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How do you create an image of the operating systems during operation?

http://support.automation.siemens.com/WW/view/en/56897157

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Contents

1 Introduction

This document shows you a solution for creating a disk image while the system is in operation.

It also includes instructions for configuration using the following Symantec products.

- Symantec System Recovery 2013
  Version 11.0.2.49853

This software can be procured from the manufacturer at

http://www.symantec.com.

WARNING **Please note that we do not give any warranty for the functioning of the procedure described in this entry, nor do we assume any liability for any faults that might arise when using the Symantec software or the software of any other provider.**

Please also note the system requirements of the backup software used.

Limitation

This document is not a substitute for the manual supplied with the backup software used.

The use of system recovery tools is not a substitute for the PCS 7 redundancy concept or for the provision of an uninterruptible power supply (UPS) required by a process control system.

This document deals only with the backup of the operating system and installed software. The backup of project data is done in the SIMATIC Manager using the "Archive" function.

Validity

Tested with SIMATIC PCS 7 V8.0 SP1.

2 General Information

2.1 Hard Disk Image

Using the appropriate software you can create a 1:1 image of hard disks or single partitions. In the case of an error you can quickly restore the system by playing back this image (Bare Metal Restore). The disadvantage here is that the backup can only be made on systems which have practically identical hardware.

In the meantime there are also solutions available which enable an incremental procedure. In this case, the complete hard disk or partition is imaged with the first backup. Each subsequent backup saves only the changes. This sort of backup procedure is necessary in particular when the system is continuously changed by an automatic update function, for example.

WARNING **Some manufacturers enable backup of the system partition on changed hardware or a virtual conversion. This procedure is not enabled for PCS 7.**

2.2 System Configuration

When using system recovery tools, it is recommended to separate the operating system with installed software and the PCS 7 project data at drive level.

For example:

- Drive C: Operating system and PCS 7 installation
- Drive D: Multiproject (ES) or OS project (server/client)

WARNING **PCS 7 OS does not support saving or backup of runtime data (Alarm Logging, Tag Logging). It is mandatory to have a redundant configuration of the OS server or OS single station in order to keep the runtime data of PCS 7 consistent even if the server fails.**

2.3 System Compatibility

The procedure described in this document has been tested in the following environment:

Hardware

- With redundant OS server IPC 847C
- Engineering Station IPC 847C
- OS client IPC 647C
- 100 Mbit network

Software

- PCS 7 V8.0 SP 1

Load

- Approx. 1,000 trend values / sec / server
- Approx. 1,000 OPC DA accesses / sec
- Approx. 10 messages / sec / server
- OS client screen changes every 30 sec (10 clients)

3 Introduction of a Disaster Recovery Plan (DRP)

3.1 Introduction of a DRP in a New Plant

In the case of new plants requiring a DRP, consideration should be given to possible scenarios throughout the life cycle of the plant, from design to configuration to operation.

The DRP should monitor and document the possible failure scenarios as a separate accompanying work package.

Configuration

- Backup frequency
- Backup schedule
- Number of images (number of restore instances)
- Central or local storage of the images (access rights)
- Creation, testing and storage of the recovery disk (boot CD / DVD)
- Coordinated backup of project data and images

Runtime

- Performance of the plant during image creation
- Performance of the network with central storage of the images

With FAT / SAT it is absolutely necessary to test the image creation in order to determine the load of the plant during image creation.

3.2 Introduction of a DRP in an Existing Plant

The criteria for introducing a DRP in new plant apply to their full extent for introducing a DRP in an existing plant.

However, introducing a DRP in an existing plant is a lot more complex than with a new plant. Tests for failure and restoring, and performance measuring can only be made to a limited extent on running plant

4 Hardware Environment

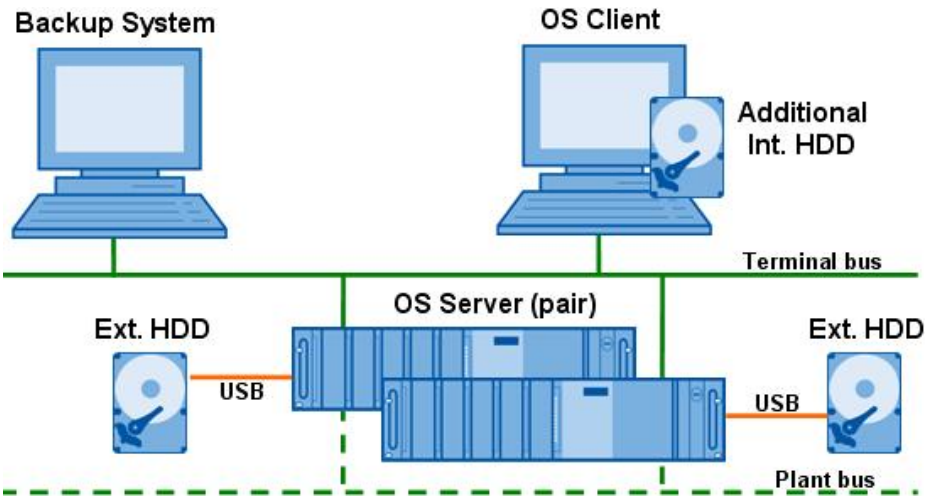
4.1 Local Backup

You have the option of storing the image of the system partition locally on the computer. This can be an existing drive, an additionally installed internal data memory or a data memory connected by USB or eSATA.

WARNING **When backing up the system partition there is a great deal of reading and writing. We recommend using an additional hard disk; an additional partition is not sufficient.**

When using external drives make sure that they are available at the time of the backup.

Figure 4-1



Advantages

- Low loading of the terminal bus
- Low additional hardware costs

Disadvantages

- System images are not stored centrally
- No access to local data media if the hardware fails
- External memories must always be available

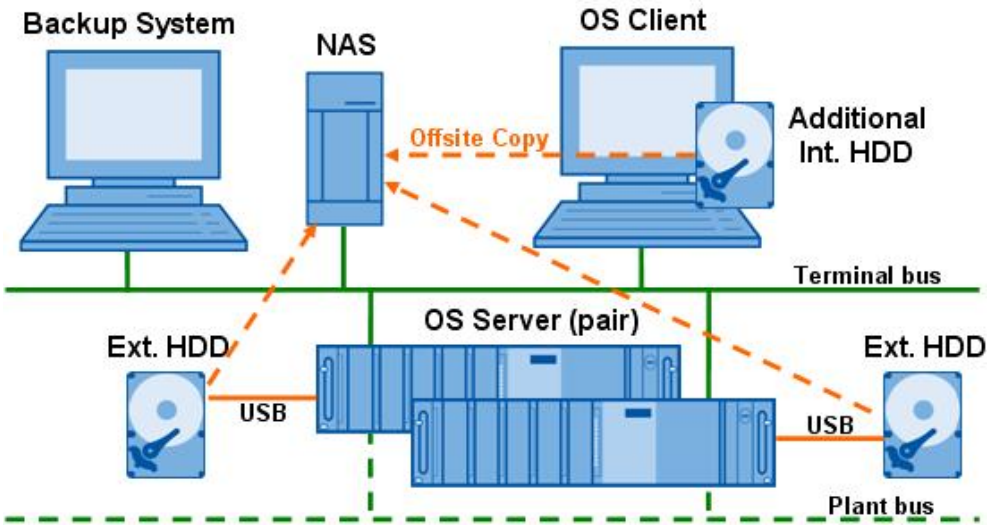
WARNING **If a backup is made on the partition on which the PCS 7 archives are configured, you must make sure that there is sufficient memory available.**

4.2 Local Backup and Central Storage

In order to be able to restore the system if there is a hardware failure, the local backup must also be on a data media that is available in such a case.

Some backup systems offer an option here of creating an off-site copy. Once a backup has been made it is copied automatically to one or more storage media.

Figure 4-2



Note With this sort of system backup there is a temporary high data transfer load on the terminal bus. If the offsite copy is made, there might be display delays on the OS client.

Advantages

- Local backup takes less time
- Central storage of the system images on a network drive or an FTP server (NAS, for example)
- High data security if the PC hardware fails

Disadvantages

- High network and computer loading during the offsite copying

4.3 Backup via the Terminal Bus

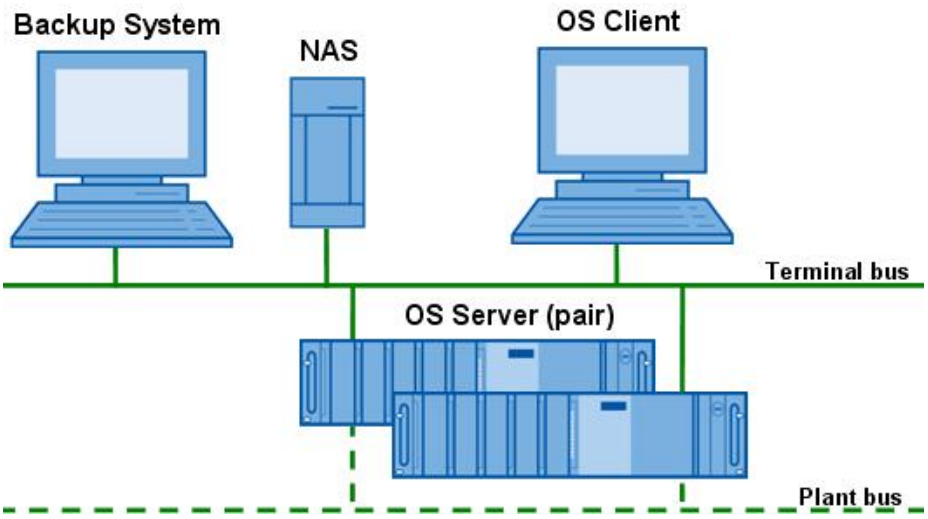
Data backup via the available network is practical for storing all the system images centrally at one location. The backup system itself can be the storage location; alternatively it can be a network storage facility (NAS – Network Attached Storage). Another advantage of this method in addition to the central storage is the possibility of simply configuring data backup in the form of a RAID system.

Note

With this sort of system backup there is a high data transfer load on the terminal bus. When the system backup is made, there might be display delays on the OS client.

When using this configuration we recommend operating the terminal bus with a 1-Gbit network.

Figure 4-3



Advantages

- Central storage of the system images on a computer or NAS
- Simple integration of data security through a RAID system
- Low additional hardware costs
-

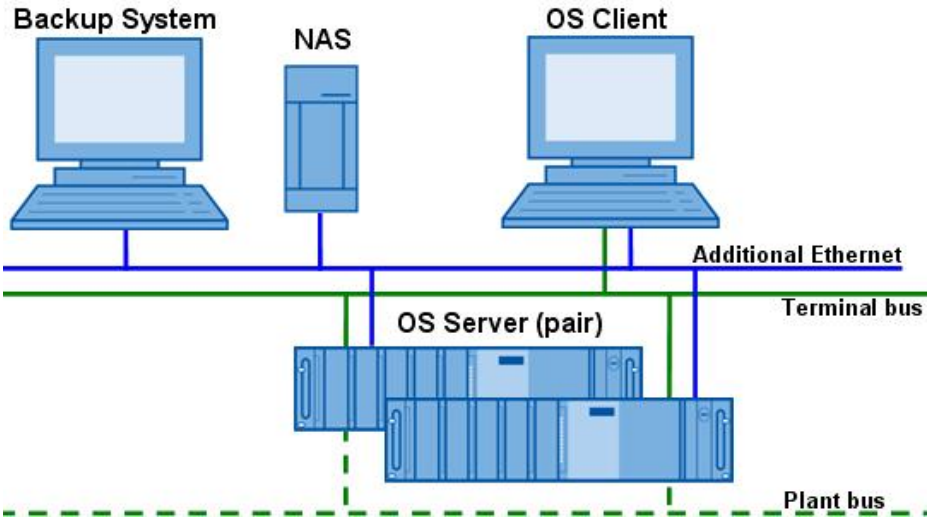
Disadvantages

- High loading of the terminal bus (possibly increased image opening times during backup).
- During restore with the Symantec Restore DVD it must be possible to access the network. It might be necessary to create an appropriate computer-specific Restore DVD.
  Instructions are available in the Symantec documentation and in section 5.1.

4.4 Backup via an Additional Network

In order to compensate the disadvantage of increased bus load, you have the option of installing an additional network. However, this requires additional network adapters, cables and network distributors for all the OS stations.

Figure 4-4



Advantages

- Central storage of the system images on a computer or NAS
- Simple integration of data security through a RAID system
- No loading of the terminal bus

Disadvantages

- More hardware to install (additional network adapters, cables and network distributors are necessary)
- Additional administration required for the network
- During restore with the Symantec Restore DVD it must be possible to access the network. It might be necessary to create an appropriate computer-specific Restore DVD.
  Instructions are available in the Symantec documentation and in section 5.1.

4.5 Installation of Symantec System Recovery 2013

It is only necessary to make a full installation on the backup server. Install the software according to the Symantec instructions on a dedicated system.

In order to make a remote backup of a system it is necessary to install the Symantec System Recovery Agent on the target computer. This can be installed through the basic setup or installed on the target computer by the backup server using the "Implement Agent" function.

Note

Please note that the settings of a firewall might hinder installation and connection via the network. Refer to the description of Symantec to see which ports and programs have to be configured in the firewall for operating the backup software.

WARNING

You must restart the system after installing the "Backup and Recovery Service".

If the OS server does not have a redundant configuration there might be gaps in the alarm logging and tag logging.

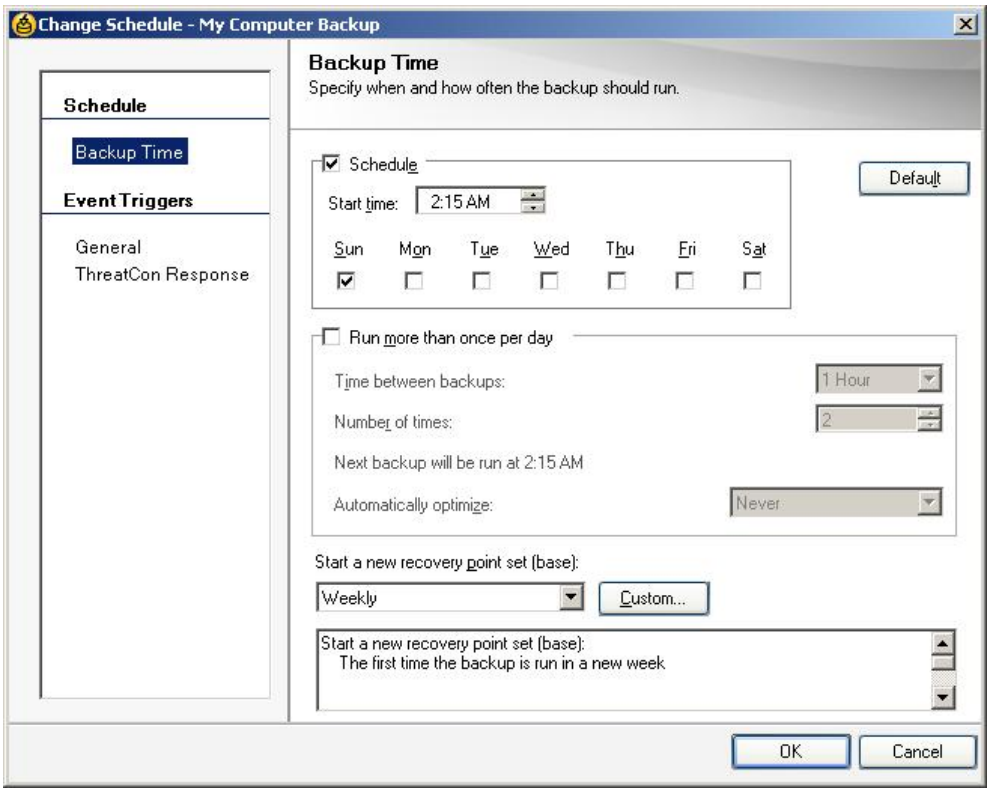
4.6 Recommendations for Time Settings

Image creation during operation increases the load on the system. In order to minimize this load it is necessary to split the image creation times. Symantec System Recovery 2013 enables you to distribute backup jobs as required.

Note the following points when configuring the backups:

- Always just 1 backup at a time
- Schedule a time buffer to avoid overlapping
- Configure by preference at times of low operation
- Do not start any backups during archive exporting to the CAS
- We recommend that you do not make a backup on the Engineering Station during compilation or downloading.

Figure 4-5



Note You can make these settings separately for each computer requiring backup.

Note Please note that the settings of a firewall might hinder installation and connection via the network. Refer to the description of Symantec to see which ports and programs have to be configured in the firewall for operating the backup software.

4.7 Recommendations for Configuration Settings

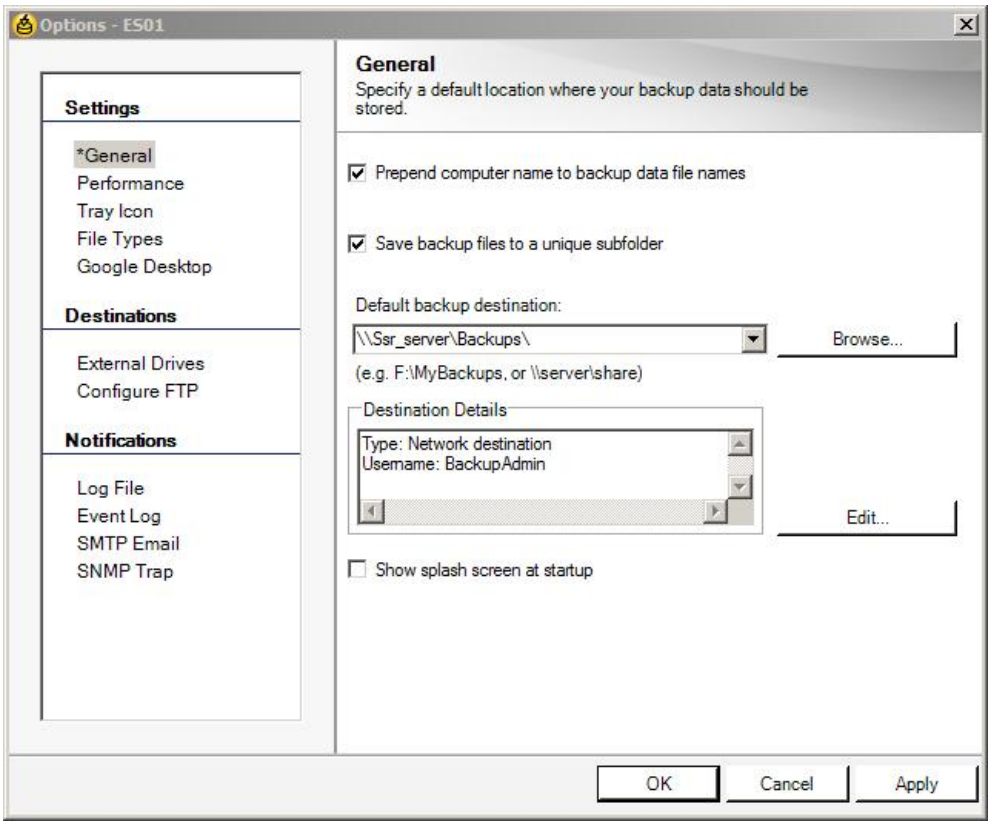
We recommend making the following settings:

- "Drive-based Backup"
  Backup of an entire drive. Backup and restoring of the computer (system drive, usually drive C).
- "Check restoring point after creation"
- "Prepend computer name to backup data file names"
  This option is very useful when backing up more than one computer on the same driver.
- "Save backup files to a unique subfolder"
  The new subfolder receives the same name as your computer.
- "Default backup destination" with associated logon data.
- Disable "Show splash screen at startup" (OS client)
  A message is displayed when creating the image. Disable this option so as not to distract the operator.

You can also set the options below as required:

- Compression levels for drive-based backups.
- Use password
- Use AES encryption

Figure 4-6



Since only the system partition (C:\) is to be backed up, all the other partitions should be excluded from the monitoring, otherwise the status of all stations would always be "At Risk".

4.8 Recommendations for Performance Settings

You can make settings that affect the computer performance and network loading during system backup.

Note You can make these settings separately for each computer requiring backup.

In order to ensure secure operation of PCS 7 you should not set the system load too high through the backup.

Basically the following holds:

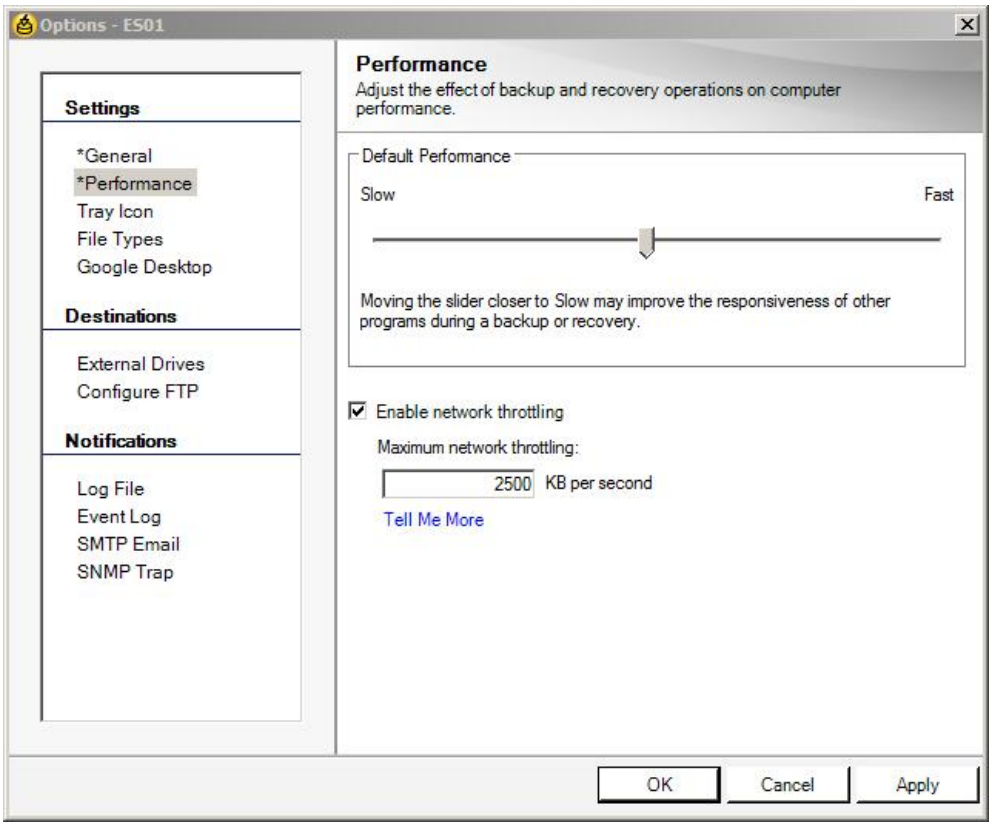
- Fast backup – high system load
- Slow backup – lower system load

The performance setting always reflects the balance between additional load on the PCS 7 system and the time taken for creating an image. We recommend to set the speed to not more than 50%.

If you make backups via the terminal bus, you should keep the network load as low as possible. For this case, Symantec provides a throttling option for the network.

Enable the throttling option and enter the value of 2500 KB/s for maximum network throttling.

Figure 4-7



5 Restore with Symantec System Recovery 2013

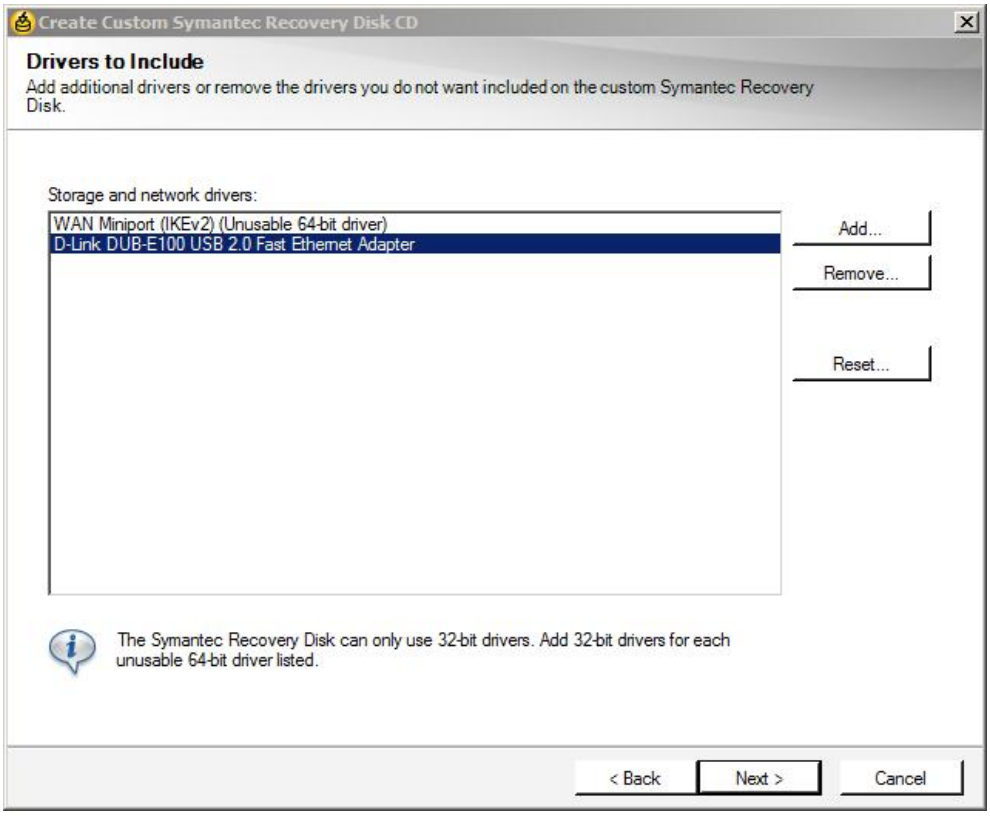
5.1 Recovery CD

In order to be able to recover the system in an emergency, you need a bootable recovery CD. For this case Symantec provides the prepared Symantec System Recovery Disk. This starts the computer with a simplified Windows system in a recovery environment.

However, it is recommended to create a user-defined Symantec System Recovery Disk in order to prevent driver incompatibilities. A user-defined Symantec System Recovery Disk contains the drivers of the current network and the storage devices of your computer. It helps to ensure that you can access the recovery points in the case of an emergency which are required to restore your computer.

Proceed as follows to create the recovery CD: Start "Tasks > Create user-defined recovery disk" and follow the instructions. Then you need the recovery disk provided by Symantec and drivers to be incorporated in your system.

Figure 5-1



5.2 Restore

In order to make a backup of the system image you start the computer using the recovery CD.

Change the network settings as required and configure the storage path of the backup file as network drive. Start the backup.

After successful backup of the system you still have to transfer the project data from the ES to the target system.

Note A backup is made always of the status of the system when the backup is created. If changes are made after this point in time, by the Windows Update Service or automatic updating of the anti-virus software, for example, then you have to run these updates again.

WARNING **Microsoft SQL saves management data for SQL servers on the system partition. If an image is backed up on a PC station, the management data and any old project data is not consistent. Then you must clear the old management data using Microsoft SQL Server Management Studio.**

5.3 Clear Management Data of Microsoft SQL

If the OS project is open or in Runtime when the image is created, the management data must be cleared in the Microsoft SQL server after the restore. You do this using the Microsoft SQL Server Management Studio.

WARNING It is not possible to start Runtime or a download of the OS project without management data clearance.

NOTE You will find information about the execution of SQL statements and SQL scripts in the help of Microsoft SQL Server Management Studio and at

http://www.microsoft.com

You must use "DROP" to separate databases that are in the RECOVERY PENDING state.

You can use "DETACH" to separate all other PCS 7 databases.

You can use the query below to determine which databases are in the RECOVERY PENDING state.

```
SELECT * from sys.databases WHERE state_desc = 'Recovery_Pending'
```

You must separate all the databases that have the following properties.

- Begin with "CC" or *ALG*
- Include *TLG* in the database name

Attached is a script that separates all the PCS 7 databases in the MS SQL after restore. You can execute the script in an SQL window.

```
DECLARE @Database nvarchar(max)
DECLARE @Sql NVARCHAR(max)

DECLARE cursorDatabaseRP CURSOR FOR select name from sys.databases
WHERE state_desc = 'Recovery_Pending'
DECLARE cursorDatabaseCC CURSOR FOR select name from sys.databases
WHERE name like 'CC%'
DECLARE cursorDatabaseALG CURSOR FOR select name from sys.databases
WHERE name like '%ALG%'
DECLARE cursorDatabaseTLG CURSOR FOR select name from sys.databases
WHERE name like '%TLG%'



OPEN cursorDatabaseRP
```

```
OPEN cursorDatabaseCC
OPEN cursorDatabaseALG
OPEN cursorDatabaseTLG

-- Drop all ALG and TLG segments remaining from restore set to
'Recovery_Pending'
FETCH NEXT FROM cursorDatabaseRP INTO @database
WHILE @@FETCH_STATUS = 0
BEGIN
   IF @Database <> 'master' AND @Database <> 'model' AND  @Database
<> 'msdb' AND @Database <> 'tempdb'
   BEGIN
         SET @Sql = 'Drop Database [' + @Database + ']'
         print @Sql
         EXEC sp_executesql @Sql
   END
   --Drop database @Database
   FETCH NEXT FROM cursorDatabaseRP INTO @database
END

-- Detach CC Database
FETCH NEXT FROM cursorDatabaseCC INTO @database

WHILE @@FETCH_STATUS = 0
BEGIN
   IF @Database <> 'master' AND @Database <> 'model' AND  @Database
<> 'msdb' AND @Database <> 'tempdb'
   BEGIN
         SET @Sql = 'SP_DETACH_DB [' + @Database + ']'
         print @Sql
         EXEC sp_executesql @Sql
   END
   --Detach database @Database
   FETCH NEXT FROM cursorDatabaseCC INTO @database
END

-- Detach ALG Database
FETCH NEXT FROM cursorDatabaseALG INTO @database

WHILE @@FETCH_STATUS = 0
BEGIN
   IF @Database <> 'master' AND @Database <> 'model' AND  @Database
<> 'msdb' AND @Database <> 'tempdb'
   BEGIN
         SET @Sql = 'SP_DETACH_DB [' + @Database + ']'
         print @Sql
         EXEC sp_executesql @Sql
   END
```

```
   --Detach database @Database
   FETCH NEXT FROM cursorDatabaseALG INTO @database
END

-- Detach TLG Database
FETCH NEXT FROM cursorDatabaseTLG INTO @database

WHILE @@FETCH_STATUS = 0
BEGIN
   IF @Database <> 'master' AND @Database <> 'model' AND  @Database
<> 'msdb' AND @Database <> 'tempdb'
   BEGIN
         SET @Sql = 'SP_DETACH_DB [' + @Database + ']'
         print @Sql
         EXEC sp_executesql @Sql
   END
   --Detach database @Database
   FETCH NEXT FROM cursorDatabaseTLG INTO @database
END



CLOSE cursorDatabaseRP
CLOSE cursorDatabaseCC
CLOSE cursorDatabaseALG
CLOSE cursorDatabaseTLG

DEALLOCATE cursorDatabaseRP
DEALLOCATE cursorDatabaseCC
DEALLOCATE cursorDatabaseALG
DEALLOCATE cursorDatabaseTLG
```


Note In the case of redundant OS systems we recommend that after restore you delete the project data on the OS before doing the download. After downloading and start there is automatic synchronization with the redundancy partner.

To ensure consistency of the project status, after successful backup of the system you have to transfer the project data from the ES to the target system (download).

Special features of the domain environment

In order to be able to participate in a domain, each domain computer must negotiate a trust token with the domain controller. This token is updated by default every 30 days. You can change this period which is designated as Secure Channel Trust. However, a trust token in a recovery point is not updated automatically by the domain controller. Therefore, when a computer is recovered by a recovery point that contains an old token, the recovered computer cannot participate in the domain until it is assigned again to the domain by someone with the appropriate authorization.

Details are available in the Symantec documentation or in the Symantec White Paper.