Session 13979

Hitachi Dynamic Tiering, Managing Your Mainframe Storage Easily and Effectively

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**Improved Performance at Reduced Cost:**

Data Locality and Pareto Distributions

**Why does it work so well?**

- **Skew** – At any time, only a small address range is active
- **Persistence** – When an address range is accessed it tends to remain so for a while

**Classic Pareto Distributions**

*(Also Known as the 80/20 Rule)*

![Graph showing Pareto Distributions](image)

**Actual Volume Workload**

![Graph showing actual volume workload](image)
V-VOL=DP-VOL (3390-A)
What the host sees – volumes that are accessed by Host and have a capacity recognized by Host, but do not have physical area. Instead they have “pages” that are maps to physical pages in the pool-VOLs.
Can be created with a larger capacity than the installed physical VOL/pool, but this is not recommended for mainframe.

Pool-VOL (3390-V)
Pools are a special type of physical volume in which V-VOL data pages are stored.

Pool-VOL (3390-V)

Mapping management information
Management area for managing mapping information of V-VOL, pool, and pool-VOL and monitoring free capacity.

Pool
Area created from 1 or more RAID Groups and in which pool-VOLs are registered.

RAID group

Host

Port

V-VOL

Shared memory

Mapping management information backup area

Mapping management information

V-VOL

3390-A

A

B

C

3390-A

3390-A

3390-A

Pool-VOL

3390-A

A

B

C

HITACHI DYNAMIC PROVISIONING FOR MAINFRAME STORAGE Architecture
Hitachi Dynamic Tiering
automated optimized Tiered Storage Management

- **Before: Tiered storage and provisioning**
  - Labor intensive
  - Data classification before tiering
  - Complicated management of multiple storage tiers

- **Now: Dynamic tiering and provisioning**
  - Controller-based automation
  - Single, self-managed, self-healing, efficient pool of data
  - All the benefits of dynamic provisioning
  - Optimized use of Flash storage
  - No need for data classification

- Simplifies operations and data management
- Reduces opex, capex, and TCO
Hitachi Dynamic Tiering
Supports Virtualized Storage

- With HDT, Hitachi Virtual Storage Platform (VSP) provides automated tiered storage management and performance acceleration for multiple tiers of heterogeneous external storage
  - As an SSD accelerator
  - As a storage virtualization controller
  - Heterogeneous storage business continuity and disaster recovery solution
  - Leveraging the breadth of offerings on VSP
Hitachi Dynamic Tiering for Mainframe and DFSMS
LIMITS OF SMS Storage Groups and ACS Routines

- 3390 volumes are "fixed" to a single tier
- To transition a volume's data to another tier requires ACS work, then migration and recall
- Stale datasets are treated the same as active ones until HSM migration
- Performance problems need intervention to migrate to "higher" storage group
- Host-based volume movement has high overhead cost
DFSMS
Storage Groups (SG) and HDT for Mainframe storage

- Now with HDT for Mainframe storage, storage tiers may be combined into a single storage group
- HDT automatically moves data within a storage group to the correct tier based on Workload performance

Subsystem
- SSD Tier 1
- SAS Tier 2
- NL SAS Tier 3
- HDT Pool
- Storage Group

HDT Volumes are optimally managed dynamically at the page level
DFSMS Storage Groups and HDT for Mainframe Storage

- Simplifies integration
- HDT can be applied to selected Storage Groups only
- DFSMS Horizontal Storage Groups and Dynamic Page based Tiering volumes can be aligned

Online SG
Batch SG
HSM Archive SG

Subsystem
Subsystem
Subsystem

FLASH Tier 0
SAS Tier 1
NL SAS Tier 2
HDT Pool
Storage Group

Complete your sessions evaluation online at SHARE.org/BostonEval
With HDT for Mainframe storage policies, individual policies can be defined for volumes mapped to different storage groups. Policies are supported based on tier ranges, analysis/migration periods, initial tier page assignments and relocation priority.

- **Online SG**: HDT Custom Policy Defined for Online Data Across Top 2 Tiers
- **Batch SG**: HDT Policy Restricted to Tier 2 Residency
- **Archive SG**: HDT Policy Restricted to Tiers 2 and 3 Residency
## HDT Operational Impact #1

<table>
<thead>
<tr>
<th>Operation</th>
<th>DFSMS/HSM</th>
<th>Dynamic Tiering</th>
</tr>
</thead>
<tbody>
<tr>
<td>What does it take to move between tiers?</td>
<td>HSM or manual; high MIPs overhead</td>
<td>Automated; offloads mainframe overhead</td>
</tr>
<tr>
<td>How responsive is a tier adjustment?</td>
<td>Slow; entire volumes are moved</td>
<td>Short as 30 minute cycles; only pages are moved</td>
</tr>
<tr>
<td>How to proactively avoid problems?</td>
<td>Static ACS routines, manual change &amp; monitoring required</td>
<td>Automated; fine-grained and self-optimizing</td>
</tr>
<tr>
<td>How well does wide striping work for performance?</td>
<td>No wide striping</td>
<td>Improved performance, automatic dynamic optimization of all available spindles</td>
</tr>
<tr>
<td>Effort to effectively manage tiers with SMS and IBM® z/OS®?</td>
<td>Manual calculations and programming</td>
<td>Automatic</td>
</tr>
</tbody>
</table>
## HDT Operational Impact #2

<table>
<thead>
<tr>
<th>Working with Storage</th>
<th>Before HDT</th>
<th>With HDT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add physical capacity</td>
<td>Add 3390-X volumes into storage groups</td>
<td>Add capacity into pool</td>
</tr>
<tr>
<td>Balance use over new capacity</td>
<td>Manually use HSM migration/recall</td>
<td>No actions are needed</td>
</tr>
<tr>
<td>Direct specific applications to specific storage resources</td>
<td>Code ACS routines, follow-up with HSM migrations and recalls</td>
<td>Set 3390-A to an HDT policy – use same ACS routines but no HSM needed</td>
</tr>
<tr>
<td>Address performance problems by moving datasets or volumes</td>
<td>Code ACS routines and use HSM migration/recall</td>
<td>HDT relocation has likely prevented the issue; otherwise use HDT policy</td>
</tr>
<tr>
<td>Maintain SMS storage groups and ACS routines</td>
<td>Constant challenge to keep updated with rules describing exceptions</td>
<td>Fewer exceptions since HDT keeps tiers properly populated</td>
</tr>
<tr>
<td>Demote data to lower tiers</td>
<td>HSM moves <em>datasets</em> to an ML “tier” that hasn’t been <em>opened</em> for a while</td>
<td>HDT automatically moves <em>pages</em> that haven’t been <em>used</em></td>
</tr>
</tbody>
</table>
Hitachi Dynamic Tiering Management

Hitachi Tiered Storage Manager for Mainframe

Complete your sessions evaluation online at SHARE.org/BostonEval
Management of Hitachi Dynamic Tiering

- Automatically detects and assigns Tiers based on media type and speed
- Control relocation of data based on either most recent IO patterns or longer term averaging
- Control relocation and analysis periods (from 30 min to 24 hours), relocation priority, tier for new allocations and the range of tiers a volume can use
- User also can dynamically:
  - Add or remove Tiers
  - Expand or shrink Tiers
  - Replace media and RAID types
  - Expand LUNs
  - Move LUNs between pools
  - Add or remove any media or RAID type
Hitachi Tiered Storage Manager for Mainframe
z/OS-based Management of Dynamic Tiering

Native z/OS host-based software provides:

- Online storage service level controls
  - Increase application performance
  - Improves problem avoidance
- Centralized and unified mainframe management of Hitachi Dynamic Tiering
  - Automation
  - Integration with DFSMS and storage groups
- Enables reporting and automatic notifications

Complete your sessions evaluation online at SHARE.org/BostonEval
Hitachi Tiered Storage Manager for Mainframe
z/OS-based Dynamic Tiering Management

Hitachi Virtual Storage Platform – Hitachi Dynamic Tiering for Mainframe Pool
Why HTSM for mainframe?

HTSM simplifies and improves operations

• Native management from z/OS
  • Control for data location from host’s point of view, not storage system’s point of view – improves control and simplifies operations
  • Ability to utilize HDT performance and relocation data with other data (such as SMF records)
  • Reduced dependency on open server-based operations

• Control of storage service levels using Dynamic Tiering policies
• Linkage with z/OS SMS (storage group) speeds integration and reduces opex
• Simplify management in large-scale environments with group operations
• Flexible command-line interface (CLI) (TSO/E REXX) enables users to get the most out of Dynamic Tiering
Easy-To-Manage Target Volumes

HTSM defines target volumes as a group. A single operation for the group applies to all volumes belonging to the group (called Tiering Policy Group [TPG]). Once the group is defined, subsequent management can be done via a group operation.
HTSM works with SMS storage groups and ACS routines. Each Tiering Policy Group can have 1 or more SMS Storage Groups. This feature gives users the capability to manage the HDT environment from a SMS point of view and makes it easy to add Dynamic Tiering to existing operations.
DFSMS and HDT and HTSM for Mainframe

- HDT can be applied to selected Storage Groups only
- HTSM for MF can be used to apply the Tiering policies by Storage Group
- DFSMS Horizontal Storage Groups and Dynamic Page based Tiering volumes can be aligned

Subsystems:
- SSD Tier 1
- SAS Tier 2
- NL SAS Tier 3
- HDT Pool
- Storage Group

Storage Groups:
- Online SG
- Batch SG
- HSM Archive SG

Complete your sessions evaluation online at SHARE.org/BostonEval
The input of HTSM for MF is CSV file. The output are TPG config and disk config.

Sample of tiering policy information CSV file

```
#comment
type,SMS Storage Group,TieringPolicyName,TieringPolicy
STORGRP,SG1,TPG1,2
DEVN,1101,TPG1,1,HIGH
STORGRP,SG2,TPG1,5,LOW
```

Sample of Disk configuration definition file

```
<?xml version="1.0" encoding="ebcdic-cp-us"?>
<APIInfo Level="7.5.0">
  <TieringPolicyGroup ID="TPG1" />
  <TieringPolicy Level="1" Entry="High">
    <DiskDevice SerialNum="FGHK2" CUNum="01" SSID="2340" CCA="11" POOLID="01" />
  </TieringPolicy>
  <TieringPolicy Level="2" Entry="Middle">
    <DiskDevice SerialNum="FGHK2" CUNum="01" SSID="2340" CCA="01" POOLID="01" />
    <DiskDevice SerialNum="FGHK2" CUNum="01" SSID="2340" CCA="02" POOLID="01" />
  </TieringPolicy>
  <TieringPolicy Level="5" Entry="Low">
    <DiskDevice SerialNum="FGHK2" CUNum="02" SSID="2340" CCA="01" POOLID="02" />
    <DiskDevice SerialNum="FGHK2" CUNum="02" SSID="2340" CCA="02" POOLID="02" />
  </TieringPolicy>
</APIInfo>
```
HTSM Customization via REXX Scripting

HTSM provides a CLI (TSO/E REXX) that enables users to tailor the operation to their environments. The CLI also has the ability to cooperate with OS services (such as TSO/E service) and other products.

For improved manageability, HTSM for MF has separated operation procedures (REXX script) and objects (such as group definition).
**Tiering Policy ID:** PROD  
**Date:** 11 Jul 2013  
**Time:** 04:49:26

***** Dynamic Pool Information - SN53004 Pool 81 *****

- **HDT Pool ID:** 81
- **HDT Pool Name:** MikeDak1
- **Monitor Mode:** Y (Automatic Execution Mode)
- **Relocation Status:** N (Relocation Finished or Stopped)
- **Relocation Progress:** 100%

<table>
<thead>
<tr>
<th>Tier 1</th>
<th>Tier 2</th>
<th>Tier 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Media</td>
<td>SAS 15K</td>
<td>SAS 10K</td>
</tr>
<tr>
<td>Unit</td>
<td>PAGE</td>
<td>PAGE</td>
</tr>
<tr>
<td>Capacity</td>
<td>1340</td>
<td>1240</td>
</tr>
<tr>
<td>Used</td>
<td>204</td>
<td>0</td>
</tr>
<tr>
<td>Entry Buffer</td>
<td>8%</td>
<td>8%</td>
</tr>
<tr>
<td>Relocation Buffer</td>
<td>2%</td>
<td>2%</td>
</tr>
</tbody>
</table>

**Most Recent Completed Relocation**

(only refreshed by next Active Relocation)

- **Relocation Start Time:** 04:00
- **Relocation End Time:** 04:17
- **Expected Migration:** 0
- **Migrated:** 0

<table>
<thead>
<tr>
<th>Tier 1</th>
<th>Tier 2</th>
<th>Tier 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expected Migration from T1:</td>
<td>n/a</td>
<td>0</td>
</tr>
<tr>
<td>from T2:</td>
<td>0</td>
<td>n/a</td>
</tr>
<tr>
<td>from T3:</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Migrated T1:</td>
<td>n/a</td>
<td>0</td>
</tr>
<tr>
<td>from T2:</td>
<td>0</td>
<td>n/a</td>
</tr>
<tr>
<td>from T3:</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

11 Jul 2013 04:49:26 *** Action TPG_QUERY_RELOCATION Successful
### HTSM for MF Reporting - Query Policy

**Tiering Policy ID:** PROD  
**Date:** 11 Jul 2013  
**Time:** 03:10:54

********** Query TPG **********

Note: Any '*' Character below indicates a Tiering Policy Mismatch between the TPG Definition and the Active HDT-MF Settings on the DKC(s).

<table>
<thead>
<tr>
<th>Devn</th>
<th>Volser</th>
<th>Group</th>
<th>Storage</th>
<th>Serial Pool</th>
<th>Tier</th>
<th>Entry Tier</th>
<th>Relocation</th>
</tr>
</thead>
<tbody>
<tr>
<td>E941</td>
<td>GSE941</td>
<td>ALPHA</td>
<td>53004</td>
<td>81</td>
<td>2</td>
<td>HIGH</td>
<td>Y (Enabled)</td>
</tr>
<tr>
<td>E942</td>
<td>GSE942</td>
<td>ALPHA</td>
<td>53004</td>
<td>81</td>
<td>2</td>
<td>HIGH</td>
<td>Y (Enabled)</td>
</tr>
<tr>
<td>E943</td>
<td>GSE943</td>
<td>ALPHA</td>
<td>53004</td>
<td>81</td>
<td>2</td>
<td>HIGH</td>
<td>Y (Enabled)</td>
</tr>
<tr>
<td>E944</td>
<td>GSE944</td>
<td>ALPHA</td>
<td>53004</td>
<td>81</td>
<td>2</td>
<td>HIGH</td>
<td>Y (Enabled)</td>
</tr>
<tr>
<td>E945</td>
<td>GSE945</td>
<td>ALPHA</td>
<td>53004</td>
<td>81</td>
<td>2</td>
<td>HIGH</td>
<td>Y (Enabled)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Devn</th>
<th>Volser</th>
<th>Group</th>
<th>Storage</th>
<th>Serial Pool</th>
<th>Tier</th>
<th>Entry Tier</th>
<th>Relocation</th>
</tr>
</thead>
<tbody>
<tr>
<td>E941</td>
<td>GSE941</td>
<td>ALPHA</td>
<td>53004</td>
<td>81 * 0</td>
<td>MIDDLE</td>
<td>Y (Enabled)</td>
<td></td>
</tr>
<tr>
<td>E942</td>
<td>GSE942</td>
<td>ALPHA</td>
<td>53004</td>
<td>81 * 5</td>
<td>LOW</td>
<td>Y (Enabled)</td>
<td></td>
</tr>
<tr>
<td>E943</td>
<td>GSE943</td>
<td>ALPHA</td>
<td>53004</td>
<td>81 * 0</td>
<td>MIDDLE</td>
<td>Y (Enabled)</td>
<td></td>
</tr>
<tr>
<td>E944</td>
<td>GSE944</td>
<td>ALPHA</td>
<td>53004</td>
<td>81 * 0</td>
<td>MIDDLE</td>
<td>Y (Enabled)</td>
<td></td>
</tr>
<tr>
<td>E945</td>
<td>GSE945</td>
<td>ALPHA</td>
<td>53004</td>
<td>81 * 0</td>
<td>MIDDLE</td>
<td>Y (Enabled)</td>
<td></td>
</tr>
</tbody>
</table>

11 Jul 2013 03:10:54 *** Action TPGQUERYPOLICY Successful
## HTSM for MF Reporting - Query TPG

### Tiering Policy ID: APACMC

- **Date:** 27 Jul 2013
- **Time:** 04:02:36

### Query TPG Tier Metrics

<table>
<thead>
<tr>
<th>TPG Total or SN:PoolID or <em>StorGrp</em> or Volser or Volser Prefix</th>
<th>Tier 1</th>
<th>Tier 2</th>
<th>Tier 3</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Used</td>
<td>Used</td>
<td>Used</td>
<td>Used</td>
</tr>
<tr>
<td><strong>Pages</strong></td>
<td>Pages</td>
<td>Pages</td>
<td>Pages</td>
<td>Pages</td>
</tr>
<tr>
<td><strong>UsedGB</strong></td>
<td>UsedGB</td>
<td>UsedGB</td>
<td>UsedGB</td>
<td>UsedGB</td>
</tr>
<tr>
<td><strong>Used%</strong></td>
<td>Used%</td>
<td>Used%</td>
<td>Used%</td>
<td>Used%</td>
</tr>
</tbody>
</table>

| TPG Total | 352 | 0   | 0   | 352   |
| SN53004:81 | 13.4GB | 0GB | 0GB | 13.4GB |
| Used% of Pool | 26.3% | 0%  | 0%  | 8.98% |
| Pool Pages | 1340 | 1240 | 1340 | 3920 |
| Pool GB | 50.9GB | 47.1GB | 50.9GB | 149GB |
| Tier% of Pool | 34.2% | 31.6% | 34.2% | 100% |

| *ALPHA* | 352 | 0 | 0 | 352 |
|         | 13.4GB | 0GB | 0GB | 13.4GB |
|         | 100%   | 0%  | 0%  | 100%  |

| GSE94* | 352 | 0 | 0 | 352 |
|        | 13.4GB | 0GB | 0GB | 13.4GB |
|        | 100%   | 0%  | 0%  | 100%  |

**Action:** TPG_QUERY_TIERS Successful
HDS HTSM for Mainframe Scripting Solution
From SDSF using z/OS SYSREXX

System Command Extension
Type or complete typing a system command, then press Enter.

```plaintext
*** rexx htsmcmdc tpg_query_status tpg(alphatpg) prefix(varend.htsmcmd)
*** cmd
```

Place the cursor on a command and press Enter to retrieve it.

More: +

```plaintext
D A L
D T C F G
D 0 D,SSID=ALL
D rexx htsmcmdc tpg_query_relocation prefix(varend.htsmcmd) tpg(alphatpg)
D rexx htsmcmdc tpg_activate tpg(alphatpg) prefix(varend.htsmcmd)
D rexx htsmcmdc tpg_deactivate tpg(alphatpg) prefix(varend.htsmcmd)
D rexx htsmcmdc tpg_query_status tpg(alphatpg) prefix(varend.htsmcmd)
D rexx htsmcmdc tpg_query_status tpg(alphatpg)
```

Wait 1 second to display responses (specify with SET DELAY)
Do not save commands for the next SDSF session

F1=Help  F5=FullScr  F7=Backward  F8=Forward  F11=ClearLast  F12=Cancel

KTC311: 21:46:37 KTQRYTPG RC=0
KTC310: 21:46:41 KTLOAD STEM(KSTEM.) MSG(KTMSG.) PREFIX(VAREND.HTSMCMD) TPG(A)
KTC311: 21:46:41 KTLOAD RC=0
KTC310: 21:46:41 KTQRYTPG STEM(KSTEM.) MSG(KTMSG.)
KTC311: 21:46:41 KTQRYTPG RC=0
KTC310: 21:46:41 KTLOAD STEM(KSTEM.) MSG(KTMSG.) PREFIX(VAREND.HTSMCMD) TPG(A)
KTC311: 21:46:41 KTLOAD RC=0
KTC310: 21:46:41 KTQRYTPG STEM(KSTEM.) MSG(KTMSG.)
KTC311: 21:46:41 KTQRYTPG RC=0
KTC310: 21:46:41 KTLOAD STEM(KSTEM.) MSG(KTMSG.) PREFIX(VAREND.HTSMCMD) TPG(A)
KTC311: 21:46:41 KTLOAD RC=0
KTC310: 21:46:41 KTQRYTPG STEM(tpg.TPG00001.) MSG(msg.)
KTC311: 21:46:41 KTQRYTPG RC=0

Complete your sessions evaluation online at SHARE.org/BostonEval
HDT for Mainframe and HTSM for Mainframe Storage - Summary

- Enables automation and more efficient use of tiered storage – self optimizes
- Improves ability to manage SLAs
- Improves performance
HDT Performance Example 1

- This example shows results from HDT testing
  - Demonstrates how HDT learns your workload
- Scenario: Customer reluctant to upgrade from 300GB to 600GB HDD
- Same capacity of HDD (not Including SSD)
  - (128) 300GB SAS
  - (64) 600GB SAS + (8) 400GB SSD
- IMPORTANT NOTE: SSD drives are added to the pool after all data sets are created

Disclaimer: PAIO workload tests used only demonstrate Dynamic Tiering behavior and concept. These tests are not intended for benchmarking purposes and results may vary depending on the workload used and the systems in the environment.
## Basic Configuration

<table>
<thead>
<tr>
<th>Config. Name</th>
<th>RAID Type</th>
<th>LCU</th>
<th>DP-VOL per Pool</th>
<th>PAIO Dataset</th>
<th>Base/Alias</th>
<th>Dev. Num.</th>
<th>Desc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDT3HF</td>
<td>RAID-6(6D+2P)</td>
<td>00 - 03</td>
<td>256</td>
<td>1024</td>
<td>64/192</td>
<td>70xx</td>
<td>(128) 300GB SAS HDP pool</td>
</tr>
<tr>
<td>HDT6HF</td>
<td>RAID-6(6D+2P)</td>
<td>08 – 0B</td>
<td>256</td>
<td>1024</td>
<td>64/192</td>
<td>72xx</td>
<td>(64) 600GB SAS HDP pool</td>
</tr>
<tr>
<td>HDT6HF Run 1 through Run 4</td>
<td>RAID-6(6D+2P)</td>
<td>08 – 0B</td>
<td>256</td>
<td>1024</td>
<td>64/192</td>
<td>72xx</td>
<td>HDT pool (8) 400GB SSD (64) 600GB SAS</td>
</tr>
</tbody>
</table>
300Gb and 600GB HDP BaselineS have been run (NO SSD Drives)

- **HDP (64)**
  - 600GB HDD

- **HDP (128)**
  - 300GB HDD

**PAIO - C6**
- 4K Skewed Series Chain(1)
- 70% Read / 30% Write

Complete your sessions evaluation online at SHARE.org/BostonEval
First Run: 600GB Tier 2 + SSD Tier 1 – 0 minutes – No Learning

LET TIERING LEARN YOUR WORKLOAD

HDP (64) 600GB HDD

Tiering (64) 600GB: No learning, same as HDP

HDP (128) 300GB HDD

PAIO - C6
4K Skewed Series Chain(1)
70% Read / 30% Write

Complete your sessions evaluation online at SHARE.org/BostonEval
Second Run: 600GB Tier 2 + SSD Tier 1 – 30 Minutes of Rest after Run 1

LET TIERING LEARN YOUR WORKLOAD

HDP (64)
600GB HDD

Tiering – Run 1: No learning, same as HDP

PAIO - C6
4K Skewed Series Chain(1)
70% Read / 30% Write

Tiering – Run 2: After 30 minutes of migration

HDP (128)
300GB HDD

Complete your sessions evaluation online at SHARE.org/BostonEval
Fourth Run: 600GB Tier 2 + SSD Tier 1 – 30 Minutes of Rest after Run 3

LET TIERING LEARN YOUR WORKLOAD

- **Tiering – Run 1:** No learning, same as HDP
- **Tiering – Run 2:** After 30 minutes of migration
- **Tiering – Run 3:** After 30 minutes of migration
- **Tiering – Run 4:** After 30 minutes of migration

**HDP (64)**
600GB HDD

**HDP (128)**
300GB HDD

**PAIO - C6**
4K Skewed Series Chain(1)
70% Read / 30% Write
HDT Performance Example 2

- This example is another way to show how HDT learns your workload

- Same 600GB tier as previous experiment except at a steady state of 24K IOPS
  - (64) 600GB SAS drives + (8) 400GB SSD

- IMPORTANT NOTE: SSDs are added to the pool after all data sets are created
24K IOP Steady State

LET TIERING LEARN YOUR WORKLOAD

24K Steady State
PAIO - C6
4K Skewed Series Chain(1)
70% Read / 30% Write

Complete your sessions evaluation online at SHARE.org/BostonEval
HDT OBSERVATIONS

Observations

• After HDT “learned” the access patterns, the throughput doubled on a smaller storage footprint
• 90% of the active dataset area was migrated to Tier 1
  • 10% of data did not meet the Tier 1 IO/hour criteria
• HDT can resolve HDD sibling pend contention
  • Migrate to a 2-tier HDT configuration
  • The VSP will learn and migrate pages that will benefit from SSD performance in HDT structure
  • A single SSD parity group can improve performance in a short time
Questions and Discussion

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Thank you

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