DB SERVER APPLICATION NOTE

EVS Database Mirroring

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INTRODUCTION

This application note describes the EVS redundant Database server. How it works and how to install it.

MIRRORING PRINCIPLES

SQL 2005 MIRRORING

Database mirroring is a new SQL Server 2005 technology available for increasing database availability.

In database mirroring, an originating SQL Server 2005 instance continuously sends a database's transaction log records to a copy of the database on another standby SQL Server instance. The originating database and server have the role of *principal*, and the receiving database and server have the role of *mirror*. The principal and mirror servers must be separate instances of SQL Server 2005.

In addition to the two partner servers (principal and mirror) a database mirroring session may have an optional third server, called the *witness*. The witness server's role is to enable automatic failover. When database mirroring is used for high availability, if a principal server suddenly fails, if the mirror server has confirmation from the witness, it can automatically take on the role of principal and make its database available within a few seconds.

The principal and mirror servers must run at least SQL Server 2005 Standard Edition. The witness server can run SQL Server 2005 Express Edition.

More information about SQL Mirroring is available on :
http://www.microsoft.com/technet/prodtechnol/sql/2005/dbmirror.mspx

VIRTUAL IP ADDRESS

SQL Server 2005 doesn't manage the clients redirection in case of failover. We have then developed a windows service that links an IP Address to the mirrored database. This service is called EVSDBIP.

EVSDBIP is installed on the Principal and mirror servers. It regularly queries the SQL server to check the mirroring status and the mirrored database state. If EVSDBIP runs on the principal server, it adds the virtual IP Address to the local TCP/IP stack. If EVSDBIP runs on the mirror server, it checks that the virtual IP Address is not configured on the server and eventually removes this IP Address from the local TCP/IP stack.

In case of failover, the server roles (principal and mirror) are switched. The Virtual IP is removed from the "old" principal server (if it is still available) and added to the "New" principal server.

EVSDBIP can manage multiple Database/IP links on the same servers. This means that multiple databases can be mirrored on the same couple of server, each database with its own virtual IP address.

EVS DATABASE MONITORING

The EVSDBIP service doesn't provide user interface to verify mirroring configuration and availability.

The tool “EVS Database Monitoring” has been developed to periodically display the EVSDBIP status on principal and mirror server.

This application verifies the EVSDBIP status and the mirroring state on each SQL server and displays the result in an “easy to use” interface. “EVS Database Monitoring” can be installed on any Windows XP/2003 computer on the network.

More information about this application is available later in this document.

MIRRORING INSTALLATION
INTRODUCTION

Database redundancy installation is divided into several steps :

- SQL Server 2005 installation
- EVSDBIP installation and configuration
- EVS Database Monitoring installation and configuration
- Database Mirroring initialisation

SQL SERVER 2005

SQL Server 2005 must be installed on

- the principal server (where the database will be used)
- the mirrored server (the backup server)
- the witness computer (workstation used for automatic failover)

SQL Server 2005 Standard Edition (or Enterprise Edition) must be installed on principal and mirror servers. SQL Server 2005 Express Edition (or higher) can be installed on the Witness workstation.

At least SQL Service Pack 1 must be applied on each server, DB mirroring is not supported for earlier versions.

EVSDBIP

EVSDBIP must be installed on the principal AND the mirror server. (not on the witness)

EVSDBIP is a windows service. It can be installed with the setup file : EvsDbIp_setup 02.07.00.exe

No special configuration is asked during the setup process.

EVSDBIP is configured through an INI file and the setup application will ask you to configure this INI file before the end of the setup.

By default, the ini file contains this configuration :

```
; config file for "EvsDbIp" service
; please refer to "EVSDBIP_analyse.doc" MSWord document to get detailed info

[EVSDBIP]

; adress static of this server
StaticIP=1.1.2.178

; login to master DB
DBLogin=sa

; password to master DB
DBPassword=evs

; port to use for communications with clients
Port=10555


; settings for CleanEdit
;[CleanEdit]
;VirtualIP=1.1.2.181
;RefIP=1.1.2.178
;DbName=CleanEditDB


; settings for IpRemote
[IpRemote]

; virtual IP to access IpRemote DB
VirtualIP=1.1.2.180

; IP of adapter to which virtual IP has to be attached
RefIP=1.1.2.178

; name of DB
DbName=IpRemoteWC
```

The options contained in the ini file are described in the following table :

Option	Description
[EVSDBIP]	General configuration category
StaticIP	IP address of the managed server (typically local IP or 127.0.0.1)
DBLogin	SQL Server Login (typically : SA). This login is used to verify mirroring state
DBPassword	Password of the SQL Server Login
Port	TCP port used to make EVSDBIP status available to client (“EVS Database Monitoring”). By default : 10555

[XYZ]	Category where is described an association “Database / IP Address” to monitor. Typically XYZ = Database name. You can create as much category as the number of database configured on your server.
VirtualIP	Virtual IP Address added to the server where the database is principal (for the XYZ category)
RefIP	Reference IP address (for the XYZ category), used to locate the network interface where the Virtual IP will be attached (don’t put 127.0.0.1 for this option)
DbName	Name of the mirrored database to monitor (for the XYZ category)

The ini file can be limited to :

```
[EVSDBIP]
StaticIP=127.0.0.1
DBLogin=sa
DBPassword=evs
Port=10555
[IpRemote]
VirtualIP=1.1.2.180
RefIP=1.1.2.178
DbName=IpRemote
```

Restart your server to make EVSDBIP running (or manually start the EVSDBIP service)

EVSDBIP logs are stored in c:\EVSLogs\EVSDBIP\

EVS DATABASE MONITORING

INSTALLATION

“EVS Database Monitoring” monitors the state of the EVSDBIP service on the principal and the mirror server.

This application can be installed on any Windows XP/2003 computer on the network.

- .NET framework 2.0 is needed to install the application
- “EVS Database Monitoring” setup file is EVS Database Monitoring Setup.msi

CONFIGURATION

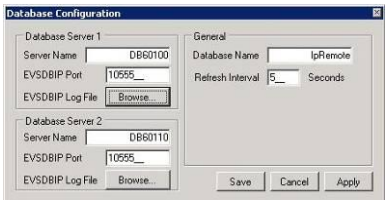
The first time you launch “EVS Database Monitoring”, nothing will be displayed in all the monitoring area. The first step to complete is to configure the databases you want to configure.

To perform this configuration:

- Choose “Databases” in the “Configuration” menu
- Press the “Add” button to add a database to monitor
- Complete the following configuration
  - **Database Server 1**
    - **Server Name** : Computername of the server or its IP address
    - **EVSDBIP Port** : by default 10555 (modify if it has been changed during the EVSDBIP installation)
    - **EVSDBIP Log File** : browse to the file C:\EVSLog\EVSDBIP\EvsDbIp.log on the database server
  - **Database Server 2**
    - **Server Name** : Computername of the server or its IP address

- **EVSDBIP Port** : by default 10555 (modify if it has been changed during the EVSDBIP installation)
- **EVSDBIP Log File** : browse to the file C:\EVSLog\EVSDBIP\EvsDbIp.log on the database server

- **General**
  - **Database Name** : name of the database monitor. Must be the same as the category name in the EVSDBIP configuration file (i.e. [XYZ] in the above explanation)
  - **Refresh interval** : time between 2 status polling on the EVSDBIP services. Cannot be less than 2 seconds.



INTERFACE

Once the databases have been added to the configuration you can choose the database you want to monitor in the first dropdown list. Only one database can be monitored by “EVS Database Monitoring” application. You can launch as many applications as you want depending on the database number you have.

The application interface is described areas by areas in the following points

SERVERS AREA

This part of the interface shows the name of the servers involved in the mirroring process

SERVERS STATUS AREA

This part of the interface shows the status of the EVSDBIP service on the 2 database servers and the role played by each server in the mirroring process.

The meaning of the colours used as background is explained in the following table.

SERVERS STATUS		
Colour	**State**	**Comments**
Server Role	Connected to EVSDBIP	The application is connected to EVSDBIP and has received the service status.
Server Role	Connected to EVSDBIP with warnings	The application is connected to EVSDBIP but has encounter a problem (No status, Database not configured on EVSDBIP,…)
Server Role	Not connected to EVSDBIP	Not connected to EVSDBIP (server unavailable, wrong port, service stopped or not responding,…)

SQL MIRRORING STATUS AREA

Here is displayed the mirroring status returned by SQL 2005 on each server.

A first “coloured” area summarise the two SQL status to display a clear global status of the mirroring process.

The meaning of the text displayed in the two other areas is explained in the following table .

SQL Mirroring Status	
Text displayed	**Status**
Suspended	Mirroring the principal database is suspended.
Disconnected	The principal database and the mirror database are disconnected.
Synchronizing	The principal database and the mirror database are in the process of synchronizing
Pending Failover	The principal database is initiating a failover.
Synchronized	The principal database and the mirror database are synchronized.
Database is not online	The principal database is not mirrored.
blank	Not connected to EVSDBIP

WITNESS STATUS AREA

This area displays the status of the witness connection from both DB servers

"VIRTUAL IP ADDRESS" AREA

Shows the Virtual IP Address configured on each database server and how this IP Address is handled. The colour coding used in this area is explained in the following table.

Virtual IP Address	
Colour	**Status**
IP Address	The IP address is not added to the «mirror » server
IP Address	The IP address is still present on the « Mirror » server
IP Address	The IP address is configured on the « Principal » server
IP Address	The IP address is not configured on the « Principal » server yet.
Blank	No status is returned

STATUS BAR

The status bar shows when the last EVSDBIP status has been received on each server.

MIRRORING INITIALISATION

The database mirroring can be initialized through different applications.

- SQL Server Management Studio
- EVS-DB-Mirroring-Setup.hta in the [IP] Director plugins or on the [DB] Server

EVS-DB-Mirroring-Setup has been developed to easily create a database mirroring. This tool is described later in this document.

If you want to use SQL Server Management Studio you must first prepare your SQL environment:

- Verify that your database is in “Full” recovery mode
- Backup the database
- Backup the transaction Log of the database
- Restore the database on the mirror server with the “norecovery” option
- Restore the transaction Log on the mirror with the “norecovery” option
- Create a database on the witness server with the same name than the one you want to mirror (for example : IpRemote)
- In the SQL Server Management Studio, right-click on the database you want to mirror and choose “Tasks” -> “Mirror...” and complete the configuration through this wizard.

More information about using the SQL Server Management Studio to mirror a database is available on : http://msdn2.microsoft.com/en-us/library/ms188712.aspx

PERFORMANCE CONSIDERATIONS

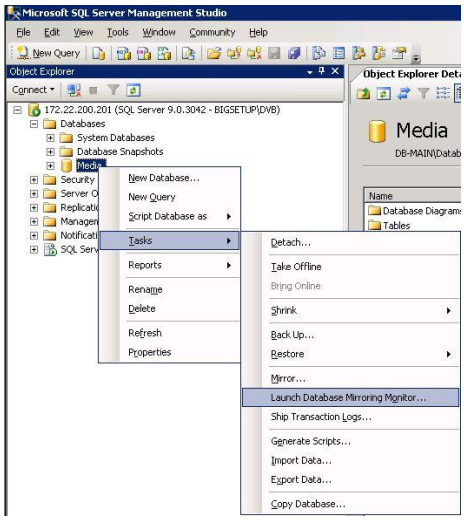
You may experience mirror slowness on heavily loaded database server.

Following our experience the slowness mainly comes from the “mirror commit overhead”, the number of milliseconds added to each transaction by the synchronous mirroring process.

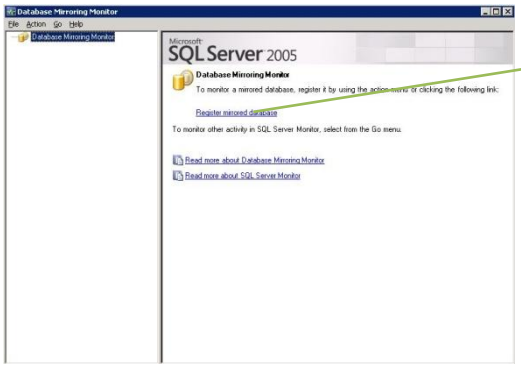
If you think you experience this kind of slowness it’s important to verify the effective mirror commit overhead you have on your database servers.

How to verify the “mirror commit overhead” :

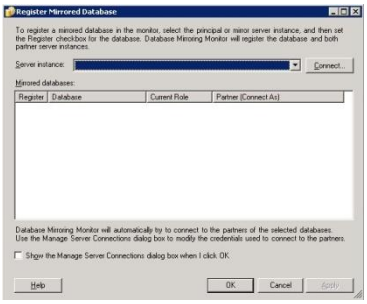
- Start the “SQL Management studio” and connect to your database server
- Right-click on your database, choose “Tasks” – “Launch Database Mirroring Monitor”



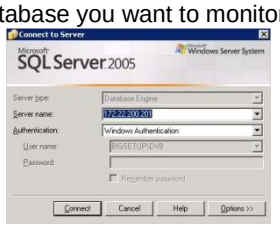
- Register a new mirrored database

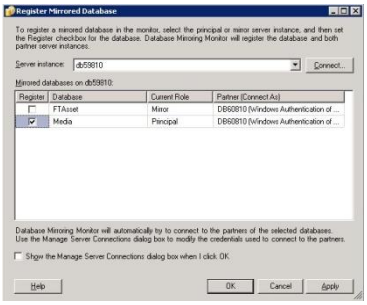


Register a new

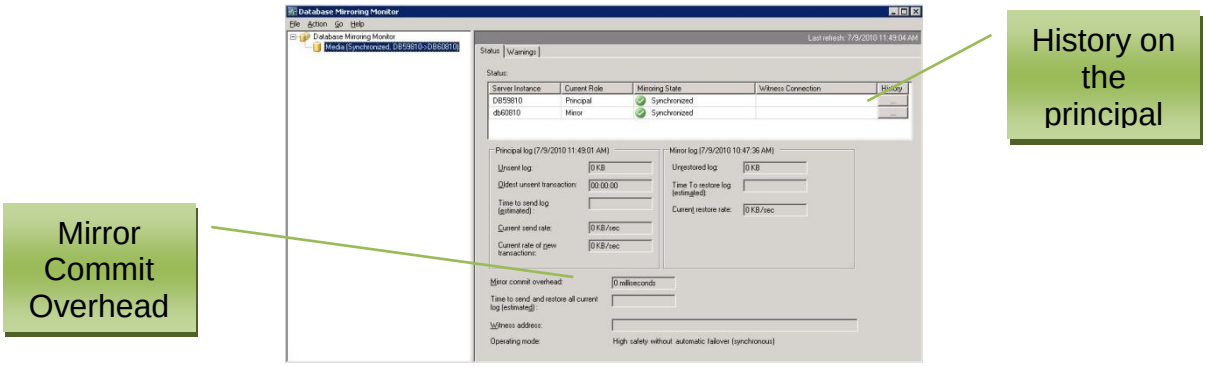


> Connect to your server and choose the database you want to monitor

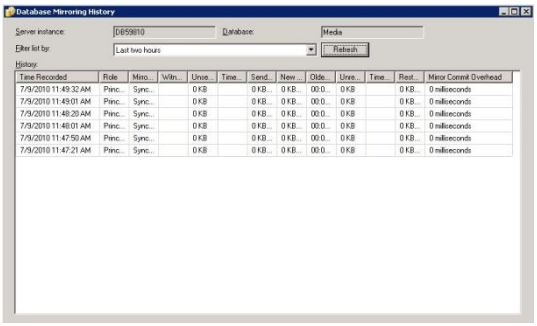




> Wait a few seconds and verify the value of the mirror commit overhead



> You can also check if your mirror commit overhead is constant in the time by checking the history of the principal server.



The mirror commit overhead should always stay below 10ms and have an average of 3 or 4 ms.

If you see that your mirror commit overhead most of the time above 30 ms you may consider to upgrade the backup server.

This mirror commit overhead is often caused by disks bottlenecks on the backup server. (you verify this bottleneck by checking the “Average Write disk queue length” of the S drive in the performance monitor)

One way to solve this is to change the RAID configuration of the DATA drive from a RAID1 to a RAID10 or RAID5.

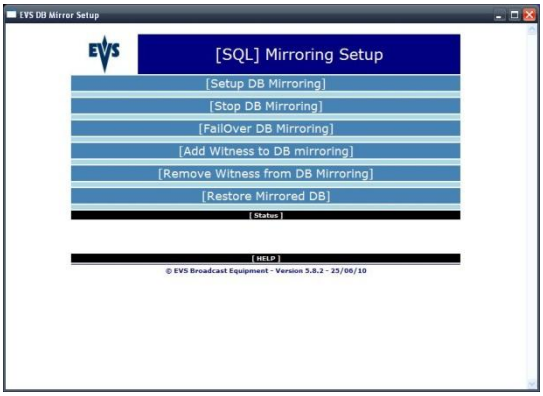
If you are experiencing this kind of issue contact the EVS support to check if an upgrade is possible.

EVS DB MIRRORING SETUP TOOL

The EVS-DB-Mirroring-Setup is a small HTA file (HTML Application).

It has been developed to easily perform administrative tasks related to DB mirroring on SQL Server 2005. The tool should be used locally on the SQL server.

The available administrative tasks are displayed in the following screenshot :



- [Setup DB Mirroring]
  Initiate database mirroring between two SQL 2005 servers and configure the witness workstation

- [Stop DB Mirroring]
  Stop Database mirroring

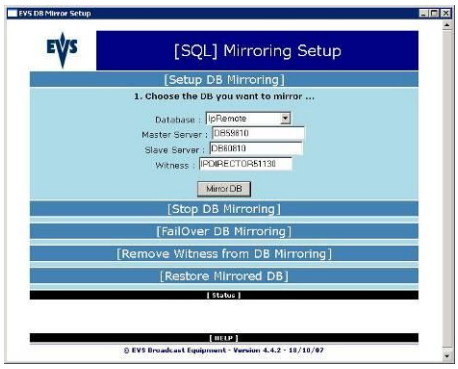
- [Failover DB Mirroring]
  Initiate a manual failover. Mirroring roles will be switched between the two SQL servers.

- [Add Witness to DB Mirroring]
  Configures a witness on a mirrored database and enables the automatic failover.

- [Remove Witness from DB Mirroring]
  Removes the witness in the current mirroring configuration and disable automatic failover.

- [Restore Mirrored DB]
  Restores a database locked by a mirroring process, from a backup file.

[SETUP DB MIRRORING]



- Click on [Setup DB Mirroring] to display the tool options
- Choose the database to mirror in the local database list
- Configure the first SQL Server name (typically local server name)
- Configure the second SQL Server name (mirror)
- Configure the Witness server name (SQL 2005 Express SP1 must be already installed)
- Click on “Mirror DB” to start the mirroring.

The tool executes the following steps :

- Check the DB recovery model and configure it to “Full”
- Create a DB Full backup on the principal server
- Create a transaction log backup on the principal server
- Restore the Full backup on the mirror server (with norecovery)
- Restore the Transaction Log backup on the mirror server (with norecovery)
- Create mirroring endpoints on principal, mirror and witness servers
- Start the mirroring process
- Add records to Hosts file on DB Servers and Witness

The witness field is not mandatory. If no witness is configured at this step, mirroring will be installed without automatic failover.

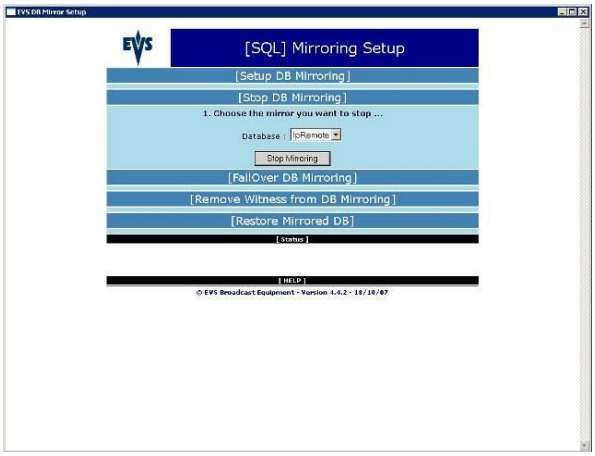
[STOP DB MIRRORING]

The HTA can also be used to stop the mirroring applied to a local database.

The tool will list the mirrored databases on your server.

You will be able to choose a mirrored database and click on “stop mirroring”.

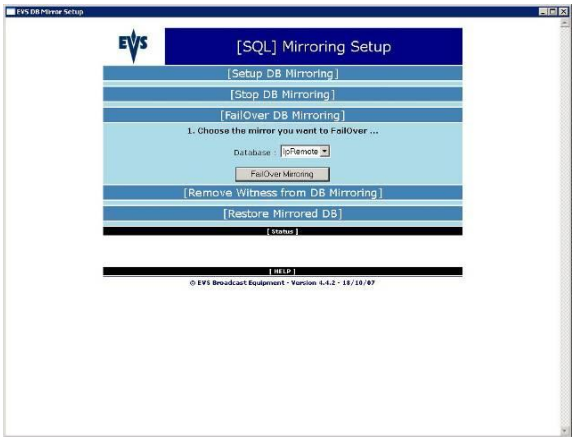
This action will definitely stop the data replication process and will remove the virtual IP managed by EVSDBIP



[FAILOVER DB MIRRORING]

This option can be used to manually switch the server roles.

The principal server will become the target of the mirroring (the mirror) and the mirror will become the principal server. EVSDBIP will then move the virtual IP address from the first server to the “new” principal server. The clients will be disconnected from the database during +/- 20 seconds.



If you click on “Failover Mirroring” you will be asked to confirm the operation.

[ADD WITNESS TO DB MIRRORING]

This option configures a witness on a mirrored database and enables the automatic failover.

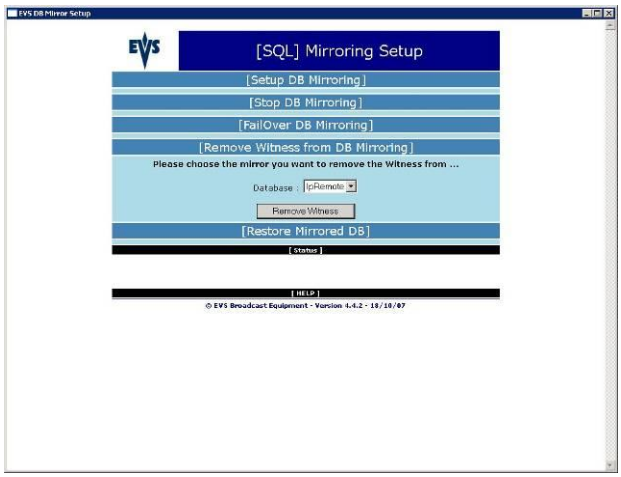
The witness instance must be already installed .

If a witness is already configured in the mirroring configuration, it will be overridden by the new configuration.

[REMOVE WITNESS FROM DB MIRRORING]

This option removes the witness configuration on the select mirrored DB.

This will disable automatic failover but the mirroring will persist (DB still replicated)



This option can be used in the following cases :

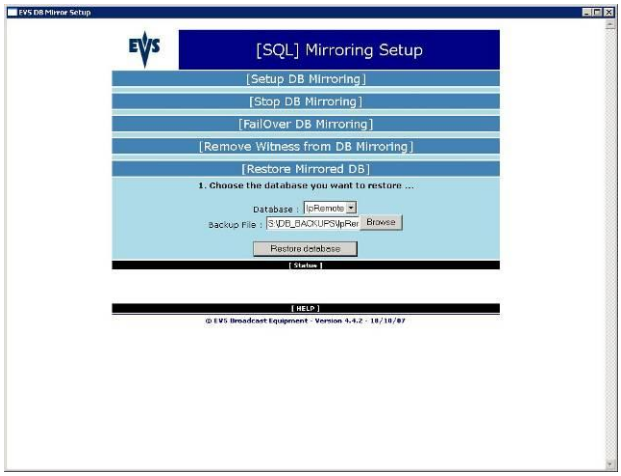
- You know that your Witness will be removed from the network and you have no other Witness to configure
- You know that your Witness and your backup DB server will be restarted at the same time but you want to keep your DB (and virtual IP) available on your main DB Server.
- You dismantle the IP Director network at the end of an event and you don't know if the mirroring will be used in the next event (typically for rental servers). It is recommended to remove the witness configuration to avoid database unavailability if you start just one DB Server (without the other and the witness).

[RESTORE A MIRRORED DB]

A mirrored database cannot be restored as a normal database. The mirroring must be first removed to be able to restore the database.

This part of the tool execute several actions to restore a mirrored DB :

- Stop mirroring off the configured database
- Take the first full database backup located in the configured backup file and restore it
- Check the DB recovery model and configure it to “Full”
- Create a DB Full backup on the principal server
- Create a transaction log backup on the principal server
- Restore the Full backup on the mirror server (with norecovery)
- Restore the Transaction Log backup on the mirror server (with norecovery)
- Create mirroring endpoints on principal, mirror and witness servers
- Restart the mirroring process



This operation can take a few minutes.

HOW TO INSTALL OR CHANGE THE WITNESS INSTANCE ?

The Witness instance is important to activate the SQL automatic failover capabilities.

If you have two database servers without any witness or if you want to change the witness server for performance or availability reason, we provide you two ways to configure the witness (Assisted or Manual).

You should find an SQL 2005 Express on each IP-Director 5 or 6
This SQL Express is ready to host the witness role without other setup.

If no SQL 2005 is installed on the computer you want to use as witness, you can perform one of the following procedures

INSTALL SQL EXPRESS ON THE WITNESS WITH THE IP DIRECTOR FULL INSTALLER (HTA INSTALL)

This is the easiest way to have a SQL 2005 express, ready to be used as witness.

- Retrieve the IP Director full installer from the IP Director release folder (HTA Install)
- Launch the HTA Install and choose “New install – install IP Director v6 on a new workstation”
- The HTA will install all prerequisites and SQL 2005 express with the needed configuration
- At the end of the installation, you can optionally uninstall the IP Director Remote Installer.
- Your workstation is now ready to be used as witness.

MANUALLY INSTALL AND CONFIGURE WITNESS INSTANCE

INSTALL SQL SERVER 2005 EXPRESS EDITION ON THE NEW WITNESS

First of all you have to ensure that your future Witness server runs SQL 2005.

If this version of SQL Server is not present on the computer, you can install it by launching SQLEXPR_ADV.EXE

This package can be downloaded from the Microsoft Website (http://msdn.microsoft.com/vstudio/express/sql/download/)

The witness instance can also easily be installed by launching the following batch file :

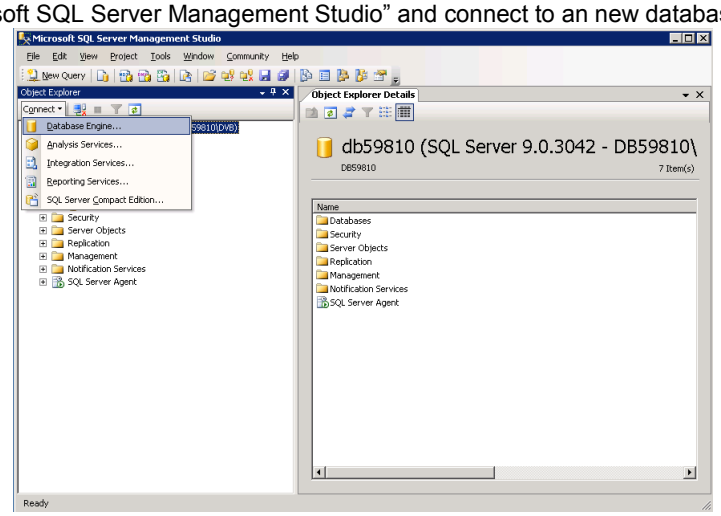
“*Install_Witness_SQL2005_Express_With_SP2.bat*” . This batch file starts a silent installation with all the needed configuration

CREATE THE DATABASE ON THE WITNESS

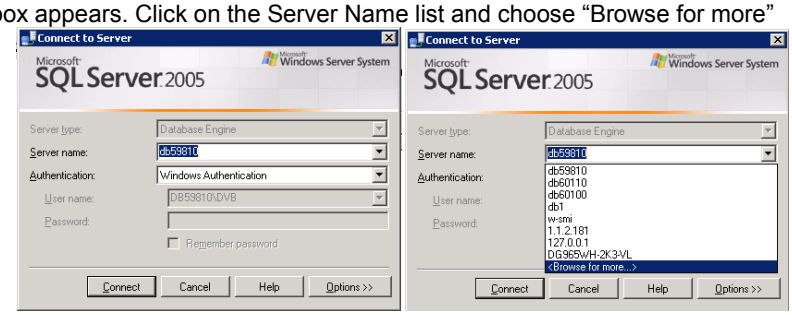
After the Witness installation, we must create a database on the witness instance with the mirrored database name.

The following screen shots will describe you the different steps to execute :

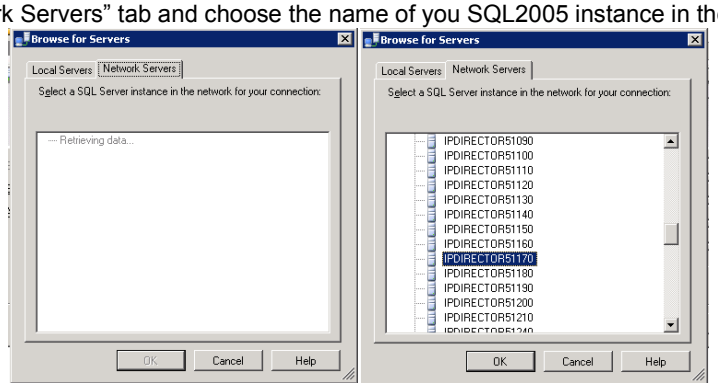
> - Launch The “Microsoft SQL Server Management Studio” and connect to an new database engine



> - The “Connect” box appears. Click on the Server Name list and choose “Browse for more”

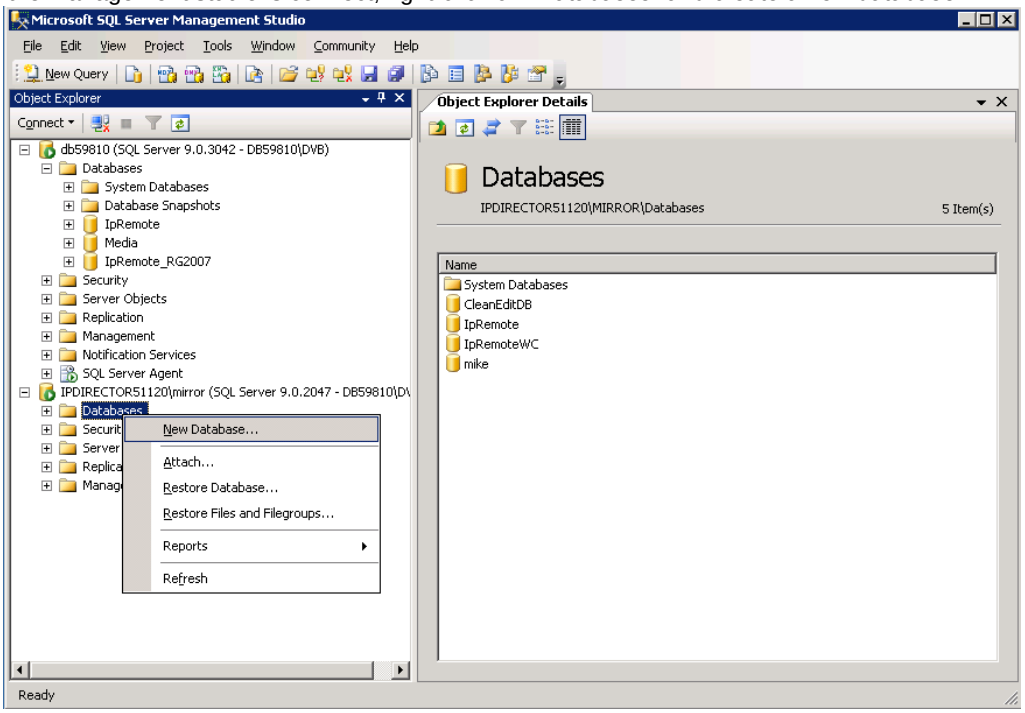


> - Click on the “Network Servers” tab and choose the name of you SQL2005 instance in the list.

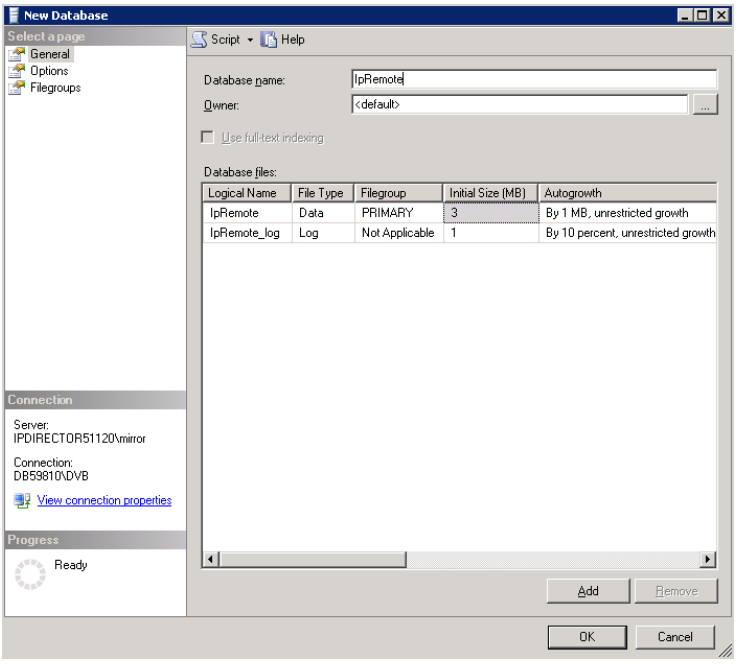


> - Click OK, Choose “Windows Authentication” as you authentication method and click “Connect”

> - When the Management studio is connect, right-click on “Databases” and create a new database

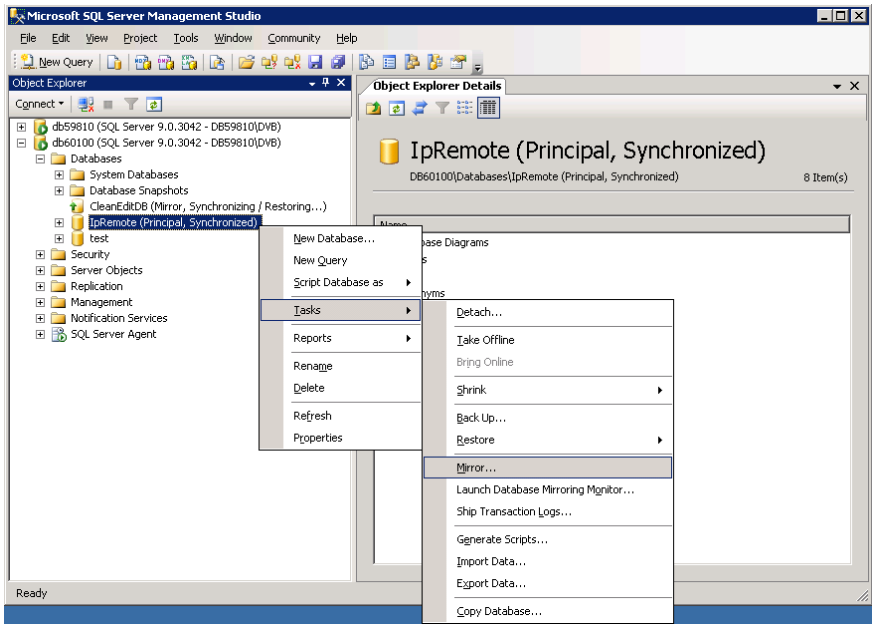


In the “New Database” screen, type your database name and click OK

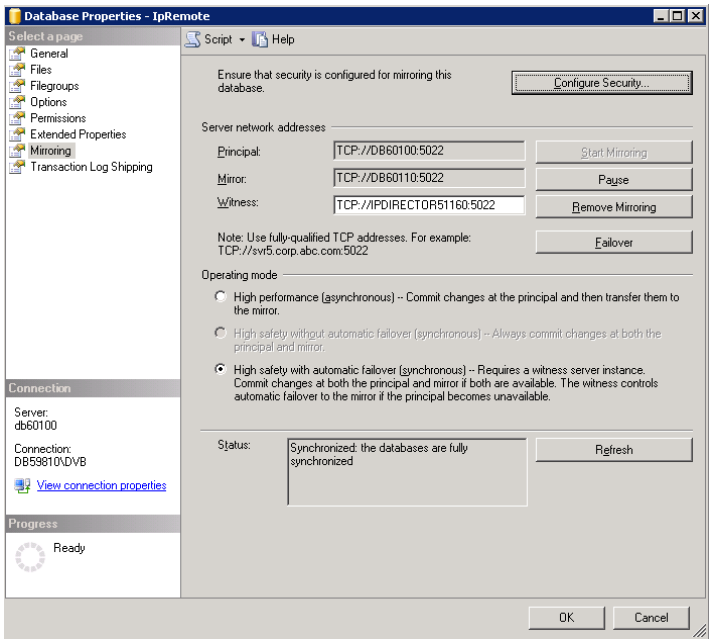


CONFIGURE THE NEW WITNESS SERVER IN THE MIRRORING CONFIG

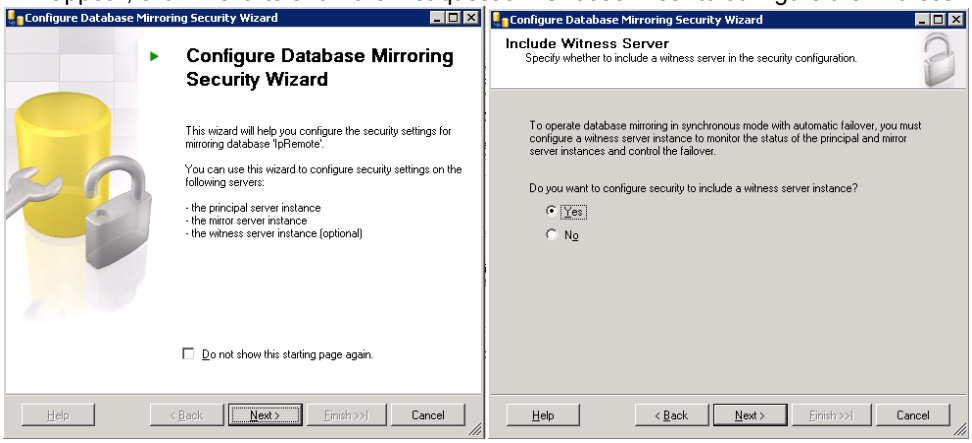
> Open the “Microsoft SQL Server Management Studio” and connect to the server where the database is principal.
> Right-Click on the database name and choose “Tasks” -> “Mirror…”



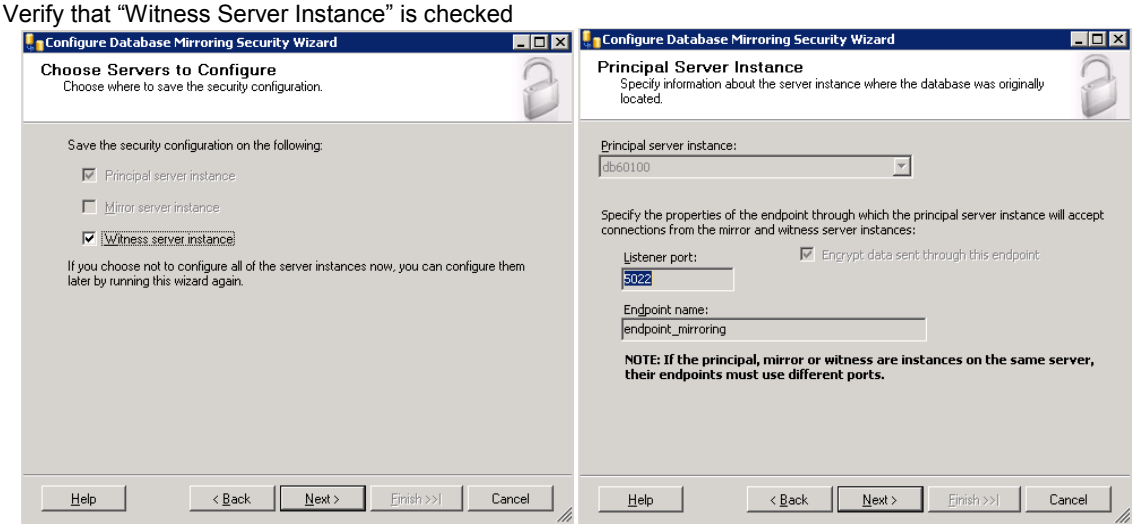
> - The actual mirroring configuration will be displayed. If you want to change the Witness, click on “Configure Security”



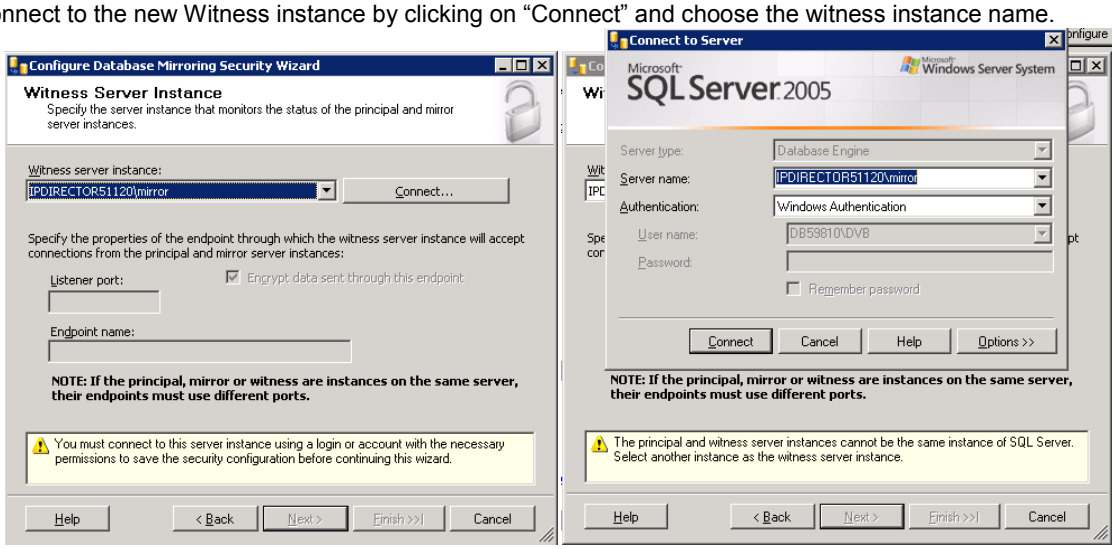
> - A wizard will appear, click “Next” to show the first question. Choose “Yes” to configure the Witness



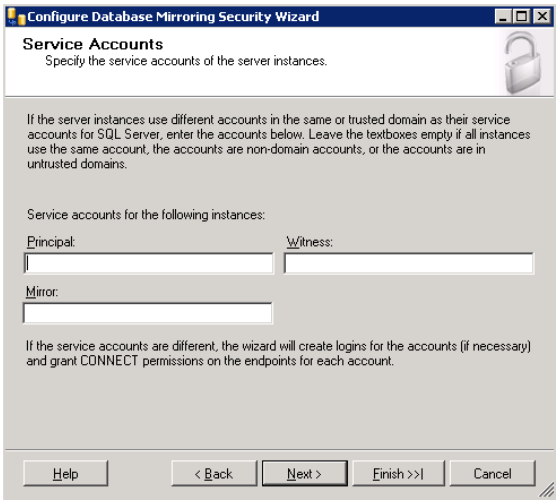
> - Verify that “Witness Server Instance” is checked

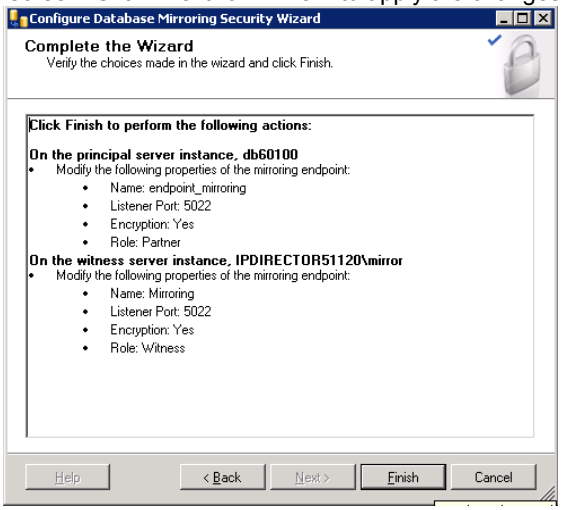


> Connect to the new Witness instance by clicking on “Connect” and choose the witness instance name.

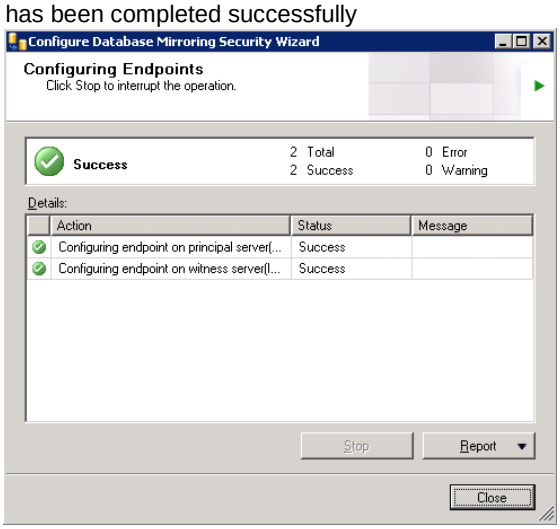


> - Nothing should be configured in the “Service Account” screen. Click “Next” or “Finish” to apply the changes





> - Verify that the configuration has been completed successfully



> - Click OK to validate your changes.