-based products support unlike storage devices, most array-based products require that the source and target come from the same vendor.</td>
<td>TDMF software is hardware independent.</td>
</tr>
<tr>
<td>Application downtime</td>
<td>Applications have different levels of business criticality and therefore have varying degrees of acceptable downtime.</td>
<td>TDMF software allows for nondisruptive data migration so applications can stay online and continue to process data throughout the migration process.</td>
</tr>
</tbody>
</table>
Introduction
What drives data migration? In a recent Softek survey, technology refresh was cited as the major reason for moving data. Technology refresh is defined as replacing an array with a new one and most commonly occurs when:

• The lease on a piece of storage equipment ends
• Data is being moved from old to new storage
• The storage system is being upgraded
• The organization has decided to standardize on a particular technology.

Typically, most data centers lease their storage hardware under three-year agreements. Once the agreement ends, the hardware needs to be replaced and the data stored on it moved to new equipment. Data migration must be completed before the lease expires to avoid additional monthly lease costs. In cases in which storage hardware is purchased rather than leased, older arrays that are fully depreciated can be expensive to maintain. Once again, purchase and implementation of new equipment requires migrating data from the older arrays.

IT organizations justify purchase or lease of new equipment by the fact that it is less expensive to maintain, performs better and supports advanced features. New arrays can support larger capacities to accommodate the growth of applications; have faster processing chips to deliver better performance; or have new features such as snapshot copies. Finally, newer arrays are justified to minimize the risk of hardware malfunction, as older arrays are perceived as being less reliable.
In many cases, technology refresh not only means replacing storage arrays, but also upgrading associated servers to better meet service level agreements or because the servers, like the arrays, have reached the end of their lease. In addition, storage and server capacity are acquired annually or more often to accommodate data and application growth. Estimates of data growth vary, but they typically range from 25 to 50 percent annually for most industries.

So, every year, a typical organization acquires storage technology to replace arrays on which lease or maintenance agreements are expiring, as well as additional capacity to accommodate anticipated growth. Thus, the IT organization must move data between servers and storage for technology refresh on a very regular basis. The storage mantra is: You have data, therefore you will move it.
IT organizations face many challenges associated with technology refresh—particularly deciding how to deal with data growth and determining how, when and where to move data. Some of the key issues associated with technology refresh include:

• **Lease overlap costs or duplicate maintenance costs, when old and new equipment are on the data center floor at the same time**

• **Migration of data between arrays from different vendors, as there may be significant incompatibilities**

• **Risk of data loss or corruption that may occur if the migration is not done properly**

• **Prolonged application downtime, or even an inability to restart applications.**

This paper focuses on how organizations can meet these challenges by leveraging data migration software.

**Data migration software**

Depending on the criticality of applications, the quantity of data to be moved and allowable downtime, there are a variety of tools that organizations can use to migrate data, each with its own considerations and limitations.

**Offline migration methods**

Offline migration methods require that applications be taken offline during data movement, and therefore are suitable only when significant downtime can be tolerated. While the amount of downtime required typically depends on the quantity of data being transferred, this offline migration mechanism is not recommended for heavily used applications or those that must be accessible outside of normal business hours. Offline migration typically requires manual manipulation of data or files, which can increase the risk of human error and may not scale to distributed or remote scenarios.
Highlights

Offline migration methods include restore from backup tapes and FTP transfer.

Restore from backup tapes
This method involves making a backup copy of data, then taking the associated arrays and/or servers offline to ensure that no new data is added. Then, the data is restored from the backup tapes to the new arrays and/or servers. Once the restore process is complete, the systems are brought online. While this is a low-cost solution, especially as nearly all organizations already use backup software, it requires significant administrative attention and application downtime.

FTP transfer
This method involves manually copying files from the source systems to the target systems via File Transfer Protocol (FTP). As it requires file-by-file movement, the method is not recommended when the data contains large numbers of individual files. FTP transfer does not provide control over the network bandwidth used for migration, which can affect other applications and users in the network environment, nor does it enable verification of the complete transfer of data.

Online migration methods
Online migration methods generally allow data movement while applications are up and running. Depending on the method chosen, however, these methods can be limited to a single vendor environment. Other methods may consume significant central processing unity (CPU) overhead, potentially resulting in application slowdown or other disruptions.

Array-based replication
While this method allows for high service level guarantees, it requires moving between similar storage devices, increasing costs and limiting the data center to a single vendor.
Volume management or replication

Volume management is used primarily to control disk resources by mapping the logical view of storage space with the actual physical disks. While it can be used to move small amounts of data, it can be slow. This solution requires a heterogeneous storage environment over an IP network and may require the costly installation of additional software.

Host-based mirroring

Host-based mirroring or replication solutions generally focus on file-by-file data movement to create a secondary data copy for disaster recovery purposes. When used for data migration, this approach may put an additional burden on application servers and may require high-cost management, especially in heterogeneous environments.

Online nondisruptive migration—Softek data migration products

There are a few products available in the marketplace today that were designed to provide nondisruptive data migration—meaning that data movement occurs without causing application outages or slowdowns. Softek’s data migration software is the proven standard for online, heterogeneous data movement, meeting the challenges of application availability and technical compatibility between source and target storage. Softek’s TDMF software moves data while maintaining application availability, making it easy to upgrade to new storage, improve application performance and manage information availability through the information lifecycle. So, whether the organization needs to upgrade to new storage hardware (from any vendor to any vendor) or needs a more effective way to migrate data based on cost/performance, TDMF software can provide
the solution. Together with Softek Logical Data Migration Facility (LDMF™) software for moving mainframe data at the dataset level, Softek TDMF technology provides the solution to meet a wide range of technology refresh and other data migration needs.

An examination of real-world scenarios can demonstrate how Softek’s data migration products are used to simplify technology refresh:

- A manufacturing company running a mission-critical Oracle customer order and tracking system on Solaris conducting local UNIX® array-to-array migration.
- A large bank running a credit and debit transaction application on IBM z/OS® conducting local mainframe array-to-array migration.
- A major savings and loan institution running an IBM DB2®, IBM CICS® and Virtual Storage Access Method (VSAM) application with high-availability requirements conducting mainframe migration with volume consolidation.
- A Fortune 500 financial services firm running a mission-critical DB2 data warehouse conducting multiserver UNIX array-to-array migration with consolidation.
- A Fortune 1000 bank running a Sybase financial application conducting a global migration to new storage over distance.
- An insurance company with a mission-critical claims processing application on Oracle conducting a global migration to new servers and new storage.
- A Fortune 500 bank running a key enterprise compliance management application conducting a local Microsoft® Windows® array-to-array migration.

The detailed descriptions of these scenarios that follow show how Softek capabilities can meet technology refresh needs and streamline technology refresh projects.
In the first example, Softek software helped a manufacturing company move 3TB of legacy data from an old storage array to a new one, without significant downtime.

Technology refresh examples
Local UNIX array-to-array migration

In this example, a manufacturing company running a mission-critical Oracle customer order and tracking system on Solaris needed to move 3TB of legacy data from an old storage array to a new storage array.

The challenges that the company faced were as follows:

- **Limited downtime**—Downtime was limited to four hours on the weekend.
- **Large volume of data**—Application storage spanned ten 300GB volumes.
- **Increase in volume size**—The planned capacity growth required an increase in volume size during migration.

The company considered the pros and cons of several different migration options, including:

- **Restore from backup tapes**—This option would have required more than four hours to copy the data, exceeding application downtime restrictions.
- **Sun Solstice Volume Manager**—This would not support the increase in volume size.
- **Array-based replication**—This option would have been expensive to install, and the company did not plan to use it following the migration. In addition, firmware upgrades required on the legacy arrays to support the current array-based replication version would have added downtime and complexity to the project.
- **VERITAS Volume Replicator (VVR)**—This option would have required installing the prerequisite VERITAS Volume Manager.
Softek TDMF technology was chosen because the asynchronous, host-based migration was cost-effective, able to work with disparate platforms, did not require changes to the source environment and could accommodate the increased volume size in the target environment. The benefits of the TDMF solution were that the Oracle application’s storage volumes were augmented, enabling continued expansion of capacity. In addition, the migration was completed without significant downtime to this mission-critical application. Most important, the storage technology upgrade was transparent to the application’s end users.

Softek solution: Local UNIX array-to-array migration with Softek TDMF solution

1. Softek TDMF technology was installed on the host prior to the weekly scheduled downtime and configured to map the source and target devices. A script was written to unmount and remount the source devices during the weekend outage. The script was run just after the weekly backups and took less than 30 seconds to run, so the scheduled downtime was not affected.
2. The TDMF solution started the copy operation once applications are back online. Copy ran slowly in background so as not to significantly affect the operation of the application.
3. All volumes were synchronized within 48 hours.
4. Switchover was performed without service outage. Old volumes were left in place while performance of new volumes was validated.
Highlights

5. Old volumes were removed from configuration.
6. TDMF software was left on the system and used to move two volumes non-disruptively within the new storage array to resolve performance problems caused by pathing issues in the new hardware.

A financial institution cannot afford downtime when moving from legacy storage to newer storage arrays.

Local mainframe array-to-array migration

In this scenario, a large Canadian bank running a credit and debit transaction application on the IBM z/OS platform was moving from legacy storage to newer storage arrays.

The challenges the bank faced included the following:

- No application downtime allowed—The application was a key revenue driver, requiring 24x7 access. The projected 18 hours of downtime to install and configure new arrays and complete migration would violate corporate IT policy and cost thousands of dollars in lost revenue.
Highlights

In the case of a large bank migrating to new storage arrays, Softek TDMF was the only option considered because no other solution could perform the migration without requiring downtime.

In this case, Softek TDMF technology was the only option considered, because no other solution could accomplish the migration without requiring downtime.

Using Softek’s solution, the bank’s migration project was completed on schedule and required no outside resources so the budget was not affected. And because no application performance impact or outages were experienced, the bank could continue to generate revenue during the migration.

Softek solution: local mainframe array-to-array migration

1. Softek TDMF software was installed nondisruptively on the host.
2. Storage administrators, without formal training, used examples in Softek’s manual to perform TDMF initialization, activation and copy tasks.
3. In the first week, administrators migrated 50 percent of volumes to target storage arrays with no performance degradation. Migration took place during peak periods of activity because TDMF software has a dynamic throttling capability that speeds up or slows down migration as application requirements change.
4. Refreshes were performed periodically so that updates made to source volume during the copy phase were made to target volume, ensuring synchronization between source and target.
5. Administrators migrated the final 50 percent of volumes over the second week, with still no application impact.

6. When final synchronization had taken place, TDMF software completed the swap operation to redirect the mainframe I/O to target volumes, which became primary volumes. Switchover was performed without service outage.

7. Backout option was available in case a failure occurs during any phase. If needed, original source volume contained all the write operations performed during the migration.

8. Old volumes were removed from configuration.

This chart depicts the bank’s local mainframe array-to-array migration.
Local mainframe migration with volume consolidation

A major savings and loan institution had an older locally attached storage array under strain that it was replacing with a new locally attached storage array. The institution was running DB2 and CICS VSAM applications with very high availability requirements.

The key migration challenges were as follows:

- **Converting data between volume sizes**—The project required moving MOD 3 arrays onto MOD 3s, and MOD 3 arrays onto MOD 9s at both volume and dataset levels
- **Limited downtime**—The only permitted system downtime was Sunday mornings.
- **Personnel constraints**—There were limited personnel available to perform the migration.
- **Complex project**—Due to the complexity of the migration and the personnel constraints, the estimated duration of the project was at least two weeks.

The savings and loan company evaluated several migration options:

- **Manual methods**—This option was considered too labor intensive, especially with the “overworked and understaffed” customer resource base. Avoiding bandwidth impacts also would be difficult.
- **Array-based replication**—This option could not be used as the project involved migrating MOD 3s to MOD 9s.

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*Highlights*

A savings and loan company faced migration challenges such as personnel constraints and strict availability requirements.
A combination of Softek’s TDMF and LDMF software was chosen because of the products’ ability to migrate data nondisruptively, handle the resizing of MODs, and move specific data at the dataset level. With the LDMF/TDMF combination, the project was completed ahead of schedule (60 hours estimated, 55 hours actual), with data migration constituting 38 hours of the total time. This was considerably shorter than anticipated, and the migration was performed while the mainframe was in production, with no impact to end users.

Softek solution: Local mainframe migration with volume consolidation

1. TDMF and LDMF software was nondisruptively installed on IBM Z800 mainframe and verified by the implementation team.

2. The team mapped source and target volume migration for TDMF migration. As part of the process, TDMF software was used to migrate a single source MOD 3 to a MOD 9, thereby establishing the target MOD 9 into the existing storage management subsystem (SMS) environment and eliminating any SMS setup requirements for the new MOD 9 volumes.

3. The team mapped the remaining MOD 3 to MOD 9 migration, which was accomplished using LDMF software. The mapping documented the target-volume SMS storage groups and storage class. This also identified any volumes that were not under SMS control.

4. TDMF migration was initiated. Over the course of ten hours (including verification), the implementation team migrated 200 MOD 3 to 200 MOD 3 and 240 MOD 3 to 240 MOD 9. This entire migration was completed transparently during production hours.

5. The implementation team set up LDMF migration by building source and target dataset migration groups (460 source volumes going to 240 target volumes at the dataset level).
6. LDMF migration was executed over a 28-hour period (submission of group migrations, monitoring progress and verification results) and no application impact was reported during this period.

7. Scheduled off-hours bounce of all database applications took place after migration, and the total duration of the outage for all applications was less than one hour.

This chart depicts the array-to-array migration with consolidation enabled by the Softek software.
Multiserver UNIX array-to-array migration with consolidation

A Fortune 500 financial services firm had a mission-critical DB2 data warehouse (24TB DB2, 10TB supporting files) on seven IBM AIX® 5.1 server platforms with the storage allocated to nine different storage arrays, some more than five years old.

The firm faced these key migration challenges:

- **Storage growth**—Storage capacity grew from 4TB to 30TB in three years, with storage added in a demand-driven, rather than a planned, fashion.
- **Locating storage**—Storage administrators were unable to precisely locate storage.
- **Complex environment**—The system could be upgraded or changed only with difficulty, resulting in numerous end user complaints about system performance.
- **Relocating data**—A new storage array was purchased to improve performance by migrating and reconfiguring volumes.
- **Source/target incompatibilities**—The firm was unable to perform migration due to the complexity of the environment; this created incompatibilities between the source and target storage arrays, so the new array sat unused for two months on the data center floor.

The firm evaluated several different migration options:

- **Offline backup and restore from tape**—This option was rejected due to time constraints.
- **Operating system (OS) synchronization tools**—This option was rejected due to the inability to control migration start/end times.
- **Array-based replication**—This was not an option because of the incompatibilities between source and target storage.
- **AIX server-native Logical Volume Manager mirroring**—This was rejected as Volume Manager was too slow and was not configured for mirroring.
Softek’s TDMF UNIX (IP) software was chosen based on its ability to migrate between disparate platforms and its flexibility in working with various logical definitions. The benefit of the TDMF solution is that the data migration could be performed in a challenging environment well within scheduled windows. The firm was finally able to take advantage of its new hardware, which enabled it to run queries four times more quickly with the new array, improve data layout, and greatly simplify administration. Most important, end user complaints about performance were eliminated almost entirely. In addition, the firm was no longer paying lease charges for unused or outdated hardware. Softek’s implementation methodology ensured that there were no manual errors and the onsite resources were used efficiently.

**Softek solution: multiserver UNIX array-to-array migration with consolidation**

1. In the premigration stage, Softek worked with the storage vendor to perform comprehensive testing and proof of concept to prove the viability of the migration strategy. The firm elected to perform migration over scheduled weekend downtime, with an estimated 24 hours for total migration.

2. In the migration stage, the migration team was given the system at 8 p.m. on Saturday night; it installed TDMF software on seven AIX hosts in less than 15 minutes.

3. The migration process was initiated with migration configuration in loopback. The actual migration started at 12 a.m. and ended at 4 a.m., moving 22TB of data in four hours.

4. As part of the migration process, the implementation team resized physical partitions on volume groups, improved the layout of the volumes on the new array, and resized the IBM Journaled File System (JFS) logs.

5. The system was handed back at 3 p.m. on Sunday, well ahead of schedule, for preliminary testing. The DB2 data warehouse started correctly and the verification script launched.
6. The firm performed extensive testing, and at the end of the scheduled application stoppage, the system went into full production.

7. At the next scheduled downtime, the old source arrays were taken out of service and sent back to the leaseholder.

A bank needed help relocating four servers to another state.

Global migration to new storage over distance

A Fortune 1000 bank running a Sybase financial application was relocating four servers from a New Jersey operations center to a New York City operations center, changing out the legacy storage arrays to newer arrays.

The bank’s key migration challenges were as follows:

- Increased storage demands and internal consolidation – These factors drove the technology refresh.
Expiration of storage lease—The New Jersey storage needed to be returned to the leaseholder.

Hardware move—Physical servers had to be moved via courier.

Data move over distance—Data had to be moved from the New Jersey storage area network (SAN) to the New York City SAN.

Limited downtime—The only allowable outage was from Friday night to Saturday morning.

The bank reviewed several migration options:

Offline migration—Restore from tape after physically moving the servers was possible but would have required complete shutdown of application servers over a 48-hour period. Availability requirements made this option impossible.

FTP transfer—The lack of bandwidth control, inability to verify the complete transfer of data and the requirement for file-by-file movement prompted the rejection of this option.

VERITAS Volume Replicator—This option required the installation of VERITAS Volume Manager on the source and target machines.

Hardware-based mirroring—This option was not possible because the source and target arrays were dissimilar.

Softek’s TDMF UNIX (IP) software was chosen for its ability to work with multiple operating systems and perform fast, controllable transfers.

The migration allowed the bank to realize economies of scale and increase administrative control. In addition, the increased storage capacity allowed the bank to more fully utilize the Sybase application in support of key operations.

Softek solution: global migration to new storage over distance

1. In the target environment, all new storage was defined, with the bank opting to use “swing server” to perform the migration. Data for the New Jersey servers was allocated to the swing server, which served as a proxy during the migration.
The Softek solution enabled a rapid, security-rich migration from the source to the target.

2. At 5 p.m. on Friday, the applications were taken offline and TDMF was installed on the New Jersey servers.

3. Migration was set up from the four servers to one target and was initiated. The complete, full refresh took two hours and involved moving 2.2TB over the bank’s wide area network (WAN). Upon completion, the TDMF solution maintained synchronization between source and target environment.

4. The migration was completed and verification testing was performed on data.

5. The New Jersey servers were shut down, physically moved to New York City and installed at the bank’s site.

6. In the target environment, the storage was zoned from the swing server to the relocated servers.

7. The servers were brought up and tested, and applications were brought up and tested. At 6 a.m. Saturday, the application was put back into production.

8. At the next scheduled outage, the New Jersey storage array was taken offline and removed for return to leaseholder.

Figure 6
Global migration to new storage over distance
Global migration to new servers and new storage

An insurance company was running a mission-critical claims processing application on Oracle. It was upgrading from legacy servers running Solaris 8 and VERITAS Filesystem/Solstice Disksuite to new servers running Solaris 9 and VERITAS Volume Manager. Six TB (allocated 2TB per server) on an older disk array were being replaced by a new array.

The insurance company faced these key migration challenges:

- **Limited downtime**—Only four hours downtime per week were permitted for any application.
- **Hardware move constraints**—Only one server could be moved at a time to avoid risk to the application infrastructure.
- **Compatibility of new storage with legacy servers**—There were insufficient connections available to directly attach new storage to legacy servers, and it was risky to install new device drivers on legacy servers.

The migration options that were considered included the following:

- **Offline migration**—This would have resulted in multiple downtime instances, each exceeding 12 hours.
- **Array-based replication**—This option could not be used due to dissimilar legacy and target storage, and because disk subsystems were incompatible.
- **VERITAS Volume Replicator**—This option would have required the installation of VERITAS Volume Manager on source servers.
- **Fabric-based appliance replication**—This was rejected because of the risk of reconfiguring the SAN.
- **Kashya**—This was rejected due to the requirement that mirrors be set up and created on the host system. Such an arrangement was unacceptable given the changes involved and the associated disruption.

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Highlights

An insurance company needed help to maintain availability while migrating a mission-critical claims processing application.
Softek’s TDMF UNIX (IP) software was chosen as the least risky option because no system reboots were required. The migration was performed without requiring a reboot of any critical service, continuous application availability was maintained during data migration, and the migration was performed without end users experiencing any loss or significant degradation in service.

Softek solution: global migration to new servers and new storage

1. In the initial phase, configurations were pre-created and user-customizable scripts were written to unmount, replace the vfstab file, and remount file systems.
2. TDMF software was installed just prior to weekly shutdown with no disruption. Each server is configured in turn, with a total elapsed time of 15 minutes for TDMF installation and configuration.
3. A full refresh from source server A to target server A was conducted over the course of a week. Big asynchronous buffer (BAB) absorbed peaks in write activity on legacy servers to minimize CPU usage and prevent high I/O load.
4. New versions of Oracle and other software preinstalled on target server A were tested. Testing involved receiving multiple application-consistent versions of production disks on a daily basis. To avoid having to refresh from the production disks every time, checkpoint and a chaining configuration were used.
5. At the completion of the testing, journal wrote to target volumes to ensure minimal data transfer on resynchronization.
6. During the next weekend’s outage, applications on target server A were brought up and pointed to the new storage volumes. Source server A was taken out of service.
7. The process was repeated for source servers B and C over the next two weeks.
8. During the next scheduled outage, the older storage array was taken out of service.

Figure 7
Global migration to new servers and storage

Local Windows array-to-array migration
A Fortune 500 bank had 5.8TB of data on two servers for a key enterprise compliance management application based on Microsoft SQL. The bank wanted to move from an older locally attached storage array to a new locally attached storage array.
The key migration challenges were as follows:

- **Adding new storage**—The goal was to free up existing storage and implement new faster, cheaper storage.
- **Limited downtime**—The application had a limited downtime window from 12 a.m. to 6 a.m. Saturday morning and from 12 a.m. to 2 a.m. Tuesday morning—but it was estimated that the full migration would take a week.
- **Reconfiguration of a large number of volumes**—There were 30 volumes to be moved, creating potential configuration issues.

The bank considered these options:

- **Restore from tape backups**—This was not possible due to application availability requirements.
- **EMC Open Migrator**—This was initially selected but failed during an early migration test.
- **File-level migration/replication**—This was considered but found to be too expensive and difficult to configure for users lacking expert-level implementation experience.

Softek’s TDMF Windows (IP) software was chosen because of its ease of use, price and ability to maintain continuous application availability during data migration.

**A Fortune 500 bank chose Softek’s TDMF Windows (IP) software for its ease of use, price and ability to maintain continuous application availability during data migration.**

**Softek solution: local Windows array-to-array migration**

1. During scheduled Saturday downtime, Softek TDMF software was installed on the production server. Target volumes were connected to the volume/disk manager and the system was rebooted to allocate the BAB buffer (RAM) and register target volume at volume/disk manager. Installation took ten minutes per server. Application was restarted at the end of scheduled downtime.
2. Migration groups were configured on source and target by the implementation team. The team, with offsite Softek support, created mount points to resolve issues related to insufficient drive letters caused by the number of volumes to be migrated.

3. TDMF full refresh was initiated in loop back configuration. Full refresh took approximately 24 hours and was performed online without any application impact.

4. With TDMF operation in normal mode, the team validated the data migrated to the new storage array by using TDMF software’s checkpoint function.

5. During Tuesday downtime, the application was stopped and source volumes were removed. The target volumes were renamed, and the application was placed back into production using new arrays.

6. Old arrays were decommissioned.

Figure 8
Local Windows array-to-array migration
Summary
For the IT manager, technology refresh is regular, continuous and problematic, unless data migration software is used to simplify and streamline the process.

The scenarios presented in this paper demonstrate how Softek’s data migration software can be leveraged to streamline technology refresh projects. Above and beyond what most other products offer, Softek’s data migration software provides nondisruptive, flexible and purpose-built solutions to the complex challenges of technology refresh.

With Softek solutions, applications remain online and continue to process data throughout the migration process. Softek’s TDMF software is completely hardware independent, accommodates increases in volume size, adjusts to system demands and has roll-back capability.

For more information
For more information about Softek solutions for technology refresh, visit:

ibm.com/services/storage