ADDENDUM #6

Data Centre Assessment Output

Coquitlam Public Library

IT Infrastructure Equipment and Installation Services RFP

#2021-02

Updated: August 9, 2021

Contact

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This addendum shall revise or clarify Coquitlam Public Library's Request for Proposal: IT Infrastructure Equipment and Installation Services. This addendum shall form part of the contract documents and is to be read, interpreted and coordinated with all other parts. The following information is provided to answer questions raised by Proponents for the above-named project, to the extent referenced and shall become a part thereof.

PERFORMANCE OVERVIEW

PROJECT: CPL RFP
PREPARED FOR: Rick Barker, ███████@coqlibrary.ca
PREPARED BY: Rick Barker, ███████@coqlibrary.ca,
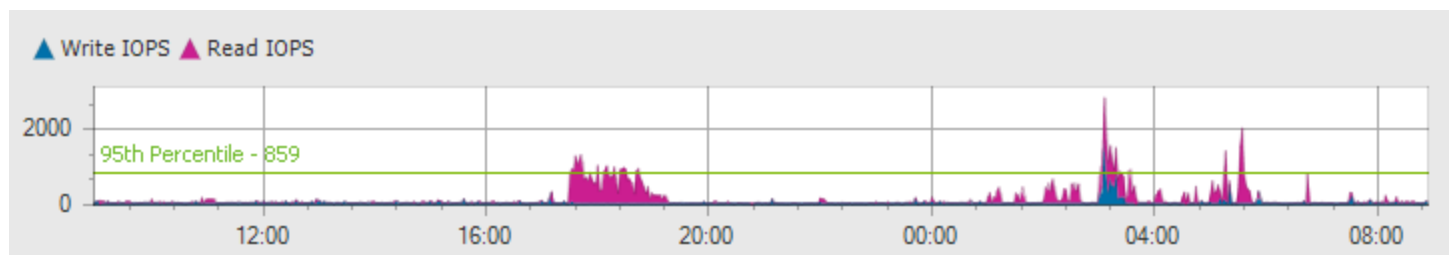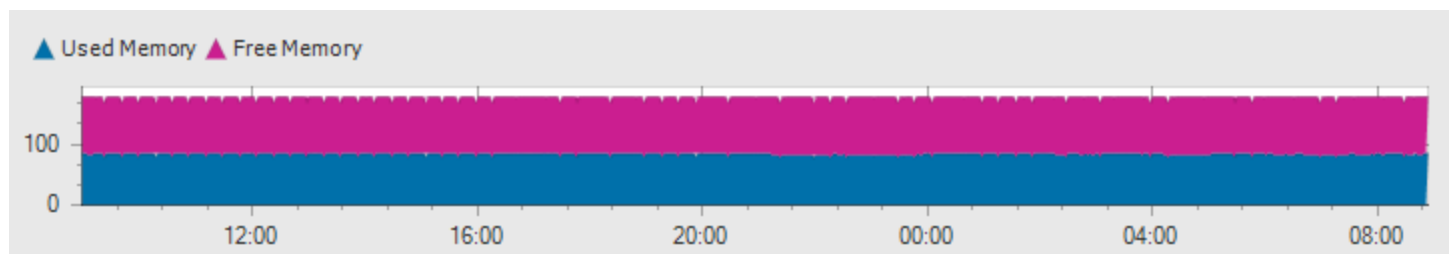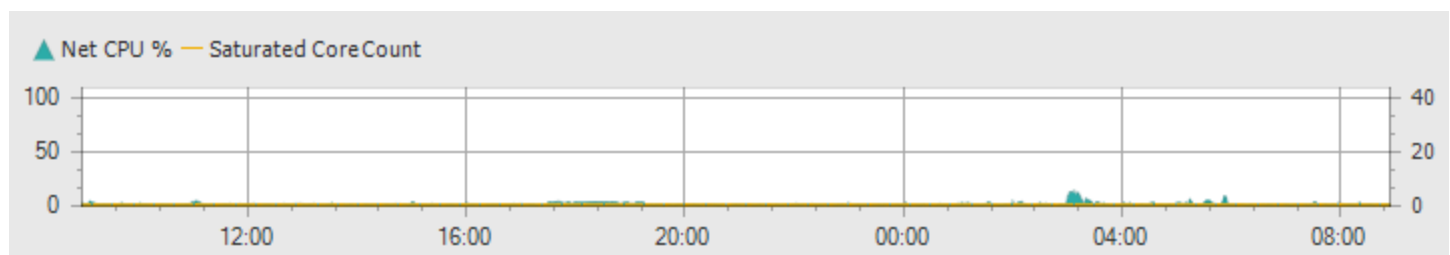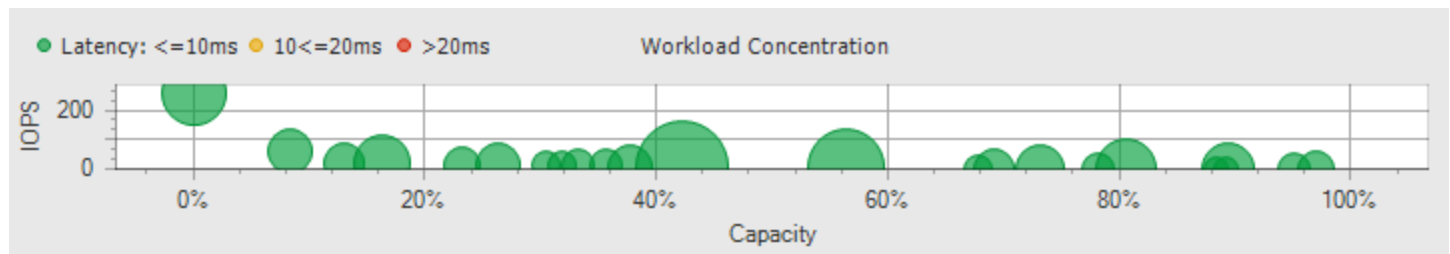**CREATED:** 8/9/2021

Intro

This document is an assessment of the server and storage workloads as observed at COQUITLAM PUBLIC LIBRARY based on servers, server disk activity, and storage capacity. The data depicted in this report may be used to make recommendations on future configurations and solutions.

This report may be used to identify times of peak IO activity, and marks the critical 95th IOPS thresholds, a key metric used as a baseline for sizing. This report includes details on servers, CPU and memory usage, as well as free and used storage capacities.

If you have any questions regarding the information presented in this report, please contact your Live Optics team for immediate assistance.
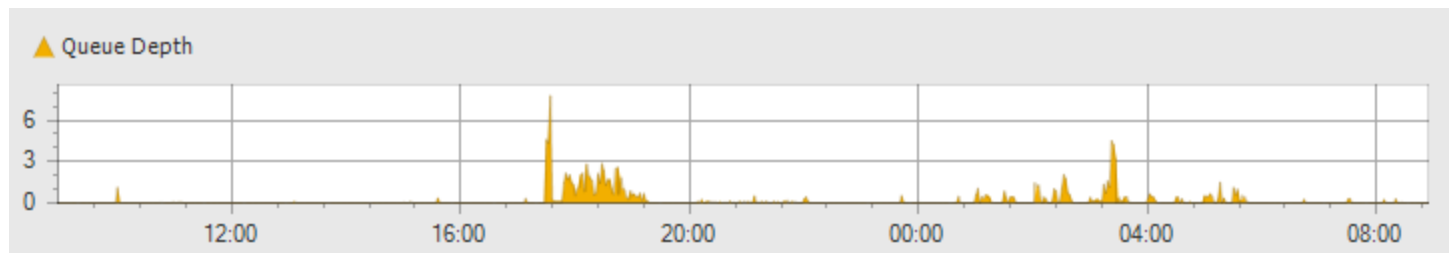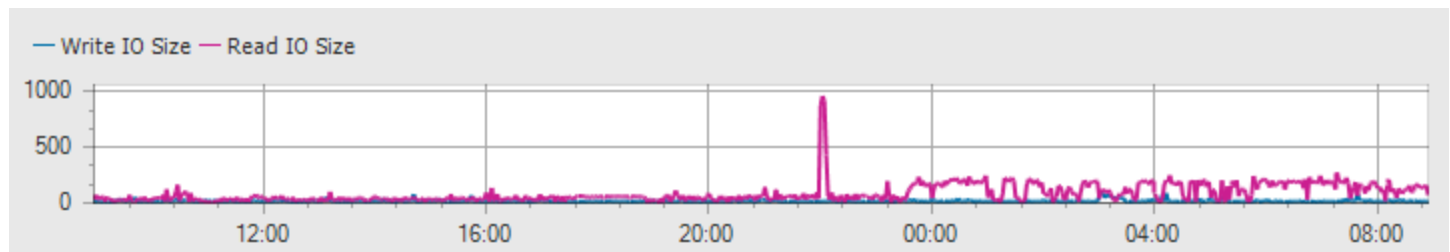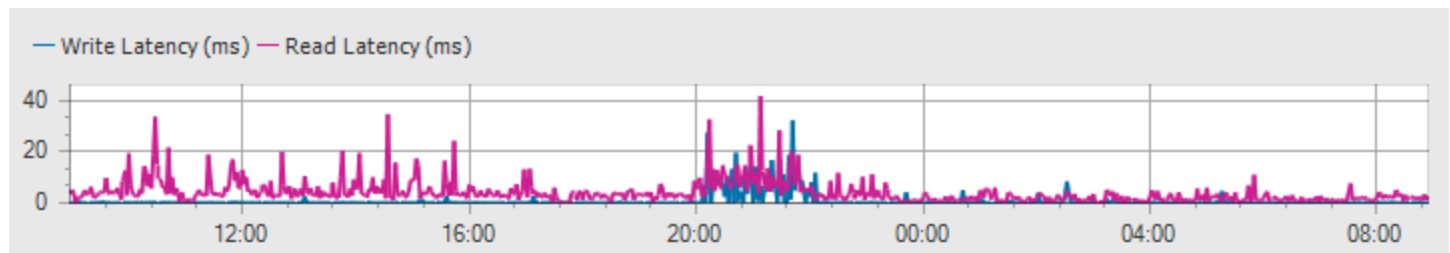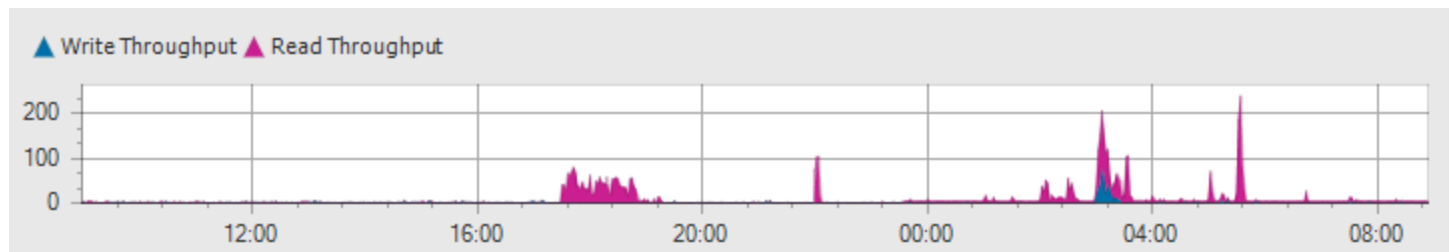
live optics

📂 Executive Summary

Time Recorded	1 Day(s), 0 Hour(s), 0 Minute(s), 8/6/2021 - 8/7/2021

|			
Total Combined Capacity	5.82 TB	**Peak Aggregate Network ...**	112.32 MB/s
Total Used/Free Capacity	2.18 TB / 3.64 TB	**Total Memory**	176.00 GB
IOPS	2845 at peak, 859 at 95%	**VM Guest Count**	0
Read/Write Ratio	83% / 17%	**Peak page fault of 31304 for server POL-TRAIN-1**	
Average Daily Write	146.69 GB	**A peak of 14.1 (14.7%) of 96 NetCPU Cycles (GHz)**	
Total Cores / Total Proces...	40 / 22	**75% of IOPS falls on 20% of your capacity (445.60 GB)**	

Workload Concentration — Latency: <=10ms, 10<=20ms, >20ms (IOPS vs Capacity)

Net CPU % — Saturated Core Count

Used Memory — Free Memory

Write IOPS — Read IOPS — 95th Percentile - 859

Network kB sent — Network kB received

live optics
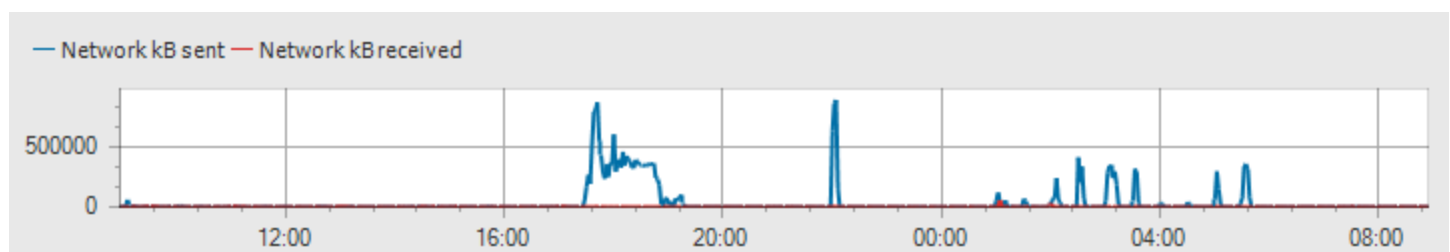
📁 Executive Storage Summary

Time Recorded	1 Day(s), 0 Hour(s), 0 Minute(s), 8/6/2021 - 8/7/2021

Total Local Capacity	5.82 TB	**Total Shared Capacity**	0 GB
Free/Used Local Capacity	3.64 TB (63%), 2.18 TB (37%)	**Free/Used Shared Capacity**	0 GB (100%), 0 GB (0%)
Disk Throughput	241 MB/s	**Total Disks**	23

📊 Workload Concentration

▲ Write Throughput ▲ Read Throughput

— Write Latency (ms) — Read Latency (ms)

— Write IO Size — Read IO Size

▲ Queue Depth

live optics
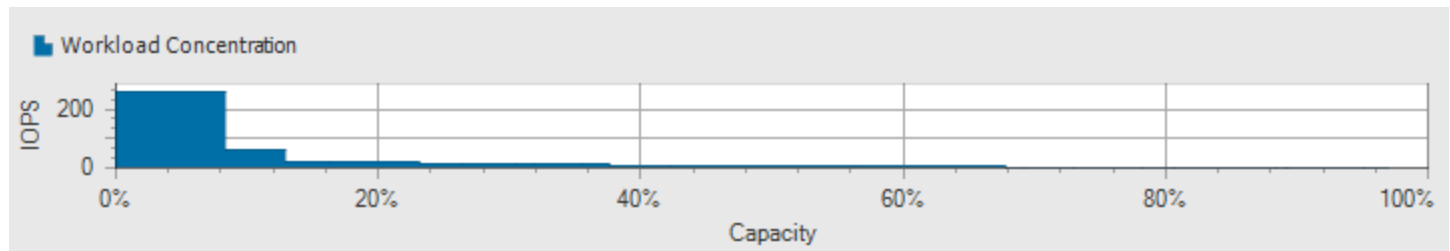
Individual Server Report: **YANG**

Operating System	Microsoft Windows Server 2012 R2 Standard
Time Recorded	1 Day(s), 0 Hour(s), 0 Minute(s), 8/6/2021 - 8/7/2021

Disk Throughput	79.80 MB/s	**Average IO size**	Read: 59.12 KB / Write: 20.94 KB
IOPS	438 at 95%	**Average Latency**	4 ms Reads and 0 ms writes
Read/Write Ratio	99% / 1%	**Average Queue Depth**	1.19
Total Local Capacity	1.22 TB	**Peak/Min CPU**	27% / 0%
Free Local Capacity	817.00 GB (65%)	**Peak/Min Memory**	12.64 GB / 12.26 GB
Used Local Capacity	433.00 GB (35%)	**Peak/Min Memory In Use**	3.74 GB / 3.36 GB

live optics
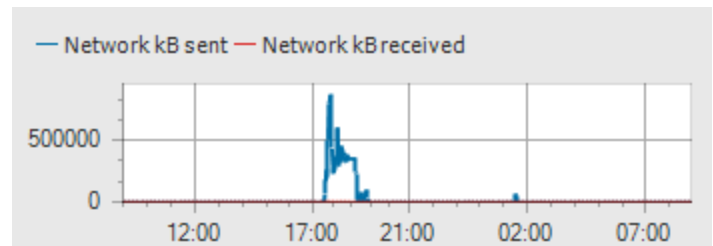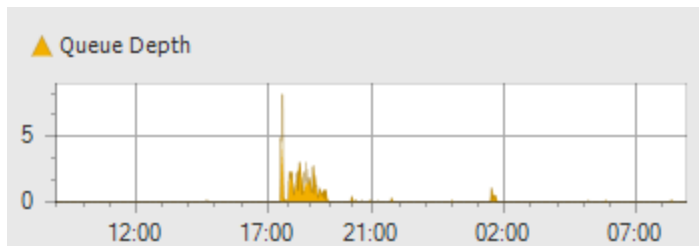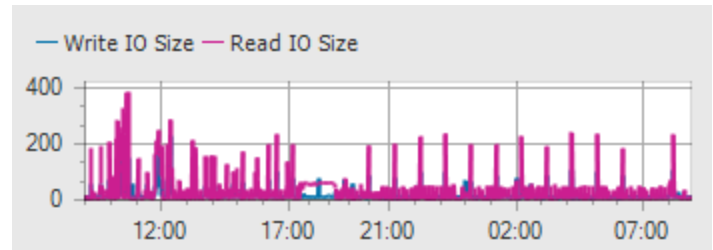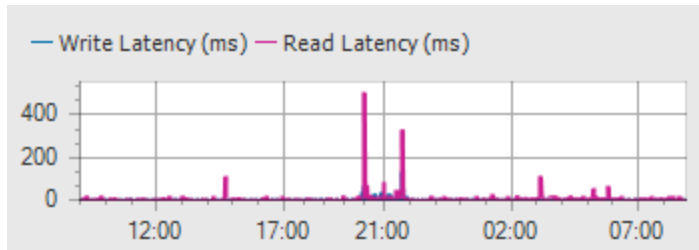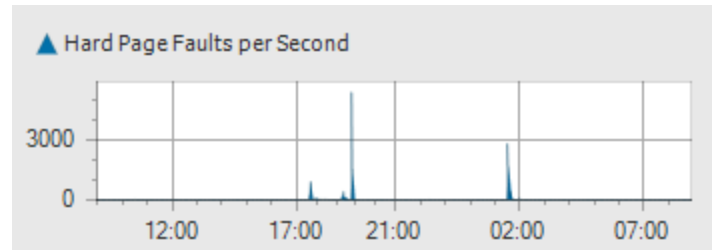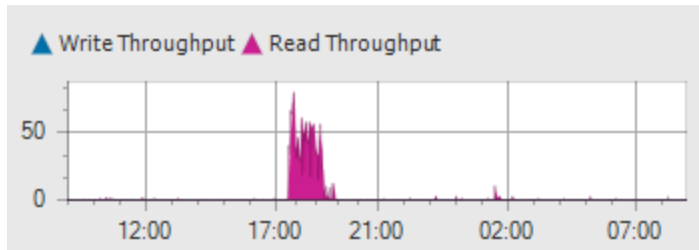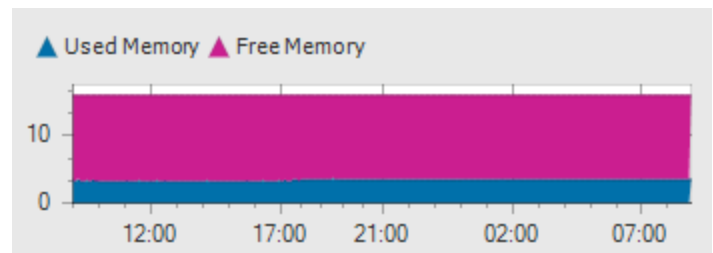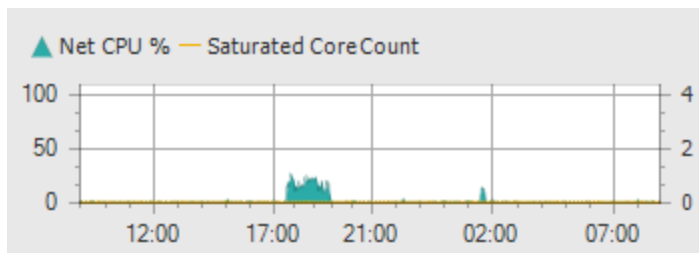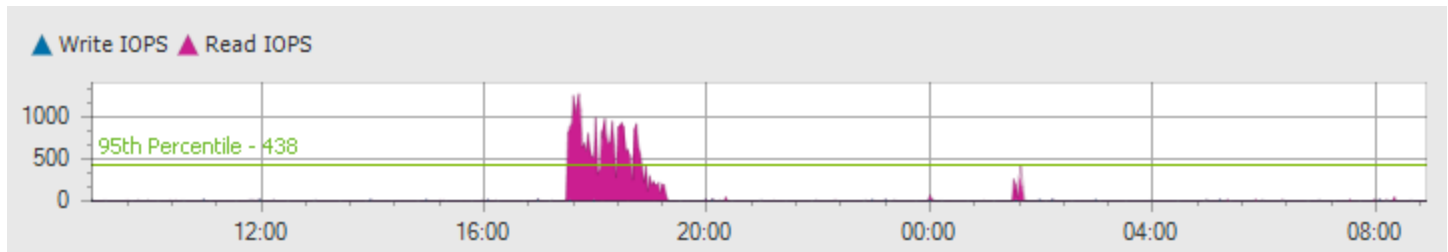
Individual Server Report: **POL-PRO**

Operating System	Microsoft Windows Server 2012 R2 Standard		
Time Recorded	1 Day(s), 0 Hour(s), 0 Minute(s), 8/6/2021 - 8/7/2021		
Disk Throughput	125.70 MB/s	**Average IO size**	Read: 77.99 KB / Write: 42.36 KB
IOPS	72 at 95%	**Average Latency**	3 ms Reads and 1 ms writes
Read/Write Ratio	74% / 26%	**Average Queue Depth**	0.45
Total Local Capacity	450.00 GB	**Peak/Min CPU**	61% / 0%
Free Local Capacity	279.00 GB (62%)	**Peak/Min Memory**	4.49 GB / 3.81 GB
Used Local Capacity	171.00 GB (38%)	**Peak/Min Memory In Use**	12.19 GB / 11.51 GB

▲ Write IOPS ▲ Read IOPS

95th Percentile - 72

▲ Net CPU % — Saturated Core Count

▲ Used Memory ▲ Free Memory

▲ Write Throughput ▲ Read Throughput

▲ Hard Page Faults per Second

— Write Latency (ms) — Read Latency (ms)

— Write IO Size — Read IO Size

▲ Queue Depth

— Network kB sent — Network kB received

live optics
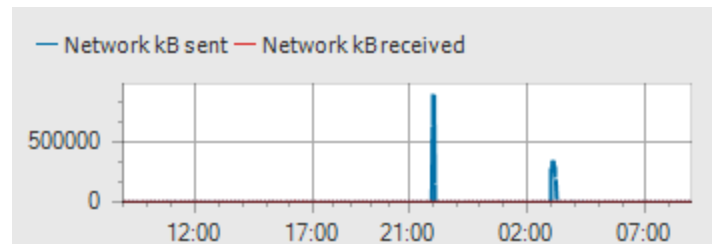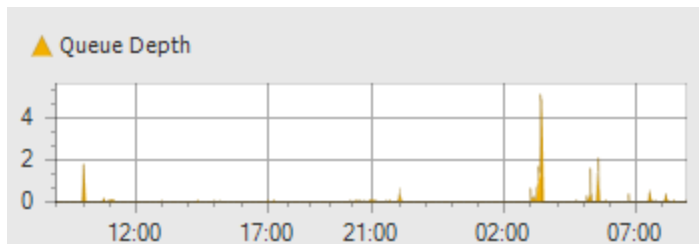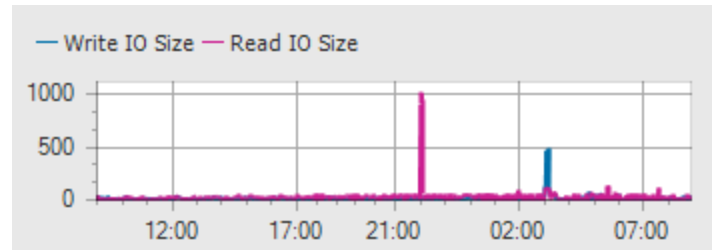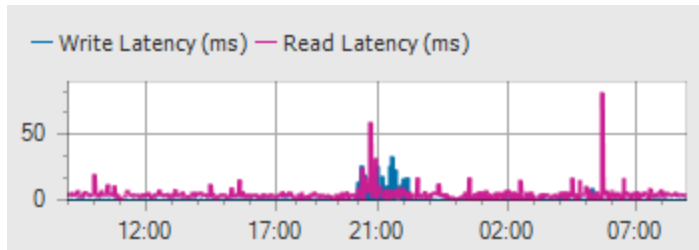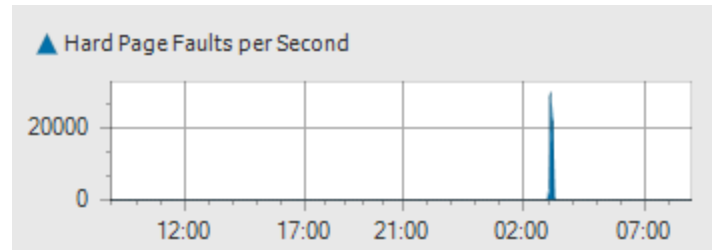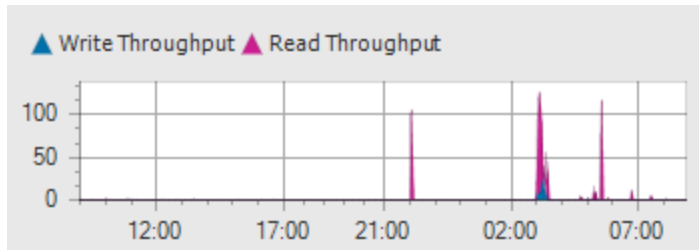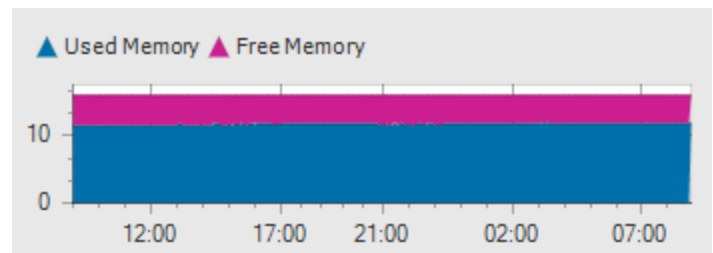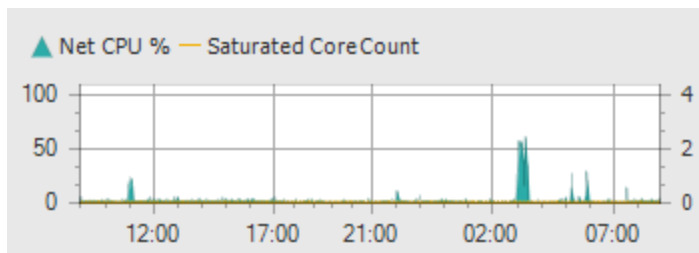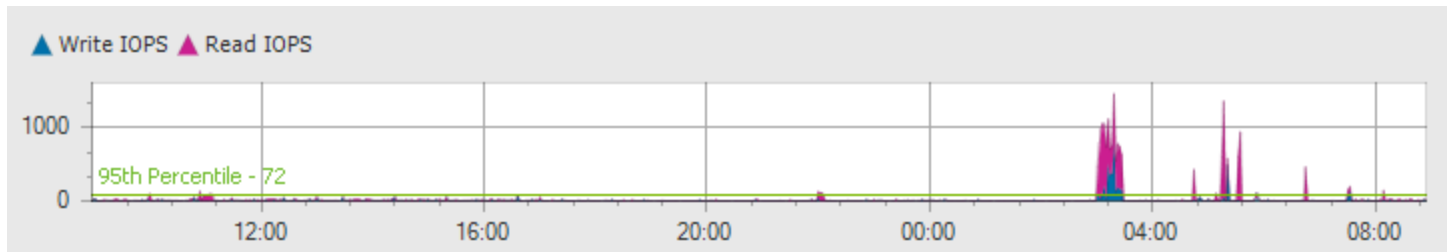
Individual Server Report: **EXCH-PO**

Operating System	Microsoft Windows Server 2012 R2 Standard		
Time Recorded	1 Day(s), 0 Hour(s), 0 Minute(s), 8/6/2021 - 8/7/2021		
Disk Throughput	51.40 MB/s	**Average IO size**	Read: 153.82 KB / Write: 35.27 KB
IOPS	45 at 95%	**Average Latency**	1 ms Reads and 1 ms writes
Read/Write Ratio	64% / 36%	**Average Queue Depth**	0.15
Total Local Capacity	820.00 GB	**Peak/Min CPU**	34% / 1%
Free Local Capacity	576.00 GB (70%)	**Peak/Min Memory**	17.68 GB / 16.56 GB
Used Local Capacity	244.00 GB (30%)	**Peak/Min Memory In Use**	15.44 GB / 14.32 GB

▲ Write IOPS ▲ Read IOPS

95th Percentile - 45

▲ Net CPU % — Saturated Core Count

▲ Used Memory ▲ Free Memory

▲ Write Throughput ▲ Read Throughput

▲ Hard Page Faults per Second

— Write Latency (ms) — Read Latency (ms)

— Write IO Size — Read IO Size

▲ Queue Depth

— Network kB sent — Network kB received

live optics
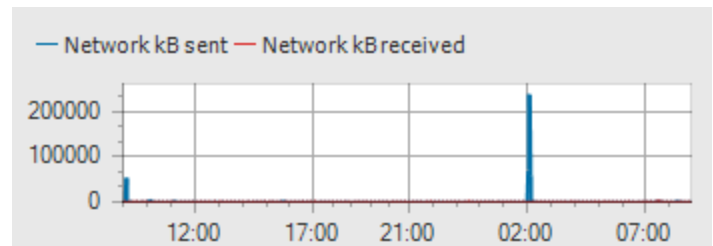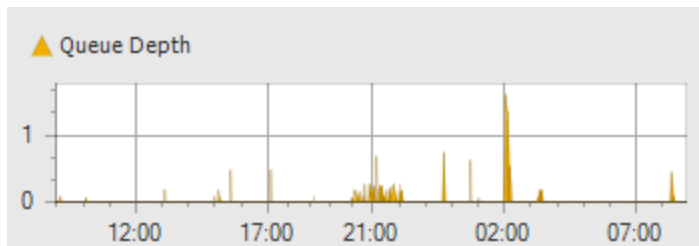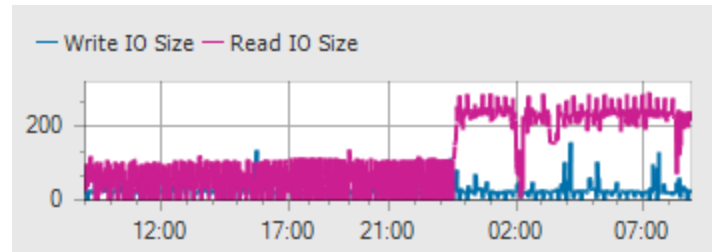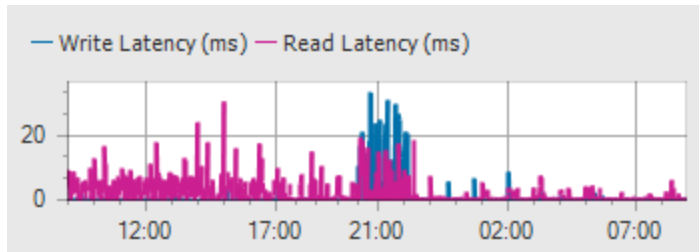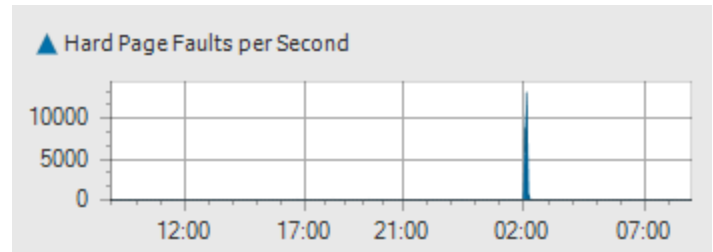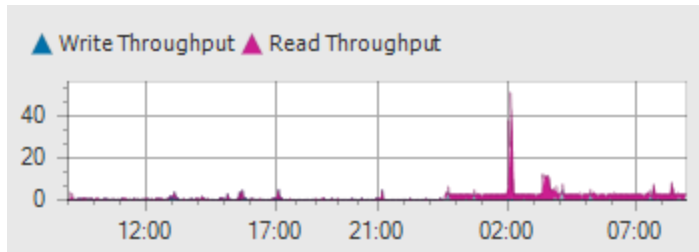
Individual Server Report: **EXCH-CC**

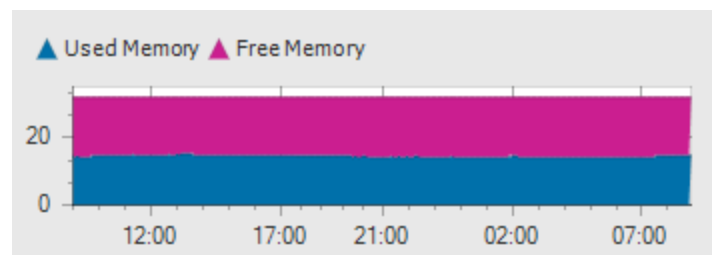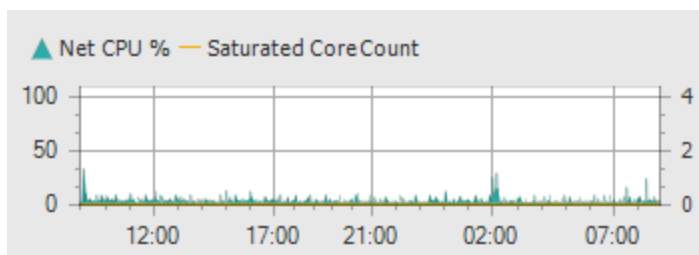|	
Operating System	Microsoft Windows Server 2012 R2 Standard
Time Recorded	1 Day(s), 0 Hour(s), 0 Minute(s), 8/6/2021 - 8/7/2021

Disk Throughput	53.40 MB/s	**Average IO size**	Read: 58.51 KB / Write: 33.04 KB
IOPS	21 at 95%	**Average Latency**	3 ms Reads and 1 ms writes
Read/Write Ratio	70% / 30%	**Average Queue Depth**	0.14
Total Local Capacity	820.00 GB	**Peak/Min CPU**	16% / 0%
Free Local Capacity	725.00 GB (88%)	**Peak/Min Memory**	22.07 GB / 21.28 GB
Used Local Capacity	95.00 GB (12%)	**Peak/Min Memory In Use**	10.72 GB / 9.93 GB

▲ Write IOPS ▲ Read IOPS

95th Percentile - 21

▲ Net CPU % — Saturated Core Count

▲ Used Memory ▲ Free Memory

▲ Write Throughput ▲ Read Throughput

▲ Hard Page Faults per Second

— Write Latency (ms) — Read Latency (ms)

— Write IO Size — Read IO Size

▲ Queue Depth

— Network kB sent — Network kB received

live optics
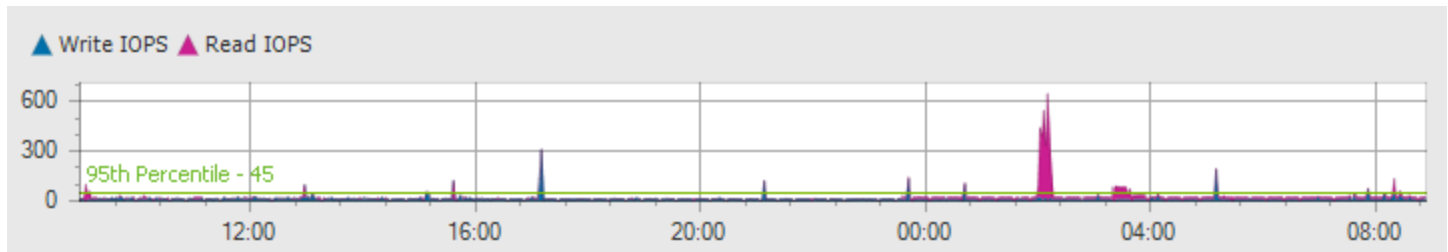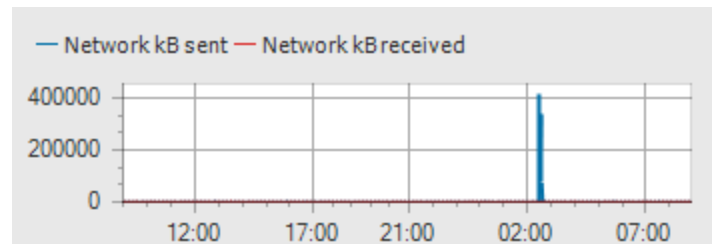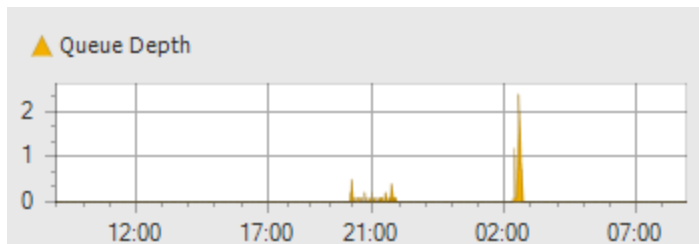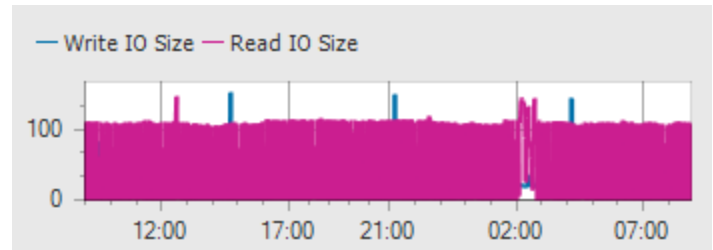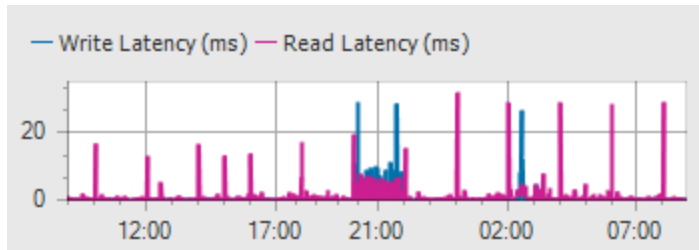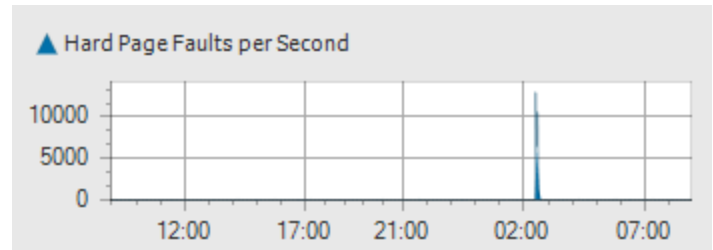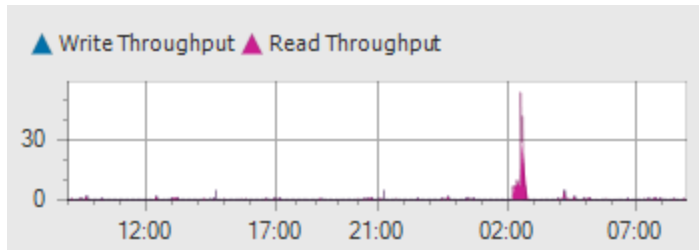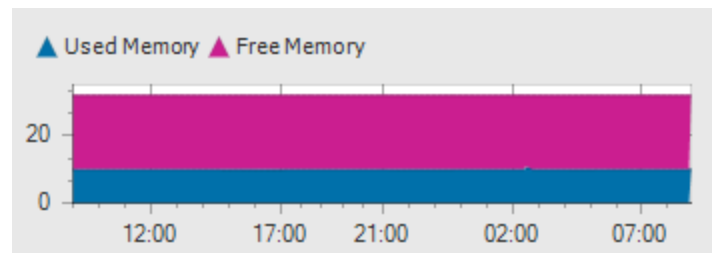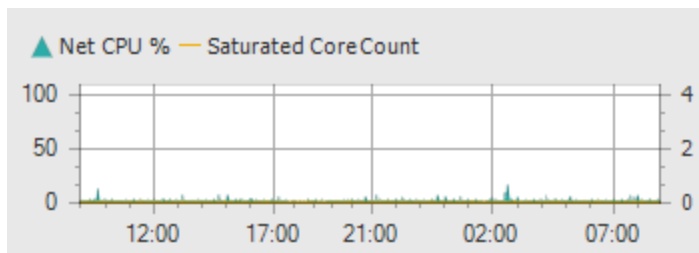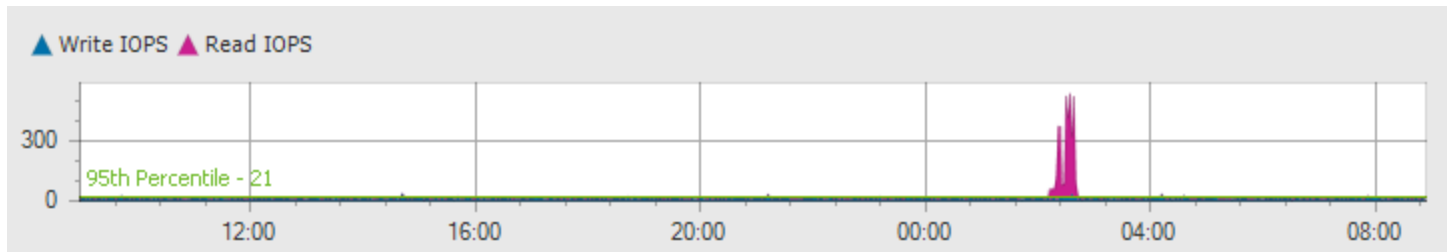
Individual Server Report: YIN

Operating System	Microsoft Windows Server 2012 R2 Standard
Time Recorded	1 Day(s), 0 Hour(s), 0 Minute(s), 8/6/2021 - 8/7/2021

Disk Throughput	14.10 MB/s	**Average IO size**	Read: 41.28 KB / Write: 18.98 KB
IOPS	15 at 95%	**Average Latency**	9 ms Reads and 0 ms writes
Read/Write Ratio	71% / 29%	**Average Queue Depth**	0.09
Total Local Capacity	1.22 TB	**Peak/Min CPU**	25% / 1%
Free Local Capacity	626.00 GB (50%)	**Peak/Min Memory**	11.47 GB / 11.23 GB
Used Local Capacity	624.00 GB (50%)	**Peak/Min Memory In Use**	4.77 GB / 4.53 GB
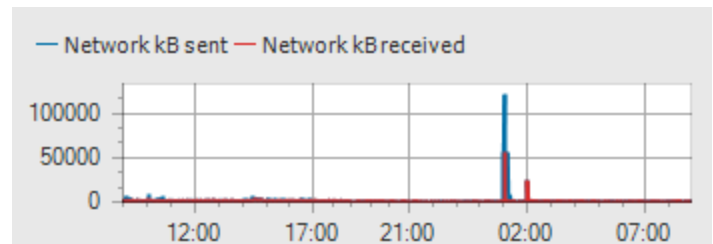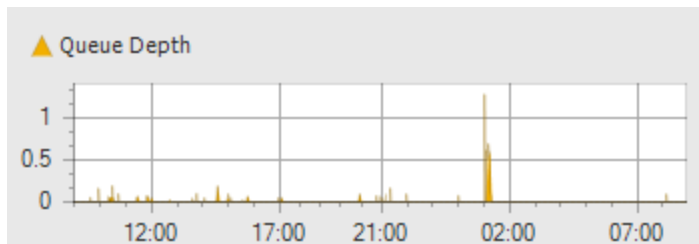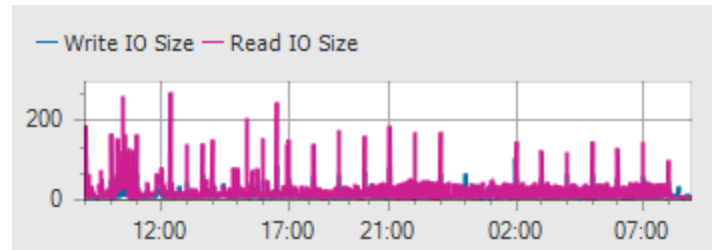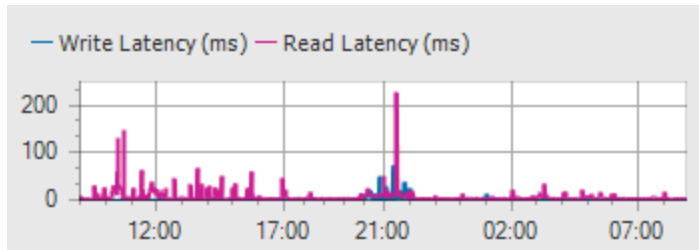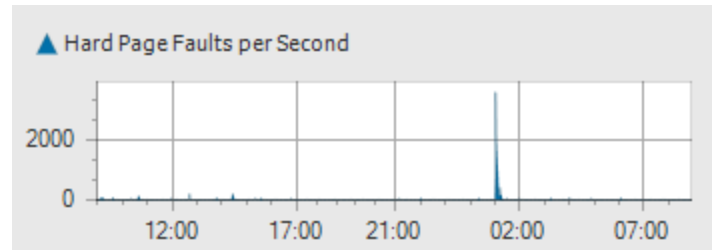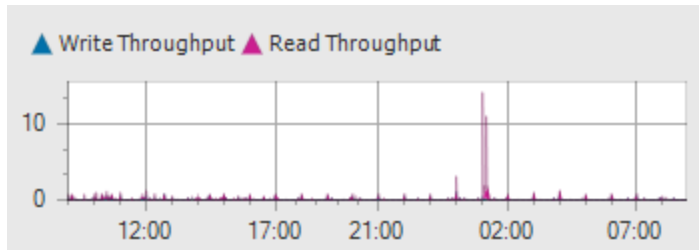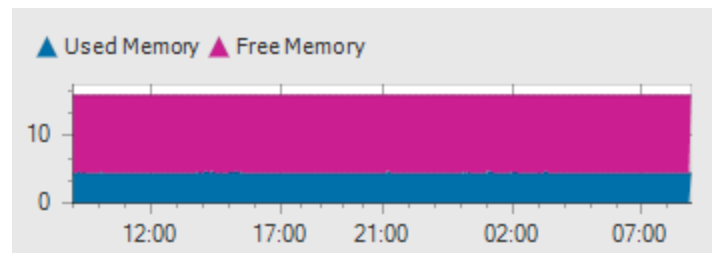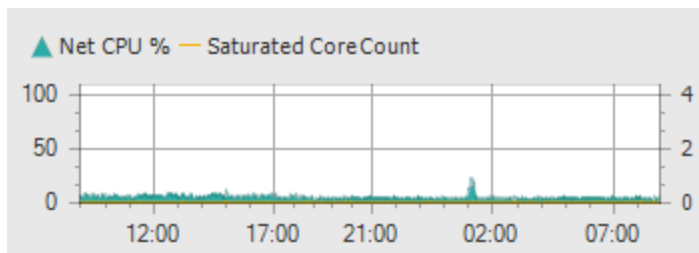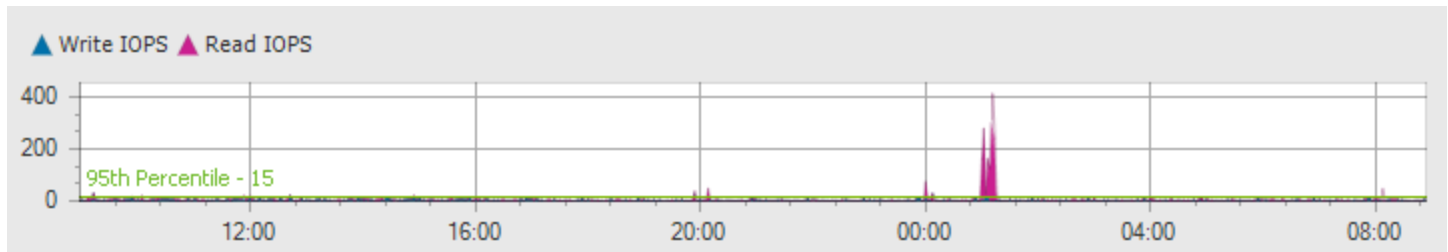
live optics

Individual Local Disk Report: **0 C:**

Operating System	Microsoft Windows Server 2012 R2 Standard		
Server Name	EXCH-CC		
Operating System	Microsoft Windows Server 2012 R2 Standard	**Disk Throughput**	53.20 MB/s
		Average Latency	2.6 ms Reads and 1.28 ms Writes
Total Local Capacity	120.00 GB	**IOPS**	21 at 95%, 122 at 99%, 526 at peak
Free Local Capacity	44.00 GB (37%)	**Read/Write Ratio**	71% / 29%
Used Local Capacity	76.00 GB (63%)	**Average IO size**	Reads: 58.58 KB / Writes: 32.70 KB
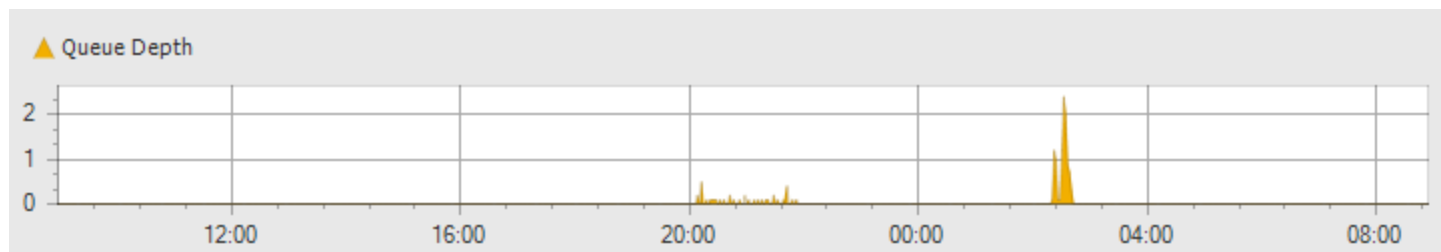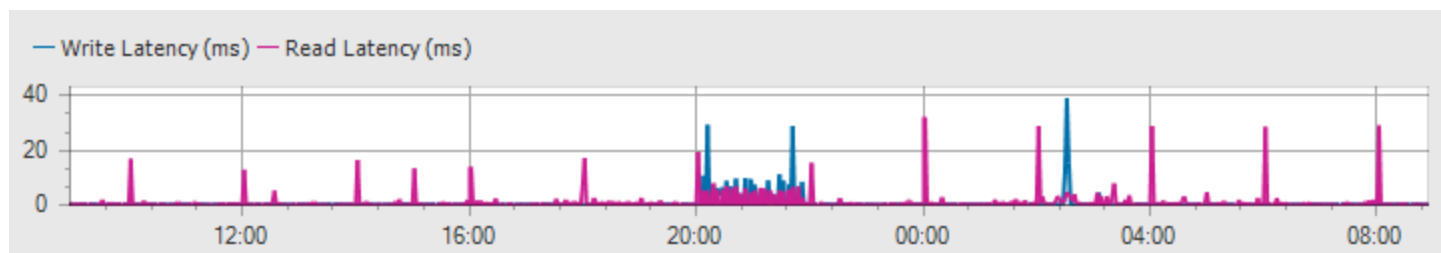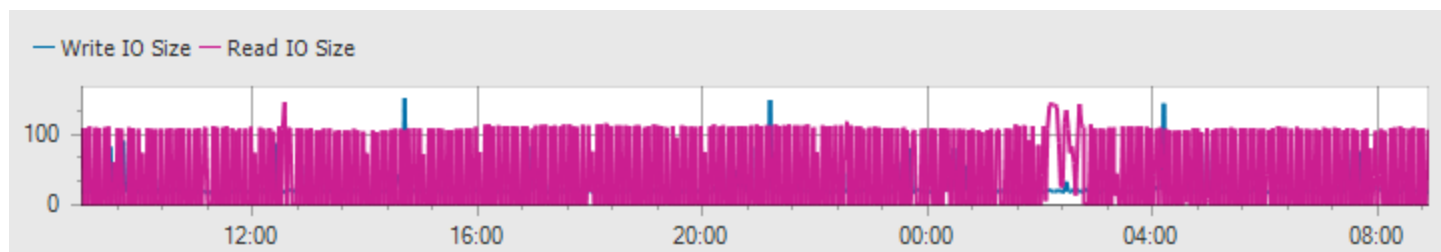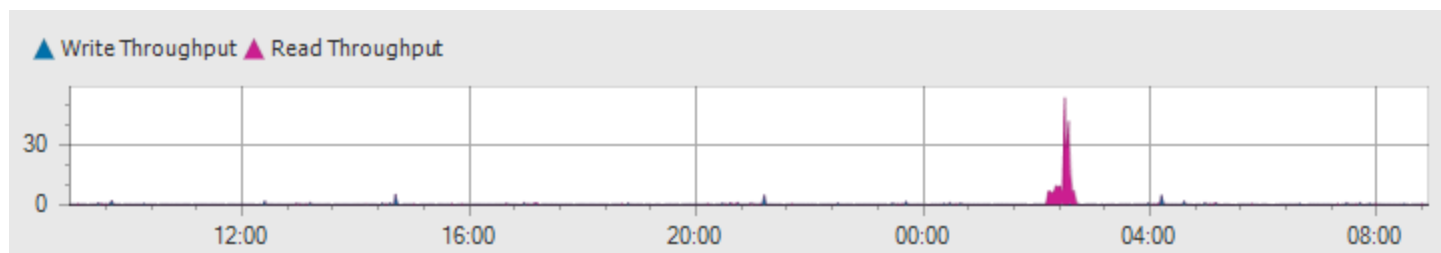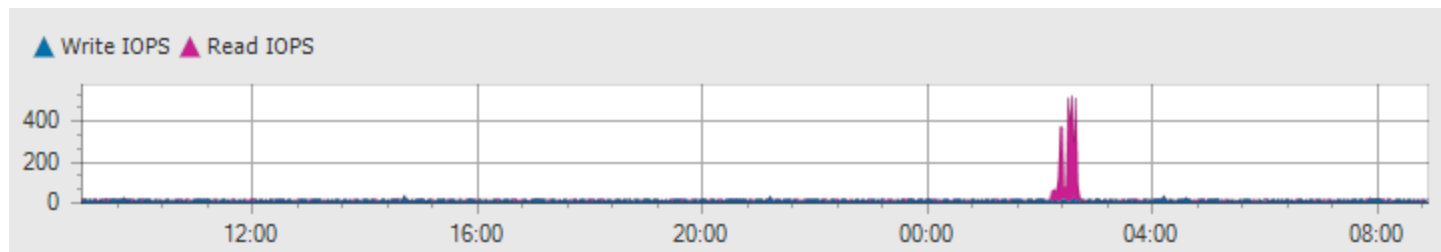
▲ Write IOPS ▲ Read IOPS

▲ Write Throughput ▲ Read Throughput

— Write IO Size — Read IO Size

— Write Latency (ms) — Read Latency (ms)

▲ Queue Depth

◯ live optics

▦ Individual Local Disk Report: **1 D:**

Operating System	Microsoft Windows Server 2012 R2 Standard
Server Name	EXCH-CC

Operating System	Microsoft Windows Server 2012 R2 Standard	**Disk Throughput**	1.00 MB/s
		Average Latency	0.19 ms Reads and 0.01 ms Writes
Total Local Capacity	700.00 GB	**IOPS**	0 at 95%, 0 at 99%, 19 at peak
Free Local Capacity	681.00 GB (97%)	**Read/Write Ratio**	25% / 75%
Used Local Capacity	19.00 GB (3%)	**Average IO size**	Reads: 0.97 KB / Writes: 3.41 KB
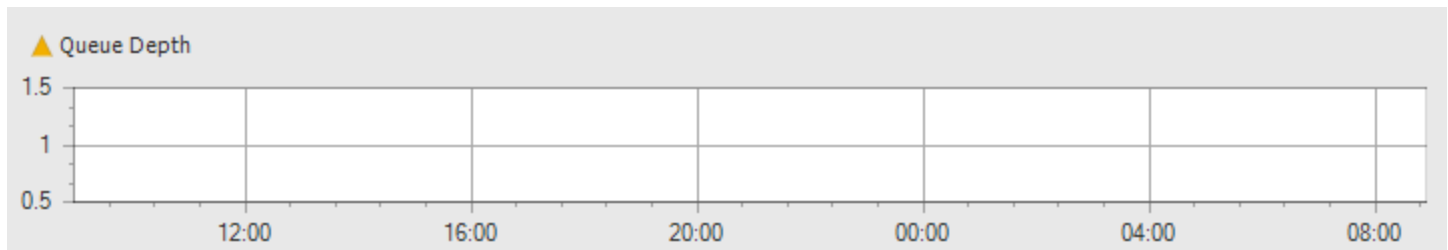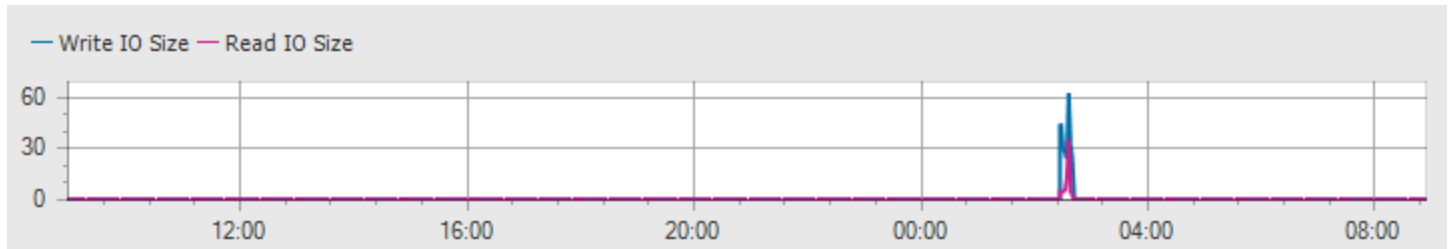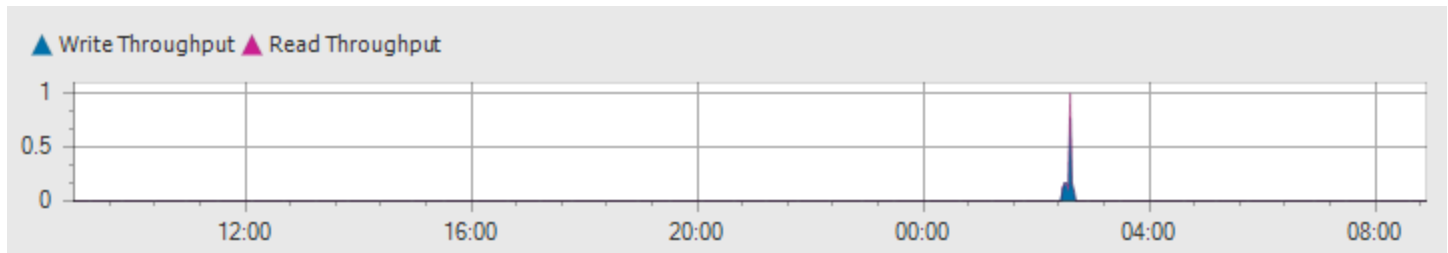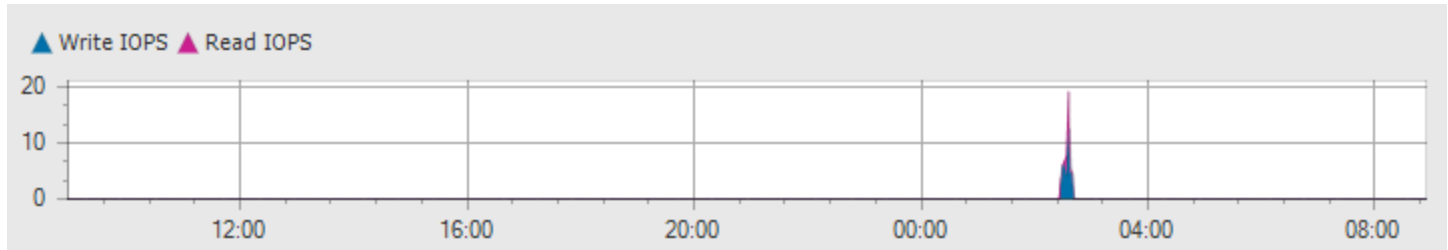
▲ Write IOPS ▲ Read IOPS

▲ Write Throughput ▲ Read Throughput

— Write IO Size — Read IO Size

— Write Latency (ms) — Read Latency (ms)

▲ Queue Depth

◯ live optics

▦ Individual Local Disk Report: **0 C:**

Operating System	Microsoft Windows Server 2012 R2 Standard
Server Name	EXCH-PO

Operating System	Microsoft Windows Server 2012 R2 Standard	**Disk Throughput**	48.90 MB/s
		Average Latency	2.43 ms Reads and 1.45 ms Writes
Total Local Capacity	120.00 GB	**IOPS**	16 at 95%, 138 at 99%, 640 at peak
Free Local Capacity	28.00 GB (23%)	**Read/Write Ratio**	56% / 44%
Used Local Capacity	92.00 GB (77%)	**Average IO size**	Reads: 59.44 KB / Writes: 37.75 KB
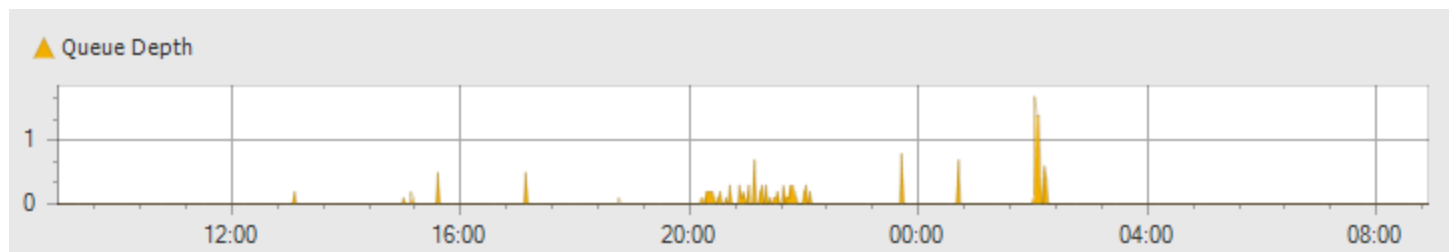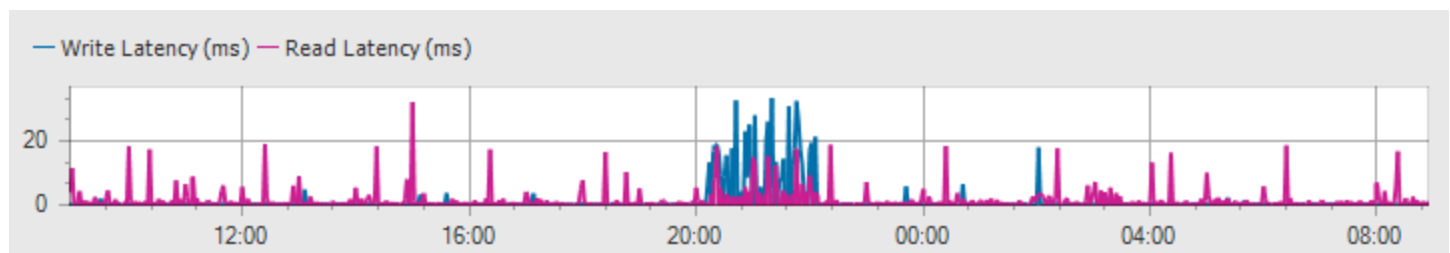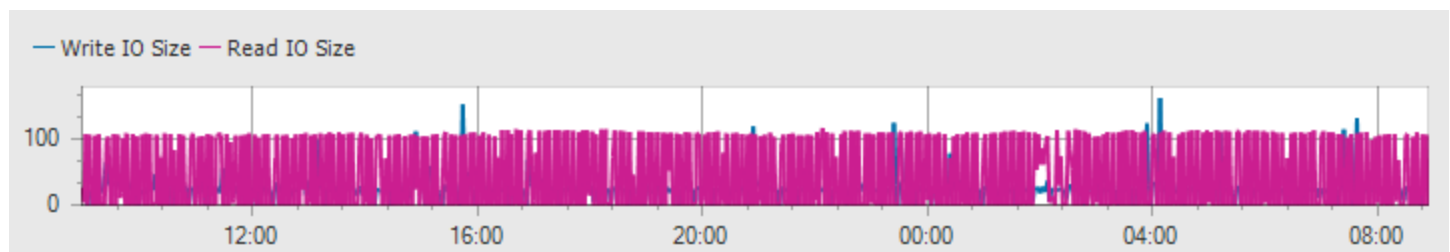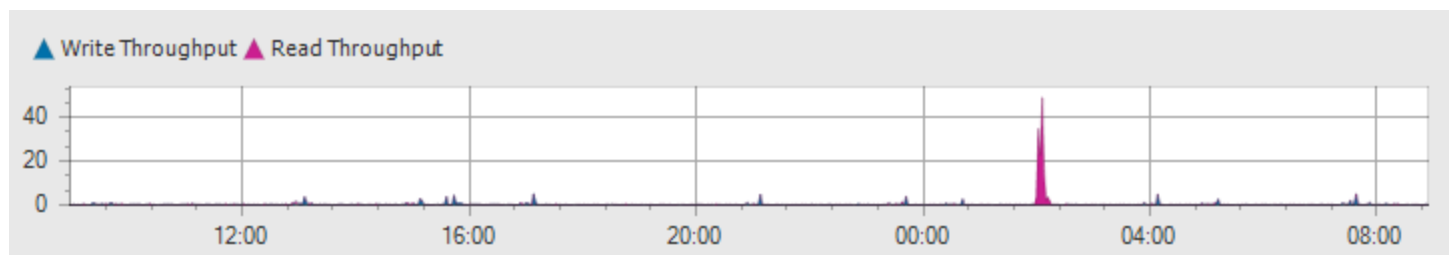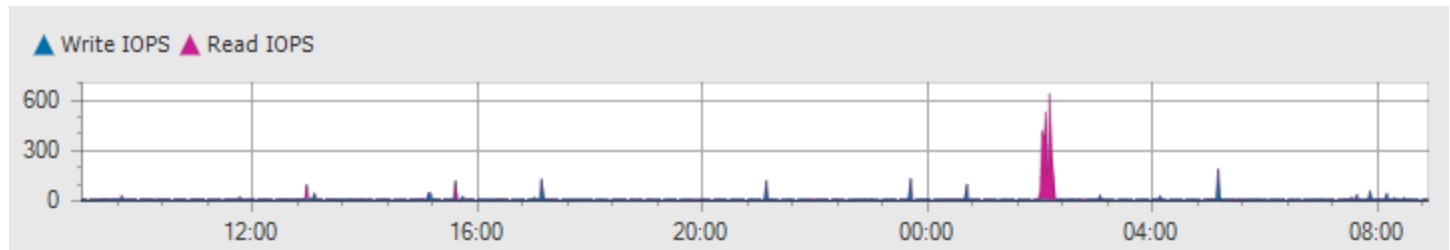
▲ Write IOPS ▲ Read IOPS

▲ Write Throughput ▲ Read Throughput

— Write IO Size — Read IO Size

— Write Latency (ms) — Read Latency (ms)

▲ Queue Depth

🗄 Individual Local Disk Report: **1 D:**

Operating System	Microsoft Windows Server 2012 R2 Standard
Server Name	EXCH-PO

Operating System	Microsoft Windows Server 2012 R2 Standard	**Disk Throughput**	27.60 MB/s
		Average Latency	1.06 ms Reads and 0.19 ms Writes
Total Local Capacity	700.00 GB	**IOPS**	18 at 95%, 76 at 99%, 285 at peak
Free Local Capacity	548.00 GB (78%)	**Read/Write Ratio**	76% / 24%
Used Local Capacity	152.00 GB (22%)	**Average IO size**	Reads: 180.98 KB / Writes: 31.91 KB

▲ Write IOPS ▲ Read IOPS

▲ Write Throughput ▲ Read Throughput

— Write IO Size — Read IO Size

— Write Latency (ms) — Read Latency (ms)

▲ Queue Depth

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▦ Individual Local Disk Report: **0 C:**

Operating System	Microsoft Windows Server 2012 R2 Standard
Server Name	OPAC-1

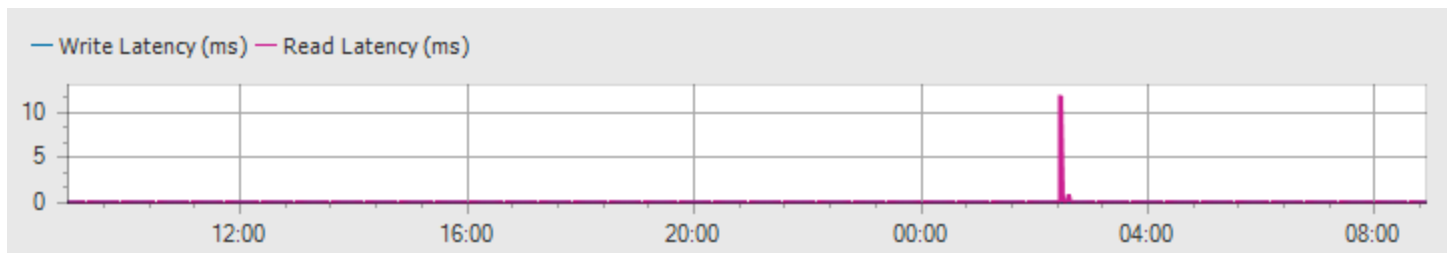| Operating System	Microsoft Windows Server 2012 R2 Standard	**Disk Throughput**	6.50 MB/s
		Average Latency	4.17 ms Reads and 0.17 ms Writes
Total Local Capacity	60.00 GB	**IOPS**	3 at 95%, 11 at 99%, 250 at peak
Free Local Capacity	28.00 GB (47%)	**Read/Write Ratio**	69% / 31%
Used Local Capacity	32.00 GB (53%)	**Average IO size**	Reads: 27.95 KB / Writes: 9.93 KB

▲ Write IOPS ▲ Read IOPS

▲ Write Throughput ▲ Read Throughput

— Write IO Size — Read IO Size

— Write Latency (ms) — Read Latency (ms)

▲ Queue Depth

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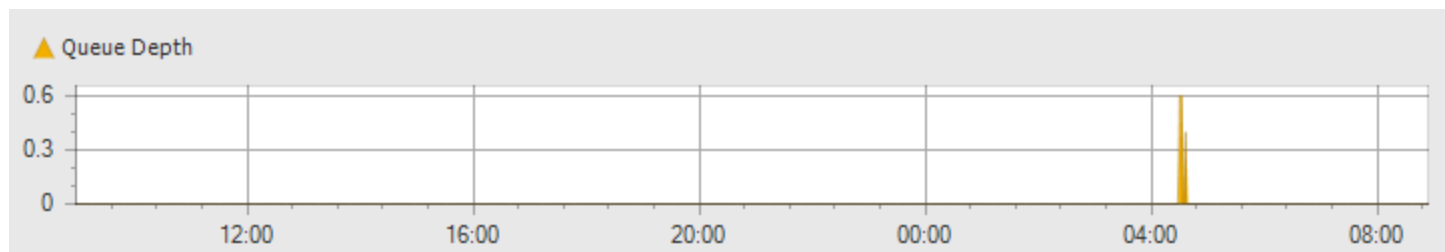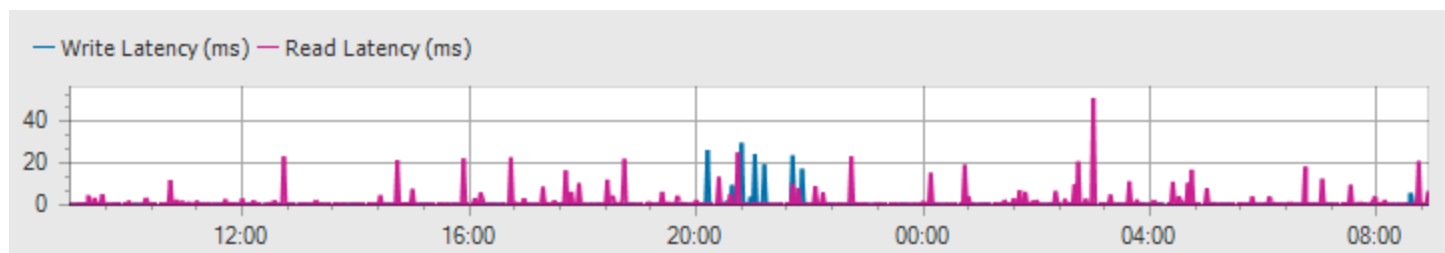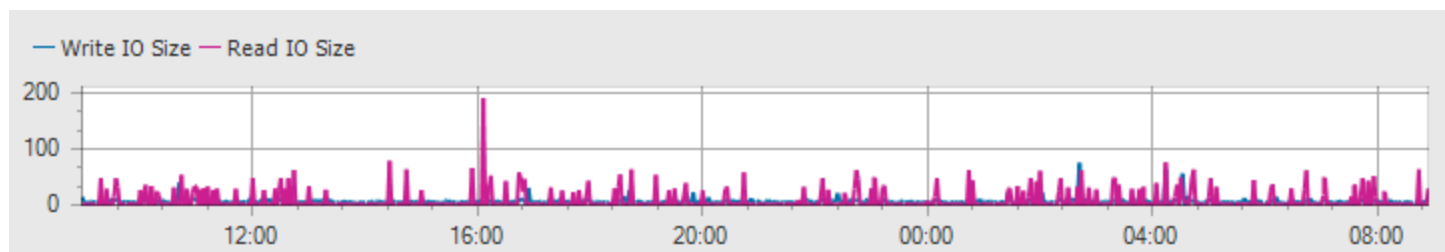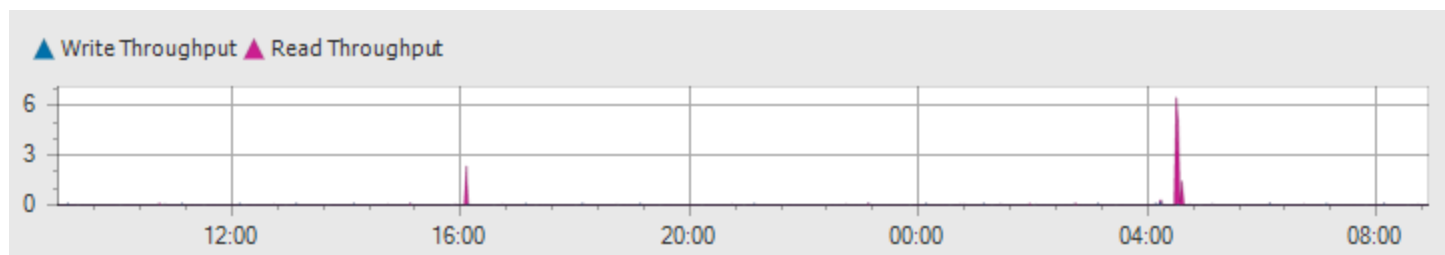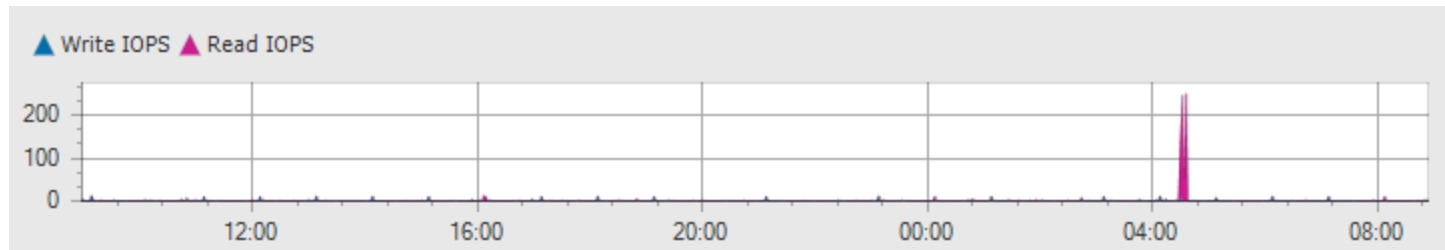
🖥 Servers Recorded

Server Name(s)	Local Capacity	Free Capacity	Used Capacity	IOPS	Disk MB/s	Read/Write Ratio
YANG	1.22 TB	817.00 GB	433.00 GB	438	80	99% / 1%
POL-PRO	450.00 GB	279.00 GB	171.00 GB	72	126	74% / 26%
EXCH-PO	820.00 GB	576.00 GB	244.00 GB	45	51	64% / 36%
EXCH-CC	820.00 GB	725.00 GB	95.00 GB	21	53	70% / 30%
YIN	1.22 TB	626.00 GB	624.00 GB	15	14	71% / 29%
POL-TRAIN-1	300.00 GB	130.00 GB	170.00 GB	13	122	70% / 30%
OPAC-PO	60.00 GB	6.00 GB	54.00 GB	12	11	55% / 45%
POL-PRO-1	450.00 GB	361.00 GB	89.00 GB	12	94	52% / 48%
PO-SERVICES	500.00 GB	184.00 GB	316.00 GB	9	68	74% / 26%
OPAC-1	60.00 GB	28.00 GB	32.00 GB	3	7	69% / 31%

Capacity shown only reports capacity that is local to the server. Shared Cluster Disk capacities are not shown in this table. IOPS shown are based on the 95th percentile IOPS for the individual server. As each server's individual 95th percentile may occur at different times than other servers, adding up the individual server 95th percentiles will not be the same as the summary aggregate 95th percentile IOPS for the entire report. The IOPS shown include any IO to shared cluster disks.

The Read and Write ratios shown represent the ratios during the top 10% of the server's IO activity as measured by IOPS.

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🖴 Disks Recorded

Server Name(s)	Device Name	Local Capacity	Free Capacity	Used Capacity	95% IOPS	Read/Write Ratio
EXCH-CC	0 C:	120.00 GB	44.00 GB	76.00 GB	21	71% / 29%
EXCH-CC	1 D:	700.00 GB	681.00 GB	19.00 GB	0	25% / 75%
EXCH-PO	0 C:	120.00 GB	28.00 GB	92.00 GB	16	56% / 44%
EXCH-PO	1 D:	700.00 GB	548.00 GB	152.00 GB	18	76% / 24%
OPAC-1	0 C:	60.00 GB	28.00 GB	32.00 GB	3	69% / 31%
OPAC-PO	0 C:	60.00 GB	6.00 GB	54.00 GB	12	55% / 45%
POL-PRO	0 C:	200.00 GB	130.00 GB	70.00 GB	16	54% / 46%
POL-PRO	1 D: E: F:	250.00 GB	149.00 GB	101.00 GB	64	76% / 24%
POL-PRO-1	0 C:	200.00 GB	153.00 GB	47.00 GB	11	54% / 46%
POL-PRO-1	1 D: E: F:	250.00 GB	208.00 GB	42.00 GB	0	51% / 49%
POL-TRAIN-1	0 C:	200.00 GB	98.00 GB	102.00 GB	9	58% / 42%
POL-TRAIN-1	1 D:	100.00 GB	32.00 GB	68.00 GB	0	76% / 24%
PO-SERVICES	0 C:	500.00 GB	184.00 GB	316.00 GB	9	74% / 26%
YANG	0 C:	60.00 GB	30.00 GB	30.00 GB	14	92% / 8%
YANG	1 D:	440.00 GB	252.00 GB	188.00 GB	259	100% / 0%
YANG	2 E:	250.00 GB	248.00 GB	2.00 GB	0	12% / 88%
YANG	3 D:	200.00 GB	115.00 GB	85.00 GB	2	100% / 0%
YANG	4 D:	300.00 GB	172.00 GB	128.00 GB	0	100% / 0%
YIN	0 C:	60.00 GB	30.00 GB	30.00 GB	13	65% / 35%
YIN	1 D:	440.00 GB	187.00 GB	253.00 GB	5	76% / 24%
YIN	2 E:	250.00 GB	197.00 GB	53.00 GB	0	13% / 87%
YIN	3 D:	200.00 GB	85.00 GB	115.00 GB	1	74% / 26%
YIN	4 D:	300.00 GB	127.00 GB	173.00 GB	0	80% / 20%

Capacity shown only reports capacity that is local to the disk. Shared Cluster Disk capacities are not shown in this table. IOPS shown are based on the 95th percentile IOPS for the individual disk. As each disks individual 95th percentile may occur at different times than other disks, adding up the individual disk 95th percentiles will not be the same as the summary aggregate 95th percentile IOPS for the entire report.

Definitions

CPU

The CPU shown in the individual server reports measures the utilization of the CPU as a percentage of the total available CPU clock cycles. When shown in the aggregate summary, the CPU aggregate represents the sum of the clock cycles utilized. The saturated core count shows the number of CPU cores that were observed to have a usage level of 90% or more during the sampling period. This count provides insight into how your CPU workloads are distributed across all the cores. If a core is saturated, the task that it is processing is bottlenecked on the CPU. By spreading tasks out over multiple threads (and thus multiple cores) the bottleneck may be removed. Live Optics supports saturated core counts for Windows and Linux hosts. Saturated core counts for other host operating systems are not supported.

IO Transfer Size

This unit of measure records the average payload size of a given set of read or write operations. The average IO transfer size may be used to describe the nature of the IO workload and is an important factor in understanding the character of an IO workload.

IOPS

Live Optics monitors the read and write operations at the block storage layer of the host operating system. IOPS are the Input / Output Operations per Second performed by a physical server host or a virtual machine.

Latency

The average time required for the host to complete an IO operation is measured as its average latency. Live Optics monitors latency at the host level. Like queue depth, the host's latency will differ from latency reported by external storage arrays, and individual disks within RAID sets. Intermittent spikes in latency should not be a matter of concern. Also, average latency reported in Live Optics is only accurate when the sustained IOPS are over 100 IOs per second. High latencies reported during very low periods of IOPS should be discounted and often can be attributed to counter skew factors associated with the latency calculation. Latency is an important factor when investigating a storage solution that is demonstrating known problems at the application layer. Most applications will not tolerate abnormally high levels of latency on a sustained basis.

MB/s

Megabytes per second represents the average rate of read and write IO transfers in terms of payload size per second. This measures the IO throughput of a given system and is an important factor in sizing storage network bandwidth requirements.

Memory

The memory shown in the individual server reports measures the total available (free) and used memory for the server. When shown in the aggregate summary, the total memory shown represents the aggregate memory usage (and free memory) of all servers in the report.

Participation

This simple chart shows the number of servers that were monitored for the given sampling period. If the connection between Live Optics and a server was lost, the participation chart will show a drop during the period when the server was out of communication with Live Optics.

Queue Depth (QD)

The number of outstanding IO operations that are the host is processing at any given time is the queue depth. Live Optics monitors queue depth at the host level. Host level queue depth will differ from the queue depth reported by external storage arrays, and individual disks within RAID sets. Storage devices tend to perform faster when queue depths are higher. However, high queue depths can also lead to higher than acceptable latencies.

Definitions Continued

Page Faults

Page Faults per Second show the rate of hard page faults that required a virtual memory page to be read from disk. High hard page fault rates may suggest insufficient physical memory allocation to the OS and can be signs of application performance problems.

Workload Concentration Line

Workload Concentration plots the total used capacity of the project by disk along the X-axis and the IOPS activity of each disk along the Y-axis. The disks are sorted by IOPS with the disks with the highest IOPS being closest to the Y-axis on the left. The vertical line drawn splits the graph into two sections, with the section on the left indicating the region that compromising 20% of the total used capacity, and the region on the right showing the remaining 80% of the capacity. The label shows you the portion of IOPS that fall on either region. Note: the IOPS shown are observed only at the disk scope. Live Optics does not analyze IO activity at a block level based on the address of individual IOs on a given disk. Additional IO concentration may or may not be present at the block level within the individual disks.

Workload Concentration Bubble

Workload Concentration plots a bubble chart of your disks and sorts them by their IO activity. The vertical placement of the bubble represents the amount of IO. The size of each bubble is proportional to the capacity of the disk. The horizontal axis demonstrates the total amount of IO that falls within a certain percentage of total capacity.