CLARiiON® Performance Monitoring Scripting

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Abstract

We all agree that CLARiiON Navisphere® Analyzer is a great performance monitoring tool for CLARiiON array. It gathers storage-system performance statistics and presents them in various types of charts. It helps to identify bottlenecks in the storage-system, but you have to access it through web-based Navisphere manager and view each CLARiiON array separately.

Based on a large-scale enterprise’s request, we have crafted and implemented a scripted approach that has been well accepted. This CLARiiON performance monitoring solution is based on Navisphere Analyzer.

It consists of 3 major functions:

- Retrieve CLARiiON performance raw data
- Extract specific SP/LUN/DISK performance metrics
- Generate a daily CLARiiON performance report

Average and Maximum values of all selected CLARiiON performance metrics are provided for a quick at-a-glance overview. Daily CLARiiON performance reports will be kept indefinitely for performance trending analysis. And the raw performance data (NAR files) can be retained for the longer term, in case further investigation or reference by specific time frame is required.

It is a centralized monitoring solution, running on a single monitoring server. It can be easily scaled to include multiple CLARiiON arrays at the same or different locations. It can also be expanded to be application aware, i.e. SQL server database, Exchange storage groups and Oracle database, etc.

Navisphere Analyzer Overview

Navisphere Analyzer works within storage domains that Navisphere Manager administers. It gathers storage-system performance statistics and presents them in an assortment of charts. It illustrates bottlenecks in the storage system.

You can install the Analyzer enabler on any storage system you want to analyze. It controls, accumulates, and manages access to SP, LUN and DISK performance information, with new information displacing the old. The stored information spans the previous 26 hours (approximately).

You can also use the Analyzer GUI to directly display performance data (in real-time mode) or as a file containing past performance data (in archive mode). It can display real-time and archive file data simultaneously.

This article focuses on automating Analyzer performance data collection and extraction.
Navisphere Analyzer requires the following:

1. Navisphere Manager must be installed and enabled on at least one of the storage systems in the storage system domain you want to analyze.
2. Analyzer must be enabled on the storage system you want to analyze.
3. JRE (Java Runtime Environment) 1.4.2 must be on the client from which you run the browser.
4. Enable statistics logging on the CLARiiON Storage system.
5. Enable advanced characteristics on the CLARiiON Storage system.

With CLARiiON Flare code Release 12 or later, I/O performance is not affected by enabling or disabling statistics logging on a CLARiiON Storage Processor (SP). The effect is less then 5% even on a high object count array (large number of LUNs). So, data collection has little effect on the CLARiiON system and host visible response times.

**CLARiiON Performance Monitoring Requirements**

The Storage Processor (SP) processes all I/Os, host requests, management and maintenance tasks, as well as operations related to replication or migration features.

In Navisphere Analyzer, the statistics for an SP are based on the I/O workload from its attached hosts. It reflects the overall performance of CLARiiON storage system. The following Performance Metrics will be monitored for each CLARiiON storage system.

A LUN is an abstract object whose performance depends on various factors. The primary consideration is whether a host I/O can be satisfied by the cache. A cache hit does not require disk access; a cache miss requires one or more disk accesses to complete the data request.

As the slowest devices in a storage system, disk drives are often responsible for performance-related issues. Therefore, we recommend that you pay close attention to disk drives when analyzing performance problems.

**SP performance metrics**

- **Utilization (%)**
  The percentage of time during which the SP is servicing any request.

- **Total Throughput (I/O/sec)**
  The average number of host requests that are passed through the SP per second, including both read and write requests.

- **Read Throughput (I/O/sec)**
  The average number of host read requests that are passed through the SP per second.

- **Write Throughput (I/O/sec)**
  The average number of host write requests that are passed through the SP per second.
- **Read Bandwidth** (MB/s)
The average amount of host read data in Mbytes that is passed through the SP per second.

- **Write Bandwidth** (MB/s)
The average amount of host write data in Mbytes that is passed through the SP per second.

**LUN performance metrics**

- **Response Time** (ms)
The average time, in milliseconds, that a request to a LUN is outstanding, including waiting time.

- **Total Throughput** (I/O/sec)
The average number of host requests that are passed through the LUN per second, including both read and write requests.

- **Read Throughput** (I/O/sec)
The average number of host read requests passed through the LUN per second.

- **Write Throughput** (I/O/sec)
The average number of host write requests passed through the LUN per second.

- **Read Bandwidth** (MB/s)
The average amount of host read data in Mbytes that is passed through the LUN per second.

- **Write Bandwidth** (MB/s)
The average amount of host write data in Mbytes that is passed through the LUN per second.

- **Average Busy Queue Length**
The average number of outstanding requests when the LUN was busy. This does not include idle time.

- **Utilization** (%)
The fraction of an observation period during which a LUN has any outstanding requests.

**DISK performance metrics**

- **Utilization** (%)
The percentage of time that the disk is servicing requests.

- **Response Time** (ms)
The average time, in milliseconds, that it takes for one request to pass through the disk, including any waiting time.
• **Total Throughput (I/O/sec)**
  The average number of requests to the disk on a per second basis. Total throughput includes both read and write requests.

• **Read Throughput (I/O/sec)**
  The average number of read requests to the disk per second.

• **Write Throughput (I/O/sec)**
  The average number of write requests to the disk per second.

• **Read Bandwidth (MB/s)**
  The average amount of data read from the disk in Mbytes per second.

• **Write Bandwidth (MB/s)**
  The average amount of data written to the disk in Mbytes per second.

• **Average Busy Queue Length**
  The average number of requests waiting at a busy disk to be serviced, including the request that is currently in service.

CLARiiON SP, LUN and DISK performance data is retrieved and processed daily. Raw performance data is kept for a longer term, i.e. 180 days, and CLARiiON performance reports are kept indefinitely for performance trend analysis.

**Scripting Functional Design**

Scripting running environment
For performance monitoring scripts to run, one Windows server is required.

OS version: Windows 2003 server standard Edition with SP1
Network: IP connectivity to multiple CLARiiON storage systems at different sites
TCP/UDP ports allowed: 6389-92, 80/443, 5414/7338, 23
Scripting language: ActivePerl 5.8.8.817
EMC software: Navisphere CLI 6.19
Java: JRE 1.4.2
Scheduling: Microsoft Scheduled Tasks

Navisphere Account: username/ password; privilege: monitor; domain: local

**Primary functions**

- Retrieve raw performance data from multiple CLARiiON storage systems
- Extract required SP, LUN and DISK performance metrics
- Process SP, LUN and DISK temp data, generate daily CLARiiON performance report for all sites, and calculate Average and Maximum values.
1. Retrieve performance raw data
   Run this script daily to retrieve the last 26 hours of analyzer history data from each CLARiiON. IP addresses of SPA on CLARiiON storage systems are stored in a text file cx_list.

   Script name: retr_nar_daily.pl
   Input file: C:\cx_list
   Log file: C:\log\retr_log
   Output files: Raw performance data will be stored in directory C:\narData\ Raw data file name will follow the naming convention as:
                 YYYY_MM_DD_ <Array_SN>_SPA.nar

2. Extract performance metrics from the raw data, and stored in directory C:\narData\ Object and perf_metric_code specification are stored in text file C:\obj_metric_list; temp files will be stored in C:\Temp\ directory.

   Script name: extract_perf_metric_daily.pl
   Input file: C:\narData\*.nar
               C:\obj_metric_list
               C:\cx_list
   Log file: C:\Log\extr_log
   Output file: temporary performance data will be stored in directory C:\Temp\ Temp data file name will follow the naming convention as:
                YYYY_MM_DD_ <Array_SN>_temp_s   (SP)
                YYYY_MM_DD_ <Array_SN>_temp_l   (LUN)
                YYYY_MM_DD_ <Array_SN>_temp_d   (DISK)

3. Concatenate 3 temp files for each CLARiiON storage array (one for sp, one for lun and one for disk) into a single file for each array. Process each concatenated file to generate a daily report for each array, and store in ./Report/ directory. Since there are more than 140 entries for each object, we calculate only maximum and average values instead of listing all entries.

   Script name: cat_files_daily.pl
   Input file: C:\Temp<Array_SN>_temp_s   (SP)
               C:\Temp<Array_SN>_temp_l   (LUN)
               C:\Temp<Array_SN>_temp_d   (DISK)
   Log file: C:\Log\cat_log
   Output file: performance report will be stored in directory C:\Report\ Report file name will follow the naming convention as:
                YYYY_MM_DD_ <Array_SN>

Other considerations
All applications running on CLARiiON utilize a number of LUNs. So, if we know how many LUNs are being used by an application, we can aggregate related LUN performance metrics to calculate application level performance metrics.

CLARiiON performance monitoring scripts can easily be made application-aware (i.e. SQL server database, Exchange storage groups and Oracle database, etc.) by using an extra layer of mapping.
Script operation guide
1. **Retrieve** each CLARiiON nar files for the last 24 hours, run script:
   C:\retr_nar_daily.pl,
2. **Extract** required performance metrics from each nar file, generate temp files(3 files for each array, ending “temp_s”, “temp_l” and “temp_d”), run script: 
   C:\extract_perf_metric_daily.pl,
3. **Generate** CLARiiON performance daily report, saved in ./Report/directory, run script: 
   C:\cat_files_daily.pl
4. **Schedule** first task starting at 1:00am daily, second task starting at 1:05am, and the third one at 1:10am

Script Adjustment Considerations
1. **Add new storage array**
   Append the array serial number and SP A IP address in one line to file cx_list, the CLARiiON array will be polled as long as there is IP connectivity between the script server and the new CLARiiON array, and a proper security setting.
2. **Remove decommissioned storage array**
   Remove the array serial number and SP A IP address in one line from file cx_list, the decommissioned array will no longer be polled.
3. **Change performance metrics**
   Add/remove performance metric codes in file obj_metric_list, adjust script cat_file_daily.pl for report formatting.
4. **File management** can be added later to prevent unmanaged log or nar files from using all available disk space.
Professional Biography

Derek is a Senior Consultant at Bell Canada with more than 15 years experiences in the IT industry. He gained extensive experience with design and implementation of major aspects of Enterprise Storage Network, specializes in enterprise storage systems, including enterprise storage implementation and data migration in SAN and NAS environments, and Enterprise high availability systems solutions. Derek also holds various EMC Proven Professional certifications (IE expert or TA specialist in different disciplines, including CLARiiON, Symmetrix and NAS.)

Reference
1. Navisphere Analyzer Administrator's Guide, P/N 069001158 REV A08