



NetApp Solution Technical Report

Manually Designed Solution

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1 Business Requirements

[Use this section to document the customer's high-level business requirements]

2 Solution Summary

2.1 Proposed Solution Summary

This is a summary of what the proposed solution will deliver.

THROUGHPUT	RAW CAPACITY	STORAGE EFFICIENCY***
182,000 IOPS / 703.13 MB/s	184.32 TB	3 : 1
AVERAGE UTILIZATION	USABLE CAPACITY	EFFECTIVE CAPACITY***
25%	52.82 TiB	158.4525 TiB
	RAW CAPACITY HEADROOM**	USABLE VS EFFECTIVE
	3,502.08 TB	
	** assumes future expansion using drives of same capacity	*** assumes use of storage efficiency technologies like compression and deduplication *** Default efficiencies have been applied to unused capacity within the cluster.

CONFIGURATION				ENVIRONMENTAL	
Model:	ASA AFF A400 MetroCluster IP	MC Switches:	4xNexus 3232C	Rack Units:	16 U
Nodes:	4	Stge Switches:	N/A	System Weight:	416.32 lbs
Total Drives:	48	ISL Links:	2	AC Power:	3534.00 W
Drive Type:	3.84TB SSD	Bridges:	N/A	Current Draw:	18.00 A
				BTU/hr:	12066.00

3 Solution Details

3.1 System Details

For rack elevation, please refer to the Storage Solution Visio Diagram

Bill Of Materials: metrocluster1: Site A: SiteA_ClusterA: netapp1/netapp2

The table below details the components of the recommended solution for Site A.

	Description		Part Number	Qty
Switches				
MC	Cisco Nexus 3232C, 32-port, No QSFPs		X190100	2
	Grand Total			2
Systems				
	ASA AFF A400	9.9.1 ONTAP		1
	Grand Total			1
Storage				
	DS224C w/ 24x3.84TB SSD		X357A	1
	Grand Total			1
Adapter Cards/ Flash Cache				
	Grand Total			0

Bill Of Materials: metrocluster1: Site B: SiteB_ClusterB: netapp3/netapp4

The table below details the components of the recommended solution for Site B.

	Description		Part Number	Qty
Switches				
MC	Cisco Nexus 3232C, 32-port, No QSFPs		X190100	2
	Grand Total			2
Systems				
	ASA AFF A400	9.9.1 ONTAP		1
	Grand Total			1
Storage				
	DS224C w/ 24x3.84TB SSD		X357A	1
	Grand Total			1
Adapter Cards/ Flash Cache				
	Grand Total			0

3.2 Environmental Details

metrocluster1: Site A:Line Voltage: 220

System Components	Qty	Rack Units	Current (Amps)		AC Power (Watts)		AC Power (VA)		Thermal Rating (BTU/hr)		Power (kWh/year)	
			Typical	Worst	Typical	Worst	Typical	Worst	Typical	Worst	Typical	Worst
Cisco Nexus 3232C, 32-port, No QSFPs	2	2	2.06	4.02	410	804	431.58	846.32	1,400	2,744	3,594.06	7,047.86
ASA AFF A400 (2xControllers, 1xChassis)	1	4	6.3	7.8	1,233	1,528	1,297.89	1,608.42	4,209	5,215	10,808.48	13,394.45
DS224C w/ 24x3.84TB SSDX357A	1	2	0.64	1.42	124	278	130.53	292.63	424	949	1,086.98	2,436.95
Total	4	8	9	13.24	1,767	2,610	1,860	2,747.37	6,033	8,908	15,489.52	22,879.26

metrocluster1: Site B:Line Voltage: 220

System Components	Qty	Rack Units	Current (Amps)		AC Power (Watts)		AC Power (VA)		Thermal Rating (BTU/hr)		Power (kWh/year)	
			Typical	Worst	Typical	Worst	Typical	Worst	Typical	Worst	Typical	Worst
Cisco Nexus 3232C, 32-port, No QSFPs	2	2	2.06	4.02	410	804	431.58	846.32	1,400	2,744	3,594.06	7,047.86
ASA AFF A400 (2xControllers, 1xChassis)	1	4	6.3	7.8	1,233	1,528	1,297.89	1,608.42	4,209	5,215	10,808.48	13,394.45
DS224C w/ 24x3.84TB SSDX357A	1	2	0.64	1.42	124	278	130.53	292.63	424	949	1,086.98	2,436.95
Total	4	8	9	13.24	1,767	2,610	1,860	2,747.37	6,033	8,908	15,489.52	22,879.26

3.3 Aggregate Details: netapp1/netapp2

This MetroCluster IP system leverages the Root-Data-Data partitioning which creates one small root partition (P3) for the root aggregates and two larger equally sized partitions (P1 and P2) for data aggregates. Up to 48 SSDs can be partitioned in this format when ONTAP first initializes. The partition sizes and number of partitions are dependent on the number of drives installed when ONTAP first initializes.

Root-Data-Data (RD2) Partition Format																								
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
P1 Data Partition	P1	P1	P1	P1	P1	P1	P1	P1	P1	P1	P1	P1	P1	P1	P1	P1	P1	P1	P1	P1	P1	P1	P1	P1
P2 Data Partition	P2	P2	P2	P2	P2	P2	P2	P2	P2	P2	P2	P2	P2	P2	P2	P2	P2	P2	P2	P2	P2	P2	P2	P2
P3 Root Partition	P3	P3	P3	P3	P3	P3	P3	P3	P3	P3	P3	P3	P3	P3	P3	P3	P3	P3	P3	P3	P3	P3	P3	P3

Aggregate Layout

Root Aggrs	Node	Site	Devices	Total	Data	Parity	RAID/Size	Reserve (TiB)	WAFL (TiB)	Parity (TiB)	Root (TiB)
netapp1_root	netapp1	A	62.35GiB P3 Partition	5	3	2	RAID_DP/5	0.0082	0.0183	0.1217	0.1561
netapp2_root	netapp2	A	62.35GiB P3 Partition	5	3	2	RAID_DP/5	0.0082	0.0183	0.1217	0.1561
				10	6	4	Totals	0.0164	0.0366	0.2434	0.3122

Root Mirror	Node	Site	Devices	Total	Data	Parity	RAID/Size	Reserve (TiB)	WAFL (TiB)	Parity (TiB)	Mirror (TiB)
netapp1_root	netapp1	B	62.35GiB P3 Partition	5	3	2	RAID_DP/5	0.0082	0.0183	0.1217	0.1561
netapp2_root	netapp2	B	62.35GiB P3 Partition	5	3	2	RAID_DP/5	0.0082	0.0183	0.1217	0.1561
				10	6	4	Totals	0.0164	0.0366	0.2434	0.3122

Data Aggrs	Node	Site	Devices	Total	Data	Parity	RAID/Size	Reserve (TiB)	WAFL (TiB)	Parity (TiB)	Usable (TiB)
netapp1_aggr1	netapp1	A	1.72TiB P1 Partition	11	9	2	RAID_DP/11	0.6950	1.5444	3.4319	13.2044
netapp2_aggr1	netapp2	A	1.72TiB P2 Partition	11	9	2	RAID_DP/11	0.6950	1.5444	3.4319	13.2044
				22	18	4	Totals	1.3900	3.0888	6.8638	26.4088

Aggrs Mirror	Node	Site	Devices	Total	Data	Parity	RAID/Size	Reserve (TiB)	WAFL (TiB)	Parity (TiB)	Mirror (TiB)
netapp1_aggr1	netapp1	B	1.72TiB P1 Partition	11	9	2	RAID_DP/11	0.6950	1.5444	3.4319	13.2044
netapp2_aggr1	netapp2	B	1.72TiB P2 Partition	11	9	2	RAID_DP/11	0.6950	1.5444	3.4319	13.2044
				22	18	4	Totals	1.3900	3.0888	6.8638	26.4088

Spares	Devices	Total	Capacity (TiB)
Root	62.35GiB P3 Partition	4	0.2436
Data	1757.17GiB P1 Partition	2	3.4320
Data	1757.17GiB P2 Partition	2	3.4320
		Total	7.1076

	Capacity (TiB)	Allocation
Drive Formatting	0.0078	0.01%
Root	0.3122	0.37%
Parity	14.2146	16.95%
WAFL	6.2507	7.45%
Mirror	26.7210	31.87%
Reserve	2.8128	3.35%
Spare	7.1076	8.48%
Usable	26.4088	31.5%
Total	83.8355	100.0%

3.4 Aggregate Details: netapp3/netapp4

This MetroCluster IP system leverages the Root-Data-Data partitioning which creates one small root partition (P3) for the root aggregates and two larger equally sized partitions (P1 and P2) for data aggregates. Up to 48 SSDs can be partitioned in this format when ONTAP first initializes. The partition sizes and number of partitions are dependent on the number of drives installed when ONTAP first initializes.

Root-Data-Data (RD2) Partition Format																								
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
P1 Data Partition	P1	P1	P1	P1	P1	P1	P1	P1	P1	P1	P1	P1	P1	P1	P1	P1	P1	P1	P1	P1	P1	P1	P1	P1
P2 Data Partition	P2	P2	P2	P2	P2	P2	P2	P2	P2	P2	P2	P2	P2	P2	P2	P2	P2	P2	P2	P2	P2	P2	P2	P2
P3 Root Partition	P3	P3	P3	P3	P3	P3	P3	P3	P3	P3	P3	P3	P3	P3	P3	P3	P3	P3	P3	P3	P3	P3	P3	P3

Aggregate Layout

Root Aggrs	Node	Site	Devices	Total	Data	Parity	RAID/Size	Reserve (TiB)	WAFL (TiB)	Parity (TiB)	Root (TiB)
netapp3_root	netapp3	B	62.35GiB P3 Partition	5	3	2	RAID_DP/5	0.0082	0.0183	0.1217	0.1561
netapp4_root	netapp4	B	62.35GiB P3 Partition	5	3	2	RAID_DP/5	0.0082	0.0183	0.1217	0.1561
				10	6	4	Totals	0.0164	0.0366	0.2434	0.3122

Root Mirror	Node	Site	Devices	Total	Data	Parity	RAID/Size	Reserve (TiB)	WAFL (TiB)	Parity (TiB)	Mirror (TiB)
netapp3_root	netapp3	A	62.35GiB P3 Partition	5	3	2	RAID_DP/5	0.0082	0.0183	0.1217	0.1561
netapp4_root	netapp4	A	62.35GiB P3 Partition	5	3	2	RAID_DP/5	0.0082	0.0183	0.1217	0.1561
				10	6	4	Totals	0.0164	0.0366	0.2434	0.3122

Data Aggrs	Node	Site	Devices	Total	Data	Parity	RAID/Size	Reserve (TiB)	WAFL (TiB)	Parity (TiB)	Usable (TiB)
netapp3_aggr1	netapp3	B	1.72TiB P1 Partition	11	9	2	RAID_DP/11	0.6950	1.5444	3.4319	13.2044
netapp4_aggr1	netapp4	B	1.72TiB P2 Partition	11	9	2	RAID_DP/11	0.6950	1.5444	3.4319	13.2044
				22	18	4	Totals	1.3900	3.0888	6.8638	26.4088

Aggrs Mirror	Node	Site	Devices	Total	Data	Parity	RAID/Size	Reserve (TiB)	WAFL (TiB)	Parity (TiB)	Mirror (TiB)
netapp3_aggr1	netapp3	A	1.72TiB P1 Partition	11	9	2	RAID_DP/11	0.6950	1.5444	3.4319	13.2044
netapp4_aggr1	netapp4	A	1.72TiB P2 Partition	11	9	2	RAID_DP/11	0.6950	1.5444	3.4319	13.2044
				22	18	4	Totals	1.3900	3.0888	6.8638	26.4088

Spares	Devices	Total	Capacity (TiB)
Root	62.35GiB P3 Partition	4	0.2436
Data	1757.17GiB P1 Partition	2	3.4320
Data	1757.17GiB P2 Partition	2	3.4320
		Total	7.1076

	Capacity (TiB)	Allocation
Drive Formatting	0.0078	0.01%
Root	0.3122	0.37%
Parity	14.2146	16.95%
WAFL	6.2507	7.45%
Mirror	26.7210	31.87%
Reserve	2.8128	3.35%
Spare	7.1076	8.48%
Usable	26.4088	31.5%
Total	83.8355	100.0%

3.5 Drive Calculation Summary

Node	Drives (Qty) (#Partitions, #Non-Partitioned)	Flash Pool Drives (Qty) (#Partitions, #Non- Partitioned)	Aggregates (Qty)	Space Utilization
netapp1	(32, 0)	(0, 0)	4	18.71%
netapp2	(32, 0)	(0, 0)	4	18.71%
netapp3	(32, 0)	(0, 0)	4	N/A
netapp4	(32, 0)	(0, 0)	4	N/A

3.6 Workload Descriptions

Workload Name	Type	TPut IOPS	Effective Capacity (TiB)	Cold Data %	Protocol	Read Latency (MS)	IO Percentages				IO Block Sizes (KB)				Working Set %
							Rand Read	Rand Write	Seq Read	Seq Write	Rand Read	Rand Write	Seq Read	Seq Write	
Site A wkload Ctrl1	Custom	45,000.00 IOPS	15.00	N/A	FCP	1	50	50	0	0	8	8	64	64	5
Site A wkload - Ctrl2	Custom	45,000.00 IOPS	15.00	N/A	FCP	1	50	50	0	0	8	8	64	64	5
Site B wkload Ctrl1	Custom	45,000.00 IOPS	15.00	N/A	FCP	1	50	50	0	0	8	8	64	64	5
Site B wkload Ctrl2	Custom	45,000.00 IOPS	15.00	N/A	FCP	1	50	50	0	0	8	8	64	64	5

3.7 Workload Aggregate Assignments

Node	Aggregate	Workload	Workload Type
netapp1	netapp1_aggr1	Site A wkload Ctrl1	custom
netapp2	netapp2_aggr1	Site A wkload - Ctrl2	custom
Netapp3	Netapp3_aggr1	Site B wkload Ctrl1	custom
Netapp4	Netapp4_aggr1	Site B wkload - Ctrl2	custom

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