

Using ASM Storage Reclamation Utility from Oracle and Zero Page Reclamation Utility from Hitachi to Reclaim Storage Capacity

Solution Operation Guide

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Solution Operation Guide

This explains how to use the process to reclaim unused disk space from Oracle Automatic Storage Management (ASM) disks on Hitachi Virtual Storage Platform. The process uses the ASM storage reclamation utility from Oracle with the zero page reclamation utility from Hitachi.

When Oracle frees up disk space in ASM disks, the corresponding storage capacity in Hitachi Dynamic Provisioning pools remains allocated. This can result in large amount of unused storage capacity unavailable for other uses.

The ASM storage reclamation utility from Oracle fills unused storage capacity in the database with zeros as the first step to release this storage capacity back to the dynamic provisioning pool. Something else must be done to finish the process.

The zero page reclaim utility from Hitachi reclaims the unused database blocks that ASM storage reclamation utility filled with zeros. This releases the storage capacity back to the dynamic provisioning pool for reuse by any new or existing LUN.

Use these procedures to reclaim unused storage space in an Oracle diskgroup in dynamic provisioning virtual volumes or in a dynamic tiering pool. This information includes the following:

- How to trigger zero page reclamation after the completion of ASM storage reclamation.
- An example showing the steps used to execute the complete process.

These benefits may result from using the procedure described in this document:

- Reclaim storage capacity that is currently a dead cost for a productive resource
- Reduction in physical storage needs, which could reduce the following:
 - Impact on the environment
 - Real estate required for storage needs
 - Storage management costs

There is an example shown on how to use this procedure. The example comes from the lab validation performed by Hitachi Data Systems. Read about this validation in [Reclaiming Unused Storage Blocks on a Hitachi Virtual Storage Platform with ASM Storage Reclamation Utility from Oracle and Zero Page Reclamation Utility from Hitachi](#).

Intended readers include database administrators charged with the operation of a system that has Oracle ASM diskgroups running on one of these Hitachi storage systems:

- Hitachi Universal Storage Platform® V and VM
- Hitachi Virtual Storage Platform

Solution Procedure

This explains how to perform the procedure for the solution.

Prerequisites

These are the prerequisites to perform this procedure.

Table 1. Hardware Prerequisites

<i>Hardware</i>	<i>Description</i>
Hitachi storage system	One of the following storage systems: <ul style="list-style-type: none">▪ Hitachi Universal Storage Platform V or VM. Requires microcode level 60-04-04 or later.▪ Hitachi Virtual Storage Platform. All microcode levels may use this procedure.

Table 2. Software Prerequisites

<i>Software</i>	<i>Version</i>
Oracle Enterprise Database Server	10g or later
Oracle ASM Space Reclamation Utility	1.1
Hitachi Dynamic Provisioning	70-02-54/00
Hitachi Storage Navigator	70-02-54/00
Command control interface from Hitachi	1-24-03/16

Other prerequisites include the following:

- Storage must support the zero page reclamation utility.
- Each Oracle tablespace is in a dynamic provisioning pool or dynamic tiering pool.
- The ASM diskgroup has at least 25% free space.

Procedure

The procedure summary consists of the following steps.

1. Verify all prerequisites.

(1) **Verify storage supports the zero page reclamation utility**—Do one of the following to check the microcode version to see if it is 60-04-04 or later when using a Hitachi Universal Storage Platform V or VM:

- Use `rai dqry` with command control interface.
- Use Hitachi Storage Navigator

(2) **Verify the Oracle tablespace or tablespaces are in a dynamic provisioning pool or dynamic tiering pool.**

(3) **Verify the diskgroup has 25% free space.**

2. Run ASRU—Run the ASRU command on the applicable diskgroups.

3. **[Dynamic Tiering Enabled Only] Check pool status**—When Hitachi Dynamic Tiering is enabled on the dynamic provisioning pool, verify that zero page reclamation can run by verifying that the dynamic tiering pool is in the STP status or MON status. Check the status with one of the following:

- Use `rai dcom get` with command control interface.
- Use Storage Navigator

4. **Run the zero page reclamation utility**—Run zero page reclaim on the V-VOL doing one of the following:

- Use `rai dcom modify` with command control interface.
- Use Storage Navigator.

Solution Example

This example shows how to use this procedure. The scenario is an Oracle ASM diskgroup on a Hitachi Virtual Storage Platform. There is 30% free space within a tablespace filled with application data. After deleting the tablespace, the storage space reclamation uses the ASM storage reclamation utility and the zero page reclamation utility.

System Environment

The system environment used for this example included the following:

- There were a total of eight virtual volumes (V-VOLs) on the storage platform.
 - Six of the eight V-VOLs contained Oracle database storage.
 - Each V-VOL used for Oracle database storage was presented as a LUN to the operating system on the database server.
- The LUNs were added to Oracle ASM.
 - A single ASM diskgroup was created for all LUNs.
- One or more tablespace was created.

Procedure

This is the example of how to perform this procedure.

Specific actions in this example were performed only to collect data on storage capacity when doing the lab validation report. You do not have to perform these actions when doing this procedure.

1. Verify all prerequisites.

(1) Verify storage supports the zero page reclamation utility.

Do one of the following to check the microcode version to see if it is 60-04-04 or later when using this on a Hitachi Universal Storage Platform V or VM.

- **Using command control interface**

To determine the microcode version, type the following at a prompt:

```
#rai dqry -l
```

The response from a rai dqry command in Figure 1 shows a microcode version that is 60-04-04 or later:

No	Group	Hostname	HORCM_ver	Ui d	Serial #	Micro_ver	Cache(MB)
1	---	bs2k-06-b6-11	01-24-03/16	0	53027	70-02-54/00	38912

Figure 1

- **Using Storage Navigator**

In Storage Navigator, check the main microcode version as shown in Figure 2.

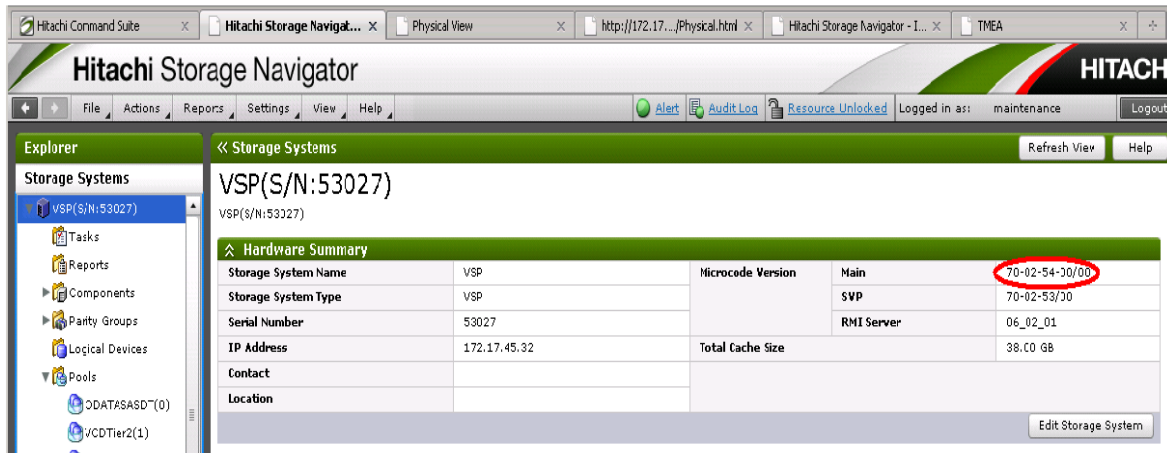


Figure 2

If you do not have the proper microcode version, follow your normal procedures to install updated microcode.

(2) Verify the Oracle tablespace or tablespaces are in a dynamic provisioning pool or dynamic tiering pool.

To use this procedure, the following must be true:

- The database storage layout needs to consist of an ASM diskgroup with two or more disks.
- The underlying disks need to be V-VOLs from a dynamic provisioning pool or a dynamic tiering pool.
- Each Oracle tablespace must exist in the ASM diskgroup.

If any of the above is not true, make the necessary changes before continuing.

(3) Verify the diskgroup has at least 25% free space.

The Oracle ASM space reclamation utility requires that the diskgroup has at least 25% free space.

See the ASRU README file for all the requirements to execute this utility. Find the ASRU README file in the ASRU directory.

To display ASRU help, type the following at an ASRU command prompt.

```
#ASRU - - hel p
```

(4) Optional. Check the space consumed by the Oracle ASM diskgroup and the storage volumes used by the ASM disks.

Check the size of the ASM diskgroup using a SQL statement. An example statement follows:

```
SQL>select b.name "DG Name", b.total_mb, (hot_used_mb + cold_used_mb) "USED_MB",  
b.free_mb from v$asm_diskgroup b where name='DATA';
```

Check the size of the V-VOLs of each LUN using command control interface or Storage Navigator.

- **Using command control interface**

First, execute the following command for each corresponding V-VOL of the dynamic provisioning pool for the ASM diskgroup.

```
# rai dvchkdsp -g DATA -v aoub
```

Figure 3 is a sample output from using that command.

Group	PairVol	Port#	TID	LU	Seq#	LDEV#	Used(MB)	LU_CAP(BLK)	U(%)	T(%)	PID
DATA	DATA1	CL3-A-1	0	0	53027	6	126	524288640	6	95	0
DATA	DATA2	CL3-A-1	0	1	53027	7	126	524288640	6	95	0
DATA	DATA3	CL3-A-1	0	2	53027	8	126	524288640	6	95	0
DATA	DATA4	CL3-A-1	0	7	53027	22	126	524288640	6	95	0
DATA	DATA5	CL3-A-1	0	13	53027	23	126	524288640	6	95	0
DATA	DATA6	CL3-A-1	0	14	53027	24	126	524288640	6	95	0
DATA	DATA7	CL3-A-1	0	15	53027	25	191100	524288640	6	95	0
DATA	DATA8	CL3-A-1	0	16	53027	26	191100	524288640	6	95	0

Figure 3

Then, sum the capacity and used space of each volume forming the ASM diskgroup. Calculate the total free capacity from the difference of the total capacity and total used space.

Alternately, use the following command for each individual volume belonging to the ASM diskgroup.

```
# raidcom get ldev -ldev_id 0x06
```

Figure 4 is a sample output from using that command.

```

Serial# : 53027
LDEV : 6
SL : 0
CL : 0
VOL_TYPE : OPEN-V-CVS
VOL_Capacity(BLK) : 524288640
NUM_PORT : 4
PORTs : CL3-A-1 0 R905-23_H11H21 : CL4-B-1 0 R905-23_H11H21 : CL2-B-1 2
OA_B5_BL4_HBA1_2 : CL2-A-2 2 OA_B5_BL4_HBA1_1
F_POOLID : NONE
VOL_ATTR : CVS : HDP : HDT
B_POOLID : 0
LDEV_NAMING : ODATASASvv1
STS : NML
OPE_TYPE : NONE
OPE_RATE : 100
MP# : 0
Used_Block(BLK) : 258048
TIER_Relocation : Enable
TIER#1(MB) : 42
TIER#2(MB) : 84
TIER#3(MB) : 0

```

Figure 4

Sum each VOL_Capacity to calculate the total capacity. Sum each Used_Block to calculate the total used space. Then, calculate the total free capacity from the difference of the two values.

- **Using Storage Navigator**

Record the total capacity and used capacity for each V-VOL from the Storage Navigator user interface, as shown in Figure 5.

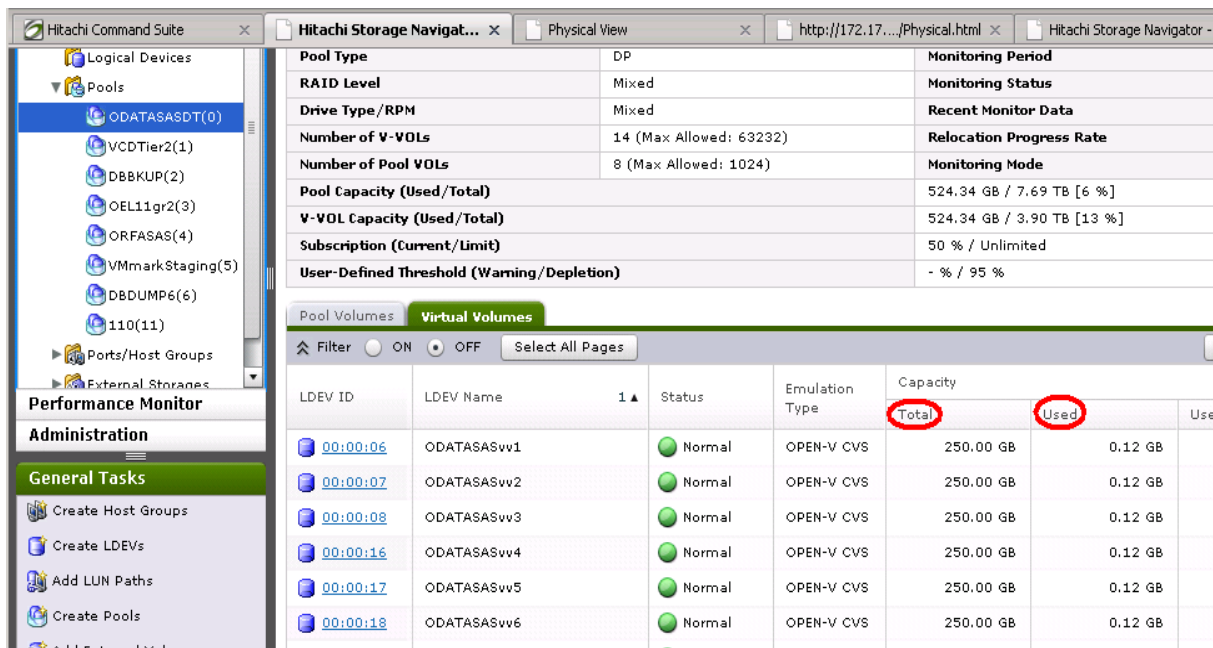


Figure 5

Then, calculate the free space of the V-VOLs by finding the difference between the combined total capacity and the combine used capacity.

When validating this procedure in the lab environment, this is where the deletion of the tablespace and its contents occurred.

This is an example SQL statement used to drop a tablespace and its contents:

```
SQL> DROP TABLESPACE SOE INCLUDING CONTENTS;
```

This is an example SQL statement used to drop a tablespace, its contents, and its datafiles:

```
SQL> DROP TABLESPACE SOE INCLUDING CONTENTS AND DATAFILES;
```

After deleting one or more tablespace and its contents, the size of the ASM diskgroups and the LUN V-VOLs was checked again at this point.

2. Run ASM Space Reclamation Utility.

Run the ASM space reclamation utility from Oracle on each diskgroup in which each dropped tablespace existed. This fills dropped tablespaces with zeros to create zero pages.

This is the command you type to start the utility:

```
#. /ASRU DATA
```

Figure 6 is an example of the screen output when running the utility:

```
Checking the system ... done
Calculating the sizes of the disks ... done
Writing the data to a file ... done
Resizing the disks... done
Calculating the sizes of the disks ... done

/u01/app/oracle/product/11.2.0/grid/perl/bin/perl -I
/u01/app/oracle/product/11.2.0/grid/perl/lib/5.10.0 /home/oracle/ASRU/ASRU1/ASRU1/zerofill
1 /dev/oracleasm/disks/DATA2 15 255996 /dev/oracleasm/disks/DATA7 15 255996
/dev/oracleasm/disks/DATA1 15 255996 /dev/oracleasm/disks/DATA3 15 255996
/dev/oracleasm/disks/DATA6 15 255996 /dev/oracleasm/disks/DATA4 15 255996
/dev/oracleasm/disks/DATA8 15 255996 /dev/oracleasm/disks/DATA5 16 255996

Calculating the sizes of the disks ... done
Resizing the disks... done
Calculating the sizes of the disks ... done
Dropping the file ... done
```

Figure 6

When validating this procedure in the lab environment, the size of the ASM diskgroups and the LUN V-VOLs was checked again at this point.

3. [Dynamic Tiering Enabled Only] Check pool status

Before starting the zero page reclamation utility, check the pool status when Hitachi Dynamic Tiering is enabled on the pool. The zero page reclamation utility will not start if either of the following is in progress on the dynamic provisioning pool:

- A relocation and monitoring cycle
- A relocation cycle

The zero page reclamation utility can proceed when the dynamic tiering pool is in one of these pool statuses:

- STP
- MON

For each dynamic provisioning pool with tiering enabled on which the zero page reclamation utility is to run, check the pool status with the following command:

```
# raidcom get thp_pool -key opt
```

Figure 7 is a sample output from running this command for pool ID 000. It shows the status (STS) of the pool when the pool is in monitoring cycle (MON) and when it is not being monitored or monitoring is stopped (STP).

PID	POLS	MODE	STS	DAT	TNO	TL_RANGE	TD_RANGE	TU_CAP(MB)	TT_CAP(MB)	T(%)	P(%)	R(%)
000	POLN	DEF	MON	VAL	1	00000038	0000000a	1218	307188	0	3	0
000	POLN	DEF	MON	VAL	2	00000000	00000005	395388	4942812	8	17	0
000	POLN	DEF	MON	VAL	3	00000000	00000000	140322	2817528	8	0	0
PID	POLS	MODE	STS	DAT	TNO	TL_RANGE	TD_RANGE	TU_CAP(MB)	TT_CAP(MB)	T(%)	P(%)	R(%)
000	POLN	DEF	STP	PND	1	-	-	1218	307188	0	0	0
000	POLN	DEF	STP	PND	2	-	-	395388	4942812	8	0	0
000	POLN	DEF	STP	PND	3	-	-	140322	2817528	8	0	0

Figure 7

The zero page reclamation utility will start with the pool statuses shown in Figure 7.

4. Run the zero page reclamation utility

Start the zero page reclamation utility on each V-VOL belonging to the ASM diskgroup using command control interface or Hitachi Storage Navigator.

- **Using command control interface**

Start the zero page reclamation utility for each V-VOL from the command line interface. This following example is for starting this utility on LDEV6:

```
# raidcom modify ldev -ldev_id 0x06 -status discard_zero_page
```

Check progress of reclaim task using the following command:

```
# raidcom get ldev -ldev_id 0x06
```

While executing, the zero page reclaim status (STS) is shown as zero progress discard (ZPD). The status goes to normal (NML) on completion. See Figure 7.

```

Serial# : 53027
LDEV : 6
SL : 0
CL : 0
VOL_TYPE : OPEN-V-CVS
VOL_Capacity(BLK) : 524288640
NUM_PORT : 4
PORTs : CL3-A-1 0 R905-23_H11H21 : CL4-B-1 0 R905-23_H11H21 : CL2-B-1 2
OA_B5_BL4_HBA1_2 : CL2-A-2 2 OA_B5_BL4_HBA1_1
F_POOLID : NONE
VOL_ATTR : CVS : HDP : HDT
B_POOLID : 0
LDEV_NAMING : ODATASASvv1
STS : ZPD
OPE_TYPE : NONE
OPE_RATE : 100
MP# : 0
Used_Block(BLK) : 258048
TIER_Relocation : Enable
TIER#1(MB) : 42
TIER#2(MB) : 84
TIER#3(MB) : 0

```

Figure 8

- Using Storage Navigator

Start the zero page reclamation utility as shown in Figure 9 at Pointer 1 by clicking **Reclaim Zero Pages** from the menu.

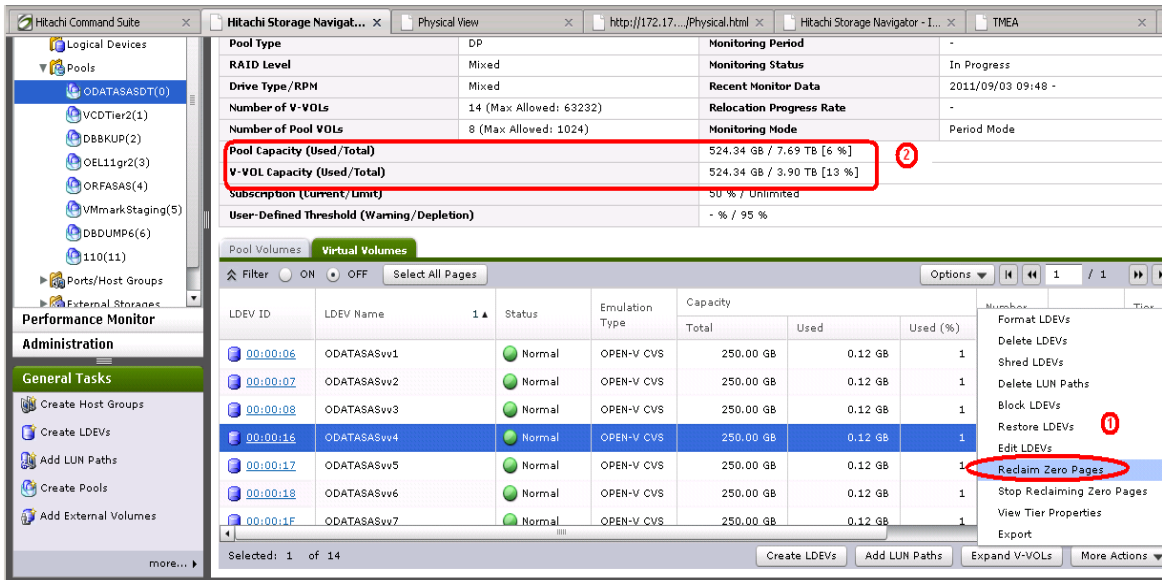


Figure 9

If the V-VOL is not in the correct state to start zero page reclamation, then it displays an error.

If the V-VOL is in the correct state to start zero page reclamation, check the utility's progress by clicking **Reclaim Zero Pages** from the menu again.

After the task completes, click the pool to see the space reclaimed with **Pool Capacity (Used/Total)** and **V-VOL capacity (Used/Total)**, as shown in Figure 9 at Pointer 2.

After completing the zero page reclamation utility on all virtual volumes, you can check to see how much space was reclaimed.

Product Features

The Zero Page Reclaim Utility from Hitachi

The zero page reclaim utility is a part of Hitachi Dynamic Provisioning. This utility reclaims allocated but unused storage in a dynamic provisioning pool. Storage is reclaimed in pages that are 42MB each on the Hitachi Virtual Storage Platform. It works on existing open system volumes without disrupting other applications.

When used, the zero page reclaim utility examines the physical capacity of the virtual volumes (V-VOLs) in the pool to determine those pages that are filled with zeroes (zero pages). When detecting a zero page in the dynamic provisioning pool, this utility unallocates the physical storage. This increases the free capacity of the dynamic provisioning pool.

The ASM Storage Reclamation Utility from Oracle

Oracle provides the ASM storage reclamation utility (ASRU) to mark unused ASM disk space. It marks this disk space by filling unused datablocks with zeros. Use this utility to mark unused space when doing the following to an Oracle ASM diskgroup:

- Deleting a large tablespace
- Deleting a database
- Adding disks

For more information about Automatic Storage Management and ASRU, see [Oracle Automatic Storage Management and Thin Reclamation](#).

Further Information

Hitachi Data Systems Global Services offers experienced storage consultants, proven methodologies and a comprehensive services portfolio to assist you in implementing Hitachi products and solutions in your environment. For more information, see the Hitachi Data Systems [Global Services](#) website.

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