Washington Systems Center - Storage

Accelerate with IBM Storage:

Managing Enterprise Wide Thin Provisioning and Compression with Spectrum Control Standard/Advanced and Storage Insights

Dominic Pruitt (dompruitt@us.ibm.com)
IBM Spectrum Storage presales SME
Control, Virtualize, & Performance
storagemvp.me @storagemvp

Session objectives

- To be able to understand the types of block volumes in the enterprise and how capacity grows in storage pools
- To be able to understand the level of capacity allocation at the Block Storage System level
- To be able to understand the level of capacity allocation and compression at the Storage Pool level and take action when necessary
- To be able to understand the growth patterns of servers and volumes
- To be able to understand storage reclamation and alerting available on capacity metrics

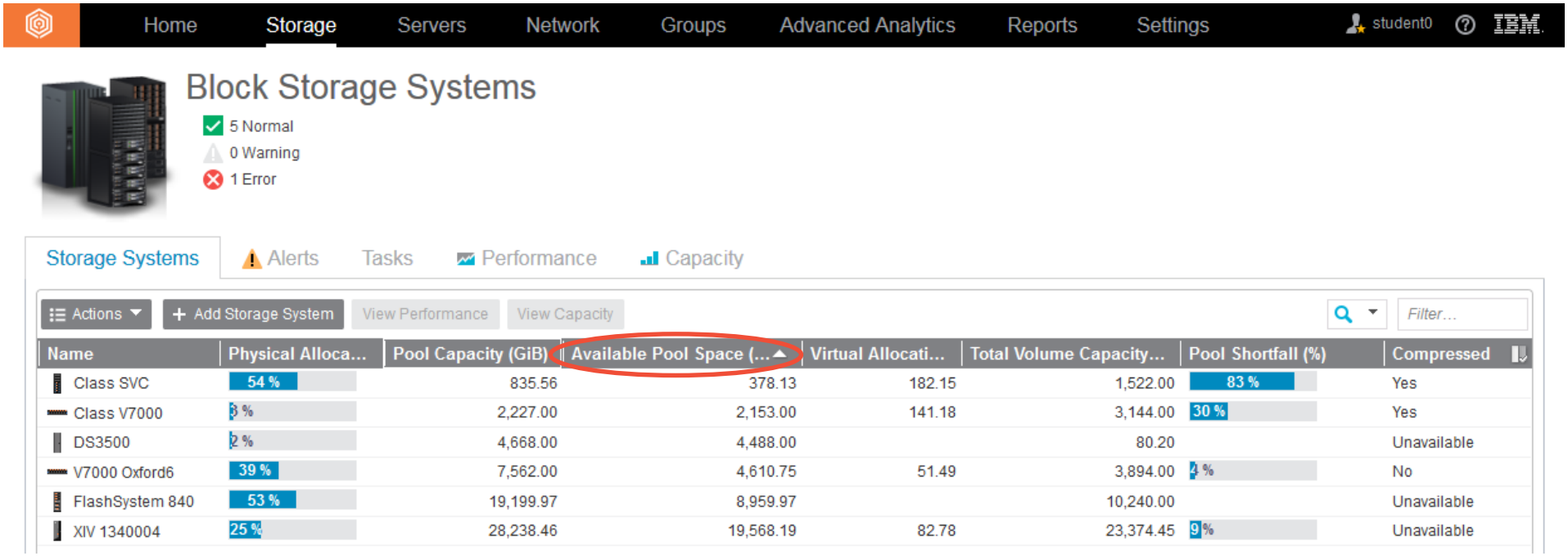
Volume Background

- Three types of volumes are found in block storage systems and how they grow:
  - Fully Allocated – capacity is allocated for the whole volume in the beginning and does not grow in additional capacity unless additional capacity is added by expanding a volume.
  - Thin Provisioned – initial capacity is allocated as a percentage of volume size, additional capacity is allocated to the volume when the application writes to new locations of the volume, upper limit of volume capacity growth is either the volume size or what capacity is available in the pool.
  - Compressed – same as thin provisioned except the new writes to the volume are compressed which reduces capacity growth rate:
    - Worst case growth is compressed volume grows at thin provisioned volume rate with compression helping little
    - Best case is compressed volume grows at a rate much slower than a thin provisioned volume because of the compression of new writes.

Storage Pool Background

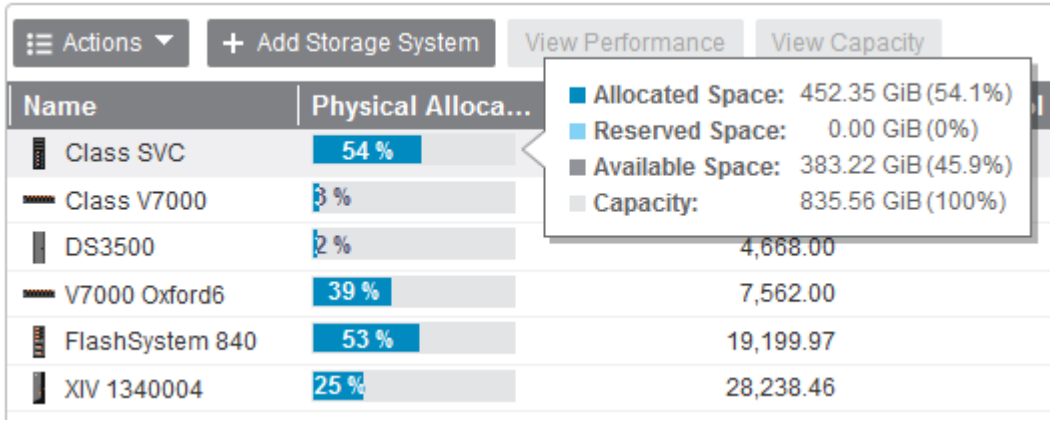
- Storage Pools experience capacity growth via:
  - Creation of new volumes including volumes for FlashCopy and Mirroring
  - Growth of Thin Provisioned and Compressed Volumes
  - Migration of volumes to a Storage Pool
  - Removal of MDisks and Arrays from Storage Pools
  - Expanding of existing volumes
- Storage Pools experience capacity reduction via:
  - Deletion of inactive or unused volumes via storage reclamation
  - Conversion of volumes from Fully Allocated to Thin Provisioned or Compressed
  - Migration of volumes from a Storage Pool
  - Addition of capacity by adding Mdisks and Arrays to Storage Pools
  - Shrinking of existing volumes

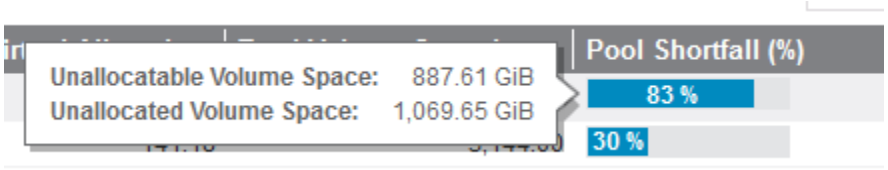
Block Storage Systems



- The Block Storage Systems window can be customized to view the above columns and sorted by available pool space.
- This shows, at a glance, the physical allocation of each storage system, pool capacity, available pool space, virtual allocation, total volume capacity, pool shortfall, and if the storage system has any compressed volumes in it.
- This information can be exported via the actions pulldown in PDF, HTML, or CSV format for ad hoc reporting.

Block Storage Systems





- There is additional hover help available to help breakdown the Physical Allocation and Pool Shortfall columns.

- One helpful number at the Block Storage Systems level is the overall Unallocatable Volume Space, this number is the amount of capacity that would be needed to ensure all thin provisioned or compressed volumes could grow to 100% capacity on this specific Storage System.

Block Storage Systems – Capacity Charting

Storage Systems | Alerts | Tasks | Performance | Capacity

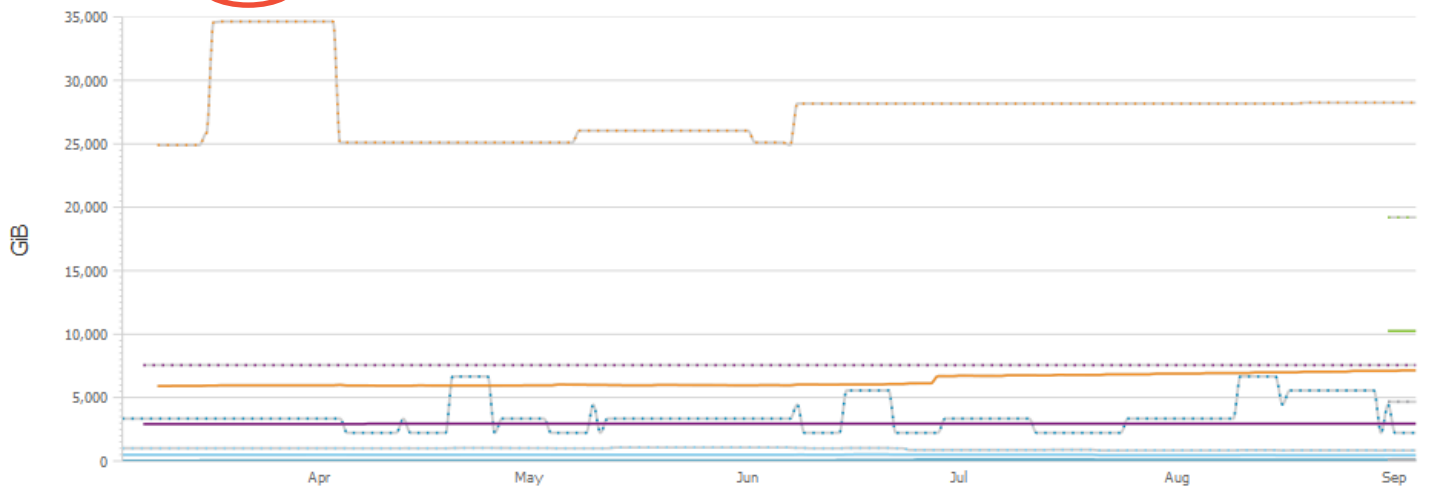
Selected Resources 6/6

- Class SVC
- Class V7000
- V7000 Oxford6
- XIV 1340004
- DS3500
- FlashSystem 840

Metrics 2/6

- Allocated Space (GiB)
- Pool Capacity (GiB)

Last: 1 week | 1 month | **6 months** | 1 year



Mar 4, 2016 - Sep 4, 2016

Actions | Filter...

Name	Physical Allo...	Pool Capacity (GiB)	Available Pool Space (GiB)	Used Pool Space (GiB)	Unreserved Pool Space (GiB)	Reser
Class SVC	54 %	835.56	378.13	457.44	378.13	
FlashSystem 840	53 %	19,199.97	8,959.97	10,240.00	8,959.97	
V7000 Oxford6	39 %	7,562.00	4,610.75	2,951.25	4,610.75	
XIV 1340004	25 %	28,238.46	19,568.19	8,670.26	19,568.19	
Class V7000	3 %	2,227.00	2,153.00	74.00	2,153.00	
DS3500	2 %	4,668.00	4,488.00	180.00	4,488.00	

Showing 6 items | Selected 6 items Mar 4, 2016, 00:00:00 – Sep 4, 2016, 11:38:59 Refreshed a few moments ago

Block Storage Systems – Capacity Charting

Block Storage Systems – Capacity Charting

Storage Systems | Alerts | Tasks | Performance | Capacity

Selected Resources 6/6
- Class SVC
- Class V7000
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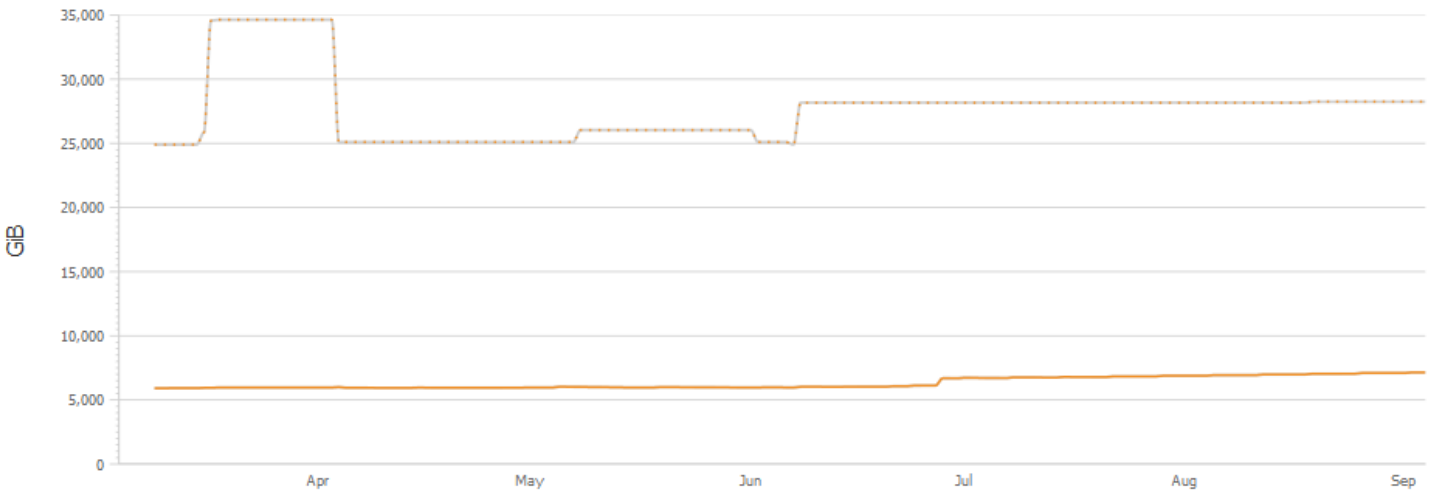

Mar 4, 2016 - Sep 4, 2016

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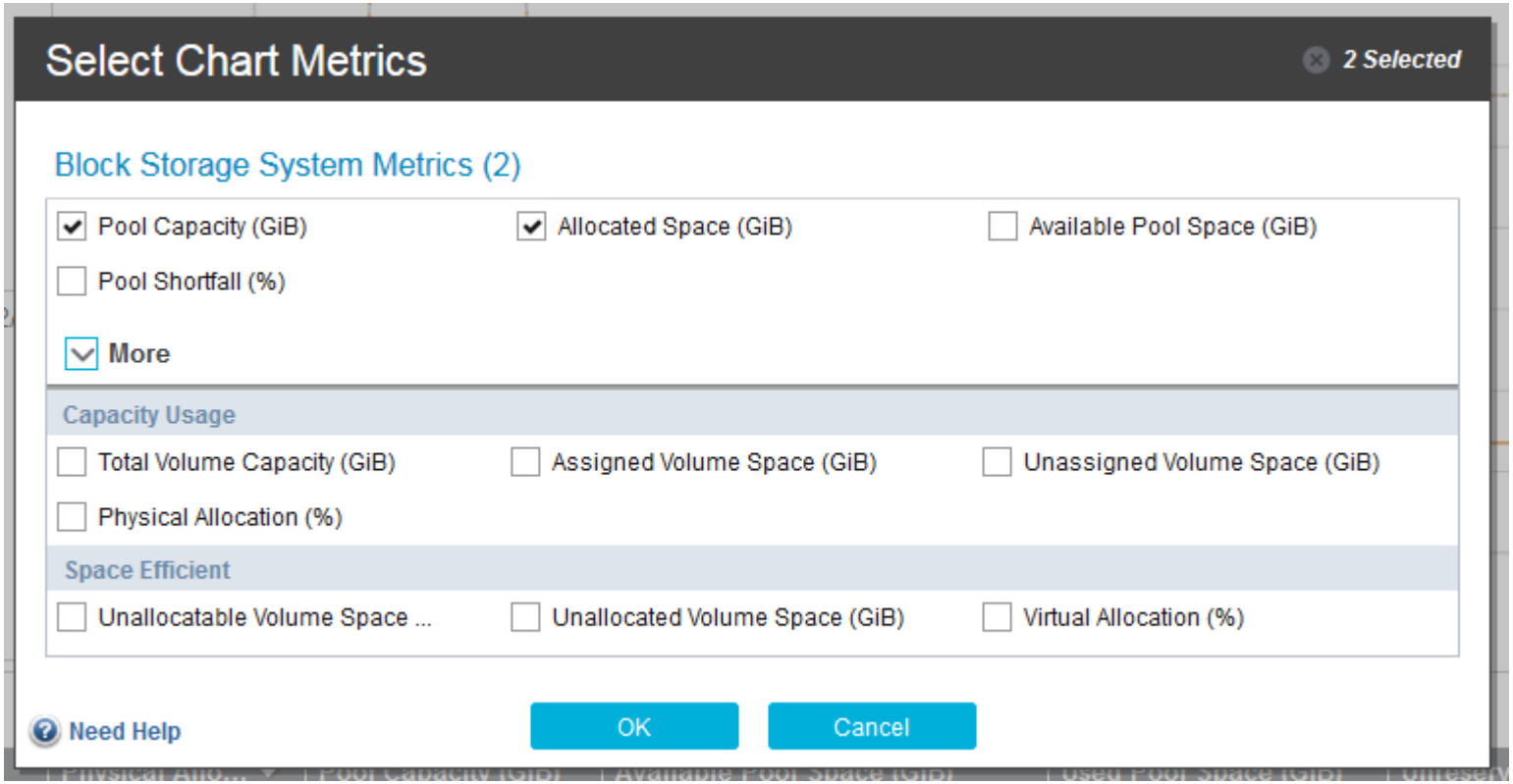
Showing 6 items | Selected 6 items Mar 4, 2016, 00:00:00 – Sep 4, 2016, 11:44:59 Refreshed a few moments ago

Block Storage Systems – Capacity Charting



- With these two capacity metrics you can tell what has happened historically at a system level, but choosing other metrics can give you insight into changes in new volumes, removal of pool capacity, and aggregate growth.
- Other useful metrics here are Total Volume Capacity, Virtual Allocation, and Unallocatable Volume Space.

Block Storage Systems – Capacity Charting

Storage Systems | Alerts | Tasks | Performance | Capacity

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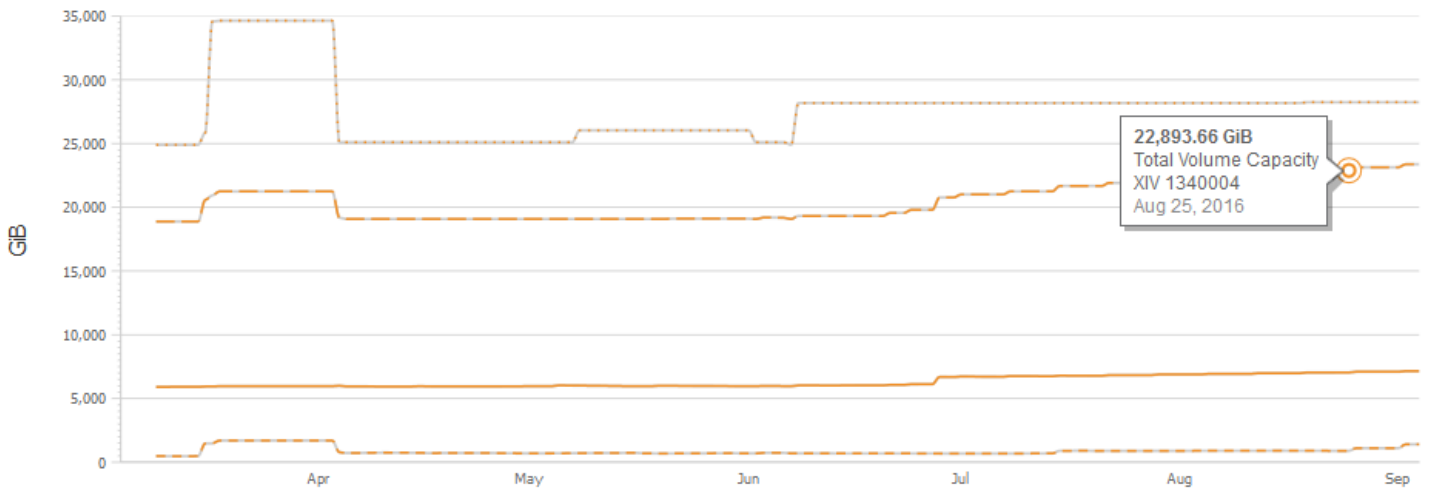
Metrics 4/6

- Allocated Space (GiB)
- Pool Capacity (GiB)
- Total Volume Capacity (GiB)
- Unallocatable Volume Space (GiB)

Last: 1 week | 1 month | **6 months** | 1 year



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DS3500	2 %	4,668.00	4,488.00	180.00	4,488.00	

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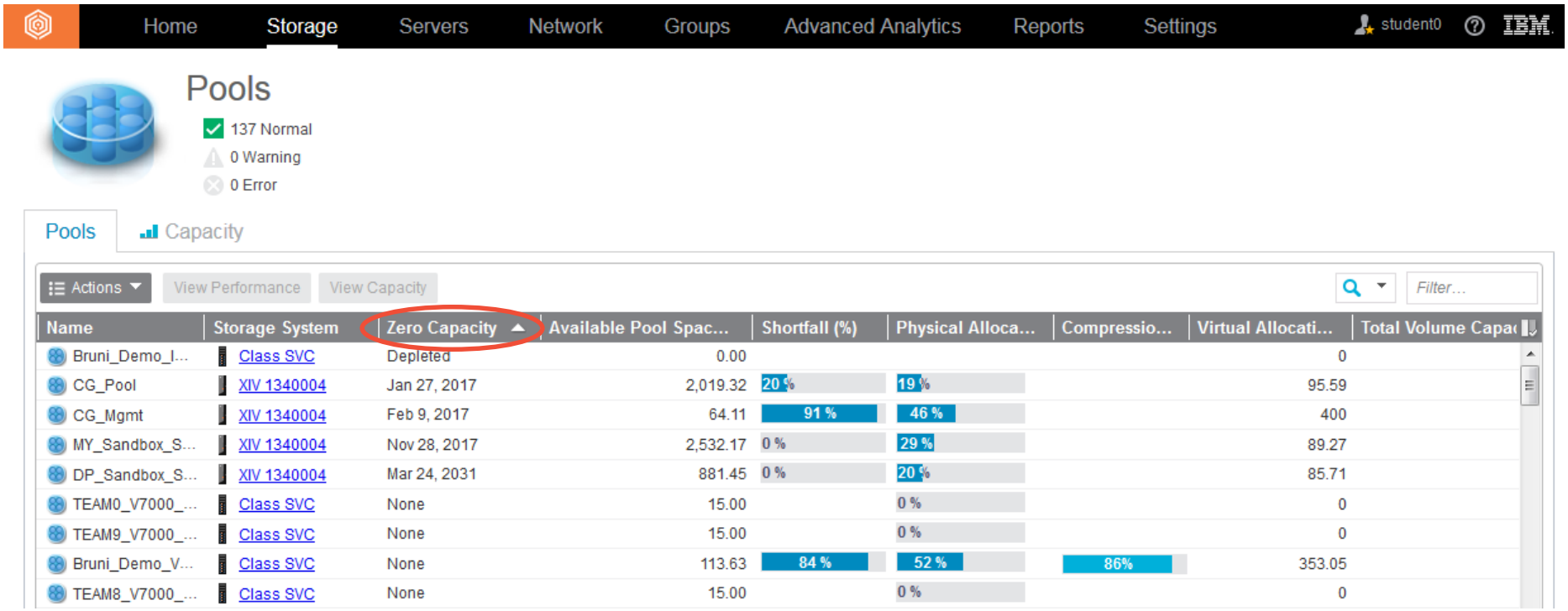
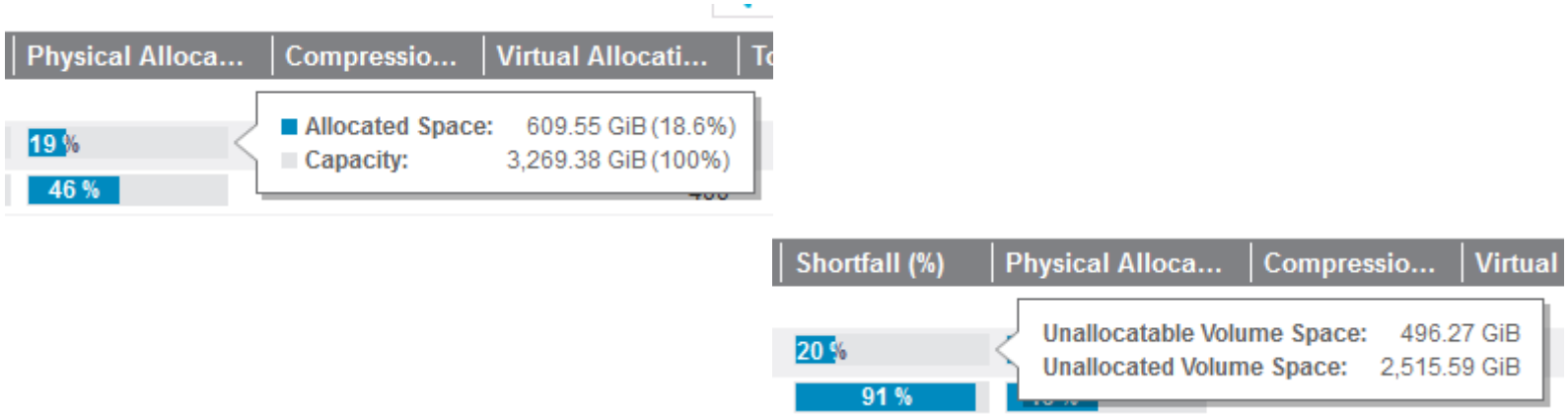
Storage Pools



- The Pools window can be customized to view the above columns and sort by the zero capacity metric. This very important metric uses up to 180 days of historical probe data to perform a linear estimation and calculation of a date on when a pool will run out of space.
- This information can be exported via the actions pulldown in PDF, HTML, or CSV format for ad hoc reporting.

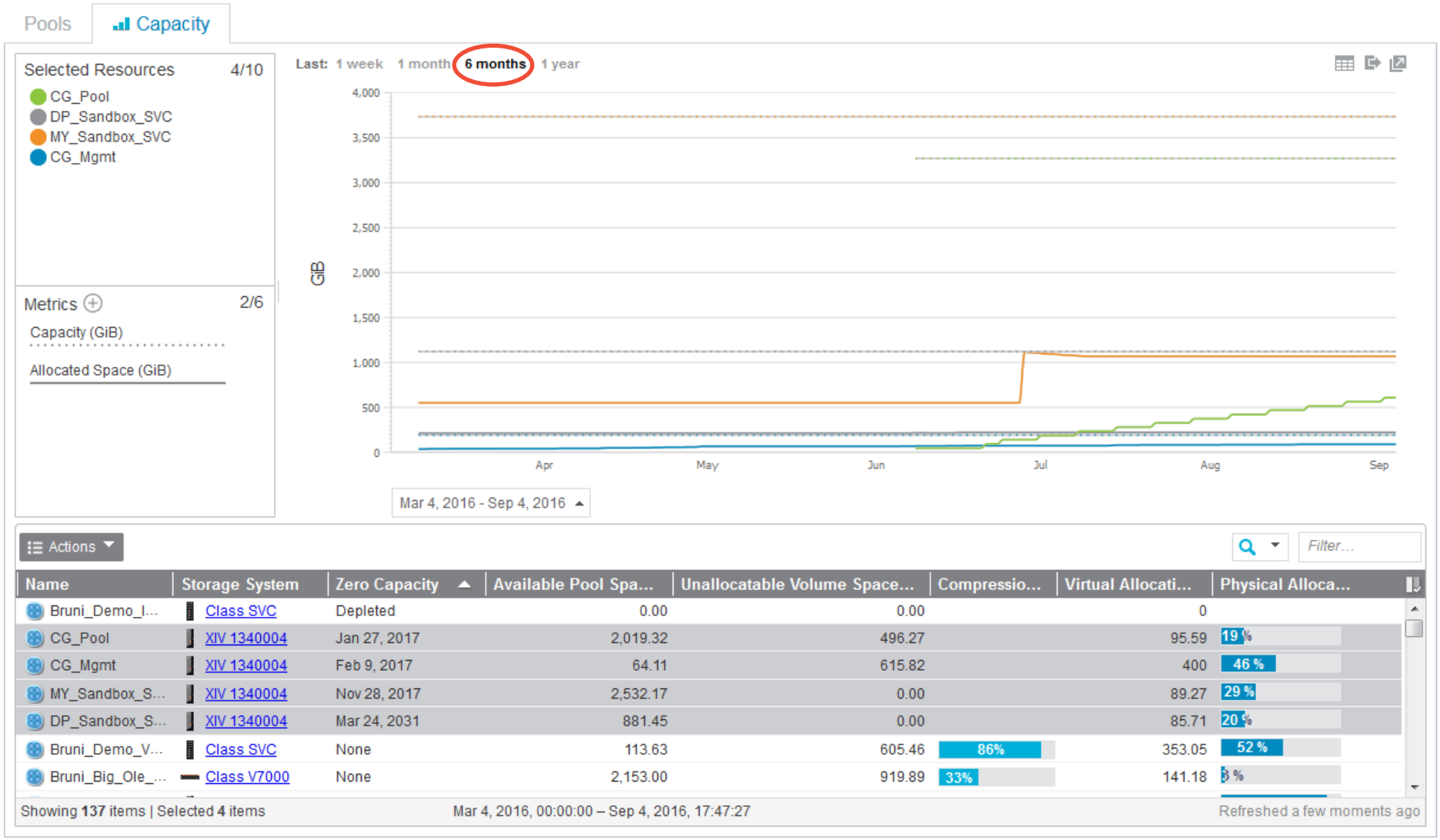
Storage Pools



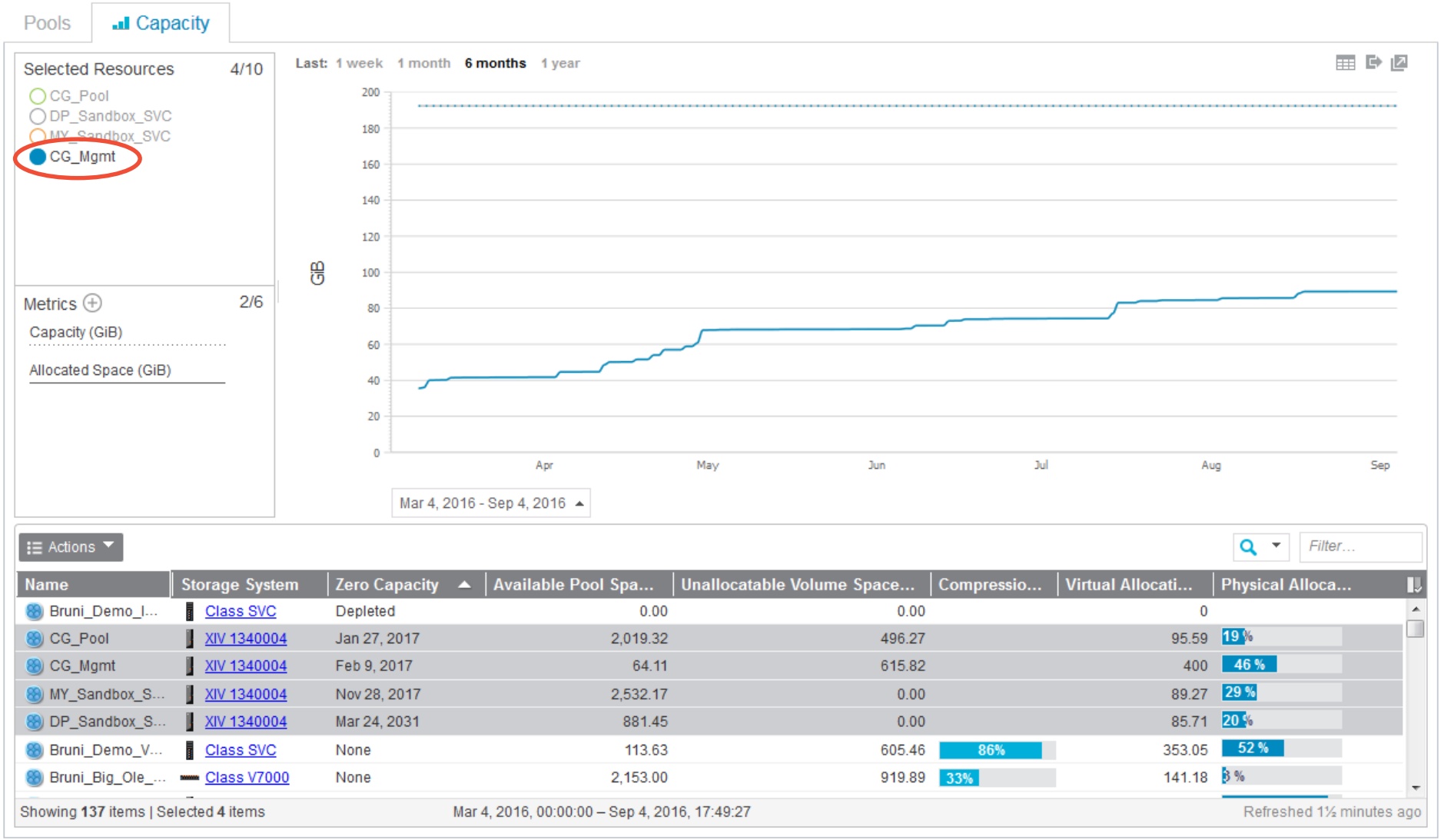
- There is additional hover help available to help breakdown the Physical Allocation and Shortfall columns (notice the Pool prefix was dropped at this level).

- Again, one helpful number at the Pools level is the overall Unallocatable Volume Space, this number is the amount of capacity that would be needed to ensure all thin provisioned or compressed volumes could grow to 100% capacity on this specific Pool.

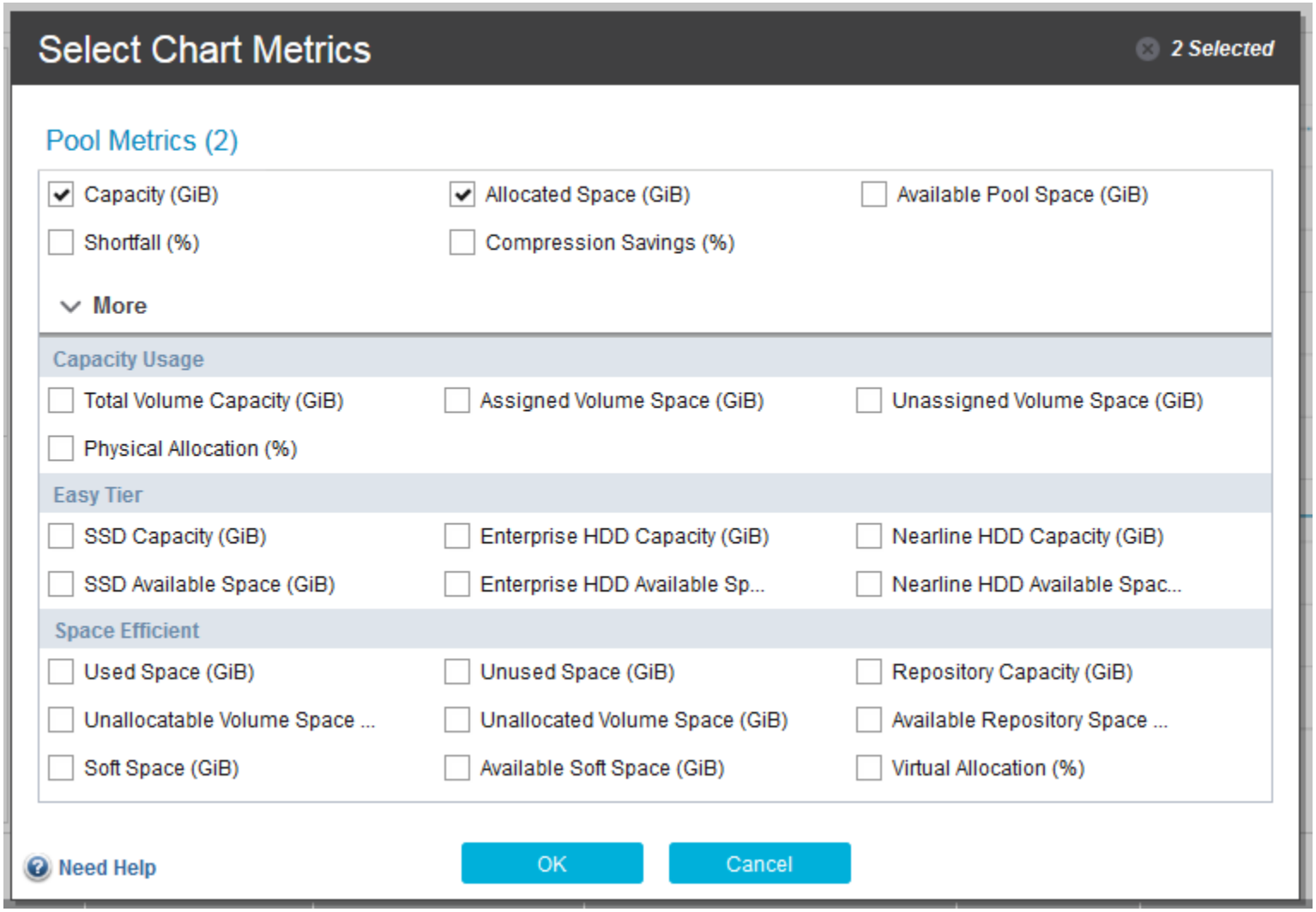
Storage Pools – Capacity Charting



Storage Pools – Capacity Charting



Storage Pools – Capacity Charting

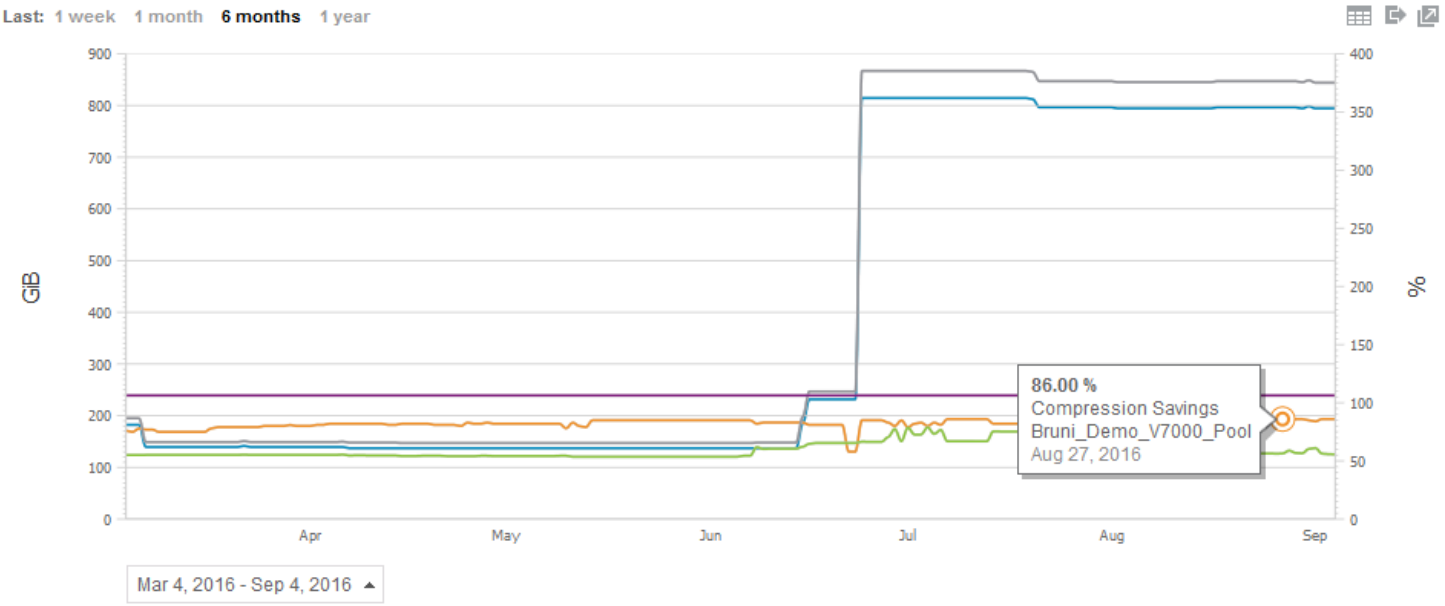


Storage Pools – Capacity Charting

Pools | Capacity

Selected Resources 1/10
Bruni_Demo_V7000_Pool

Metrics 5/6
Capacity (GiB)
Allocated Space (GiB)
Compression Savings (%)
Total Volume Capacity (GiB)
Virtual Allocation (%)



Actions | Filter...

Name	Storage System	Zero Capacity	Available Pool Spa...	Unallocatable Volume Space...	Compressio...	Virtual Allocati...	Physical Alloca...
CG_Mgmt	XIV 1340004	Feb 9, 2017	64.11	615.82		400	46 %
MY_Sandbox_S...	XIV 1340004	Nov 28, 2017	2,532.17	0.00		89.27	29 %
DP_Sandbox_S...	XIV 1340004	Mar 24, 2031	881.45	0.00		85.71	20 %
Bruni_Demo_V...	Class SVC	None	113.63	605.46	86%	353.05	52 %
Bruni_Big_Ole_...	Class V7000	None	2,153.00	919.89	33%	141.18	8 %
GF_SVC6	XIV 1340004	None	176.29	21.81		95.84	89 %
MY_ESX_CLAS...	Class SVC	None	63.00	282.19		173.21	83 %

Showing **137** items | Selected **1** item Mar 4, 2016, 00:00:00 – Sep 4, 2016, 17:57:27 Refreshed 1½ minutes ago

Storage Pools – Capacity Charting

Pools | Capacity

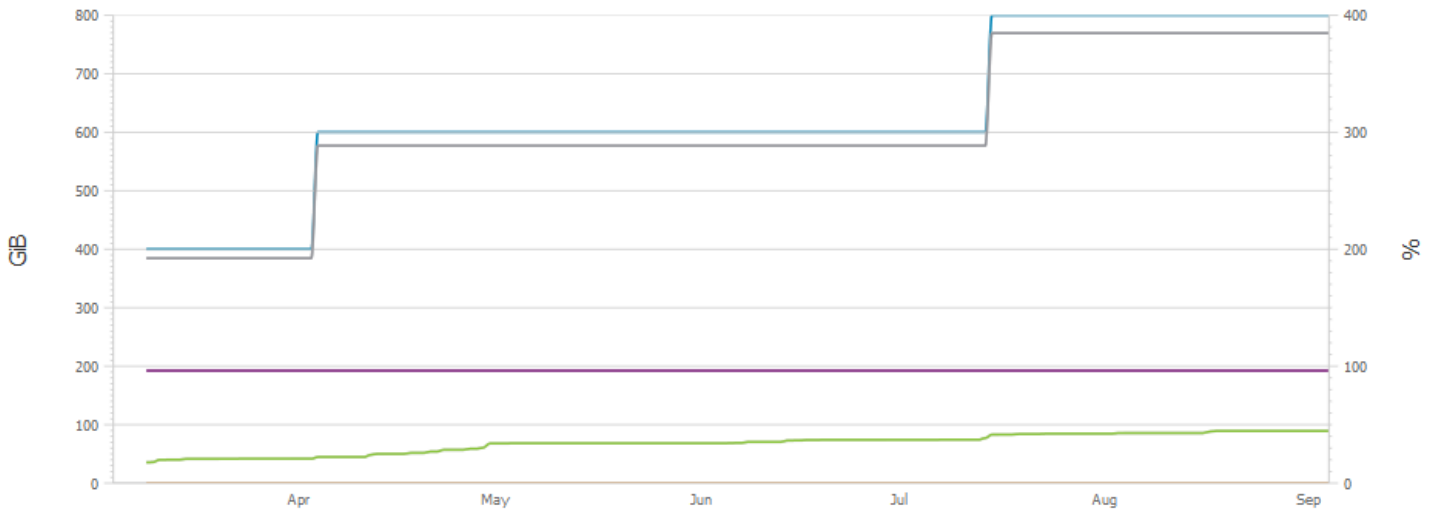
Selected Resources 1/10

CG_Mgmt

Metrics 5/6

- Capacity (GiB)
- Allocated Space (GiB)
- Compression Savings (%)
- Total Volume Capacity (GiB)
- Virtual Allocation (%)

Last: 1 week 1 month **6 months** 1 year



Mar 4, 2016 - Sep 4, 2016

Actions

Filter...

Name	Storage System	Zero Capacity	Available Pool Spa...	Unallocatable Volume Space...	Compressio...	Virtual Allocati...	Physical Alloca...
Bruni_Demo_I...	Class SVC	Depleted	0.00	0.00		0	
CG_Pool	XIV 1340004	Jan 27, 2017	2,019.32	496.27		95.59	19 %
CG_Mgmt	XIV 1340004	Feb 9, 2017	64.11	615.82		400	46 %
MY_Sandbox_S...	XIV 1340004	Nov 28, 2017	2,532.17	0.00		89.27	29 %
DP_Sandbox_S...	XIV 1340004	Mar 24, 2031	881.45	0.00		85.71	20 %
Bruni_Demo_V...	Class SVC	None	113.63	605.46	86%	353.05	52 %
Bruni_Big_Ole_...	Class V7000	None	2,153.00	919.89	33%	141.18	8 %

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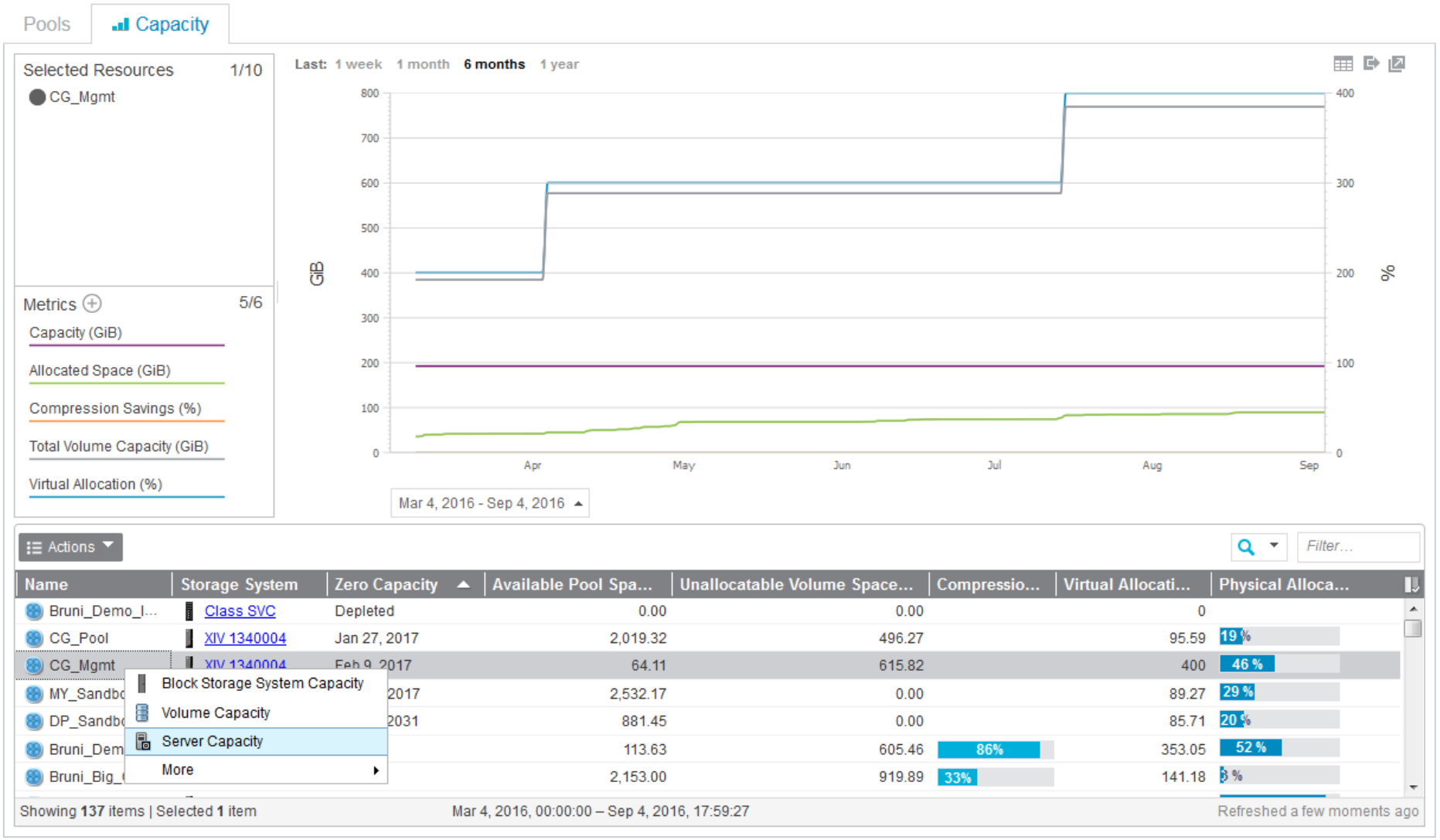
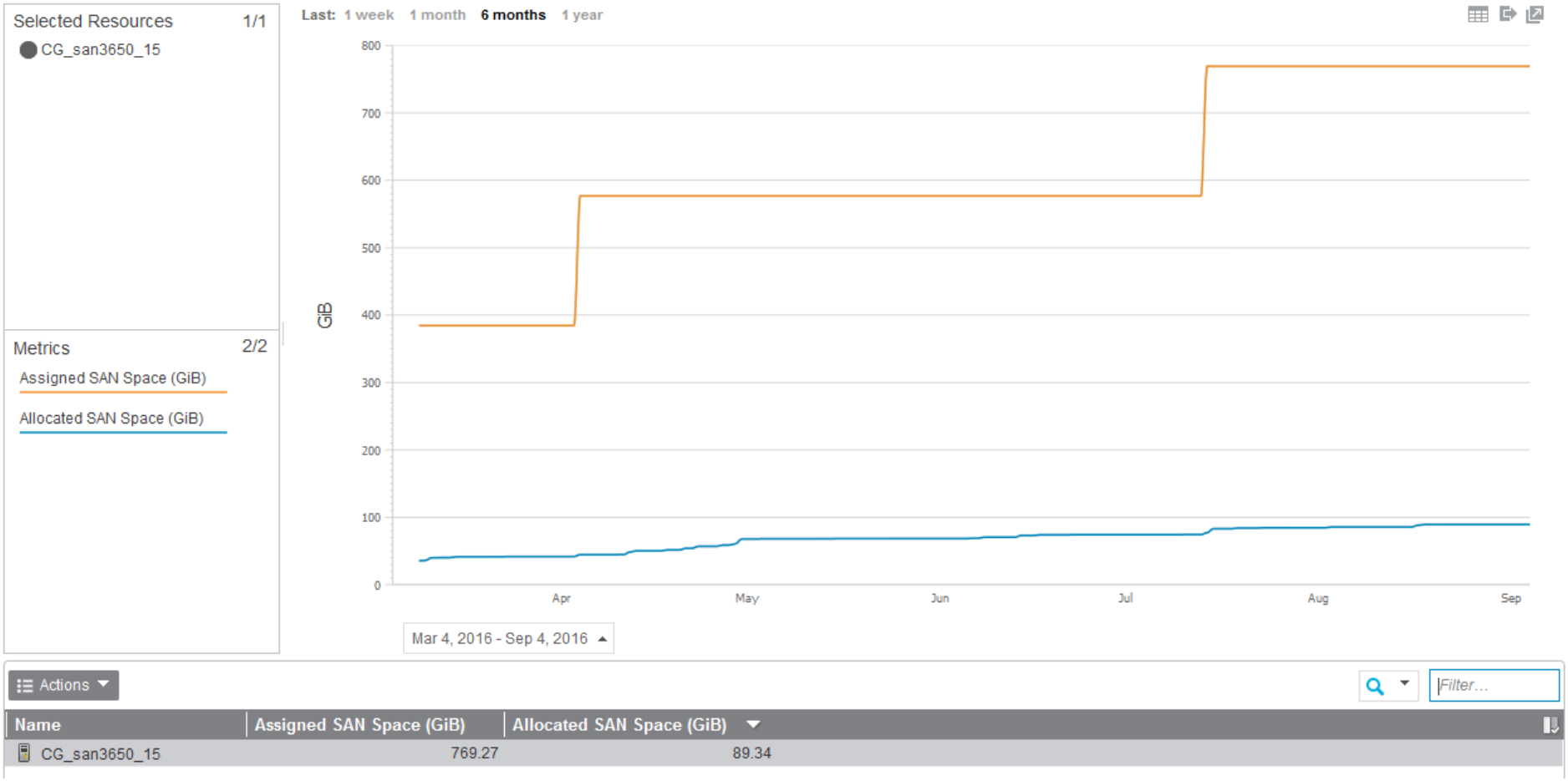
Storage Pools – Capacity Charting

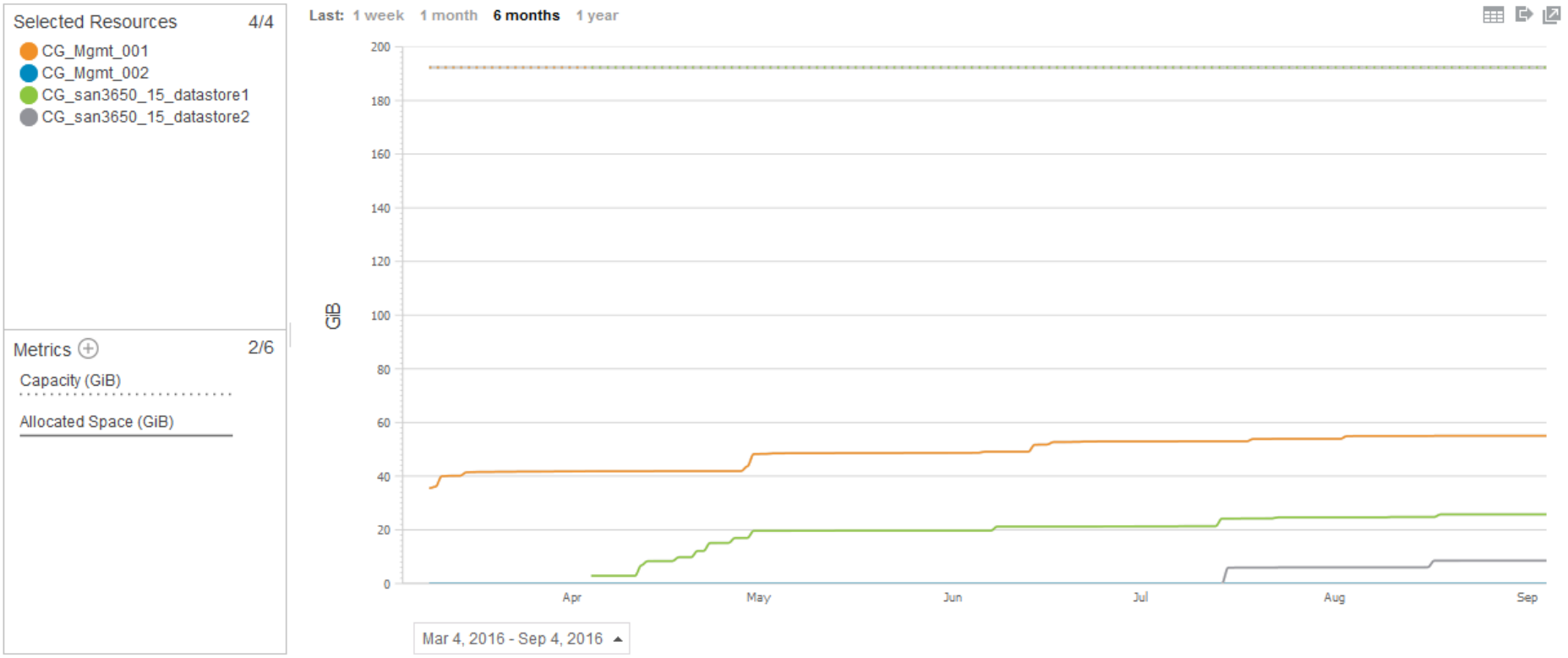


Storage Pools – Capacity Charting (Server)



- This is the aggregated growth of all the volumes on this server, the host connection needs to be added as a Server for this to work.

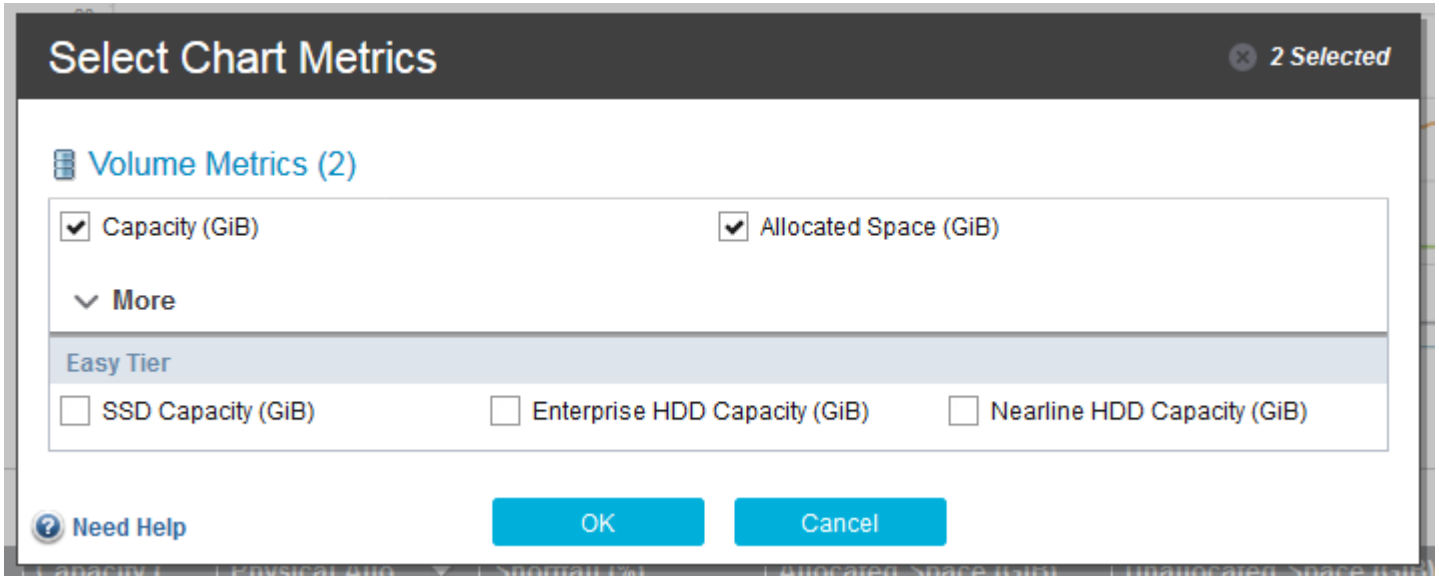
Storage Pools – Capacity Charting (Volumes)



Actions | Refresh | Filter...

Name	Pool	Capacity (...	Physical Allo...	Shortfall (%)	Allocated Space (GiB)	Unallocated Space (GiB)	Used Allocated Space (%)
CG_Mgmt_001	CG_Mgmt	192.32	29 %	53 %	55.06	137.26	
CG_san3650_...	CG_Mgmt	192.32	13 %	61 %	25.76	166.55	
CG_san3650_...	CG_Mgmt	192.32	4 %	65 %	8.51	183.80	
CG_Mgmt_002	CG_Mgmt	192.32	0 %	66 %	0.00	192.32	

Storage Pools – Capacity Charting (Volumes)

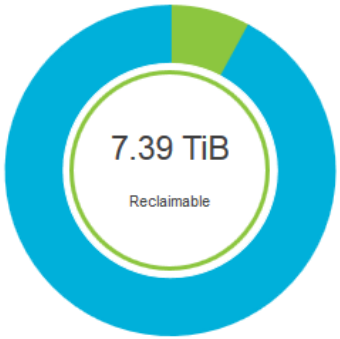


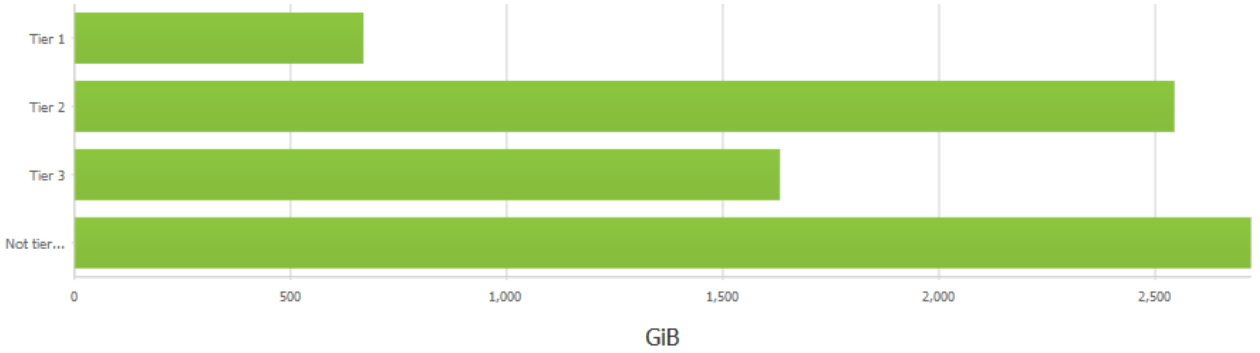
- These are the volume capacity metrics available today when capacity charting.
- Compression savings is not part of this list to see individual volume historical compression, all we can see is most recent compression savings in the table. We can see historical compression savings at the Pool level (on slide 16).
- Checking the Easy Tier boxes will provide us insight into historical movement of extents also.

Storage Reclamation

Reclamation

View By: Reclaimable Capacity





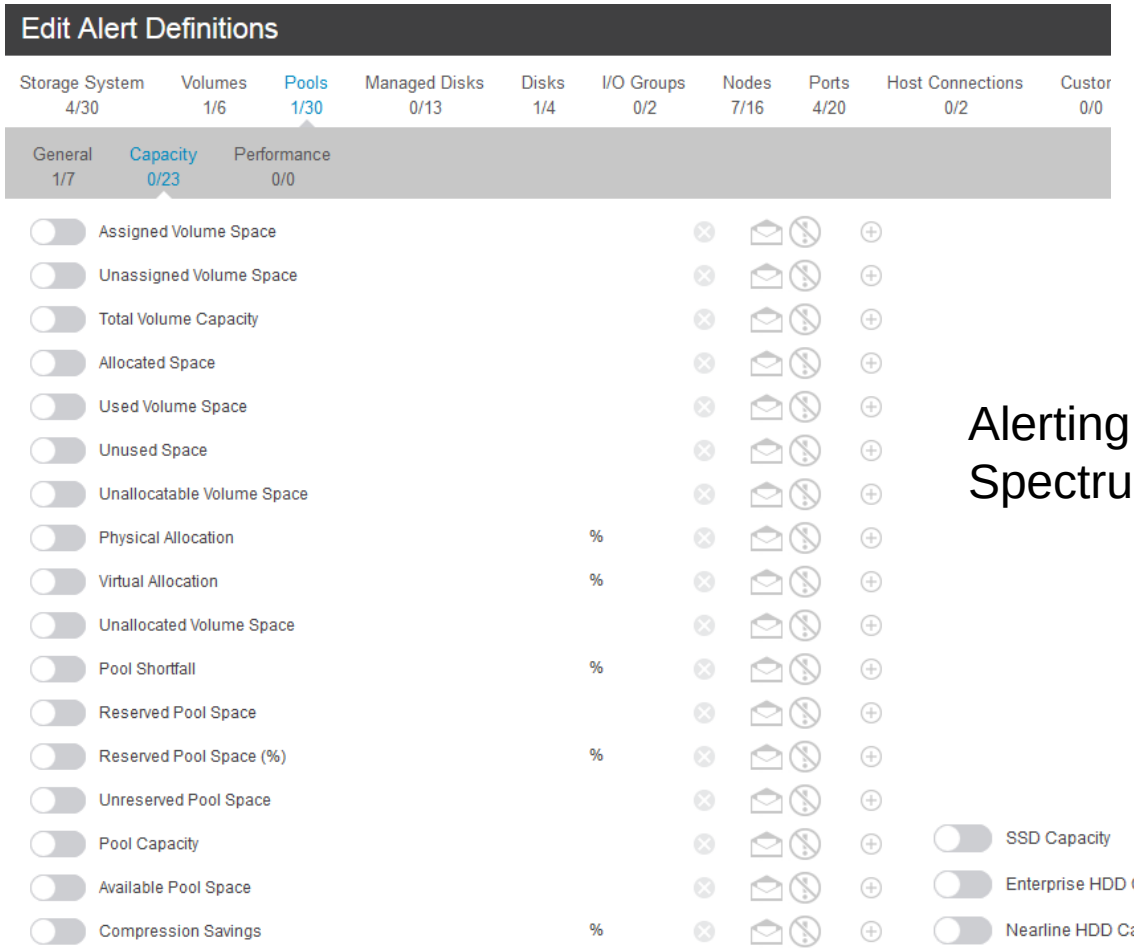
Recommendations | Excluded

Actions | Refresh | View Performance | View Capacity | Filter...

Name	Tier	Time of Last IO	Pool	Storage System	Capacity (...	Allocated Space (GiB)
vsc-connections-node2-br...	Tier 2	1 day	VSC-Tier3-Pool1	SVC-2145-SVC02-IBM	24.00	24.0
vsc-connections-node2-si...	Tier 3	1 day	VSC-Tier2-Pool1	SVC-2145-SVC02-IBM	18.00	18.0
vsc-connections-node2-g...	Tier 2	1 day	VSC-Tier1-Pool1	SVC-2145-SVC02-IBM	14.00	14.0
vsc-connections-web2-sil...	Tier 3	1 day	VSC-Tier2-Pool1	SVC-2145-SVC02-IBM	10.00	9.1
ecx_20160607113153_inf...	Tier 2	2 days	ECX-FC-Pool	SVC-2145-furious-IBM	1,126.13	12.4
ecx_20160613151537_S...	Tier 2	2 days	ECX-FC-Pool-DoNot-Delete	SVC-2145-SVC02-IBM	274.73	33.0
V7000-storea_vol	Tier 1	2 weeks	Virtualizer_P1	DS8000-2107-75BLG91-IBM	20.00	20.0
V7000-storea_vol	Tier 1	2 weeks	Virtualizer_P1	DS8000-2107-75BLG91-IBM	20.00	20.0
V7000-storea_vol	Tier 1	2 weeks	Virtualizer_P1	DS8000-2107-75BLG91-IBM	20.00	20.0
iofarm_kryptonite		2 weeks	General-Use_pool	XIV-2812-7825410-IBM	32.05	1.1
ecx_20160621143536_vsc	Tier 2	2 weeks	ECX-FC-Pool	SVC-2145-furious-IBM	1,126.13	237.9
mdmd		3 weeks	General-Use_pool	XIV-2812-7825410-IBM	17.00	16.9
mdmxiv2		3 weeks	General-Use_pool	XIV-2812-7825410-IBM	16.00	0.0

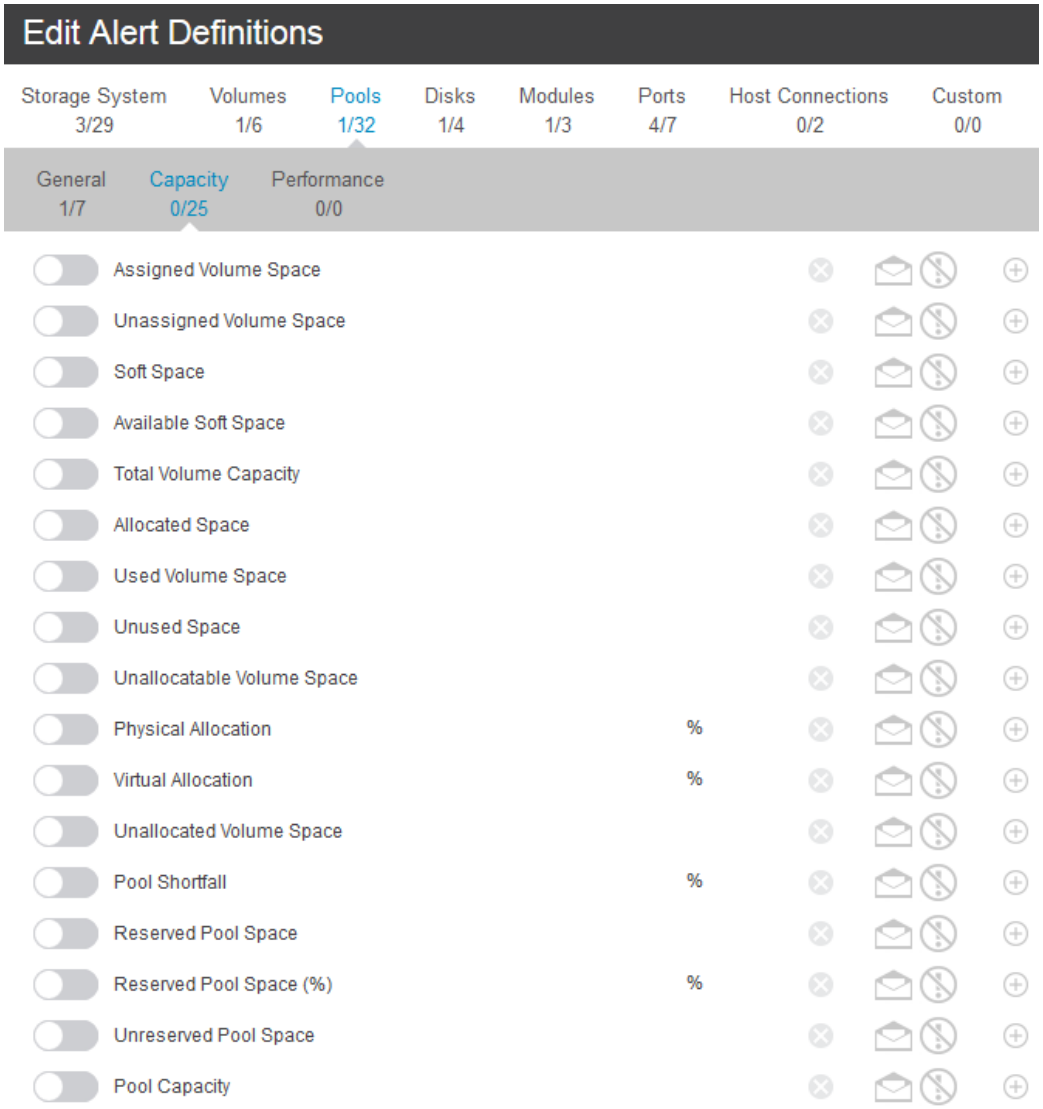
Showing **1** - **500** of **5085** items | Selected **0** items Refreshed a few moments ago Page **1** of **11**

Block Storage Systems – Alerting on Capacity



Alerting is only available with Spectrum Control Standard/Advanced

Block Storage Systems – Alerting on Capacity (XIV)



Alerting is only available with Spectrum Control Standard/Advanced

Summary & Closing Thoughts …

- To borrow from the investing world … Past Performance Is No Guarantee Of Future Returns …Past Capacity Allocation is no guarantee of Future Capacity Allocation … because of unpredictable behavior in servers, applications, and humans.

- Anytime a thin provisioned or compressed volume runs out of capacity, it will go offline and people will know. It must be monitored. We now have tools to do this and to gain insight into new write workloads to pools and volumes.

- Establish IT policies on virtual allocation limits, unallocatable volume space, and frequent storage reclamation. Set capacity alerts on them so notification occurs.

- It's OK, and preferred, to fully allocate mission critical volumes.

- Fully Allocated to Thin Provisioned or Compressed migrations may buy time.

- Public Spectrum Control Storage Insights Demo to try this out ...
  - https://sidemo.ib.ibmserviceengage.com/srm/ (need your IBMid to access)
  - OR http://ibm.biz/insightsdemo

Q & A?