HITACHI DYNAMIC TIERING (HDT): AN IN-DEPTH LOOK AT MANAGING HDT AND BEST PRACTICES

BRANDON LAMBERT, SR. MANAGER
MICHAEL ROWLEY, PRINCIPAL CONSULTANT
AMERICAS SOLUTIONS AND PRODUCTS
Hitachi Dynamic Tiering simplifies storage administration by automatically optimizing data placement in 1, 2, or 3 tiers of storage that can be defined and used within a single virtual volume. Tiers of storage can be made up of internal or external (virtualized) storage, and use of HDT can lower capital costs. Simplified and unified management of HDT allows for lower operational costs and reduces the challenges of ensuring applications are placed on the appropriate classes of storage.

By attending this webcast, you will

• Hear about what makes Hitachi Dynamic Tiering a unique storage management tool that enables storage administrators to meet performance requirements at lower costs than traditional tiering methods.

• Understand various strategies to consider when monitoring application performance and relocating pages to appropriate tiers without manual intervention.

• Learn how to use Hitachi Command Suite (HCS) to manage, monitor and report on an HDT environment, and how HCS manages related storage environments.
AGENDA

- The HDT lifecycle
- HDT performance basics
- HDT basic guidelines
- Monitoring HDT with Hitachi Tuning Manager
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HDT LIFECYCLE

Plan
- Turn on HDT Heat Maps
- Consider HW Limits
- Design HDT Environment
  - What to Monitor and Cycle
- Historical Performance Trend

Implement
- Build HDT Pools
- Add Daily Monitoring
- Implement
- Migrate Into Pools
- Adjust Configuration
- Basic Trend Report (Cap./Perf.)

Daily Operations (Monitor/Report)
- Cont. Daily Monitor (Alarm)
- Capacity Trend/Plan
- Tune Configuration (HW, Cycle, Apps, Policies)
- Relocation Reporting (Gradual or Erratic)
- Performance Trend/Troubleshoot
AGENDA

- The HDT lifecycle
- HDT performance basics
- HDT basic guidelines
- Monitoring HDT with Hitachi Tuning Manager
- Back-end I/O (read and write) counted per page during the monitor period
- Monitor ignores “RAID I/O” (parity I/O)
- Count of IOPH for the cycle (period mode) or a weighted average (continuous mode)
- HDT orders pages by counts high to low to create a distribution function
  - IOPH vs. terabytes
- Monitor analysis is performed to determine the IOPH values that separate the tiers

**Diagram:**
- Illustration of monitoring and analysis of IOPH values over capacity ranges.
POOL TIER PROPERTIES

What is being used now in the pool in terms of capacity and performance.

Can display just the performance graph for a tiering policy.

The I/O distribution across all pages in the pool. Combined with the tier range, HDT decides where the pages should go.

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**View Tier Properties**

<table>
<thead>
<tr>
<th>Tier</th>
<th>Drive Type/RPM</th>
<th>Capacity (Used/Total)</th>
<th>Performance Utilization</th>
<th>Buffer Space (New page assignment/Tier relocation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier1</td>
<td>GSD/</td>
<td>118.69 GB / 275.05 GB [43 %]</td>
<td>0 %</td>
<td>0 % / 2 %</td>
</tr>
<tr>
<td>Tier2</td>
<td>SAS/1.0k</td>
<td>11.52 TB / 36.57 TB [33 %]</td>
<td>7 %</td>
<td>0 % / 2 %</td>
</tr>
<tr>
<td>Tier3</td>
<td>SATA/7.2k</td>
<td>21.59 TB / 26.86 TB [50 %]</td>
<td>42 %</td>
<td>8 % / 2 %</td>
</tr>
</tbody>
</table>

**Performance Graph (HDTContinuous24.1(2))**

Object: Entire Pool

The graph shows the distribution of I/O across different capacity levels.
CAUTION ABOUT PERFORMANCE UTILIZATION (P%)

- P% is only an approximation of tier utilization
- It is based on assumptions of read/write ratios (50-50)
- P% does not factor in RAID I/O (parity I/O)
- It should not be used to calculate I/O counts
- It should not be used to determine relative utilization at lower P% values
  - P% is not accurate enough for comparing small differences
- P% is only used to signal that a tier may be overutilized
- P% cannot absolutely report that a problem exists
- Ignore P% unless it is over 60%
- Prior to V04+a continuous modes, P% uses the weighted average IOPH values. In V04+A continuous mode uses the monitoring result of the last cycle (period mode value) for calculating P% performance utilization

A better measure of actual tier utilization is to use parity group utilization
TIER RANGE VALUES

- Tier range values dynamically change according to workload
- Tier range values are always calculated to keep upper tiers generally full
- Pages compete for upper tiers. Pages can be pushed down if more aggressive workloads come on the scene
- Pages that do not remain “hot enough” (competitive) will demote
- Newly active data on dormant (or new) pages or migrated volumes will need protection
  - Policy settings work well
AGENDA

- The HDT lifecycle
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CHOOSING A MONITOR STRATEGY: RECOMMENDED START POINT

- Start with continuous mode
- Start with automatic
- Start with 8-hour
- Investigate Hitachi Tiered Storage Manager for custom scheduling of monitor and relocation cycles
CHOOSING A MONITOR STRATEGY

- Use tiering policies to protect or restrict tier use

- 3-tier pool
  - Liberally use ALL
  - Use level 4 if Tier 1 use should be restricted (not used) and when Tier 2 is well configured
  - Note that incorrectly using level 5 will cause performance issues
  - Levels 1 and 2 can cause overcommitment (and waste) of Tier 1
  - Levels 2, 3, and 4 can overcommit Tier 2

- 2-tier pool
  - Liberally use ALL
  - Liberally use level 4 (or 3 or 5) if Tier 1 use should be restricted (not used) and when Tier 2 is well configured
RELOCATION RATES

- Standard relocation throughput is about 3TB/day
- Write pending and MP utilization rate influences the pace of page relocation
  - When WritePending is 55%, 20-second wait is inserted per page
  - MP utilization rate influences pacing
    - 60% or more: 6 pages or less in 5 seconds
    - 50-60%: 8 pages or less in 5 seconds
    - 40-50%: 10 pages or less in 5 seconds
    - 30-40%: 12 pages or less in 5 seconds
    - 30% or less: Unlimited

- When SOM904 is ON, only 1 page is relocated per second
  - For example, when page migration takes 600 ms, the next page migration starts after sleep for 400 ms (1,000 ms - 600 ms)
  - If page migration takes 1 second or more, the next page migration starts without sleep procedure.
  - HDT relocate pages in less than 40MB/sec
HDT TUNING SUMMARY

- HDT tunes tier ranges dynamically (neither Hitachi Tuning Manager (HTnM)) or Hitachi Tiered Storage Manager (HTSM) is used)

- If a tier P% approaches 60% utilization, we aim to move I/O down a tier
  - 60% sustained I/O to accommodate peaks and prevent queuing
  - Tier range is increased, reducing the tier’s utilized capacity. All of the tier capacity will not be used – but that is better than overloading the tier with too much IOPH

- If all tiers are over (60%/60%/60%), the pool is over utilized – tier ranges are increased again to share the problem

- You can’t “lose storage” but you might put more I/O into a pool than it can handle

- You should be looking for these situations, evaluating the issues, and adding capacity
**HDT TUNING SUMMARY**

- Do not underestimate the importance of Tier-3 performance
  - HDT will relocate dormant pages to Tier 3. If these pages become active, Tier 3 must perform well enough to cope with some host I/O and relocation I/O

- Tiering policy can be used to help or hinder
  - Helps
    - Use level 3 or 4 to stage data into Tier 2 before it is needed
    - Use level 1 or 2 to stage important data before “Mondays”
  - Hinders
    - When using level 1-4 on dormant data
    - Leaving level 1 or 2 set too long

- T% and R% should not be changed unless needed to artificially reduce capacity
# TIER SIZE MATTERS

<table>
<thead>
<tr>
<th>Tier</th>
<th>Drive Type/RPM</th>
<th>Capacity (Used/Total)</th>
<th>Performance Utilization</th>
<th>Buffer Space (New page assignment/Tier relocation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier 1</td>
<td>SSD/-</td>
<td>1.05 TB / 1.07 TB [98 %]</td>
<td>6 %</td>
<td>0 % / 2 %</td>
</tr>
<tr>
<td>Tier 2</td>
<td>SAS/10k</td>
<td>21.24 TB / 23.59 TB [90 %]</td>
<td>17 %</td>
<td>8 % / 2 %</td>
</tr>
<tr>
<td>Tier 3</td>
<td>SATA/7.2k</td>
<td>1.97 TB / 10.74 TB [18 %]</td>
<td>80 %</td>
<td>8 % / 2 %</td>
</tr>
</tbody>
</table>
Task Failed

An error occurred during Start Tier Relocation.

⚠️ The operation cannot be executed because the specified pool has following problems.
- The pool usage exceeds the threshold.
- The threshold value of the pool.
- The pool status.

<table>
<thead>
<tr>
<th>Pool Status</th>
<th>Pool Capacity</th>
<th>Used Capacity</th>
<th>Used %</th>
<th>Warning Threshold</th>
<th>System Threshold</th>
<th>Depletion Threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>78.562 GB</td>
<td>63.051 GB</td>
<td>81 %</td>
<td>70</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>1 Warning</td>
<td>41.090 GB</td>
<td>29.555 GB</td>
<td>72 %</td>
<td>70</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>2 Warning</td>
<td>23.885 GB</td>
<td>19.830 GB</td>
<td>83 %</td>
<td>70</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>3 Normal</td>
<td>30.765 GB</td>
<td>22.847 GB</td>
<td>85 %</td>
<td>70</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>4 Warning</td>
<td>2.510 GB</td>
<td>1.938 GB</td>
<td>77 %</td>
<td>70</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>5 Warning</td>
<td>3.217 GB</td>
<td>2.759 GB</td>
<td>85 %</td>
<td>70</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>6 Normal</td>
<td>27.292 GB</td>
<td>17.819 GB</td>
<td>85 %</td>
<td>70</td>
<td>80</td>
<td>80</td>
</tr>
</tbody>
</table>

View Tier Properties

<table>
<thead>
<tr>
<th>Tier1</th>
<th>SAS/15k</th>
<th>Capacity (Used/Total)</th>
<th>16.43 TB / 20.44 TB (81 %)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Performance Utilization</td>
<td>38 %</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Buffer Space (New page assignment/Tier relocation)</td>
<td>8 % / 2 %</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tier2</th>
<th>SAS/7.2k</th>
<th>Capacity (Used/Total)</th>
<th>5.70 TB / 6.01 TB (71 %)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Performance Utilization</td>
<td>84 %</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Buffer Space (New page assignment/Tier relocation)</td>
<td>8 % / 2 %</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tier3</th>
<th>SAS/7.2k</th>
<th>Capacity (Used/Total)</th>
<th>39.84 TB / 40.55 TB (92 %)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Performance Utilization</td>
<td>100 %</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Buffer Space (New page assignment/Tier relocation)</td>
<td>8 % / 2 %</td>
</tr>
</tbody>
</table>

Performance Graph (DP-DEV1.0)

- Tier 1 Range
- Tier 2 Range

Objects: Entire Pool
AGENDA

- The HDT lifecycle
- HDT performance basics
- HDT basic guidelines
- Monitoring HDT with Hitachi Tuning Manager
HDT AND HTNM

WHAT'S AVAILABLE TODAY

- All HDT-level reporting in HTnM is in Performance Reporter
  - Some point-in-time metrics are fed into Mobility
- All HDT reports are custom created
- A set of custom reports are included with this presentation
Nine tables in Performance Reporter for HDP/HDT are

- VVOL Tier Type Configuration (Individual DP-VOL capacity info by tier)
- VVOL Tier Type I/O Information (Individual DP-VOL performance metrics by tier)
- HDP Pool Configuration (Design and Capacity Info)
- Pool Summary (Total Pool Performance Info)
- Pool Tier Type Configuration (HDT Pool Design and Capacity)
- Pool Page Relocation (HDT Pool Relocation Info)
- Pool Tier Page Relocation (HDT Tier Relocation Info)
- Pool Tier Type IO Information (HDT Tier Performance Info)
- Pool Tier Type Operation Status (HDT Tier Performance Info)
# HDT CAPACITY MANAGEMENT AT THE POOL

## HDP/HDT POOL UTILIZATION – USEFUL FIELDS

### Time Stamp for Collection
- Collected Every 8 Hours by Default

### Type of Pool (HDP/HDT)

### Pool Physical Capacity

### Total Provisioned Capacity

### Free Physical Capacity

### Used Physical Capacity

### Physical Used %

### HDP/HDT POOL UTILIZATION

#### - USEFUL FIELDS

<table>
<thead>
<tr>
<th>Date and Time</th>
<th>Pool ID</th>
<th>Attribute</th>
<th>Total Actual Capacity</th>
<th>Total Managed Capacity</th>
<th>Free Capacity</th>
<th>Used Capacity</th>
<th>Usage %</th>
<th>Status</th>
<th>Warning</th>
<th>Threshold</th>
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</thead>
<tbody>
<tr>
<td>06 08 2013 17:00:00</td>
<td>0</td>
<td>Dynamic Provisioning</td>
<td>95.566</td>
<td>208.0010</td>
<td>65.6250</td>
<td>29.9414</td>
<td>1.0000</td>
<td>NORMAL</td>
<td>70.0000</td>
<td></td>
</tr>
<tr>
<td>06 08 2013 17:00:00</td>
<td>0</td>
<td>Dynamic Provisioning (Tiering)</td>
<td>15.8320</td>
<td>3.0000</td>
<td>15.6680</td>
<td>0.1641</td>
<td>1.0000</td>
<td>NORMAL</td>
<td>70.0000</td>
<td></td>
</tr>
<tr>
<td>06 08 2013 17:00:00</td>
<td>0</td>
<td>Dynamic Provisioning (Tiering)</td>
<td>55.8555</td>
<td>189.0947</td>
<td>82.7695</td>
<td>173.0859</td>
<td>67.0000</td>
<td>NORMAL</td>
<td>70.0000</td>
<td></td>
</tr>
<tr>
<td>06 08 2013 17:00:00</td>
<td>0</td>
<td>Dynamic Provisioning (Tiering)</td>
<td>95.8945</td>
<td>26.0010</td>
<td>91.6699</td>
<td>4.2246</td>
<td>4.0000</td>
<td>NORMAL</td>
<td>70.0000</td>
<td></td>
</tr>
<tr>
<td>06 08 2013 17:00:00</td>
<td>0</td>
<td>Dynamic Provisioning (Tiering)</td>
<td>10,235.8194</td>
<td>41,633.0020</td>
<td>4,334.7285</td>
<td>5,701.1309</td>
<td>65.0000</td>
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<td>70.0000</td>
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<tr>
<td>06 08 2013 17:00:00</td>
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<td>Dynamic Provisioning (Tiering)</td>
<td>145.8106</td>
<td>92.0000</td>
<td>14.8438</td>
<td>30.9668</td>
<td>31.0000</td>
<td>NORMAL</td>
<td>70.0000</td>
<td></td>
</tr>
<tr>
<td>06 08 2013 17:00:00</td>
<td>0</td>
<td>Dynamic Provisioning (Tiering)</td>
<td>15.8320</td>
<td>3.0000</td>
<td>15.6680</td>
<td>0.1641</td>
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<td>5,701.1309</td>
<td>65.0000</td>
<td>NORMAL</td>
<td>70.0000</td>
<td></td>
</tr>
</tbody>
</table>

- Time Stamp
- Type of Pool
- Total Actual Capacity
- Total Managed Capacity
- Free Capacity
- Used Capacity
- Usage %
- Status
- Warning
- Threshold
HDT CAPACITY MANAGEMENT AT THE POOL

HDP/HDT POOL UTILIZATION – NOTES

- Reports on both HDP and HDT pools
- Capacity metrics are in gigabytes
- Using historical information in HTnM, reports detailing growth of the pool can be used for capacity trend analysis
- Alerts can be set for pools including usage percentage and status as warnings for out-of-space conditions beyond alerts set in HDvM and SN2
HDT CAPACITY MANAGEMENT AT THE POOL

HDT POOL UTILIZATION BY TIER– USEFUL FIELDS

<table>
<thead>
<tr>
<th>Media Composition by Tier</th>
<th>Free Tier Physical Capacity</th>
<th>Used Tier Physical Capacity</th>
<th>Total Tier Physical Capacity</th>
<th>Physical Tier Capacity Used as % of Pool</th>
</tr>
</thead>
</table>

![Graph showing HDT pool utilization by tier over time with various tiers highlighted.]

- **Media Composition by Tier**
- **Free Tier Physical Capacity**
- **Used Tier Physical Capacity**
- **Total Tier Physical Capacity**
- **Physical Tier Capacity Used as % of Pool**

---

The graph above illustrates the utilization of tiers over time, with different colors representing various tiers. The table below provides specific data for each tier, including date and time, pool ID, tier number, tier type, free capacity, total capacity, used capacity, usage as a percentage of the pool, and usage as a percentage of the tier.
Capacity metrics are in gigabytes

Trend of size and usage of storage tiers can be obtained by trending total capacity, used capacity, usage percentage in pool, or usage percentage in tier

Alerts can be set for lower tiers to flag high capacity usage percentage for review. Low tiers by default have lowest utilization percentage due to HDT standard of writing to higher tiers first
HDT CAPACITY AT THE DP-VOL

HDT V-VOL UTILIZATION BY TIER – USEFUL FIELDS

<table>
<thead>
<tr>
<th>Date and Time</th>
<th>LDEV Number</th>
<th>Pool ID</th>
<th>Tier Number</th>
<th>Tier Type</th>
<th>Used Capacity</th>
<th>Usage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>08-28-2012 11:00:01</td>
<td>00:06:06</td>
<td>2</td>
<td>2</td>
<td>SSD</td>
<td>798</td>
<td>1.56</td>
</tr>
<tr>
<td>08-28-2012 11:00:01</td>
<td>00:06:06</td>
<td>2</td>
<td>2</td>
<td>SAS/15k</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>08-28-2012 11:00:01</td>
<td>00:06:06</td>
<td>2</td>
<td>3</td>
<td>SATA/7200</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>08-28-2012 11:00:01</td>
<td>00:13:13</td>
<td>5</td>
<td>1</td>
<td>SAS/10k</td>
<td>42</td>
<td>50.00</td>
</tr>
<tr>
<td>08-28-2012 11:00:01</td>
<td>00:14:14</td>
<td>5</td>
<td>1</td>
<td>SAS/15k</td>
<td>42</td>
<td>50.00</td>
</tr>
<tr>
<td>08-28-2012 11:00:01</td>
<td>00:16:16</td>
<td>5</td>
<td>1</td>
<td>SAS/10k</td>
<td>42</td>
<td>50.00</td>
</tr>
<tr>
<td>08-28-2012 11:00:01</td>
<td>00:17:17</td>
<td>5</td>
<td>1</td>
<td>SAS/10k</td>
<td>42</td>
<td>50.00</td>
</tr>
</tbody>
</table>

LDEV Number
Size
Percent of used V-VOL capacity on each tier.
Large capacity proportion (85+%) in single tier may indicate HDT is not suitable for data type. Investigation of data workload/type and comparison to other workloads in pool is suggested.

Large capacity proportion in high tier may indicate a need for verification of data type on volume.
- If high-performing but low-value data, use of tiering policy may eliminate waste.

A historical trend of capacity movement between tiers on V-VOL may indicate a poor candidate for HDT or a different HDT architecture required for volume.
HDT PERFORMANCE AT THE POOL

HDT POOL IOPS BY TIER – USEFUL FIELDS

<table>
<thead>
<tr>
<th>Date and Time</th>
<th>Pool ID</th>
<th>Tier Number</th>
<th>Tier Type</th>
<th>Avg I/O /sec</th>
<th>Date and Time</th>
<th>First</th>
<th>Previous</th>
</tr>
</thead>
<tbody>
<tr>
<td>06 30 2013 17:00:00</td>
<td>2</td>
<td>2</td>
<td>SAS/10k</td>
<td>0</td>
<td>06 30 2013 17:00:00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>06 30 2013 17:00:00</td>
<td>2</td>
<td>2</td>
<td>SAS/15k</td>
<td>0</td>
<td>06 30 2013 17:00:00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>06 30 2013 17:00:00</td>
<td>2</td>
<td>3</td>
<td>SATA/7200</td>
<td>0</td>
<td>06 30 2013 17:00:00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>06 30 2013 17:00:00</td>
<td>30</td>
<td>2</td>
<td>SAS/10k</td>
<td>26.6555</td>
<td>06 30 2013 17:00:00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>06 30 2013 17:00:00</td>
<td>30</td>
<td>1</td>
<td>SAS/15k</td>
<td>27.0661</td>
<td>06 30 2013 17:00:00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>06 30 2013 17:00:00</td>
<td>30</td>
<td>3</td>
<td>SATA/7200</td>
<td>0.9597</td>
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Average IOPS Per Tier
Data is collected every 15 minutes

IOPS per tier can be used for historical data analysis and trending
  – View IOPS growth per tier over time
  – Find tiers that are busy during specific cycles
    – Batch vs. transaction
    – Backups
    – Database maintenance
    – Business vs. after hours
HDT PERFORMANCE AT THE POOL

HDT POOL PERFORMANCE BY TIER – USEFUL FIELDS

- Average IOPS Per Tier
- Average IOPS Percentage Utilization Per Tier
HDT POOL PERFORMANCE AT THE POOL

HDT POOL PERFORMANCE BY TIER – NOTES

- Data is collected every monitoring period
- Average IOPS utilization percentage per tier is number of IOPS processed per tier compared with total IOPS per tier possible as defined by storage array (same as performance utilization (P%) in SN2)
- Allows trending of IOPS and tier utilization over time
- Alerts can be set on utilization to monitor when tier gets to standard load-sharing thresholds (60%) or overutilization point
HDT PERFORMANCE AT THE POOL

HDT POOL PERFORMANCE BY TIER – NOTES

- Average IOPS utilization percentage provides general insight on whether HDT design is correct
  - High IOPS utilization in Tier 1 or 2 indicates Tier 1 may need additional drives/parity groups to support additional performance needs
  - High IOPS utilization in Tier 3 indicates Tier 1 and/or 2 may need additional drives/parity groups to support additional performance needs
  - Low IOPS utilization in a single tier indicates tier may be too large and can be maintained/reduced in subsequent pool changes
  - Balanced IOPS utilization under 60% indicates a well-designed HDT pool
  - Balanced IOPS utilization over 60% indicates a pool running low on performance growth capability
HDT PERFORMANCE AT THE DP-VOL

HDT V-VOL PERFORMANCE BY TIER – USEFUL FIELDS

Average IOPS Per Tier Per V-VOL
HDT PERFORMANCE AT THE DP-VOL

HDT V-VOL PERFORMANCE BY TIER – NOTES

- Metrics collected every 15 minutes
- Provides insight into how IOPS count is broken out by tier of storage per V-VOL
- Can be used to look at specific V-VOL or application use of tiers of storage over historical periods
- High IOPS count in low tier of storage with high concentration of pages in same tier may indicate additional research to determine if volume or application is good candidate for HDT
  – Assuming tiering policy is not in place for V-VOL
HDT RELOCATION MONITORING

HDT POOL RELOCATION STATUS – USEFUL FIELDS

- Pages Moved During Relocation Cycle
- Relocation Progress Percentage During Relocation Cycle
- Relocation Start and Stop Time
HDT RELOCATION MONITORING

Collected after each relocation period

Progress percentage can be used in alerting customer if relocation didn’t complete

Relocation start and end times define how long a relocation cycle takes

Relocation cycles that barely finish during relocation window may indicate collection/relocation configuration needs adjustment

Time between relocation start and end divided by number of pages moved indicates page movement speed (rule of thumb is ~35 MB/sec)
HDT RELOCATION MONITORING

HDT POOL TIER RELOCATION INFORMATION – USEFUL FIELDS

Promoted and Demoted Pages by Tier
HDT RELOCATION MONITORING

HDT POOL TIER RELOCATION INFORMATION – NOTES

- Collected after each relocation period
- Promoted pages defines how many pages were promoted out of this tier
- Demoted pages defines how many pages were demoted out of this tier
QUESTIONS AND DISCUSSION
UPCOMING WEBTECHS

- 2013 WebTechs
  - Upgrade Your Enterprise with Hitachi Data Systems, December 4, 9 a.m. PT, noon ET
  - 2014 schedule to be published soon.

Check [www.hds.com/webtech](http://www.hds.com/webtech) for

- Links to the recording, the presentation, and Q&A (available next week)
- Schedule and registration for upcoming WebTech sessions
- Questions will be posted in the HDS Community: [http://community.hds.com/groups/webtech](http://community.hds.com/groups/webtech)
THANK YOU