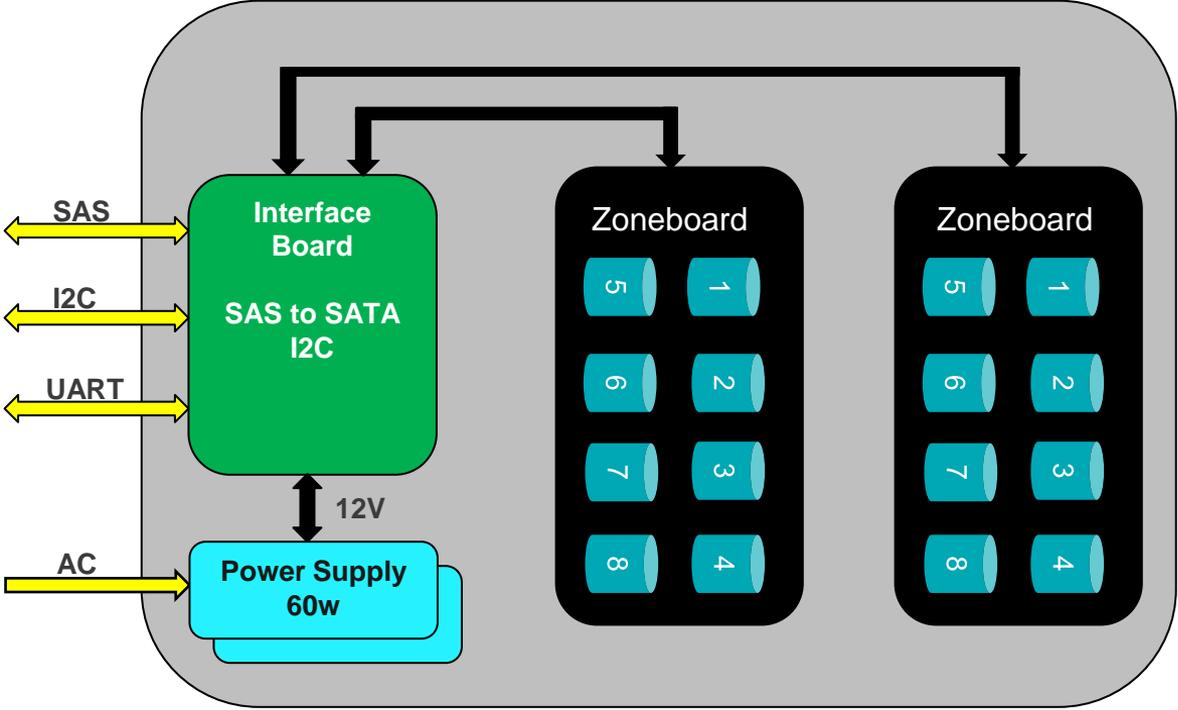


# Alexandria Overview

Sept 4, 2015

# Alexandria 1U System Block Diagram

Alexandria 1U System



# Alexandria System Feature Set

## Key Hardware Features

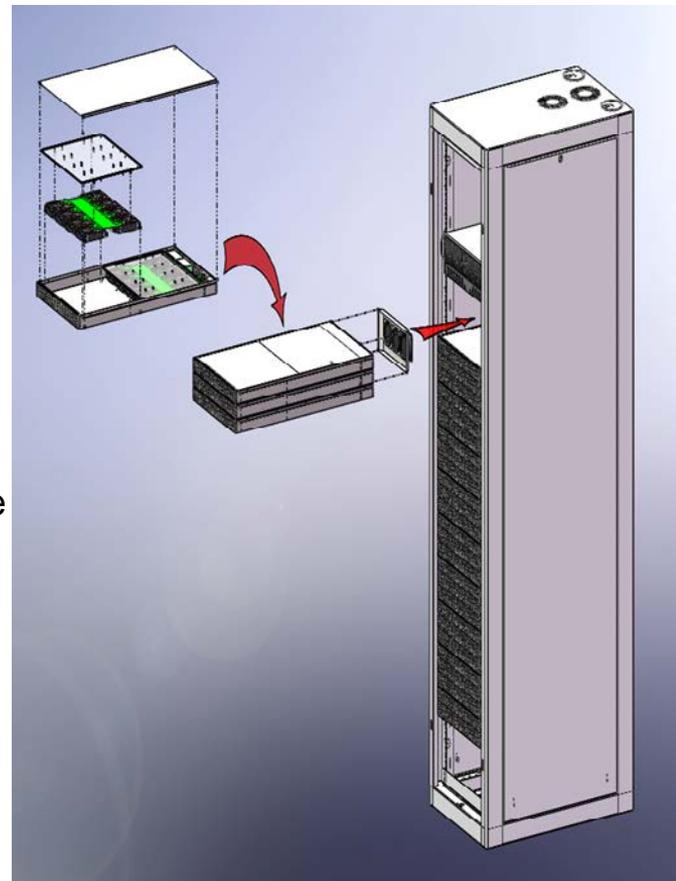
- x86 Xeon based CPU
- Top of Rack SAS Expander
- Seagate Developed 1U/16 Drives
- Under 2500lbs
- 42U, 19" Rack

## Key Software Features

- VTL- virtual tape library APIs presented through SSC-3 and SMC-3
- Access to these virtual tape libraries can be exported across multiple protocol interconnects - 10GbE, GbE, IB, or FC.
- Works with Hierarchical Storage Managers (i.e. TSM or NetBackup)
- SMC-3 interfaces will mount multiple virtual tapes
- Build-in Erasure Code for optimum data integrity

## Key Customer Benefits

- Reduced power, lower cost
- Significant TCO gains
- Simple deployment and replacement design



# Alexandria: Shared Drive PCB

## What is it

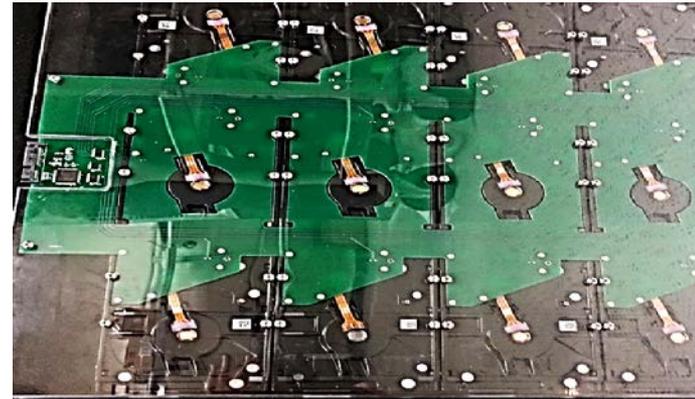
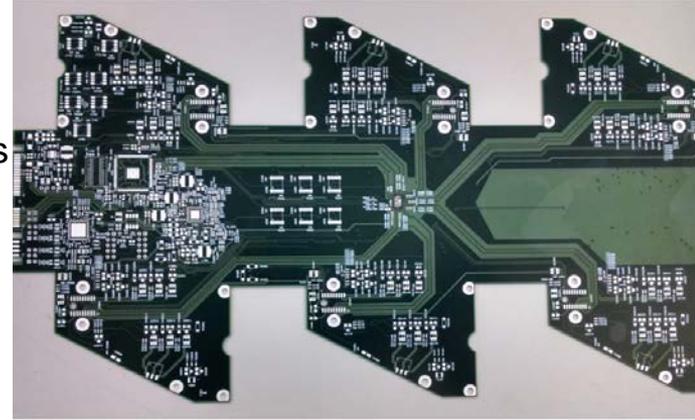
- Low cost, scalable, Cold Store solution
- Lower system cost and power using 1 shared controller to run 8 drives
- Provides lower TCO over tape.
- Can be packaged and sold as a stand alone Storage Node w/SDK

## Key Features

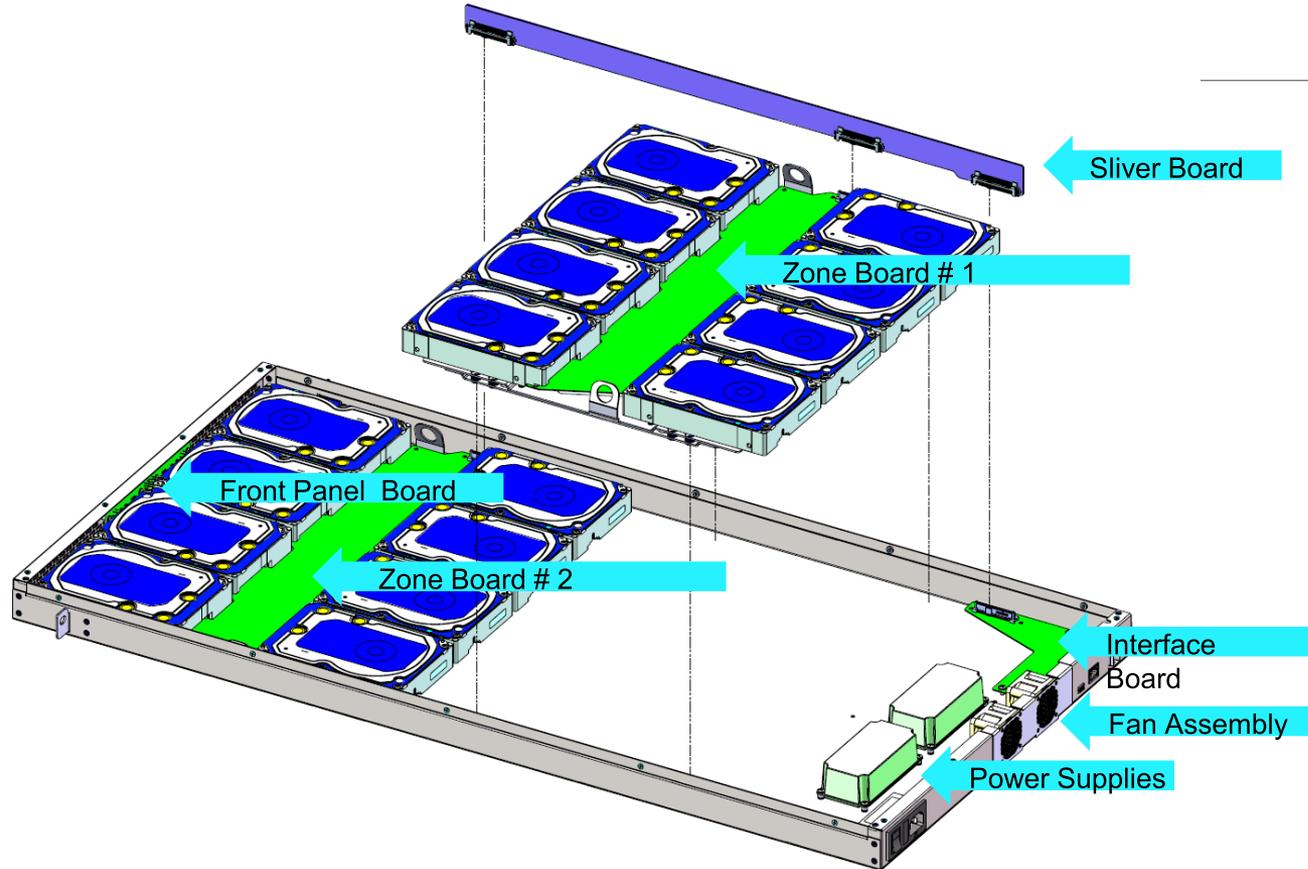
- 8 drives per zone -> One drive on at any time/zone
- High Density: Able to pack 16 drives or greater in 1U
- 3.5", 8TB, SATA drives, 4PB/rack, <1.3kW/rack
- LED front panel indicator on each storage node
- Redundant 12 V open frame power supplies in each storage node

## Key Customer Benefits

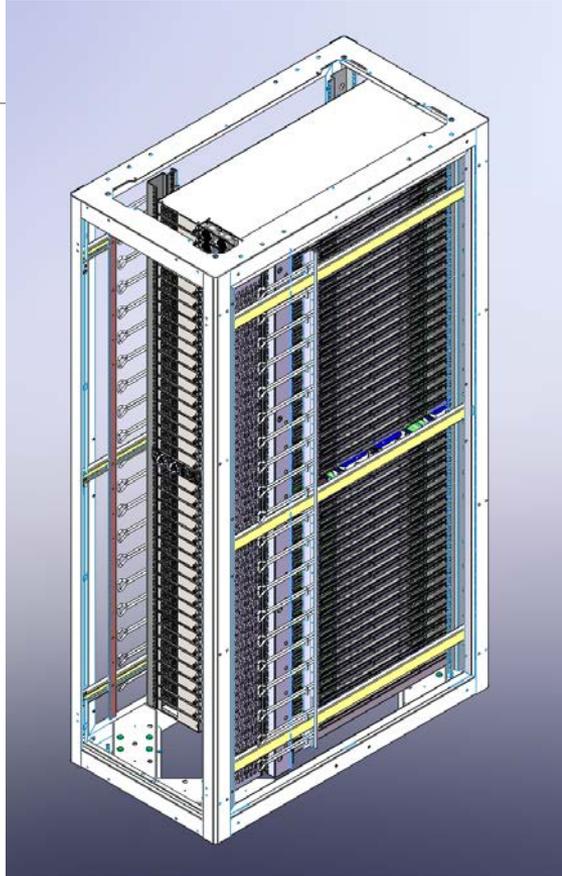
- Leveraging on HDD core knowledge and infrastructure
- Each zone is the replacement service FRU
- Simple deployment and replacement design



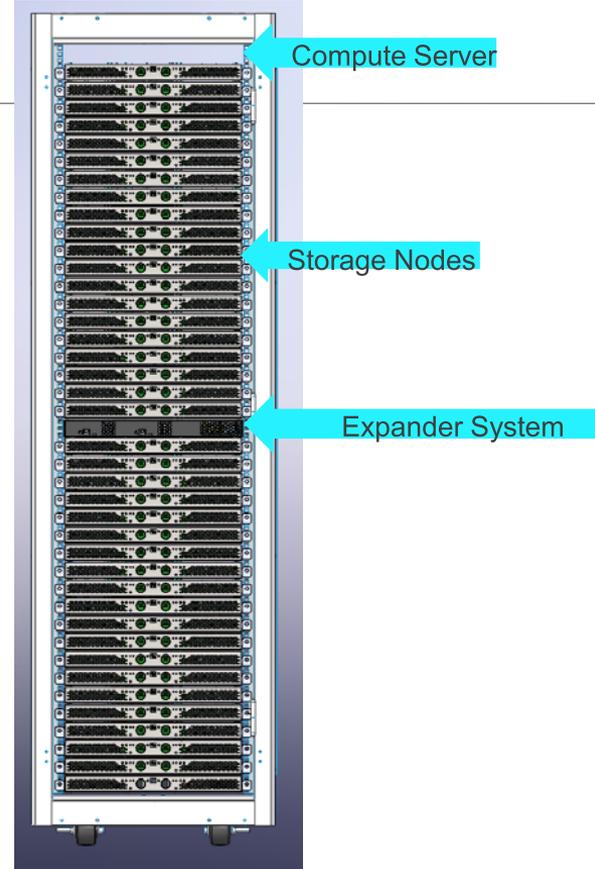
# Alexandria Storage Node System



# Alexandria Rack System

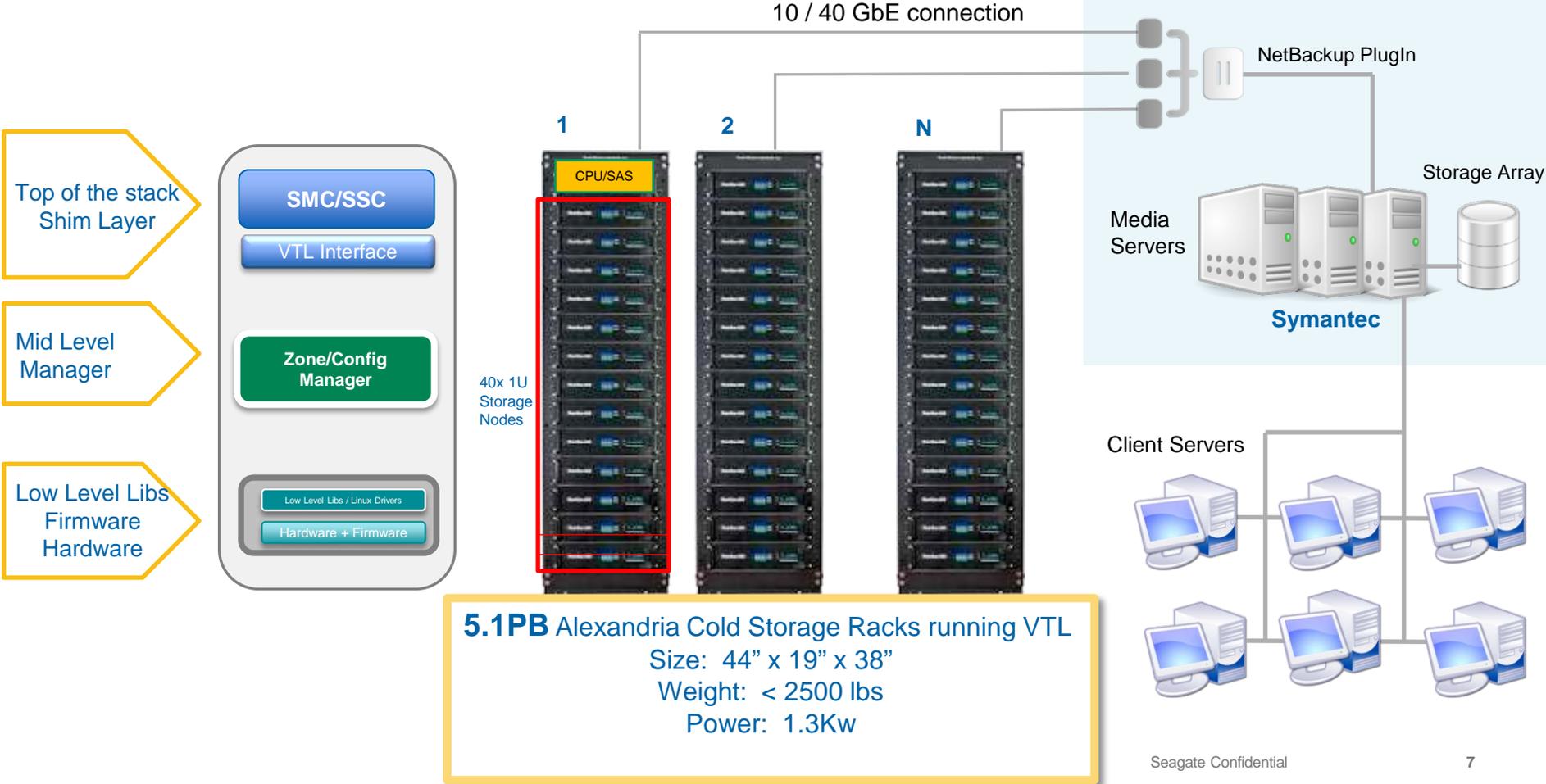


Rear ISO View



Front View

# Alexandria Final End User System Diagram



# Summary

---

**The Alexandria storage solution is a favorable alternative to large-scale tape storage in the following categories**

- Hardware cost
- Lower power consumption
- Faster random access performance
- Ease of manageability
- Scalability

**While archive solutions are the first logical application of “shared electronics” solutions, Seagate is investigating broader application of this technology**

# Backup

---

# Object Storage on Alexandria Hardware

---

## Object interface implementation

- **Leverages Openstack Swift on the back-end**
- **Adds power control to stock Swift code**
- **Presents a standard object storage front end (Swift or S3)**
- **Client does not need to be aware of the power state of any drives or where in the system data is stored**
  - **Compatible with many cloud storage clients without modifications to the client**

# Alexandria Object Storage Definition

---

## Possible use cases for object storage

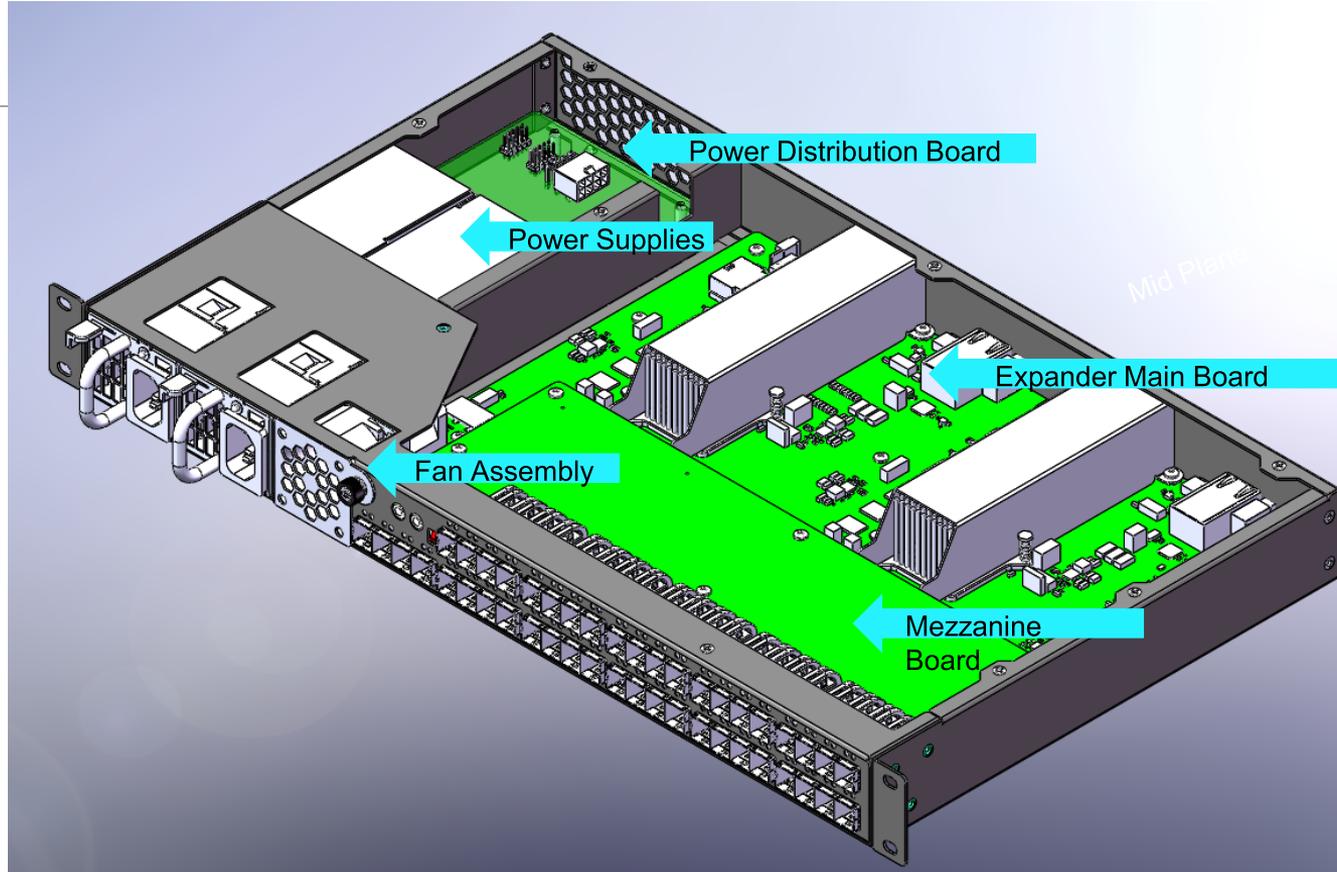
ALEXANDRIA WITH OBJECT INTERFACE IS	ALEXANDRIA WITH OBJECT INTERFACE IS NOT
- a very low TCO system which can be accessed using standard cloud storage interfaces	- a high cost, high performance, system which can be accessed using block / file interfaces
- a repository for massive amounts of data which do not need to be accessed frequently	- a repository for data which needs to be accessed frequently
- a system which can handle a large amount of throughput for writes, including writes from multiple sources	- a system which can perform well while executing simultaneous read and write transactions
- a system which has very high sequential read performance	- a system which has very high random read performance

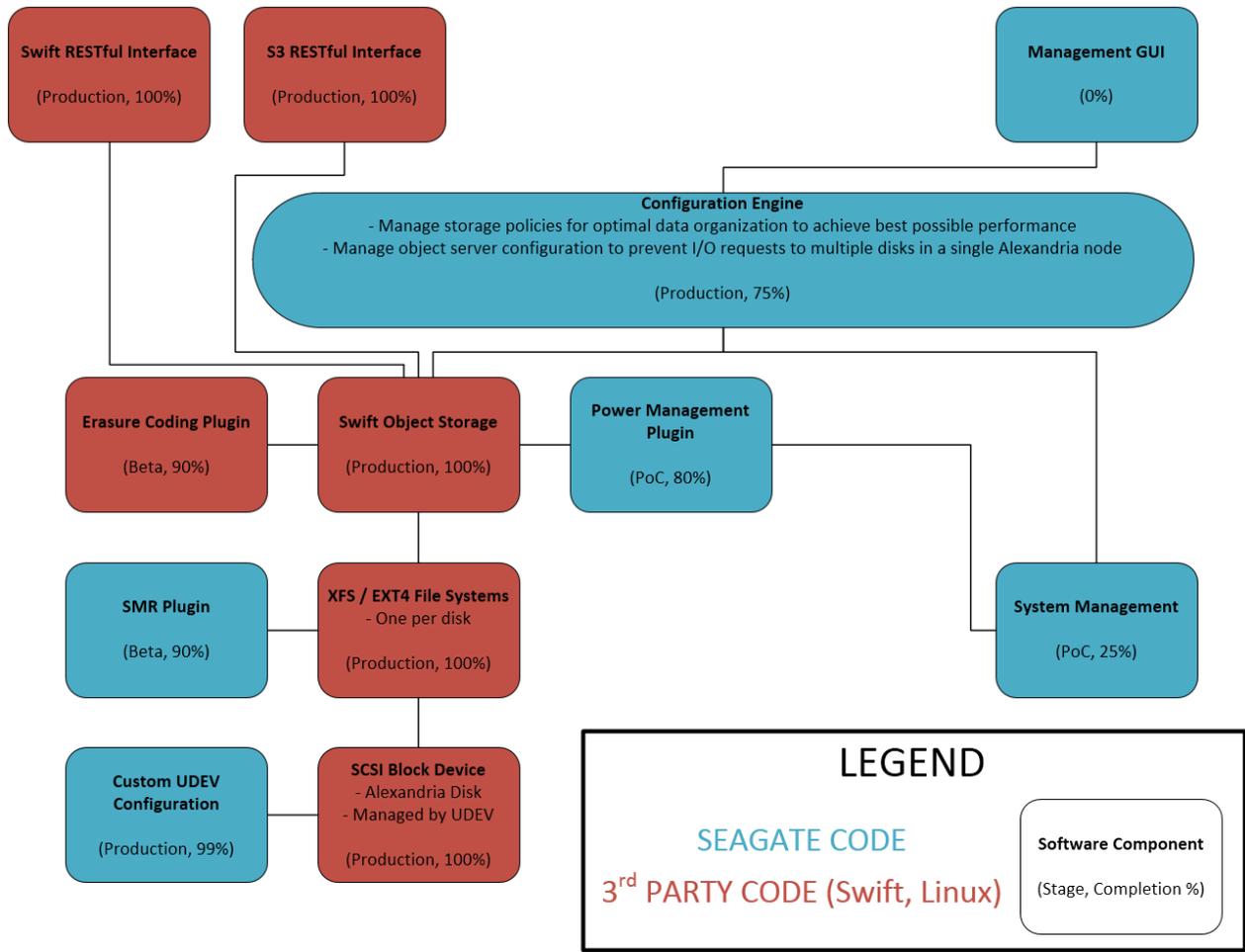
# Object Storage Features

## List of status and owners for different features

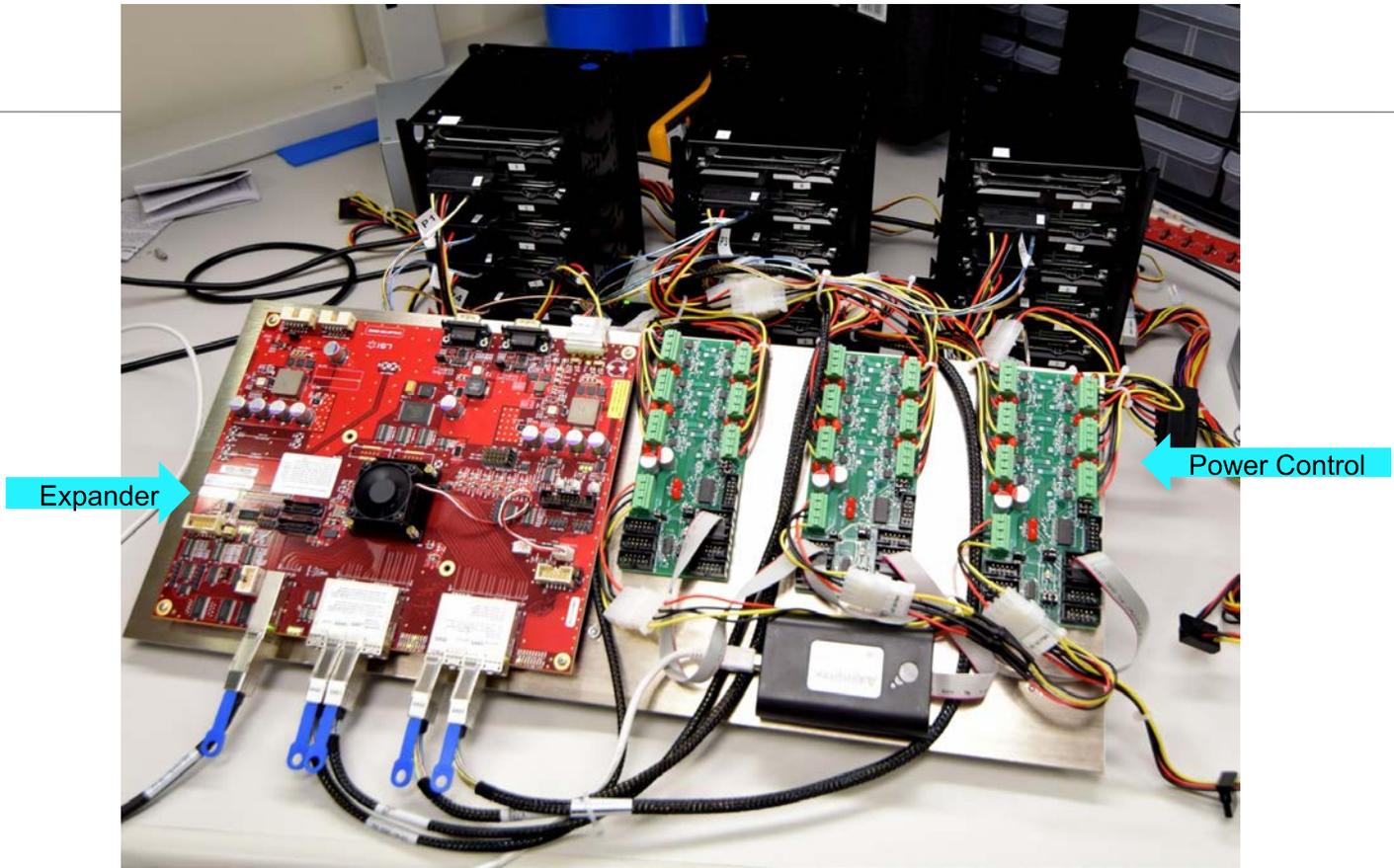
FEATURE	OWNER	STATUS
Object Interface (Put, Get, Delete)	Openstack Swift	Production
Replication	Openstack Swift	Production
Data Integrity / HDD Validation	Openstack Swift	Production
Erasur Coding	Openstack Swift	Beta
S3 Interface	Openstack Swift	Legacy
Power Management / Hot Plug Support	Seagate	POC Functional
Data Integrity / HDD Validation Scheduler	Seagate	Not Started
SMR Optimization	Seagate	Beta
System management (monitor disk usage)	Seagate	Partial POC Functional
User Interface (GUI)	Seagate	Not Started
Deduplication	Seagate	Support not planned

# Alexandria Expander System





# Alexandria System Proof of Concept



Expander

Power Control

# Engineering Summary

## Current Status

- Completed bench level test evaluation of Alexandria 8-in1 with Lombard HDDs
  - Error rate measurements for each slot completed and compared to original circuit board
  - No optimization was performed (used existing flash image for testing)
  - BER analysis results show only .1 order lower than the original board
- Completed Integration of 1U enclosure: Two zones, interface card, power supplies and the front panel LED
- Successfully unit tested the first Alexandria production board, verifying the complete path from Linux platform $\leftrightarrow$ LSI 3008 HBA $\leftrightarrow$ LSI 3X36 expander $\leftrightarrow$ I2C $\leftrightarrow$ SATA BUS $\leftrightarrow$ Alexandria Zone Board $\leftrightarrow$ PIC processor
- Demonstrates the successful power managed functionality, read and write functionality, and data integrity test



2015												2016												2017
Q1			Q2			Q3			Q4			Q1			Q2			Q3			Q4			
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	



Hardware	
CPU	X86 Xeon base
Expander	LSI demo
# of 1Us	5
Drive Technology	CMR
Drive Capacity	4TB
# of drives/1U	16
1U Capacity	64TB
Rack Capacity	320TB
Rack Configuration	25U
Software	
S3 Interface	Openstack,Swift
Object	Openstack,Swift
Data Integrity/HDD Validation	No
Replication	Openstack,Swift
Erasure Coding	None
Power Management/Hot plug	Seagate
HDD Validation Scheduler	No
SMR Optimization	N/A
System mangement (monitor disc usage)	Seagate Beta
GUI	No
Deduplication	No

Hardware	
CPU	X86 Xeon base
Expander	Custom
# of 1Us	5
Drive Technolgy	SMR
Drive Capacity	8TB
# of drives/1U	16
1U Capacity	128TB
Rack Capacity	320TB
Rack Configuration	25U
Software	
VTL	Quadstor
Object	No
Data Integrity/HDD Validation	Quadstor
Replication	Quadstor
Erasure Coding	No
Power Management/Hot plug	Seagate
HDD Validation Scheduler	Seagate/Quad
SMR Optimization	Seagate
System mangement (monitor disc usage)	Seagate
GUI	Seagate
Deduplication	No