
System Migrations Without Business Downtime

An Executive Overview

Businesses grow. Technologies evolve. System migrations may be inevitable, but business downtime isn't.

All businesses strive for growth. It's what keeps shareholders happy and staff gainfully employed. To improve productivity, companies also endeavor to automate processes. In addition, as technologies advance and data storage costs decline, organizations collect more data and put it to more uses. Consequently, you have to upgrade your systems, and it definitely won't be the last time you do. The question is, how can you migrate from your old, overburdened server to a new, more powerful one without stopping operations?

Of course, upgrades are not the only cause of migrations. From time to time, vendors come out with new hardware and operating system versions that offer such significant, incremental value that failing to migrate to the new version would put your company at a competitive disadvantage. Again, the question is, how can you make the switch without impeding business processes?

This fundamental quandary—the seemingly impossible goal of migrating systems without business downtime—and the solutions to it are the subject of this executive overview.

The challenge:
Your systems are running up against capacity constraints and you need to upgrade, but your business can't tolerate any downtime. How can you migrate all of your data and applications to a new system without impacting users?

At one time, the question never arose in many organizations. Migrations were scheduled on weekends, when the company was shut down. If it was expected to be a particularly long process, the IT department simply waited for a long weekend. In the United States, the Thanksgiving holiday was a particularly opportune time because it always falls on a Thursday, and no one worked on the Friday after Thanksgiving Day. Nobody, that is, except the IT staff who had to come in to do a migration.

Now, performing upgrades and migrations on a weekend—long or not—is no longer an option for many IT departments. Some companies sell their wares and offer customer support 24/7 over the Web. In fact, not working on the Friday after Thanksgiving is impossible for retailers that depend on their systems to support sales in their physical stores as well. It is usually one of the busiest days of the retail sales year, by far.

Beyond the retail sector, other companies use e-business to facilitate supply chain operations around the clock. And some have set up operations around the globe, including places that, compared with the primary data center location, celebrate an entirely different set of holidays, define “weekend” differently and are in time zones that are offset by several hours.

The result in all of these circumstances is that maintenance windows have shrunk to the point where they are no longer adequate to accommodate system migrations.

The need for upgrades and migrations is not going to disappear. Consequently, organizations need a way to perform them without impacting business operations. It sounds like an impossible assignment: decommission an old server and swap in a new one while incurring, at most, a trivial amount of business downtime. However, not only is this not impossible, but, depending on your IT infrastructure, it might be easy. And you might already have everything you need to make it happen.

High Availability Means High Availability. Period.

Maintaining fully synchronized old and new systems during a migration allows business operations to carry on unaffected while the IT staff runs tests, audits and other processes to verify objects on the new system before making the switch—without impeding normal operations and without the need to schedule the bulk of the migration work at night or on a weekend.

High availability (HA) solutions are designed to help you avoid all downtime, including during system migrations. How? Consider how HA solutions work. They monitor your production system and replicate data and object changes to a second system that serves as a hot-backup server. The software also typically provides an easy and fast way to switch users to the backup system when your production server becomes unavailable or you need to take it offline to perform maintenance.

HA solutions are able to maintain system availability during migrations because the replication software usually doesn't require that the production and backup servers run the same version of an operating system or that the servers be of the same size. This means that you can place an upgraded server into the HA topology without needing to upgrade all servers in the topology simultaneously.

There are three general techniques for using HA in a migration scenario:

- Switch Method
- Cascade Method
- Parallel Method

Switch Method

Most HA products allow you to halt the transmission portion of the replication processes so that any changes to data and objects will still be captured on the primary system, but they will not be sent to the backup. When transmission is restarted, the HA software resynchronizes the two systems by sending all of the captured changes to the second system. The switch method takes advantage of this feature to facilitate system migrations with minimal downtime. The process is as follows:

1. Stop the replication transmission processes, but allow the users to remain on the primary system. The journals and/or other HA data stores will continue to collect all of the transactions. Users continue to do their work as usual.
2. Upgrade the secondary system (hardware, operating system, or both) by saving and restoring the data from the old secondary system to the new one. This can be done any-time, as it does not affect users.
3. In the HA topology, replace the old secondary system with the new one and re-establish communications between it and the primary system.
4. Turn the replication transmission processes back on, allowing the HA software to replicate all of the transactions that have transpired on the primary system since the connection to the secondary system was severed.
5. When the two systems are resynchronized, perform a controlled switch of the users to the new secondary system. Easy switching functionality is standard in most advanced HA software.
6. Now that the users are on the secondary system, repeat the upgrade process for the primary system.
7. Reconnect the two systems, allow the HA software to resynchronize the systems and perform a controlled switch back to the original configuration.

Even when using the switch method, it is possible to omit the second switch (switching back to the original production server) if the primary and backup systems are both able to act equally well as the production platform. This is possible when the servers have similar capacity (CPW, storage, etc.) and are in the same location or in equally advantageous locations.

HA isn't just a way to facilitate instantaneous disaster recovery. Nor is it only a means to perform maintenance or data backups on a backup server so the primary system can remain available longer. While these two scenarios are popular examples of high availability, HA software also provides an extremely effective way to perform migrations without downtime.

There are a few issues that you should consider before using the switch method, including the following:

- While the server on one side of the HA topology is being upgraded, the other server is the only one that is available to run production processing. This leaves your data and applications vulnerable if a disaster strikes during the migration process. It should be noted that, because the data and objects on the old secondary system are complete and up-to-date as of the point when you halted the replication processes, there are really only two threats in this case:
 1. In the event of a disaster or other unplanned downtime on the active system, business applications will not be available until one of the two systems can be brought back online.
 2. Transactions may be lost if the disaster destroys the active system's disks, including the journal files, because replication is not occurring during the upgrade of the other server.

The probability of unplanned downtime events is small, but the threat is still too great for some businesses. If yours is one of them, you will have to use one of the other two migration methods, which will be described later.

- To reduce costs, some companies use a "smaller" backup system, one that has a significantly lower performance rating than their primary system. Their thinking is that planned downtime can be scheduled for "off-hours," when many administrative systems are not being used; and, during unplanned downtime events, which are typically rare, the company can accept the curtailment of some non-critical systems until the primary system can be brought back online. In this case, the upgrade of the primary system will have to be performed during those "off-hours" to avoid seriously impeding business operations.
- While replication transmission is turned off, data and object updates build up in the active system's journal receivers and/or any other HA data stores. If the upgrade takes considerable time and is performed while the business is operating at peak capacity, those journal receivers and/or other HA data stores may consume considerable space. Before beginning the upgrade process, you must ensure that sufficient disk space is available to accommodate these requirements.
- Currently, many System i HA products use remote journaling as the replication transmission mechanism, either exclusively or as an option. In itself, this is not an impediment to using the switch method. However, remote journaling can be run in either of two modes: asynchronous and synchronous. In asynchronous mode, the writing of an update to the local journal and the completion of the user transaction is independent of the writing of the update to the remote journal. Thus, asynchronous remote journaling is compatible with the switch method.

Synchronous remote journaling is not compatible. Synchronous remote journaling writes updates to the remote journal receiver before writing them to the local receiver. During normal processing, the user's transaction is not considered complete until the remote journaling function is complete.

Although this synchronous process may slow down transactions, some companies still insist on synchronous journaling because otherwise there is a very small chance that some transactions may be lost during a disaster.

Under the switch method, the remote server is unavailable. Therefore, synchronous remote journaling will not allow the completion of any transactions. Thus, if the use of synchronous remote journaling is mandatory in your organization, you will have to use one of the other migration methods.

Cascade Method

Tip: An HA solution— or migrate-while-active software—capable of replicating data and applications in a many-to-one topology can also be used to migrate several decentralized servers onto a single consolidated server without downtime.

The cascade method is appropriate in environments where two new servers (for production and backup) are replacing one or more old servers. Figure 1 illustrates the topology required for the cascade migration method.

Using this method, after bringing in the two new systems and configuring them, you use the HA software to replicate data and objects from the old backup system (labeled System “B” in Figure 1) to the new primary system (System “C”) and from there to the new backup (System “D”). After all four systems are full replicas of all of the others, you can keep this cascading replication running while you test the new systems. Any updates made on System “A” will be replicated in real-time, or near real-time, down through the entire chain. Consequently, the new primary and secondary systems will always contain an up-to-date replica.

When you are ready to go live with the new primary and secondary servers, simply switch users to the new primary server. You can then decommission the old primary and secondary systems at your leisure. Using this method, you will have a hot-backup system available throughout the migration process.

The cascade method is advantageous even for companies that originally chose to implement a smaller backup server (System “B”). Unlike with the switch method, where the backup system must assume the production role while the primary system is being upgraded, when using the cascade method, the only time the backup system would need to take over production operations is if a disaster strikes the production system during the migration process. The migration will be delayed, but the business can continue. This is still a better outcome than if a disaster strikes the active system during a switch-method migration.

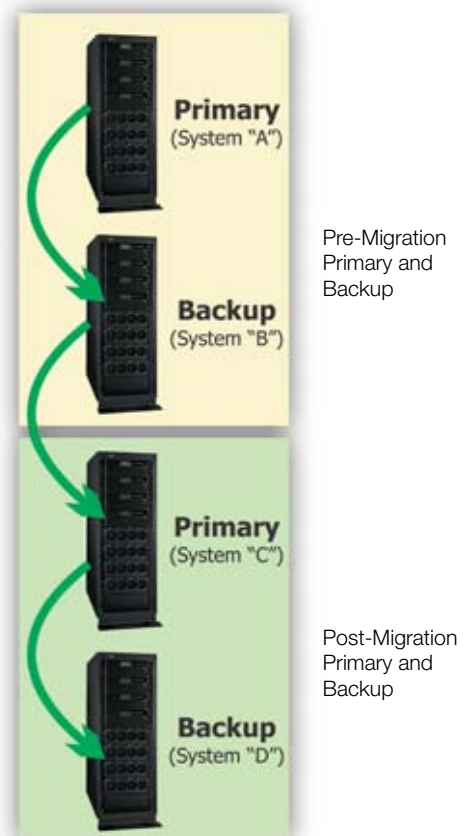


Figure 1: Cascade Migration Method

Another benefit of this approach is that only a single switch—from the old to the new primary system—is required. Using the switch method, two switches are usually necessary—from the primary to the backup server and then back to the primary.

There is one potential problem with the cascade method. It assumes that all the necessary data and objects are being replicated between the original systems. If there were any mistakes made in the configuration of replication from the old primary system to the old backup system (System “A” to “B”), the data being moved to the new servers may be incomplete or incorrect. The new servers will only be as complete as the old backup server. This should not be a concern for a company that regularly audits its HA environment, but it does mean that extra care should be taken to ensure that the original replication setup is correct and complete before starting the migration.

Parallel Method

When determining how to begin a migration project, start by getting the facts. Being informed and consulting with those who have experience will ensure a quick ROI. Make sure that the initial planning for this project is conducted thoroughly. Because you probably perform migrations so infrequently, get the experience of a team that does these migrations all the time. Then choose the approach that will best suit your needs and make it happen. You will likely never migrate a system again without the assistance of a high availability software solution.

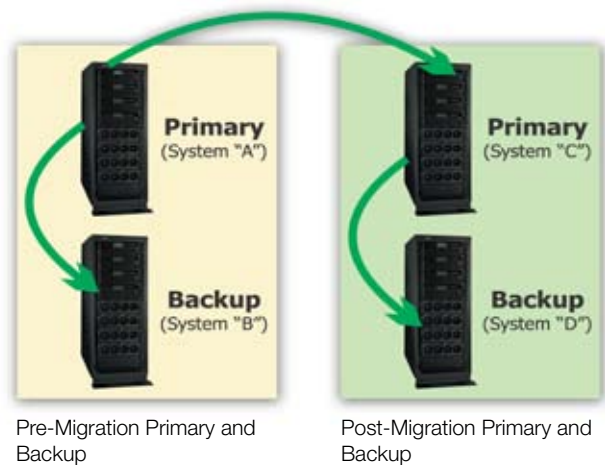
As illustrated in Figure 2, the parallel migration method shares two benefits with the cascade method. First, there is always a hot-backup system available throughout the migration process. And, second, only a single switch—from the old to the new primary system—is required to upgrade both the primary and backup systems.

The difference between the cascade and parallel methods is in the replication topology during the migration. Rather than replicating from the old backup system to the new primary system (the cascade method), the old primary system (System “A” in Figure 2) replicates to the new primary system (System “C”). From there, the new primary replicates to the new backup (System “D”).

In addition to replicating data and objects to the new primary system, the old primary system continues to replicate to the old backup system (System “B”). This ensures that the old backup system remains fully synchronized and ready to take over operations until the new primary and backup are ready to go live.

Once the replication processes have fully loaded the new primary and backup systems and those new systems have been fully tested, users can be switched to the new primary system and the old systems can be decommissioned.

Figure 2: Parallel Migration Method



Vision Solutions offers a range of high availability and migrate-while-active solutions that can minimize migration downtime in most midrange business computing environments.

Because many of the benefits of the cascade and parallel methods are similar, the choice between the two revolves around the additional advantage, and challenges, of the Parallel method:

Advantage

- **Data Integrity:** The parallel method reduces the risk of migrating missing or incorrect data to the new servers. Because the migration is done using a new “A” to “C” replication configuration that was carefully planned and designed specifically for the migration process, even if the old “A” to “B” HA configuration was incorrect, the new systems will not be affected by this error.

Challenges

- **Bandwidth:** Using the parallel method, during the migration process the old primary system will have to replicate data and objects to two systems simultaneously. You must be certain that there is adequate bandwidth both on the network and on the channels out of the old primary system to handle this.
- **Processing workload:** Using the parallel method, there will also be some additional processing required on the primary system to manage the dual simultaneous replication streams. If your system is already near capacity (which might be why you are upgrading in the first place), this may result in unacceptable application response times during the upgrade process.
- **Complexity:** The configuration required for the parallel method is slightly more complex than for the cascade method, but it results in the least downtime for users.

Vision Solutions HA

Issue: You need to migrate your IBM System i to a new server, but you don't have an HA solution.

No problem.

Upgrade/Migrate While

Active from Vision

Solutions virtually eliminates migration downtime.

Vision Solutions' high availability products work across multiple platforms to ensure business continuity, boost productivity and accelerate business processes. Affordable and easy to use, they eliminate both planned and unplanned downtime with only minutes a day of administration.

- **ITERA HA for i5/OS** is an easy, affordable and worry-free way for small and medium sized businesses to protect their critical System i applications and data.
- **MIMIX HA for i5/OS** is built for the most demanding enterprises. MIMIX HA virtually eliminates planned and unplanned IT downtime with automated features that minimize HA administration and ensure HA integrity.
- **ORION HA for i5/OS** delivers maximum protection and continuous availability for critical applications in large and sophisticated enterprise environments.
- **HA for AIX** keeps your AIX environment resilient and protected, easily and more affordably than with other solutions.
- **Double-Take® for Windows** is the world's most relied upon solution for protecting Microsoft Windows® environments.

All of Vision Solutions' HA solutions allow you to employ any of the three methods described above to minimize downtime during migrations. When using the System i-based solutions (ITERA HA, MIMIX HA or ORION HA) to facilitate the switch method, your HA environment must use asynchronous remote journaling as the replication transport engine or you must use local journaling and the product's internal transport mechanism. The latter option, local journaling, is available only in MIMIX HA and ORION HA.

Eliminating Migration Downtime in Non-HA Environments

Not all companies have deployed HA in their IT environments. Instead, some can still schedule planned downtime for off-hours, accept occasional unplanned downtime and depend on nightly backups and local journaling to protect their data. Without HA in place, these companies lack the additional systems needed to avoid downtime during upgrades or migrations. But there is still an inexpensive way for them to achieve the same objective.

Vision Solution's Upgrade/Migrate While Active is a cost-effective solution that virtually eliminates migration downtime traditionally associated with system upgrades and migrations. It does so by leveraging Vision's HA technologies to rapidly copy business-critical data to your new System i and keep it synchronized with your production system, in real-time. Upgrade/Migrate While Active replicates all data, user profiles, authorities, data areas, data queues, IFS files, programs, spool files and all other objects needed for a successful migration. After validating your new System i environment, you can move users and processes to it in just minutes.

Because Upgrade/Migrate While Active keeps your new system synchronized with the old one until you are ready to make the switch, you take your time to validate the new system while users work normally on the old one.

Case in Point: Adventist Health

Hardware limitations strained Adventist Health's IBM AS/400 model 730 and made subsecond response time increasingly difficult to attain. To remedy the problem, the healthcare organization acquired a powerful new IBM System i model 570. Being a 24/7 healthcare facility that was dependent on its systems, Adventist Health couldn't afford to incur downtime during the upgrade, but the best of the traditional migration procedures would have rendered systems unavailable for up to 20 hours. Adventist Health found a solution to this dilemma by using Vision Solutions' Upgrade/Migrate While Active. This allowed Adventist Health's new System i 570 to run in parallel with the existing production system until the organization was ready to make the switch.

Without incurring downtime on the production system, 800 gigabytes of data were synchronized to the 570 over the course of three evenings. Then, with both computers synchronized and testing completed, active users were logged off the old system and on to the new one. This was done at midnight, when Adventist Health's systems begin a new admitting day.

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high availability and disaster
recovery, please visit Vision
Solutions' Web site:
www.visionsolutions.com*

Migration Without Downtime

Most companies are now utterly dependent on their information systems. Critical applications are essential to ongoing operations. What's more, many organizations now require the availability of their essential systems 24/7 to support Internet operations and/or global facilities, suppliers and customers. For these companies, downtime is not an option, regardless of the time of day or week.

***“There were alternatives,
but Upgrade/Migrate While
Active was the best.
We cut our downtime to a
fraction of what it would
have been—it really worked
out very well for us.”***

—Adventist Health

Yet the need for system upgrades and migrations is inevitable. Growth in the business pushes the limits of existing systems. The demand for new functionality intensifies the strain. Even without pushing up against performance constraints, new hardware and operating systems that offer new highly productive or more secure functionality occasionally come along with the promise of an ROI that can't be ignored.

In the past, any upgrade or migration required system downtime—typically lots of downtime. This no longer has to be the case. HA solutions include inherent capabilities to facilitate migration and allow for parallel old and new operations until the new system is fully tested and ready to assume operations. Then, downtime is limited to the time required to switch users from the old system to the new—a task that the HA software can also help you to perform very quickly.

Even if you don't yet have an HA solution, software that includes some of the core HA functionality, such as Vision Solutions' Upgrade/Migrate While Active, can help you to accomplish the same objective of minimizing downtime, without the expense of implementing a full HA solution.



iTERA HA

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