

Dell EMC PowerMax and VMAX All Flash: Data Protector for z Systems (zDP) Essentials

Abstract

This document describes Data Protector for z Systems (zDP) features and functionality for the Dell EMC™ PowerMax 8000 and VMAX™ 950 All Flash arrays for mainframe.

September 2019

Revisions

Date	Description
September 2019	Revision 0.1 which includes content related to OS 5978 SR (Q3 2019) as well as reformatting and attributions of release 0.2

Acknowledgements

This paper was produced by the following:

Authors: Justin Bastin

Contributors: Brett Quinn, Bruce Klenk, Paul Scheuer

Support: Mainframe Corporate Systems Engineering

The information in this publication is provided “as is.” Dell Inc. makes no representations or warranties of any kind with respect to the information in this publication, and specifically disclaims implied warranties of merchantability or fitness for a particular purpose.

Use, copying, and distribution of any software described in this publication requires an applicable software license.

Copyright © 2019 Dell Inc. or its subsidiaries. All Rights Reserved. Dell, EMC, Dell EMC and other trademarks are trademarks of Dell Inc. or its subsidiaries. Other trademarks may be trademarks of their respective owners. [8/29/2019] [Technical White Paper] [H15201.2]

Table of contents

1	Introduction.....	5
1.1	Terminology.....	5
2	What is zDP?.....	6
3	TimeFinder SnapVX explained.....	7
4	zDP use cases.....	10
5	How does zDP work?.....	11
6	zDP implementation.....	12
7	Creating zDP versioned data groups.....	13
7.1	Defining a versioned data group.....	13
7.2	Defining a target set.....	13
7.2.1	Considerations when building a target set:.....	14
8	Starting zDP through mainframe enablers.....	15
8.1	Linking VDG to target set.....	16
9	zDP with SRDF.....	18
10	zDP enhancements.....	19
10.1	zDP enhancements: May 2017.....	19
10.2	zDP enhancements: May 2018.....	19
10.3	zDP enhancements: September 2019.....	20
11	Conclusion.....	21
A	Technical support and resources.....	22

Executive summary

Much of the focus on data protection in the last twenty years has been on recovery from loss of a data center due to unplanned outages or disasters. The emphasis has been on providing copies of data at alternate sites and on ensuring that data integrity of the copies is preserved. “Availability with data integrity” has been the goal.

In recent years the focus of business continuity planning has expanded beyond recovery from unplanned outages to include a focus on recovery from widespread data corruption. Data corruption risk has taken on new and more dangerous forms beyond simple processing errors that introduce errant data to now include the willful hacking and destruction of data. As a result the responsibility of CIOs has expanded beyond providing for rapid recovery from data center loss to ensuring “rapid recovery from loss of data integrity.”

Data Protector for z Systems (zDP) is designed to address the problem of large scale recovery from logical corruption. zDP is a Dell EMC™ z/OS-based application that utilizes TimeFinder SnapVX snapshots to enable rapid recovery from logical data corruption. zDP achieves this by providing multiple, frequent, and consistent point-in-time copies of data in an automated fashion across multiple volumes from which an application level recovery can be conducted. By providing easy access to multiple different point-in-time copies of data (with a granularity of minutes), precise remediation of logical data corruption can be performed using storage or application-based recovery procedures. zDP provides the following benefits:

- Faster recovery times as less data must be processed due to the granularity of the available point in time data copies
- Cross application data consistency for recovery data
- Minimal data loss compared to the previous method of restoring data from daily or weekly backups. This is especially important for non-DBMS data, which does not have the granular recovery options provided by log files and image copies associated with database management systems.

Prior to zDP, the only way to recover from logical data corruption was an offline copy, either a BCV (Business Continence Volume), sometimes known as a “gold copy” or a backup made to offline physical or virtual tape. Even in the best data centers practicing the latest data protection procedures, often only one offline copy of the “state of the business” was being made per day. Considering that 144 snapshots can be taken in a 24 hour period (at 10 minute intervals) with zDP as compared to a single Business Continence Volume (BCV) or offline tape backup, zDP gives you 144x the granularity to recover from a situation that could have otherwise been detrimental or fatal to your business. zDP enables rapid recovery from hacks, malware, sabotage and human error! The key question is, have you done all you can to prepare for data loss, for data held to ransom, or data corruption?

Audience

This white paper is intended for information technology professionals, z/OS systems architects and IT storage administrators. This white paper assumes you have a basic knowledge of Dell EMC PowerMax and VMAX™ All Flash technologies.

1 Introduction

This white paper includes environmental considerations needed to understand and deploy Data Protector for z Systems (zDP). It describes the evolving data protection solutions that provide the building blocks for zDP. This paper discusses zDP both from the mainframe and PowerMax or VMAX 950 All Flash Array point of view.

zDP provides a granular level of protection for your mainframe assets so that a processing error, malicious intent or human error may not cause a data center-wide outage. zDP utilizes the concept of snapshots of Dell EMC PowerMax source volumes that allow applications to restore data at a more granular level. This granularity provides point-in-time recovery for both database and non-database systems.

With point-in-time copies, selectable recovery points and the ability to automate backup processes, users can elevate their data center and mission critical data management to a level of security never before possible.

1.1 Terminology

zDP: Data Protector for z Systems: Dell EMC software product providing a granular level of backups for data

TimeFinder SnapVX: Backup technology built on Virtual Provisioning enabling customers to take snapshots of Dell EMC Source Volumes on VMAX Arrays

Local snapshot: Data copy taken at the Source PowerMax Array

Remote snapshot: Data copy taken at the Target/remote PowerMax Array

Versioned Data Group (VDG): Logical group of source volumes that associates volumes along with settings for creating multiple point-in-time images

Snapshot: Pointer based, point-in-time image of single volume

Snapset: Named point-in-time consistent image of all source volume snapshots in a VDG

Snapset Capture: Continuous automated process of creating snapsets

Target Set: Group of devices which have been defined to zDP as the desired LINK targets to a snapset

2 What is zDP?

Data Protector for z Systems is a mainframe software solution providing continuous data protection for your mainframe data assets. Deployed on TimeFinder SnapVX, Dell EMC's new space efficient volume snap capability, your environment can increase the granularity of application recovery. Increasing granularity involves leveraging zDP's three main components; versioned data groups (VDG), snapsets, and Target Sets. To assist customers with zDP, the software includes the ability to manage, operate and monitor your environment through JCL and SCF commands. These components working together provide seamless integration for your backups to use and leverage zDP.

3 TimeFinder SnapVX explained

TimeFinder SnapVX is a Dell EMC software product that provides space-efficient, volume snap capabilities on the PowerMax and VMAX 950 storage platform. Built on thin (virtual) provisioning, TimeFinder/SnapVX supports up to 256 'target-less' snapshots on each source volume. The target-less ability provides a reduction in both metadata footprint and capacity consumption while allowing a large number of snaps to be created with minimal impact to application performance. Using the default mode COPY, backend storage is allocated once the snapshot is linked to a target volume, allowing the user to use the snapshot immediately or each time a source track is updated when there is an active snapshot. Users can link one snapshot to multiple target volumes to have multiple copies of data and data versioning when needed. However, users do not need to link a snapshot to a target volume until users need to use the data from the snapshot in a meaningful way. Because snapshots are a Read-Only structure, the changes made on the source volume will not propagate to the snapshot.

A snapshot can be viewed as a container that saves the pointers of the source volume. Because there is no backend storage during the creation of a snapshot (using the CREATE command), users are not using storage on their array to capture a point-in-time copy.

When a snapshot is no longer needed, users can unlink the target volume from the snapshot and terminate the snapshot. This is a fast and efficient way to reclaim any space uses that snapshot. Figure 1 SnapVX described.

Finally, it is important to differentiate between snapshot and snapset. A snapshot represents the pointer based, point-in-time image of one volume. This is what SnapVX primarily does. A snapset is the pointer based image of a point in time copy of multiple volumes within a single Versioned Data Group (VDG). For example, VDG EMCVDG may have snapshots of volumes AAAAAA, BBBBBB, and CCCCCC. Snapset terminology is used throughout future zDP discussions.

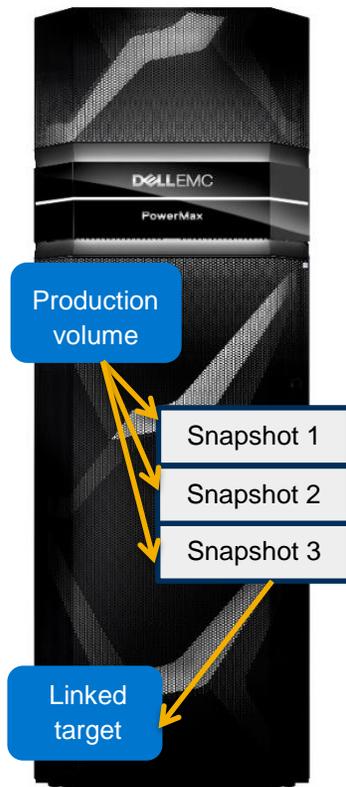


Figure 1 Snapshots and a linked target

Three snapshots of a production volume were taken. To use the data in the third snapshot use the LINK command.

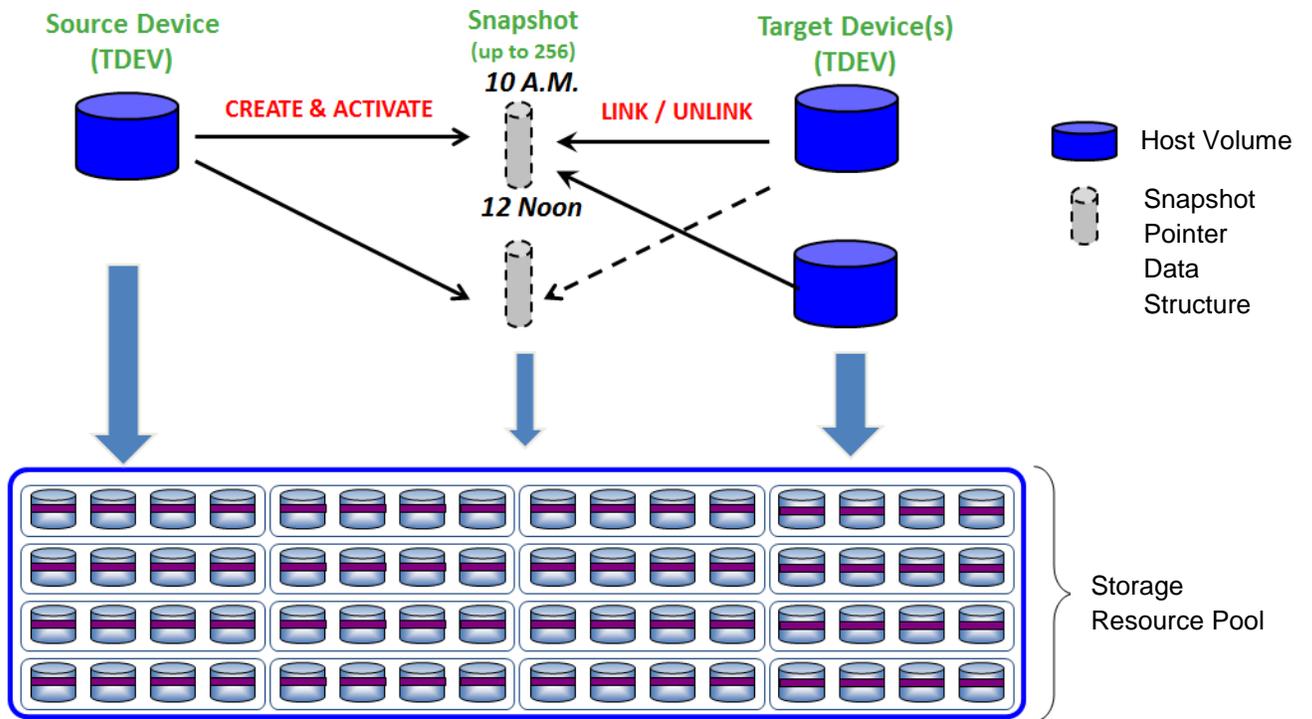


Figure 2 Relationships Between Source and Target Devices to Snapshots

Figure 2 shows the relationships between source devices for snapshots and target devices for snapshots. The user creates and links a snapshot using the COPY or NOCOPY option. The dotted line indicates the mutually exclusive relationship between snapshots and a single target volume. While not depicted here it is also possible to cascade copies by taking snapshots from linked targets.

4 zDP use cases

zDP creates multiple snapshots (a snapshot is a dependent write consistent pointer-based construct that provides an immutable point-in-time copy of the data) which can be leveraged in the following ways:

- After taking consistent snapshots of data, users use the data on a rescue system to restore the data to a known point-in-time.
- Create a “golden copy” of the data on the local or remote site with zDP.
- Build a persistent copy of the environment that could be used for disaster recovery testing.

5 How does zDP work?

zDP runs within the Mainframe Enablers Resource Pak Base in a z/OS environment. The zDP application automates the creation of consistent snapshots on a continuous basis. zDP uses a construct called a 'Versioned Data Group' (VDG) that defines the source volumes used for the point-in-time copies. These source volumes can be referred to by SYMM ID, z/OS device number, SCF Group Name Services (GNS) group name, or volume serial number. Once the customer starts the VDG through EMCSCF address space, the source volumes defined in that VDG are used to create "snapsets". When the maximum number of snapsets is reached, zDP terminates the oldest snapset within the VDG (based on MAX_SNAPSETS parameter setting). zDP snapsets are similar to SnapVX snapshots in that storage is used the first time a source track is updated following the snapshot, when the user links the snapshot to a target and updates the target volume, or when the user links the snapshot in COPY mode.

To link the entire snapset to a group of target volumes, the user must define a set of target volumes called the Target Set. It is important to note that a zDP Target Set does not need to be defined. To build snapshots/snapsets. However, in order to use the data from a snapset you must link the snapset to the Target Set from within zDP, or link individual snapshots from the snapset to target volumes using the EMCSNAP batch utility. Finally, while zDP runs, you can use the zDP Versioned Data Group (VDG) query commands to monitor and report on the zDP application.

6 zDP implementation

zDP Implementation is a two-stage process, including the planning phase and the implementation phase. The planning phase is done in conjunction with a Dell EMC representative who has access to tools that can help size the capacity needed for zDP.

The implementation phase includes the following for z/OS:

- A batch interface that allows customers to submit jobs to define and manage zDP
- A zDP run-time environment that executes under your Dell EMC SCF started task that creates and manages snapshots (leveraging SnapVX)

7 Creating zDP versioned data groups

Before starting zDP users must create the VDG and Target Set while defining the characteristics of the VDG and Target Set. Once the creation and definition of the VDG and Target Set is complete, users can start zDP.

7.1 Defining a versioned data group

During the creation of a VDG users provide installation-specific parameters. The VDG and Target Set use a JCL batch job (using the EIPINIT program in your MFE LINKLIB).

Here is sample JCL that users could use to define a VDG.

```
//jjjjjjjj JOB (ZDP),EMC,CLASS=A,MSGCLASS=X,NOTIFY=&SYSUID,
//          REGION=0M
/*JOBPARM LINES=999999
//*
/* CREATE AND DEFINE A VDG
/*
//ZDPDEF EXEC PGM=EIPINIT,REGION=0M
//STEPLIB DD DISP=SHR,DSN=your.mfe.linklib
//SYSPRINT DD SYSOUT=*
//SCF$PD40 DD DUMMY ---> Point to the SCF you are running
/*
//SYSIN DD *
GLOBAL MAX_RC(4)
DEFINE VDG VDGNEW,
.... zDP Options here
MODIFY VDG VDGNEW,ADD,
      CCUU(gggg,dddd-dddd) ---> gggg = Gatekeeper, dddd-dddd = devices
/*
```

After receiving the 0 return code, users can now see that VDG is created with the query command.

7.2 Defining a target set

In order to use the data from the snapshots, link the VDG to a Target Set. To define a Target Set in JCL, specify a name for the Target Set and then add the devices that save the data from the snapshots. Here is sample JCL your installation standard to define and add devices to a new Target Set.

```
//JJJJJJJJ JOB (ZDP),EMC,CLASS=A,MSGCLASS=X,NOTIFY=&SYSUID,
//          REGION=0M
/*JOBPARM LINES=999999
//*
/* DEFINE A TGT & ADD DEVICES
/*
//ZDPDEF EXEC PGM=EIPINIT,REGION=0M
//STEPLIB DD DISP=SHR,DSN= your.mfe.linklib
//SYSPRINT DD SYSOUT=*
//SYSUDUMP DD SYSOUT=*
//SCF$PD40 DD DUMMY ---> Point to the SCF you are running
/*
```

```
//SYSIN      DD  *
GLOBAL MAX_RC(4)
DEFINE TARGET_SET TGTNEW2
MODIFY TGT TGTNEW2,ADD,
          CCUU(gggg,dddd-dddd) ---> gggg = Gatekeeper, dddd-dddd = devices
/*
```

7.2.1 Considerations when building a target set:

- Target Sets must contain equal or greater number of volumes than the VDG used in the LINK operation.
- Target sets should have equal or larger volume size to the volumes in the VDG. For example, if the VDG has ten 3390 mod 3, the target set must have at a minimum ten 3390 mod 3. If users were to have ten 3390 mod 9 in the target set and linked the VDG (with mod 3) the LINK would work but users would need to specify the REFVTOC parameter in the GLOBAL parameters) in order to use the remaining space on the volume.

After creating a VDG, zDP provides commands to modify the contents of the VDG so that you can adapt to your ever-growing IT needs. For example, use the MODIFY VDG command to add or remove devices from the group. Authorities for all zDP commands are managed with SAF calls. See *Mainframe Enablers 8.3 Installation and Customization Guide* for details on zDP commands which can be restricted.

8 Starting zDP through mainframe enablers

After users have added and customized the configuration parameters for zDP, zDP should be started from the EMCSCF started task. Use the command “F emcscf,zDP START vdg_name”. If the VDG_NAME is found, the zDP started task creates SNAPSETs in that VDG. Note that there does not need to be a “Target Set” for the SNAPSET to be created. This is based on the ‘target-less snapshot’ principal underlying SnapVX.

When users start the VDG, the z/OS SYSLOG SCF and EIP messages indicates that the SNAPSET has been created. For example, the VDG called VDGNEW and zDP produced the following messages in SYSLOG. (Also, users can reference a LOGOPT DD statement to see zDP messages.

Snapshot creation message:

```

SCF0740I ZDP START TESTVDG1
SCF0741I ZDP START command accepted
SCF0746I ZDP VDG TESTVDG1 Started
EIP0200I *** EMC zDP - V8.2.0 (000) - Wednesday, April 5, 2017 ***
EIP0250I VDG TESTVDG1, SMF Recording enabled, Record Id 228, Tracks
EIP0201I VDG TESTVDG1, Beginning cycle 39, Snapset TESTVDG1.....170
951304C00039
EIP0217I VDG TESTVDG1, Devices validated for consistency, via ECA
EIP0204I VDG TESTVDG1, SNAPSET TESTVDG1.....170951304C00039 created
EIP0202I VDG TESTVDG1, Completed cycle 39, next cycle scheduled for
13:14:32

```

When a zDP creates snapsets, it refers to the duration and frequency of the snapset as a cycle. For example, the VDG 'CYCLE_TIME(10,35)' parameter, indicates to zDP to take a snapset of every volume in this VDG every 10 minutes and stop the VDG from taking any more snapsets after 35 cycles. Users can see the first cycle in Figure 3. This is an important concept to understand because when users query the VDG after it has taken 35 cycles, a unique 'SNAPSET_NAME' exist in the output. Each 'SNAPSET_NAME' represents one cycle.

To find out the names of the SNAPSETs for a specific VDG, use the QUERY command. Note that when a VDG takes a SNAPSET it uses Engineuity Consistency Assist feature of Hypermax OS to ensure that snapset dependent write consistent.

8.1 Linking VDG to target set

After creating a VDG and successfully starting it, and creating snapsets, users can link a snapset to a Target Set to use the data. Users create a Target Set. First, it is suggested to query the VDG to see what snapsets are available to use. The following is a sample JCL job that queries the status of the snapsets:

```

//jjjjjjjj JOB (ZDP),EMC,CLASS=A,MSGCLASS=X,NOTIFY=&SYSUID,
//          REGION=0M
/*JOBPARM LINES=999999
//*
/*  QUERY VDG OPTIONS
//*
/*
//ZDPDEF  EXEC PGM=EIPINIT,REGION=0M
//STEPLIB DD DISP=SHR,DSN= your.mfe.linklib
//SYSPRINT DD SYSOUT=*
//SYSUDUMP DD SYSOUT=*
//SCF$PD40 DD DUMMY ---> Point to the SCF you are running
//*
//SYSIN   DD *
GLOBAL MAX_RC(4)
QUERY VDG VDGNEW, SNAPSET
QUERY VDG VDGNEW, SNAPSET, DETAIL
/*

```

Within the query output look for the 'SNAPSET_NAME' and select the snapset you would like to link to your target devices. Normally users can reference the Create Date to indicate what snapset data they want to access. Note that the 'SNAPSET_NAME' is needed in the LINK command. Figure 4 provides sample output from a query command that has the VDG SNAPSET_NAME.

SNAPSET_NAME	STATE	CREATE DATE	TIME
VDGNEW.....160141534C00002	ACT	01/14/2016	15:34:30

Figure 3 VDG SNAPSET_NAME query

Using the SNAPSET_NAME, and Target Set (created earlier), users can customize the following JCL to link the snapset to the Target Set, making the data accessible to the target volumes.

```
//JBASTI00 JOB (ZDP),CSEEMC,CLASS=A,MSGCLASS=X,NOTIFY=&SYSUID,
//          REGION=0M
/*JOBPARM LINES=999999
//*
//* LINK / UNLINK A TARGET_SET
//*
//*
//ZDPDEF EXEC PGM=EIPINIT,REGION=0M
//STEPLIB DD DISP=SHR,DSN=your MFE linklib
//SYSPRINT DD SYSOUT=*
//SYSUDUMP DD SYSOUT=*
/*SCF$XXXX DD DUMMY ---> Point to the SCF you are running
//*
//SYSIN DD *
GLOBAL MAX_RC(4)
LINK VDG(vdg name from above),SNAPSET(160141534C00002) TGT(target set from
above)
```

9 zDP with SRDF

The following applies to zDP and SRDF:

- zDP supports snapshot creation in locally attached VMAX or PowerMax arrays, remote to VMAX All Flash ,or PowerMax via SRDF/S or SRDF/A or PPRC.
- zDP can go up to and not exceed four hops.
- If a z/OS CEC attached to your remote side (R2), you could access the snapshots created using commands that were sent from your R1 environment, or create snapshots locally from a zDP environment running on a host attached to the R2 PowerMax or VMAX array. Leverage zDP to execute SnapVX commands utilizing the RMT (remote) keyword across SRDF links. For example:

```
//ZDPDEF EXEC PGM=EIPINIT,REGION=0M
//STEPLIB DD DISP=SHR,DSN=<mfe.linklib>
//SYSPRINT DD SYSOUT=*
//SYSUDUMP DD SYSOUT=*
//*SCF$PD49 DD DUMMY
//SYSIN DD *
GLOBAL MAX_RC(4)
DELETE VDG ZOS_DBS_DC2,ALLOWNE → Deletes VDG with definitions
DEFINE VDG 'ZOS_DBS_DC2',
        CYCLE_TIME(240,6)
MODIFY VDG 'ZOS_DBS_DC2',ADD,
        SYMDEV(B10F,
                0000A0-0000A3,000190-000193,000280-000283,000370-000373),
        RMT(0D)
//
```

10 zDP enhancements

10.1 zDP enhancements: May 2017

Mainframe Enablers enhanced zDP's usability and monitoring capabilities. Some of the new features include:

- The QUERY SNAPSET command with the SNAPSET option provides a new entry in the output called 'RDP Cache Utilization' percentage. This information allows customers to monitor their VMAX/PowerMax Replication Data Pointers (RDP) usage. In the event a customer's RDP usage exceeds a threshold, customers should work with Dell EMC support to look at reducing the RDP usage.
- Create VDG ISPF panels (via existing zDP ISPF panels) or batch JCL statements add three new parameters on the Versioned Data Group (VDG).
 - RDP Cache Util(ww,cc) – 'ww' is a percentage for when warning messages should be sent to z/OS. 'cc' is a percentage when the RDP threshold reaches a critical level and messages will be sent to z/OS.
 - SMF rec number – This permits the customer to set a SMF record number for zDP. SMF records are will be cut for that VDG at the beginning of each cycle. This time is specified in the 'Cycle Time' input parameter
 - TRACKS – Provides additional output for your VDG for all total changed and unique tracks within the VDG. Please understand that turning TRACKS(Y) will create a lot of data for the VDG.
- TERMINATE ALL command available via zDP ISPF panels and batch JCL statements. This command enables customers to terminate multiple zDP snapsets with one statement. The ability to ensure the customer chooses to do this with a confirmation message in the zDP ISPF panels or a WTOR message in SYSLOG (if running in batch mode) is provided.
- If a zDP snapset fails during the ACTIVATE command, zDP automatically cleans up and terminates the snapsets.

10.2 zDP enhancements: May 2018

Mainframe Enablers version 8.3 also delivered several enhancements to zDP, expanding management capabilities of existing z/OS structures and security parameters. Enhancements included;

- Secure Snapsets: zDP builds on top of SnapVX secure Snapshot capability. With zDP secure snapsets, customers can set an expiration interval on the zDP Snapset. With the expiration interval set, the snapset will be terminated by Hypermax OS only when the expiration interval expires and cannot be terminated from a host command. This provides increased security to your most critical data that zDP manages. The new parameters to set your snapsets to a secure state are explained in the SnapVX and zDP Product Guide.
- Five Minute Cycle Time: Cycle time enables customers to specify how often zDP should create a snapset. Previous to Mainframe Enablers 8.3, customers set the zDP cycle time to no less than 10 minutes. This enhancement will enable customers to set the cycle time as low as five minutes enabling more granular copies of your data.
- COPY_ONCE VDG Parameter: This parameter will increase space savings for your zDP snapsets because enables customers to identify which data to snapped once and not needed for every snapset iteration.

- The ability to define a VDG and Target group by specifying an SRDF Group: Customers today use SRDF groups when working within PowerMax and VMAX All Flash. This enhancement will enable customers to use existing SRDF Groups to define and manage VDG and Target groups.

zDP has also made significant enhancements to how various commands are processed by the PowerMax and VMAX 950 All Flash Array. The result of these enhancements will improve performance for the QUERY and ACTIVATE commands. For more information about enhancements, refer to latest Product Guide for SnapVX and zDP.

10.3 zDP enhancements: September 2019

With the release of PowerMax OS 5978 SR and Mainframe Enablers version 8.4, zDP delivers exciting new enhancements to more efficiently manage your environment.

- An increase in the number of Snapsets for a VDG from 256 to 1024, providing up to a 4x increase in the total number of Snapsets allowed, enabling more point in time copies for increased granularity in RPO.
- Snapset creation on demand. zDP now supports immediate creation of Snapsets of a VDG, which is very convenient for taking a snap just prior to a batch or job cycle. Consider a customer's business timing like yearend / quarter close; on demand Snapsets can enhance protection of critical RPOs.

On demand Snapset creation is even possible with VDG Snapset creation running

- Dynamic modification of Version Data Groups and Target Sets, enabling changes to VDGs without having to stop and start them.
- **zDP LINK operations improved performance: With a 5978.* microcode and customers must redefine the VDG with MFE 8.4, will improve performance zDP LINK operations**

While a VDG is taking snapsets, customers now have the ability alter VDG parameters while the VDG is running Please refer to the Dell EMC TimeFinder SnapVX and zDP 8.4 Product Guide for parameters can be dynamically modified.

11 Conclusion

zDP, built on TimeFinder SnapVX, provides consistent point in time copies of data that automate and enhance an IT environment's ability to recover in the case of logical errors or pervasive logical corruption such as ransomware encryption. zDP provides 144 times more recovery capability compared to daily snapshot, clone, or traditional TimeFinder technology. However, zDP does not prevent users from using existing JCL and slowly migrating to SnapVX and zDP. With zDP IT infrastructures can experience data protection unlike anything in the industry today. As of Mainframe Enabler 8.2, zDP has added many new usability features to give customers more insight and control of this tremendous powerful Dell EMC exclusive function.

A Technical support and resources

[Dell.com/support](https://www.dell.com/support) is focused on meeting customer needs with proven services and support.

[Storage technical documents and videos](#) provide expertise that helps to ensure customer success on Dell EMC storage platforms.