Protecting Microsoft SQL Server databases using IBM Spectrum Protect Plus

Version 1.0

Contents

Executive summary

Database administrators working extensively with Microsoft SQL Server are challenged when faced with mission-critical use cases such as backup, recovery, development and operations (DevOps), and business analytics. This is especially true given that their SQL Server databases have expanded in size and number over time, and that the databases need to be up and running 24x7x365.

This document focuses on protecting SQL databases using IBM® Spectrum® Protect Plus. IBM Spectrum Protect Plus provides features to quickly achieve application-consistent SQL database recovery and replication to validate and test backups.

Audience

The target audience for this document includes IBM Technical Specialists, Support Engineers and Certified Partners, engineers, and Microsoft SQL Server database administrators (DBAs).

The solution: IBM Spectrum Protect Plus

IBM Spectrum Protect Plus is a data-protection and availability solution for virtual environments and for applications on virtual and physical environments. IBM Spectrum Protect Plus can be implemented as a standalone solution or can integrate with your IBM Spectrum Protect environment to offload copies for long-term storage and governance with scale and efficiency.
IBM Spectrum Protect Plus can be deployed in minutes and can help protect your environment within an hour.

In the solution proposed, an IBM Spectrum Protect Plus server runs in the on-premises data center, performing virtual machine (VM) and application backups to a local or external vSnap repository. It can be powered by any storage in the backend. This solution allows enterprises to run backup, restore, cloning and instant-access tasks, while simultaneously replicating data to a disaster recovery (DR) location.

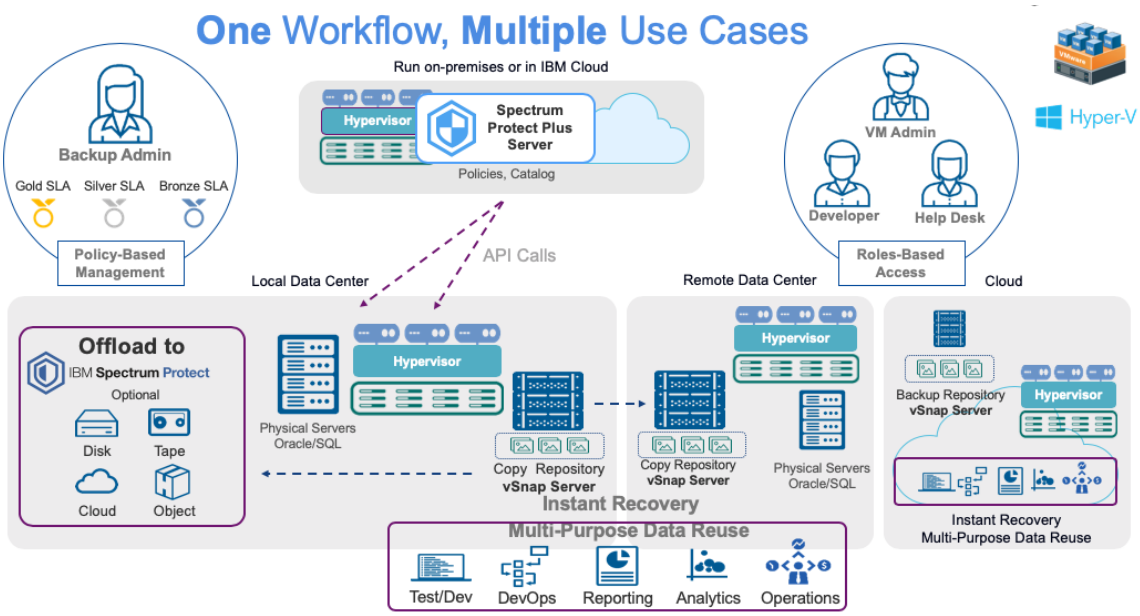

Figure 1 : IBM Spectrum Protect Plus overview

Microsoft SQL Server setup on Microsoft Windows

For the creation of this SQL Server environment, we used the following Microsoft software versions:

- Microsoft Windows Server 2012 R2
- Microsoft SQL Server 2012 (64-bit)

We created the SQL Server database on a separate IBM storage system volume or logical unit number (LUN), not on the system disk C:\, as shown in Figure 2. In production environments, you should consider separating data, log and temporary data onto different volumes or LUNs for optimal performance and security. If the data volumes have been lost, data can still be restored using the up-to-date logs that are stored on a separate volume or volumes.

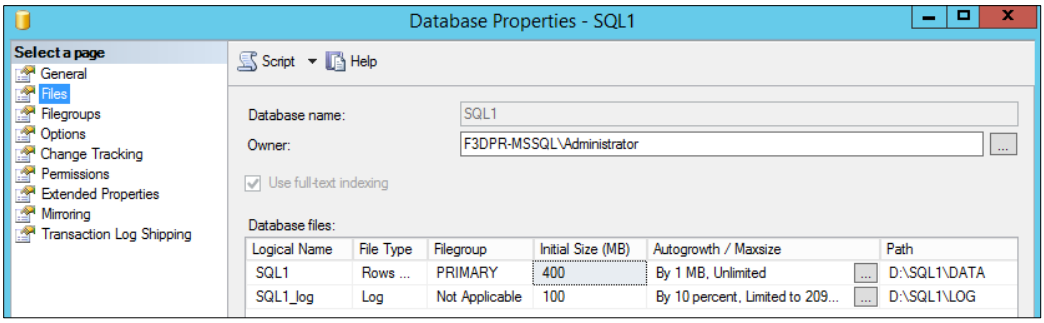

Figure 2: Database layout view of the Microsoft SQL Server Management Studio

IBM Spectrum Protect Plus requirements for SQL Server backup and restore

You must register a SQL Server database server in IBM Spectrum Protect Plus before you can create and execute backup and restore tasks. IBM Spectrum Protect Plus will then discover databases on the SQL Server database server if it fulfills the requirements below.

- IBM Spectrum Protect Plus supports the SQL Server database versions and the operating system releases mentioned in the system requirements section of the knowledge center.
- Windows Remote Shell (WinRM) must be enabled on the database server. A Microsoft technical note describes this task: https://support.microsoft.com/en-gb/help/555966
- The Microsoft iSCSI Initiator service must be enabled and running on the database server.
- The user that you configure to connect to the database server must have “Log on as a service” rights, which are assigned through Administrative Tools in the Control Panel. For more information, read this Microsoft article: https://technet.microsoft.com/en-us/library/cc794944.aspx
- Login credentials must have public and system administrator (sysadmin) permission enabled, plus permission to access cluster resources in a SQL Server AlwaysOn environment.
- To perform log backups, the SQL Server agent service user must be a local Windows administrator and must have sysadmin permissions enabled to manage SQL Server agent jobs.
- The hostname of the IBM Spectrum Protect Plus appliance must be resolvable from the SQL servers.

Please check the IBM Spectrum Protect Plus documentation for details. Note that the IBM Spectrum Protect Plus Installation and User’s Guide refers to a web page because system

requirements can change over time. For details about SQL Server environments supported by IBM Spectrum Protect Plus and requirements, please check this web page:
http://www-01.ibm.com/support/docview.wss?uid=swg22013790

Create SLA policies

In IBM Spectrum Protect Plus, service level agreement (SLA) policies define when and how often backup jobs will be run, and how long the backup data will be kept. Once IBM Spectrum Protect Plus knows the backup frequency and retention, it can schedule backup jobs on user-defined sites. In our environment, we have two defined sites, primary and secondary. IBM Spectrum Protect Plus comes with three predefined SLA policies—Gold, Silver and Bronze—but also allows administrators to create customized policies.

IBM Spectrum Protect Plus can reuse an SLA policy for multiple backup targets. For purposes of clarity only, we created multiple SLA policies for the backups of different data types. We modified the Bronze policy for the VM backup and created new policies for the SQL Server database backups.

Figure 3 shows a configuration example for the policy that we used for the SQL database backup.

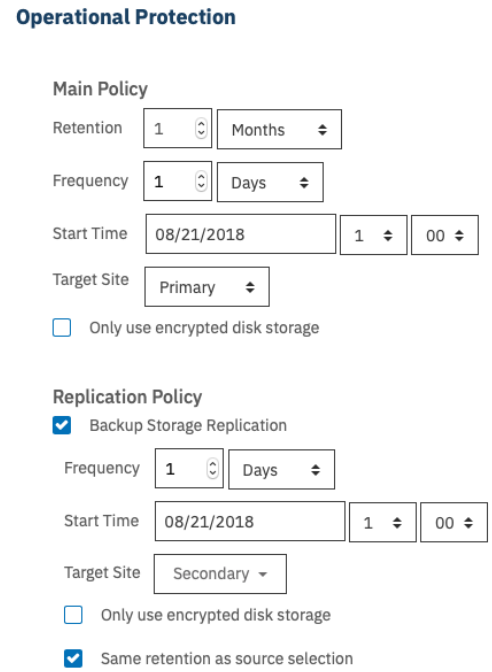

Figure 3: Configure or edit an SLA policy

Registration of VMs and databases

Resources that IBM Spectrum Protect Plus needs to recognize are registered through the IBM Spectrum Protect Plus user interface with a one-time operation performed when a backup job is defined.

Registration of VMware objects

Complete the following steps to register your VMware environment in IBM Spectrum Protect Plus:

1. Expand the Hypervisor menu, then expand the VMware menu and select **Backup**.

2. Press the “Manage vCenter” button and then the blue “+” sign.

3. Enter the vCenter properties, including an IP name or address, the administrator name, and a password, as shown in Figure 4.

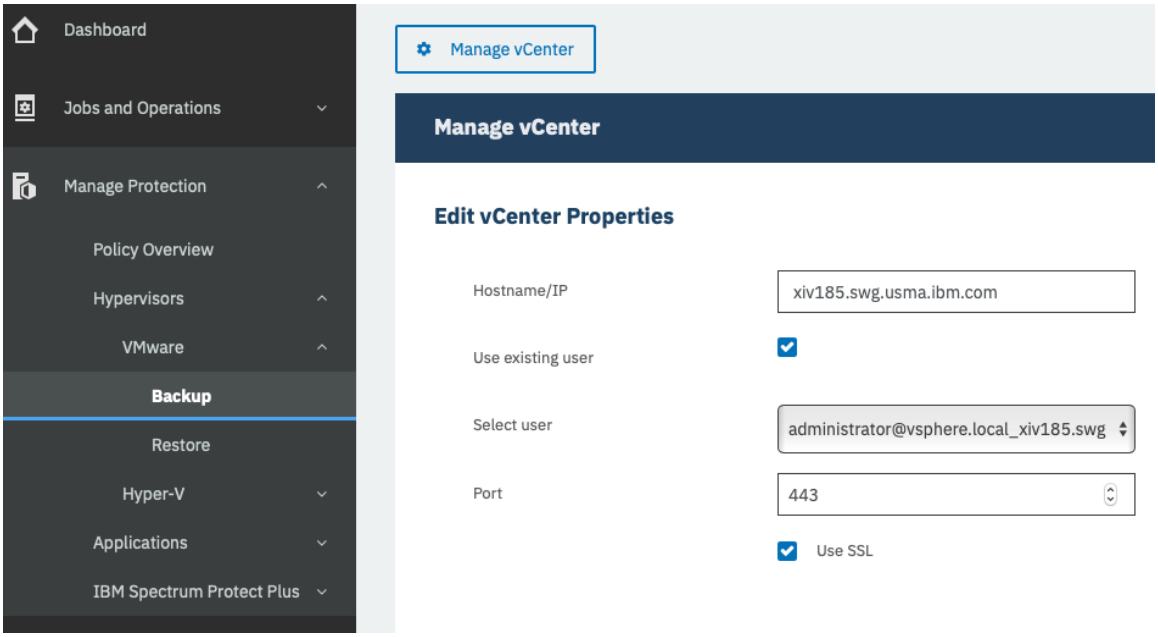

Figure 4: Register a vSphere environment in IBM Spectrum Protect Plus

4. Click the "Save" button. IBM Spectrum Protect Plus confirms a network connection and the access data and, if successful, catalogs the VMware environment as a "provider."

After successful registration, run an IBM Spectrum Protect Plus inventory job to discover VMware objects such as VMs and datastores or database instances on a database server.

Find your VMware environment in the list of providers, press the "Actions" button and select **Inventory** to discover VMware objects such as VMs and datastores.

IBM Spectrum Protect Plus automatically creates and maintains a Hypervisor Inventory job that is scheduled on a daily basis.

Registration of the SQL Server databases

Register the databases in IBM Spectrum Protect Plus in almost the same way as the VMware hypervisor:

Expand the Application menu and then the SQL menu. Select **Backup** and press the "Manage vCenter" button, followed by the blue "+" sign. Enter the access data for the database server.

Figure 5 shows the registration of a sample SQL database:

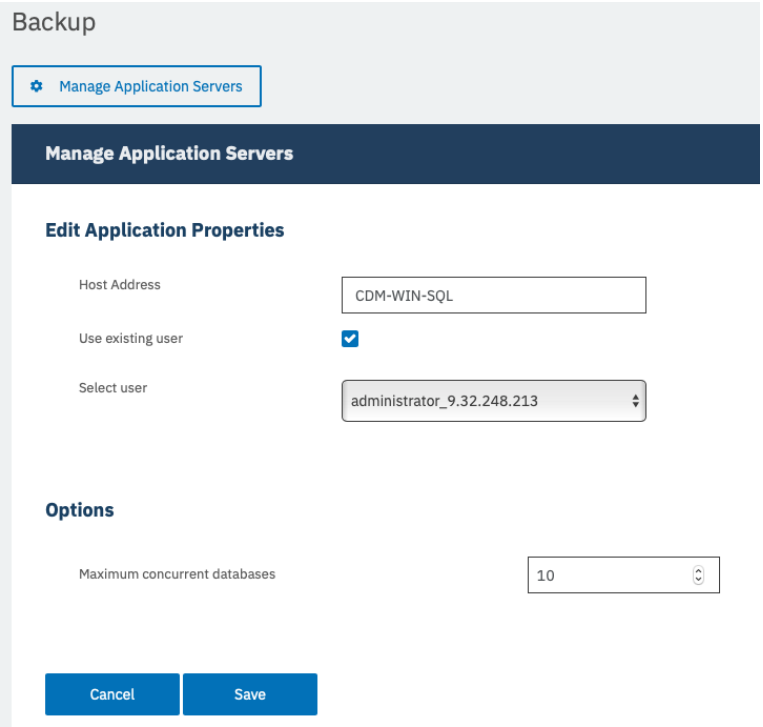

Figure 5: SQL database server registration in IBM Spectrum Protect Plus

The maximum number of databases that can be backed up simultaneously on a registered server can be set with the "maximum concurrent databases" option. This value will affect the performance of the database backup job.

For AlwaysOn Availability Groups, every node must be registered in IBM Spectrum Protect Plus. After a successful registration, run an IBM Spectrum Protect Plus inventory job to discover the database instances on the database server. For AlwaysOn Availability Group environments, the inventory job will discover all the Availability Groups and all the databases under the Availability Groups.

Perform VM and database backups

To perform a backup with IBM Spectrum Protect Plus, you must assign an SLA policy to target objects, such as a VM or application to be backed up.

The product supports SQL Standalone/Cluster Failover and AlwaysOn scenarios, and you filter them by clicking on the view from the SQL backup section.

Figure 6: Standalone/Failover and AlwaysOn view

SQL Standalone and Failover Cluster backup

Select the Hypervisor or Application menu and navigate to the Backup menu. Select the VM or database to back up and then press **Select SLA Policy**. Figure 7 shows an example for an SQL database named "SPP_demo_database."

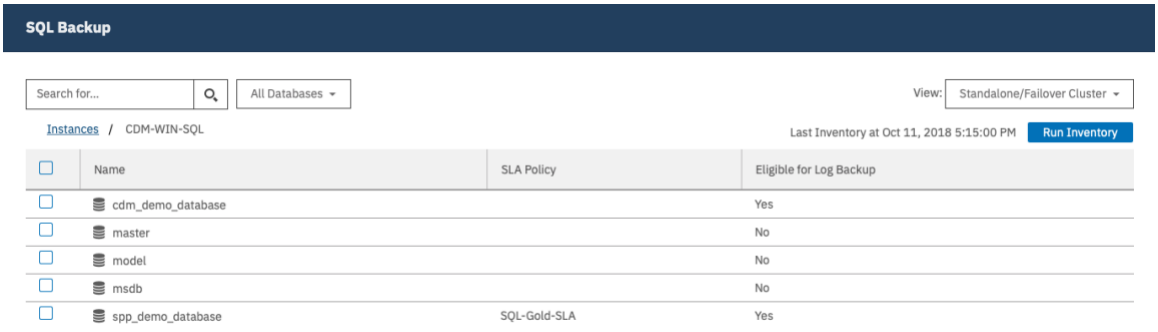

Figure 7: SLA policy assignment

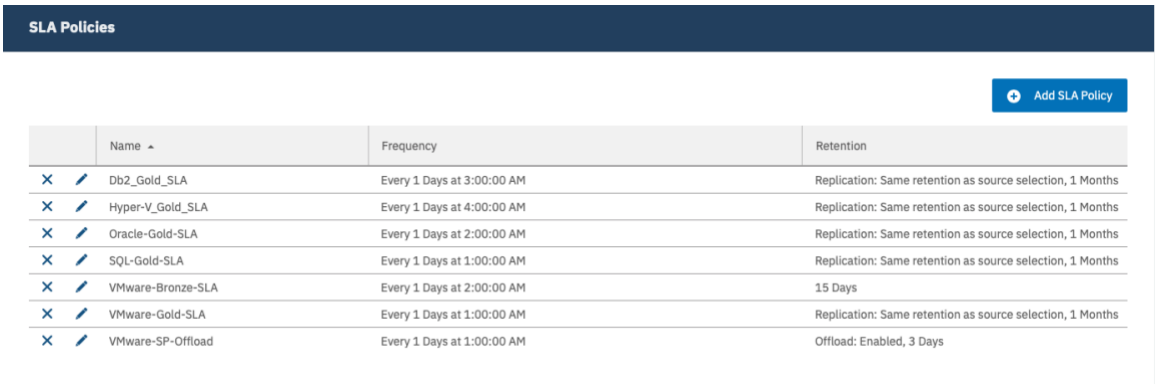

Figure 8: SLA policies overview

After an SLA policy has been assigned, IBM Spectrum Protect Plus will schedule the backup as defined in the policy. In addition, you can always initiate a backup manually. Then click the "Actions" button and select **Start**.

SQL AlwaysOn Availability Groups backups

From the SQL application window, change the view from "Standalone/Failover Cluster" to "Always ON." This will list all the Availability Groups in the SQL environment. In Figure 9, the Availability Group is named "LABAAG14" and the database is named "DB-14."

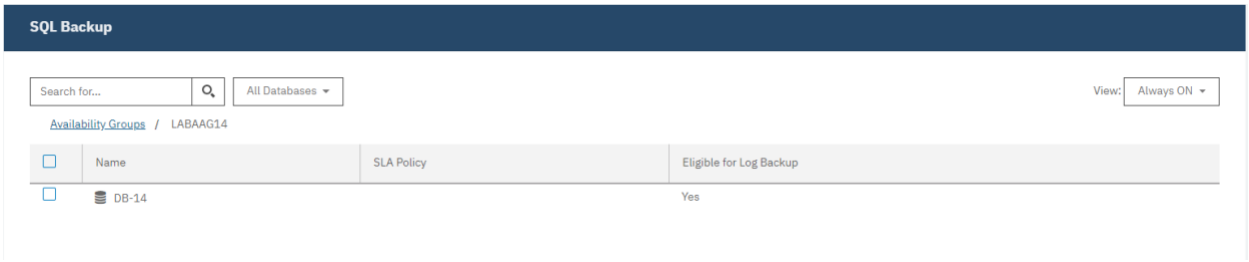

Figure 9: SQL AlwaysOn Availability Groups database selection

SQL incremental backup requirements and limitations

IBM Spectrum Protect Plus uses update sequence number (USN) change journal technology to perform incremental backups in an SQL environment. The USN change journal provides write range tracking for a volume when the file size is increased to a specific threshold. The changed bytes offset and length extent information can be queried against a specific file.

The following requirements enable write range tracking:

- Windows 2012 R2 or later
- New Technology File System (NTFS) version 3.0 or later
- Cluster Shared Volumes File System (CSVFS) support
- The following technologies are not supported for changed bytes tracking:
- Resilient File System (ReFS)
- Server Message Block (SMB) 3.0 protocol
- SMB Transparent Failover (TFO)

Backup options

SQL log backup

When selecting the database backup, IBM Spectrum Protect Plus has the ability to back up the logs associated with the databases. Just select options from the backup job configuration and select “Enable Log Backup.” Then IBM Spectrum Protect Plus automatically truncates post-log backups of databases that it backs up. If database logs are not backed up, these logs are not truncated and must be managed separately.

Figure 10: Backup options

You may specify the value of the maximum number of parallel streams per data by selecting that number in the “Options” section. Multiple parallel streams might improve backup speed, but high bandwidth consumption might affect overall system performance.

Behind the scenes, IBM Spectrum Protect Plus uses the Windows task scheduler to manage log backups. Log backup jobs are configured at a database level, as before the actual log backup is done via calling IBM Spectrum Protect Plus SQL. The log backup schedule is independent of backups defined in SLAs (such as database backups) and is configured during SLA backup. Moreover, previous log backup history is reported in the SLA backup.

Below is the log backup workflow of IBM Spectrum Protect Plus:

- Collects the cluster/AlwaysOn Availability Group information if necessary, to provide the necessary input parameters for the log backup.
- Checks the database recovery mode; if neither the full recovery mode nor bulk logged recovery mode is selected, skips the database for log backup configuration.

- For non-AlwaysOn databases (AlwaysOn databases require full database backup before adding to the group), IBM Spectrum Protect Plus will check the prior backup history; if no full backup is present, it will take a snapshot backup.
- Checks if the log backup job, task or policy exists. If they do not exist, it will check whether the schedule exists or not. If the schedule does not exist, it will create a new schedule.
- The new schedule will be created with the job, task and policy that will invoke the SQL agent.
- Configures the owner/run as user to be the IBM Spectrum Protect Plus registered user with SQL sysadmin permission and local administrator permission.
- Checks log backup history.
- Saves log backup metadata.

Note: SQL Failover Cluster Instance (FCI) configures log backup jobs on all the cluster nodes. The log backup is created on the active node only.

Perform a database restore with restore type "Test"

IBM Spectrum Protect Plus supports the allocation of the database backup for test purposes without restoring it. This function allows a database administrator, developer or user to evaluate the database contents without delay.

In this solution document, we demonstrate how to reuse the data of an SQL backup. Check the *IBM Spectrum Protect Plus Installation and User's Guide* for a detailed description.

To perform a test restore of an SQL database with IBM Spectrum Protect Plus, select the "Application" menu and navigate to the "Restore" menu. Select the database to restore and then click the blue button to the right of the database name. You can also click on the database name, and IBM Spectrum Protect Plus will show a list of available backups with different timestamps. In either case, the selected database backup shows up on the right of the screen. To remove the backup item you have selected, click the red button next to it. Figure 11 shows an example of an SQL database restore from the secondary site.

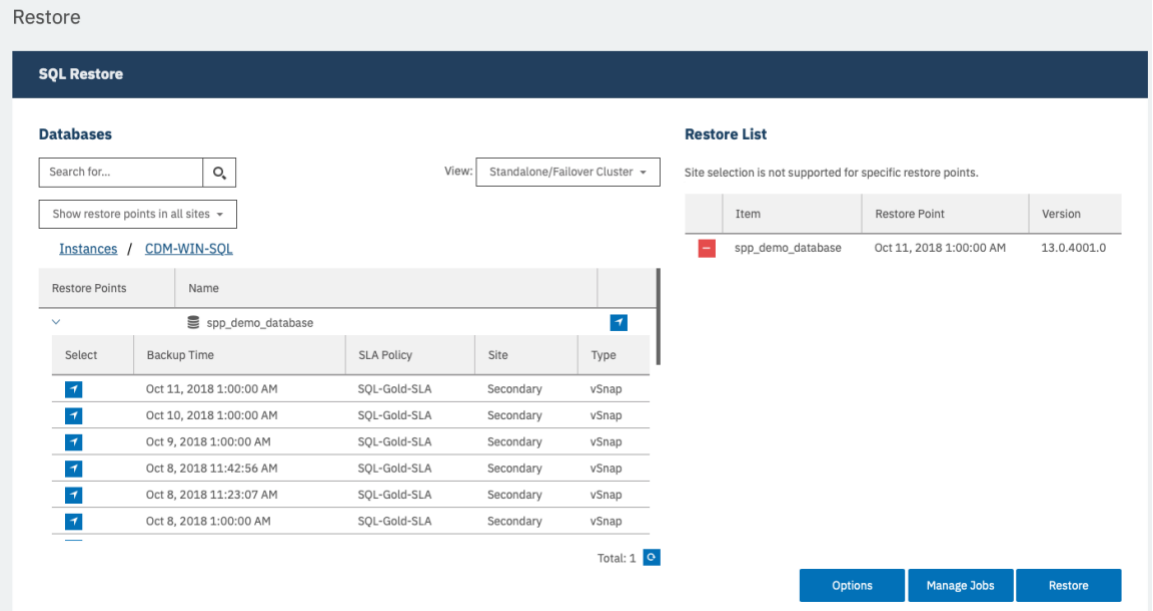

Figure 11: Select the database and the database backup to restore

To configure your test restore operation, click the “Options” button and make the changes as below and as shown in Figure 12 and Figure 13:

- An existing SQL database server, which in our example is located at the secondary site
- You can rename the restored database (optional).
- Set Restore Type to “Test.”

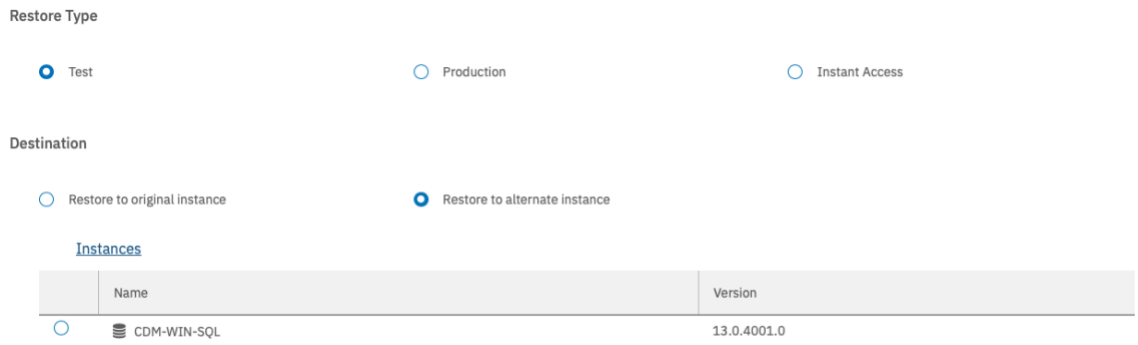

Figure 12: Restoring a database to an alternate host

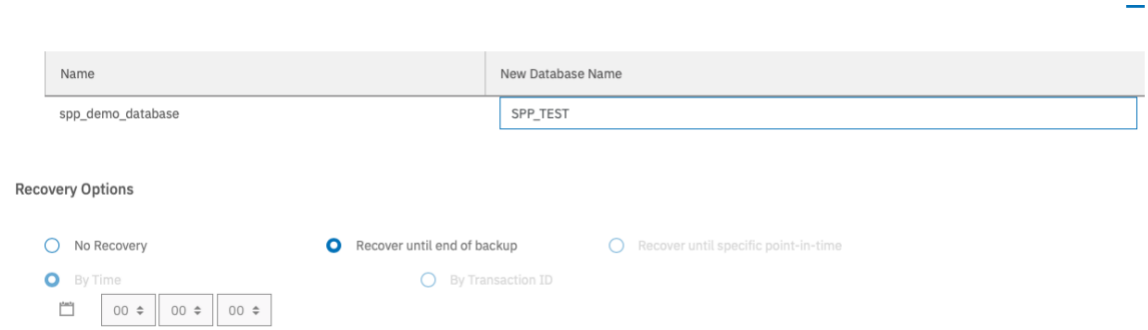

Figure 13: Entering a new database name

Restore type

IBM Spectrum Protect Plus offers three types of database restore. Understand all the restore types and select the most suitable one for your scenario:

Test: During a test restore, IBM Spectrum Protect Plus does not restore the original database, but rather creates a clone of the database backup and mounts it using the vSnap server.

Production: In production mode, the agent first restores the files from the vSnap volume back to primary storage and then spins up the new database using the restored files.

Instant Access: In Instant Access mode, no further action is taken after mounting the share. Users can complete any custom recovery using the files in the vSnap volume. An Instant Access restore of an AlwaysOn database is restored to the local destination instance.

Recovery options

IBM Spectrum Protect Plus offers three types of SQL database recovery operations. Understand all the SQL recovery options and select the most suitable one for your scenario:

No Recovery: Sets the selected database to a RESTORING state. If you are managing transaction log backups without using IBM Spectrum Protect Plus, you can manually restore log files and add the database to an Availability Group, assuming that the LSN of the secondary and primary database copies meets the criteria. The No Recovery option does not support production-mode restores to SQL AlwaysOn groups.

Recover until end of backup: Restore the selected database to the state at the time the backup was created.

Recover until specific point-in-time: When log backup is enabled through a SQL backup job definition, point-in-time restore options will be available when creating a SQL restore job definition.

Application options and consideration

The maximum parallel streams per database applies to each database in the job definition. This option sets the number of parallel streams for a single database. A single database can be broken up into multiple streams of data. This option sets the maximum number of streams.

Figure 14: Database streams option

This maximum parallel streams per database option and the maximum concurrent database option from the SQL management section will determine backup performance. The maximum concurrent database specifies the maximum number of databases that can be backed up in parallel on a single database server.

Figure 15: Maximum concurrent database option on a single server

A single backup job can have multiple database servers and each database can have multiple parallel streams. All these options have to be taken into account to determine overall system performance.

Perform a database restore to original destination

IBM Spectrum Protect Plus can restore your database backup to the original destination, which is often the production environment ("production restore"). Start the restore process as described in the previous section (1.15), but this time select "Restore to original instance" and restore type "production."

Note that if the database still exists, you must open **Options** and confirm that "Overwrite existing databases" is checked.

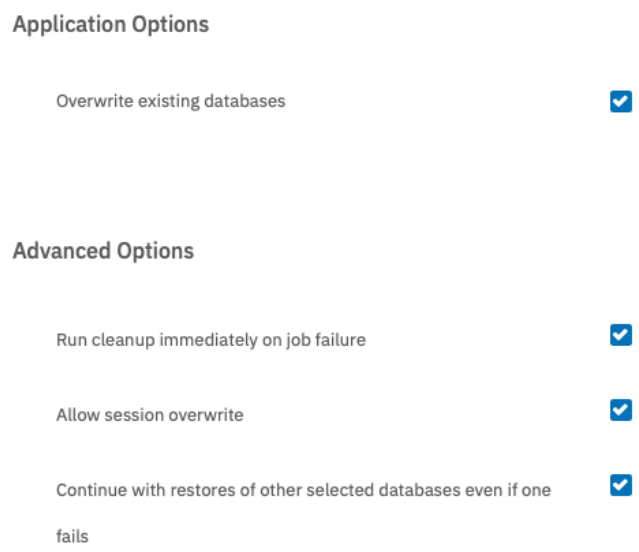

Figure 16: Database restore: Overwrite existing databases

SQL AlwaysOn Availability Group restore

For SQL AlwaysOn Availability Groups, test restores will only restore a single instance of the database. It will not restore the Availability Group. To restore the Availability Groups together, you must run a production restore.

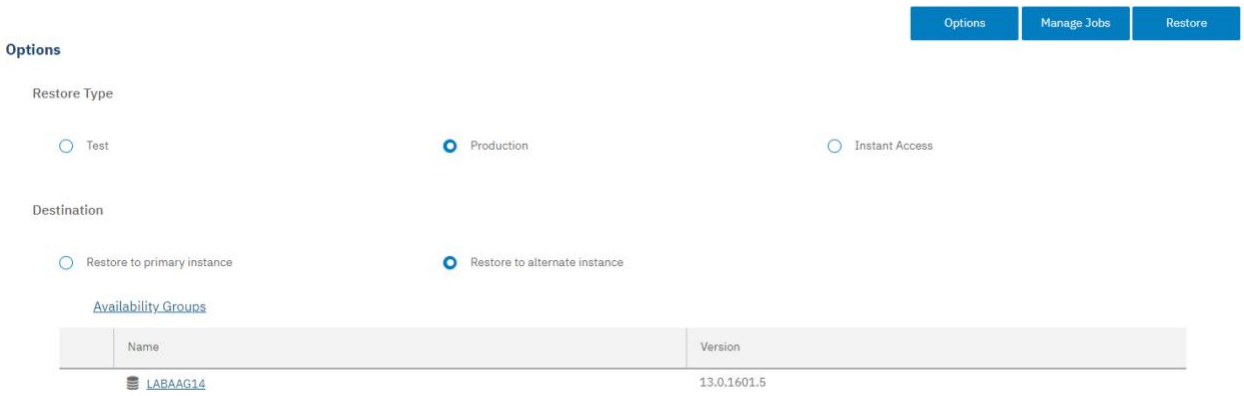

Figure 17: SQL AlwaysOn Availability Group Production Restore: Availability Groups

Conclusion

In this white paper, we have demonstrated how to protect SQL Server databases using IBM Spectrum Protect Plus and have covered some best practices.

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