

StorTrends Whitepaper

“Storage Resource Management”

American Megatrends International GmbH
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1. Introduction

The scope of Storage Industry which is embracing all the new technological advancements is getting wider and deeper everyday. With data growth per year averaging 50% to 100%, organizations are not only faced with rising hardware costs but also with the increased cost of managing the storage. According to ESG, the cost of storage management and administration is three times the cost of initial Hardware acquisition. SRM today is not just limited to device and quota management. All aspects of NAS and SAN management now come under the purview of SRM. The basic responsibilities of SRM are:

- Discovery of Storage Nodes
- Effective Storage provisioning and capacity management
- File and Array level utilization
- Performance monitoring and characterization
- Backup and Recovery management
- Workflow management
- ILM
- Intuitive Presentation and Reporting mechanisms.

2. StorTrends –Data Collection, Analysis and Trending Module

This module lays the foundation of StorTrends SRM. The design is centered on a kernel level and an application level component that are glued into a very flexible and extensible framework. This makes it very easy to extend SRM to cover bigger and wider range of attributes without having to redesign from scratch. The key kernel component is the data collection agent that interfaces with other modules to collect instantaneous data about all the monitored resources. The other component, which is an application layer module, is called the 'data container '. This layer provides an interface for storing collected data in a structure that spans time to provide a context for trending data. Recent and instantaneous data along with statistical data going back into months and years are maintained.

3. Storage Provisioning and Capacity Management

Capacity provisioning is probably one of the biggest challenges any storage administrator faces today. This challenge begins from Day 1, when the volumes are to be appropriately created and provisioned. iTX with its Thin-provisioning architecture takes this headache out. Once the initial hurdle is crossed, the next big and persistent problem an storage administrator faces is to take an inventory of what is present today and predicting how much of growth is anticipated over the next few months, year or even beyond. Just present moment inventory, which most of the storage stacks provide is just not enough to help out. Capacity planning is a very inexact science and it is very time consuming to administer without appropriate tools. StorTrends, with its statistically collected and maintained data along with extrapolation algorithms provide all that is required to predict capacity growth and enable strategic capacity planning to a reasonable degree of accuracy.

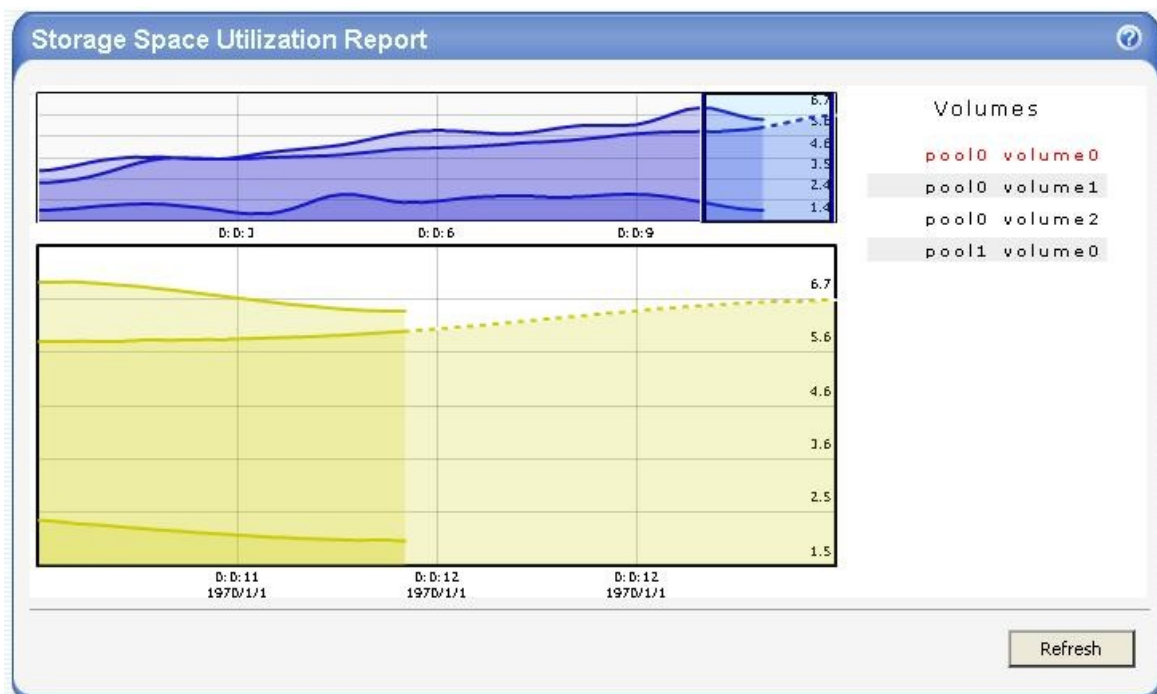


Figure 1: Storage provisioning and capacity management, showing long-term and short-term trends

4. Performance Trending

Performance data at various levels of the I/O stack is collected and presented both for immediate analysis and statistical review. A few items worth special mention here are:

I/O latency monitoring and analysis. Today with so many SATA drives populated into a single 2U or 3U enclosure, vibrational stability is very important. SATA drives with their dense track densities are very intolerant to vibrations and result in long recovery cycles and ultimately may be 'FAILED' by the RAID controller. Tracking I/O latencies is a very key attribute to detecting any such looming failures.

H/W health monitoring and tracking S.M.A.R.T. indications. Various key parameters like enclosure temperature, Power supply, Fans etc. are continuously monitored

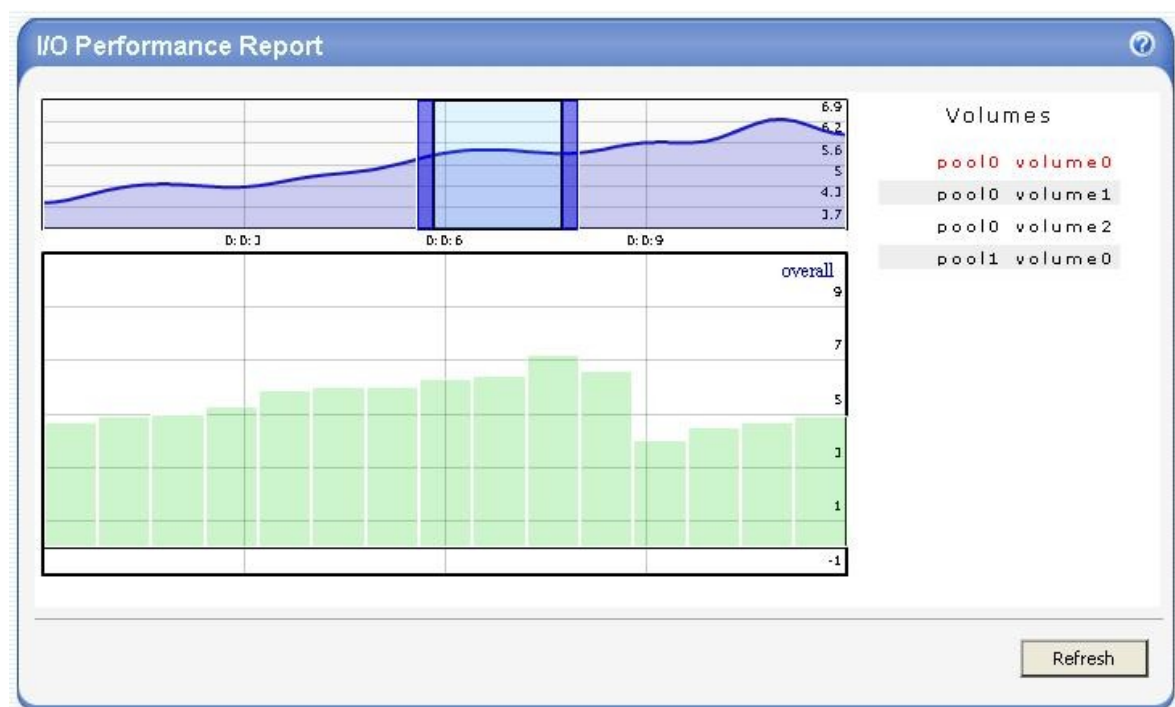


Figure 2: Performance data collection and trending, showing historic and instantaneous data

5. Workflow Management

This is probably the least understood yet most important aspect of a storage stack today. This forms the basis of background task scheduling and thereby ensuring the system maintains good I/O performance. System and I/O activities are continuously monitored and recorded. This information comes in very handy to pick up a period of relaxed activity to schedule background tasks like ILM and capacity expansion balancing.

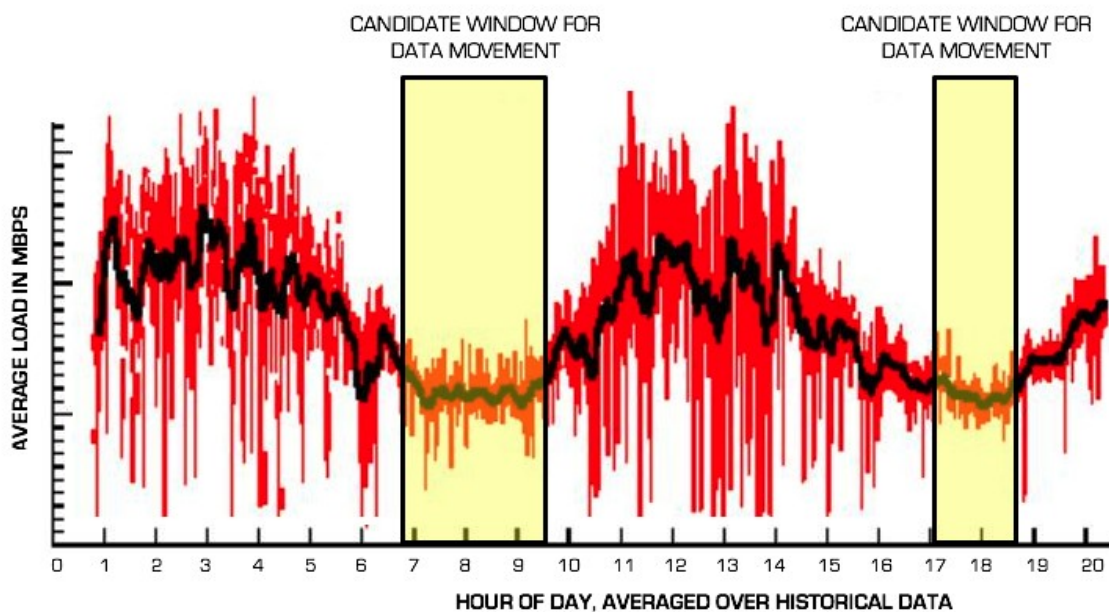


Figure 3: Workflow management, choosing the appropriate time to move data

6. Backup and Restoration Management

This falls under two categories:

First, to manage space effectively when numerous snapshots are created for backup and recovery. StorTrends with Tiered Storage and three level space mapping ensures that Snapshots are maintained in the most capacity-optimized manner.

Next, to ensure that the so called 'recovery images' are indeed consistent and good. Today, recovery management is more important than backup. Statistics show that a good fraction of recovery fail for various reasons. StorTrends offer various features to ensure the consistency and validity of 'recovery images'. At the NAS level, Snapshots are mounted and checked for correctness using 'fsck'. At SAN level, external agents perform scheduled 'chkdsk' chores on snapshots to assure correctness of snapshots.

In replication environments, background tasks are scheduled to check for the integrity of snapshots by creating and comparing CRCC checksums of images. This not method does not put any burden on the communication links.

7. Information Lifecycle Management

StorTrends provide excellent ILM features by tracking block level usage attributes. This is a vast subject and is outside the scope of this document.

8. Presentation and Reporting Module

StorTrends offer a very elegant management interface for the various SRM chores. The collected data can also be exported out for use by other applications like Excel.

StorTrends SRM Key Benefits

Built around an flexible and extendable framework

Storage unit discovery

Capacity Trending and analysis tools

Statistical and instantaneous performance monitoring

Backup and Recovery management

Workflow management

Tiered storage management

Presentation and reporting tools

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American Megatrends, Inc.
6145-F Northbelt Parkway
Norcross, GA 30071

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American Megatrends International GmbH
D 81825 München , Wardeinstrasse 3 a
Deutschland

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More information: europa@ami.com - www.ami.de - www.ami.com