MAXAVA ARCHITECTURE EXPLAINED

Maxava IBM i HA/DR Technical Insight

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Chapter 1

Introduction

The worldwide landscape of High Availability and Disaster Recovery (“HA/DR”) is rapidly changing. Businesses are moving away from traditional tape backup solutions and introducing real-time data replication into their disaster recovery environments. Companies running on the IBM i platform have a plethora of choices to make when evaluating their HA/DR options – Hardware or Software Replication, Conventional or Cloud Based Solutions, and use of the Audit Journal, or a more advanced and less invasive solution? When they do so they are required to make some big decisions on the architecture they will depend on for their future data security and business continuity.

This paper has been written for those organizations that are evaluating their current HA/DR solution options and are looking to improve on their current approach.

It provides a high-level view of what an HA/DR solution offers and some of the fundamental considerations when deciding between hardware and software (logical) replication.

It then reviews in more depth some of the critical factors relating to HA/DR software replication and how Maxava HA has been designed to address them. The most important of these include;

- Integrity of replication
- Reliability
- Processing performance
- Ease of use
- Speed of transfer from production to backup environments (to avoid backlogs on production causing data loss on a system failure)

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Chapter 2

Real-time Replication for HA/DR

The role of real-time HA/DR solutions is to maintain an identical copy of a production environment on a Backup system. The transactional activity that occurs on the Production environment must be recreated in real-time on the Backup system. The objective is to allow the customer to maintain two identical copies of their database, up to date to the second and often in locations many miles apart. It gives businesses the ability to switch or 'roleswap' between the two database copies. Data can be replicated in various ways by a variety of products but at the fundamental level the options are Hardware Replication (PowerHA) or Software Replication (often referred to as Logical Replication) such as Maxava HA.

A primary responsibility of HA software should be to ensure all Object and Data Activity is relayed off the Source system with the absolute minimum of delay. HA/DR software must prepare for the possibility of the Source system failing without warning. Having activity which has occurred on the Source system but that has not yet been sent to the Back-up system will have the obvious repercussion of loss of data, an unacceptable result in today's time-critical business environments.

Chapter 3

Hardware Replication & Software Replication

IBM's PowerHA is considered Hardware Replication while products like Maxava HA are known as Software (or logical) Replication. There are pro's and con's with each approach. Hardware replication is an option for businesses that have the infrastructure (SAN), bandwidth and implementation of iASP architecture, which is necessary for use of PowerHA. The IBM Lab Services group in Rochester teaches classes on how to use iASP with various applications.

With Hardware Replication, the backup database is passive and is not available for use for other purposes such as query lookups or running reports. More importantly when it is being backed up changes are cached on the source system and during this period you do not have HA/DR. A total failure would mean lost data. The use of Metro Mirror assists in this area; however it is the more expensive option. Not only that, if someone was to update some of the data on the Target iASP whilst it was varied on being backed up, a full refresh would need to be performed to re-sync the data once more. This all requires extra time and effort.

Logical Replication does not require iASPs or SAN based storage (although they are supported by Maxava HA). The backup database can be used for non-update workload such as tape backups, queries and reporting without the need to halt the send of journal data from the source system. Logical Replication also has the ability to roll-back any partial or corrupt transactions via journaling while Hardware Replication currently does not support this and any updates necessitate a full refresh.

Chapter 3

Hardware Replication & Software Replication

Logical replication which allows Library Redirect also allows for multiple source systems to replicate to a single large target system. This is useful where you have a system which cannot be LPAR'ed for cost or other reasons.

When considering the choice between Hardware and Software Replication, you should carefully assess your options in the context of how your production environment is set-up, your technical minimum requirements, the project budget, ease of implementation and ongoing use and the technical skills and resources necessary and available to you.

Maxava HA Technology Choice

- Maxava HA is logical replication

Benefits of using Logical Replication include:

- Easier and more flexible backup options
- Ability to omit objects from replication
- Ability to work with and use the target copy for reporting and query lookup
- Whilst backups are running changes are still being sent to the target system and cached there
- With Library Redirect you can have multiple source systems replicate to a single target.
- Ability to roll back transactions via journaling or refresh individual objects where required without the need for a full refresh.

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Chapter 3

Hardware Replication & Software Replication

Logical replication also avoids some of the disadvantages of the features of Hardware Replication which can cause difficulty, such as:

- Full refreshes required if updates performed on the target.
- More expensive from a hardware point of view.
- Target database not available for query lookup whilst being updated.
- Does not replicate the system ASP.
- Have to replicate the entire ASP, so cannot replicate individual libraries or objects. Therefore, no ability to decrease communication loads by omitting work files or libraries etc.

Chapter 4

Data Transfer

The ability to maintain near real-time updating depends on getting the transactions from the Source system to the Back-up environment.

Hardware replication transfers data at the iASP level. Software (Logical) replication solutions typically use either their own proprietary transfer protocols or utilize the Remote Journaling functionality of the IBM i operating system. Remote Journaling is explained in more detail in the section below.

Maxava HA Technology Choice

- Maxava HA utilizes IBM Remote Journaling.

Chapter 5

Remote Journaling

Remote Journaling is part of the IBM i Operating System (iOS) and is available at no extra cost on your IBM i. According to Larry Youngren (IBM i Developer of Remote Journaling), Remote journaling is sometimes referred to as “better plumbing” for high availability environments. Part of that reputation stems from its ability to perform certain operations more efficiently than other approaches can.

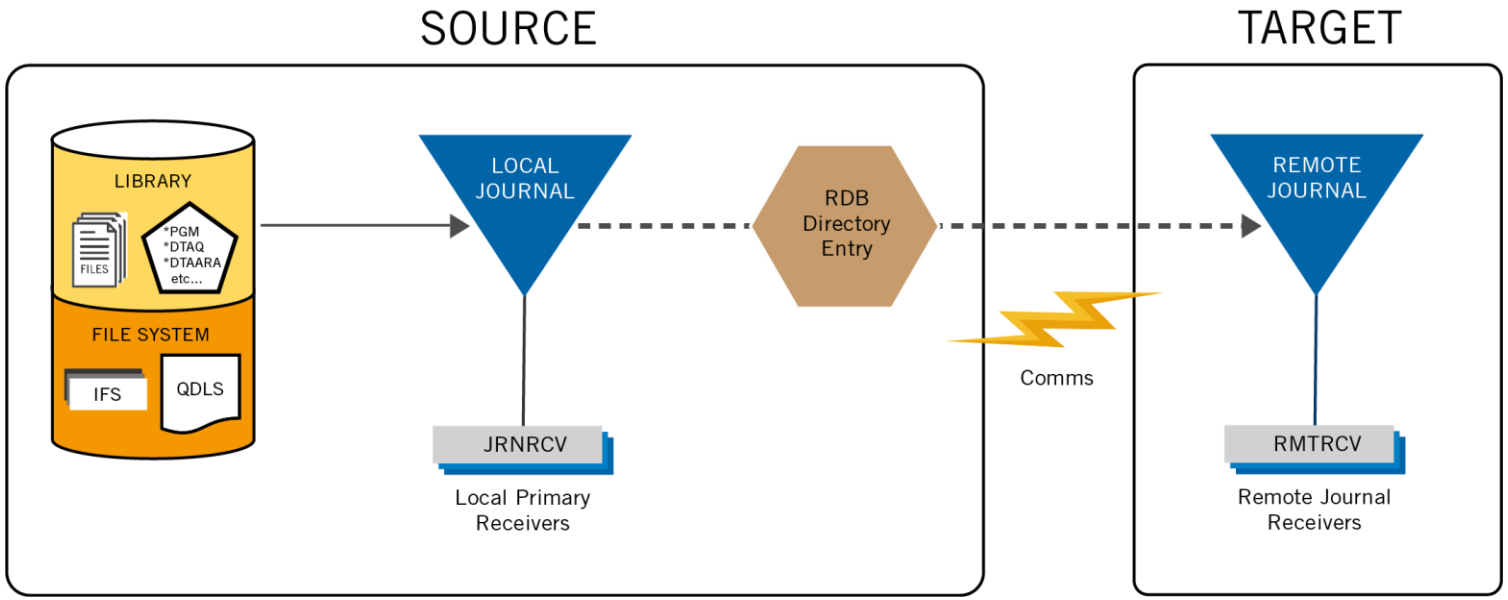
Data is written to local journals and then sent to duplicate remote journals on another LPAR or machine across any distance. It can be run in synchronous or asynchronous modes.

In synchronous mode, the preferred choice, data is written to the backup database first and then it is written to the primary database. This option requires enough bandwidth to send in real time, otherwise jobs on the Source system have to wait for confirmation of the remote write before continuing. This method guarantees that data updates are written to the target journal before the source and therefore there is little or no opportunity for entries to be lost if the source system were to fail.

In asynchronous mode, data is written to the primary database first and then sent to the target journal. Therefore, there is no wait restriction on locally running jobs. Most HA/DR sites operate in asynchronous mode.

Chapter 5

Remote Journaling



If all the activity is collected from the various journals on the Production Machine, the decision to be made is:-

a) SORT the activity into the right sequence, and then SEND the activity to the Backup machine
or
b) SEND the activity to the Backup machine, then SORT the activity when it gets there

IBM's introduction of remote journaling promotes the choice of SEND/SORT, as this gets the data sent quicker and takes the sort load off the Production Machine. The quicker it's sent, the less latency has been introduced.

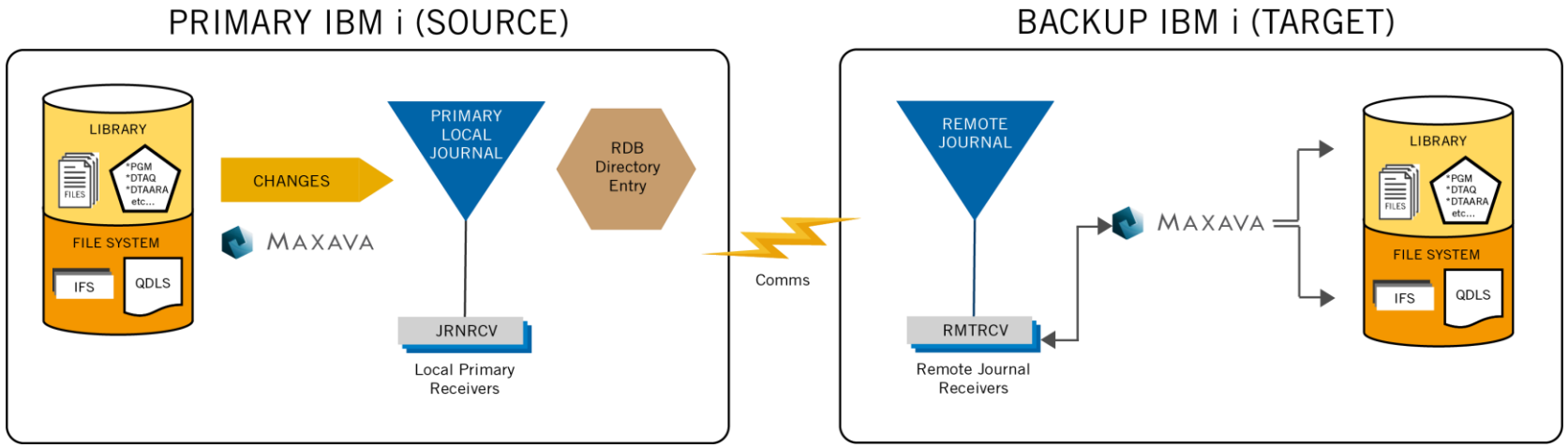
Chapter 5

Remote Journaling

Data Activity is recorded in Data Journals by the IBM i OS. We have the option of reading the Local Data Journal or the Remote Data Journal, to discover the information we need to know about Data Activity. We need that information, so we can replicate it. So, a job must be running either on the Source to read the Local Journal, or on the Back-up, to read the Remote Journal.

If we read the Local Journal, then we need our own mechanism to relay that information to the Back-up. If we read the Remote Journal, the relaying is done for us by the OS at the microcode level.

Maxava chose to read the Remote Data Journal, to take advantage of the auto-relaying by the OS, to ensure the information gets to the Back-up in real-time, rather than after-the-event, and to move any processing load off the Source system.



Chapter 5

Remote Journaling

Some other Logical Replication products may have the data arrive before the actual object creation process. This introduces a degree of latency and requires additional CPU cycles on the Back-up system as they have to hold the data updates and then go back and merge them into the object afterwards.

Others again look to read the local entries on the Source system, even combine multiple journals into one send process and then send to the target system to be processed. These approaches use valuable Source system resources.

Maxava HA Technology Choice

- Maxava chose to use Remote Journaling for its suite of HA products.

Benefits of using Remote Journaling include:

- Operates at the microcode level
- Fully written and supported by IBM
- Does not have the performance issues of some of the other methods
- Supports synchronous transfer

The use of Remote Journaling also avoids a number of potential issues which are common to alternative replication methods. Products not using Remote Journaling commonly;

- Do not support synchronous transfer
- Use additional source system resources
- Are vendor rather than IBM supported

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Chapter 6

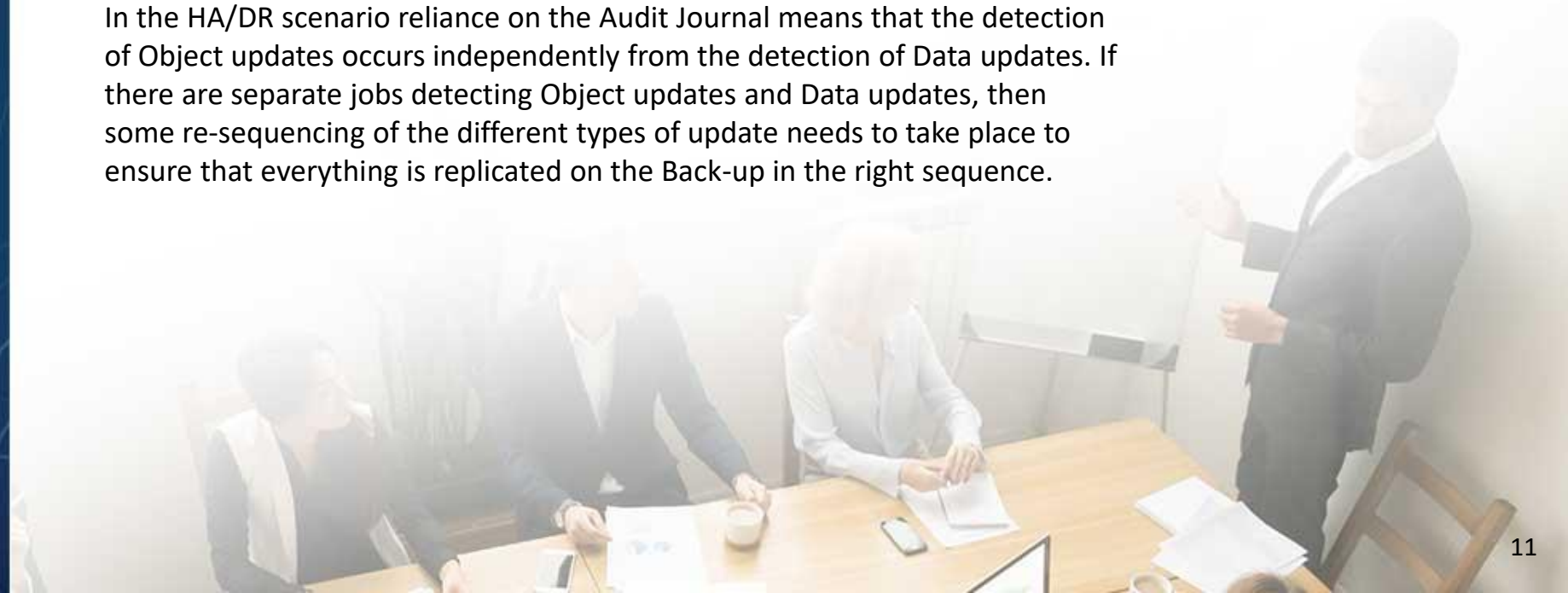
The Audit Journal

The Audit Journal was developed for security purposes rather than HA/DR and as such is not ideal for use as a basis for HA/DR solutions. Some of the issues introduced by relying on the Audit Journal are described below.

When the Audit Journal is being used for Security – which is its primary function, there are many entries written to it that have no relevance to the HA/DR requirement. However, all these non-relevant entries still need to be read, to get to those that are required for HA/DR purposes.

Activating the Audit Journal process, results in a significant resource overhead on the Production System.

In the HA/DR scenario reliance on the Audit Journal means that the detection of Object updates occurs independently from the detection of Data updates. If there are separate jobs detecting Object updates and Data updates, then some re-sequencing of the different types of update needs to take place to ensure that everything is replicated on the Back-up in the right sequence.



Chapter 6

The Audit Journal

The use of the audit journal also happens ‘after the fact’, so object replication is staged or delayed. When an object is created the create process is picked up by the audit function and a journal entry, or entries, written to the audit journal itself. A process now needs to either; read those entries on the Source system and attempt a save of the object, which of course could now be locked, or send the entries to a target system to have a save request then sent back to the Source system once more. All of this uses extra resources on the systems and is happening well after the Object Create process has completed.

Maxava HA Technology Choice

- Maxava chose to not use the System Audit Journal for its suite of HA products. Instead it utilizes functionality provided by IBM for the purpose of intercepting command functions. This real-time capture functionality is further explained in the MAXSYS section below.

The reasons why Maxava chose not to use the System Audit Journal include

- The system audit journal was designed and optimized for system security purposes rather than replication. Attempting to modify its use for replication purposes is not ideal and is not its original design function.
- Significant system overhead is introduced by activating the audit journal process.
- Use of the System Audit Journal introduces the additional complication of being required to merge separate streams of object and data changes together to permit replication to occur.
- Staged or delayed replication of object creates and object changes are often introduced by methods relying on the System Audit Journal.

Chapter 7

Different types of Logical Replication

For those considering Logical Replication solutions, it is important to understand that not all products operate in a similar way. Some use Remote Journaling, others use proprietary mechanisms to transfer Activity from the Production to Back-up environments. Even amongst those products that use Remote Journaling there are significant and important differences that directly impact performance, reliability and replication integrity.

At a basic level, the activity that occurs on the Production Machine is a combination of Object Activity and Data Activity. If a file is created and then records written to it, the creation of the file is “Object Activity” while the writing of records to the file is “Data Activity”.

HA/DR software works by taking the stream of changes and applying them in the same order on the Back-up system. The order is important because, for instance, a file created by Object Activity needs to be created on the Back-up system before data records can be written to it by Data Activity.

The IBM i operating system enables journaling of both kinds of activity. Object Activity is recorded in the Audit Journal and Data Activity in one of the Data Journals.

The data journals will record the actual updated data. The Audit Journal records only that an Object has changed or been created, but does not actually store the change made.

When designing Maxava HA we looked at the various options to replicate Data and Object Activity.

One option was to use the Audit Journal and Data Journals as described above and is the method commonly used by our competitors.

Chapter 7

Different types of Logical Replication

One of the main challenges with this approach is to ensure that sequencing of activity remains correct without excessive overhead or delays on the production system. As it is necessary to sort the combined activity from both Audit and Data Journals and to sequence them correctly, it is necessary to sort activity by precise time and then apply sequentially.

This requires sorting and sequencing either on the production system or on the Back-up system. One of the following approaches is therefore necessary;

Approach 1

- Read the Data Journals on the Production machine
- Send the relevant journal records for Object Activity to the Back-up
- Read the Audit Journal on the Production machine
- Send all the relevant journal activity to the Back-up
- Rearrange data and objects into the right sequence on the Back-up machine
- Apply it

Approach 2

- Read the Remote Journals on the Back-up machine
- Read the Audit Journal on the Production machine
- Send all the relevant journal activity to the Back-up
- Rearrange data and objects into the right sequence on the Back-up machine
- Apply it

Chapter 7

Different types of Logical Replication

Approach 3

- Read the Data Journals on the Production machine
- Read the Audit Journal on the Production machine
- Rearrange data and objects into the right sequence on the Production machine
- Send all the relevant journal activity to the Back-up
- Apply it

However, even in doing this, the fact that the Audit Journal only indicates that an Object has changed without providing the actual change means that a delay is introduced in “going back” to the Primary System to obtain and then apply the actual object change. This also introduces significant complexity and scope for out of sync conditions to occur.

Maxava decided to take a unique approach to solving this problem. Our approach, which is conceptually simple;

- Ensures both Object and Data Activity are captured and moved off the Production System immediately without pre-processing
- Avoids the need for sorting and sequencing data and object activity as above
- Avoids the delay and risk associated in going back to the primary system for details of Object Activity
- Minimizes processing overhead
- Reduces comparative bandwidth requirements by avoiding transferring unnecessary Audit Journal information
- Maximizes use of the IBM i operating system features to maximize efficiency and ensure close compatibility with the OS

Chapter 7

Different types of Logical Replication

This approach relays activity in the order in which it occurs, meaning the Back-up system need only process the activity it is sent, without the need for any re-sequencing.

Maximising the use of the IBM i OS, ensures the role of Maxava HA becomes simply to read updates on the Production system and then replay them on the Back-up system quickly and accurately. This method is uncomplicated, there is no requirement to use the Audit Journal and minimum resources are used on the Production Machine.

Maxava maximized the use of the OS and entirely avoids the traditional sequencing and delay issues introduced by using the Audit Journal.

So how does Maxava HA work?

Approach 4

- Deposit required object changes via the MAXSYS library into the appropriate local journal in real-time
- Read the Remote Journals on the Back-up machine
- Apply it

Maxava uses the MAXSYS library for data replication to enable all Object Activity to be combined with that Data Activity in one journal. As both Object and Data Activity are captured as they are happening, all Activity is relayed to the Back-up in the order in which it happens, through the same Remote Journal. Everything that is needed to replay & replicate transactions is available and already in proper sequence when it arrives on the Back-up. (Refer to the MAXSYS section for further explanation)

Chapter 7

Different types of Logical Replication

As all activity goes through Remote Journaling in the correct sequence, Maxava HA simply has to replay what the Remote Journal delivers. In this way Maxava HA can always ensure that the object arrives on the Back-up before the data.

Due to impacts on workload on the production and/or backup systems, and more importantly impacts on any backlog of updates waiting to be sent from the production system, it is important to understand which approach (1, 2, 3 or 4) the product being evaluated utilizes. Maxava HA uses approach 4.

Maxava HA Technology Choice

- Maxava chose to use a unique approach and allow required object changes to be deposited into the source local journal via the MAXSYS library in real-time.

Significant Benefits of using Maxava's Method include:

- Real-time capture of object creates and changes.
- Virtually no chance of locking issues.
- Object changes and updates deposited into the local journal in sequence

The Maxava approach also avoids major disadvantages prevalent in Alternative Methods including :

- Use of the audit journal
- Use of unnecessary, additional source system resources
- Delayed replication of objects

Chapter 8

MAXSYS

With Maxava HA Software, MAXSYS is a library that sits above QSYS in the System Library List. It contains a copy of IBM commands necessary to perform dynamic replication.

Each copied command has its CPP (Command Processing Program) changed to a Maxava version and is also tagged with an exit point program so that it will initiate a Maxava HA function, prior to the normal execution of the QSYS command of the same name. It sits above QSYS so that it will always be the Maxava HA version of the command which is executed.

This gives the Maxava HA software the opportunity to relay all the information necessary to achieve dynamic replication to the Back-up system and to take other appropriate actions.

As discussed in the sections above; reading the Audit Journal will gather information on all add/change/delete Object Activity after it has happened. Using MAXSYS to intercept the command which causes the add/change/delete means that the information regarding the add/change/delete Object Activity is gathered as it is happening. Real-time.

This means virtually no chance of Object Locking, because the command call activity has not yet been completed and control released to the calling program.
Also Object Activity is relayed to the Back-up Environment in real-time, not ‘after the event’.

Several IBM i products have adopted the library-above-QSYS concept, and many end-user companies do also. IBM documentation supports the technique of having “Application Libraries and IBM-Supplied Libraries” coexisting in the System Library List.

Chapter 8

MAXSYS

MAXSYS causes a Maxava HA action to be initiated prior to the execution of a QSYS command. This Maxava HA action has no significance to applications and the QSYS command executes as normal.

MAXSYS is the reason there is no basic requirement for there to be any core HA jobs active on the Source system reading audit journals and is the reason why there is no re-sequencing activity required on the Back-up.

A Role Swap requires that all the activity that was occurring on the Source, now needs to be occurring on the Back-up, and all the activity that was occurring on the Back-up, now needs to be occurring on the Source. The less there is to Stop and Start, the fewer steps there are in the Role Swap process and the less chance of any issues occurring.

Maxava HA Technology Choice

- Maxava chose to use command intercept functionality via the MAXSYS library rather than the audit journal for its suite of HA products.

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Chapter 8

MAXSYS

Benefits of using MAXSYS include:

- Real-time capture of object creates and changes.
- Virtually no chance of locking issues.
- No jobs to start or stop on the systems, once in the library list always active.
- IBM approved method.
- The Maxava approach also avoids major disadvantages prevalent in Alternative Methods including;
- Use of the audit journal
- Additional jobs to be started, monitored and ended
- Use additional source system resources
- Delayed replication of objects
- Good chance of object locks which would stop complete replication to the target system.

Chapter 9

Before and After Imaging

Before and after image checking is a valuable feature of Maxava HA which provides significant benefits.

It is an option that may be switched off if preferred by the customer however deactivation is not recommended due to the major advantages it provides.

Data Records on the Production machine are typically being changed hundreds, if not thousands, of times per second by the users and their applications. Maxava HA is designed to be in sole charge of identically repeating all those record changes to the Back-up system. It is critically important, to ensure integrity of the Backup system, that only Maxava HA changes records on the Back-up.

However, it is possible that records may be being changed by someone or some process other than the HA/DR software on the Back-up system. If this is occurring, the earlier it is detected and addressed the better. Maxava HA uses the Before Image; to check that a record is indeed as it should be, before it is updated to the After Image.

If there is a difference between the Before Image and what is on the Back-up prior to update, corrective action can be initiated immediately. Without Before and After image checking discrepancies in the database may continue to go unnoticed until full audits are run. Even using autonomics, corrections only occur at the time the autonomic program identifies a discrepancy. In effect Maxava HA is conducting continual audit checking on an update-by-update basis and highlighting situations which may need further investigation. This is in addition to extensive audit and autonomics functionality within the product range.

Chapter 9

Before and After Imaging

As an example of a situation which could occur; if there was a database file with 100 records on the Production machine, then there would be an identical 100 record file on the Back-up. As records changed on the Production machine, HA software would repeat that change on the Back-up. Should a “rogue job” run on the Back-up, which changed all 100 records in the Back-up file – and then subsequently a legitimate job was to run on the Production machine which changed 60 of the 100 records, those 60 record changes would be applied on the Back-up, leaving the other 40 records in a corrupted state.

If only the after image was being applied to the backup database, so without the Before Image compare, this situation would remain undetected by standard replication.

As Maxava HA does the Before Image compare, the first of those 60 legitimate changes would instantly highlight the issue and background activity would immediately be initiated, that would ensure all 100 records were correct.

Taking both the Before and the After image does have some minor impact on bandwidth requirements. This is not typically a problem as it is only updates and deletes, not adds, which create the dual journal entries. There is often a misconception that journals will double in size using Before and After images and that bandwidth requirements will double. In practice, this is far from the case.

The impact of any increase in journal size and therefore bandwidth usage is not significant in most operational environments and should be considered against the very real benefits that Before image checking delivers.

Chapter 9

Before and After Imaging

Maxava HA Technology Choice

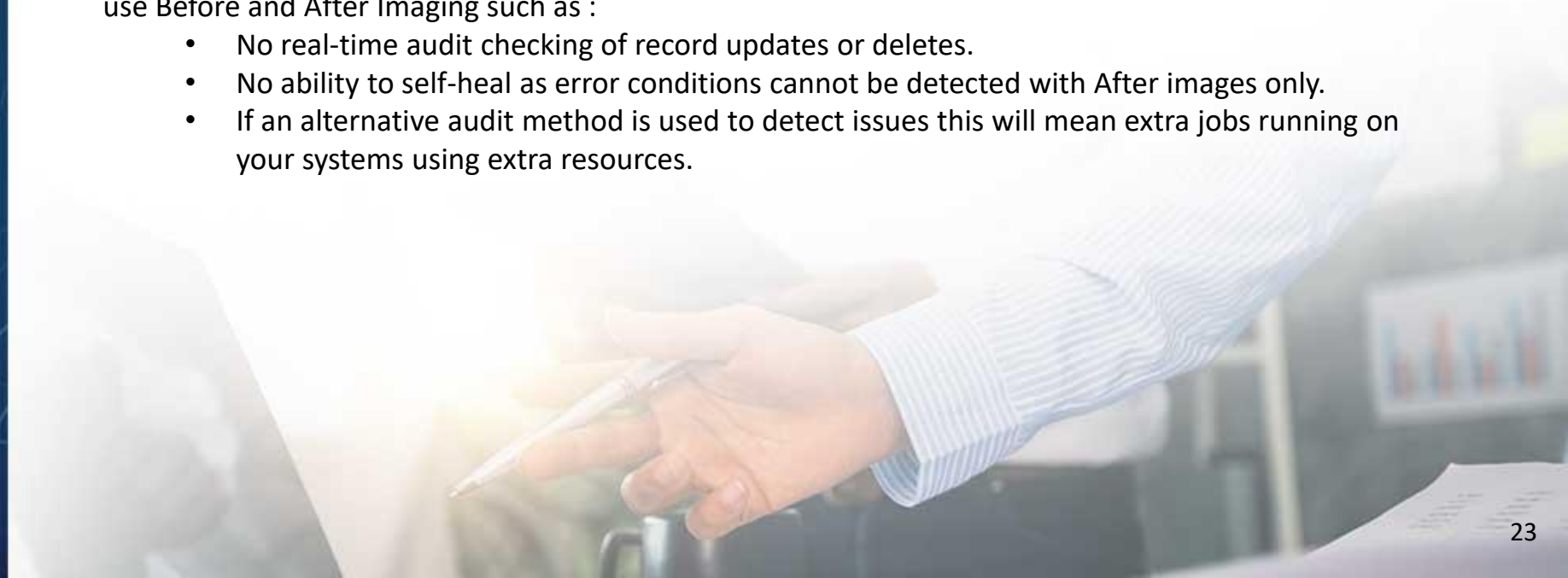
- Maxava HA provides the ability to use Before and After image support (recommended) or just After images for its suite of HA products.

Benefits of using Before and After Images include:

- Real-time audit checking of each record update and delete
- Allows for detection of data issues which in turn allows autonomic healing.
- IBM standard journal function
- In most instances does not significantly increase storage or bandwidth requirements.

The Maxava approach also avoids major disadvantages prevalent in Alternative Methods which do not use Before and After Imaging such as :

- No real-time audit checking of record updates or deletes.
- No ability to self-heal as error conditions cannot be detected with After images only.
- If an alternative audit method is used to detect issues this will mean extra jobs running on your systems using extra resources.



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Chapter 10

Source & Back-up Workload

The Maxava approach is, where possible, to minimize Production system workload. This is achieved by undertaking as much of the required replication workload on the Back-up system. The majority of Maxava HA core dynamic replication activity on the Source system is streamlined within what happens during the execution of the MAXSYS resident commands, rather than having to have independently running jobs. No requirement to enable and run system audit functions and jobs means there is less workload happening on the source system and no need for management software to check these jobs are running.

It also has the benefit of minimizing the number of jobs that it is necessary to stop and start during the time critical situation of a Failover or Role Swap.

The core purpose of any HA activity that happens on the Source, should be ideally to get information to the Back-up ‘with all speed’. Once it is safely relayed to the Back-up, then appropriate actions can take place, without affecting the Production machine performance.

Maxava HA Technology Choice

- Maxava HA has been designed to have as small a footprint as possible on the source system.

Chapter 11

Latency

Ideally there should be no latency or ‘transaction backlog’ in an HA/DR environment.

If the communication link between the Source and Back-up fails, journal entries will accumulate in the Local Journal, waiting to transfer. When the link is re-established, the IBM i OS’s on the Production and on the Back-up, will work together to ensure that the Remote Journal gets quickly back into sync with the Local Journal.

If the communications link is too slow, the sending of the local receivers to the Back-up system can fall behind. Maxava HA, of course, has no control over this but our monitoring features allow this to be clearly visible allowing network changes to be assessed as necessary. It should be noted that with modern bandwidth and network capabilities it is rare that network and bandwidth issues are a significant problem.

If the Local and Remote Journals are in-sync, then any backlog in processing is completely on the Back-up. This is an area in which Maxava HA excels, with multiple stream apply processing across many apply groups being designed into the basic architecture for maximum performance. (Maxava HA was designed from the outset to successfully handle volume/performance demands in the Telco industry that were beyond the capability of our competitors)

There are times however when a backlog can occur, if for instance, replication is suspended whilst a tape backup is in progress. When the backup is complete, any backlog should disappear quickly. As noted above Maxava HA has the ability to multi-stream data across a large number of apply groups to process any backlogs quickly.

Chapter 11

Latency

Maxava HA was designed from the outset, for the most demanding environments, with the largest of transaction volumes. We believe that Maxava is the fastest product on the market. This is an important feature as it is very important to eliminate any latency between primary and backup machines and to be role-swap ready.

Maxava HA is an ideal choice for high transaction customers like Banks, Telecommunication Companies and Stock Exchanges. The performance of course works equally well in SMB environments and it is always comforting to know that there is extra performance available “on tap” if ever needed.

Maxava HA Technology Choice

- Maxava HA was designed to allow multiple stream apply processing.

Benefits of using Maxava HA’s Apply Architecture include :

- Maxava HA was designed from the outset, for the most demanding environments, with the largest of transaction volumes.
- Allows processing via multiple apply groups
- Allows the easy addition of extra apply groups to enhance performance if required and fine tune.
- We believe that Maxava HA products have the fastest apply process for target systems.
- Makes use of IBM’s remote journaling

Chapter 12

Autonomics

Autonomics is designed to correct any Object discrepancies found between the Production and Back-up systems during replication.

If an Object is detected as being different between the Source and Back-up systems Autonomics provides the functionality to correctly re-sync that object.

The Maxava philosophy with respect to Autonomics is that it should be unnecessary and merely a “nice to have” in rare circumstances where out of sync situations have unexpectedly occurred.

The first objective is always to ensure that accurate replication occurs and that Autonomics is not necessary.

If however, an out-of-sync situation does occur, it is important to have resources available to ensure detection at the earliest possible time so that it can be investigated, the root cause ascertained, and corrective action taken to resolve the issue and prevent it reoccurring in the future.

Maxava HA Autonomics works efficiently and effectively in the background whilst allowing normal operations to continue.

Chapter 12

Autonomics

Maxava Autonomics has 4 modes of operation which are user configurable;

1. Fix immediately
2. Fix at a time pre-determined by the customer
3. Report the issue but do not fix
4. Do not report the issue nor attempt to fix it

Maxava HA Autonomics also gives you the customer the ability to allow save while active requests to be made and for large files to be repaired at the block level.

While Maxava HA obviously suspends replication on a file-by-file basis until an error has been corrected, replication of all other files continues as normal.

Maxava HA Technology Choice

- Maxava HA provides flexible Autonomics to correct object discrepancies

Benefits of using Maxava HA Autonomics include :

- Easily to configure
- Able to configure settings at the system level, individual library or even object level
- Able to set Autonomics to fix immediately, delayed, report or ignore for a given level
- Ability to sync at the object level or using partial record blocks for large files

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Chapter 13

Auditing

In order to check the data and object consistency of target databases, audit capabilities need to exist within your HA/DR solution. If users or processes accidentally manage to update the target system there needs to be a means of checking the data stored and correcting it.

Maxava HA provides flexible auditing at multiple levels for customers to check their target databases

- Existence audits check that an object is physically on the target system.
- Description audits check the object and its key attributes
- Content audits check the data contained within the object

The Maxava HA audits can be run for a given configuration, library, object, generic list of named objects or by object type. Audits can be run in reporting only and full fix modes.

Chapter 13

Auditing

Audit results are shown in easy to view logs via the Maxava HA GUI or TUI interfaces. Audit warnings and actions taken are clearly shown and where an audit was run in reporting only mode, there is the option to manually synch listed objects.

In conjunction with the Maxava HA Autonomics process, partial database content audits can also be configured to run for large files where the information is checked and repaired at the block level.

Maxava HA Technology Choice

- Maxava HA provides flexible auditing at multiple levels

Benefits of using Maxava HA Autonomics include :

- Easy to run
- Existence, Description and Content options
- Able to run at configuration, library or object levels
- Can be run in reporting only or full fix mode
- Easy to view logs.
- Work in conjunction with Maxava HA Autonomics

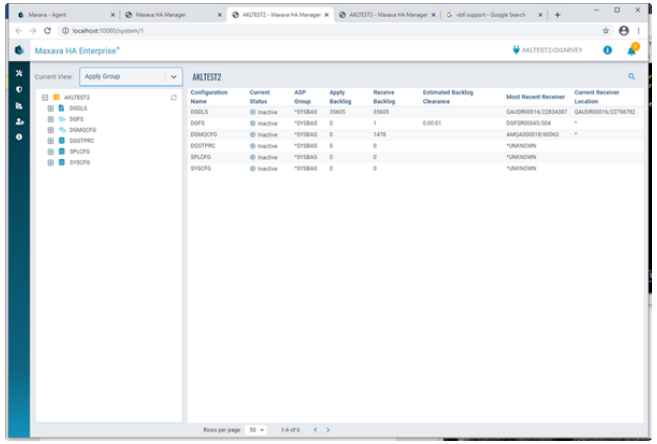
Chapter 14

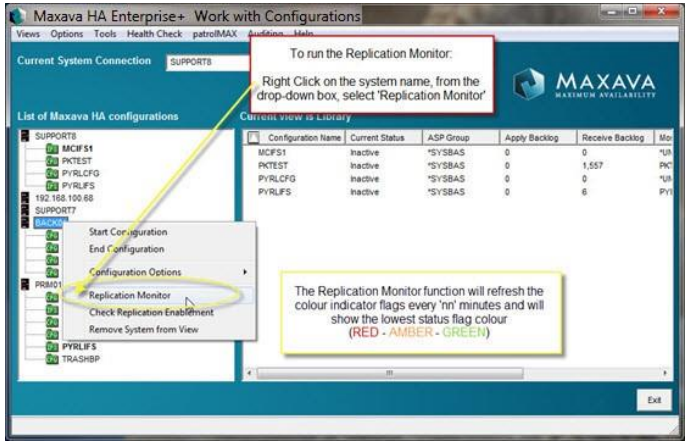
Administration and Monitoring Interfaces

Maxava HA provides a variety of User Interfaces that allow the monitoring and maintenance of multiple systems and configurations. The right choice for the administrator will depend on a number of factors such as home working or on-site, browser based or Windows app based, traditional or more modern. Administrators should be able to pick and choose the one that is right for them at that moment.

For those looking for a modern graphical option a browser-based interface using node.js at the back-end is the recommendation. Modern and intuitive to use, the functionality needed to maintain HA is available for a more mobile and non-traditional work force.

The popular Windows GUI is still in use by thousands of administrators world-wide. Using a tree-structure it shows a composite view of all the Maxava HA environments for all machines (or LPARs) in a network.





Chapter 14

Administration and Monitoring Interfaces

There is also a Green-screen alternative to the GUI, which allows the system it is executed on to be monitored and administered. The Green-screen only requires 5250 access to be able to be run from a command line on the required system.

Maxava has also created maxView, with which you can access Maxava HA and key IBM i system resource information – anywhere, anytime from a remote web device or Smartphone. Various maxView versions are provided with Maxava HA dependent on the particular version of Maxava HA selected.

All of the User Interfaces give an easy-to-read view of the current replication situation with alerts. A traffic-light system (Red/Amber/Green) is used to simply highlight any areas that may require attention.

For those interested in taking their Monitoring to the next level – total system monitoring - Maxava provides Mi8. Monitor Mi8 is an intelligent solution built for multiplatform, local and remote monitoring. Mi8 Cloud-based architecture enables you to monitor systems for current and potential issues, whether system, application or Maxava HA. Monitored alerts are delivered to the expert you choose, via your platform of choice, with the capability to allow for immediate remedial action if necessary.

Chapter 14

Administration and Monitoring Interfaces

With Monitor Mi8 and maxView Manager the interactive command feature allows certain actions and requests to be sent back to the system, so you can answer messages, run jobs, start and stop configurations, run audits, even remotely role swap your systems all from a mobile interface. With the intuitive Maxava interfaces, you will see a visual alert of system status and your Maxava HA environment, and be able to take action immediately.

Most Maxava customers spend no more than 5 minutes per day checking that everything is running normally and efficiently. Maxava HA issues alerts and other status information in such a way that it is extremely simple to integrate it into a Systems Management approach.

Managed Service Monitoring Packages are also available through the Maxava Services Department.

Chapter 14

Administration and Monitoring Interfaces

Maxava HA Technology Choice

- Maxava HA provides multiple interfaces to allow monitoring and support of your systems no matter where you are.

Benefits of using Maxava HA Interfaces include:

- Maxava has multiple interface choices which suit different types of Administrator.
- The Maxava HA GUI allows multiple systems to be configured, monitored and managed from a single interface.
- The Maxava Interfaces utilize a traffic-light system (Red/Amber/Green) for highlighting any areas that may require attention over and above the normal expected reporting options.
- If 5250 is the only communications option available or the preferred method for whatever reason, the Maxava HA TUI allows you to perform all the day to day admin tasks.
- The maxView products allow system and HA monitoring to be accessible to not only the technical staff, but also management and operations. They allow you to be remote and still have control over your systems via your Smartphone.
- Monitor Mi8 provides a total alerting solution for HA, systems and customer applications.

Chapter 15

Applications & Compatibility

Maxava HA replicates Data and Objects (and, of course, other disk contents, such as the IFS, IBM MQ, QDLS, etc). These are fundamental to all software applications and the particular application software utilising these Data and Objects are fundamentally irrelevant from a Maxava HA perspective.

Of the many hundreds of Maxava HA customers located globally and using a host of different applications, Maxava has never experienced a compatibility issue which it was not able to address.

Part of the Discovery Phase of a Maxava HA implementation, is to assist in identifying those items (libraries, objects within libraries, IFS paths, etc) which should not be, or are not required to be, replicated.

Maxava HA Technology Choice

- Maxava HA is application independent.

Chapter 16

Library Redirect

Maxava HA is normally used to replicate between a Source machine and a Back-up machine or between a Source LPAR and a Back-up LPAR (which might be on the same physical machine).

Maxava HA can also be used to replicate between LibraryA and LibraryB within the same LPAR or machine across any distance. LibraryB is maintained by Maxava HA to have exactly the same contents as LibraryA with only the library names being different to meet the requirements of the OS.

One use for this would be to make it possible to do full library backups to tape, whilst still providing 24x7availability to Users. On a single system within the same physical ASP you can have production LibraryA replicate to backup LibraryB. When desired you can end replication to LibraryB and take a backup whilst your production users are still updating LibraryA.

Maxava HA Technology Choice

- Maxava HA allows library redirect replication.

Benefits of using Library Redirect include :

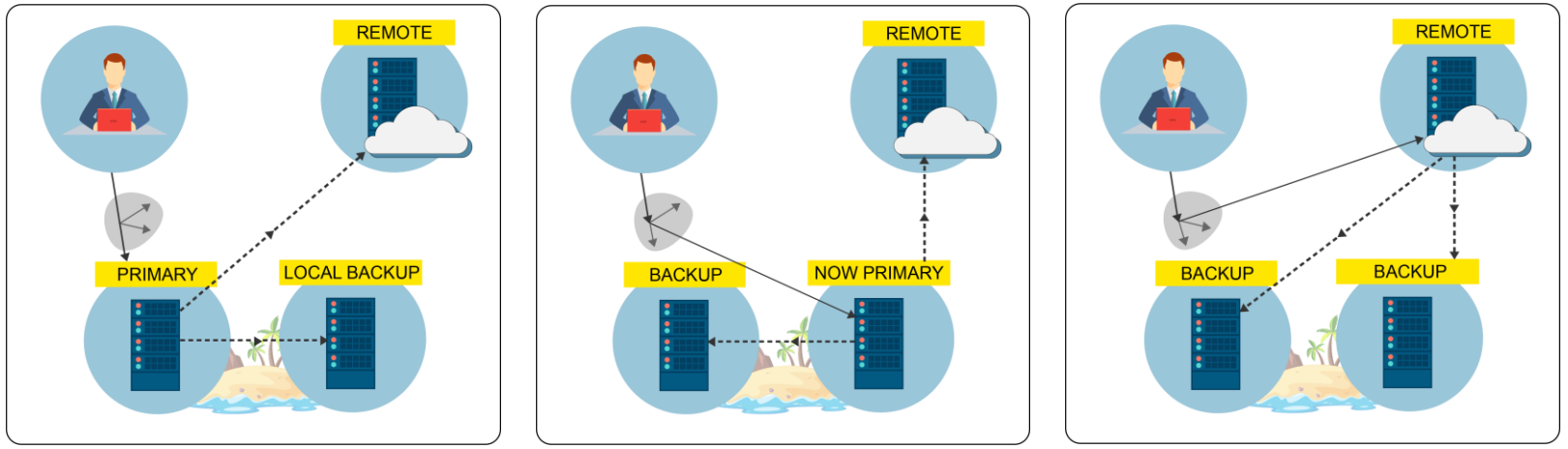
- Ability to replicate within the same physical ASP
- Ability to allow backup and 24x7 operations on a single system
- Ability to allow multiple source systems with the same library naming convention to replicate to a single backup system.

Chapter 17

Role Swap & Simulated Role Swap (SRS)

For successful role-swaps - regular testing is the key.

Can you switch your network, to connect users and devices to the alternative system and will the Back-up be ready – is it in-sync with the Source?



Going to your target system and doing some non update work on it, say a few stock enquiries, will prove that the data you happen to view is valid. What it does not tell you is how your main applications and user access will work out when a full swap is performed.

Chapter 17

Role Swap & Simulated Role Swap (SRS)

To check data consistency audits can be run to verify that all objects are the same, not just some of them. Full or Partial Audits can be run at regular intervals, say every Sunday. This again lets you know your data is correct however does not test that all the required libraries, objects and user profiles exist to allow you to run your business successfully on the target. Only a role swap or fail over test will do that.

In order to run a full role swap test where data is going to be updated on the target system and sent back to the source system, a standard role swap or fail over processes can be used.

If your testing is going to run work which you do not want sent back to your source system, so say a new billing run or a month end etc, then you need to take one of the following actions

- End replication and take a full backup of your target system before you start the test. When finished restore back to the save point and allow replication to continue once more.
- End replication and then run your test. When complete take a fresh save from your source system and refresh the target databases. Allow replication to continue from the new save point.

- Initiate the Maxava HA SRS process and have your target system suspend update and switch to primary mode. Run your tests. When complete end the Maxava HA SRS process. It will then roll back as many changes as possible. If there is anything that cannot be recovered in full, an audit or resync can be configured to request the required object from the source system.

Chapter 17

Role Swap & Simulated Role Swap (SRS)

To assist customers in checking that they are Role Swap ready, Maxava HA customers have the ability to test using the Maxava HA Simulated Role Swap (SRS) procedure. SRS is a process, which allows the current Backup system to be used as a test Primary environment whilst the current production system remains in use.

The Maxava HA Simulated Role Swap (SRS) will place the Back-up environment into a test state and once complete will recover back to how the replication was before the testing occurred with minimal or no user intervention required.

Maxava HA Simulated Role Swap (SRS) is not a replacement for Maxava HA Role Swap or Maxava HA Failover, but is a feature that allows certain testing to be performed on the Back-up system, that relates to what Role Swap and Failover need to use if they were invoked.

It is important to note that switching the network is a physical exercise that cannot be fully proven virtually. A full monthly trial Role Swap is the recommended approach if you need to check user access, network interfaces, data consistency and application performance.

If the goal of a role swap test is simply to investigate application function and performance on the target system, then instead of Role Swapping the machines, then Role Swapping them back again our recommended approach is to use the SRS (Simulated Role Swap). This allows you to continue using your source system whilst testing on the target. So no production system outage and when complete it will roll back the changes made in most instances without the need for major saves and restores.

Chapter 17

Role Swap & Simulated Role Swap (SRS)

Maxava can provide technical services to assist with Failover and Role Swap planning and execution.

Maxava HA Technology Choice

- Maxava HA provides a Simulated Role Swap function to assist customers to more easily test on their target systems.

Benefits of using Simulated Role Swap include:

- No outage required on the production system
- No major save or restore operations required as most changes can be simply rolled back.
- Core Role Swap and Fail Over functions tested without having to initiate them from the live commands.

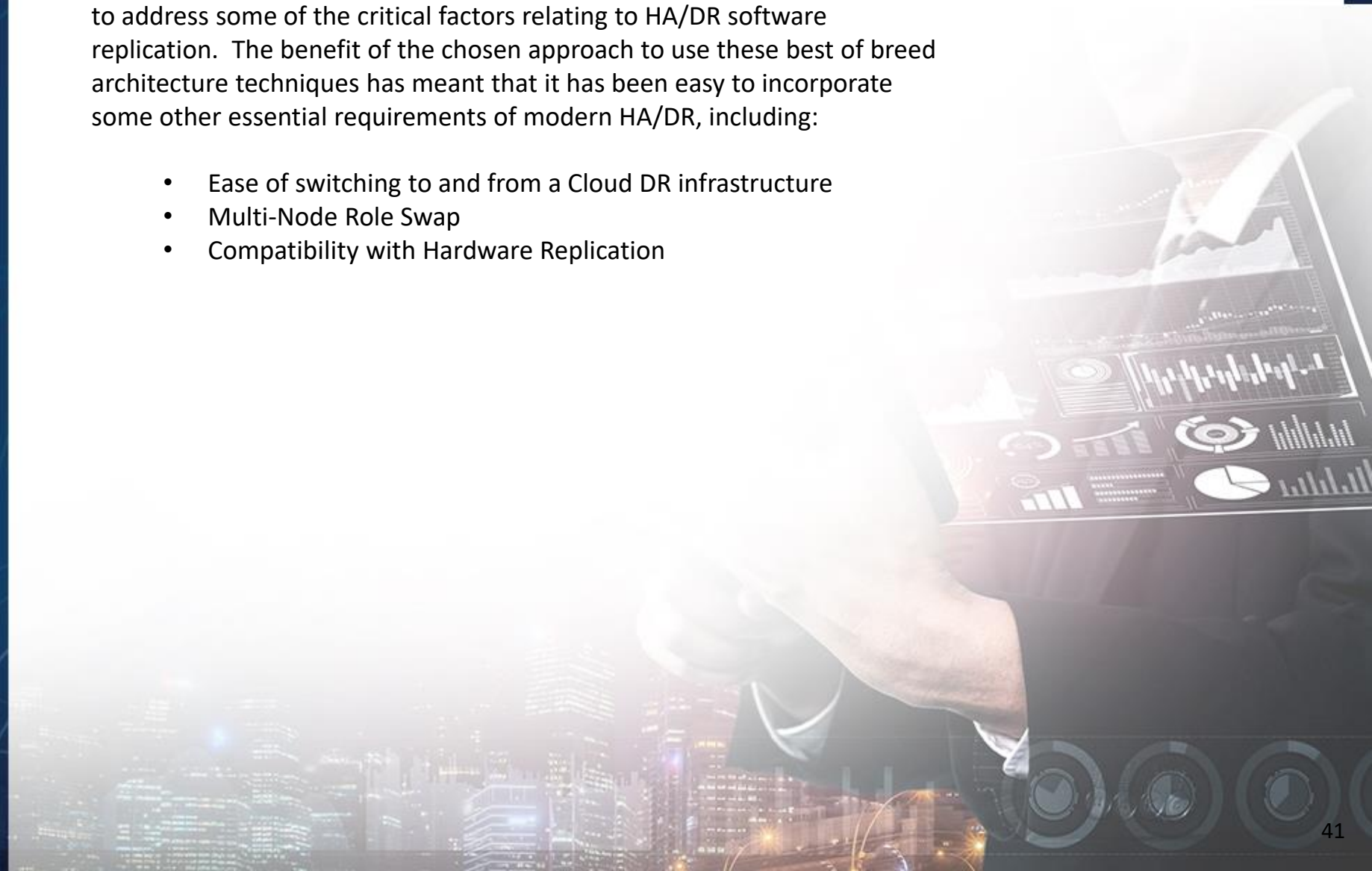
PREVIOUS | NEXT

Chapter 18

More flexibility

We have seen, in preceding chapters, how Maxava HA has been designed to address some of the critical factors relating to HA/DR software replication. The benefit of the chosen approach to use these best of breed architecture techniques has meant that it has been easy to incorporate some other essential requirements of modern HA/DR, including:

- Ease of switching to and from a Cloud DR infrastructure
- Multi-Node Role Swap
- Compatibility with Hardware Replication



Chapter 18

Cloud DR

Many businesses that run IBM i do not have access to a Secondary Datacenter or even a Backup IBM i Server. These businesses may prefer to focus on their core activities and leave their Disaster Recovery to be fully managed by a Professional Availability Team who also provide Datacenter Services and DR Testing.

This model is known by a variety of terms; Disaster Recovery as a Service (DRaaS), Software as a Service (SaaS) and Recovery as a Service (RaaS).

The same replication capability is available in these infrastructure models, the only difference is that it is pushed to a shared (virtualized) or private IBM i server in an offsite Datacenter at a secure remote location.

Why do IBM i customers choose Cloud DR?

- Removes the capital cost of a second hardware server – effectively ‘leasing’ the second server
- Introduces shared Datacenter Resources
- Fully Managed IBM i Disaster Recovery and High Availability provided by Support Providers
- Monthly Payment Schedule
- SLA’s for RPO and RTO
- Support Providers have the experience to manage role-swaps and other tests (often included in the service fees)

Chapter 18

Multi-Node Role Swap

The drive towards different levels of protection has led many businesses to a multiple target infrastructure. One classic scenario we often see is a local Backup server located very near to the main Production IBM i and a second Backup server out of Region. It is not unusual to see the first of those two systems on the same island, city or even datacenter, with the Remote Backup server in another country.

For these scenarios the Maxava HA architecture provides a simple to use testing function called a Multi-Node Role Swap. Lets say that normally A replicates to B & C. The MNRS provides the choice of moving Production to either B or C, and will re-establish full replication to the remaining two systems so B to A & C or in other circumstances C to A & B.

Why do IBM i customers choose Multi-Node Role Swap?

- Covering their bases for local and regional outages.
- Sharing the management of the Targets with a remote Service Provider.
- Reduction in risk by using 2 targets is advantageous for insurance calculations

Chapter 18

Running Alongside Hardware Replication

Sometimes customers come to us with an existing local hardware replication solution in place, but with fears of a regional outage that would affect the local data centers. For these scenarios, a special version of replication and Multi-Node Role Swapping is provided.

Where customers are using a PowerHA installation, Maxava can still provide out of Region protection with a 'second drop' where Maxava HA is used to replicate to an out of region Data Center using logical replication.

Why do IBM i customers choose to run both hardware and software replication?'

- Utilizing the different strengths of each type of solution.
- Covering their bases for local and regional outages.
- Sharing the management of the Targets with a remote Service Provider.
- Reduction in risk by using 2 targets is advantageous for insurance calculations.

Chapter 19

Summary

We have briefly looked at the various forms of IBM i data replication and focused on the Maxava architecture with logical replication and remote journaling.

If your organization is looking to introduce data replication for Disaster Recovery and High Availability and you are considering a logical replication solution, then you need to consider the following questions:

- Does the product use Remote Journaling?
- Does it use the Audit Journal and if so, what impact will that have on the production machine?
- Is processing carried out on the Source or Back-up machines?
- Is it truly a real-time solution?
- Are you confident that the solution will replicate your transaction workload without latency?
- Does the product enable Before and After image testing to ensure data integrity?
- What monitoring tools are available and can the environment be remotely monitored via Smartphone or tablet mobile device?
- Is the role-swap an uncomplicated process?
- Is role-swap testing included in the implementation?

For further details on the various Maxava products available, or to schedule a free, no-obligation demonstration or 30-day trial, visit us at www.maxava.com or email us at info@maxava.com

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