



# Hot Band Workloads and High End HP Storage Products

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## SNIA Emerald™ Training

*SNIA Emerald Power Efficiency  
Measurement Specification,*  
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# Hot Band IO Patterns

- The Hot Band workload is comprised of several different IO streams, some of which contain hot spots, or regions of more intense IO demand.
- This results in varying degrees of logical block address re-referencing in certain regions of the overall IO space that can be either contained with the cache of an array, or can be placed on storage devices that deliver a higher IO rate.



# Hot Band IO Patterns

## Hot Band IO Profile

IO Profile	% of workload	Read/Write Percentage	IO Size (KiB)	Access Pattern	Usable Address Range
Write Stream 1	5	0/100	See Table 12	Sequential	0-100%
Write Stream 2	5	0/100	See Table 12	Sequential	0-100%
Write Stream 3	5	0/100	See Table 12	Sequential	0-100%
Read Stream 1	5	100/0	See Table 12	Sequential	0-100%
Read Stream 2	5	100/0	See Table 12	Sequential	0-100%
Read Stream 3	5	100/0	See Table 12	Sequential	0-100%
Read Stream 4	5	100/0	See Table 12	Sequential	0-100%
Read Stream 5	5	100/0	See Table 12	Sequential	0-100%
Uniform Random	6	50/50	See Table 12	Random	0-100%
Hot Band 1	28	70/30	See Table 12	Random	10 -18%
Hot Band 2	14	70/30	See Table 12	Random	32-40 %
Hot Band 3	7	70/30	See Table 12	Random	55-63 %
Hot Band 4	5	70/30	See Table 12	Random	80-88 %

Hot Bands concentrate 54% of the IO in 32% of the space



# Hot Band IO Patterns

- The Hot Band workload when run on High End Storage demonstrates the power/performance advantage of two product features
  - ◆ Array Based Cache
  - ◆ Storage Tiering
- Although the initial goal was solely cache focused, there is also a benefit of implementing faster tiers in the product such as HP P9500 Smart Tiering



# SNIA Green TWG Cache Friendly Performance Comparison Chart Cache and Tiering Speedup on HP P9500 Storage Product

	Hot IOPS	Hot RT	Rnd IOPS	Rnd RT	C/WS ratio	Cache Hit Ratio
Small Array	4330	32.8 ms	430	33.4 ms	<<	N/A
Large Array Cache Assist only	39900	8.97 ms	18410	22.5 ms	~1%	60%/24%
Large Array (Tiered)	42870	5.77 ms	N/A	N/A	~3%	60%/24%

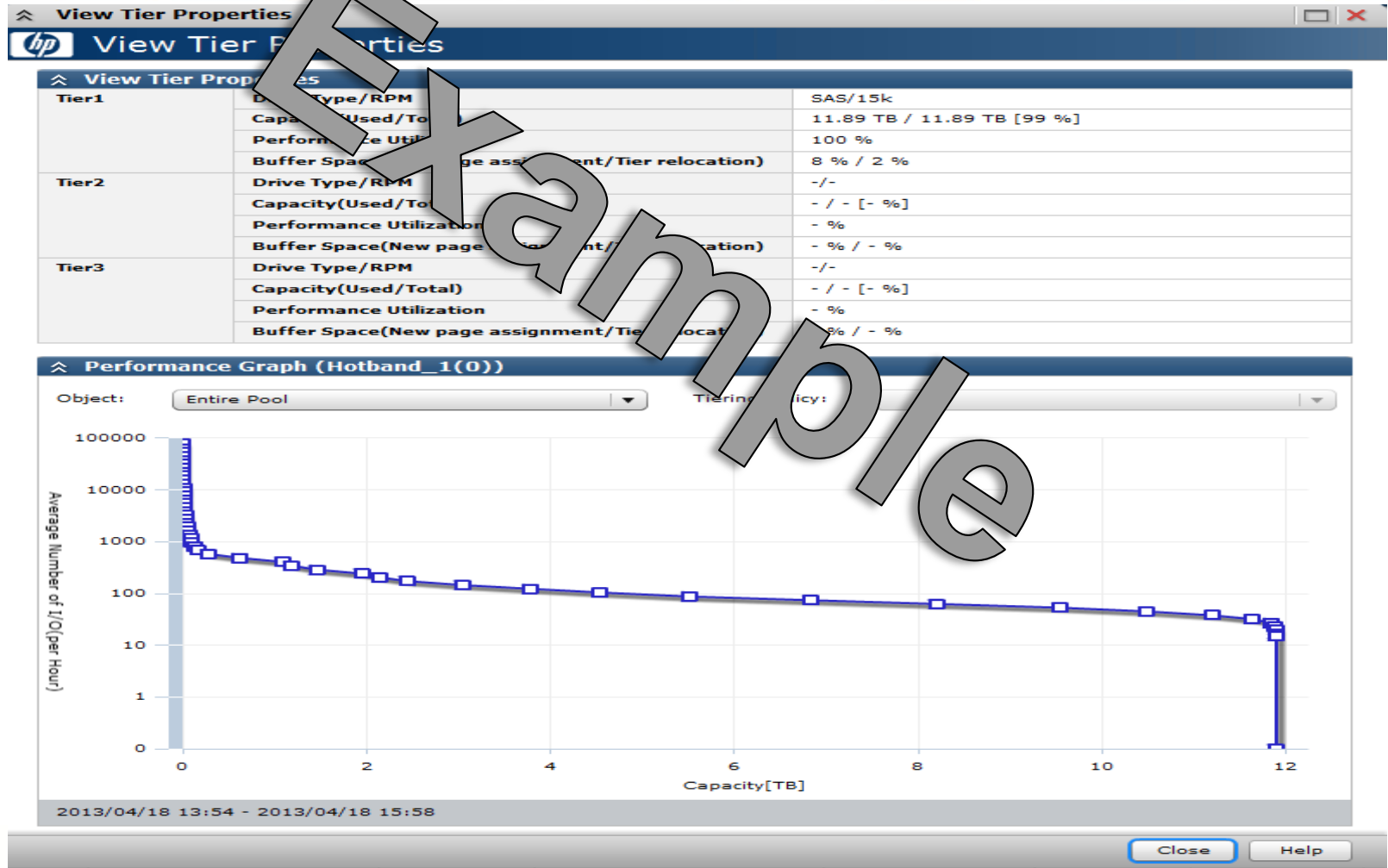
# SNIA Green TWG Tiered Storage w/Hot Bands Analysis and Tier Configuration Process



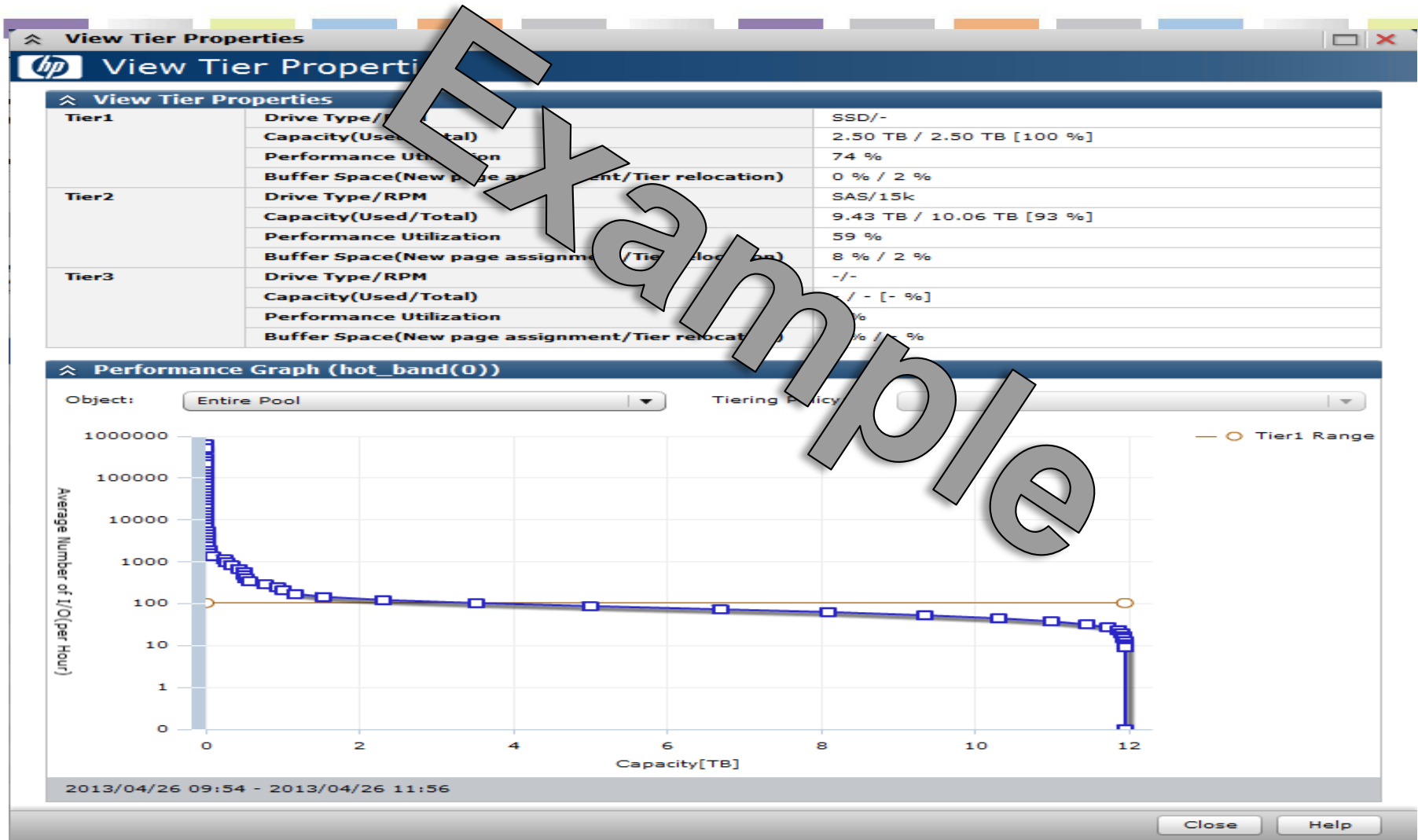
- The Workload Analysis Process Consists of Two Steps
  1. Create a single pool large enough to hold the desired working set
  2. Run the Hot Band workload on that pool and use the analysis tools to produce a report guiding the composition of the tier(s)
  
- The tier construction process involves 2 decision points.
  1. Which technology to deploy
  2. The capacities of the tier(s)
  
- The following slides illustrate an example of these activities



# SNIA Green TWG Tiered Storage w/Hot Bands Initial Tier Property Analysis



# SNIA Green TWG Tiered Storage w/Hot Bands Final Tier Property Analysis





# The HP P9500 Power Calculator

P9500PowerCalc\_Rev1.0.xls [Read-Only] [Compatibility Mode] - Microsoft Excel

File Home Insert Page Layout Formulas Data Review View

Clipboard Font Alignment Number Styles Cells Editing

Rev. 1.1

**P9500 Power Calculator**

**Purpose:**  
The SAN Power Calculators have one intended purpose: Approximate the electrical and cooling load of redundant and failover modes of operation for facilities planning.

**Notes:**  
1. The Power Calculators are not intended to provide precise results because of the many variables involved. Where precise power electrical loads are required, measurements should be made on the actual hardware configured, as it will be used.  
2. Final site installation of HP products must comply with all relevant national, state, municipal and local electrical and fire code requirements.  
3. Electrical ratings are listed in the Product Quick Specs.  
4. Values shown are actual measurements from all electronics and HDD's in the array exercised at the same time.

**Instruction:**  
1. Use dropdown menu to configure the system by selecting drive type and count, host and array interconnects and memory capacities.  
2. Watch for error messages and correct as necessary.

**DKC Frames**  
DKU Frames  
DKU Chassis

**# of Frames**  
1  
0

**# of Chassis**  
2

**Disks**  
500 GB 7.2k RPM  
1 TB 7.2k RPM  
300 GB 10k RPM  
600 GB 10k RPM  
900 GB 10k RPM  
146GB 15k RPM  
300 GB 15k RPM  
200GB SSD  
400GB SSD

**# of Array Groups One AG = 4 Disks**  
0  
0  
0  
0  
0  
26  
0  
0  
0  
0  
0  
1  
1  
1  
1  
2  
C16G  
96

**MP Blades**  
CHA sets  
DKA sets  
ESW Pairs  
Cache Platform pairs  
Cache Module Size  
Total Cache (GB)

**P9500 Configuration**

26	Total Array Groups
1	DKC frames
0	DKU frames
2	DKU Chassis
0	MP Blade Pairs
1	CHA pairs
1	DKA sets
1	ESW pairs
2	Cache Platform pairs
6	Cache dimm's
96	Cache Capacity (GB)

**Total Calculated System power Consumption (W)**  
Idle: 2072  
Active: 2386

**Total Calculated System Heat Dissipation(BTU/Hr)**  
Idle: 6506.1  
Active: 7491.5

Ready License Configuration Sheet2

1:10 PM 5/31/2013



# SNIA Green TWG Tiered Storage w/Hot Bands Primary Metric Comparison

Configuration	Tier Type	Power Consumption (w/ Hot Bands)	IOPS	IOPS/Watt
Large Array (Initial)	15k RPM	7491 Watt	18410	2.457
Large Array (Cache Assist)	15k RPM	7491 Watts	39000	5.326
Large Array (Tiered)	15k + SSD	7283 Watts	42870	5.886



# SNIA Green TWG Hot Band Workload

## Conclusions and Observations



- The Hot Band workload is amenable to performance optimization by both storage subsystem cache and the proper deployment of tiered storage.
- As a result of high cache hit rates (~60%) the overall performance contribution of tiered storage is limited.
- In addition to the increase in IO rate (132%), there is also a corresponding decrease in power consumption from the substitution of SSDs in the configuration
- The net effect of these two parameter changes is a 140% improvement in the SNIA primary active metric (IOPS/Watt) of

