

## Technical Note

### Protecting Microsoft SQL Server® with Asigra Cloud Backup™

**Table of Contents**

<b>Introduction</b>	<b>3</b>
<b>Overview - Asigra Cloud Backup Software Platform</b>	<b>3</b>
<b>Microsoft SQL Server Backup Set in Asigra DS-Client</b>	<b>3</b>
<b>VSS-Aware Backup Set in Asigra DS-Client</b>	<b>3</b>
<b>Microsoft SQL Server Database Recovery Model</b>	<b>3</b>
<b>How to Create a Microsoft SQL Server backup Set in Asigra DS-User</b>	<b>4</b>
I. "Microsoft SQL Server" kind of backup set	4
II. "VSS-Aware Backup Set" kind of backup set	4
<b>Asigra DS-Client Microsoft SQL Server Backup Strategies</b>	<b>5</b>
<b>Full Database Dump Always</b>	<b>5</b>
<b>Full Database Dump Plus Differential Backup</b>	<b>5</b>
<b>Full Dump Always</b>	<b>6</b>
<b>Full Dump + Differential Backup</b>	<b>7</b>
<b>Full Dump + Incremental Backup</b>	<b>7</b>
<b>On Demand Tail-Log Backup</b>	<b>8</b>
<b>Additional Microsoft SQL Server backup considerations</b>	<b>8</b>
<b>Defining a MSSQL Backup Set</b>	<b>8</b>
<b>Restore A Point Of Time Contained In The Transaction Log</b>	<b>9</b>
<b>Other Considerations</b>	<b>9</b>
<b>About Asigra</b>	<b>9</b>

## Introduction

This Technical Note provides information on the configuration, backup and restore of Microsoft SQL Server database engine in a stand-alone or clustered configuration, with Asigra Cloud Backup™. It is expected that the reader of this paper has knowledge of the Windows operating system, Microsoft SQL Server management practices as well as familiarity with backup and recovery techniques for Microsoft SQL Server. A working knowledge of Microsoft network components is also required; as well as a basic understanding of setup and management of Asigra DS-Client.

## Overview - Asigra Cloud Backup Software Platform

Asigra Cloud Backup is a unique alternative to traditional backup methods, replacing conventional tape based systems with a fully automated online solution. It provides centralized and automated backups of PCs, file servers and application/database servers with secure offsite storage and immediate online restoration.

The solution uses an Asigra DS-Client, which is the data-collection software module installed on the customer network, which hosts the Asigra Cloud Backup client application software that performs the data backup and restore activity.

Asigra DS-System, which is the centralized repository of backed up data, receives backed-up data from the Asigra DS-Client and stores it in the Asigra DS-System which leverages online disk storage. A single Asigra DS-System can back up data from numerous Asigra DS-Clients, within a single customer environment or across separate multiple customers. When a restore is needed, Asigra DS-System assembles and retrieves the data requested for restoring by Asigra DS-Client, although Asigra DS-Client handles the actual restore of data to the appropriate location.

Asigra DS-Client offers the advantage of automatic and unattended online backup for Microsoft SQL Server 2000, 2005 , 2008, 2008R2 and 2012 in a standalone or clustered environment using either the “Microsoft SQL Server” or “VSS-Aware Backup Set” type of backup sets:

## Microsoft SQL Server Backup Set in Asigra DS-Client

- Backup the whole database server or any database
- Scheduled automatic backup and on demand backup
- Simplifies the management of backup and restore
- Backup option includes full, incremental and differential backup with transaction log backup

- Perform transaction log tail backup
- Restore to the same database server or an alternate location
- SQL backup takes advantage of retention rule match customer’s retention policy
- Combined with Asigra Backup Lifecycle Management (BLM) to achieve the goal of long term storage
- Using local only and local storage option to facilitate restore at LAN speed

## VSS-Aware Backup Set in Asigra DS-Client

- Backup the whole database server or any database
- Scheduled automatic backup and on demand backup
- Simplifies the management of backup and restore
- Backup option includes full and differential backup with backup permissions and backup stream options
- Restore to the same database server or an alternate location
- SQL backup takes advantage of retention rule to match customer’s retention policy
- Combined with BLM to achieve the goal of long term storage
- Using local only and local storage option to facilitate restore at LAN speed

## Microsoft SQL Server Database Recovery Model

Backup and restore operations occur within the context of recovery models. SQL Server provides three recovery models for databases: Full, Simple and Bulk-Logged. These models determine how SQL Servers work with transaction logs, and select the operation that it logs and whether it truncates the log. Truncating the transaction log is the process of removing committed transactions and leaving freed log space to new transactions.

- **Simple recovery model:** The simple recovery model is generally useful only for testing development databases or for databases containing mostly read-only data. Simple recovery requires the least administration. Data is recoverable only to the most recent full backup or differential backup. Transaction logs are not backed up, and minimal transaction log space is used. After the log space is no longer needed for recovery from possible server failure, the space is reclaimed. Database could be recovered only to the end of a backup and the changes

since the most recent backup are unprotected. Therefore, under the simple recovery model, the backup intervals should be short enough to prevent the loss of significant amounts of data.

The full recovery and bulk-logged recovery models provide greater protection for data than simple recovery. These recovery models rely on backing up the transaction log to provide complete recoverability and to prevent work loss in the broadest range of failure scenarios.

- **Full recovery model:** This model fully logs all transactions and retains all the transaction log records until after they are backed up. No work is lost due to a misplaced or damaged data file. The database in full recovery model can be recovered to an arbitrary point in time, assuming that the tail of the log has been backed up after the failure. If the tail of the log is damaged, changes since the most recent log backup must be redone.

Use the full recovery model when your database contains critical information, and you must be able to recover all the data and you must be able to restore a database to a specific point in time in the past.

- **Bulk-logged recovery model:** This model reduces log space usage by using minimal logging for most bulk operations, such as index creation and bulk loads, while fully logging other transactions. Bulk-logged recovery increases performance for bulk operations and is intended to be used a supplement to the full recovery model. The bulk-logged recovery model supports all forms of recovery, though with some restrictions. If the log is damaged or bulk-logged operations occurred since the most recent log backup, changes since the last backup must be redone. Otherwise, no work is lost. Database in Bulk-logged recovery model could be recovered to the end of any backup. Point-in-time recovery is not supported.

## How to Create a Microsoft SQL Server Backup Set in Asigra DS-User

### I. “Microsoft SQL Server” kind of backup set

The following is the steps to create a Full database dump SQL backup sets:

1. In Asigra DS-User, click Sets > New Backup Set > Select ‘Microsoft SQL Server’ in the window of ‘Choose the kind of backup set’ > select the backup source machine in the window of ‘Select a Microsoft SQL Server to backup.’ and click next
2. ‘Ask for Network Credentials’ and input credentials which has rights to backup the source databases and click next

3. Select the dump path which SQL server is going to dump the database in the screen of ‘Select share & path for the database dump’, make sure the location selected is large enough to hold the database dump and click next
4. Select the database to be protected from the list in the screen of ‘Choose the database(s) to backup’, multiple database or the whole server could be added to the backup set and click next
5. In the screen of ‘Specify backup item options:’ the options of ‘Run DBCC before backup’, ‘Backup Transaction Log’ and ‘Stop on DBCC errors’ will be displayed and click next
6. In the screen of ‘Choose a retention rule for this backup set’ a retention rule could be set up according to the retention policy and click next
7. in the screen of ‘Specify backup set options’ you can specify the ‘Database backup policy and you can choose ‘Full dump always’, ‘Full dump + differential backup’ or ‘Full dump + incremental backup’ and other options (we will discuss them in detail in the rest of the whitepaper) and click next
8. In this screen notification options could be specified and click next
9. In this screen backup schedule could be specified for this backup set and click next
10. In the last screen of the wizard you can specify the backup set type information and click ‘Finish’ and the backup will be created.

### II. “VSS-Aware Backup Set” kind of backup set

The following are the steps to create a full database dump VSS-Aware SQL backup sets:

11. In Asigra DS-User, click Sets > New Backup Set > Select ‘VSS-Aware Backup Set’ in the window of ‘Choose the kind of backup set’ >select “Microsoft SQL Server in the windows of ‘Please select VSSAware Backup Set Type’> select the backup source machine in the window of ‘Select the computer’ and click next
12. ‘Ask for Network Credentials’ and input credentials which has rights to backup the source databases and click next
13. Select database(s) to be backed up in the screen of ‘Please select components for backup’. Multiple databases or the whole server could be added to the backup set and click next
14. In the screen of ‘Specify backup item options:’ the options of ‘Backup permissions’, ‘Backup Streams’ will be displayed and click next
15. In the screen of ‘Specify backup set options’ you can specify

the 'Database backup policy and you can choose 'Full dump always 'or 'Full dump + differential backup' and other options (we will discuss them in detail in the rest of the whitepaper) and click next

16. In this screen notification options could be specified and click next
17. In the screen of 'Choose a retention rule for this backup set' a retention rule could be set up according to the retention policy and click next
18. In this screen backup schedule could be specified for this backup set and click next
19. In the last screen of the wizard you can specify the backup set type information and click 'Finish' and the backup will be created.

## Asigra DS-Client Microsoft SQL Server Backup Strategies

Asigra DS-Client greatly simplifies the backup and restore operation as well as managing the backup process. For any deployment, we recommend that you must balance business recovery requirements and available resources to define the right backup strategy for you.

### Asigra DS-Client provides two types of backup policy for databases in simple recovery model:

The simple recovery model provides the simplest form of backup and restore. Backup is easy to manage because the transaction log is never backed up. However, if there are no log backups, a database can be restored only to the end of the most recent backup of the data. If a failure were to occur, updates that are made after the most recent backup of the data are lost.

Asigra DS-Client provides full database and differential backup for the databases in the simple recovery model. The backup set could be configured with option of "Backup Transaction Log"; however when the backup runs, Asigra DS-Client automatically detects the backup source database recovery model is simple and will skip the instructions of backing up transaction log.

### Full Database Dump Always

A full database dump backup backs up the whole database. This includes part of the transaction log so that the full database backup can be recovered. Full database dump backups represent the database at the time the backup finished.

Under the simple recovery model, after each backup, the database

is exposed to potential work loss if a disaster were to occur. The work-loss exposure increases with each update until the next full backup, when the workloss exposure returns to zero and a new cycle of work-loss exposure starts. For example the backup is schedule daily at 8:00PM, work-loss exposure increases over time between 8:00PM on day 1 and 8:00PM on day 2.

At the first backup (or one database is newly added to the backup set), Asigra DS-Client instructs SQL Server to dump the database configured in the backup to the specified dump location configured in the backup set, and then Asigra DS-Client send the whole compressed databases to Asigra DS-System. In the following backup, SQL Server will still dump all the database contents (full dump) and Asigra DS-Client will perform delta processing so only compressed delta (changed data blocks) is being sent over to Asigra DS-System. For a small database that can be backed up quickly, the best practice is to use full database backups. However, as a database becomes larger, full backups take more time to finish and require more storage space. Therefore, for a large database, you might want to supplement full database dump backups with differential backups.

### Full Database Dump Plus Differential Backup

A differential database backup records only the data that has changed since the last full database backup. This full backup is called the differential base. Differential database backups are smaller and faster than full database backups. For large databases, differential backups can occur at shorter intervals than database backups. This reduces the work-loss exposure. Differential database backups are especially useful if a subset of a database is modified more frequently than the rest of the database. In these cases, differential database backups enable you back up frequently without the overhead of full database backups.

At the first backup (or one database is newly added to the backup set), Asigra DS-Client instructs SQL Server to dump the database configured in the backup to the specified dump location configured in the backup set, and then Asigra DS-Client send the whole compressed databases to Asigra DS-System. In the following backup, SQL Server will only dump the changed database contents and Asigra DS-Client will still perform delta processing to eliminate same blocks comparing to the last backup (if any) so only compressed delta are being sent over to Asigra DS-System. Under the simple recovery model, after each backup, the database is exposed to potential work loss if a disaster were to occur. The work-loss exposure increases with each update until the next differential backup, when the workloss exposure returns to

zero and a new cycle of workloss exposure starts.

Asigra DS-Client reduces the complexity of maintaining the differential base of the protected databases. If a protected database has a new differential base, then Asigra will do a full a dump for this database again and create a differential base so the next backup will be differential backup again. For large databases, a full database backup requires longer time. To save time, you can follow a full database backup with a series of differential backups. Each successive differential database backup is larger than its predecessor, requiring more backup time, space, and restore time. Therefore, we recommend that you take a new full backup at an appropriate interval to provide a new differential base.

**In the following scenarios, a new differential base backup will be created instead of differential backup:**

1. If another backup is performed, not by the same backup set in this specific Asigra DS-Client.
2. Asigra DS-Client will create a new differential base according to the Asigra DS-Client Advanced Parameter: MaxGenerations. By default, the value is 10 and it means every 10th backup, Asigra DS-Client will automatically create a new differential base. For example a backup set is set to protect 30 generations: every 10th generation (MaxGenerations), a new differential base backup will be created. Please be noted MaxGenerations is an Asigra DS-Client global parameter and can affect the entire backup sets in one Asigra DS-Client.
3. When the number of generation configured in the backup set is reached, or when a new master file has been recreated to avoid the master/delta chain being too long. For example, a backup set is configured to protect 7 generations. When the 8th generation happens, a full dump will be created.
4. The database is restored.

As a best practice, when you use differential database backups, we recommend the following guidelines: backup should be scheduled at an interval that makes sure that your differential backups do not become too large.

**Asigra DS-Client provides four types of backup policy for databases in Full and Bulk-logged recovery model:**

The full recovery model uses log backups to prevent data loss in the broadest range of failure scenarios, and backing and restoring the transaction log (log backups) is required. The advantage of using log backups is that they let you restore a database to any point of time that is contained within a log backup (point-in-time recovery). You can use a series of log backups to roll a database

forward to any point in time that is contained in one of the log backups. Be aware in order to minimize your restore time, Asigra DS-Client always restore the database to the point of time when the backup finishes running. If you want to restore the a point of time that is contained within a log backup, then the databases have to be restored as files first by Asigra DS-Client and then the database can be loaded to SQL Server and the log could be rolled forward using Transaction-SQL manually.

Assuming you can back up the active log after a disaster occurs; you can restore the database up to the point of failure without data loss by restoring the database to the dump file and restore using T-SQL.

**Full Dump Always**

The option 'Backup Transaction Log' in the Asigra DS-Client also play an important role in SQL Server backup. Aside from permitting you to restore the backed-up transactions, a log backup truncates the log to remove the backed up log records from the log file. If you do not back up the log frequently enough, the log files can fill up.

**When the backup set is configured with the option 'Backup Transaction Log' disabled:**

At the first backup (or one database is newly added to the backup set), Asigra DS-Client instructs SQL Server to dump the database configured in the backup to the specified dump location configured in the backup set, and then Asigra DS-Client send the whole compressed databases to Asigra DS-System. In the following backup, SQL Server will always dump the full database contents and Asigra DS-Client will perform delta processing so only compressed delta (changed data blocks) are being send over to Asigra DS-System.

**When the backup set is configured with the option 'Backup Transaction Log' enabled:**

In every backup, SQL Server dumps the full database and then transaction log; and transaction log is being truncated. And Asigra DS-Client will send the first full backup compressed and transaction log to Asigra DS-System and in the following backup, Asigra DS-Client will perform delta processing and compression and only changed blocks and transaction logs will be sent to Asigra DS-System. Under this backup policy, restore to a point of time contained in the transaction log is possible; the databases and log files have to be restored as files first by Asigra DS-Client and then the database can be loaded to SQL Server and the log could be rolled forward using Transaction-SQL manually. If using this backup policy, an entire database could be re-created in one step from a full backup by restoring the database. If the database

already exists in the restore destination, the restore operation overwrites the existing database; if the database does not exist there, the restore operation creates it. The restored database matches the state of the database when the backup is completed, minus any uncommitted transactions. When the database is recovered, uncommitted transactions are rolled back.

## Full Dump + Differential Backup

Regardless of whether you have selected the option of 'Backup Transaction Log' or not, a new full base backup will be created instead of a differential backup:

1. If another backup is performed, not by the same backup set in this specific Asigra DS-Client.
2. Asigra DS-Client will create a new differential base according to the Asigra DS-Client Advanced Parameter: MaxGenerations. By default, the value is 10 and it means every 10th backup, Asigra DS-Client will automatically create a new differential base. For example a backup set is set to protect 30 generations: every 10th generation (MaxGenerations), a new differential base backup will be created. Please be noted MaxGenerations a Asigra DS-Client global parameter and affect the entire backup sets in one Asigra DS-Client.
3. If the generation configured in the backup set is reached or a new master file has to be recreated to avoid the master/delta chain being too long. For example, a backup set is configured to protect 7 generations. When the 8th generation happens, a full dump will be created.
4. The database is restored.

When the backup set is configured with the option 'Backup Transaction Log' disabled: Asigra DS-Client will perform a full dump of the databases selected for the first time backup, and then next backup will be incremental backup based on the last full backup Asigra DS-Client performed. The subsequent backup will be differential backup until a new differential base has been created.

When the backup set is configured with the option 'Backup transaction log' enabled, Asigra DS-Client performs a full backup (a new differential base is created) plus a transaction log backup and truncate the transaction log. In the subsequent backup, Asigra DS-Client will try to perform a different backup based on the previous differential base if possible, followed by a backup of the transaction logs and truncating the transaction log. Backup the transaction log helps prevent filling up the disk.

When performs restoring database, internally Asigra DS-Client will manage to restore the most recent base backup and apply

the differential backup (if necessary). This automatic process is transparent to the user.

Under this backup policy, restore to a point of time contained in the transaction log is possible; the databases and log files have to be restored as files first by Asigra DS-Client and then database could be loaded to SQL Server and log could be rolled forward using Transaction-SQL manually.

## Full Dump + Incremental Backup

Under this backup policy, at the first backup (or databases is newly added to the backup set), Asigra DS-Client instructs SQL Server to dump the full database to be protected to dump location configured in the backup set and Asigra DS-Client will send the whole compressed databases and transaction log to Asigra DS-System, followed by truncating the transaction log. In the following backup, SQL Server will only dump the transaction log files for the period between the last full/ incremental backup and current incremental backup, and Asigra DS-Client performs delta processing so only compressed unduplicated log files are being transmitted to Asigra DS-System.

### In the following scenarios, a new full backup will be created instead of incremental backup:

1. If another backup is performed, not by the same backup set in this specific Asigra DS-Client.
2. Asigra DS-Client will create a new differential base according to the Asigra DS-Client Advanced Parameter: MaxGenerations. By default, the value is 10 and it means every 10th backup, Asigra DS-Client will automatically create a new differential base. For example a backup set is set to protect 30 generations: every 10th generation (MaxGenerations), a new differential base backup will be created. Please be noted MaxGenerations a Asigra DS-Client global parameter and affect the entire backup sets in one Asigra DS-Client.
3. If the generation configured in the backup set is reached or a new master file has to be recreated to avoid the master/delta chain being too long. For example, a backup set is configured to protect 7 generations. When the 8th generation happens, a full dump will be created.
4. The database is restored.

Incremental log backups generally use fewer resources than full backups. As a result, you can create them more frequently than full backups, reducing your risk of losing data. Please note that the incremental backup schedule is also governed by the parameter MaxGenerations. By default the value is 10, which mean every 10th backup, the backup is going to be a full dump plus a

transaction log file. Take this into consideration and schedule the full dump will happen only when your environment allows.

With incremental backups, you can recover the database to the point of failure or to a specific point in time; the databases and log files have to be restored as files first by Asigra DS-Client and then the database could be loaded to SQL Server and the log could be rolled forward using Transaction-SQL manually.

Note: In this backup set type, the configuration of option 'Backup Transaction Log' will be ignored because the transaction log is always being backed up.

### On Demand Tail-Log Backup

This backup is only available for on-demand backup. In most cases, under the full or bulk-logged recovery models, SQL Server 2005 and later versions require that you back up the tail of the log to capture the log records that have not yet been backed up when emergency situation appears. A log backup taken of the tail of the log just before a restore operation is called a tail-log backup.

SQL Server 2005 and later versions usually require that you take a tail-log backup before you start to restore a database. The tail-log backup prevents work loss and keeps the log chain intact. When you are recovering a database to the point of a failure, the tail-log backup is the last backup of interest in the recovery plan. If you cannot back up the tail of the log, you can recover a database only to the end of the last backup that was created before the failure.

Not all restore scenarios require a tail-log backup. You do not have to have a tail-log backup if the recovery point is contained in an earlier log backup, or if you are moving or replacing (overwriting) the database and do not need to restore it to a point of time after the most recent backup. Also, if the log files are damaged and a tail-log backup cannot be created, you must restore the database without using a tail-log backup. Any transactions committed after the latest log backup are lost.

In order to perform a restore, the databases and log files have to be restored as files first by Asigra DS-Client and then database could be loaded to SQL Server and log could be rolled forward using Transaction-SQL manually.

### Additional Microsoft SQL Server Backup Considerations

Always back up the system databases (master and msdb) on a regular basis and at times when alterations of system-level information for Microsoft SQL Server are performed. Also back up the model database if it is modified. Asigra recommend you do backups of the system databases daily because they are unlikely to become large enough to consume a significant amount of resources during the backup operation.

The same recommendation applies to the distribution database in replicate Microsoft SQL Server environments. You cannot back up the tempdb database. It is re-created each time the SQL each time the SQL Server is started.

Regardless of the frequency of database backups, Asigra highly recommends you always run DBCC Checkdb on a database immediately before backing it up to check the logical and physical consistency of the database. See your Microsoft SQL Server documentation for more information about using the Microsoft SQL Server database consistency checker.

Microsoft SQL Server 2005 has several components apart from the database engine. For some components, the configuration data is not stored inside a SQL Server database, or a database backup alone is not sufficient to provide the necessary recoverability capabilities for the component.

### Defining a MSSQL Backup Set

**In Asigra DS-Client, you have to define a SQL backup set includes:**

- What database are you going to protect? Sometimes you only need to protect certain databases instead of the whole database engine; The number of generations is the number of backup versions DS-Client tries to keep. If backup runs daily and in the backup set we define generation is 7, then the earliest restore point is a 7 days ago.
- How many generations the backup should protect, this will decide the life time of the backup data staying on the Asigra DS-System online storage
- Retention policy: retention policy also provide a rule to decide what a certain time point, what backed up data should be kept, or should be deleted or archived to Asigra BLM archiver
- Backup schedule: it defines how often the backup set should run.
- Database connectivity between Asigra DS-Client and MSSQL Server: the backup set should be configured with a backup user with Windows Administrator level privileges. The SQL logon user or Windows user name must be added to the Microsoft SQL Server SYSADMIN fixed server role

Other options such as local cache and local storage: local cache allows backup continues and sends data to a local storage buffer while Asigra DS-System is not available. And local storage will save generations at the local storage space for certain of period to enable fast restore; restore will reads data from storage on the LAN instead of WAN and it greatly reduce the time of the restore window.

## Restore a Point of Time Contained in the Transaction Log

In order to restore to the point of time contained in the transaction log, all the backup file should be restored as individual files and from SQL management studio we can restore the full dump and if applicable, the differential dump and all the log files, and we can use Transaction SQL to restore the dump and apply the log with STOPAT options.

Commencing from SQL 2005, Microsoft doesn't support SQL backup through pipe due to security reasons; thus the databases must be dumped to the physical disk first then Asigra DS-Client will process the dump files. The dump location could be on the SQL Server itself or a dump location on the LAN which SQL Server service account must need has right to write. Thus service account such as NetworkService or LocalSystem won't be able to write to a remote UNC location.

## Other Considerations

- Multiple SQL Servers on same machine: If multiple instances of Microsoft SQL Server are running, Asigra DS-client will list all the instances during them creation of the backup set.
- SQL Server listening on a non-default port: In this scenario, SQL browser service is required to be running during the backup.

Should you have any further questions please contact us at [info@asigra.com](mailto:info@asigra.com) or speak with your dedicated Asigra Sales Manager.

---

## About Asigra

Trusted since 1986, Asigra provides organizations around the world the ability to recover their data now from anywhere through a global network of partners who deliver cloud backup and recovery services as public, private and/or hybrid deployments. As the industry's first enterprise agentless cloud-based recovery software to provide data backup and recovery of servers, virtual machines, endpoint devices, databases and applications, SaaS and IaaS based applications, Asigra lowers the total cost of ownership, reduces recovery time objectives, eliminates silos of backup data by providing a single consolidated repository, and provides 100% recovery assurance. Asigra's revolutionary patented Recovery License Model provides organizations with a cost effective data recovery business model unlike any other offered in the storage market. Asigra has been recognized as a Gartner Cool Vendor and has been included in the Gartner Magic Quadrant for Enterprise Backup and Recovery Software since 2010.

More information on Asigra can be found at [www.recoveryiseverything.com](http://www.recoveryiseverything.com)

