



Flash Memory Summit - Enterprise SSD Performance Testing & Analysis

Chuck Paridon - Storage Works Division, Hewlett Packard



- **SSD Performance Assessment: It's Importance to Array OEMs**
 - ◆ Due to the Current High Cost per GB, This Attribute is the Differentiator, Second Only to Data Integrity
 - ◆ Very Precise Performance Measurements Are Required as Only the Highest IO Demand can be Economically Justified Using SSDs.

- **HP's Enterprise SSD Performance Assessment Audience**
 - ◆ Due to the Importance Cited Above, Performance is a Major Criterion for Making Purchasing Decisions
 - ◆ HP Field Engineering Must be Competently Versed in the Proper Deployment of SSDs.

- Basic Methodology: Synthetic Workload Applications
 - ◆ Traditional “Four Corners” Test (with one more in the middle)
 - › Big block (>>64kB) Sequential Reads
 - Multi-threaded IO Streams Operate in Autonomous Space
 - › Big block (>>64kB) Sequential Writes
 - Multi-threaded IO Streams Operate as Above
 - › Small block (8kB) Random Reads
 - Multi-threaded IO Streams Uniformly Distributed Over Entire Space
 - › Small block (8kB) Random Writes
 - Multi-threaded IO Streams Distributed as Above
 - › Small block (8kB) Random Read/Write Mix
 - OLTP-like Workload

➤ Justification of Basic Methodology

- ◆ Many Enterprise Applications can be Decomposed into These Components
 - › A Hybrid Workload can be Created by Choosing an Appropriate Mix of These
- ◆ It is Quite Difficult to Select One (or even a few) Traces to Adequately Represent Enterprise Workloads
- ◆ Due to the High Degree of Consolidation and Wide Distribution of Many Workloads Across Enterprise SSDs, the Assumption of Uniformity of Distribution is Justified
- ◆ Devices in an Enterprise Environment are Seldom Idle, Simplifying “Idle Recovery” Test Cases
- ◆ Synthetic Workloads Such as These are Easily Generated Using Simple Tools

➤ Some Additional Test Case Details

◆ Removal of Transients

- › This is Quite Elusive for Many Devices
- › Devices Must be in Steady State Before the Measurement Interval Can Commence
- › The Achievement of this State is More Dependent Upon What the Devices Have Recently Experienced Rather Than the Current Workload
- › Using the Workload that is to be Measured to Achieve this State is Essential

➤ Issues Facing Future Enterprise SSD Performance Assessment

- ◆ As a Result of “Hysteresis Effects”, Very Precise Measurement Contexts will be Required to Accompany as Performance Statements.

➤ Conclusions

- ◆ Due to the High Cost per GB, SSD Performance Has a Profound Influence on Purchasing Decisions
- ◆ There are two Main Audiences for Enterprise SSD Performance Assessment:
 - › Purchasing as Mentioned Above
 - › Field Engineering
- ◆ For Purposes of Evaluating the Performance of Enterprise SSDs, Synthetic Workloads do an Adequate Job.
- ◆ The Critical Issues Regarding Future SSD Performance Assessment Involve a very Precise Description of the Context Under Which the Measurement Occurred