Maximum Efficiency

For Any HPC/AI Workload

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NUG XXXIV20-06-23

WEKA

Why

- **Compute workload isolation**

-> flexible Processor utilization

-> better Application performance

-> easy Client QoS

- **Storage Hardware Economics**

-> maximum Value of your HW

-> affordable Data placement

-> linear (Meta) Data scaling

This is Important

Key Takeaways

Energy

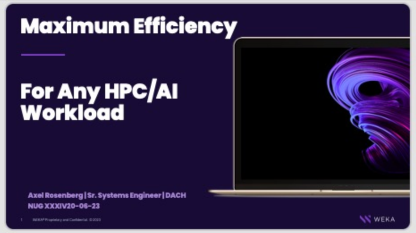
Storage server resource efficiency

Performance

Application server performance optimization

Intelligence

(Meta) Data management and scalability



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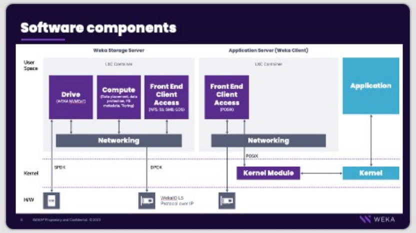

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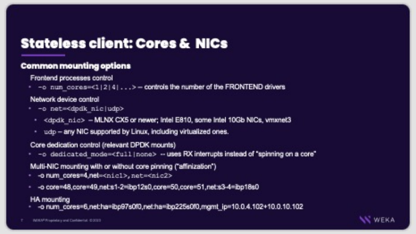

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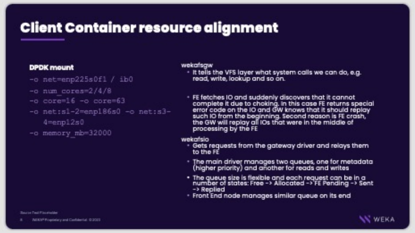

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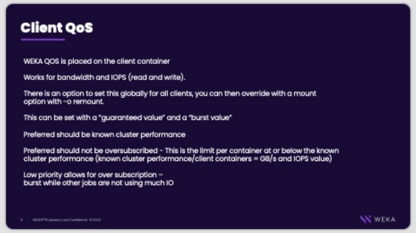

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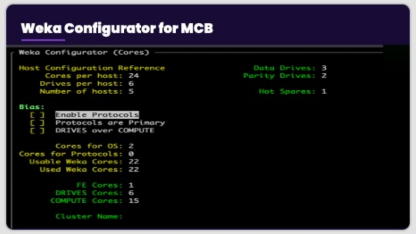

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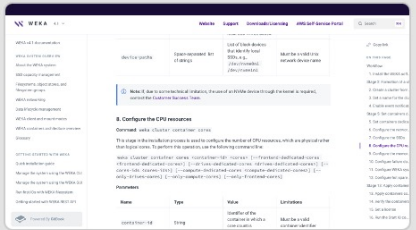

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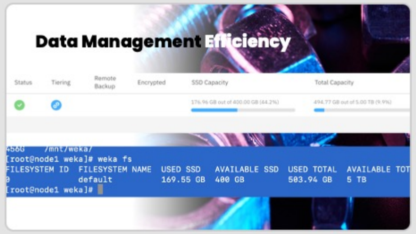

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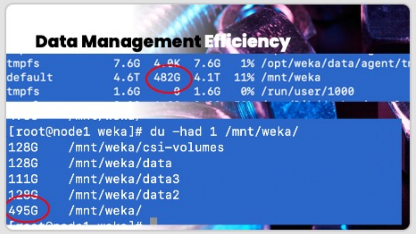

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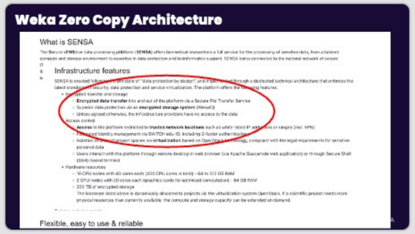

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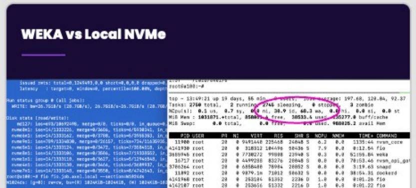
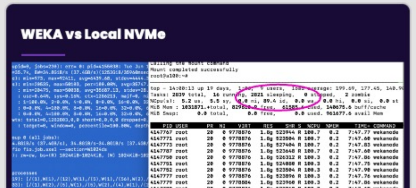
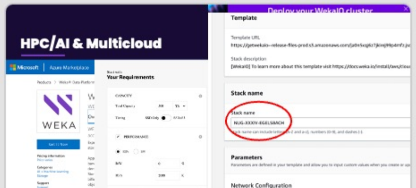
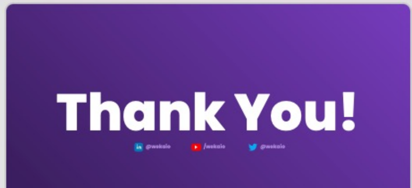


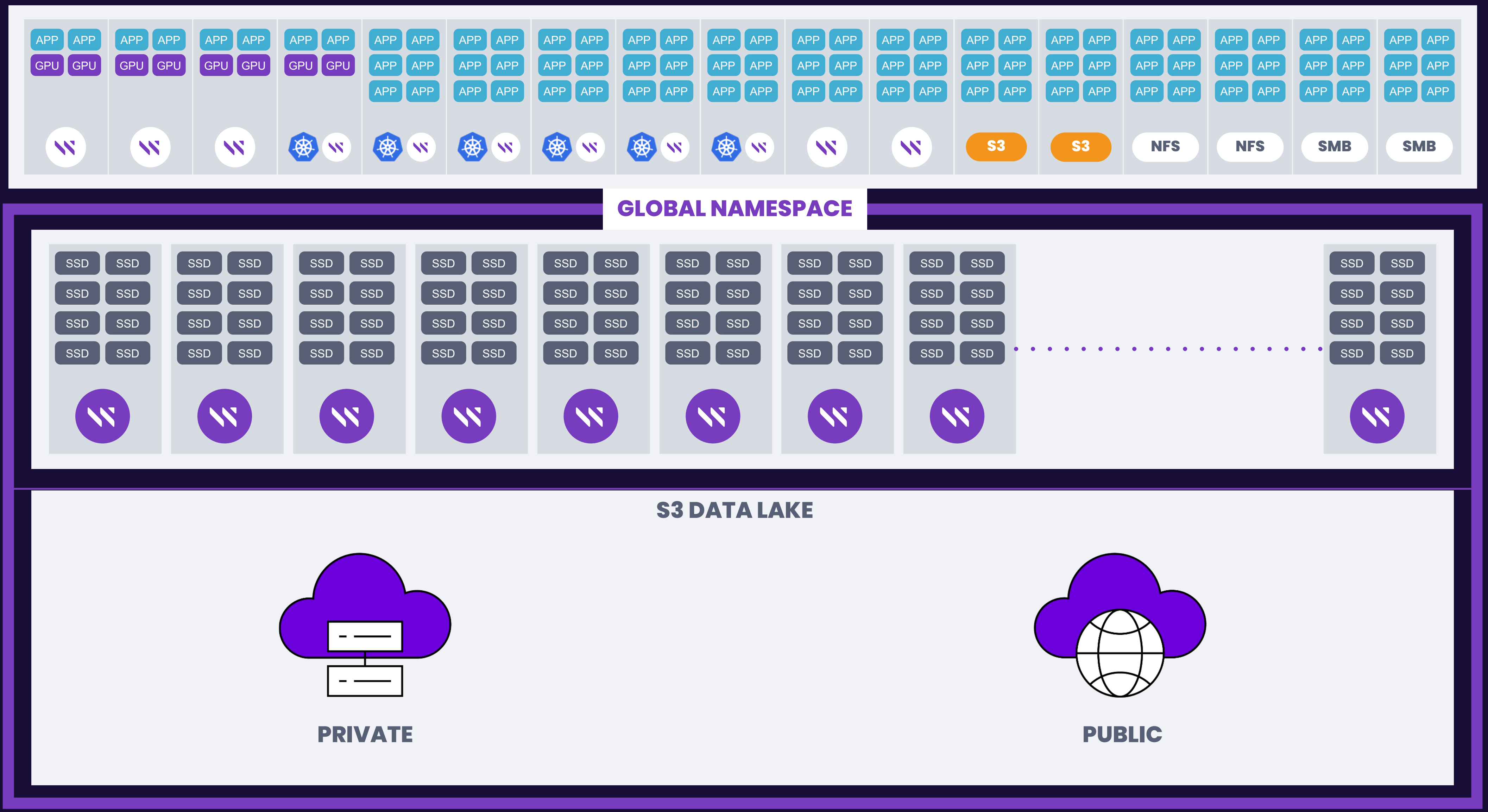






I/O intensive Applications

Clients data access via POSIX, NFS, SMB, S3, CSI and GPU Direct



Client

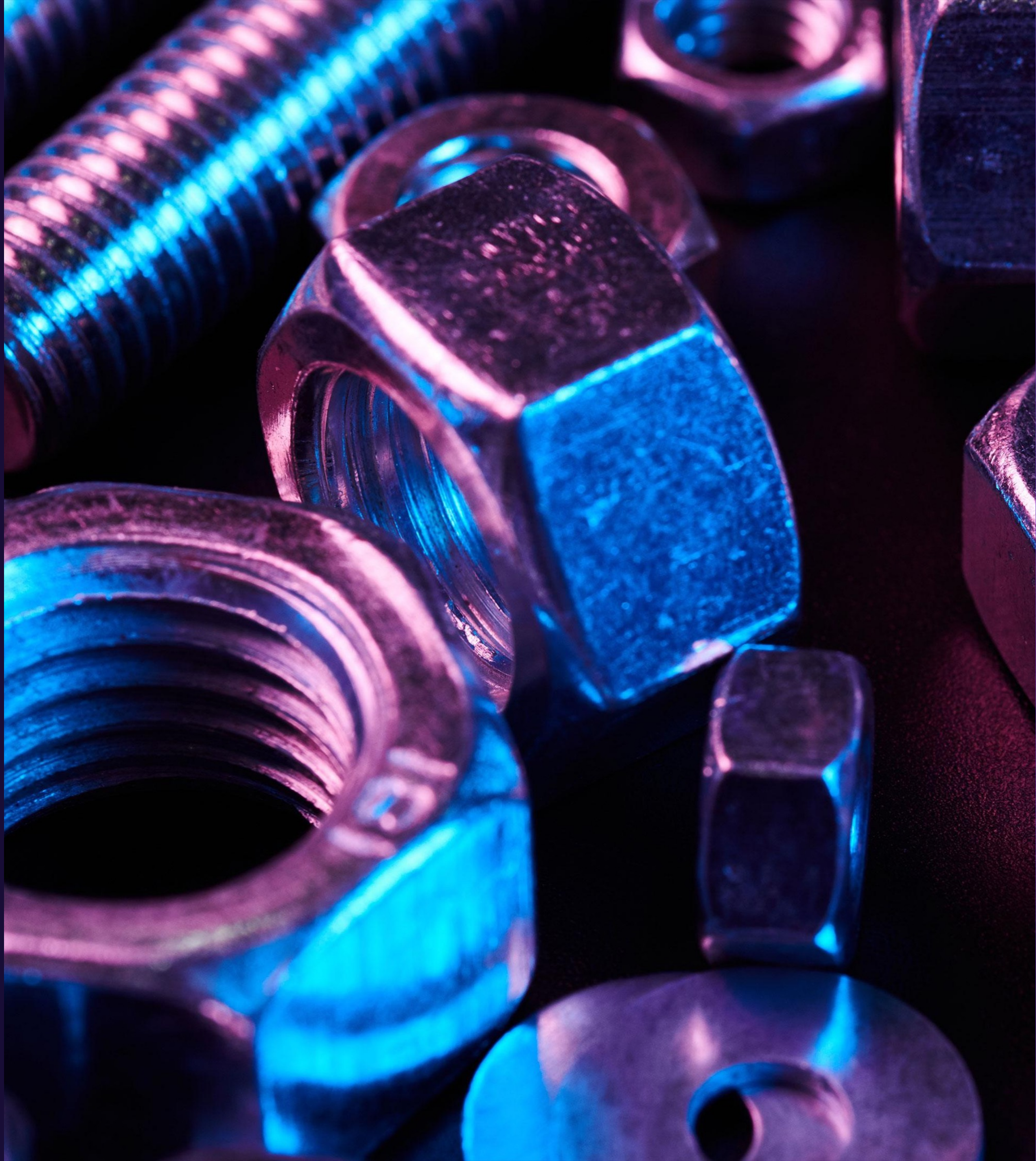
Backend

Automatic Tiering and Data Protection via S3 to On- Prem or Public Cloud Object Store

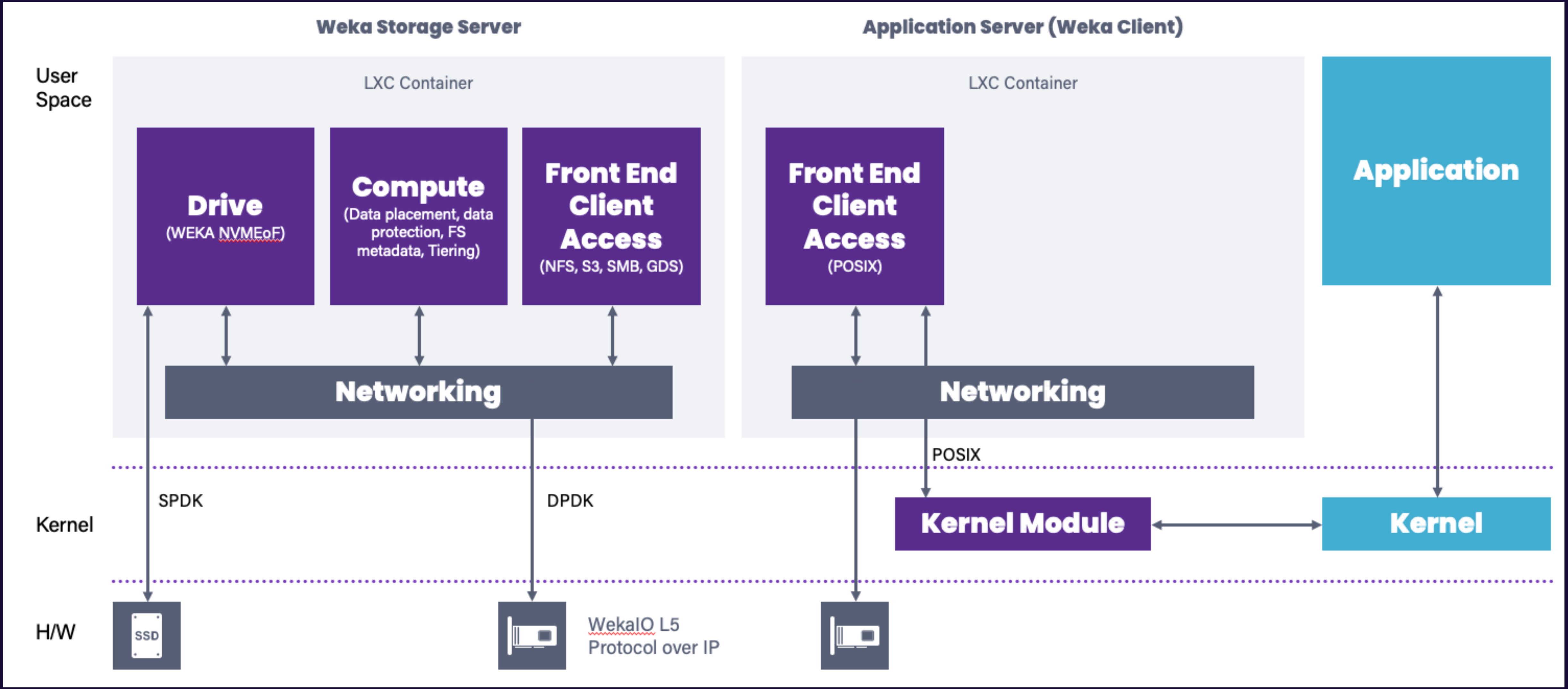
WEKA

Workload

WEKA User-Space Containers



Software components



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Stateless client: Cores & NICs

Common mounting options

Frontend processes control

- -o num_cores=<1|2|4|...> -- controls the number of the FRONTEND drivers

Network device control

- -o net=<dpdk_nic|udp>
  - <dpdk_nic> – MLNX CX5 or newer; Intel E810, some Intel 10Gb NICs, vmxnet3
  - udp – any NIC supported by Linux, including virtualized ones.

Core dedication control (relevant DPDK mounts)

- -o dedicated_mode=<full|none> -- uses RX interrupts instead of “spinning on a core”

Multi-NIC mounting with or without core pinning (“affinization”)

- -o num_cores=4,net=<nic1>,net=<nic2>
- -o core=48,core=49,net:s1-2=ibp12s0,core=50,core=51,net:s3-4=ibp18s0

HA mounting

- -o num_cores=6,net:ha=ibp97s0f0,net:ha=ibp225s0f0,mgmt_ip=10.0.4.102+10.0.10.102

WEKA

Client Container resource alignment

DPDK mount

```
-o net=enp225s0f1 / ib0
-o num_cores=2/4/8
-o core=16 -o core=63
-o net:s1-2=enp186s0 -o net:s3-
   4=enp12s0
-o memory_mb=32000
```

wekafsgw

- It tells the VFS layer what system calls we can do, e.g. read, write, lookup and so on.
- FE fetches IO and suddenly discovers that it cannot complete it due to choking. In this case FE returns special error code on the IO and GW knows that it should replay such IO from the beginning. Second reason is FE crash, the GW will replay all IOs that were in the middle of processing by the FE

wekafsio

- Gets requests from the gateway driver and relays them to the FE
- The main driver manages two queues, one for metadata (higher priority) and another for reads and writes
- The queue size is flexible and each request can be in a number of states: Free -> Allocated -> FE Pending -> Sent -> Replied
- Front End node manages similar queue on its end

Source Text Placeholder

WEKA

Client QoS

WEKA QOS is placed on the client container

Works for bandwidth and IOPS (read and write).

There is an option to set this globally for all clients, you can then override with a mount option with -o remount.

This can be set with a ”guaranteed value” and a “burst value”

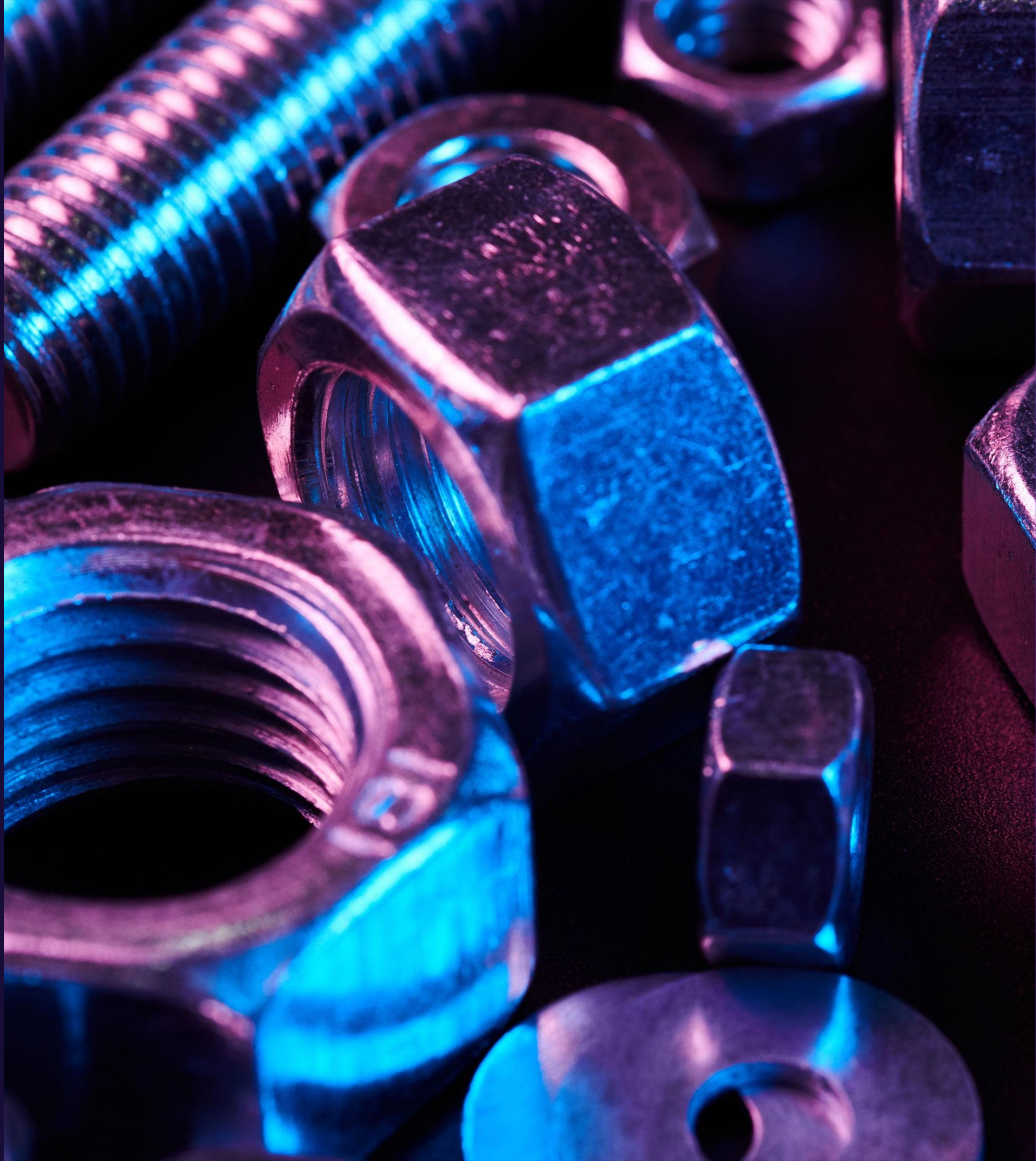
Preferred should be known cluster performance

Preferred should not be oversubscribed - This is the limit per container at or below the known cluster performance (known cluster performance/client containers = GB/s and IOPS value)

Low priority allows for over subscription –
burst while other jobs are not using much IO

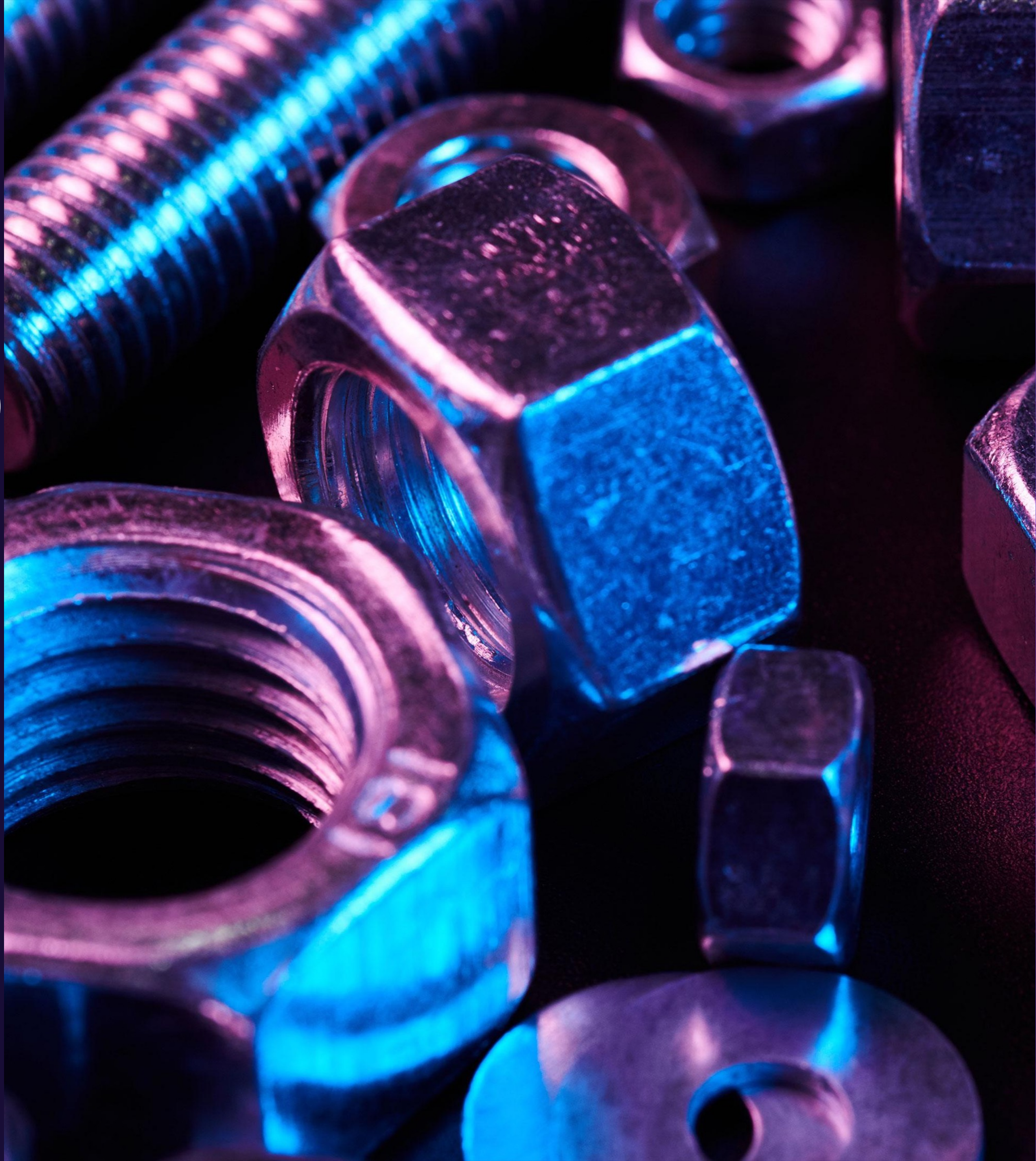
Resources

Leveraging HW resources at the most optimal mix including NUMA intelligence and power management.



Backend Core Efficiency

WEKA MCB (Multi Container Backend) Lets you assign your processors for Hardware and Software resources dynamically.



Weka Configurator for MCB

```
Weka Configurator (Cores)

Host Configuration Reference                          Data Drives: 3
      Cores per host: 24                            Parity Drives: 2
     Drives per host: 6
     Number of hosts: 5                               Hot Spares: 1

Bias:
  [ ]   Enable Protocols
  [ ]   Protocols are Primary
  [ ]   DRIVES over COMPUTE

          Cores for OS: 2
   Cores for Protocols: 0
    Usable Weka Cores: 22
      Used Weka Cores: 22

             FE Cores: 1
         DRIVES Cores: 6
        COMPUTE Cores: 15

         Cluster Name:
```

		local SSD will be added	
`device-paths`	Space-separated list of strings	List of block devices that identify local SSDs, e.g., `/dev/nvme0n1` `/dev/nvme1n1`	Must be a valid Unix network device name

Note: If, due to some technical limitation, the use of an NVMe device through the kernel is required, contact the Customer Success Team.

8. Configure the CPU resources

Command: `weka cluster container cores`

This stage in the installation process is used to configure the number of CPU resources, which are physical rather than logical cores. To perform this operation, use the following command line:

```
weka cluster container cores <container-id> <cores> [--frontend-dedicated-cores <frontend-dedicated-cores>] [--drives-dedicated-cores <drives-dedicated-cores>] [--cores-ids <cores-ids>] [--compute-dedicated-cores <compute-dedicated-cores>] [--only-drives-cores] [--only-compute-cores] [--only-frontend-cores]
```

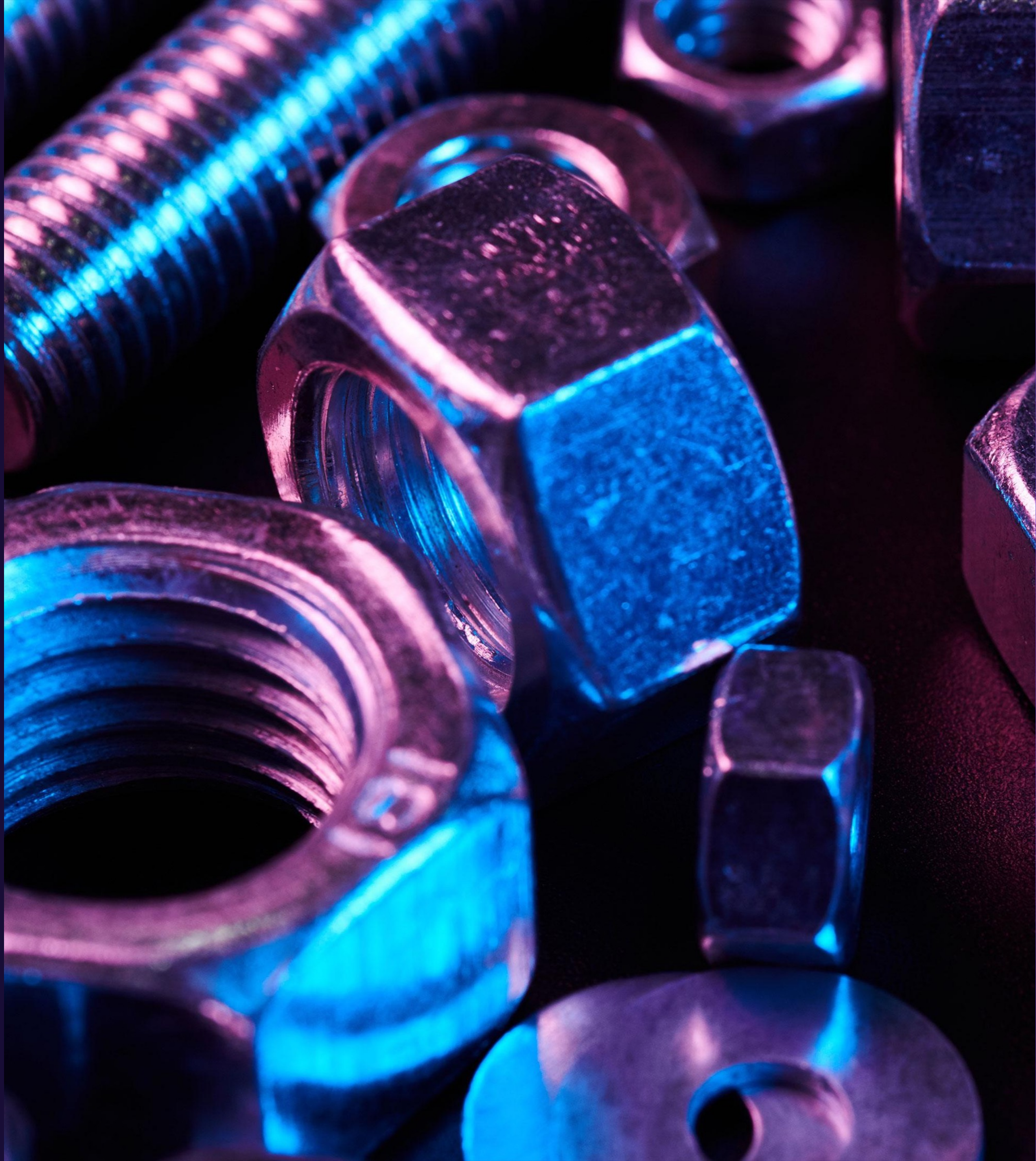
Parameters

Name	Type	Value	Limitations
`container-id`	String	Identifier of the container in which a core count is	Must be a valid container identifier

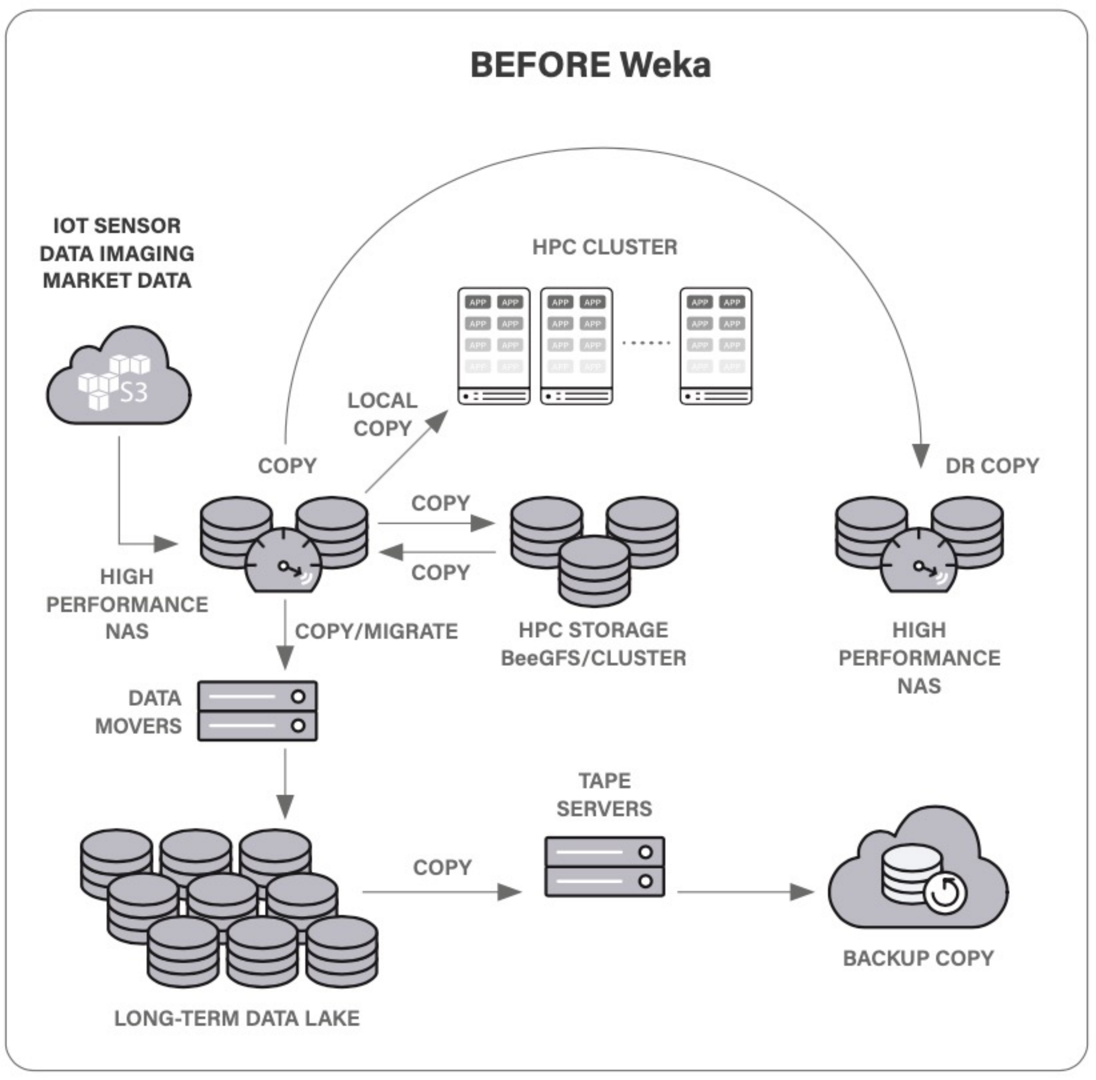
Data Management Efficiency

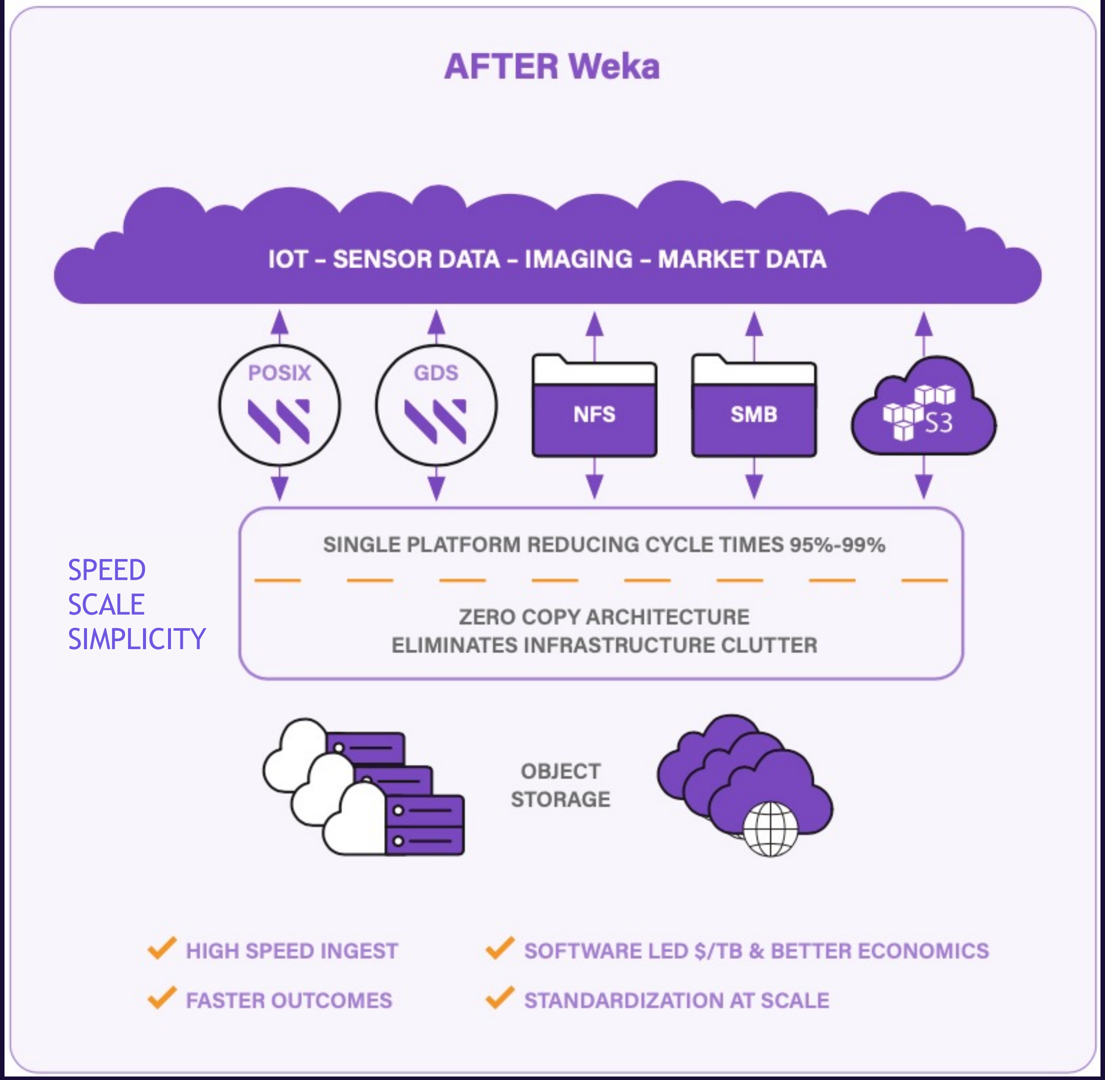
WEKA's zero-copy architecture enables intelligent data placement. Revolutionize research and results by managing data-oceans transparently to your (AI)-compute farm.

On-prem, hybrid and Multi-Cloud. WEKA runs anywhere.



Weka Zero Copy Architecture





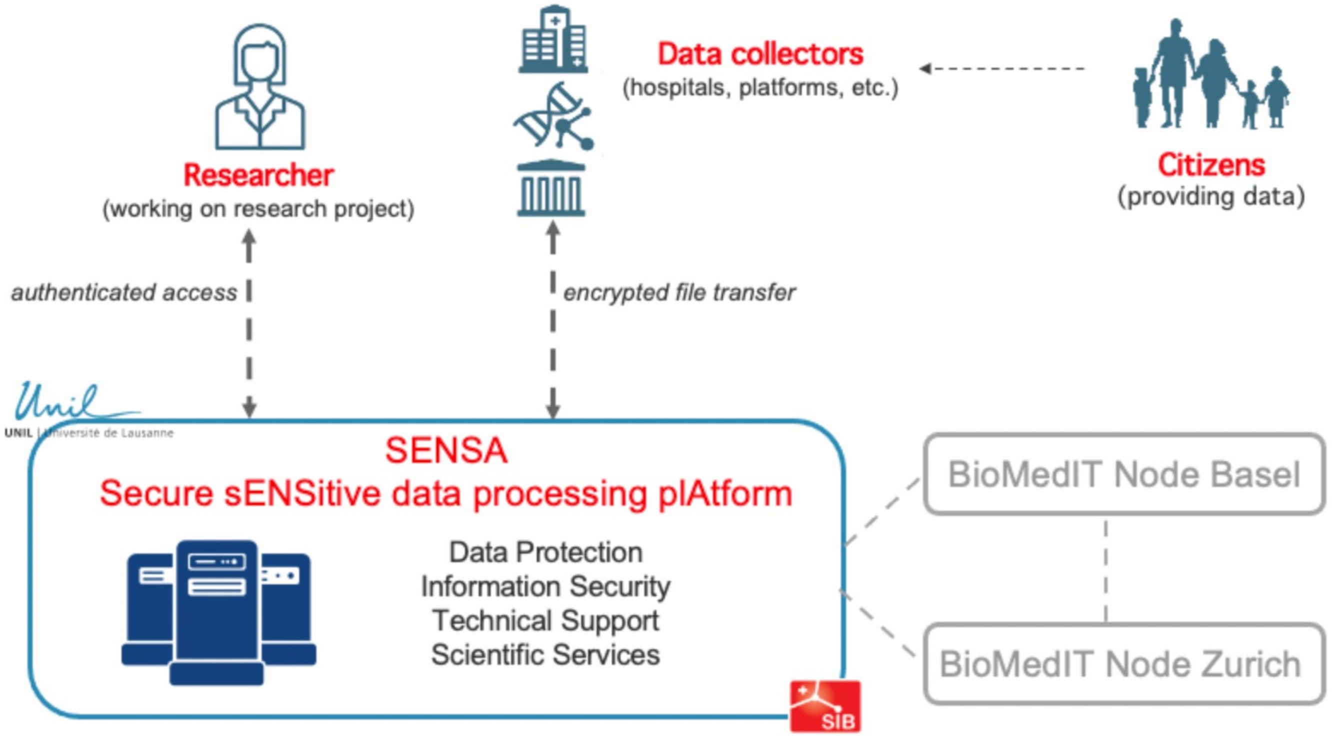
WEKA

Weka Zero Copy Architecture in Practice

What is SENSA

https://sensa.biomedit.ch/index.html#infrastructure

The **S**ecure s**ENS**itive data processing pl**A**tform (**SENSA**) offers biomedical researchers a full service for the processing of sensitive data, from a tailored compute and storage environment to expertise in data protection and bioinformatics support. SENSA being connected to the national network of secure IT infrastructures (BioMedIT), it also acts as a gateway to the Swiss Personalized Health Network (SPHN.ch) to enable nationwide biomedical projects. SENSA is provided by the University of Lausanne and the SIB Swiss Institute of Bioinformatics, and builds on over 15 years of experience in operating high performance computing infrastructure for biomedical researchers.



Flexible, easy to use & reliable

A

Weka Zero Copy Architecture

What is SENSA

The **S**ecure s**ENS**itive data processing pl**A**tform (**SENSA**) offers biomedical researchers a full service for the processing of sensitive data, from a tailored compute and storage environment to expertise in data protection and bioinformatics support. SENSA being connected to the national network of secure

IT

SI

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Infrastructure features

SENSA is created following the principle of "data protection by design", and implemented through a dedicated technical architecture that enforces the latest standards in security, data protection and service virtualization. The platform offers the following features:

- Encrypted transfer and storage
  - **Encrypted data transfer** into and out of the platform via a Secure File Transfer Service
  - Superior data protection via an **encrypted storage system** (WekaIO)
  - Unless agreed otherwise, the infrastructure providers have no access to the data
- Access control
  - **Access** to the platform restricted to **trusted network locations** such as white-listed IP addresses or ranges (incl. VPN)
  - Federated identity management via SWITCH edu-ID, including 2-factor authentication
  - Isolation of distinct project spaces via **virtualization** based on OpenStack technology, compliant with the legal requirements for sensitive personal data
  - Users interact with the platform through remote desktop in web browser (via Apache Guacamole web application) or through Secure Shell (SSH)-based terminal
- Hardware resources
  - 10 CPU nodes with 40 cores each (400 CPU cores in total) - 64 to 512 GB RAM
  - 2 GPU nodes with 20 cores each (graphics cards for optimised computation) - 64 GB RAM
  - 200 TB of encrypted storage

    The hardware listed above is dynamically allocated to projects via the virtualization system OpenStack. If a scientific project needs more physical resources than currently available, the compute and storage capacity can be extended on demand.

https://sensa.biomedit.ch/index.html#infrastructure

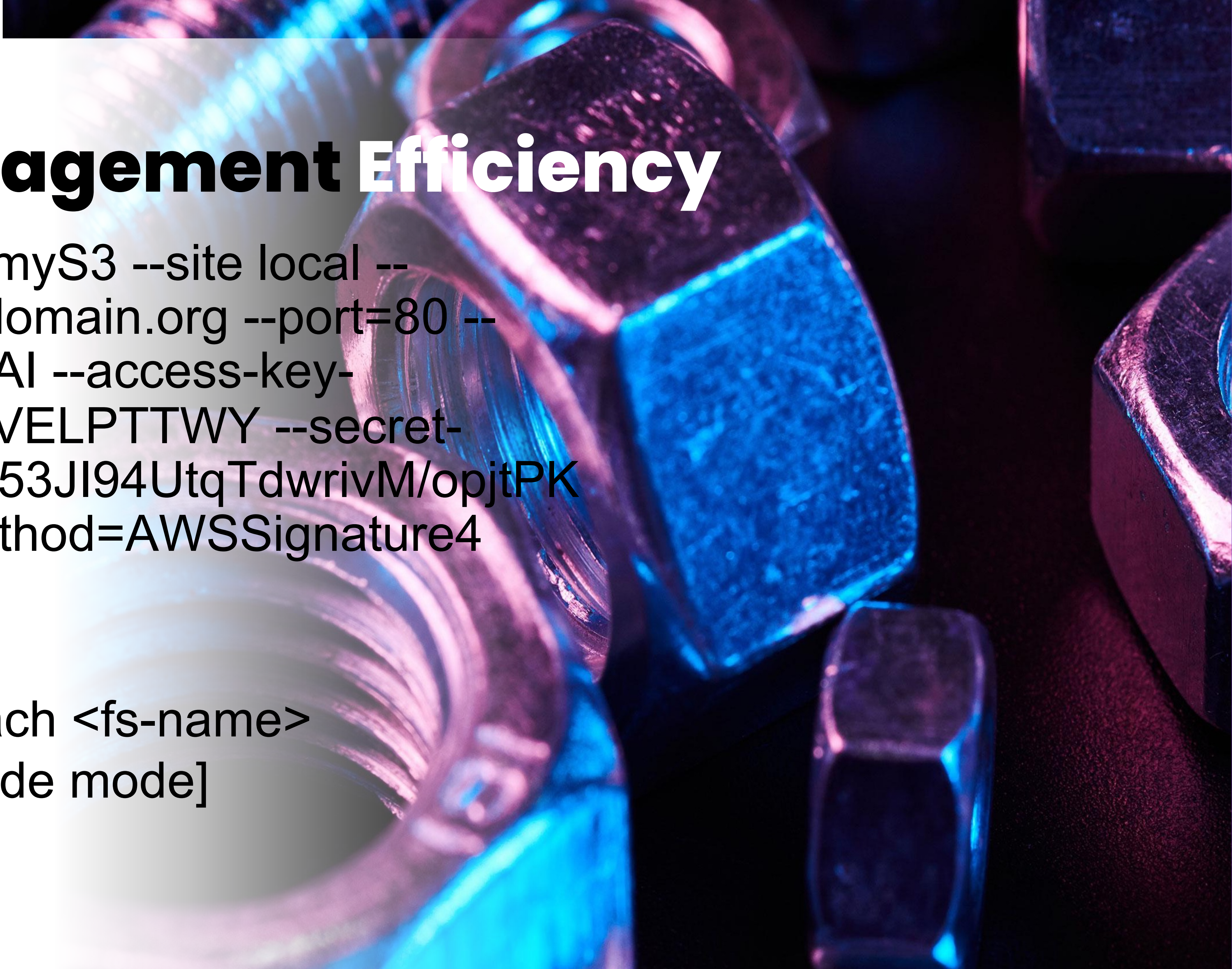
Flexible, easy to use & reliable

A

Data Management Efficiency

weka fs tier s3 add myS3 --site local --
hostname=s3.localdomain.org --port=80 --
bucket=weka-HPC-AI --access-key-
id=AKIA3EOCJV63VELPTTWY --secret-
key=8PN+XWkDUa53JI94UtqTdwrivM/opjtPK
6CSuZi3 --auth-method=AWSSignature4

weka fs tier s3 attach <fs-name>
<obs-name> [--mode mode]

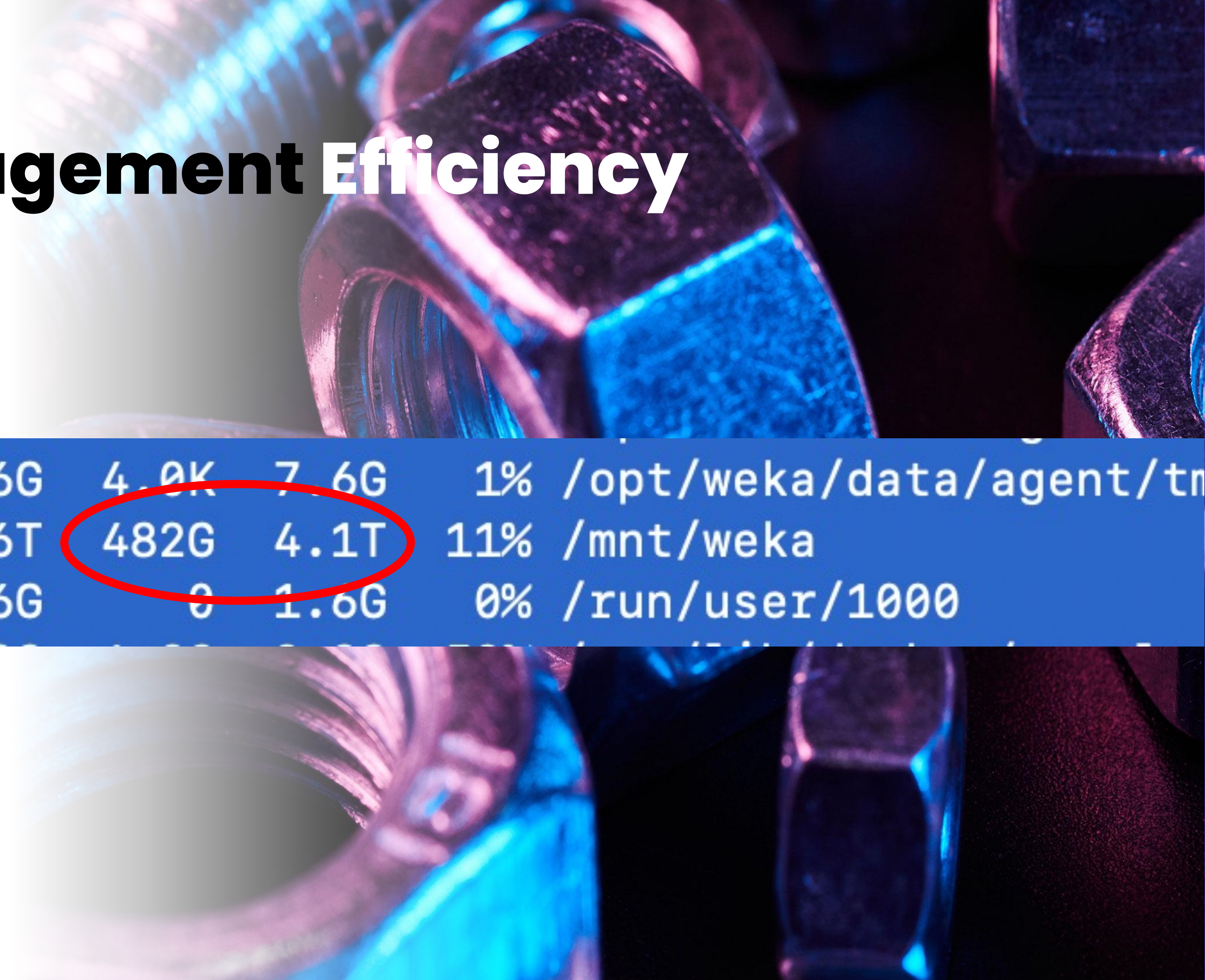


Data Management Efficiency

Status	Tiering	Remote Backup	Encrypted	SSD Capacity	Total Capacity
				176.96 GB out of 400.00 GB (44.2%)	494.77 GB out of 5.00 TB (9.9%)

```
456G     /mnt/weka/
[root@node1 weka]# weka fs
FILESYSTEM ID  FILESYSTEM NAME  USED SSD   AVAILABLE SSD  USED TOTAL   AVAILABLE TOTA
0              default          169.55 GB  400 GB         503.94 GB    5 TB
[root@node1 weka]#
```

Data Management Efficiency



```
tmpfs      7.6G  4.0K  7.6G   1% /opt/weka/data/agent/tm
default    4.6T  482G  4.1T  11% /mnt/weka
tmpfs      1.6G     0  1.6G   0% /run/user/1000
```

WEKA vs Local NVMe

```
    issued rwts: total=0,1249493,0,0 short=0,0,0,0 dropped=0,
    latency   : target=0, window=0, percentile=100.00%, depth

Run status group 0 (all jobs):
  WRITE: bw=26.7GiB/s (28.7GB/s), 26.7GiB/s-26.7GiB/s (28.7GB/

Disk stats (read/write):
    md127: ios=693/10692498, merge=0/0, ticks=0/0, in_queue=0,
  nvme0n1: ios=14/1333226, merge=0/3686, ticks=6/5930341, in_q
  nvme6n1: ios=14/1333162, merge=0/3708, ticks=5/3955353, in_q
  nvme9n1: ios=709/1334830, merge=0/26157, ticks=734/11635935,
  nvme5n1: ios=14/1333124, merge=0/3472, ticks=7/3584518, in_q
  nvme8n1: ios=14/1333106, merge=0/3506, ticks=7/19338552, in_
  nvme1n1: ios=14/1333110, merge=0/3627, ticks=5/12946548, in_
  nvme4n1: ios=14/1333130, merge=0/3466, ticks=6/3689937, in_q
  nvme7n1: ios=14/1333148, merge=0/3550, ticks=8/4742643, in_q
root@a100:~# fio fio.job.axel.local --section=W1024ds
W1024ds: (g=0): rw=rw, bs=(R) 1024KiB-1024KiB, (W) 1024KiB-102
...
fio-3.35
Starting 230 processes
Jobs: 230 (f=230): [W(230)][49.0%][w=25.2GiB/s][w=25.8k IOPS][
```

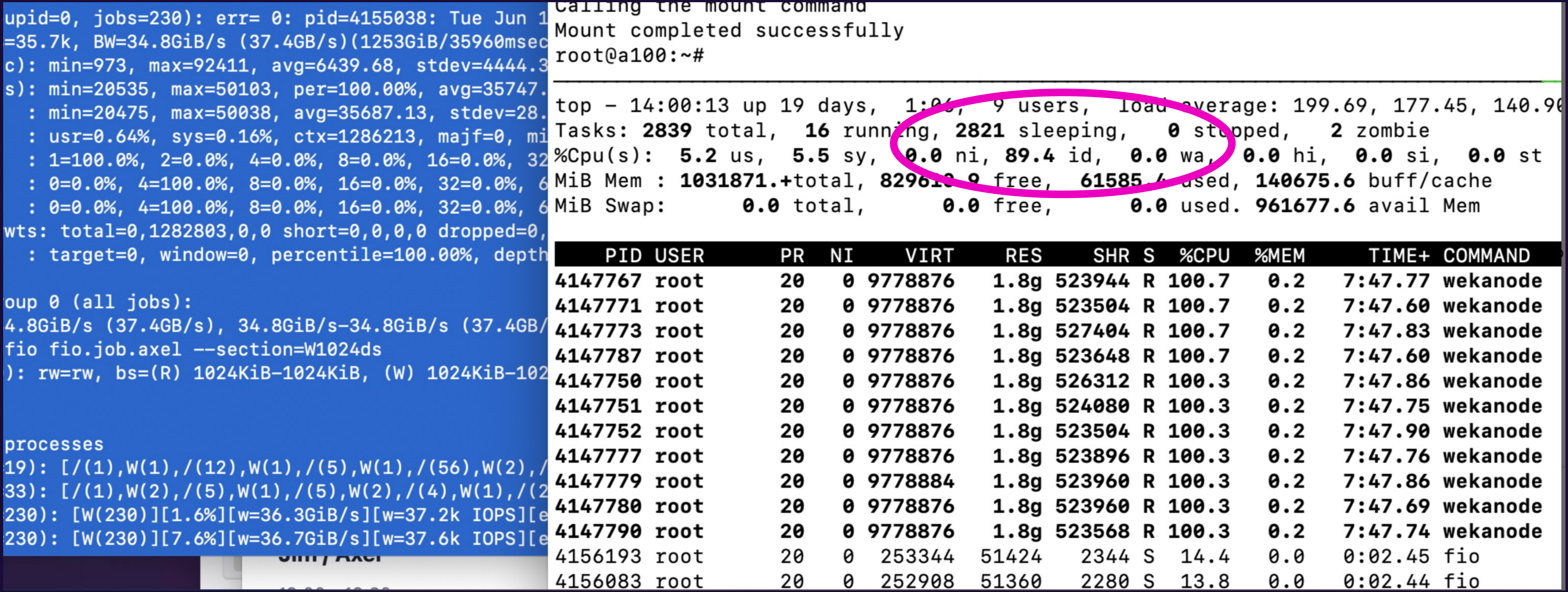
```
1.5T     /raid/axel/0
root@a100:~#

top - 13:49:21 up 19 days, 55 min,  0 users,  load average: 197.68, 120.84, 92.37
Tasks: 2750 total,   2 running, 2745 sleeping,   0 stopped,   3 zombie
%Cpu(s):  0.1 us,  0.7 sy,  0.0 ni, 30.9 id, 68.3 wa,  0.0 hi,  0.0 si,  0.0 st
MiB Mem : 1031871.+total, 858061.4 free,  38533.4 used, 135277.0 buff/cache
MiB Swap:      0.0 total,      0.0 free,      0.0 used. 988025.2 avail Mem

    PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM     TIME+ COMMAND
  11900 root      20   0 9491440 225468  24048 S   6.2   0.0   1135:44 nvsm_core
4141930 root      20   0  318312 104496  50436 S   7.9   0.0   0:12.54 fio
3685945 root      20   0 7730272  99808  23940 S   0.3   0.0  51:55.84 weka
  16717 root      20   0 4499288  83276  20048 S   0.0   0.0  70:53.46 nvsm_api_gat
3706264 root      20   0 6858400  78904  20852 S   0.0   0.0   3:19.63 snapd
  11892 root      20   0 9879.1m  71012  50632 S   0.0   0.0  38:54.31 dockerd
4141968 root      20   0  253104  51352   2236 D   1.0   0.0   0:01.26 fio
4142107 root      20   0  253656  51332   2216 D   1.0   0.0   0:01.22 fio
4141975 root      20   0  253132  51328   2212 D   1.0   0.0   0:01.28 fio
4141979 root      20   0  253148  51328   2212 D   1.0   0.0   0:01.29 fio
4142105 root      20   0  253648  51300   2184 D   0.7   0.0   0:01.19 fio
4142102 root      20   0  253636  51284   2152 D   0.7   0.0   0:01.24 fio
```

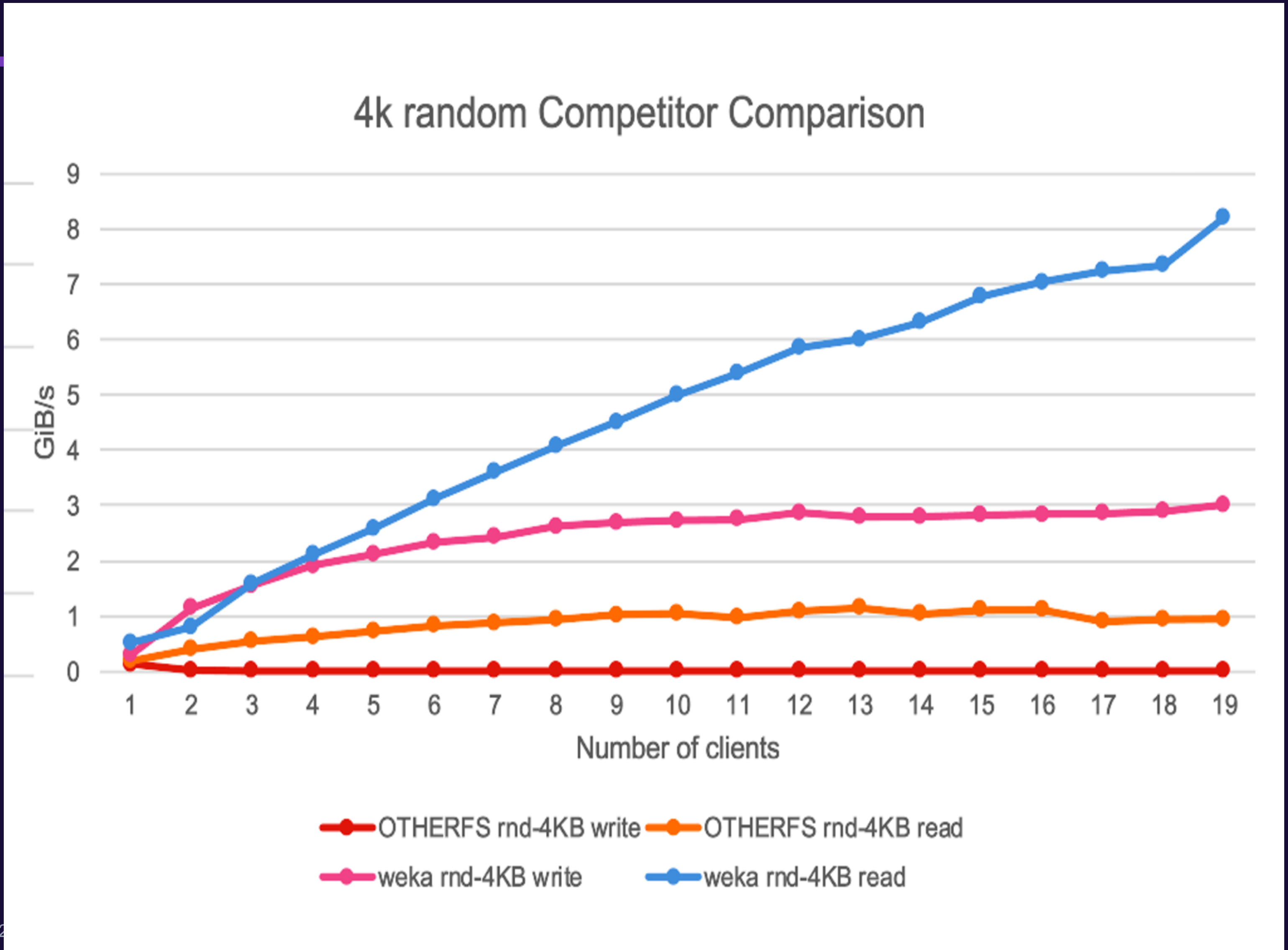

WEKA

WEKA vs Local NVMe



WEKA

WEKA vs OTHERFS



HPC/AI & Multicloud aka Cloud-Bursting

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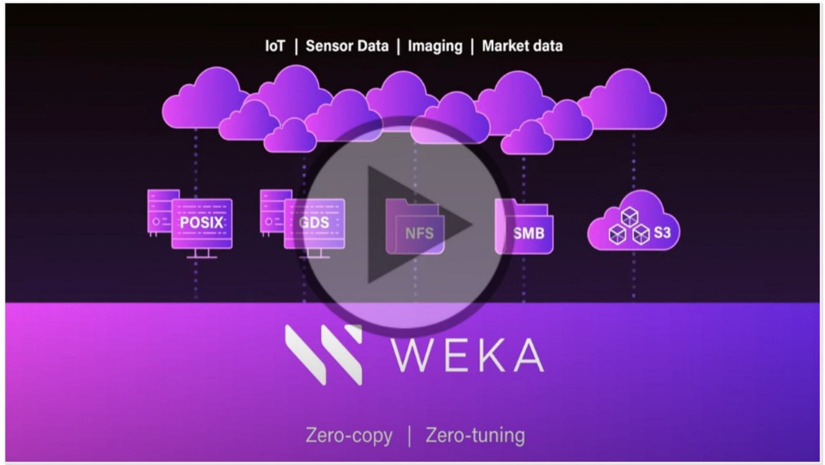
WEKA Data Platform is the fastest storage platform for compute accelerated applications.

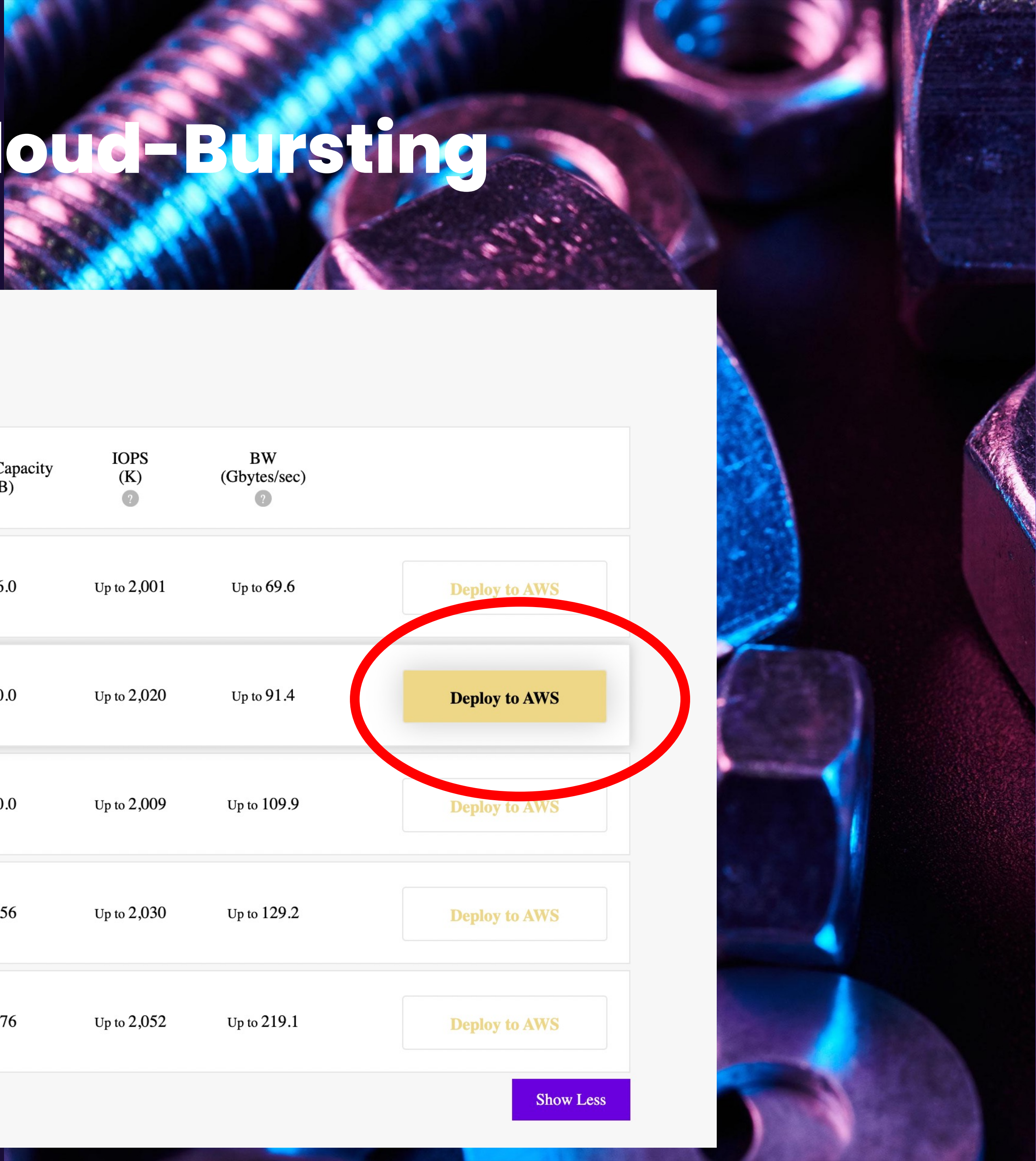
Experience up to 10x data pipeline velocity improvements over traditional and cloud-based storage solutions, saving time and money.

Application environments that need low-latency access to millions of small files and high bandwidth for large files have limited storage options. The WEKA Data Platform combines dense NVMe storage of Azure Virtual Machine Lsv3-series instances with Azure Blob Storage in a single, efficient namespace, for your high-performance workloads, scaling to billions of files and hundreds of petabytes. It has a rich feature set that includes transparent object tiering, instantaneous snapshots, snap-to-object (remote clouds), backup, disaster recovery ("DR"), encryption, quotas, Active Directory integration, Kubernetes CSI driver, and much more. The WEKA Data Platform supports multiple file service protocols including full POSIX, NFS, SMB and S3, with full data share-ability across protocols. The WEKA Data Platform delivers the speed, simplicity and scalability for demanding workloads including AI, machine learning, visual effects rendering, genomics, high frequency trading, data analytics, and software builds.



WEKA Data Platform Cloud Edition

HPC/AI & Multicloud aka Cloud-Bursting



Start with
Your Requirements

CAPACITY

Total Capacity: 500 TB

Tiering: SSD Only / SSD+S3

☑ PERFORMANCE

● IOPs ○ BW

R/W: 0 %

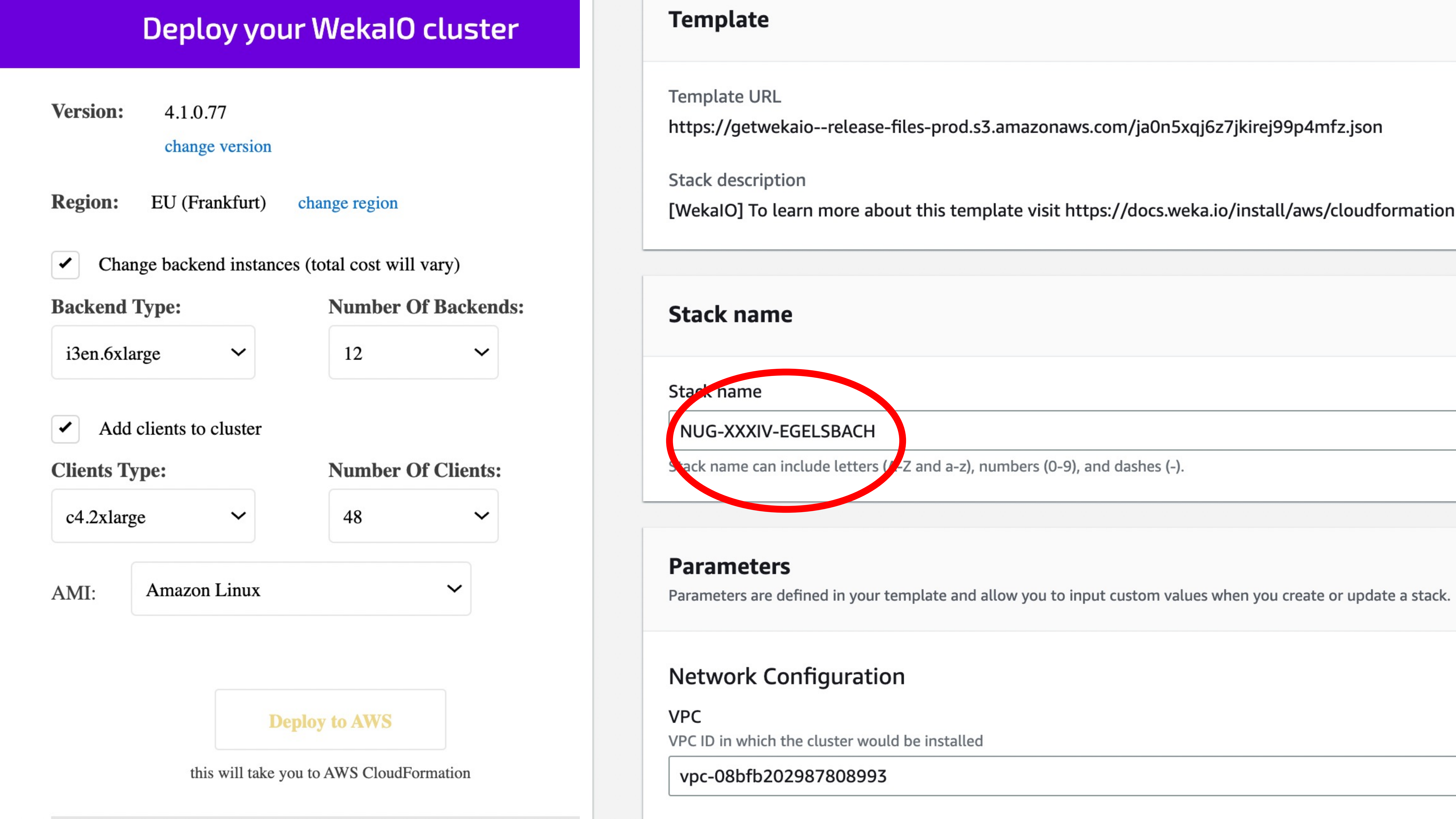
IOPs: 2000 K

Region: EU (Frankfurt)

View all
Your Options

Instance Type	Cluster Size	Usable Capacity (TB)	IOPS (K)	BW (Gbytes/sec)	
i3en.2xlarge	150	596.0	Up to 2,001	Up to 69.6	Deploy to AWS
i3en.6xlarge	66	780.0	Up to 2,020	Up to 91.4	Deploy to AWS
i3en.3xlarge	151	900.0	Up to 2,009	Up to 109.9	Deploy to AWS
i3en.12xlarge	45	1,056	Up to 2,030	Up to 129.2	Deploy to AWS
i3en.24xlarge	38	1,776	Up to 2,052	Up to 219.1	Deploy to AWS

Show Less



Deploy your WekaIO cluster
Version:
4.1.0.77
change version
Region:
EU (Frankfurt)
change region
Change backend instances (total cost will vary)
Backend Type:
i3en.6xlarge
Number Of Backends:
12
Add clients to cluster
Clients Type:
c4.2xlarge
Number Of Clients:
48
AMI:
Amazon Linux
Deploy to AWS
this will take you to AWS CloudFormation
Template
Template URL
https://getwekaio--release-files-prod.s3.amazonaws.com/ja0n5xqj6z7jkirej99p4mfz.json
Stack description
[WekaIO] To learn more about this template visit https://docs.weka.io/install/aws/cloudformation
Stack name
Stack name
NUG-XXXIV-EGELSBACH
Stack name can include letters (A-Z and a-z), numbers (0-9), and dashes (-).
Parameters
Parameters are defined in your template and allow you to input custom values when you create or update a stack.
Network Configuration
VPC
VPC ID in which the cluster would be installed
vpc-08bfb202987808993

Thank You!

@wekaio   /wekaio   @wekaio