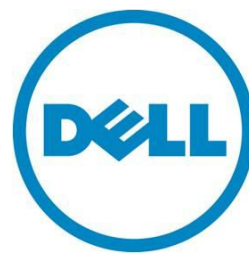


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# Disaster Recovery Solution for Windows™ Based Appliances

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## Executive summary

This whitepaper explains the methodology of using SD cards placed into the Internal Dual SD Module (IDSM) slots on PowerEdge servers containing a hidden WinRE partition as a disaster recovery solution for windows based appliances in the event of catastrophic hardware or software failure. It is the hope of the authors this solution be accepted as a Disaster Recovery behavior within Dell for all Windows based appliances using the PowerEdge line of servers which support SD card(s) at boot.

This paper defines the recovery process used for the solution. This document also gives examples of the process, and coding techniques to create an appliance disaster recovery solution using SD cards in a redundant configuration to aid in the restoration of appliance operation due to a disaster which has caused the loss of data, or the need to revert the affected appliance to a factory default state.

## The Appliance Concept

A computer appliance can easily be defined as a separate and discrete hardware device with integrated software which is closed and sealed, and generally considered not serviceable by the owner. An appliance contains hardware and software pre-integrated and pre-configured in the factory before delivery to a customer. This type of solution is considered turn-key. With this definition in mind it is important to consider the ability of an appliance to be rolled back to factory default with minimal vendor interaction.

Disaster Recovery (DR) ties directly into Business Continuity (BC) and plays a key role in business decisions concerning information technology spending. When developing solutions designed to supply a specific resource customized to a customer's environment, it is of utmost importance these solutions have the ability to be reset to factory default quickly and easily to speed time to recovery for businesses in the event of a disaster.

The appliance described in this document relates to the Quickstart Data Warehousing Appliance 1000 and 2000 as a platform for Business Intelligence (BI). Data Warehouse and BI at the most basic level is the ability for an organization to collect, maintain, and organize knowledge. This knowledge is transformed from data into opportunities by implementing an effective strategy. The goal of business intelligence is to support better business decision-making, and the decision makers want to know their tools are available to aid in the decision making process. Requiring a business to wait days or even weeks to bring a solution back online when it has such great significance on business strategy does not lend itself to creating credibility with customers.

To follow industry practices for appliance based solutions a solution has been developed tested, and put into place which reduces the time required to restore a Windows based appliance to its factory default state. This in turn reduces the time to recovery of the appliance to full and operational state. This solution does not require the shipment of new hardware or OS media to the customer unless there is a component failure that needs to be replaced or an on-site technician, requiring minimal vendor interaction.

## Introduction

In a disaster which has created a state where the appliance will not function correctly, or the need arises to revert the appliance back to factory defaults, the customer can follow a simple procedure, guided by a Dell ProSupport professional, which will destroy all data on the disks connected to the PERC controller in the appliance and reinstall the default appliance image back onto these disks. **This solution is a destructive restoration of the factory appliance image on the internal hard drives. It is located on an internal Dual SD card Module (IDSM).. This is not a means of restoring customer data to the appliance, only the operating system factory image and storage RAID configuration.**

## Recovery Steps

1. Selecting Factory Restore from Boot menu or by pressing F11 and selecting the SD
2. The system boots to the hidden partition on the SD card
3. The system boots to WinPE from the SD recovery partition.
4. The recovery script runs which overwrites any configuration on the PERC.
5. The default appliance image is restored.
6. The system boots into Windows.

At this point, the appliance is restored back to factory state. The appliance is now ready to begin initial setup.

On first boot, License Agreements (EULA) needs to be accepted and administrator passwords set.

The Quickstart Data Warehouse Appliance ships with a user interface (UI) that simplifies the final steps of installation of SQL Server at the customer site. Some of the steps that are required:

7. After Domain credentials are supplied, the appliance is restarted and joins the customer domain. SQL Server installation completes after the user logs in as a domain administrator.
8. At completion of the SQL Server installation, Boomi installation begins.
9. After completion of the Boomi installation, Boomi has a separate process to restore the ATOM back to the customer device.

Customer customized SQL data and operating system file restoration is not within the scope of this solution and it is the responsibility of the customer to have a validated restorable backup file containing the customized customer data..

## Appliance Configuration

The following section describes the hardware configuration used to test the solution in this document. Table 1 contains the reference information used as the base hardware configuration of the appliance, including the disk and RAID level configuration. This information is required when utilizing the LSI MegaCLI script to configure the disk geometry on the PERC controller.

**Table 1. Hardware Configuration**

Component	Description
Platform	PowerEdge 720XD
Memory	192GB
Number of HDD Units	26
HDD Unit Size	900GB
PERC	H710P mini
OS Disk Configuration	2 HDD (RAID 1)
Data Disk Configuration	18 HDD (RAID 1)
State Disk Configuration	2 HDD (RAID 1)
Log Disk Configuration	4 HDD (RAID 10)

The following section describes the hardware configuration used to test the solution in this document. Table 2 contains the reference information used as the base software configuration of the appliance, including the disk numbers used to configure the disks and partitions. The partition on the SD card is hidden and referred to as a WinRE partition used for Windows recovery.

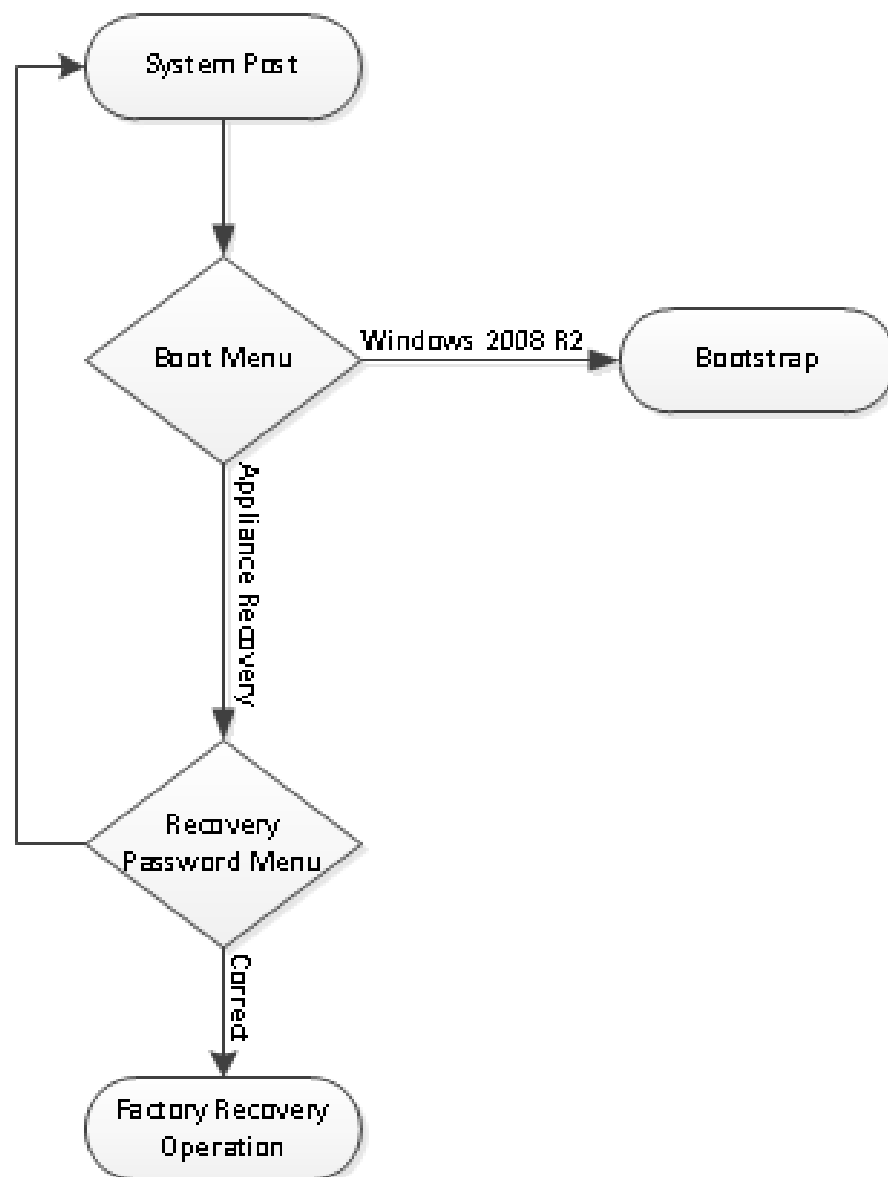
**Table 2. Software Configuration**

Component	Description
Operating System	Windows Server 2008 R2 SP1 Enterprise Edition
Applications	SQL Server 2012 Dell Boomi
Boot Devices	IDSM 2x 16GB SD Card (Mirror Mode - added redundancy)
SD Partition Type	Hidden
SD Partition Size	16GB

## Logical Recovery Process Flow

The following section describes the logical process used by Recovery Process 1. The system is powered on and completes the POST and begins the boot process from the PERC controller. The boot menu prompts the user for input for either booting to the operating system, or the appliance recovery option. If the user submits Windows 2008 R2 the bootstrap code is processed and the appliance boots from the PERC controller to the system disk. If the user submits Appliance Recovery, the appliance boots from the boot.wim on the SD card, contained in the \Sources folder. After processing boot.wim the user is prompted for the password to begin the image restore process. If the user does not provide the correct password the system must be rebooted to gain to access another boot path. Figure 1 provides a flowchart of Recovery Process 1.

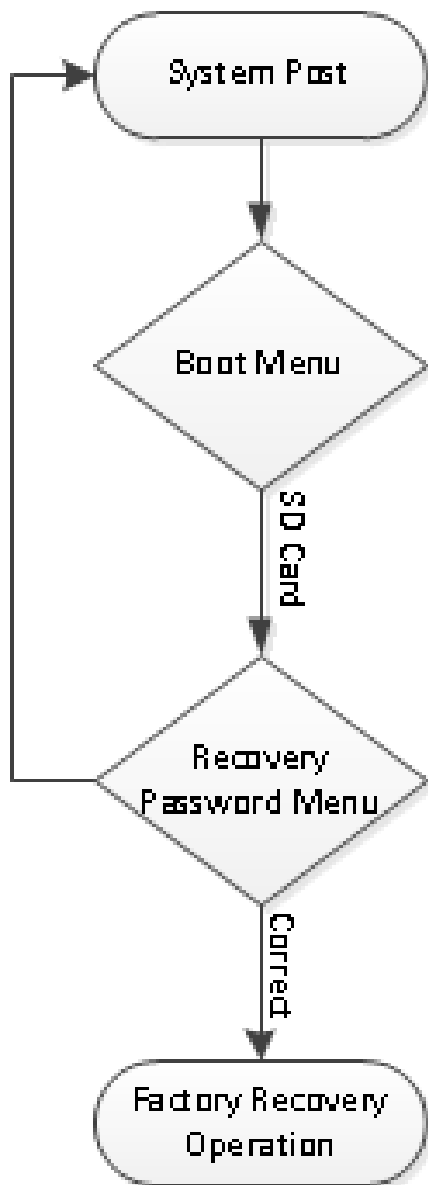
Figure 1. Recovery Process 1





The following section describes the logical process used by Recovery Process 2. The system is powered on and the user must select “F11 BIOS Boot Menu” when prompted during POST. When prompted to enter the BIOS Boot Menu the user must select SD card from the boot options, at which time the appliance boots from the boot.wim on the SD card, which is contained in the \Sources folder. After processing boot.wim the user is prompted for the password to begin the image restore process. If the user does not provide the correct password the system must be rebooted to gain to access another boot path. Figure 2 provides a flowchart of Recovery Process 2.

Figure 2. Recovery Process 2



## Tools

The following section displays the tools associated with the MDW\_Recovery.cmd script used to re-deploy the appliance.

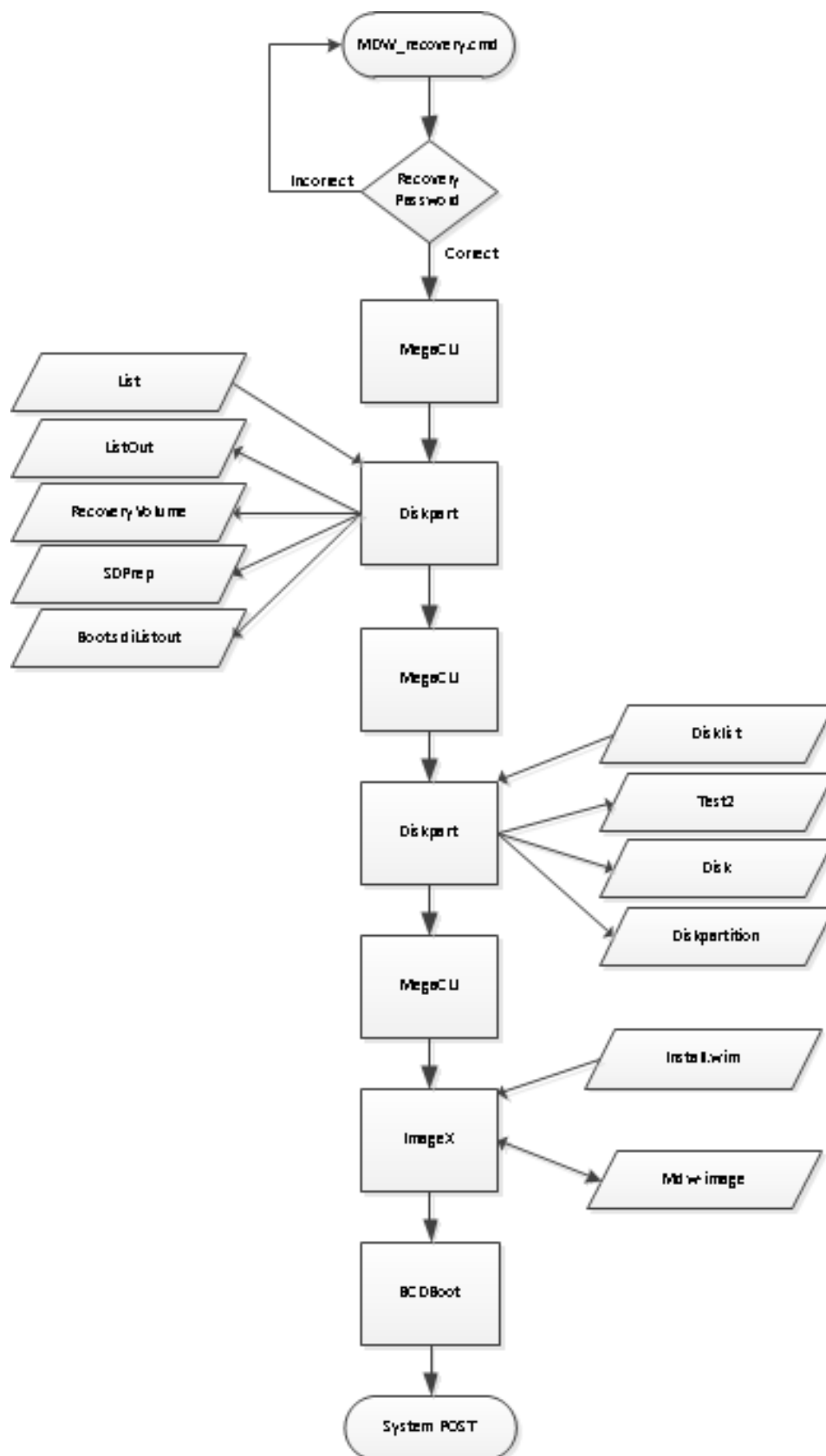
Table 3. Tools

Filename	Purpose
MegaCLI	LSI tool used to manipulate the RAID functions and disk geometry on physical and virtual disks associated with the PERC controller.
Diskpart	Microsoft tool used to manipulate the logical disk information associated with the operating system.
ImageX	Microsoft tool used to capture and deploy WIM images to the hard drive.
BCDBoot	Microsoft tool used to boot Windows after completion of the image deployment.
Timeout.exe	Microsoft tool used to track time.
Findstr.exe	Microsoft tool used to search for string information.

## Logical Recovery Operation Flow

The following section describes the logical flow of the recovery operation scripts. The tools used to build the appliance are MegaCLI, diskpart, imagex, and bcdboot. MegaCLI creates the disk geometry on the PERC controller. Diskpart creates the disk partitions and formats the partitions with NTFS. ImageX copies the install.wim file to the PERC disks, and BCDBoot starts the operating system after completion of the image copy. Refer to figure 3 on the next page for a visual representation of the steps completed by MDW\_recovery.cmd.

Figure 3. Recovery Operation



## Reference Files

The following section describes the software elements required to correctly implement the DR solution. This includes the text files read in, and logs which are written out during the operation of MWD\_recovery.cmd. When the recovery operation begins, WinPE opens the Boot.wim file and mounts a ramdisk with a mount point of X. The SD card disk mount point is R.

**Table 4. Reference Files**

Filename	Purpose	Location
Disklist.txt	Predefined file containing list disk information	X:\sources\recovery\tools
List.txt	Predefined file containing list volume information	X:\sources\recovery
ListOut.txt	File associated with the list information written out by diskpart.	R:\logs
RecoveryVolume.txt	File written by diskpart when creating the recovery volume on the SD card.	R:\logs
SDPrep.txt	Contains the contents of recoveryvolume.txt	R:\logs
Boot.SDIListOut.txt	File containing the contents of listout.txt	R:\recovery\windowsre
Test2.txt	File containing the contents of disklist.txt	R:\logs
Diskpartition.log	File containing the contents of disk.txt	R:\logs
Disk.txt	File containing the output of diskpart during the recovery operation	R:\logs
MDW-image	File containing the output of imagex during the imaging process	C:\
Install.wim	Factory default image containing the operating system and applications installed in the operating system.	R:\wim
Boot.wim	Bootstrap code for WinPE and file structure of the ramdisk used to house the recovery tools.	R:\wim
Winpeshl.ini	Specifies the location of the exact path to MWD_recovery.cmd recovery script.	X:\Windows\System32

## Scripts

The following section displays the script associated with the DR solution.

Table 5. Scripts

Filename	Purpose
MDW_recovery.cmd	Command based script that completes the recovery operation.

## Creating WinRE.wim

The following section describes the process used to create WinRE.wim which is placed on the SD card in the WIM directory.

1. Copy boot.wim to a separate location and rename it WinRE.wim. For additional information on creating WinPE.wim or Boot.wim files: <http://technet.microsoft.com/en-us/library/cc709665%28v=ws.10%29.aspx>
2. Use DISM to mount the image. (Please refer to <http://technet.microsoft.com/en-us/library/dd744525%28v=ws.10%29.aspx> for information about DISM and the packages required to make WinRE.wim. This includes the language package placed inside en\_us).
3. Create a file winpeshl.ini and specify the exact path to the recovery script.

*Ex:[LaunchApp]*

*AppPath=%SYSTEMDRIVE%\sources\recovery\tools\MDW\_recovery.cmd*

4. Copy winpeshl.ini into <mountpoint of image>\Windows\System32
5. Copy timeout.exe and findstr.exe files (if not included in the boot.wim file) to <mountpoint of image>\windows\system32
6. Create the path: <mountpoint of image>\Sources\recovery\tools
7. Copy MDW\_recovery.cmd, MegaCLI64.exe, list.txt, disklist.txt, and imagex.exe files into the directory <mountpoint of image>\sources\recovery\tools
8. Exit from the directory by closing all windows explorer windows associated with WinRE.wim.
9. Unmount the image using DISM.
10. Copy WinRE.wim into the SD card directory of your share and place another copy under the WIM folder.

## Folder Structure of SD Card

There are only 2 folders located on the SD card, SD and WIM. These directories house the files used to complete the recovery and installation of the appliance.

Table 6. SD Card Directories

Directory	Contents
SD	<p>Boot, EFI, logs, Sources, bootmgr, bootmgr.efi</p> <p>Note: Sources dir contains boot.wim (which acts as a winpe). These SD contents are copied to the SD card which will make it act as bootable SD card.</p> <p>Note: boot.wim and winre.wim are same files. So once winre.wim is created, copy it to SD\sources as boot.wim.</p>
WIM	<p>Contains the WIM files used to recover the appliance (install.wim, winre.wim) (both these files are copied to the SD card. Install.wim will be in the root of SD card (r:\install.wim), winre.wim in r:\recovery\windowsre\winre.wim).</p>

## Folder Structure of WinRE.wim

Table 7. WinRE.wim Directories

Directory	Contents
Sources\recovery\tools	Disklist, imagex.exe, list, megacli64.exe, MDW_recovery

Note: all the remaining directories under winre.wim are created during the process of its creation.

## Conclusion or Summary

Providing a recovery image within the internal dual SD card module on Dell PowerEdge servers provides a Disaster Recovery functionality in the event of failures and loss of appliance functionality. This method allows customers to quickly recover the appliance back to factory defaults after component failure or user error. It improves customer experience by helping to re-install a factory image without the need of onsite support. This solution can be expanded for any type of appliance that requires a factory image to be shipped within the system.

The Internal Dual SD Module provides redundancy by configuring the SD cards in Mirror mode. In the event of a failed SD card, the mirror copy will ensure customer can recover the appliance without further delays. Dell designs Solutions with redundancy and high availability best practices at every level to help minimize downtime. Servers are designed with redundant power supplies, network, storage, and can help customers implement Disaster Recovery solutions.

For a complete recovery methodology to be in place with the appliance, a SQL Server maintenance plan should be implemented by the customer to back up their SQL data. To learn more about SQL Server maintenance plans click [here](#). This maintenance plan should be used in conjunction with a backup application like Windows Backup or similar products from other vendors. To learn more about Microsoft Windows Backup click [here](#).