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Dell EMC DD Boost for Microsoft Applications (Application Direct) - SQL Protection

Abstract

This white paper focuses on how the integration of Dell EMC™ DD Boost for Microsoft® Applications (Application Direct) and SQL creates a superior backup solution for SQL environments.

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Revisions

Date	Description
September 2019	Initial release and updated for 19.1 version release
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May 2021	Updated for 19.8 version release

Acknowledgments

Author: Vinod Kumar Kumaresan

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Executive summary

Challenges for Database Administrators (DBAs)

The data protection landscape is changing, application owners, such as DBA's meeting the backup window is becoming a problem due to explosion of data that needs to be protected, Businesses must meet strict Service Level Agreements (SLAs) for backup and recovery – often referred to as Recovery Point Objectives (RPO) and Recovery Time Objective (RTO). To meet these challenges, SQL DBAs are often forced to find solutions outside the normal backup and recovery solution. In the context of data protection, Lets focus on the solution provided by Dell EMC to transform operations to a modern management approach.

Solution: Application Direct for SQL

Dell EMC PowerProtect DD series appliance is a multiprotocol purpose built backup appliance that provides CIFS/NFS, VTL, NDMP, mainframe, IBM-I, Application Direct with and Cloud Tiering protocol capabilities. PowerProtect DD series appliance being cloud enabled, with native tiering of deduped data to public, private, or hybrid clouds for long-term retention and secure multitenancy capabilities that enable enterprises and service providers to deliver DD series in a private/public cloud. In the past SQL DBAs were being asked to rely on IT for backup and recovery using backup application.

The combination of Application Direct with DD series yields impressive efficiency for backup and replication, capitalizing on DD series ability to reduce storage requirements and address the breadth of today's data protection challenges. Client-side deduplication enabled by Application Direct speeds backups by 50% and reduces bandwidth requirements up to 98%. Where, environments can scale higher, backup and restore faster, and reduce the load on the server during backup.

The new wave modern management is designed for self-service to empower application owners too backup directly from the application data source to protection storage. This model is popular because it provides control directly in the hands of data owners.

Application Direct networking features for link failover, aggregation, and load balancing provide optimal network utilization while ensuring that backup jobs complete. Application Direct gives application owners direct control of backup to DD series using Microsoft SQL Server Management Studio (SSMS). By giving application owners control of the recovery process through native utilities, they do not need to go through backup admins and so achieve faster recovery.

Audience

This white paper is intended for SQL database administrators, systems engineers, partners, and members of the Dell EMC and Partner Professional Services community who are looking for more control of their applications, faster and more efficient backups, and flexible data protection solutions.

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1   Introduction

The purpose of this white paper is to discuss how the Application Direct for SQL Server Software provides a unique and a powerful integration between SQL database backup and DD series. The goal of Application Direct for SQL Server Software is to better serve database administrators by empowering them with the tools that provide them with superior data protection.

1.1   SQL Backup and Recovery

Microsoft SQL Server is a business-critical application requiring a reliable and customizable data protection infrastructure. To create backup copies of Microsoft SQL data, the DBA leverages the SSMS application, Often SQL administrators use the following methods to backup data:

- Customized backup processes within SSMS
- Scheduled backup operations created by the backup administrator in a backup application

1.1.1   SQL Backup Methods

Microsoft App Agent for SQL Server backups can be performed on both SQL stand-alone and cluster environments using the below methods to backup all the databases or only the required database of a SQL Server instance.

- Using SSMS to perform the Microsoft App Agent for SQL Server backups
- Using CLI to perform the Microsoft App Agent for SQL Server backups
- Using T-SQL script to perform the Microsoft App Agent for SQL Server backups

1.1.2   SQL Recovery Models

There are three different recovery models of SQL Server, The three SQL Server recovery models: simple, full, and bulk-logged.

Simple Recovery Model

Enables to recover the database to the point of the last backup. However, database cannot be restored to the point of failure or to a specific point-in-time.

Full Recovery Model

Enables to recover the database to a specific point-in-time. However, restore can be done from backups that are complete up to the point-in-time that is selected.

Bulk-logged Recovery Model

The bulk-logged recovery model is a special-purpose model that works in a similar manner to the full recovery model. The only difference is in the way it handles bulk data modification operations. The bulk-logged model records these operations in the transaction log using a technique known as minimal logging. This saves significantly on processing time but prevents using the point-in-time restore option.

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1.2　DD Series Deduplication Storage System
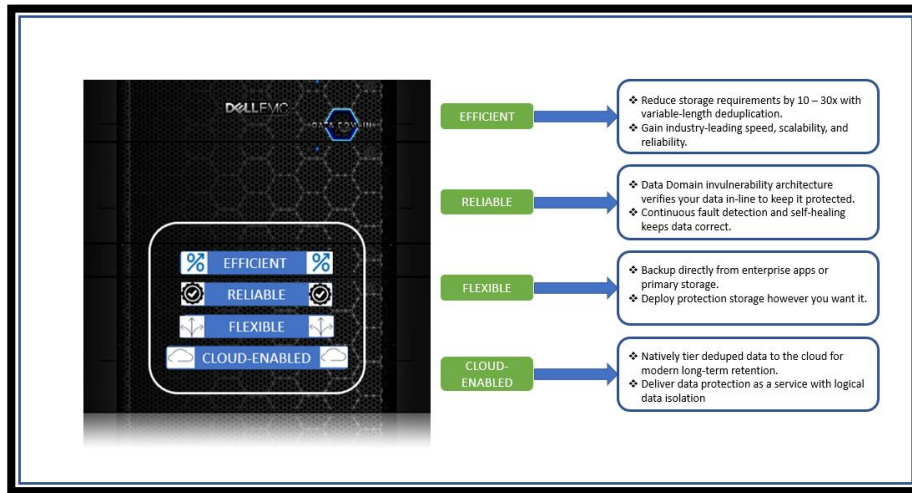
- DD series appliance originated as the groundbreaking purpose-built backup appliance – or PBBA - revolutionizing data protection for thousands of users by dramatically reducing storage requirements and enabling efficient Disaster Recovery (DR) with deduplication
- Modern DD series systems and the DD OS powered portfolio of solution delivers the most trusted protection storage in the market. With unmatched efficiency brought about through Dell EMC's industry-leading deduplication, scalability, reliability, and performance
- Protection storage from Dell EMC is flexible, with the ability to backup directly from enterprise apps or primary storage. DD series is available How You Want It depending upon the environment demands. DD series is cloud enabled, with native tiering of deduped data to public, private, or hybrid clouds for long-term retention and secure multitenancy capabilities that enable enterprises and service providers to deliver DD series in a private/public cloud
- Hardware assisted compression in DDOS 7.0 offloads CPU workload with GZFAST compression providing 30% more logical capacity comparing with previous versions. This feature is enabled by default on all DD6900/DD9400/DD9900 systems

DD series Data Invulnerability Architecture (DIA) lays out the industry's best defense against data integrity issues by providing unprecedented levels of data protection, data verification, and self-healing capabilities that are unavailable in conventional disk or tape systems.
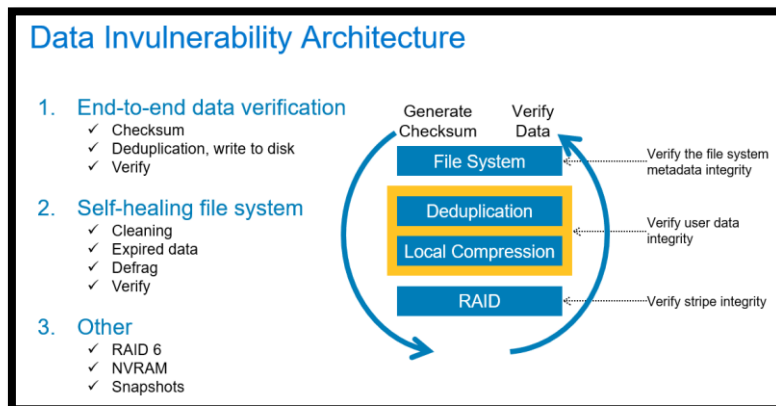
1.3　Overview of Application Direct with SQL Server backups

The Microsoft App Agent for Application Direct with SQL Server module integrates with the SQL Virtual Device Interface (VDI). The interface enables the user to configure the module by using a Plug-in in SSMS. The Plug-in is similar to the SQL native backup and restore Graphical User Interface (UI). DBAs can use the Microsoft native tools to backup and restore the SQL data.

Application Direct backups to a DD series system use the following components

- **The Application Direct library API** enables the backup software to communicate with DD series system
- **The Distributed Segment Processing (DSP) component** reviews the data that is already stored on the DD series system and sends only unique data for storage. The DSP component enables the backup data to be deduplicated on the database or application host to reduce the amount of data transferred over the network

1.3.1　Architecture - Microsoft App Agent for Application Direct with SQL Server

Application Direct important components for SQL Server
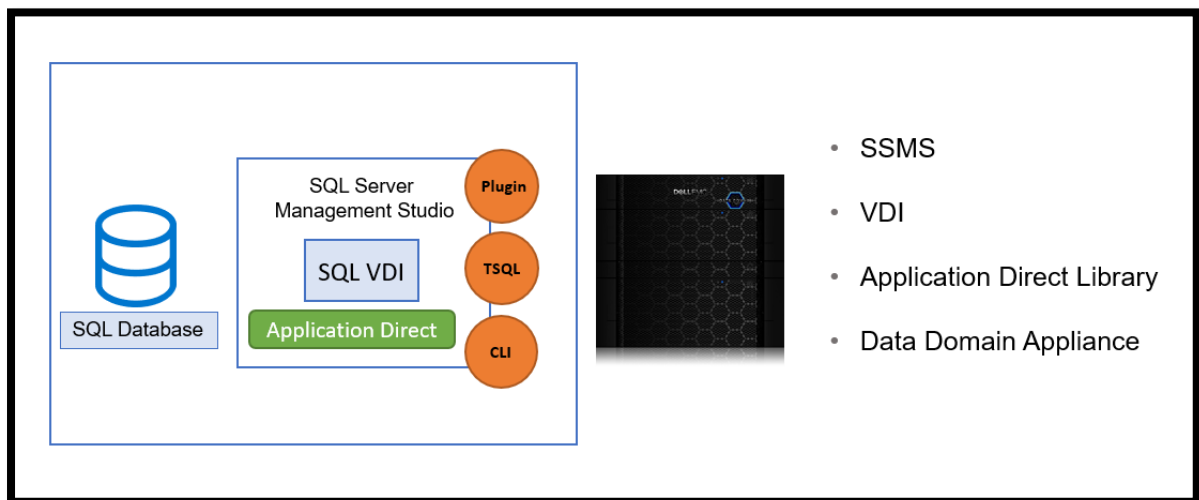
SSMS plug-in: The Microsoft App Agent for Application Direct with SQL Server has an SSMS plug-in UI. The plug-in is similar to the SQL native backup and restore UI.

Virtual Device Interface: The Microsoft App Agent for Application Direct with SQL Server uses a VDI, which is an API provided by SQL Server, to integrate with the SQL Server and enables the Application Direct with Microsoft App Agent to backup and restore SQL Server data.

Application Direct library: Performs source-based deduplication and sends the backup data to the DD series.

SQL-CLR Assembly: CLR and T-SQL scripts must be integrated to create functions or procedures to perform backups and restores in a SQL environment. The Microsoft App Agent installation deploys the CLR assembly. The CLR assembly contains one exportable SQL function type routine to run any Microsoft App Agent command at the command prompt.

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1.3.2   Lockbox Configuration:

The lockbox is an encrypted file that the Microsoft App Agent uses to store confidential data, such as login credentials, and protect that data from unauthorized access.

Registering a DD series to a new lockbox creates the PersistedSettings.xml file in the lockbox folder. Registering a server to or removing a server from the lockbox updates the PersistedSettings.xml file.

The PersistedSettings.xml file contains the DD series information, such as the server name, communication protocol, FC service name, username of the DD Boost user, and storage unit.

Recommendations for lockbox configuration: For a DD series system, one of the following lockbox types can be configured according to the environmental requirements.

Single Lockbox	Shared Lockbox	Multiple lockboxes
In a stand-alone environment, create a single lockbox on the host.	In an environment with multiple instances, a single lockbox can be configured in a shared location and grant each remote host individual access to the lockbox. Note: Do not use a single shared lockbox to perform remote backup operations in a cluster environment. The backup will fail. Use multiple lockboxes in a cluster environment.	In an environment with multiple instances, lockbox can be configured on each instance in the environment.

Lockbox operations are administered using the msagentadmin administration command.

Note: The user running the lockbox operations must be an administrator. When the PowerProtect Data Manager centrally manages the SQL host, the PowerProtect Data Manager automatically performs the lockbox configuration when the PowerProtect protection policy is created and configured.

Kindly see - PowerProtect Microsoft Application Agent SQL Server User Guide which describes the commands for creating, registering, and managing the lockbox.

1.3.3   Features and capabilities of Microsoft App Agent for Application Direct with SQL Server

Backup and recovery features:

- Federated backups and restores of Always On availability group (AAG) databases
- Instance-level backups and restores
- Multiple database backups and restores
- Scheduled backups with SQL Agent Jobs
- Transact-SQL (T-SQL) scripting with improved return codes to perform backups and restores in a SQL environment
- Table restores, which are also known as granular level restores, with ItemPoint for SQL Server
- Flat file restores and restores at file group level
- Redirected restore to the same or a different SQL Server, same or a different SQL instance, and same or a different database
- Support for the backup and recovery of a Domain-Independent SQL Always On availability group
- Support for the backup and recovery of a clusterless Always On availability group
- Support for using a copy-only full backup as the basis for a transaction log backup

- Support for the point-in-time restore of an active filegroup
- Enhanced SQL instant access mount time management
- SQL Server 2019 - support for backup and restore operations with SQL Server 2019 on the application host
- Starting with version 19.5, the stripe level of a backup at the individual database level can be modified
- **Support for cloud-based operations on AWS, Azure, and GCP -** The Microsoft application agent 19.8 introduced support for cloud-based operations on Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform (GCP). This operational support provides protection for all cloud-based data and includes support for the on-premises functionality. Please see PowerProtect Microsoft Application Agent SQL Server User Guide for details on how to configure the Microsoft application agent to use the Data Domain cloud tier for the movement of backup data to the cloud and the recall of the backup data from the cloud.

DD series Cloud Tier features:

- Marking save sets to move from a DD series active tier to a DD series Cloud Tier
- Manually recalling save sets from a DD series Cloud Tier to a DD series storage unit
- Automatically recalling save sets from a DD series Cloud Tier to a DD series storage unit or restoring backups directly from the cloud
- Deleting save sets on a DD series Cloud Tier

Note: Direct restore operations are only available for DDOS 6.1 using Elastic Cloud Storage.

Environmental support:

- IPv4 and IPv6 support
- Coexistence with other backup products that protect data that the Microsoft App Agent does not protect However, the Microsoft App Agent cannot co-exist with the database application agent
- Common lockbox path, that is, the same lockbox in a common location for the Microsoft App Agent, the database application agent, and the file system agent
- Supports DD series High Availability for improved resiliency

User interface:

- Displaying the Windows cluster name and the backup preference in the Connections panel in the UI, in the case of Always On availability groups.
- Displaying a message in the Database Restore UI to enable the instant file initialization feature on SQL Server for a better performance of database restores, if the feature is not enabled.
- Caching data related to SQL Server, SQL Server instances, databases, and other settings on the General, Files, and Options pages whenever the application agent starts. The application agent also caches the save set information during a particular session.
- Retrieving a particular number of save sets or backup versions and displaying them depending on the value that is specified in the Database Restore UI.

Naming conventions for backups with Application Direct

- When naming SQL Server instance, database, and filegroups, consider that the Microsoft application agent does not distinguish the difference between upper and lowercase letters. The names are not case-sensitive.

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- If there are two or more databases with the same name but with different capitalization, such as DB1 and db1, the Microsoft application agent views these databases as the same and by default backs up only one of the databases.

The following table describes the special characters that are supported for naming database backups in SQL stand-alone, cluster, and Always On availability group configurations with Application Direct.

Special character	Name
~	Tilde
`	Accent grave
!	Exclamation mark
@	At the rate
%	Percentage
^	Caret
&	Ampersand
(	Open parenthesis
)	Close parenthesis
-	Hyphen
_	Underscore
{	Open curly bracket
}	Close curly bracket
\	Backslash
.	Period
'	Apostrophe

1.3.4   Best practices to Backup and Restore SQL Server with Application Direct

- Configure backups to use the same DD series path - To ensure the consistency of the backups on the DD series system, configure all the backups of a SQL Server instance to use the same DD series system and path.
- Configure connection settings - DD series do not distinguish among Transmission Control Protocol (TCP)/Internet Protocol (IP), Fibre Channel (FC), and LAN, WAN, and MAN network types. DD series can successfully operate where packet loss is strictly 0% and latency is less than 20 milliseconds.

- Use supported characters - For DD series, the Microsoft Application supports locale-specific date and time processing and setting the date and time display language can be set to non-English characters. However, database and path names must be written in ASCII characters only.

- Configure DD series quota limits - The Microsoft App Agent does not have a parameter to control the total size that it consumes. The quota limits can only be set on the DD series system on a per-MTree (storage unit) basis.

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- Configure usage limits for DD series streams - Configure enough of DD series streams for better performance of backups and restores. The streams control backup and restore parallelism for each database.

  The Microsoft App Agent requires one stream per save set that is backed up or restored. When striped backups are performed, each stripe requires one stream. The stripes are concurrently executed for each database. Databases are sequentially backed up and restored. When stripes are used, the number of streams must be equal to or more than the number of stripes. The minimum number of streams for a nonstripe environment is 1.

- Enable instant file initialization - For better restores, enable the instant file initialization feature on SQL Server. SQL Server's initialization procedure writes zeros to the portion of the disk that contains the data and the log files. Enabling the instant file initialization feature does not enable zeroing of the disk for the datafile.

- Delete expired backups by using the ddbmexptool expiry tool - The Microsoft application agent does not delete the expired backup copies automatically. The expired backup copies must be explicitly deleted using the ddbmexptool expiry tool.

- Configure the database backup stripe level - Starting with version 19.5, the stripe level of a backup can be modified at the individual database level. And starting with version 19.6, using the procedures given in section "**Configure the database backup stripe level"** in PowerProtect Microsoft Application Agent SQL Server User Guide the stripe level can be set only for self-service stand-alone SQL Server backups and not applicable for centralized backups performed through PowerProtect Data Manager.

  Note : After upgrading from version 19.5, centralized backups ignore any parallelism and backup stripe settings that were previously configured on the **Extended Properties** page in SQL Server Management Studio (SSMS). For centralized backups with version 19.6 or later, the parallelism settings must be configured through the PowerProtect Data Manager UI.

  The backup stripe level configuration includes the following features:
  - ✓ The backup stripe level setting for individual databases has a higher priority than the stripe level setting through the backup command with the -S option
  - ✓ For any database, the minimum supported stripe level is 1 and the maximum supported stripe level is 32
  - ✓ In an FCI or AAG cluster, setting the backup stripe level of a database at any node reflects across all the nodes in the cluster

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2   Scheduled and Manual SQL Server data Protection

2.1   Scheduled SQL Server data protection:

Microsoft SQL Server backup jobs can be scheduled by using.

Scheduling SQL Server backups by using SQL Server Agent - Job-scheduling agent which is contained in the Microsoft SQL Server package.

Windows Task Scheduler – SQL Server backups can be scheduled using batch file on the built-in Microsoft Windows Scheduler.

2.2   Manual SQL Server data Protection using Application Direct

The Microsoft App Agent for Application Direct with SQL Server supports multiple tools to perform manual backups. Backups can be configured using the Microsoft App Agent SSMS plug-in (UI), Microsoft App Agent for Application Direct commands, or T-SQL scripts.

2.2.1   SQL Server backup using the Microsoft App Agent for Application Direct SSMS Plug-in

The Microsoft App Agent supports a user interface to perform backup operations through an SSMS Plug-in.
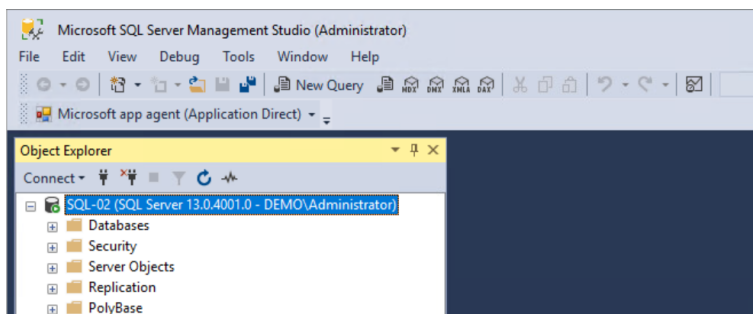
Configuring a SQL Server backup operation in the Microsoft App Agent for Application Direct SSMS Plug-in consists of the following tasks:

- Configuring general backup settings
- Configuring optional backup settings
- Monitoring the backup operation

When DD series system is connected only on the backup LAN, and the SQL host is multihomed and has an interface on the backup LAN, the backups to the DD series system proceed over the backup LAN by default.

If both the DD series and the SQL host are multihomed, and are connected to the backup LAN, ensure that the DD series system that is specified on the Microsoft app agent for Application Direct SSMS plug-in is the same as the backup LAN IP address. The backups to the DD series proceed over the backup LAN.

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Configuring general backup settings: To configure SQL backups with the Microsoft App Agent for Application Direct SSMS Plug-in, general backup option needs to be specified on the Backup > General page.
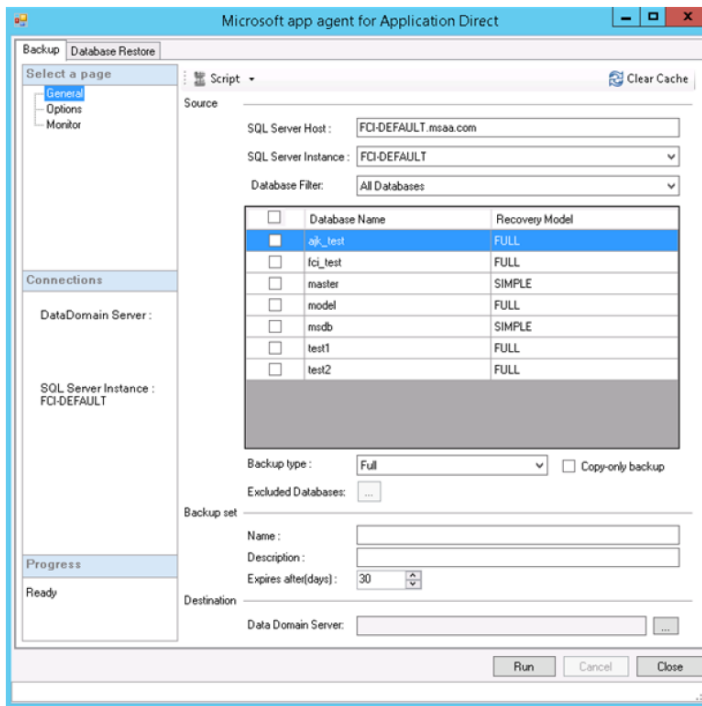
Configuring optional backup settings: When configuring SQL backups with the Microsoft App Agent for Application Direct SSMS Plug-in, Optional backup settings can be specified on the Backup > Options page. All settings on the Options page are optional.
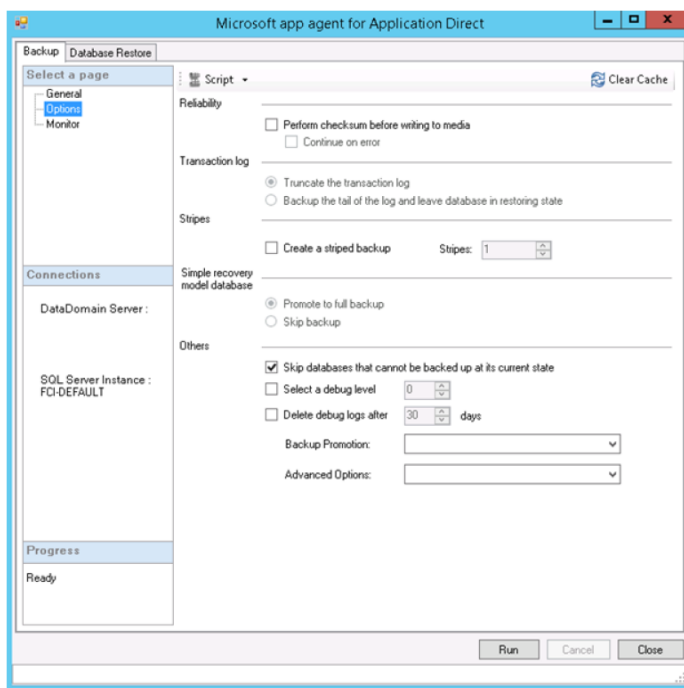
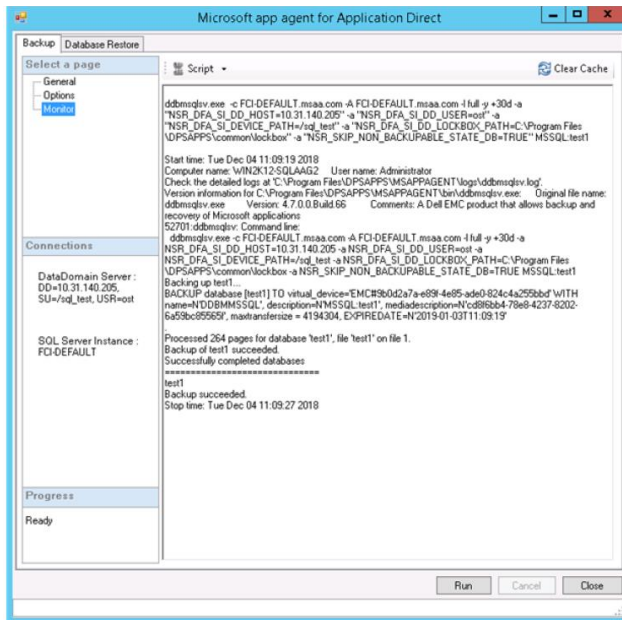**Monitoring the backup operation:** After a backup operation is run from the Microsoft App Agent for Application Direct for Enterprise Apps SSMS Plug-in, the Backup > Monitor page displays the backup script and status.

2.2.2 SQL Server backup using Application Direct commands

Using **ddbmsqlsv** command backups of Microsoft SQL Server data can be configured from a command prompt.

To perform specific backup-related and restore-related operations, the Microsoft App Agent also supports the ddbmadmin.exe command besides the msagentadmin.exe command. However, the ddbmadmin.exe command is deprecated.

Syntax for backups of a stand-alone server

Run the ddbmsqlsv command with the following syntax to back up a stand-alone SQL Server:

```
ddbmsqlsv -c <client_name> -l {full | incr | diff} -a "NSR_DFA_SI=TRUE" -a
"NSR_DFA_SI_USE_DD=TRUE" -a "NSR_DFA_SI_DD_HOST=<server_name>" -a
"NSR_DFA_SI_DEVICE_PATH=<storage_unit_name_and_path>" -a "NSR_DFA_SI_DD_USER=<DD_Boost_user>"
[<optional_parameters>] "<backup_path>"
```

Syntax for backups of an Always On availability group

Run the ddbmsqlsv command with the following syntax to back up a stand-alone SQL Server:

```
ddbmsqlsv -c <cluster_name> -A <virtual_server> -l {full | incr | diff} -a "NSR_DFA_SI=TRUE" -
a "NSR_DFA_SI_USE_DD=TRUE" -a "NSR_DFA_SI_DD_HOST=<server_name>" -a
"NSR_DFA_SI_DEVICE_PATH=<storage_unit_name_and_path>" -a "NSR_DFA_SI_DD_USER=<DD_Boost_user>"
[<optional_parameters>] "<backup_path>"
```

Run the ddbmsqlsv command with the following syntax to back up a clusterless Always On availability group (AAG):

```
ddbmsqlsv -a "SKIP_CLIENT_RESOLUTION=TRUE" -c <AAG_name> <AAG_GUID> -l {full | incr | diff} -
a "NSR_DFA_SI=TRUE" -a "NSR_DFA_SI_USE_DD=TRUE" -a "NSR_DFA_SI_DD_HOST=<server_name>" -a
"NSR_DFA_SI_DEVICE_PATH=<storage_unit_name_and_path>" -a "NSR_DFA_SI_DD_USER=<DD_Boost_user>"
[<optional_parameters>] "<backup_path>"
```

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Kindly see [PowerProtect Microsoft Application Agent SQL Server User Guide](#) for detailed information about using the Application Direct commands to perform SQL backups.

2.2.3 SQL Server backup using the Microsoft Application Direct T-SQL scripts

The Microsoft App Agent for Application Direct for Enterprise Apps enables to generate a SQLCLR script that can be used to backup the SQL Server.

The SQL-CLR backup command, emc_run_backup, uses the Microsoft App Agent for Application Direct for Enterprise Apps with SQL Server backup command prompt options. Also, VARCHAR parameters to be provided with this command.

Sample T-SQL backup script

```
USE [master]
GO
DECLARE @returnCode int
8 -l full -N "Set1" -y +0d -a "NSR_DFA_SI=TRUE" -a
"NSR_DFA_SI_USE_DD=TRUE" -a "NSR_DFA_SI_DD_HOST=10.31.192.10" -a
"NSR_DFA_SI_DD_USER=ost" -a "NSR_DFA_SI_DEVICE_PATH=/ddsub7" -a
"NSR_SKIP_NON_BACKUPABLE_STATE_DB=TRUE" "MSSQL:"'
IF @returnCode <> 0
BEGIN
RAISERROR ('Fail!', 16, 1)
END
```

Any SQL Server standard interfaces can be used, such as the SSMS Query window and OSQL command-line tool, to run the SQL-CLR scripts. SQL-CLR script can be used to schedule SQL Server backups by using the SQL Server Agent.

2.2.3.1 SQL Server push backups using Application Direct T-SQL scripts

To backup either all databases or only the specific databases of a SQL Server instance from a source host to DD series by using a different host, perform the following steps:

1. Start SSMS on a different host to perform the backup.

2. Connect to the source SQL Server instance on the source host.

3. In the SSMS window on the different host, click New Query.

4. In the New Query window, run the T-SQL script to perform the backup

T-SQL push backup script

```
USE [master]
GO
DECLARE @returnCode int
EXEC @returnCode = dbo.emc_run_backup ' -c CLUST-SQL-02.contoso.com -A
CLUST-SQL-02.contoso.com -l full -y +0d -a "NSR_DFA_SI=TRUE" -a
"NSR_DFA_SI_USE_DD=TRUE" -a "NSR_DFA_SI_DD_HOST=nmmddtwo.sp2010.com" -
a "NSR_DFA_SI_DD_USER=ost" -a "NSR_DFA_SI_DEVICE_PATH=/ddbmav2b75" -a
"NSR_SKIP_NON_BACKUPABLE_STATE_DB=TRUE" "MSSQL$Inst1:Clus-SQL-01-DB01"
"MSSQL$Inst1:CLUST-SQL-02-DB01" "MSSQL$Inst1:CLUST-SQL-02-DB02" "MSSQL
$Inst1:CLUST-SQL-02-DB03"'
IF @returnCode <> 0
BEGIN
RAISERROR ('Fail!', 16, 1)
END
```

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2.2.3.2 Federated backups of SQL Always On availability group databases by using T-SQL scripts

To perform federated backups, same backup command and options that are used when Performing backups with T-SQL scripts but with the following modifications.

- Specify the Windows cluster name for <client_name> in -c <client_name>
- Specify the backup object name for <save_set_name> in -N <save_set_name>
- Specify #<AlwaysOn_Availability_Group_name> in the backup object name

Sample T-SQL script to backup an entire Always On availability group

```
USE [master]
GO
DECLARE @returnCode int
EXEC @returnCode = dbo.emc_run_backup '-c SQL2012clus3.brsvlab.local -
S 4 -l full -y +30d -a "NSR_DFA_SI=TRUE" -a "NSR_DFA_SI_USE_DD=TRUE" -
a "NSR_DFA_SI_DD_HOST=ddve-01" -a "NSR_DFA_SI_DD_USER=sqlboost" -a
"NSR_DFA_SI_PATH=/sqlboost" -a "NSR_DFA_SI_DD_LOCKBOX_PATH=C:\Program
Files\DPSAPPS\common\lockbox" -a
"NSR_SKIP_NON_BACKUPABLE_STATE_DB=TRUE" -N "MSSQL$SQ12INST4#sql2012-
aag3:" "MSSQL$SQ12INST4#sql2012-aag3:"'
IF @returnCode <> 0
BEGIN
RAISERROR ('Fail!', 16, 1)
END
```

Note: The Microsoft App Agent does not support backing up multiple Always On availability groups in the same operation.

Listing backups

Backups performed to a DD series can be listed using `msagentadmin administration` command or the `ddbmexptool` command.

List backups and save files with msagentadmin administration command

The Microsoft App Agent supports list commands to view backups and save files.

List backups or save files using the msagentadmin administration command with the following syntax.

```
msagentadmin administration {--list | --listfiles} --ddhost "<server_name>" --ddpath
"<storage_unit_name_and_path>" --dduser "<DD_Boost_username>" --appID "mssql"
[<optional_parameters>]
```

List backups with the Application Direct expiry tool

List backups or save files using expiry tool with the following syntax.

```
ddbmexptool -l -n MSSQL -a "DDBOOST_USER=<DD_Boost_user>" -a "DEVICE_PATH=<storage_unit>" -a
"DEVICE_HOST=<name>" -a "CLIENT=<client_name>" [<optional_parameters>]
```

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Move and recall save sets on a DD series Cloud Tier

The Microsoft App Agent supports management of data with a DD series Cloud Tier. Below tasks can performed using `msagentadmin.exe administration` command.

- Mark save sets to move them from a DD series storage unit to a DD series Cloud Tier
- Recall save sets from a DD series Cloud Tier to a DD series storage unit
  The Microsoft App Agent supports the following types of recall

  Seamless or automatic: When a restore operation needs the save sets that are present on a DD series Cloud Tier, the Microsoft App Agent automatically recalls the save sets to the active tier on DD series. However, when Elastic Cloud Storage (ECS) used with DD OS 6.1 or later, the Microsoft App Agent restores the save sets on the cloud tier device directly from ECS to the client without recalling to the active tier.

  Manual: When both of the following conditions exist, recall the save sets manually before performing a restore operation:

  > When a restore operation needs the save sets that are present on a DD series Cloud Tier
  > When the Microsoft App Agent is not required to automatically recall and restore the save sets

Moving save sets to the DD series Cloud Tier

Save sets can be moved to a DD series Cloud Tier using below command.

```
msagentadmin.exe administration --move --ddhost "<server_name>" --ddpath
"<storage_unit_name_and_path>" --dduser "<DD_Boost_username>" [--tier] [--client
<client_name>] [--after <start_time>] --before <end_time> --appID <application_ID> --config
<config_file_path> [--debug <debug_level_1_through_9>]
```

Recalling save sets from the DD series Cloud Tier

Save sets can be recalled from the DD series Cloud Tier device to the DD series storage unit using the below command.

```
msagentadmin.exe administration --recall --ddhost "<server_name>" --ddpath
"<storage_unit_name_and_path>" --dduser "<DD_Boost_username>" [--tier] [--client
<client_name>] [--after <start_time>] --before <end_time> --appID <application_ID> --config
<config_file_path> [--debug <debug_level_1_through_9>]
```

Deleting backups

Delete backups using either the msagentadmin administration command or the ddbmexptool command.

To delete save sets or backups, run the msagentadmin administration command with the following syntax:

```
msagentadmin administration --delete --ddhost "<name>" --ddpath "/
<storage_unit_name_and_path>" --dduser "<DD_Boost_user>" --appID "mssql" <optional_parameters>
```

Delete backups with the Application Direct expiry tool: On a DD series system, to delete the backups and the metadata files that are within a specific save time range and regardless of the expiry date, run the following command:

```
ddbmexptool -d -n MSSQL -a "DDBOOST_USER=<DD_Boost_user>" -a "DEVICE_PATH=<storage_unit>" -a
"DEVICE_HOST=<server_name>" -a "CLIENT=<client_name>" [<optional_parameters>]
```

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Delete expired backups with the Application Direct expiry tool

To delete expired backups, run the following command

```
ddbmexptool -k -n MSSQL -a "DDBOOST_USER=<DD_Boost_user>" -a "DEVICE_PATH=<storage_unit>" -a
"DEVICE_HOST=<server_name>" -a "CLIENT=<client_name>" [<optional_parameters>]
```

Delete expired backups by running the expiry tool with T-SQL

With the Microsoft application agent, the CLR deployment tool includes the dbo.emc_run_delete stored procedure, which enables you to run the expiry tool from a regular SQL Server Management Studio UI.

The stored procedure runs the expiry tool, and uses the command-line arguments that are passed into the stored procedure.

The stored procedure also ensures that the delete command includes -Y and the -n mssql options.

The expiry tool requires the -Y and the -n mssql options because you cannot intervene, and the Microsoft application agent supports only the MSSQL plug-in through the T-SQL interface.

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3 Restoring SQL Server Data with Application Direct

The Microsoft App Agent for Application Direct with SQL Server supports multiple tools to recover databases. Databases can be recovered using the Microsoft App Agent SSMS Plug-in (UI), Microsoft App Agent for Application Direct commands, or T-SQL scripts.

3.1 SQL Server restore using Application Direct SSMS Plug-in

Configuring a SQL Server restore operation in the Microsoft App Agent for Application Direct SSMS Plug-in consists of the following tasks:
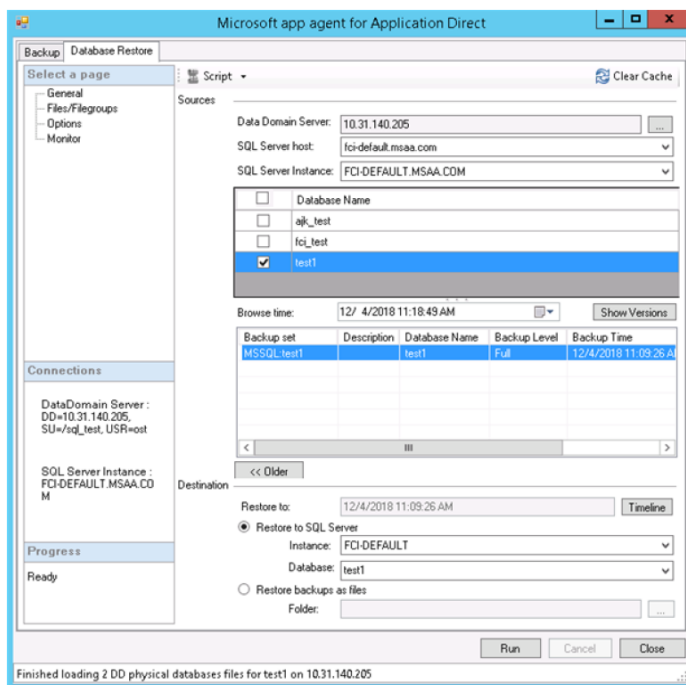
- Configuring general restore settings
- Configuring files and filegroup restore settings
- Configuring optional restore settings
- Monitoring the restore operation

The Microsoft App Agent caches SQL Server restore settings. The Microsoft App Agent automatically loads the information from the last recovery operation and populates restore settings. Caching saves time by eliminating the need to reselect the settings each time while running a restore operation. To clear the cached settings, click Clear Cache.

The Script option is available in each page of the Database Restore tab, which generates a command prompt equivalent script. Script can be used to create a .bat file to perform automation and other tasks.

Configuring general restore settings:

To configure SQL restores with the Microsoft App Agent for Application Direct for Enterprise Apps SSMS Plug-in, General restore options need to be specified first on the Database Restore > General page.

Configuring files and filegroup restore settings: When configuring SQL restores with the Microsoft App Agent for Application Direct SSMS Plug-in, the default destination folders of the database files (.mdf and .ndf) and log files (.ldf) can be changed on the Database Restore > Files/Filegroups page. All settings on the Files/Filegroups page are optional.
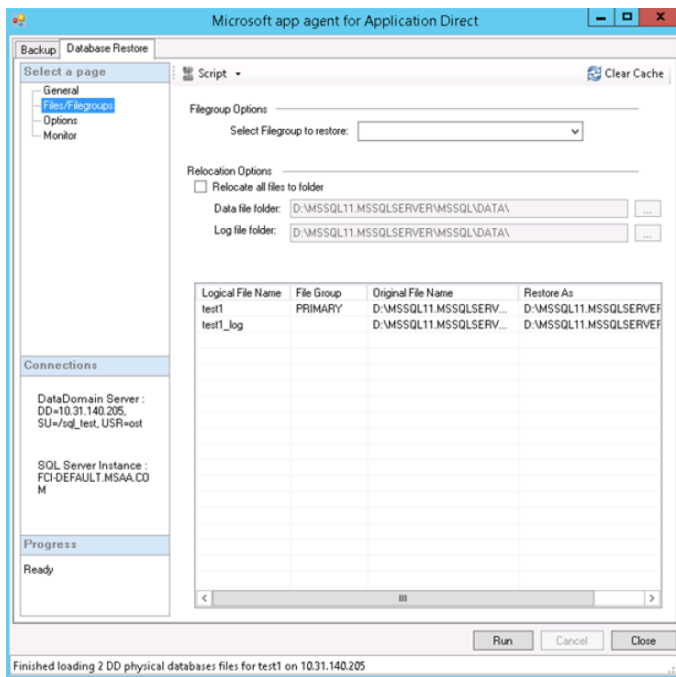
Configuring optional database restore settings: When configuring SQL database restores with the Microsoft App Agent for Application Direct for Enterprise Apps SSMS Plug-in, Optional restore settings can be specified on the Database Restore > Options page.

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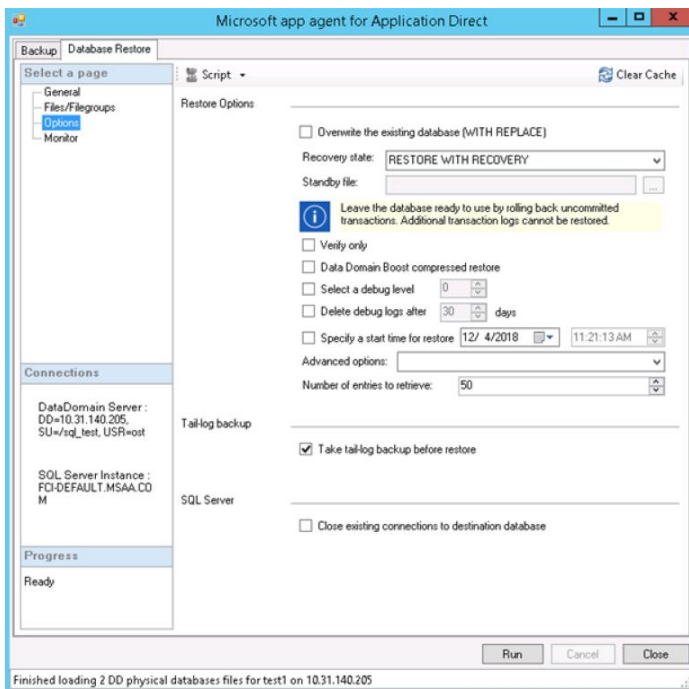
Monitoring the restore operation: After a database restore operation is run from the Microsoft App Agent for Application Direct for Enterprise Apps SSMS Plug-in, the Database Restore > Monitor page displays the restore script and status.
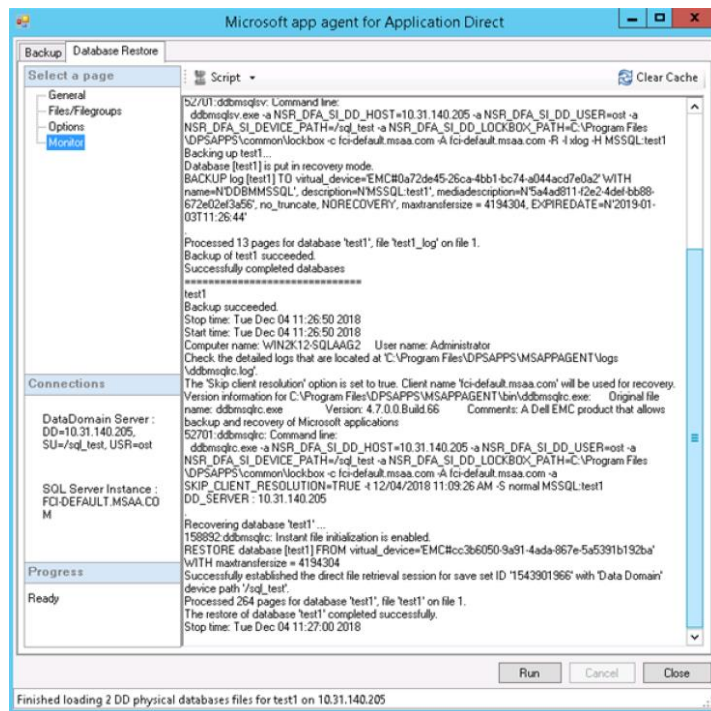
3.2   SQL Server restore using Application Direct recover command

Using **ddbmsqlrc** command Microsoft SQL Server databases restores can be configured from command prompt.

To perform specific backup-related and restore-related operations, the Microsoft App Agent also supports the ddbmadmin.exe command besides the msagentadmin.exe command. However, the ddbmadmin.exe command is deprecated.

Syntax to restore databases on a stand-alone server

```
ddbmsqlrc.exe -c <client_name> -S {normal | norecover | standby:<filepath>\undo.ldf} -a
"NSR_DFA_SI=TRUE" -a "NSR_DFA_SI_USE_DD=TRUE" -a "NSR_DFA_SI_DD_HOST=<server_name>" -a
"NSR_DFA_SI_DD_USER=<DD_Boost_user>" -a "NSR_DFA_SI_DEVICE_PATH=<storage_unit_name_and_path>"
[<optional_parameters>] "<restore_path>"
```

Syntax to restore databases in an Always On availability group

```
ddbmsqlrc.exe -c <cluster_name> -A <virtual_server> -S {normal | norecover |
standby:<filepath>\undo.ldf} -a "NSR_DFA_SI=TRUE" -a "NSR_DFA_SI_USE_DD=TRUE" -a
"NSR_DFA_SI_DD_HOST=<server_name>" -a "NSR_DFA_SI_DD_USER=<DD_Boost_user>" -a
"NSR_DFA_SI_DEVICE_PATH=<storage_unit_name_and_path>" [<optional_parameters>] "<restore_path>"
```

3.3 SQL Server restore using Application Direct T-SQL scripts

The Microsoft App Agent for Application Direct enables to generate a SQL-CLR script that can be used to restore SQL Server databases.

The SQL-CLR restore command, emc_run_restore uses the Microsoft App Agent for Application Direct for Enterprise Apps with SQL Server restore CLI options. Also, VARCHAR parameters to be provided with this command.

Sample T-SQL restore script

```
USE [master]
GO
DECLARE @returnCode int
EXEC @returnCode = dbo.emc_run_restore ' -c win8sqlsp.sharepoint.com -
f -t "02/03/2015 04:04:36 AM" -S normal -a "NSR_DFA_SI=TRUE" -a
"NSR_DFA_SI_USE_DD=TRUE" -a "NSR_DFA_SI_DD_HOST=10.31.192.10" -a
"NSR_DFA_SI_DD_USER=ost" -a "NSR_DFA_SI_DEVICE_PATH=/ddsub7" -d
"MSSQL:dbtest" "MSSQL:db100"'
IF @returnCode <> 0
BEGIN
RAISERROR ('Fail!', 16, 1)
END
```

3.3.1 SQL Server push restores using Application Direct T-SQL scripts

To restore either all databases or only the specific databases of a SQL Server instance from DD series to a destination host by using a different host perform the following steps.

Procedure

1. Start SSMS on a different host to perform the restore.

2. Connect to the destination SQL Server instance on the destination host.

3. In the SSMS window on the different host, click New Query.

4. In the New Query window, run the T-SQL script to perform the restore

Sample T-SQL push restore script

```
USE [master]
GO
DECLARE @returnCode int
EXEC @returnCode = dbo.emc_run_restore ' -c clust-sql-01.contoso.com -
A clust-sql-02.contoso.com -f -t "06/22/2015 02:38:48 PM" -S normal -a
"NSR_DFA_SI=TRUE" -a "NSR_DFA_SI_USE_DD=TRUE" -a
"NSR_DFA_SI_DD_HOST=nmmddtwo.sp2010.com" -a "NSR_DFA_SI_DD_USER=ost" -
a "NSR_DFA_SI_DEVICE_PATH=/ddbmav2b75" -d "MSSQL$Inst1:CLUST-SQL-02-
DB02" "MSSQL$Inst1:CLUST-SQL-02-DB01"'
IF @returnCode <> 0
BEGIN
RAISERROR ('Fail!', 16, 1)
END
```

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3.3.2 SQL Always On availability groups restore by using T-SQL scripts

To restore databases from federated backups, same restore command and options can be used that performs database restores with T-SQL scripts, but for <client_name> in -c <client_name>, by specifying the Windows cluster name.

Sample T-SQL script to restore a federated backup to the source database

```
USE [master]
GO
DECLARE @returnCode int
EXEC @returnCode = dbo.emc_run_restore '-a
"NSR_DFA_SI_DD_HOST=ddve-01" -a "NSR_DFA_SI_DD_USER=sqlboost" -a
"NSR_DFA_SI_DEVICE_PATH=/sqlboost" -a "NSR_DFA_SI_DD_LOCKBOX_PATH=C:
\Program Files\DPSAPPS\common\lockbox" -c sql2012clus3.brsvlab.local -
C" 'testdb1_Data'='E:\sql2012_data\ database1.mdf', 'testdb1_Log'='F:
\sql2012_log\database1_log.LDF'" -f -S normal -$ "MSSQL$SQ12INST4:" -d
"MSSQL$SQ12INST4:database1" "MSSQL$SQ12INST4:database1"'
IF @returnCode <> 0
BEGIN
RAISERROR ('Fail!', 16, 1)
END
```

Sample T-SQL script to restore a federated backup to a different instance and database (redirected restore)

```
USE [master]
GO
DECLARE @returnCode int
EXEC @returnCode = dbo.emc_run_restore '-a
"NSR_DFA_SI_DD_HOST=ddve-01" -a "NSR_DFA_SI_DD_USER=sqlboost" -a
"NSR_DFA_SI_DEVICE_PATH=/sqlboost" -a "NSR_DFA_SI_DD_LOCKBOX_PATH=C:
\Program Files\DPSAPPS\common\lockbox" -c sql2012clus3.brsvlab.local -
C" 'testdb1_Data'='E:\sql2012_data\database1.mdf', 'testdb1_Log'='F:
\sql2012_log\database1_log.LDF'" -f -S normal -$ "MSSQL$SQ12INST4:" -d
"MSSQL$SQ12INST5:copy-database1" "MSSQL$SQ12INST4:database1"'
IF @returnCode <> 0
BEGIN
RAISERROR ('Fail!', 16, 1)
END
```

3.4 Performing table-level recovery for SQL Server data

The Microsoft App Agent supports table-level recovery of SQL Server data using the Microsoft app agent for Application Direct SSMS plug-in. The Microsoft App Agent does not support the Script option to perform table restores using a command prompt or T-SQL scripts.

When installing the Microsoft App Agent, ItemPoint also needs to be installed to perform table-level restores. Otherwise, the Table Restore tab does not appear in the Microsoft app agent for Application Direct SSMS plug-in.

To perform table-level restores, the backup images need to be mounted first and mount options needs to be specified by using the Microsoft app agent for Application Direct SSMS plug-in. Once the backup is mounted, using ItemPoint table restore can be completed for Microsoft SQL Server.

When performing table-level recovery, ItemPoint must load all the outstanding transactions that are present in a backup. To load large databases, ItemPoint requires a few hours to read the data because of poor Virtual File System performance.

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3.4.1 Launching the Microsoft app agent for VM Direct SSMS plug-in

Steps to launch the Microsoft app agent for VM Direct SSMS plug-in

1. From the Windows Start menu, select Microsoft SQL Server Management Studio.

2. In the Microsoft SQL Server Management Studio, in the Connect to Server window, specify the server information and credentials, and then click Connect.

3. In the toolbar, click Microsoft app agent for VM Direct.

### 3.4.2 SQL table-level restore configuration:
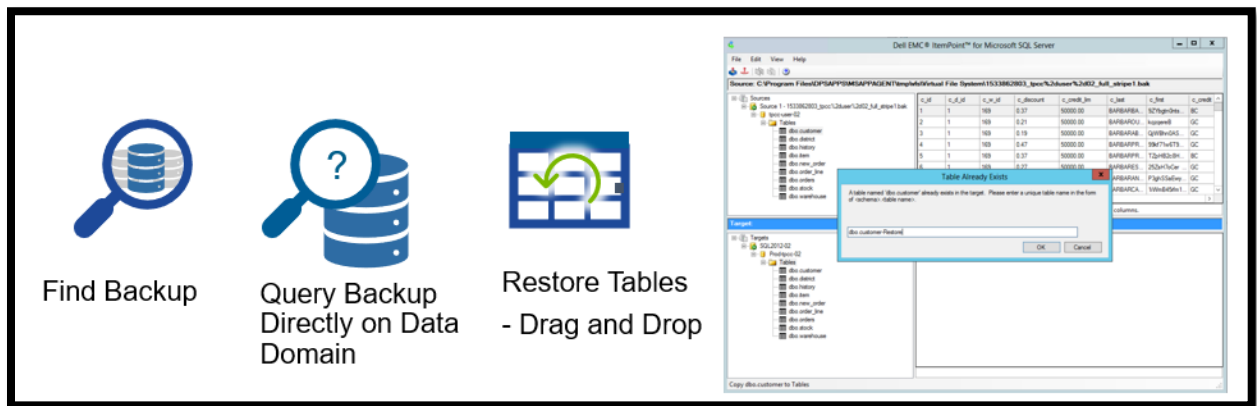
Configuring a SQL table-level restore operation with Microsoft App Agent for Application Direct SSMS Plug-in consists of the following tasks:

- Configuring general table restore settings
- Configuring optional table restore settings
- Monitoring the table restore mount operation
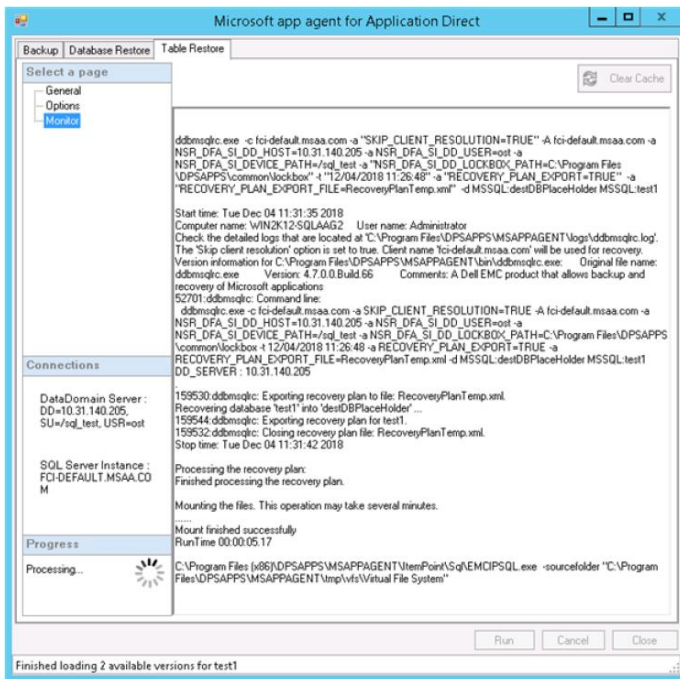- Restoring table-level data using ItemPoint

Configuring general table restore settings: To configure SQL table-level restores with the Microsoft app agent for Application Direct SSMS plug-in, specify the general table restore options on the Database Restore > General page.
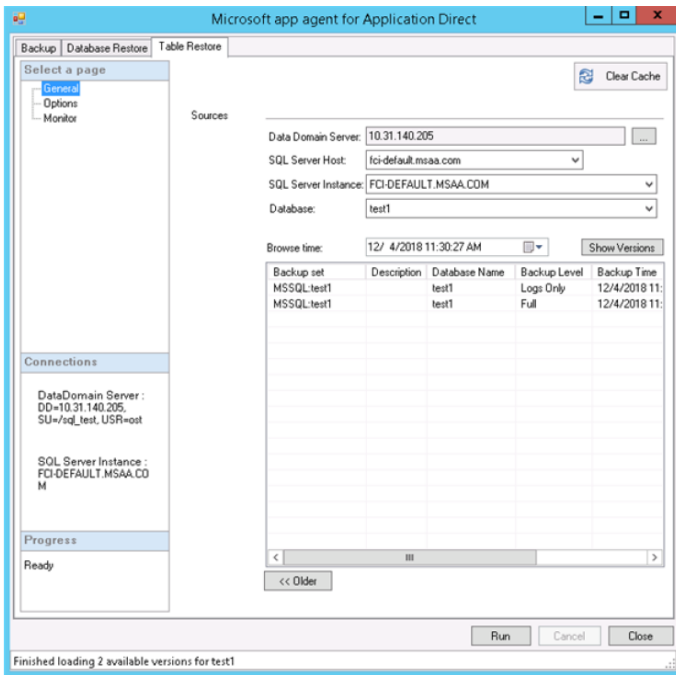
Configuring optional table restore settings: When SQL backups configured with Microsoft app agent for Application Direct SSMS plug-in, optional backup settings can be specified on the Table Restore >Options page.
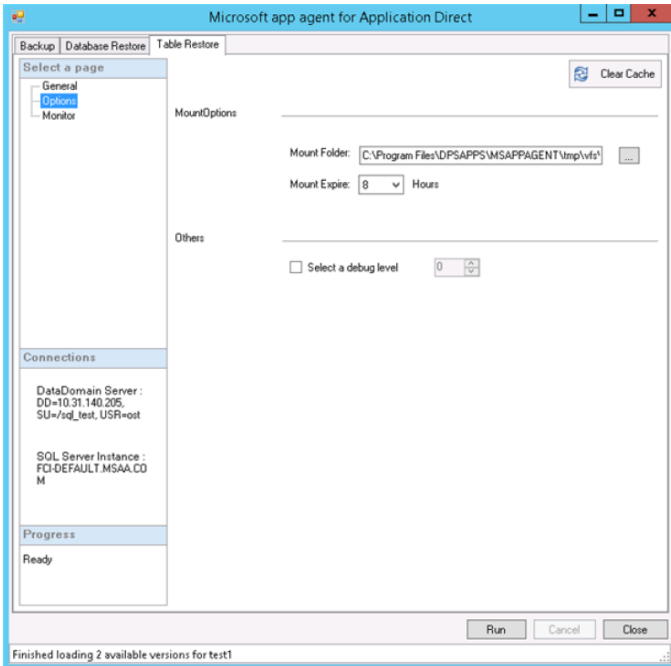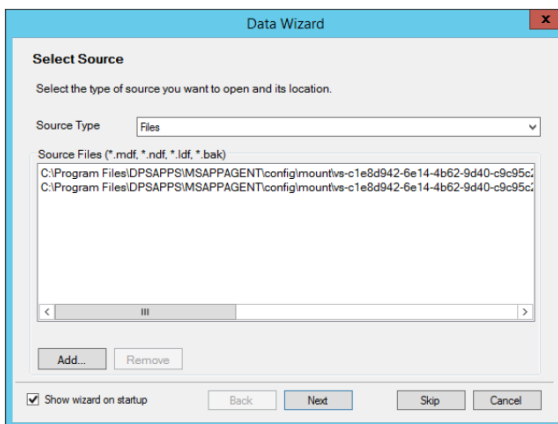

Monitoring the table restore mount operation: After a table-level restore mount operation is run from the Microsoft app agent for Application Direct SSMS plug-in, the Table Restore > Monitor page displays the mount script and status.

Restoring table-level data using ItemPoint: After the backup images are mounted using the Microsoft App Agent SSMS plug-in, complete the table-level restore using ItemPoint for Microsoft SQL Server.

Once the table level restore is configured and run through the Microsoft App Agent SSMS plug-in, ItemPoint launches.

1 On the **Select Source** page, select the source backup files from the mounted volume that contains the SQL backup data

2 On the **Select Target Server** page, specify the details and login credentials for the target SQL Server and database.

3 Click **Finish**. The Data Wizard closes and ItemPoint loads the tables contained in the source backup files
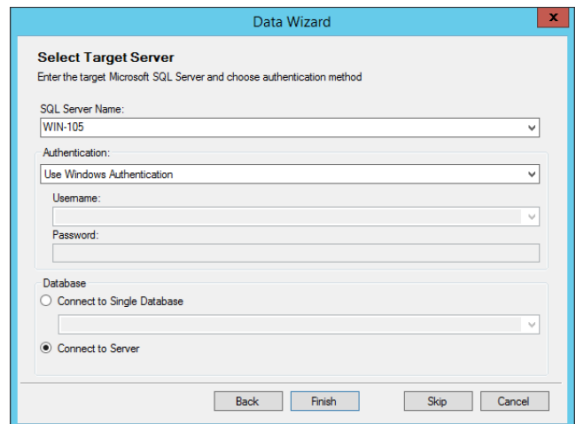
4 Use ItemPoint to browse and restore the individual tables.

5 Exit ItemPoint for Microsoft SQL Server to dismount the mounted backup images

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4 Performing SQL Server disaster recovery

The Microsoft application agent supports disaster recovery of data on both DD series system and DD series Cloud Tier.

The Microsoft application agent for Application Direct supports disaster recovery.

Steps:

1. Create a target Windows host with the same name as the source hostname.

2. Install a SQL Server instance with the same name as the source instance name.

3. Install the Microsoft application agent on the target Windows host.

4. Browse the backups of the source instance by selecting the appropriate storage unit.

5. Restore the system databases, such as master, model, msdb, and so on, to the target instance.

6. Restore all the user databases to the target instance.

Perform disaster recovery from the DD series Cloud Tier

The Microsoft application agent provides a command-line tool to complete disaster recovery of save sets that are in DD series Cloud Tier.

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Application Direct features for SQL Protection

Distributed Segment Processing (DSP)

DSP allows the Microsoft App Agent to perform parts of the deduplication process, which avoids sending duplicate data to the DD series system.
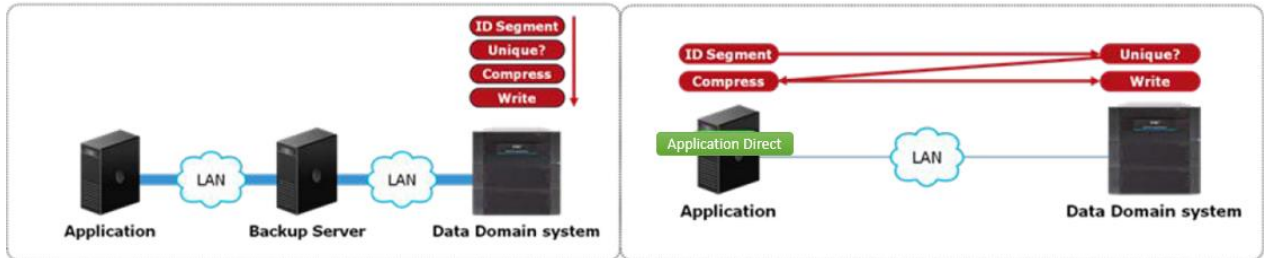
The Microsoft App Agent loads the Application Direct library during backup and restore operations. The DSP feature provides the following benefits:

- Increases throughput because the Application Direct library sends only unique data to the DD series system. Greater throughput is attained with higher redundancy, greater database server workload, and greater database server capability
- Decreases network bandwidth requirements by sending the unique data to the DD series system through the network

DSP supports the following modes of operation for sending backup data to a DD series system:

- Distributed segment processing enabled
- Distributed segment processing disabled

```
sysadmin@ddve-01# ddboost option show
Option                            Value
-----------------------------     -------
distributed-segment-processing    enabled
```

Note: The distributed segment processing feature cannot be disabled on an extended retention DD series system.

Advanced load balancing and link failover

The advanced load balancing and link failover feature enables the combination of multiple Ethernet links into a group and the registration of only one interface on the DD series system with Application Direct for SQL Server.

When a DD series system is used that has an interface group configured, the following actions occur when a backup or restore is performed with Application Direct for SQL Server:

- Application Direct for SQL Server negotiates a connection with the DD series system on the registered interface
- The DD series system receives the data, load balances the data transfer, and distributes the data on all the interfaces in the group

The load-balancing feature provides greater physical throughput to the DD series system when Ethernet Link Aggregation is used to configure the interfaces into a virtual interface.

Note: This topic is relevant only when using an Ethernet connection for backup and restore operations with the Microsoft App Agent.

Encrypted managed file replication

- On enabling the encrypted file replication feature, when the database servers set up a replication job, the session between the source and destination DD series systems uses Secure Sockets Layer (SSL) to encrypt all image data and metadata sent over the WAN
- Enabling this feature on the DD series system is transparent to the Microsoft App Agent
- Encrypted file replication uses the ADH-AES256-SHA cipher suite, which cannot be changed on the DD series operating system. On enabling this feature, file system restart is not required on the DD series system
- When encrypted file replication is enabled, replicator license needs to be installed on any source and destination DD series systems that have DD OS 5.0 or later
- When encrypted file replication with the encryption of data-at-rest feature is enabled, the backup process uses SSL to encrypt the backup image data over a WAN

SQL Server Transparent Data Encryption (TDE)

- Microsoft SQL transparent data encryption (TDE) is a feature that performs real-time I/O encryption and decryption of the data and log files
- TDE uses a Database Encryption Key (DEK), which is stored in the database boot record for availability during recovery. Encryption of the database file is performed at the page level
- The pages in an encrypted database are encrypted before they are written to disk and decrypted when read into memory. When using this feature, ensure that the certificate and private key are backed up with the encrypted data
- Microsoft SQL Server 2008 and later introduce the TDE database-level encryption feature which provides protection for the entire database at rest, without affecting existing applications
- The Microsoft App Agent supports SQL data encryption at the cell level, at the full database level by using TDE, or at the file-level with encryption options provided by Microsoft

Application Direct over Fibre Channel (FC)
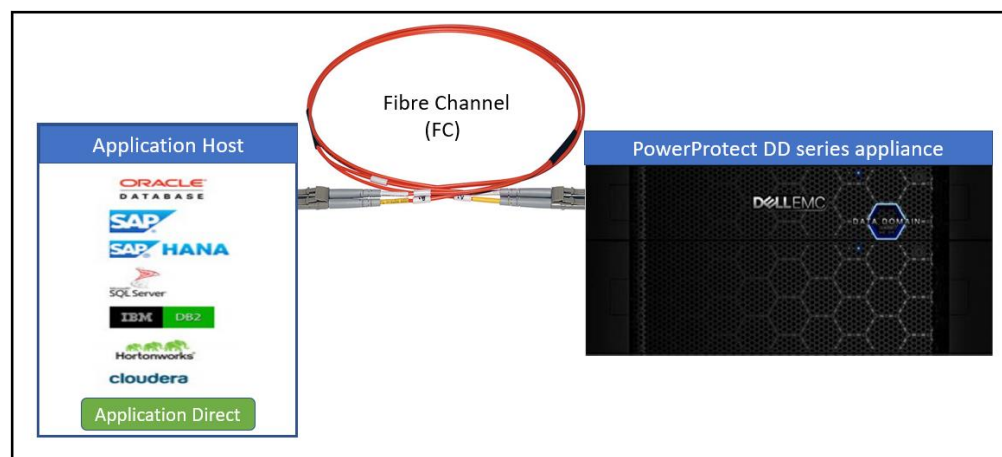
- DD OS release 5.3 and later provides support for Application Direct to move data over Fibre Channel and Ethernet
- Although Fibre Channel is a general-purpose data transport mechanism, Application Direct over FC only uses Fibre Channel as a transport
- When Fibre Channel is used traffic can be offloaded from the production IP networks, which can reduce network congestion and improve the ability to meet aggressive SLAs for backup windows
- Application Direct over FC provides the benefit of advanced load balancing and path failover, but it is achieved through different means
- With Application Direct over FC, the DD series system advertises processor-type-scsi devices to the database server. The database server discovers all the device paths and creates generic SCSI devices. The backup workload will use the most appropriate paths based on the defined path selection criteria. If any of the device paths are not available, Application Direct library will choose the best available paths.

Conclusion

Application Direct for SQL Server enables application owners to have direct control over backups to a DD series system by using SSMS.

Application Direct for SQL Server provides the following benefits:

- Shorter backup times. Application Direct for SQL Server enables client-side deduplication by distributing parts of the deduplication process to the application server.

- Seamless integration with existing infrastructure. Connectivity infrastructure change is not required because Application Direct for SQL Server supports Application Direct over Fibre Channel and IP.

- Direct integration with the SSMS

- Optimized data mobility. Application Direct for SQL Server uses Application Direct as the data mover. When DSP is enabled, backup times improve because Application Direct for SQL Server sends only unique data across the network and to the protection storage, which reduces network utilization by up to 99%.

- LAN-free backup and restores. Application Direct for SQL Server supports Fibre Channel transport.

- Supports the advanced load balancing and failover feature when using Application Direct over IP for backup and restore workflows, which improves backup reliability and efficiency.

- Protection storage integration. With Application Direct for SQL Server, DBAs and application owners can backup their databases directly to protection storage without the need of configuring local disks as backup repository.

- Application integration with Application Direct storage units. This removes management and resiliency limitations that will be experienced when NFS exports and CIFS shares is used. With all the intelligence built into the protection storage in terms of storage efficiency, replication, extended retention, quotas, and the DD series Data Invulnerability Architecture (DIA), Application Direct for SQL Server can now interact with the applications and the protected data stores.

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A   Technical support and resources

Dell.com/support is focused on meeting customer needs with proven services and support.

[Storage and data protection technical white papers and videos](#) provide expertise that helps to ensure customer success with Dell EMC storage and data protection products.

A.1   Related resources

- [PowerProtect Microsoft Application Agent SQL Server User Guide](#)
- [Dell EMC PowerProtect Microsoft Application Agent_ Release Notes](#)
- [Dell EMC DD OS Administration Guide](#)
- [Dell EMC PowerProtect Data Manager Administration and User Guide](#)
- [Data Domain Boost Business value white paper](#)

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