Data Backup and Recovery: Avoid costly mistakes by using a Bare-Metal Restore solution.

Continuous Data Protection for Linux and Windows

An R1Soft White Paper

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Table of Contents

Introduction

Disaster can strike at anytime and cause serious damage to an organization's reputation, revenue, and overall health. There are several options available in the marketplace today that offer data backup and recovery, but not all solutions are ideal for every organization. With the right solution in place, organizations can quickly get their data back online and avoid costly mistakes. The ideal solution for any environment should include a bare-metal restore process.

Defining Bare-Metal Restore

Bare-Metal Restore is the process of instantly rebuilding a computer or server from scratch after a catastrophic failure. The process entails restoring a server's disk image including operating systems, applications, files, and data without the requirements of any previously installed software. A Bare-Metal Restore includes everything needed to completely restore a server back to its original state.

Traditional Steps for Data Recovery

A traditional method used to restore data requires at least ten steps, often repeating multiple steps. The time it takes to complete the ten steps can take hours or days depending on the number of servers that need to be restored.

1. Repair hardware if necessary.
2. Collect all necessary OS install media and CDs.
3. Re-install O/S from CD.
4. Reboot.
5. Apply multiple service packs or patches.
6. Reboot, possibly several times.
7. Re-install backup software from CD.
8. Patch backup software to latest level.
9. Reboot.
10. Load recovery tapes or files and restore data.

Defining the Top Four Reasons That Cause Data Loss

All servers are vulnerable to the four common causes of data loss. Without the proper solution, an organization may experience data loss at some point during the course of its existence.

1. Network, Application, or Hardware Failure

- Power failure resulting in data in volatile memory not being saved to permanent memory.
- A server can malfunction due to improper maintenance.
- Hardware failure including a hard disk crash or sudden power surge.
- Application interaction with databases using SQL statements to retrieve data from a database or inserting data into a database.
- Database drop due to hardware or network failure causing full or partial data loss.

2. User Error

- A system administrator, support technician, or helpdesk representative working with a file system or database can use the wrong command or SQL statement and cause data corruption.
- Accidental or intentional deletion of a file system or database while performing maintenance.
- Files and databases can become corrupt or data loss can occur during data migration when moving data from one system to another.

3. Crime

- Hackers and data thieves using malicious viruses, worms, trojans and other methods to steal important data.

4. Natural Disasters

- Natural disasters include earthquakes, floods, tornados, hurricanes, and even fire.

The acts described above can cause serious loss in data and company revenues. Downtime or permanent data loss could possibly result in bankruptcy, law suits, and damaged reputation for a company.

Two Avoidable Outcomes of Data Loss

There are two avoidable outcomes of severe data loss.

1. Data can be recovered with the help of a trained support technician at a high cost.
2. Data is permanently lost and requires data to be re-entered.

Both of these outcomes can cost an organization thousands, even millions in lost revenue. However, with the right solution in place, both outcomes can be easily avoidable and data can be recovered quickly.

The High Price of Data Loss

The cost of a data loss event is directly related to the value of the data, the length of time that the data is unavailable, and the amount of data that was lost. The ability to recover data depends on the cause of the data loss incident. The five most common costs associated with data loss include the following:

- Continuing without the data.
- Recreating the data.
- Notifying users in the event of a compromise.
- The value of the lost data if the data cannot be retrieved.
- Collateral costs such as damaged hardware.

The cost of data recovery can be expensive. Organizations have to consider all of the resources needed to recover data.

Data Recovery

Typically hosting companies use a combination of rsync and homegrown programs to backup files. Using rsync and homegrown programs does not provide the level of protection and reliability needed for data recovery. These companies generally have in-house support technicians with limited system administration skills. As a result, less than ideal solutions are developed and implemented. Often times, rsync and homegrown programs are not ideal solutions for recovering data.

If a proper backup and recovery solution is in place, the time it takes a technician to perform the recovery manually can be fast. On the other hand, if the data is not readily available, it can take hours to find the data and perform the necessary recovery procedures adding up to hundreds, even thousands of dollars in labor.

Cost of Data Recovery

The National Archives and Records Administration in Washington found some startling results after a data loss. Of companies that lost their data center for 10 days or more due to a disaster, 93% filed for bankruptcy within one year of the disaster. Half of the businesses filed for bankruptcy immediately. [1]

It is difficult to precisely measure the intrinsic value of data and the value of different types of data varies. Several sources suggest that the value of 100 megabytes of data is valued at approximately $1 million. This sum translates to $10,000 for each megabyte of

[1] National Archives & Records Administration in Washington: http://www.rbs2000.com/index.php?cat_id=103&nav_tree=179,10

lost data.[2] When data is lost, value-creating opportunities are lost. And in a networked environment these losses are multiplied.

Data loss and the high cost of data recovery services from in-house technicians or outsourced data recovery specialists can be avoided. Even if you have the resources in-house or the funds to hire an outsourced data recovery specialist, neither one of these options are an ideal solution. They do not provide the protection upfront and ease of restoring data with a solution specifically designed for data backup and recovery.

Avoid Mistakes Before It Cost You Thousands

According to Dynamic Markets Ltd, "Only 38 percent of businesses have any kind of business continuity plan in place to keep them operating in the event of disaster or disruption."[3] You can prevent data loss with the right solution.

The only near continuous data protection and backup solution on the market, developed by R1Soft, includes Bare-Metal Disaster Recovery. R1Soft's Bare-Metal Restore feature allows you to restore servers directly from disk-based backup using CDP Technology. Unlike traditional backup software, there is NO need to first partition your drive and install the operating system.

What is CDP Technology?

Continuous Data Protection (CDP) Technology from R1Soft provides the ability to restore servers directly from disk-based backup. There is no need to first partition your drive and install the operating system. Instead, you use the Bare-Metal Restore process built directly into the CDP Server. Each recovery point stored on the CDP Server is virtually a complete disk image as seen at a particular point-in-time. Each disk image includes the file system formatting, partition table, and volume management data needed to rebuild the entire disk.

The Innovative Standard of Righteous Software

Traditional backup methods typically involve the process of reinstalling the operating system and software applications and then, if possible, restoring the data and settings. With the Righteous Software Backup technology, you will be able to immediately restore your servers directly from disk-based backup without having to first partition your drive and install the operating system.

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[2] "Keep Those Data Protection and Recovery Options Open," *Storage Management Solutions*, November 1997; and ONTRACK Data International, Inc., "The Data Recovery Solution," (1998).
[3] Dynamic Markets Ltd.: http://www.rothstein.com/links/arch/rothstein_recommended32.html

A Bare-Metal Restore Scenario

There are many reasons a server can crash. Regardless of the reason, the server must be brought back online in as little time as possible.

In the case of disaster or for quick roll-back, your Windows or Linux Server can be booted into a special disaster recovery mode. Once booted into disaster recovery mode, a recovery point can be streamed across the network directly onto your server's hard disks from the CDP Server.

With CDP Technology, technicians can use any of the following methods to perform a bare-metal restore.

Disaster Recovery Methods

- **Windows PE Builder (Windows Boot CD-ROM and PXE Boot builder) –** R1Soft distributes a utility to make Microsoft Windows Pre-Execution environments and burn them onto a bootable CD-ROM. The PE Builder utility is available for download at http://download.r1soft.com/. The utility builds an ISO image based on your own Windows install CD and license. PE Builder generates the files necessary for a successful Windows PXE boot using a standard DHCP and TFTP server.
- **Linux Boot CD-ROM -** A bootable CD ISO is available for download at http://download.r1soft.com/. Burn the ISO image to a CD and boot your Linux Servers from it.
- **Linux PXE (network) Boot -** A tar.gz file is available for download at http://download.r1soft.com/. Extract this file to your TFTP server. A sample DHCP server configuration is also provided.
- **Linux Live Boot –** Linux Live Boot is a self-extract install available for download at http://download.r1soft.com/. Extract this file to a Linux server. A new boot loader (grub or lilo) option will be installed to boot your Linux server directly into disaster recovery mode. An administrator can also initiate a boot into disaster recovery mode via command line.

CDP Bare-Metal Restore Key Features

R1Soft delivers the number one continuous data protection, restore, and disaster recovery software for the web hosting industry. R1Soft is a solution that enables disk-based data protection, Linux disaster recovery**,** and Bare-Metal Restore for servers and workstations running Linux and Windows systems.

Below is a list of features available with each CDP Server.

- The Only Near-Continuous Online Backups for MySQL Servers on the market.

- Restore any combination of tables or databases to original or alternate locations.
- Store over 50 Recovery Points per Day.
- Only changed disk sectors are read from the disk during a scheduled synchronization, or backup.
- Compression (up to 100:1 compression ratios).
- End-to-End Strong Encryption.
- Easy to install and configure.
- Full online searchable HTML Help documentation available.
- R1Soft offers the only Continuous Data Protection solution for Linux Server backups.
- The software is the first high performance backup and restore product for MySQL and the only software to offer True Granular Restore™ for MySQL.

Top Benefits of CDP Server and Bare-Metal Restore

1. Bare-Metal Disaster Recovery

Restore servers directly from disk-based backup. Unlike traditional backup software, there is NO need to first partition your drive and install the operating system.

2. High Performance

Sector-based backups increase throughput and reduce overhead. Servers can be fully operational with minimal performance impact during backups. Backups can typically be performed at anytime, even on busy servers.

3. Small Backup Windows

Only changed disk sectors are copied between backups. Incremental backups can be completed in minutes.

4. Open File Backups

Righteous Backup is a total solution including built-in support for backing up open files. No third-party software is required.

5. Snapshots

CDP technology provides consistent, point-in-time, system-wide backup images.

6. Near-Continuous Backups

During normal host operation, the R1Soft CDP Agent keeps a journal of disk changes. Incremental backups know what sectors on the disk have changed before the backup

operation starts, eliminating the need for file-by-file or block-by-block comparisons for each backup.

7. Designed with Resellers in Mind

Delegate control to various administrators on a server-by-server basis.

8. Remote Administration

Software can be completely controlled offsite using a web-based interface.

9. Compression

Incremental, sector-based backups disregard unused portions of the disk and copy only the disk sectors that have changed since the last backup. When utilized with traditional compression, this feature reduces backup storage by as much as 90% as compared to a traditional system-wide, file-by-file backup.

10. End-to-End Strong Encryption

Using RSA keys, data is continuously encrypted while in storage and during network transmission. Decryption during a restore is possible only when the encryption key holder enters their passphrase.

11. Data Integrity

Data is verified during backup and restore using MD5 check sums.

CDP for Bare-Metal Technical Overview

R1Soft's Continuous Data Protection Solution is a server software application that enables disk-based data protection and disaster recovery for Linux Servers and work stations running Microsoft Windows and Linux operating systems. CDP Server protects disk volume data using replication and synchronization over the network storing point-in-time snapshots in disk-based storage.

R1Soft's CDP solution is a near-Continuous Backup system capable of providing hundreds of recovery points per day scheduled as little as 5 or 10 minutes apart. CDP Server works by reading your hard disk volumes at the sector level, bypassing the file system for the ultimate experience in performance and recovery. The disk sector synchronization is performed while the server is online and provides no interruption to other I/O requests even on a busy server. By reading the disk at the lowest possible level, point-in-time recovery images contain your files and all the formatting, partition tables, and volume configuration needed for complete and instant disaster recovery.

The Data Protection Process

Scheduled point-in-time volume snapshots are scheduled on the CDP Server. The CDP server periodically connects to the CDP Agent program and synchronizes changed disk sectors to the CDP Server. The CDP Server creates a new point-in-time image of the disk volume every time it connects to the agent for synchronization. The point-in-time images are called recovery points and are stored in what Righteous calls a Disk Safe.

R1Soft's unique Near-CDP process for Linux tracks changes at the block level of your storage volume. During synchronizations, or backups, only changed blocks are read from the disk. These disks are sent over the network to the CDP Server to be archived in a recovery point. Very large volumes and databases can be backed up quickly after the initial seed backup.

Recovery points only consist of a copy of changed disk sectors. Even on very large volumes, disk synchronization typically only takes seconds or minutes to complete. The more frequently recovery points are scheduled the faster they complete. When compression is enabled hundreds of recovery points can be stored in less space than it takes to store one disk image.

In between synchronization requests from the CDP Server, the CDP Agent passively tracks changes to the hard disks as they are happening. This process introduces no overhead and requires a relatively small amount of memory. The synchronization process only requires about 6 MB of memory per 100 GB of disk storage.

Secure Data Management and Archiving

Data on the CDP Server is stored in R1Soft's patent-pending Disk Safe storage format. Storing the data on disk format enables the CDP Server to archive point-in-time recovery images for long periods of time using as little disk space as possible. A rotation policy can be defined for each configured backup schedule. This policy specifies the number of different incrementals to keep for each schedule and old recovery points are automatically deleted. This flexible system of minutely, hourly, daily, weekly, and monthly recovery point management is capable of meeting a variety of needs.

Please consider the following examples demonstrating the flexibility of the automatic data protection policy:

- synchronize every 10 minutes – retain the last 48 recovery points
- synchronize hourly – retain the last 48 recovery points
- synchronize daily at midnight – retain the last 7 recovery points
- synchronize weekly on Sundays – retain the last 4 recovery points
- synchronize monthly on the 1st – retain the last 48 recovery points

The CDP Server can automatically manage a variety of policies to meet your specific requirements. In addition to policy based management, any unwanted recovery point can

be deleted by an administrator at any time. Selected recovery points can also be locked to prevent automatic deletion by a policy.

End-To-End Strong Encryption

CDP Server supports strong encryption of disk data using RSA keys and the blowfish cipher. During a synchronization, data is encrypted (and optionally compressed) on the agent and sent to the server over the network where the data is stored in encrypted form. The data can only be decrypted using an RSA key protected with a passphrase. During a bare-metal restore process, disk sectors are decrypted on-the-fly at the Linux or Windows Agent.

Who is R1Soft?

Founded in 2006, Houston, Texas based R1Soft develops innovative disk based backup products for Linux and Windows servers. Continuous Data Protection (CDP) products deliver nearly continuous data protection, open file backups, bare-metal disaster recovery, and an easy to use web interface. Priced affordably for any sized hosting company, R1Soft makes it possible for every organization to implement and utilize the benefits of a solid backup and recovery system.

Why R1Soft?

R1Soft has become the leader in backup and recovery software solutions. CDP products have been deployed on thousands of servers across the world. Small, medium, and large organizations depend on R1Soft products to automate the demanding tasks of backing up large amounts of data minutely, hourly, daily, weekly, and monthly.

Contact R1Soft Today

To learn more about R1Soft, Bare-Metal Restore, and CDP products, visit http://www.r1soft.com or call 1-800-956-6198.