Lawson M3 on IBM PowerHA for i

IBM

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1. Introduction

The IBM® i™ and its predecessors the iSeries® and AS/400® are known for their legendary reliability. However, one computer system may no longer be sufficient in providing the level of availability required in today's demanding business environment. As companies continue to increases their reliance on computer systems and the mission critical data that these systems store and process, system availability is of utmost importance. Companies must prepare for unplanned outages resulting from disasters or other unforeseen circumstances and planned outages due to regularly scheduled maintenance or other planned activities. Regardless of whether the outage is planned or unplanned, companies must be prepared to handle any outage and keep downtime to a minimum.

A high availability solution can include elements of data resiliency, device resiliency, and application resiliency and allow you to meet requirements for handling both planned and unplanned outages. This paper focuses on the use of PowerHA™ for i and more specifically the Solution Based GUI in simplifying the implementation of a cross-site mirroring with geographic mirroring solution for Lawson M3 environments on IBM i. Even though we chose to focus on cross-site mirroring with geographic mirroring in this paper we also describe the other solutions that are available to you so you are aware of all the options that are available to you.

Since there are many possible high availability solutions to choose from and likely only one is the right one for you. We strongly recommend that you work with a service provider or someone with high availability experience to plan and implement your high availability solution. In addition this report also referrers numerous time to the following Redbook®, "*Implementing PowerHA for IBM i".* Redbook SG24-7405. It is also recommended that you are familiar with this Redbook since it contains more details on topics discussed in this paper.

Note: Starting with M3 10.1 (M3BE 14.1.2 and LCM 9.1.5.0) support has been added to Lawson's Life Cycle Manager, LCM, to allow both LCM and M3 Business Engine to be directly installed into an iASP. In addition support was added to apply fixes and perform function like upgradedb on installations that reside on an iASP. This report was written with the intention of showing how to migrate an existing M3 installation into an iASP for new installations running M3 10.1 (M3BE 14.1.2 and LCM 9.1.5.0) or higher some steps in the report can be skipped.

2. High Availability Overview

High Availability is a term commonly used to describe approaches involving both hardware and software technologies that are employed, often in combination, in an effort to reduce the number and duration of system outages. Outages can be one of two types.

- A planned outage that would be done for an even such as an upgrade or some sort of maintenance.
- A unplanned outage which can be the result of a hardware, power, or network failure.

By implementing a high availability solution that meets your particular needs for both planned and unplanned outages you can minimize or eliminate down time and ensure the system is available when you need it.

The core of any high availability solution is maintaining either a second copy or a switchable set of objects. This can be done with:

- Logical replication
- Hardware replication

Both replication options are explained further in the below section. This paper will focus on the hardware replication side, but we are mentioning logical replication so you can be aware of all the options that are available. For more details on any of the options described in this section please refer to Redbook SG24-7405 "Implementing PowerHA for IBM i"

2.1 Independent Auxiliary Storage Pools

An Independent Auxiliary Storage Pool or iASP is an auxiliary storage pool (ASP) that can be located on internal or external storage and be brought online or taken offline independent of system data or other ASPs. An ASP is a collection of disks grouped together logically. To your system an ASP looks like a single unit of storage. Switched disk and hardware replication solutions on the IBM i all utilize iASPs

2.2 Clusters

High availability clusters are central to many high availability solutions.   A clustered environment is a collection of multiple redundant computer systems or logical partitions configured in what is commonly referred to as a cluster. Each system or partition in a cluster is called a cluster node. These nodes function as a distributed computing system that enables critical resources on the production system, such as data, devices, and environment attributes to automatically be available on one or more backup systems if the production system is not available. IBM i cluster technology provides the underpinnings and mechanisms that make switched disk and hardware replication solutions possible.

Clusters can be simple, consisting of only two nodes or very complex with a large number of nodes. IBM i clustering provides the necessary tools to configure, monitor, and manage a clustered environment. For more information on IBM i clustering technology refer to Redbook SG24-7405, "Implementing PowerHA for IBM i".

2.3 Administrative Domain

An administrative domain provides a mechanism to maintain a consistent operational environment across the defined cluster nodes. It ensures that highly available applications and data function as expected when a failure occurs or when you manually switch over to a backup node. In a high availability environment, you must ensure that the operational environment is identical on every system where the application can run, or where the application data resides. If you change configuration parameters or data on one system, that same change has to be replicated to all the other systems.

A cluster administrative domain provides you with the mechanisms to identify resources that need to be maintained consistently across the systems in your high availability environment. In addition, the cluster administrative domain also monitors for changes to these specified resources and then keeps these changes synchronized across the active domain.

2.4 Switched disk

A switched disk configuration utilizes disks that can be switched between different nodes in a high availability cluster. Switched disk can be used to create a simple and cost effective high availability solution for planned and some unplanned outages. In a switch disk environment only one copy of the data exists. Because there is only one copy of the data, performance is not impacted by data synchronization.

In a switched disk environment, the distance between the production and backup system is limited by the physical length of the cables used to connect the systems. The maximum distance recommended is fifteen meters. In addition to using iASPs, switched disk requires IBM i high availability cluster technology. The cluster technology is shipped with operating system option 41 "HA Switchable Resources". An iASP must be configured as part of a high availability cluster in order to be switchable.

2.5 Hardware replication

Cross-site mirroring is a collective term used for high availability solutions based on hardware replication. With hardware replication a copy of the production data is mirrored to a backup system, so two or more copies of the data will exist. The three variations of cross-site mirroring supported on the IBM i include: geographic mirror, metro mirror, and global mirror.

2.5.1 Geographic mirror

Geographic mirror utilizes page level mirroring performed at the operating system level. An exact copy of the production data is maintained on a backup system by utilizing synchronous mirroring.   Synchronous mirroring means that the source system waits until acknowledgement from the target system that the data has been received. Synchronous mirroring keeps the data consistent and prevents data loss.

Geographic mirror allows for production and mirrored copies to be separated geographically. This offers protection in the event of a site-wide outage. However, because of synchronous communication, longer distances may impact performance and require more communication bandwidth.

Both HA switchable resources (option 41 of the operating system) and iASPs are required for an geographic mirror solution. An external storage server is optional.

2.5.2 Metro mirror

Metro mirror is similar to geographic mirror except metro mirror utilizes disk sector level mirroring performed by an external storage server. In a metro mirror environment the mirroring is synchronous preventing data loss between the production and backup system. Production data and backup data can be located on the same external storage server or on different external storage servers separated geographically. With separate storage servers the production and backup storage servers can be located up to 300 kilometers away. However, because of synchronous communication, longer distances may impact performance and/or require more communication bandwidth.

External storage servers, HA switchable resources (option 41 of the operating system), and iASPs are required for a metro mirror solution.

2.5.3 Global mirror

Global mirror utilizes disk I/O level mirroring between external storage servers. The mirroring is asynchronous, meaning that the source system does not wait for acknowledgement from the target system that data has been received. Depending on the distance between the storage servers this means that the data on the backup system might lag the data on the production system by a few seconds. This allows the production and the backup server to be separated by virtually unlimited distances with no impact to application performance.

External storage servers, HA switchable resources (option 41 of the operating system), and iASPs are required for a global mirror solution.

2.6 Logical replication

Logical replication utilizes object based replication performed at the middleware or application level. For journaled objects the data is replicated to a backup system by applying journal changes to the backup data. For non-journaled objects the objects are saved and then written to the backup system.

Since logical replication is performed at the object level it is possible to be more selective with data and object replication, which may reduce network traffic. The replication process can be synchronous to prevent data lag or asynchronous allowing virtually unlimited distance between production and backup systems.

Logical replication environments can be implemented using internal storage or external storage servers. Independent ASPs are not required for logical replication solutions. Products that provide logical replication services are provided by IBM and independent software vendor (ISV) products. For more information about logical replication products see:

- IBM DataMirror (www.datamirror.com)
- noMax (www.maximumavailability.com)
- Trader's (www.quick-edd.com/uk/index_uk.htm)
- Vision Solutions (www.visionsolutions.com)

3. PowerHA

PowerHA for i, previously known as the High Availability Solutions Manager (HASM), is a licensed pro-gram product that provides simplified configuration and management for high availability solutions on the IBM i operating system. Combined with high availability switchable resources (option 41 of the operating system) and iASPs, PowerHA for i enables a complete end-to-end hardware based clustering solution for high availability and disaster recovery. PowerHA for i allows system administrators to configure and manage their high availability solution using one of two Web based interfaces:

- Cluster Resource Services GUI or Task Based GUI
- High Availability Solutions Manager GUI or Solution Based GUI

3.1 PowerHA Tasked Based GUI

The Cluster Resource Services graphical interface or Task based GUI lets IBM i Administrators perform tasks with IBM i high availability technologies, such as working with clusters, Cluster Resource Group (CRG), Device Domain, Cluster Administrative Domain to configure their high availability solution and manage it by performing planned switchovers

Note: This paper will focus on the Solution Based GUI, the Task Based GUI is being mentioned here to make sure you are aware that there are other ways to create and maintain a high availability solution.

3.2 PowerHA Solution Based GUI (HASM)

PowerHA for i provides a solution-based approach for customers willing to implement a High Availability environment by selecting one of 4 solutions proposed:
- Switched disk between logical partitions
- Switched disk between systems
- Switched disk with geographic mirroring
- Cross-site mirroring with geographic mirroring

The graphical interface option called "High Availability Solutions Manager" or Solution based GUI avail-able from IBM Systems Director for i5/OS allows administrators to select and configure one of the prede-fined high availability and/or Disaster Recovery solutions which are based on i5/OS® high availability technologies, such as independent disk pools and clusters. All the hardware requirements must be in place to allow the creation of the new high availability solution environment.

As soon as the solution has been set up, the IBM i Administrators will be able to manage their new high availability environment from both GUI interfaces. The Solution based GUI guides users through the process of selecting, configuring, and managing a high availability solution. The user must complete each step before continuing to subsequent steps. When PowerHA for i is installed, you can access the Solution Based GUI in the IBM Systems Director Navigator for i5/OS.

4. Lawson M3 Application Architecture

Lawson M3 is a supplier of collaboration software which focuses on the manufacturing, maintenance, and distribution industries and serves many customers around the world. The Lawson M3 ERP solution tested here is a Java™-based application which runs on IBM i servers.

4.1 Lawson M3 Business Engine

Lawson M3 Business Engine provides the foundation for Lawson's M3 business software. Although M3 Business Engine has its roots in the OS/400® and RPG platforms, the current version is built with Java technology, providing additional flexibility.

4.2 Lawson M3 WorkPlace

Lawson M3 WorkPlace is a role-based user interface that combines portal and Web technology with pre-defined work flows. These predefined work flows can be modified and combined with company-specific components and work flows. M3 Workplace can provide employees with fast, easy access to work-related information and applications, thereby potentially helping increase their productivity and efficiency. M3 Workplace is built on top of IBM WebSphere® Application Server

4.3 Lawson M3 Life Cycle Manager

The Lawson M3 Life Cycle Manager or LCM is a framework that facilitates standardized and uniform in-stallation, configuration and management of Lawson M3 products. The framework also enables admini-stration and customization of several servers and products from a centralized location.

4.4 Lawson M3 Database(s)

Lawson M3 Business Engine and Lawson M3 Workplace have their own sets of databases on the IBM i server. For the purpose of this document the Lawson M3 benchmark database and data set was used. The Lawson M3 Business Engine benchmark database has the following data:

- Customers: 200,017 (OCUSMA table)
- Items: 100,856 (MITMAS table)
- Customer locations: 2,000

This database contained 3,045 physical files and 8,012 logical files; the total size of the database library (not including journals and journal receivers) was 5.47 GB.

5. Lawson M3 Applications in an iASP

This section list the objects and applications that were moved into the iASP, it also list objects that remained in the system ASP or SYSBAS.

5.1 Objects migrated to the iASP

The following Lawson M3 components were moved into the independent auxiliary storage pool or iASP:

- M3 Business Engine database
- M3 Business Engine IFS directory
- Life Cycle Manager IFS directory
- HTTP configuration and log files
- WebSphere Application Server Profile directories
- M3 WorkPlace Application
- M3 WorkPlace databases

5.2 Objects remaining in SYSBAS

The following objects remained in SYSBAS

- Lawson M3 library M3DJVA
- WebSphere Application Server Product directories

Note: The M3DJVA library contains objects that must remain on SYSBAS. It also contains service programs that could have been put in a separate library and moved to an iASP, but this was not done for this exercise. Hence, the entire library needed to be duplicated on the backup system.

6. Creating the High Availability Environment and Migrating Data using HASM

The Power HA for i Solution Based GUI, also referred to as HASM, can be used to simplify the implementation of geographic mirroring in a Lawson M3 environment. Use of HASM automates many of the steps required to implement a geographic mirroring high availability solution and to migrate date for Lawson M3 applications to an iASP. Before you begin implementing any high availability solution ensure accurate planning is done and that the solution you are choosing is the best option for you. In addition you may want to consult your business partner to help determine the solution that best fits you requirements.

There are 5 steps in HASM that must be completed in order to setup the high availability environment. Each of these steps is explained in more details in this section. There are many potential high availability solutions but only one is right for you. Even though we choose to implement Cross-Site-Mirroring with Geographic Mirroring in this paper, that does not mean that will be the best solution for you. Please research each of the four solutions HASM provides and then decide which is best for you.

For more details on HASM or any of these steps please refer to Redbook SG24-7405 "Implementing PowerHA for IBM i"

6.1 See how IBM high availability solutions work

To start log onto IBM Systems Director Navigator for i5/OS using a web browser connecting to port 2001 on the target system.

- http://mysystem:2001.

Then select the High Availability Solutions Manager Menu. See Figure 1 below.
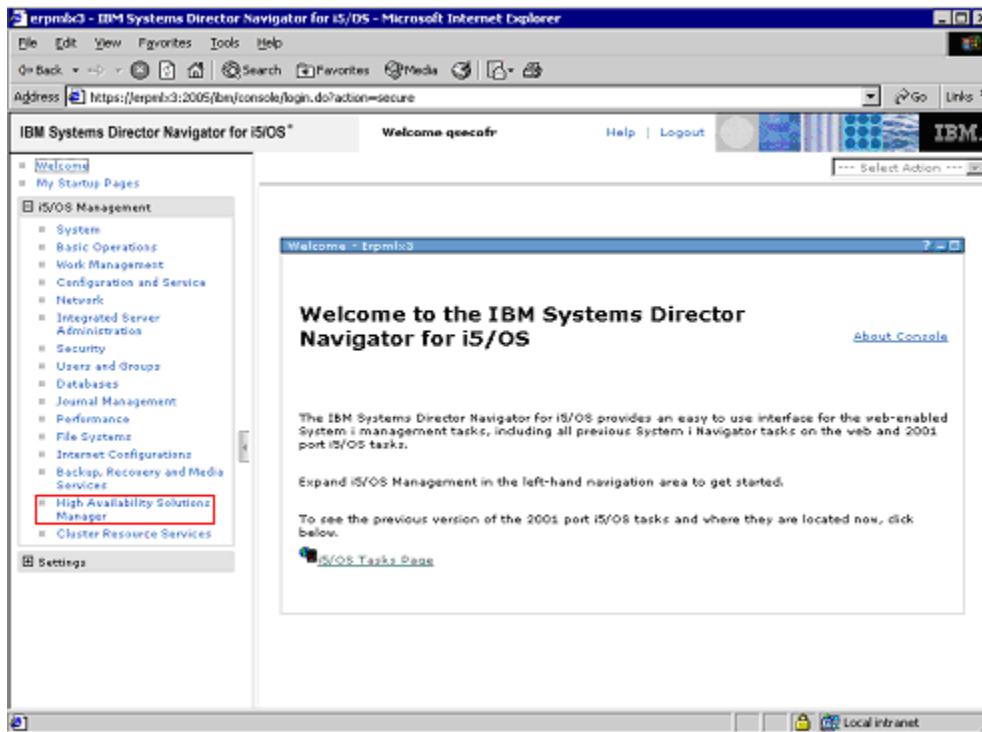
Figure 1. IBM Systems Director Navigator

The first step in HASM is to ensure that you understand how each of the potential high availability solutions work. The solution based GUI provides a flash demo with details on each of the potential solutions. It is highly recommended that you watch this demo. See Figure 2 below.

www.ibm.com/support/techdocs
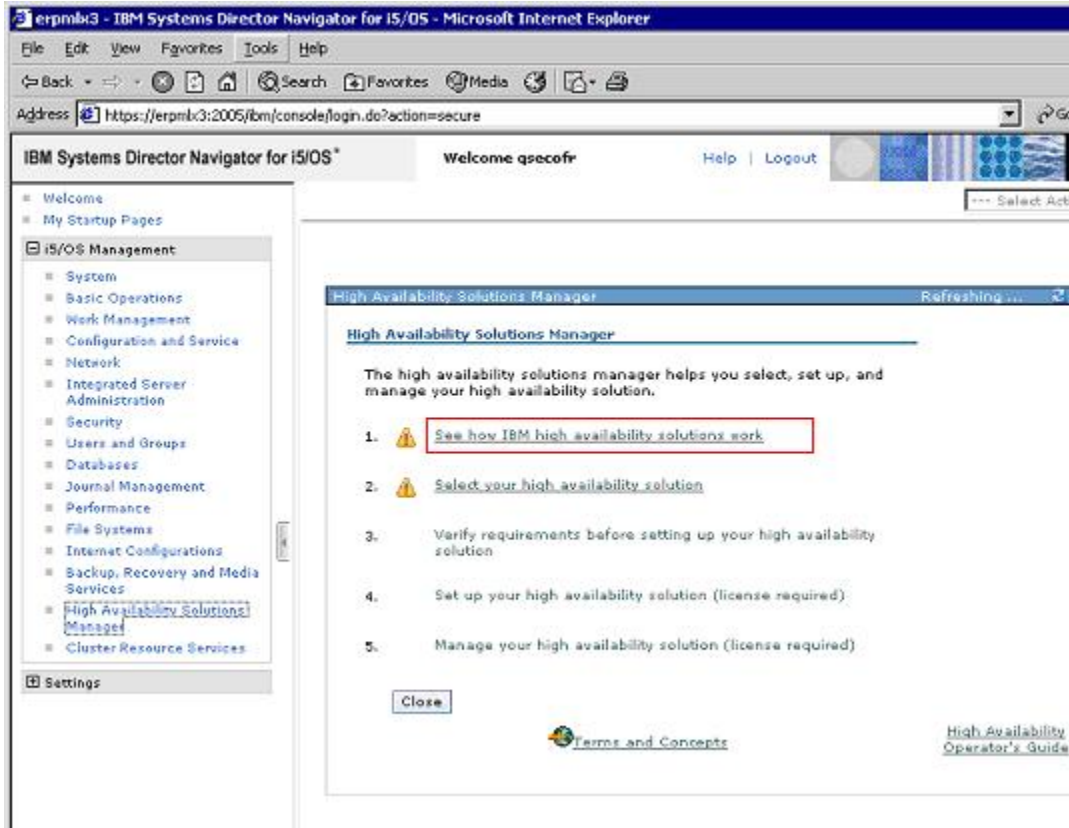
Figure 2. Solution Based GUI step1, see how IBM high availability solutions work

6.1.1 Select your high availability solution

The next step is to choose the high availability solution you want. Again we chose "Cross-Site-Mirroring with Geographic Mirroring" as the solution we used, but that may not be the best solution for you. See Figure 3 and Figure 4 below.

www.ibm.com/support/techdocs
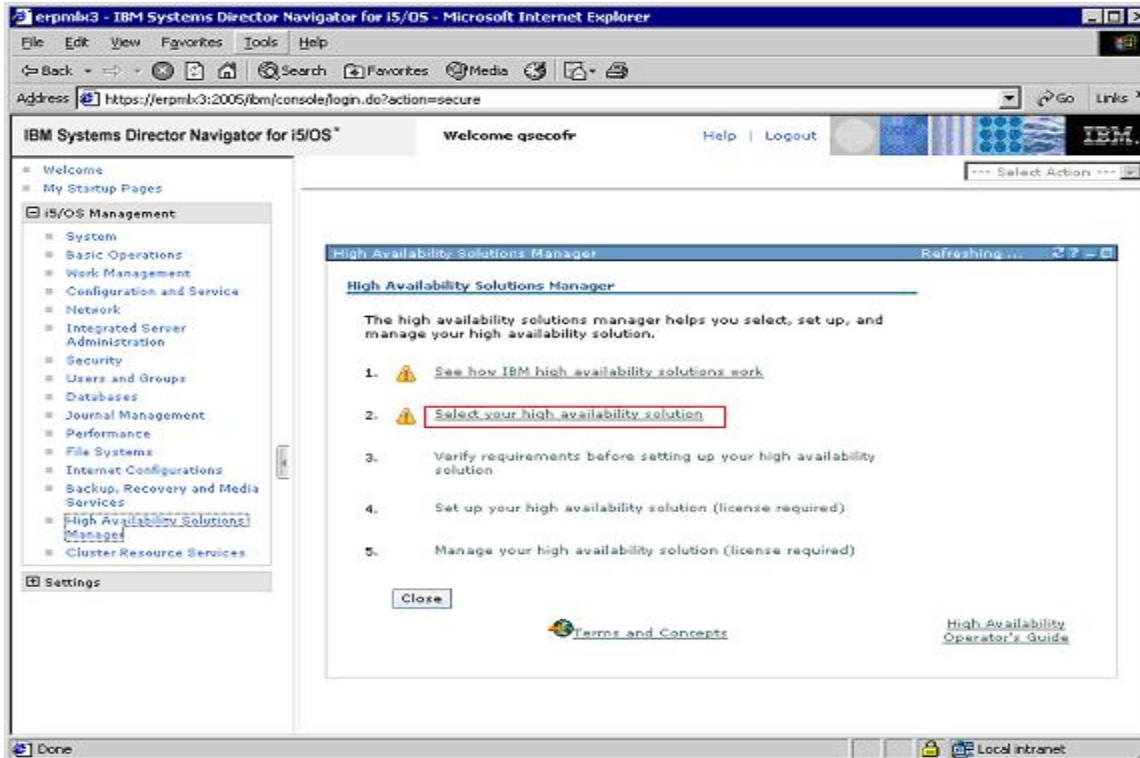
Figure 3. Solution Based GUI step 2, select your high availability solution
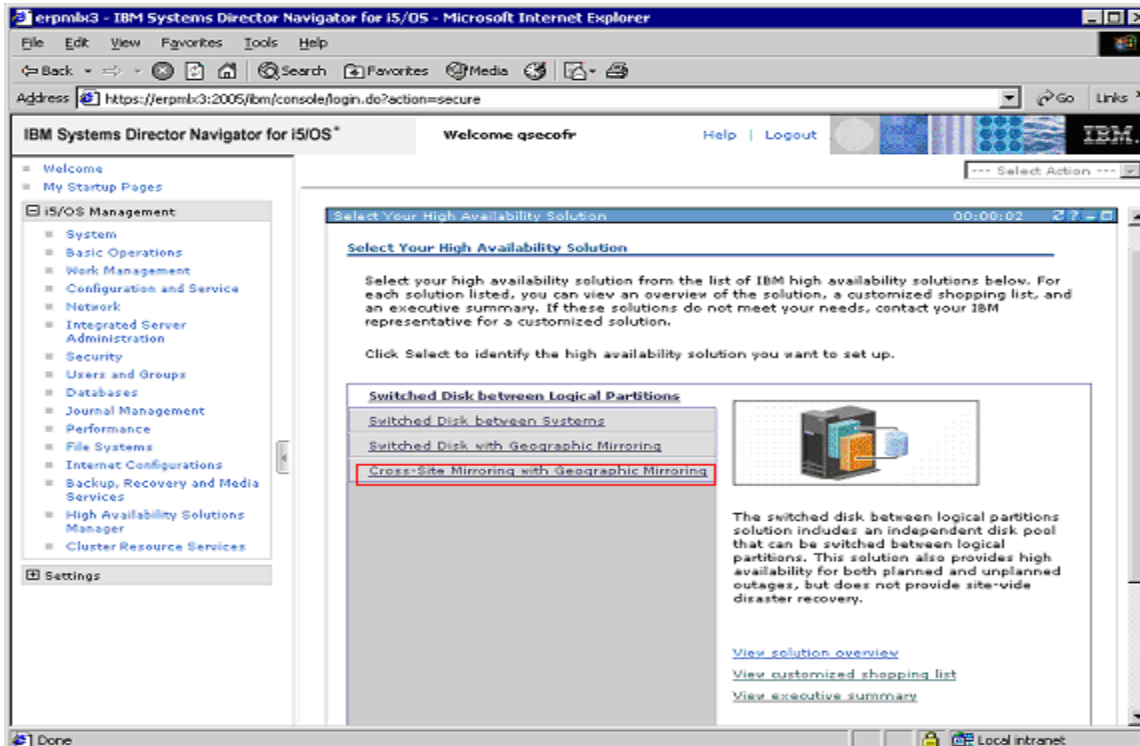
Figure 4. Select High Availability Solution

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6.1.2 Verify requirements before setting up your high availability solution

The next step is to verify requirements that need to be met in order to setup the high availability solution you selected. During this step you will also need to provide information about the backup system, data ports to use, and take over IP address to use. Below are the steps to do this:

1. Go to step 3 Verify Requirements, see Figure 5.
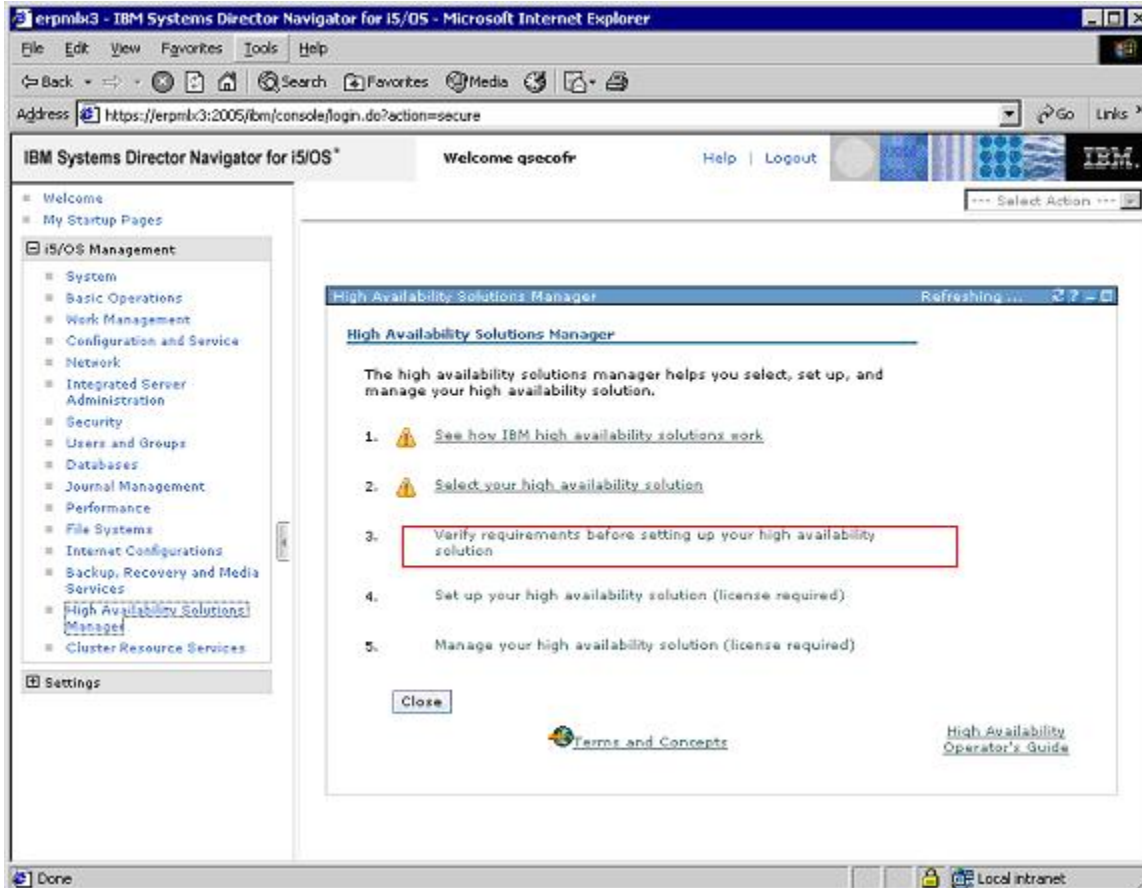
Figure 5. Solution Based GUI step 3, verify requirements

2. During the first phase of this step a list of requirements is generated. All requirements listed must be met before you are allowed to continue on to the forth step and setup the high availability solution. See Figure 6 below.
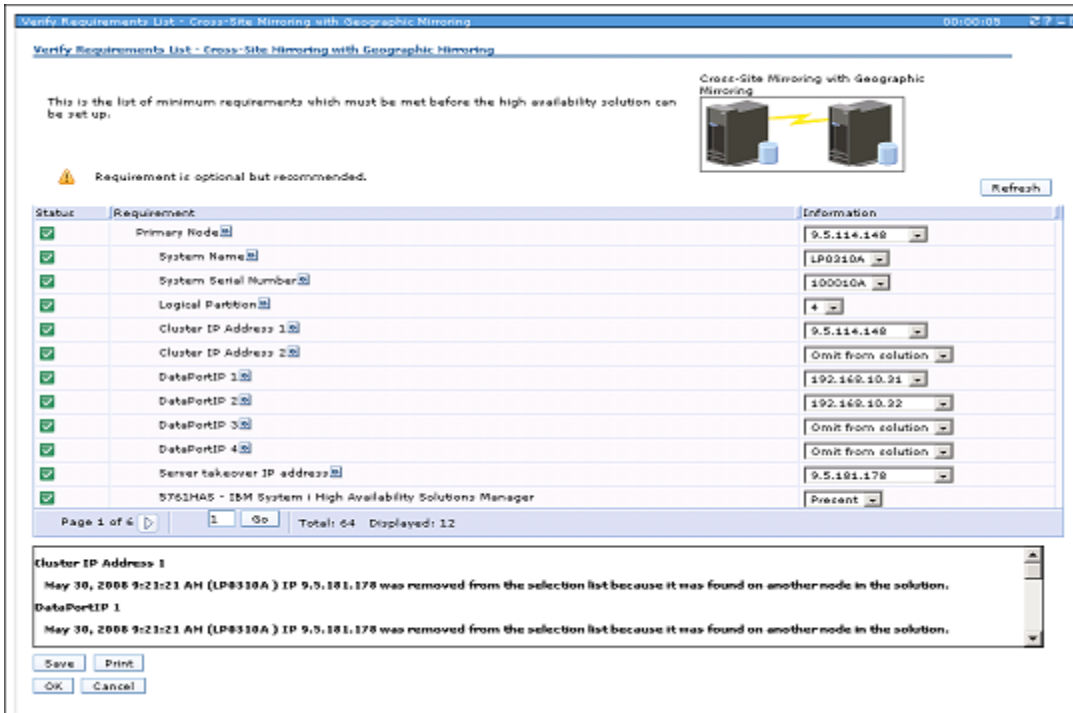
Figure 6. Verify Requirements

3. Ensure the following entered on the verify requirements screen, see Figure 7:

- Backup node name

- Enter any additional data port name.

- Enter Server Take Over IP Address.

- Any secondary ports

Figure 7. Shopping List

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6.1.3 Set up your high availability solution

Now that all the requirements have been met, the next step is to set up the high availability solution. You will also migrate the Lawson M3 BE databases, directories, and user profiles during this process. The steps below will guide you through this.

Note: It is recommended that you do a backup of your system before starting this step. Up to this point no changes to the system have occurred, however, starting with this step changes to the system will be done. Also this step will be the longest and will likely take a significant time to complete.

1. Go to Step 4 , Set up your high availability solution, see Figure 8
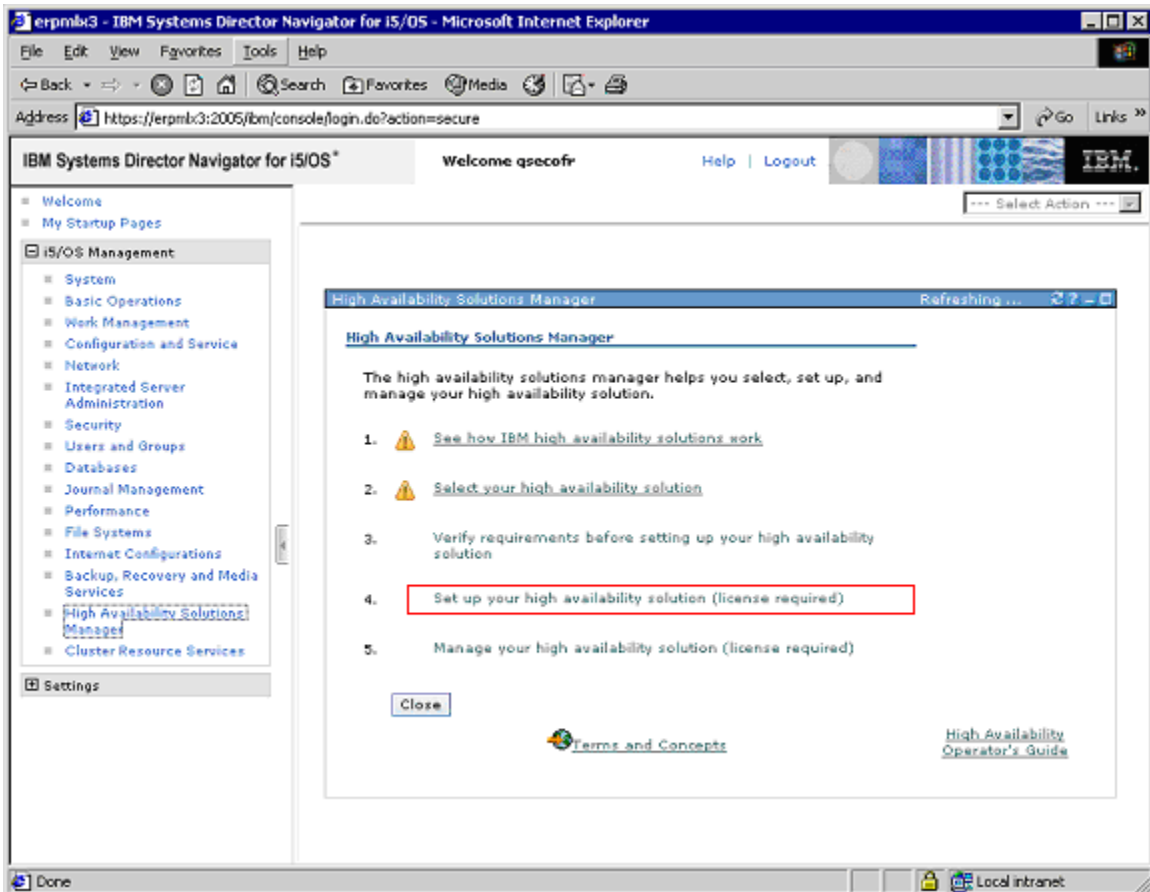
Figure 8. Solution Based GUI step 4, set up your high availability solution

2. Setting up the high availability solution consists of several sub steps that can be done one at a time. Follow the first 4 sub-steps as shown in Figure 9. These first steps will create the iASPs, setup the cross site mirroring between the two systems, and verify that a switch over can be done between the two systems.
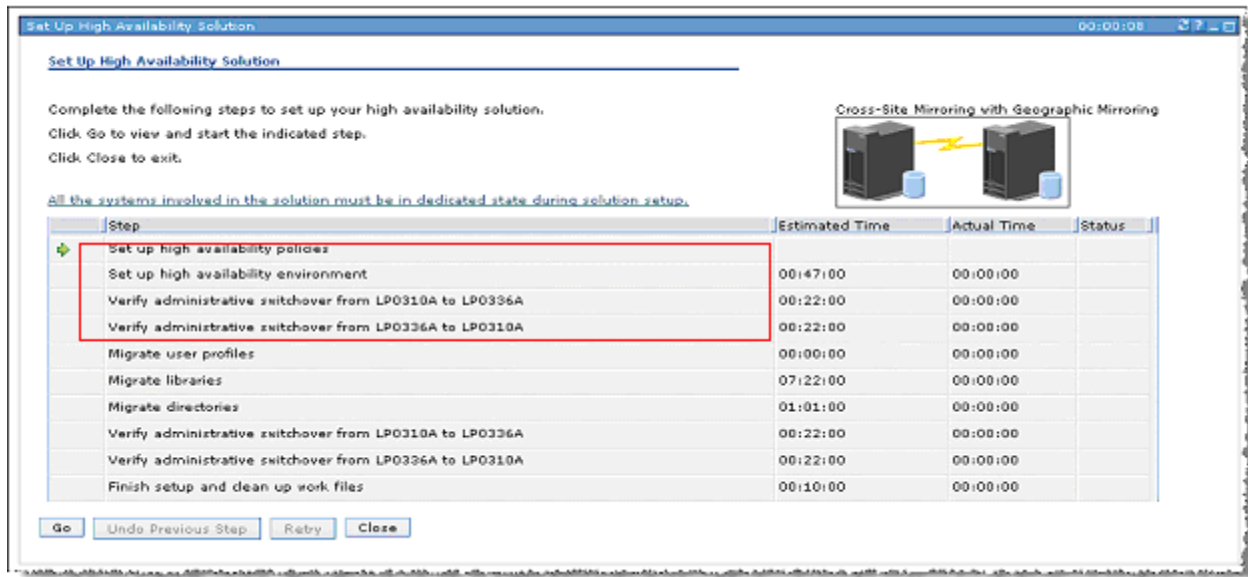
Figure 9. Steps to setup your high availability solution

3. Ensure the system value QRETVRSEC is set to 1 to allow user profiles to be migrated to the administrative domain. This can be done by running the command below.

   - `CHGSYSVAL SYSVAL(QRETSVRSEC) VALUE('1').`

4. Follow the next three sub steps to migrate the user profiles, directories, and databases we want to move to the iASP, see Figure 10.

   a.   The profiles we migrated were:

      - M3DBREADS

      - M3DBUSR

      - M3SRVADM

      - M3SRVADMS

      - LCMADMIN

   b.   The database we migrated was:

      - MVXJDTA

   c.   The directories we migrated were:

      - /M3B3   - Default M3 Business Engine root dir

      - / LifeCycle   - Default Life Cycle Manager root dir
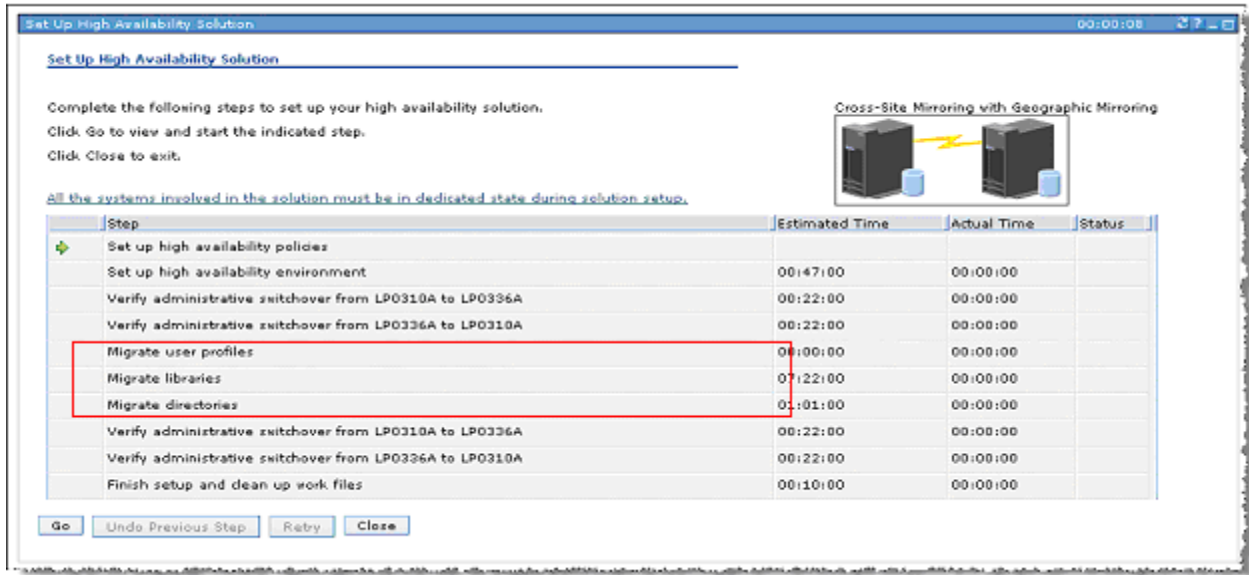
Figure 10. Migrate user profiles, libraries, and directories

5. Finally follow the last three sub steps to verify that we can still do a switch over between both systems and then finish the setup, see Figure 11.
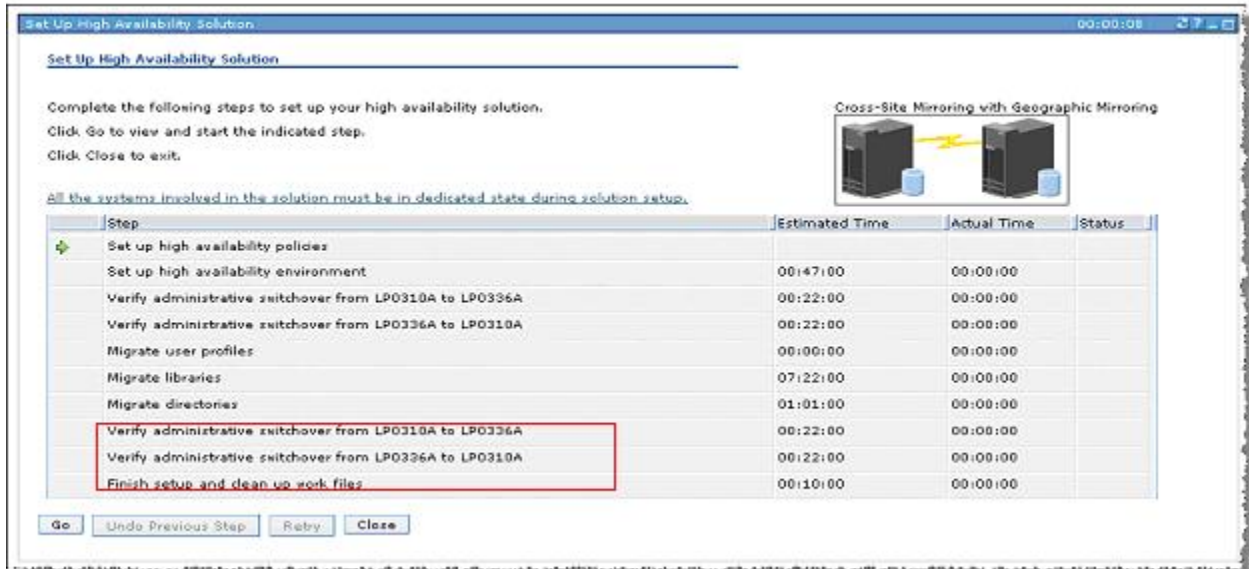
Figure 11. Verify Switchovers

6.1.4 Manage your high availability solution

HASM also provides a management function to monitor your high availability solution. From the management page you can view the current status of you high availability environment and perform tasks such as switch overs, shut down the high availability environment, or resume the high availability environment.

1. Select step 5, Manage your high availability solution, see Figure 12.
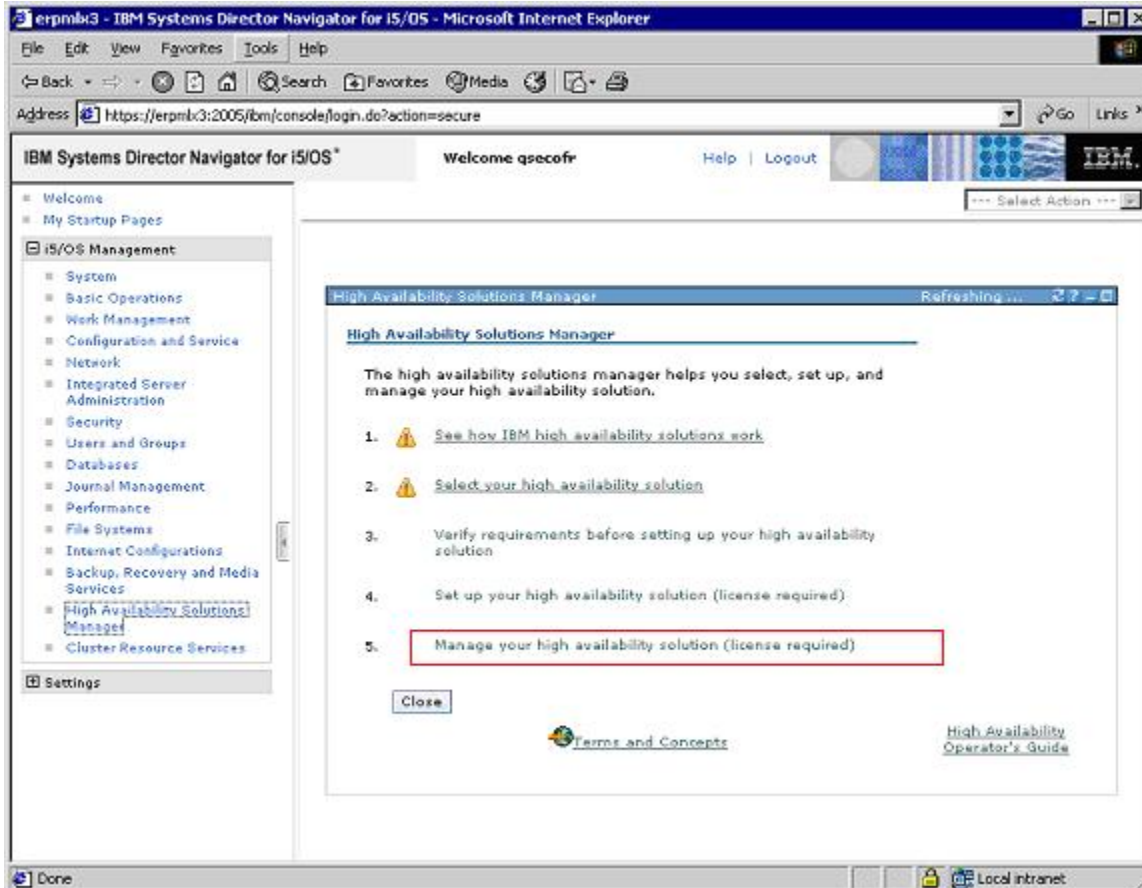

Figure 12. Solution Based GUI step 5, manage your high availability solution

2. Figure 13 shows the management page
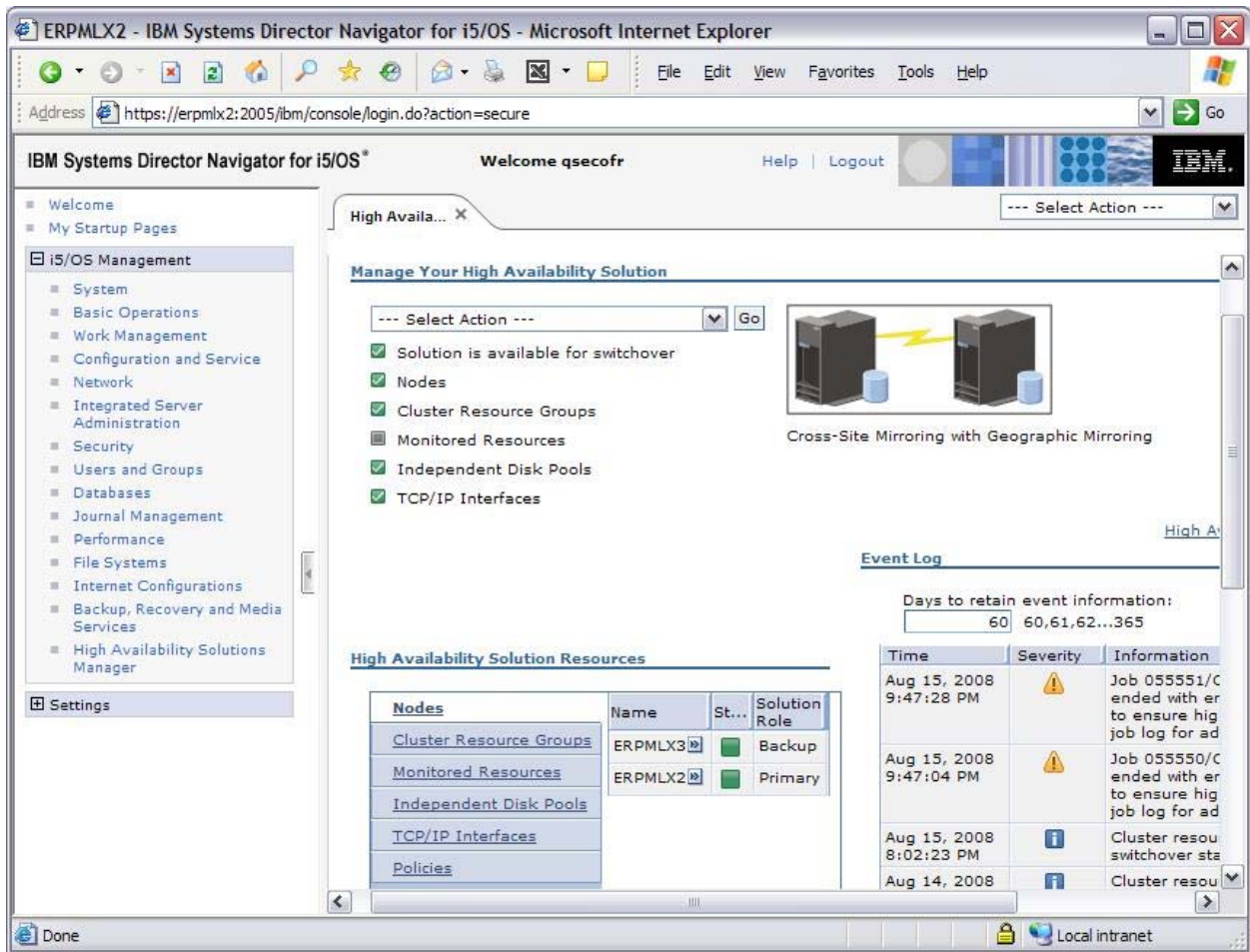
Figure 13. Using the Solution Based GUI to manage your high availability solution

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7. Additional Migration and Configuration Steps for Lawson M3 Applications

This section lists the steps that were done to migrate all required applications to the iASP and any additional configuration steps that were needed to be able to run the applications on an iASP. Applications that are included here are:

- M3 Business Engine

- WebSphere Application Server

- M3 Workplace, including databases

- HTTP Server configuration/log files

- M3 Life Cycle Manager

There are additional M3 applications that can be potentially moved to an iASP, but were not tested here. An example of one of these is Lawson Web Services. Since this is installed on top of WebSphere and Lawson M3 WorkPlace it is assumed it would work in the high availability environment we created here as well.

7.1 Moving Lawson M3 Business Engine

Below are the steps required to move the Lawson M3 Business Engine to the iASP.

7.1.1 Migrating Lawson M3BE IFS dirs, users, and databases using HASM

All of the Lawson M3 Business Engine directories, databases, and user profiles were migrated in the previous chapter during the setup of high availability solution. See section 6.1.3 for more details.

7.1.2 Ensure M3DJVA library is installed on backup system.

The M3DJVA library contains job descriptions and subsystem descriptions which are objects that cannot reside on an iASP. It also contains service programs that were not put in a separate library for this exercise and hence the entire library needs to be duplicated on the backup system. Below are the steps to do this.

1. Save M3DJVA on primary system

   - SAVOBJ OBJ(*ALL) LIB(M3DJVA) DEV(*SAVF) SAVF(DLTME/M3DJVA)

2. FTP and Restore M3DJVA on backup

   - RSTOBJ OBJ(*ALL) SAVLIB(M3DJVA) DEV(*SAVF) SAVF(DLTME/M3DJVA) OPTION(*NEW)

7.1.3 Modify MOVEX.properties

The following lines in MOVEX.properties need to be changed

1. license.servers.addr=**10.10.5.118**

   - Change to take over IP address

2. db.con.source=**My_System_Name**

   - Change to: db.con.source=iASP_NAME

3. db.con.url=**jdbc:as400://10.10.5.118;errors=full**

   - Change to: jdbc:as400://take.over.ip;errors=full;database name=iASP_Name

4. auth.dname=cn=**MySystemName.my.comany.com**_BM,ou=BM,o=lawson,c=US

   - Change to takeover IP

7.1.4 Modify Set Database Authority Program.

The Set Database Authority Program needs to be modified in order to work with the iASP using the steps below.

1. Open M3DJVA/JUSRC , Member: JSETAUTDCL

2. Change the following line:

   - From:

     o CHGVAR   &UpdPath   VALUE('/QSYS.LIB/' *TCAT &DataLib   *TCAT '.LIB')

   - To:

     o CHGVAR   &UpdPath   VALUE('/iASP/QSYS.LIB/' *TCAT &DataLib   *TCAT '.LIB')

3. Change the following line:

   - From:

     o SBMJOB CMD(CALL PGM(JSETAUTDCL) + PARM(&File &DataLib &Owner &PrimGroup &DBUser &DBRead   &Batch))   JOB(SETAUTD)

   - To:

     o SBMJOB CMD(CALL PGM(JSETAUTDCL) PARM(&FILE &DATALIB &OWNER &PRIMGROUP &DBUSER &DBREAD + &BATCH)) JOB(SETAUTD) CPYENVVAR(*YES)

4. Save changes then compile, overwrite existing member

5. Run the Set Database Authority Program

   - SETASPGRP ASPGRP(IRD_iASP)

   - ADDLIBLE M3DJVA

   - GO MVXSTART -> Option 82 -> Option 40

7.2 HTTP Server

The HTTP Server configuration and logs files can also be put on the iASP. Thus when a switch over occurs the same HTTP Server configuration can be started on the backup system. Steps below show how to set this up.

1. Create an HTTP Server on the primary system following the steps outlined in the Installation Guide for M3 Workplace, System i™. only one additional change is needed.

   a. For the path to the configuration file, instead of the default /www/myserver point to the iASP, i.e. /myiasp/www/myserver

2. On the backup server need to create a duplicate HTTP server, but use the same configuration files

   a. Make sure the iASP is allocated to the backup system

   b. Create a HTTP Server with the same name and but point to the configuration files that were created in the previous step on the iASP, i.e. /myiasp/www/myserver

   c. When prompted, select "Use this existing file without change for this new server configuration"

7.3 Installing WebSphere Application Server into a iASP

WebSphere can be installed into an iASP as long as the steps below are followed. The recommended way to install WebSphere into an iASP is to do the install on both the primary and backup system. Leaving the product dir on SYSBASE and putting the profile dir on the iASP. This sections shows the steps necessary to do this.

Note: The same set of steps below apply to both WebSphere 6.1 and WebSphere 7.0, some commands may only show one version of WebSphere, but either version of WebSphere can be used

7.3.1 Restrictions for running WebSphere under an iASP

To share the same UserData directory on an iASP, the following restrictions apply:

   I. The same prerequisite and optional software for WebSphere Application Server is installed on both the primary and secondary systems.

   II. The names of the installation libraries for the WebSphere Application Server installations must be the same (i.e. WAS61A, WAS61B... etc).

   III. Maintenance of the WebSphere Application Server installations sharing the UserData directory is done such that they are kept at the same fix level.

   IV. The product default Java Virtual Machine (JVM) value must be the same for both primary and secondary installations. This should not be an issue if the primary and secondary systems have the same IBM Developer Kit for Java product options installed.

The most practical way of achieving the second restriction is to ensure that the installation is the first WebSphere Application Server 6.1 installation on each system. After installing, look in the <app_server_root>/properties/product.properties file to find the name of the installation library.

To determine the JVM that the WebSphere Application Server product installation is enabled to use, view the contents of file app_server_root/properties/product.properties.

   o If was.use.j9=false, then the installation is enabled to use the "classic" JVM.

   o If was.use.j9=true, then

   o If was.j9.version=32bit then the installation is enabled to use the "std32" JVM

   o Else if was.j9.version=64bit then the installation is enabled to use the "std64" JVM.

Use the enablejvm command to change the product default JVM.

7.3.2 Installing WebSphere on the primary system

The steps below show how to perform the install on the primary system. After performing these steps you will have the product dir (ProdData) dir on SYSBAS and the profile dir (UserData) on the iASP.

1.) CD to the WAS dir on the WebSphere installation image
   - o   cd /QOPT/WEBSPHERE/WAS
2.) Make a copy of the default response file into the dir of your choosing
   - o   cp /QOPT/WEBSPHERE/WAS/responsefile.nd.txt /WAS61ND
3.) Edit the following option in the response file you created in Step 2
   - o   -OPT silentInstallLicenseAcceptance="true"

   - o   -OPT installLocation="/QIBM/ProdData/WebSphere/AppServer/V61/ND"

   - o   -OPT defaultProfileLocation="/MyIASP/QIBM/UserData/WebSphere/AppServer/V61/ND"

   - o   -OPT PROF_enableAdminSecurity="false"

   - o   -OPT PROF_omitAction=samplesInstallAndConfig
4.) Install WebSphere using the modified response file from Step 3
   - o   INSTALL -options /was61nd/responsefile.nd.txt

7.3.3 Installing WebSphere on the backup system

The steps below show how to perform the install on the backup system. After performing these steps you will have the product dir (ProdData) on SYSBAS and the profile dir (UserData) on the iASP.

1.) Ensure the iASP is available on to the backup system.
2.) CD to the WAS dir on the WebSphere installation image
   - o   cd /QOPT/WEBSPHERE/WAS
3.) Make a copy of the default response file into the dir of your choosing
   - o   cp /QOPT/WEBSPHERE/WAS/responsefile.nd.txt /WAS61ND
4.) Edit the following option in the response file you created in Step 2
   - o   -OPT silentInstallLicenseAcceptance="true"

   - o   -OPT installLocation="/QIBM/ProdData/WebSphere/AppServer/V61/ND"

   - o   -OPT defaultProfileLocation="/MyIASP/QIBM/UserData/WebSphere/AppServer/V61/ND"

   - o   **-OPT allowOverrideProfileLocation="true"**

   - o   **-OPT profileType="none"**

   - o   -OPT PROF_enableAdminSecurity="false"

   - o   -OPT PROF_omitAction=samplesInstallAndConfig
5.) Install WebSphere using the modified response file from Step 3
   - o   INSTALL -options /was61nd/responsefile.nd.txt

Note: The two option in bold prevent the default profile from being created a second time. The default profile already exists on the iASP and was created when the install was done on the primary system.

7.3.4 Adding iASP group to WebSphere's job description

WebSphere will not be able to see libraries and databases on the iASP unless the job description WebSphere 6.1 runs under is changed to set the iASP group. That can be done using

- CHGJOBD JOBD(QWAS61/QWASJOBD) INLASPGRP({MYiASP})

Note: This must be done on both Primary and Backup systems

7.3.5 Changing Host Name in WebSphere

By default when WebSphere is installed it uses what ever the system name is set to as the host name throughout the configuration files. That is not always the name we want WebSphere to use. In a high availability environment like we created here we want WebSphere to use the Takeover IP Address. By switching WebSphere to use the TakeOverIP Address we can then run WebSphere on either the backup or primary system and avoid any IP or naming issues when a switch over occurs. To change WebSphere's host names follow the instructions listed in the Info Center link below.

http://publib.boulder.ibm.com/infocenter/wasinfo/v6r1/topic/com.ibm.websphere.base.iseries.doc/info/iseries/ae/tagt_hostname.html

Note: This since the profile directory resides on the iASP changing the host name only needs to be done once.

7.3.6 Recommended clean up after a switch over

When a switch over is done it is recommended that WebSphere's OSGi cache is cleaned up. This step could be added to an auto start or stop program and occur automatically when a switch over is done. Chapter 8 provides more details on creating auto start or stop programs.

To cleanup the OSGi cache do the following:

1. Ensure the server is not running

2. cd /MYIASP/Websphere_profile_dir/profiles/ProfileName/bin

3. Run: osgiCfgInit

7.4 Installing M3 WorkPlace

Installing M3 WorkPlace can be done using the standard instructions in: Installation Guide for M3 Workplace, System i. However, there are a few changes that need to be made. These changes are covered in the sections below.

7.4.1 Manual work around for older LCM versions (Optional)

For users running LCM 9.0.3.0 together with M3BE 14.0.1 follow the directions below. **If you are on version 9.1.5.0 of LCM this section can be skipped**. LCM versions prior to 9.1.5.0 do not handle WebSphere product dir and profile dir being in separate locations. Thus the following steps must be done before proceeding to section 7.4.2

1. Make a copy of the following files:

    o C:\Program Files\Lawson \LifeCycle Manager\Server\products\General\templates\check_was_path.vm

    o C:\Program Files\Lawson \LifeCycle Manager\Server\products\General\templates\server_add_middleware.vm

2. Edit the CheckWasPath installationPath line in check_was_path.vm so it matches below

    o <CheckWasPath installationPath="/QIBM/ProdData/WebSphere/AppServer/**vX**/ND"/>

    o Where **vX** = WebSphere version (v61 or v7).

3. Edit the addpath path line in server_add_middleware.vm so it matched below

    o Set: <addpath path="/qibm/proddata/websphere/appserver/**vX**/nd" type="WASPRODPATH" />

    o Where **vX** = WebSphere version (v61 or v7).

4. Follow steps in 7.4.2

5. Restore check_was_path.vm and server_add_middleware.vm using the copy made in step 1.

Note: It is important to ensure these files are restored since leaving the modified version in place will affect any future installs done via LCM.

7.4.2 Installing M3 WorkPlace

Install M3 WorkPlace can be done using the standard instructions in: Installation Guide for M3 Workplace, System i. Below are the modifications needed to install M3 WorkPlace into the iASP.

1. During the "Attach IBM WebSphere Application Server" step make sure you specify the path to the WebSphere install you created above. i.e.
/{MYiASP}/QIBM/UserData/WebSphere/AppServer/V61/ND

2. During the "Install M3 Workplace Application" step if the "File root path" is under the WebSphere directory, make sure that you specify the path to the WebSphere install you created previously.

3. The first time you go the "Replicate M3 Business Engine Users" step it will fail since it will be unable to see the M3 Business Engine db on the iASP. You must go through replicate users once and allow it to fail .This creates a configuration directory. The steps below show how to modify the files in that configuration directory to allow replicate users to complete successfully.

   a. Open file:
   /MYIASP/QIBM/UserData/WebSphere/AppServer/V61/Base/profiles/profile_name/replication/{config_name}/properties.xml

   b. Locate the following lines from:

   < <database>

           <driver>com.ibm.as400.access.AS400JDBCDriver</driver>

           <url>jdbc:as400:10.1.1.98;naming=sql;access=read only;block

           size=512;blocking enabled=true;do escape processing=false;data compression=true;prompt=false;transaction isolation=none</url>

           <databasename></databasename>

           <user>M3DBUSR</user>

       <encryptedpassword>{{ENCRYPTED}##01eF4+VhYAhFY=</encryptedpassword>

     </database>

   c. Modify the url and databasename lines as shown below.

   < <database>

           <driver>com.ibm.as400.access.AS400JDBCDriver</driver>

           <url>jdbc:as400:10.1.1.98;**database name={MYiASP};**naming=sql;access=read

           only;blocksize=512;blocking enabled=true;do escape processing=false;data

           compression=true;prompt=false;transaction isolation=none</url>

           <databasename>**={MYiASP}**</databasename>

           <user>M3DBUSR</user>

       <encryptedpassword>{{ENCRYPTED}##01eF4+VhYAhFY=</encryptedpassword>

     </database>

   d. Retry " Replicate M3 Business Engine Users" step but use the existing configuration that was modified here

4. Complete rest of M3 Workplace install

7.5 Moving M3 WorkPlace Databases to iASP

All of the M3 WorkPlace databases need to be moved to the iASP. This can be done through HASM by going back to step 4, Set up your high availability solution, and selecting the retry option on the Migrate libraries step. See figure 15 below. The databases we moved were:

- MWPx0

- MIEADMx0

- MIEMETAx0

Note: WebSphere needs to be shutdown before performing this step.

Figure 14. Migrate libraries

7.6 Additional M3 WorkPlace changes

After installing M3 WorkPlace and moving the databases to the iASP there are a few additional steps that need to be done. Those steps are below.

7.6.1 Set Authorities for M3 WorkPlace databases

Authorities are not preserved when the database were restored to the iASP in section 7.5. The steps below show how to properly setup the authorities for the M3 WorkPlace databases.

1. GRTOBJAUT OBJ(MWPx0) OBJTYPE(*LIB) USER(MWPADM MWPUSR) AUT(*USE)

2. Invoke the following SQL Stored Procedures:

   o call MWP90.pMISC_setrights_sp_exec ('MWPx0', 'MWPUSR')

   o call MWP90.pMISC_setrights_sp_exec ('MWPx0', 'MWPADM')

   o call MWP90.pMISC_setrights_sp_write ('MWPx0'   , 'MWPADM')

7.6.2 Migrating M3 WorkPlace user profiles

All of the user profiles used by M3 WorkPlace need to be migrated into our high availability environment. This can be done through HASM by going back to step 4, Set up your high availability solution, and selecting the retry option on the Migrate user profiles step. See figure 16 below. In our test the following M3 WorkPlace user profiles were migrated:

- MIEADMx0, MIEMETAx0, MWPADM, MWPUSR, and MWPx0
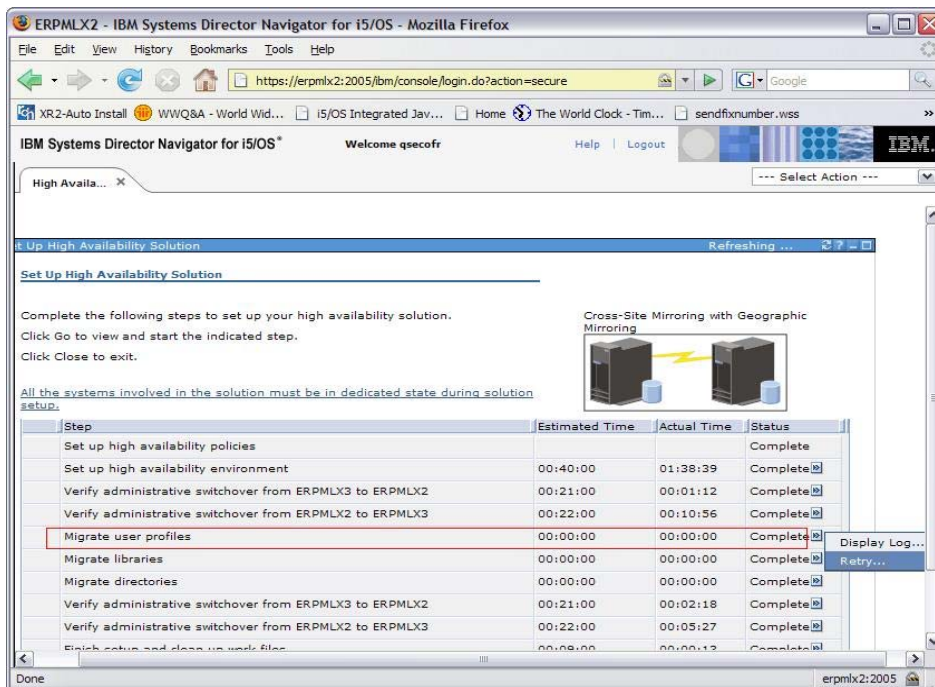
Figure 15. Migrate user profiles

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7.6.3 Changing Host Name in M3 Workplace

By default M3 WorkPlace also uses what ever the system name is set to as the host name throughout its configuration files. Again that is not always the name we want to use. In a high availability environment like we created here we want M3 WorkPlace to use the TakeOverIP Address. By switching M3 WorkPlace to use the TakeOverIP Address we can then run M3 WorkPlace on either the backup or primary system and avoid any IP or naming issues when a switch over occurs. Steps to modify the M3 WorkPlace files are below.

1. Edit mne.properties

    a. Open file:

        - /MYIASP/QIBM/UserData/WebSphere/AppServer/V61/Base/profiles/MWPx0/installedApps/MWPx0Cell/MWP_EAR.ear/MNE.war/WEB-INF/properties/mne.properties

    b. change line below from :

        - HelpUrl=http://mysystem.comany.com/mnehelp

    c. To:

        - HelpUrl=http://mysystem.comany.com/mnehelp

2. Modify M3 WorkPlace application server configuration

    a. Log into WorkPlace and select user manager

    b. Select Work with application server

    c. Open application server

    d. Change IP address to takeover IP address

7.7 Move Life Cycle Manager to iASP

The /LifeCycle IFS directory was moved during the setup of the high availability solution, see section 6.1.3 for more details. In addition make sure LCM library exists on both the primary and backup systems and both libraries contain the same objects. The LCM library should have been created on the backup system since objects in it are part of the Administrative Domain that was created during the setup of the high availability solution. If the library doesn't exist or is missing objects copy the missing objects over to the backup system. All objects in library LCM can be part of an Administrative Domain. Thus it is recommended to add any missing objects manually to the Administrative Domain.

Note: Starting with M3 10.1 (M3BE 14.1.2 and LCM 9.1.5.0) support has been added to Lawson's Life Cycle Manager, LCM, to allow both LCM and M3 Business Engine to be directly installed into an iASP. In addition support was added to apply fixes and perform function like upgradedb on installations that reside on an iASP. This report was written with the intention of showing how to migrate an existing M3 installation into an iASP for new installations running M3 10.1 (M3BE 14.1.2 and LCM 9.1.5.0) or higher some steps in the report can be skipped.

8. Creating and Registering Auto Start and Stop Programs

To further automate the switchover and/or failover process, exit programs can be utilized. Exit programs can be used to automatically stop and start the Lawson M3 applications during a switchover and automatically start the Lawson M3 applications during a failover. Exit programs can also be used to keep objects, not migrated to the iASP or part of the administrative domain, synchronized between the production and backup systems.

Two exit programs will need to be used, one for the shutdown and one for the startup. To use an exit program, the name and location of the exit program must be entered in the designated data area in library QUSRHASM. The name of the data areas are QSHUTDOWN and QSTARTAPP. In order for the programs to be called on a switch over they need to be registered in a specific data area.

- For the Startup program:
    - CHGDTAARA DTAARA(QUSRHASM/QSTARTAPP) VALUE('STARTUP   MYLIB   ')
- For the Shutdown program:
    - CHGDTAARA DTAARA(QUSRHASM/QSHUTDOWN) VALUE('SHUTDOWN MYLIB   ')

The programs can reside in any library you choose and can be any name of your choosing. However if the name of the library and/or program is less than 10 characters, then the names must be padded with spaces as shown in the above example. Also the library and program names cannot exceed 10 characters in length.

The exit programs are called with the user profile QPGMR. During the processing of the exit programs we created the user profile is switched to M3SRVADM, so it is necessary to grant QPGMR the necessary authority to M3SRVADM in order to execute the exit programs successfully.   Run the command below to grant the necessary authority.

- `GRTOBJAUT OBJ(M3SRVADM) OBJTYPE(*USRPRF) USER(QPGMR) AUT(*USE)`

 The exit programs need to exist on both the production and backup host and all of the commands to configure the exit programs need to be run on both hosts. See Appendix A.1 and A.2 for sample exit programs we used.

Note: HASM does not support parameter passing for exit program. If parameter passing is required you can register your exit program via the Cluster Resource Group or CRG instead of HASM. The draw back to using the CRG is you lose the automated planned switch overs that the HASM management web page gives you. Instead any planned switch over would have to be done manually. For more details on using exit program via the CRG refer to Redbook SG24-7405, "Implementing PowerHA for IBM i".

9. Testing of Cross Site Mirroring with Lawson M3

Several tests were run using the Lawson M3 Order Entry benchmark. See Appendix A.3 for a description of the benchmark. The first tests were done to validate that the M3 environment was working on both the primary and backup system. The second set of tests was done to get a general idea of the overhead of using mirroring. The final tests were done to calculate the times it takes to perform a switch over.

9.1   Validation of M3 environment

The chart below shows results that were achieved on both the primary and backup systems. Both systems were identical in terms of hardware and software and thus results should be equivalent, which is what the results in Figure 17 show as well. The key here is the validation of the M3 applications on our high availability solution. Not only is M3 fully functional on the primary system, but when switched over to the backup system all applications continue to run without any issues.
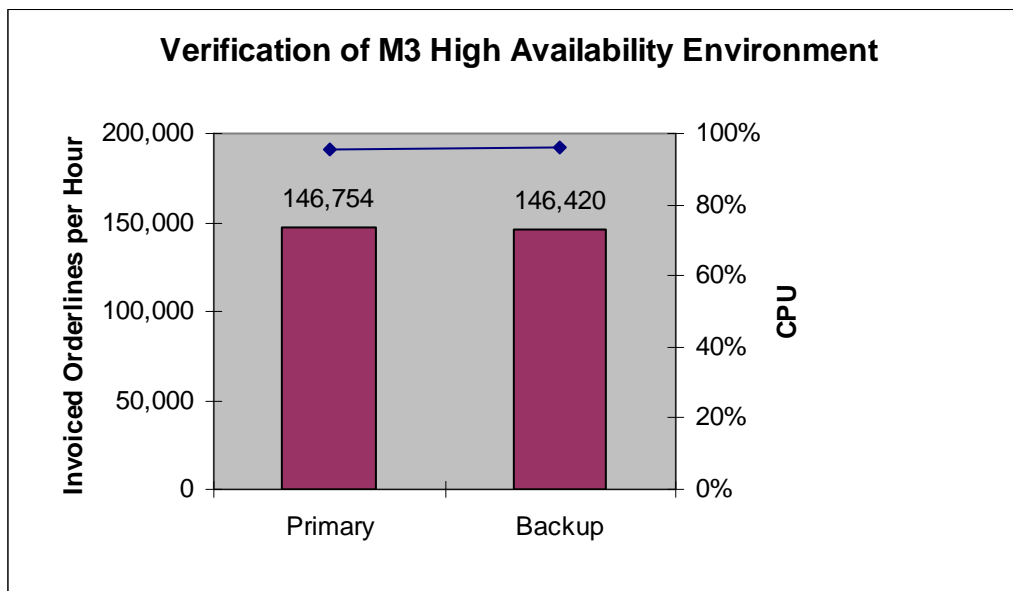
Figure 16. Verification of M3 in a High Availability Environment

9.2   Over head of mirroring

There is overhead for having and maintaining a mirrored copy of the iASP. That overhead can vary depending on your configuration. Figure 18 shows the overhead we saw on the primary system for mirroring. In addition to overhead on the primary system there is overhead on the backup system as well in the form of CPU usage. CPU will be used on the backup system to maintain the mirrored copy of the data .In the tests done here the CPU usage on the backup system was 8%. Again results may vary, but this overhead needs to be taken into account when planning your high availability solution.

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Overhead of Mirroring on Primary System

150,659	146,754 **-3%**
No Mirroring	Mirroring

Y-axis left: Invoiced Orderlines per Hour (0 to 200,000)
Y-axis right: CPU
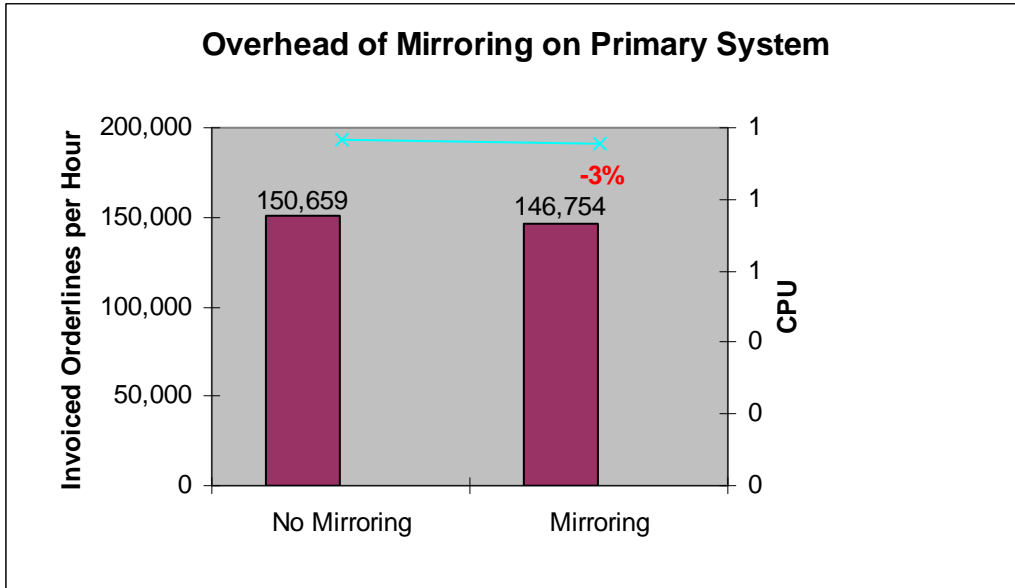
Figure 17. Overhead of Mirroring on Primary System

9.3 Switchover times

Several switch overs were done and timed to gauge the time it takes for an average switch over to occur. Times may vary based on size and type of system you have and the number of database objects in the iASP. The size of the db objects should not have any significant impact on the switch over times. Also the size and number of non-database objects such as IFS objects should not have any significant impact on the switch over times. For the tests here only one M3 database was present. In a customer environment it may be possible to have several databases in the iASP, hence that could cause the switch over times to be higher than what is reported here. The key point of the times reported here is to show that switching over is not an instantaneous event. It takes a certain amount of time and switch over times is another factor that needs to be accounted for when planning your high availability solution.

The average time for a switch over in our environment was 17 minutes. It did not matter if we were switching from the primary system to the backup system or visa versa. Switchover times in each case did not vary by much more than a minute. Also the 17 minute switch over time includes calling both the startup and shutdown programs. Calling these programs adds on average about 2 to 3 minutes to the switch over process. Thus if we exclude the startup and shutdown exit programs the switch over times would be closer to 14 minutes on average.

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10. Summary

High availability in a Lawson M3 environment can be a crucial element in today's demanding business environment. By utilizing the PowerHA for I High Availability Solution Manager it is possible to greatly reduce the complexity of implementing and managing a geographic mirroring high availability solution. When properly migrated and configured in a geographic mirror environment, the Lawson M3 applications will be able to easily switch back and forth between production and backup systems. By creating and registering startup and shutdown exit programs the Lawson M3 application can also be automatically restarted on the backup system after a planned switchover or failover. Also by utilizing a Takeover IP address the host that the Lawson M3 applications are running on will be transparent to the user.

Running your Lawson M3 applications in a geographic mirror environment provides the data resiliency and the flexibility to quickly recover from both planned and unplanned outages. Thus the combination of geographic mirroring with PowerHA for i High Availability Solution Manager allows you to easily implement and manage a high availability environment that achieves your availability goals.

Note: Starting with M3 10.1 (M3BE 14.1.2 and LCM 9.1.5.0) support has been added to Lawson's Life Cycle Manager, LCM, to allow both LCM and M3 Business Engine to be directly installed into an iASP. In addition support was added to apply fixes and perform function like upgradedb on installations that reside on an iASP. This report was written with the intention of showing how to migrate an existing M3 installation into an iASP for new installations running M3 10.1 (M3BE 14.1.2 and LCM 9.1.5.0) or higher some steps in the report can be skipped.

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11. References

International Business Machines Corporation. *Implementing PowerHA for IBM i*. Redbook SG24-7405. First edition, 2008.

International Business Machines Corporation. WebSphere Application Server, Version 6,1 Information Center.
<http://publib.boulder.ibm.com/infocenter/wasinfo/v6r1/topic/com.ibm.websphere.base.iseries.doc/info/iseries/ae/tagt_hostname.html >

Appendix

A.1 Startup exit program

Below is the code example for the startup exit program. This program is made up of two components. A CL program and a Qshell script. Each is listed below.

Passing parameters into an exit program is not supported by the High Availability Solution Manager, thus the M3 environment name, HTTP Server name and other values are hard coded and will need to be changed. After making the necessary modifications, compile the exit program and place it in a library of your choosing. Regardless of the library used to store the exit programs, make sure that the user profile QPGMR has at least *USE authority to that library. QPGMR is the user profile used by the High Availability Solution Manager to call the exit program.

Note: This program is given as an example only to help guide you on how to create a startup exit program. This may not be an optimal solution for all environments.

A.1.1 CL Startup exit program

```
/******************************************************************************/
/* PROGRAM: STARTUPM3                                                       */
/* PURPOSE: Start Lawson M3 jobs                                            */
/*                                                                          */
/* PARAMETERS: None.  Parameters are not supported by HASM                  */
/*                                                                          */
/* Note: Program submits a batch jobs which runs a .qsh script              */
/*       Batch Job name is: M3START                                         */
/*       Check M3START JOB LOG FOR ADDTIONAL ERRORS                         */
/******************************************************************************/
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```

```
             /* YOUR INFORMATION HANDLING SYSTEM OR OTHERWISE, EVEN IF WE ARE EXPRESSLY       */
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             /*                                                                                */
             /* COPYRIGHT                                                                      */
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             /* Use, duplication or disclosure restricted                                      */
             /* by GSA ADP Schedule Contract with IBM Corp.                                    */
             /* Licensed Material - Property of IBM                                            */
             /*                                                                                */
             /**********************************************************************************/
             PGM
                     DCL        VAR(&ADMINID) TYPE(*CHAR) LEN(10)
                     DCL        VAR(&CURUSER) TYPE(*CHAR) LEN(10)
                     DCL        VAR(&ADMHANDLE) TYPE(*CHAR) LEN(12)
                     DCL        VAR(&CURHANDLE) TYPE(*CHAR) LEN(12)


                     MONMSG     MSGID(CPF2103)
                     MONMSG     MSGID(CPF0000) EXEC(GOTO CMDLBL(ERROR))
             /* REMEMBER CURRENT USER PROFILE:           */
                      RTVJOBA    CURUSER(&CURUSER)
                      CALL       PGM(QSYS/QSYGETPH) +
                                 PARM(&CURUSER '*NOPWDCHK' &CURHANDLE)
             /* SWITCH TO LAWSON M3 USER PROFILE M3SRVADM:       */
                     CHGVAR     VAR(&ADMINID) VALUE('M3SRVADM')
                     CALL       PGM(QSYS/QSYGETPH) +
                                 PARM(&ADMINID '*NOPWDCHK' &ADMHANDLE)
                     CALL       PGM(QSYS/QWTSETP) PARM(&ADMHANDLE)
             /* Setup Environment */
                     ADDLIBLE   LIB(M3DJVA)
                     SETASPGRP  ASPGRP(HASMiASP)


             /* START LAWSON M3 JOBS */
                     QSH CMD('/etc/M3/StartupM3.qsh')
             /* SWITCH BACK TO ORIGINAL USER PROFILE: */
                     CALL       PGM(QSYS/QWTSETP) PARM(&CURHANDLE)
                     GOTO       CMDLBL(END)
             ERROR:
                     SNDPGMMSG  MSGID(CPF0001) MSGF(QCPFMSG) MSGDTA('LAWSON +
                                 M3 STARTUP FAILED') MSGTYPE(*ESCAPE)


             END:
                     ENDPGM
```

A.1.2 Qshell startup script

```
##########################################################################################
# Program: StartupM3.qsh                                                           #
# Purpose: Starts up M3BE jobs, M3 WorkPlace, and HTTP Server instance             #
#                                                                                  #
# Logging: Log is written to /etc/M3/startup.log                                   #
#                                                                                  #
#                                                                                  #
##########################################################################################
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# Licensed Material - Property of IBM                                              #
#                                                                                  #
##########################################################################################


# Create log file
        if [ -e /etc/M3/startup.log ]
        then
                rm /etc/M3/startup.log
        fi


        touch -C 819 /etc/M3/startup.log
```

```
# Start M3BE jobs and M3 License Server
        echo "Starting M3 environment BM" | tee -a /etc/M3/startup.log
        system "M3DJVA/STRMVX ENVIRON(BM) TYPE(*SBM) AUTOSTART(*YES)
                LICSERVER(*YES)" 2>&1 | tee -a /etc/M3/startup.log


# Start M3 WorkPlace
        echo "Starting WorkPlace instance MWP60" | tee -a /etc/M3/startup.log
        /hasmiasp/qibm/proddata/websphere/appserver/v61/base/bin/startserver
                -profileName MWP60 MWP_AS 2>&1 | tee -a /etc/M3/startup.log


# Start HTTP Server Instance
        echo "Starting HTTP Server: MWP60" >> /etc/M3/startup.log
        system "STRTCPSVR *HTTP HTTPSVR(MWP60)" 2>&1 | tee -a /etc/M3/startup.log
```

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A.2 Shutdown exit program

Below is the code example for the shutdown exit program. This program is made up of two components. A CL program and a Qshell script. Each is listed below.

Passing parameters into an exit program are not supported by the High Availability Solution Manager, thus the M3 environment name, HTTP Server name and other values are hard coded and will need to be changed. After making the necessary modifications, compile the exit program and place it in a library of your choosing. Regardless of the library used to store the exit programs, make sure that the user profile QPGMR has at least *USE authority to that library. QPGMR is the user profile used by the High Availability Solution Manager to call the exit program.

Note: This program is given as an example only to help guide you on how to create a shutdown exit program. This may not be an optimal solution for all environments.

A.2.1 CL Shutdown exit program

```
/*******************************************************************************/
/* PROGRAM: SHUTDOWNM3                                                       */
/* PURPOSE: Shutdown Lawson M3 jobs                                          */
/*                                                                           */
/* PARAMETERS: None.  Parameters are not supported by HASM                   */
/*                                                                           */
/* Note: Program submits a batch jobs which runs a .qsh script               */
/*     Batch Job name is: M3STOP                                             */
/*     Check M3STOP JOB LOG FOR ADDTIONAL ERRORS                             */
/*******************************************************************************/
/* LICENSE AND DISCLAIMER                                                    */
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/* ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.                               */
```

```
          /*                                                                            */
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          /**************************************************************************************************/


             DCL        VAR(&ADMINID) TYPE(*CHAR) LEN(10)

             DCL        VAR(&CURUSER) TYPE(*CHAR) LEN(10)

             DCL        VAR(&ADMHANDLE) TYPE(*CHAR) LEN(12)

             DCL        VAR(&CURHANDLE) TYPE(*CHAR) LEN(12)


             MONMSG     MSGID(CPF2103)

             MONMSG     MSGID(CPF0000) EXEC(GOTO CMDLBL(ERROR))


   /* REMEMBER CURRENT USER PROFILE:         */
             RTVJOBA    CURUSER(&CURUSER)

             CALL       PGM(QSYS/QSYGETPH) +

                        PARM(&CURUSER '*NOPWDCHK' &CURHANDLE)
   /* SWITCH TO LAWSON M3 USER PROFILE M3SRVADM:       */
             CHGVAR     VAR(&ADMINID) VALUE('M3SRVADM')

             CALL       PGM(QSYS/QSYGETPH) +

                        PARM(&ADMINID '*NOPWDCHK' &ADMHANDLE)

             CALL       PGM(QSYS/QWTSETP) PARM(&ADMHANDLE)

    /* Setup environment */

             ADDLIBLE   LIB(M3DJVA)

             SETASPGRP  ASPGRP(HASMiASP)

     /* SHUTDOWN LAWSON M3 JOBS */

             QSH CMD('/etc/M3/ShutdownM3.qsh')

   /* SWITCH BACK TO ORIGINAL USER PROFILE: */

             CALL       PGM(QSYS/QWTSETP) PARM(&CURHANDLE)

             GOTO       CMDLBL(END)



   ERROR:

             SNDPGMMSG  MSGID(CPF0001) MSGF(QCPFMSG) MSGDTA('LAWSON +

                        M3 SHUTDOWN FAILED') MSGTYPE(*ESCAPE)



   END:

             ENDPGM
```

A.2.2 Qshell Shutdown script

```
###############################################################################
# Program: ShutdownM3.qsh                                                     #
# Purpose: Shuts down M3BE jobs, M3 WorkPlace, and HTTP Server instance       #
#                                                                             #
#  Logging: Log is written to /etc/M3/shutdown.log                            #
#                                                                             #
#                                                                             #
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################################################################################

# Create log file
        if [ -e /etc/M3/shutdown.log  ]
        then
                rm /etc/M3/shutdown.log
        fi
        touch -C 819 /etc/M3/shutdown.log
```

```
# Stop M3BE jobs and M3 License Server
        echo "Stopping M3 environment BM" | tee -a /etc/M3/shutdown.log
        system "M3DJVA/STRMVX ENVIRON(BM) ACTION(SHUTDOWN)"  2>&1 | tee -a
                /etc/M3/shutdown.log


        echo "Stopping Movex License Server" | tee -a /etc/M3/shutdown.log
        jobid=$(ps -s M3LICSVR | grep m3srvadm/m3licsvr | cut -c53-)
        if [ "$jobid" = "" ]
        then
                echo "Error License Server Process not found" | tee -a
                        /etc/M3/shutdown.log
        else
                system "ENDJOB $jobid" 2>&1 | tee -a /etc/M3/shutdown.log
        fi


# Stop M3 WorkPlace
        echo "Stopping WorkPlace instance MWP60" | tee -a /etc/M3/shutdown.log
        /hasmiasp/qibm/proddata/websphere/appserver/v61/base/bin/stopserver
            -profileName MWP60 MWP_AS 2>&1 | tee -a /etc/M3/shutdown.log


# Stop HTTP Server Instance
        echo "Stopping HTTP Server: MWP60" | tee -a  /etc/M3/shutdown.log
        system "ENDTCPSVR *HTTP HTTPSVR(MWP60)" 2>&1 | tee -a
                /etc/M3/shutdown.log


# End M3 Subsystems
        echo "Ending M3 Subsystems" | tee -a  /etc/M3/shutdown.log
        system "ENDSBS SBS(M3JVA) OPTION(*IMMED)" 2>&1 | tee -a
                /etc/M3/shutdown.log
        system "ENDSBS SBS(M3JVAASJ) OPTION(*IMMED)" 2>&1 | tee -a
                /etc/M3/shutdown.log
        system "ENDSBS SBS(M3JVABCH) OPTION(*IMMED)" 2>&1 | tee -a
                /etc/M3/shutdown.log
        system "ENDSBS SBS(M3JVAINT) OPTION(*IMMED)" 2>&1 | tee -a
                /etc/M3/shutdown.log
        system "ENDSBS SBS(M3JVAMIJ) OPTION(*IMMED)" 2>&1 | tee -a
                /etc/M3/shutdown.log
        system "ENDSBS SBS(M3LICSVR) OPTION(*IMMED)" 2>&1 | tee -a
                /etc/M3/shutdown.log
```

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A.3   Lawson M3 Order Entry Benchmark

The Lawson M3 Order Entry Benchmark kit uses a load generation tool to simulate a number of virtual users entering orders at a reasonable rate. The Order Entry transaction, OIS100, is what is used for this. The Order Entry transaction was chosen for its relative complexity and connection to a real life scenario. Further, it's easily repeatable, can be run infinitely and allows for a large variance in data.

The results from the order entry tests can be calculated into an entity called Universal Performance Unit or UPX. UPX is the sizing indicator used by Lawson M3 for customer sizings. The UPX is a theoretical transaction consisting of an average CPU time required for a typical customer load. A theoretical number of UPX'es per hour can calculated via a user number, activity and the production timeframe.

Thus even though a customer may have many other transactions types than just the order entry transaction that is running here, the results here likely still apply, since all other transaction can be derived via CPU time from this one transaction using UPX. It's is the overall performance of the Lawson M3 Business Engine to handle high volumes of transactions that is being stressed, the transaction type in not key in this, since all business logic share the same application foundation and architectural design.

Only a small number of virtual users, or vusers, were used to drive the scenario. The vusers were configured to wait an average of one second between each step. Thus there is almost no key think time between steps of a transaction. This is not at all representative of a customer environment, however, the goal of the benchmark is to achieve the maximum throughput from the Lawson M3 Business Engine on a given system configuration.

The benchmark scenario works as follows:

After logging in, the user performed an order entry operation consisting of seven steps:
1.   Create a new order
2.   Enter order line 1
3.   Enter order line 2
4.   Enter order line 3
5.   Enter order line 4
6.   Enter order line 5
7.   Close the order

Throughput is calculated by counting the number of fully invoiced order lines once every minute throughout the benchmark test. Once the run was complete, the number of invoiced order lines per hour over a particular measurement interval was calculated from this data. The measurement interval was defined to be a 90 minute period beginning 15 minutes after the run started.   The reported throughput metric for this benchmark is *number of invoiced order lines per hour*. An invoiced order line is one that has completed all of the interactive and batch processing required for that order and the order lines to have a status of 77 or completed. To demonstrate that the results were repeatable, each result consisted of two runs with identical parameters.

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