

# Software Defined Data Center (SDDC)

## VM and Storage Cyberinfrastructure

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# Software Defined Data Center

On *Sikuliaq* the Cyberinfrastructure addressed in this upgrade consists of

- Local area networking (LAN) and VLAN Segmentation
- Disk storage
- Computational server hardware - CPU + RAM

Abstracting this hardware in the form of a **Software Defined Data Center (SDDC)** allows for maximum flexibility in allocating hardware resources and provides an extremely high level of resiliency for uninterrupted services.

New guest Operating Systems (Linux and Windows) can quickly and dynamically be carved out of the generalized SDDC hardware. Guests can also be migrated from on VM Server host to another allowing for a **fully zero single point** of failure design.



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# Existing VirtualBox and Storage

Circa ~2013

- 3x 2u VM Servers
  - 24 CPU / 64 GB RAM
- 3x 3u NAS Storage
  - 23 TB (RAID 6)
- 1x 4u NAS Storage
  - 96 TB (RAID 6)

## Total Capacity

- VM: 72 CPU / 192 GB RAM
- 69 TB Storage Total
  - + 96 TB Expansion
- 18u Rackspace

## Redundancy

Power Supplied, RAID, NICs



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# SDDC Upgrade

- 3x 1u VMWare Servers
  - 32 CPU / 512 GB RAM
- 1x 2u Fujitsu SAN Storage
  - 110 TB (RAID 6)

## Total Usable Capacity (N+1)

- VM: 64 CPU / 1024 GB RAM
- 110 TB Storage Total
- 10 GB Ethernet
- 7u Rackspace

## Redundancy

Zero Single Point of Failure  
Power, RAID, NICs, VM Hosts



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# SDDC Hardware



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# Portable Rack



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# SDDC Upgrade Criteria

- 5 Year Life Cycle Replacement for Sikuliaq's current VM and Storage Hardware
- Software Defined Data Center (SDDC) Architecture
- Zero-Single Point of Failure Design
- High Availability Virtual Machine Capabilities
- Planned capacity through 2025
- Expansion ready if additional capacity is needed
- 5 Year Support Contracts
- On Board Spare Parts



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# 2025 VM Capacity Planning

	2019	2020 Proposal	2025 Estimate
<b>VM Guests</b>	58 VMs	80	120
<b>Average CPU per VM</b>	0.82 Cores	0.4 Cores	0.4 Cores
<b>Average RAM per VM</b>	1.09 GB	4 GB	6 GB
<b>Average DISK per VM</b>	56 GB	100 GB	200 GB

<b>VM Guests</b>	120
<b>Average CPU per VM</b>	120 x 0.4 Cores = 48 CPU cores Total
<b>Average RAM per VM</b>	120 x 6 GB = 720 GB Total
<b>Average DISK per VM</b>	120 x 200 GB ≈ 25 TB Total



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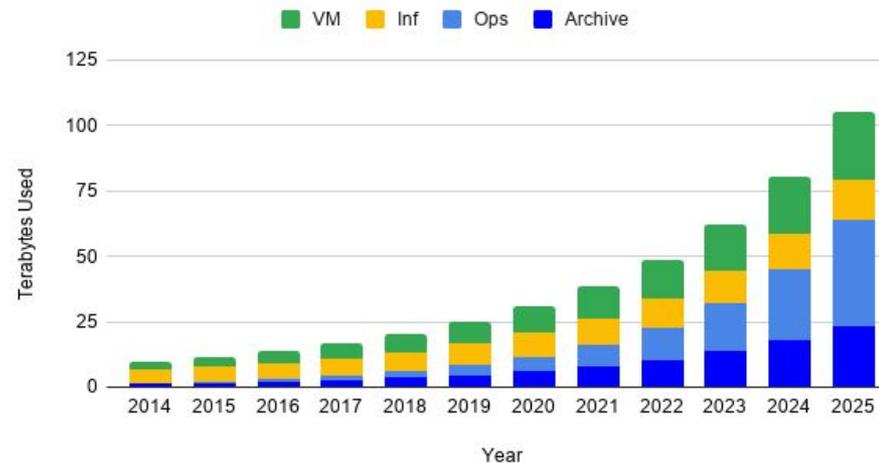
<https://www.sikuliaq.alaska.edu>



# 2025 Storage Capacity Planning

Data Set	Minimum (Most Likely by 2025)	Maximum (Potential) Capacity
VM	25 TB	50 TB
Infrastructure	15 TB	30 TB
Operations	40 TB	80 TB
Archive	25 TB	400 TB
~15% Buffer	15 TB	0 TB
<b>Total</b>	<b>120 TB</b>	<b>560 TB</b>

Sikuliaq Shiptside Estimated Storage Capacity Requirements



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# Storage Capacity Planning

## Modeling Exponential Growth

$$\text{Capacity (year)} = (\text{Initial Capacity}) e^{\text{rate} (\text{year} - \text{Start\_year})}$$

For example, *Sikuliaq's* annual underway science data archive from 2014 to 2019 started at 1.2 TB and has doubled approximately every 2.57 years.

$$\text{rate} = \frac{\ln(2)}{\text{Double Time}} = \frac{\ln(2)}{2.57 \text{ years}} = .27$$

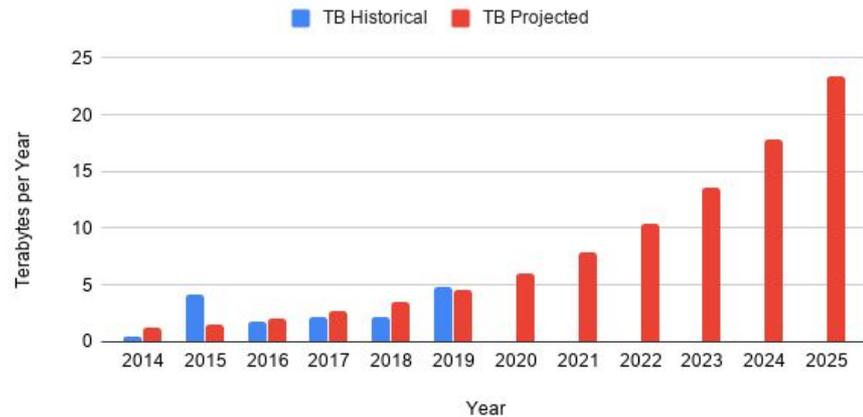
## Estimating Capacity Requirements

Sikuliaq Data Archive growth can be estimated in total TeraBytes (TB) required:

$$\text{TB}(\text{year}) = (1.2 \text{ TB}) \times e^{0.27 \times (\text{year} - 2014)}$$

## Sikuliaq Underway Data Archive Capacity Growth

Based on 2014-2019 data and modeled with a 2.57 year double time.



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# VMWare VCenter

The screenshot displays the VMware vSphere Client interface. The top navigation bar shows the user is logged in as Administrator@VSPHERE.LOCAL. The main dashboard provides a summary of the environment's resources:

- CPU:** 230.96 GHz free (8.56 GHz used | 239.52 GHz total)
- Memory:** 1.42 TB free (83.36 GB used | 1.5 TB total)
- Storage:** 12.38 TB free (4.25 TB used | 16.63 TB total)

Summary statistics for the environment:

- VMs:** 25 total (23 Powered On, 2 Powered Off, 0 Suspended)
- Hosts:** 3 total (3 Connected, 0 Disconnected, 0 Maintenance)
- Objects with most alerts:** 1
- Installed Plugins:** 3 (VMware vRops Client Plugin, VMware vSAN H5 Client Plugin)

The 'Recent Tasks' table shows the following activity:

Task Name	Target	Status	Details	Initiator	Queued For	Start Time	Completion Time	Server
Deploy plug-in	shp-sddc-vcenter.sikuliaq.alaska.edu	Completed	com.vmware.vcintegritycli...	VSPHERE.LOCAL/vsphere-...	16 ms	10/26/2020, 12:09:11 PM	10/26/2020, 12:09:12 PM	shp-sddc-vcentersikuliaq.al...



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# Fujitsu iSCSI SAN

ETERNUS AF250 S3 User

**Normal** Storage Name : shp-sddc-stor Model : ET253SAU-4602011106 Date : 2020-10-26 20:17:18

Overview Volume RAID Group Thin Provisioning Advanced Copy Connectivity **Component** System

Component > Controller Enclosure

**Category**

- shp-sddc-stor
  - Controller Enclosure
    - Controller Module
    - Channel Adapter
    - Battery
    - Power Supply Unit
  - Drive Enclosure
  - Drives

**Controller Enclosure**

Summary **Front View** Rear View

▼ CE Front View

▼ CE Drives Information

Parts	Status	Capacity	Speed	Type	Usage	RAID Group	Health
Slot#0	✓ Spare	15.60 TB	-	SSD-L	Global Hot Spare	-	100 %
Slot#1	✓ Available	15.60 TB	-	SSD-L	Data	0 : Group-0_0	100 %
Slot#2	✓ Available	15.60 TB	-	SSD-L	Data	0 : Group-0_0	100 %
Slot#3	✓ Available	15.60 TB	-	SSD-L	Data	0 : Group-0_0	100 %
Slot#4	✓ Available	15.60 TB	-	SSD-L	Data	0 : Group-0_0	100 %
Slot#5	✓ Available	15.60 TB	-	SSD-L	Data	0 : Group-0_0	100 %
Slot#6	✓ Available	15.60 TB	-	SSD-L	Data	0 : Group-0_0	100 %
Slot#7	✓ Available	15.60 TB	-	SSD-L	Data	1 : Group-1_0	100 %
Slot#8	✓ Available	15.60 TB	-	SSD-L	Data	1 : Group-1_0	100 %
Slot#9	✓ Available	15.60 TB	-	SSD-L	Data	1 : Group-1_0	100 %
Slot#10	✓ Available	15.60 TB	-	SSD-L	Data	1 : Group-1_0	100 %
Slot#11	✓ Available	15.60 TB	-	SSD-L	Data	1 : Group-1_0	100 %
Slot#12	✓ Available	15.60 TB	-	SSD-L	Data	1 : Group-1_0	100 %



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# 2020 Installation Timeline

- **April - May:** Systems Procurement
- **August:** Vendor Installation
- **Sept-Dec:** Shore Side Preparation
- **Jan 2021:** Vessel Installation
  - Shutdown / Un-Rack Legacy systems
  - Rack new SDDC systems
  - Re-connect and power on Legacy systems
  - Power on new SDDC
  - Migrate VM's and storage from old VirtualBox to new VMWare systems.



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