



Advancing Object Storage for Extreme Scale

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www.sagestorage.eu

The SAGE2 project has received funding from the European Union's Horizon2020 Research & Innovation Programme under grant agreement 800999

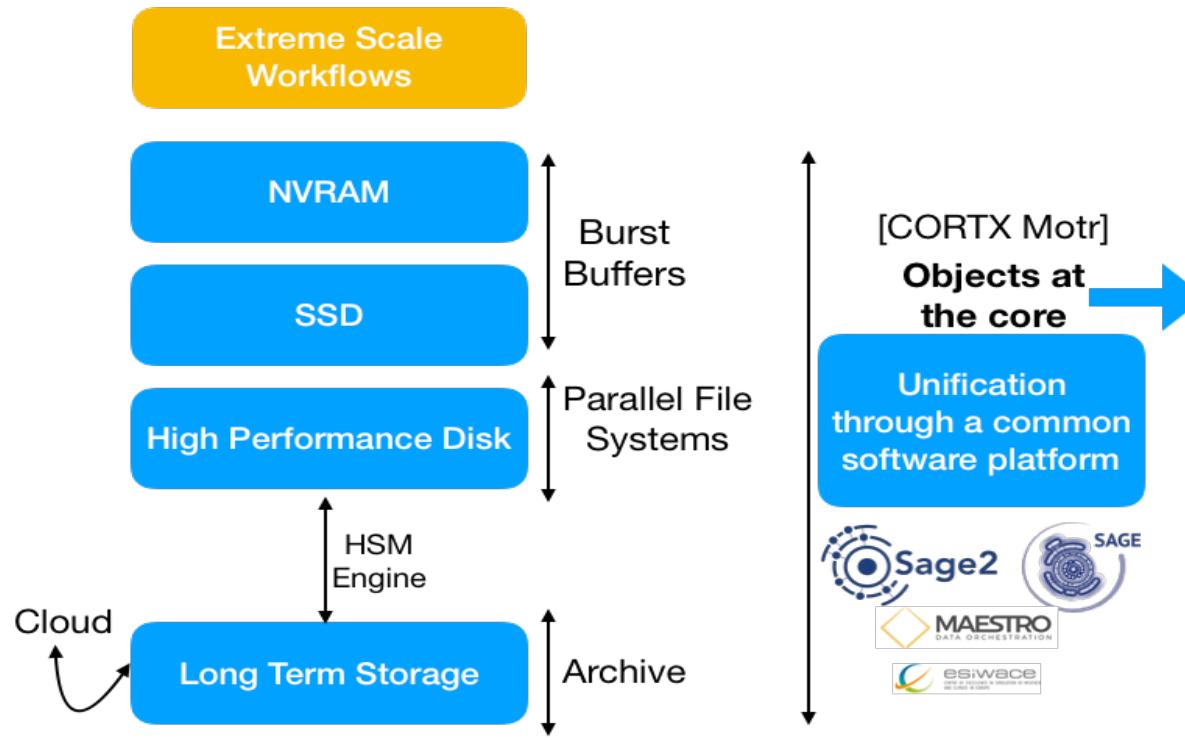
Object Stores in the realm of Extreme scale Computing

- ★ Object Stores – Designed originally to store unstructured data
- ★ Object stores - stores data in a flat hierarchy with each “objects” uniquely accessible, as opposed to traversing a file system tree
- ★ Extremely relevant for cloud storage (Think Amazon S3 buckets) as a storage backend to many web applications, etc
- ★ Are Object stores relevant for HPC and Extreme Scale computing?
- ★ A series of requirements gathering workshops with HPC community (Circa ~2012 onwards)
 - ★ Reported in: <http://www.pdsw.org/pdsw-discs16/wips/danilov-wip-pdsw-discs16.pdf>



Object store: Provision of the functionalities for extreme scale

Support for POSIX



Transaction Management

Support for PMEM & Storage Tiers

Unified Telemetry

Pluggability of Third party Data Management Tools

Cloud Ingest

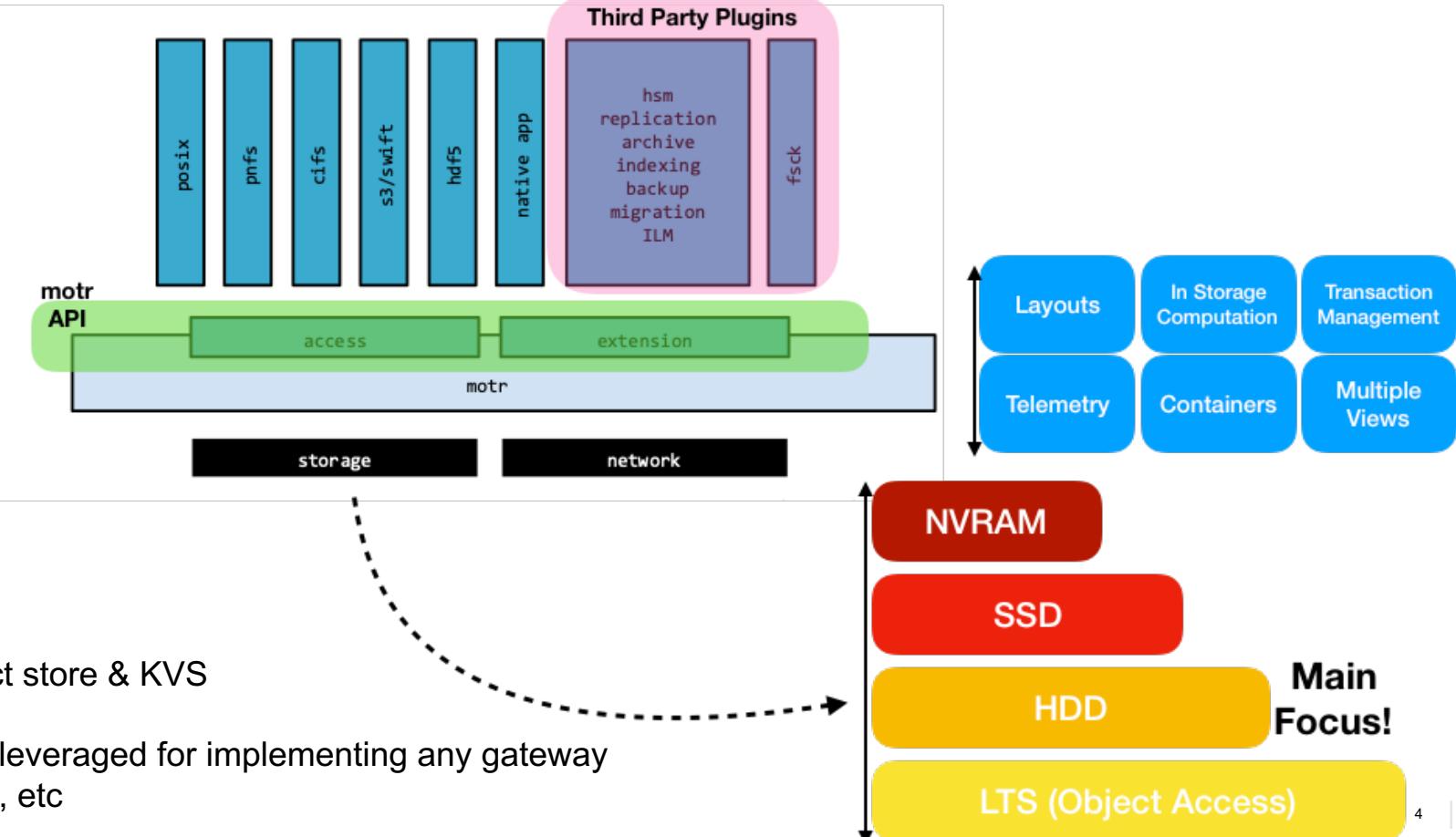
I/O middleware libraries Support

SAGE2

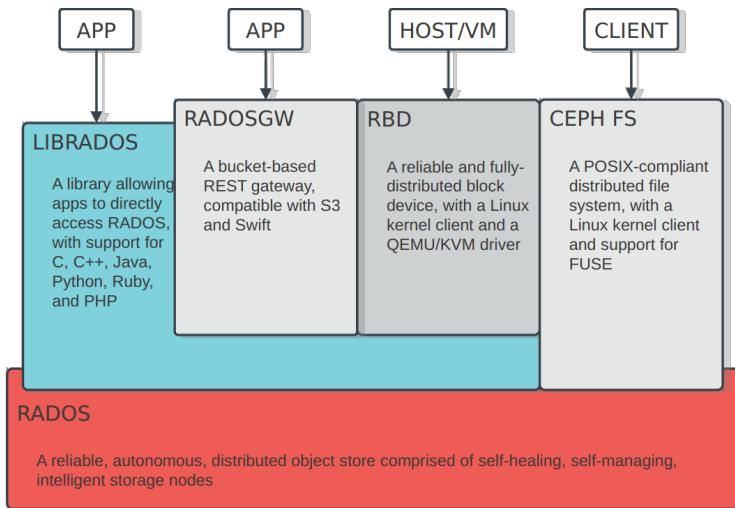
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Motr is the open source version of formerly "Mero"

CORTX Motr Architecture



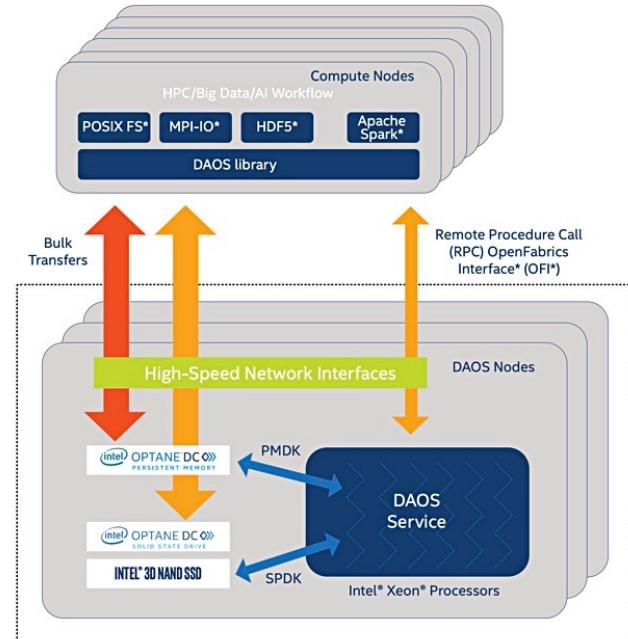
Other Object Stores approach (eg: Ceph and DAOS)



Ref: Redhat

DAOS Service = Motr Services = RADOS

LIBRADOS = DAOS Library = Motr API



Ref: Blocks and Files

<https://blocksandfiles.com/2019/11/28/intel-daos-high-performance-storage-file-system-explainer/>

Note: Interesting complementarities!
They all have a role to play



Sage2 EU R&D project (2018 – 2021)



SEAGATE
UK



France



UK



France



Germany



UK



UK



France

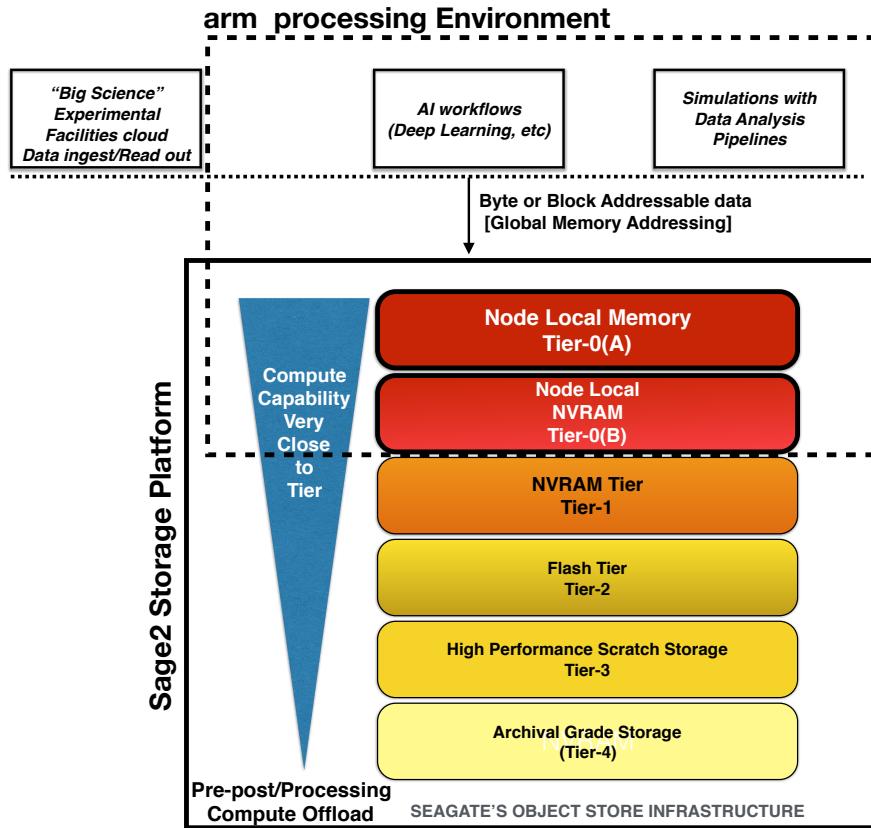


Sweden

Cortex demonstrated in real world
Exascale HPC/AI
use cases



Sage2 Summary: Exploring the next generation of Object Storage Features



Vision:

Extending storage systems into Compute nodes & blurring the lines between memory & storage

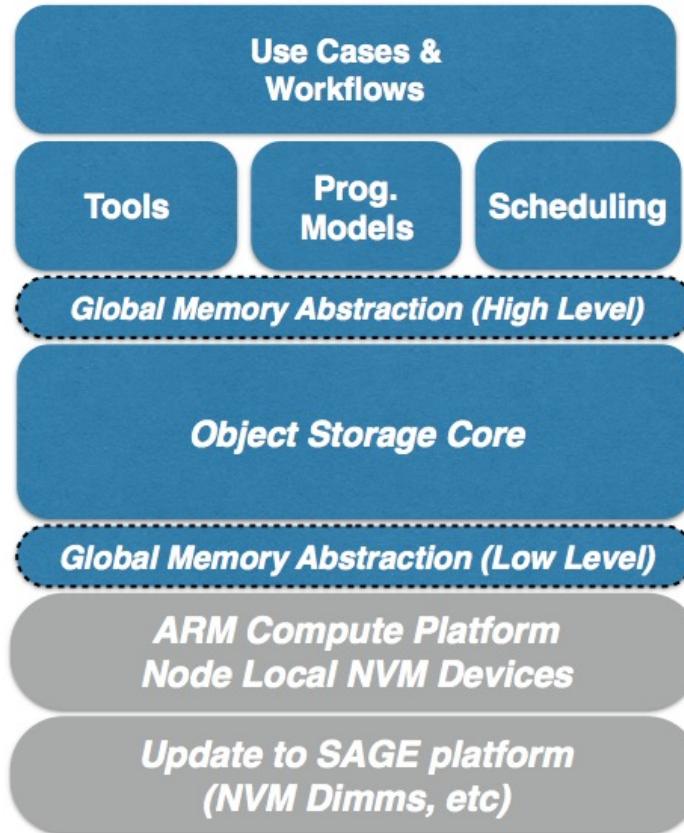
Four primary Innovations

- 1. Compute node local Memories** part of storage stack
- 2. Byte Addressable extensions** into Persistent storage (Global Memory Abstraction)
- 3. Co-design** with new workflows: Mainly Data analytics pipelines w/ AI/Deep learning
- 4. Co-design with ARM based environments –** moving towards European HPC Ecosystem Goals.

AI/DL use cases expected to be memory intensive & will exploit node local memory which will need to be extended



Sage2 - Key Stack Components



Tools/ Prog. Models/Schedulers

- dCache, High Speed Object Transfer, I/O Containers, TensorFlow, Slurm for Mero, Object access Prog. Mod, Simple Access Interface

GMA

- High Level – API for mapping Objects in Memory
- Low Level – Incorporating NVDIMMs

Object Storage Core

- Motr for GMA
- Motr extreme scale comps. - QoS, DTM, Function Shipping
- Motr for Sage2 (Incl. ARM port)

ARM

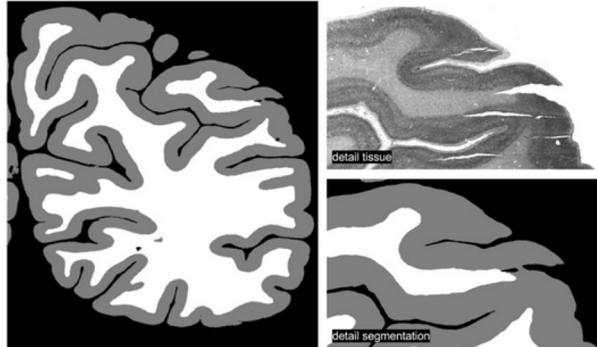
- ARM support for NVDIMMs



Sage2 Use Cases

AI Based Data Analysis
[1] Cervical Cancer Diagnosis

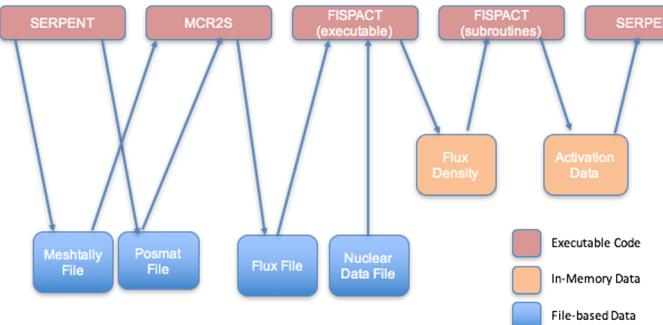
AI Based Data Analysis
[2] Multi-label Classification of Large Videos



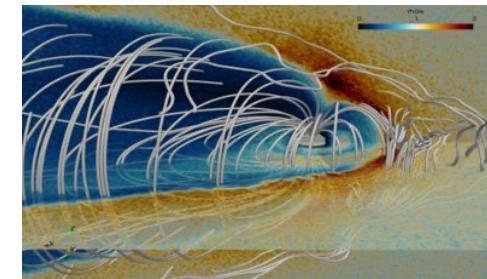
[3] Brain Image Data Analysis

Machine Learning
[6] Tensorflow for machine learning monitoring data

[5] Multi-Physics
Multi-stage workflows
(Nuclear Fusion)



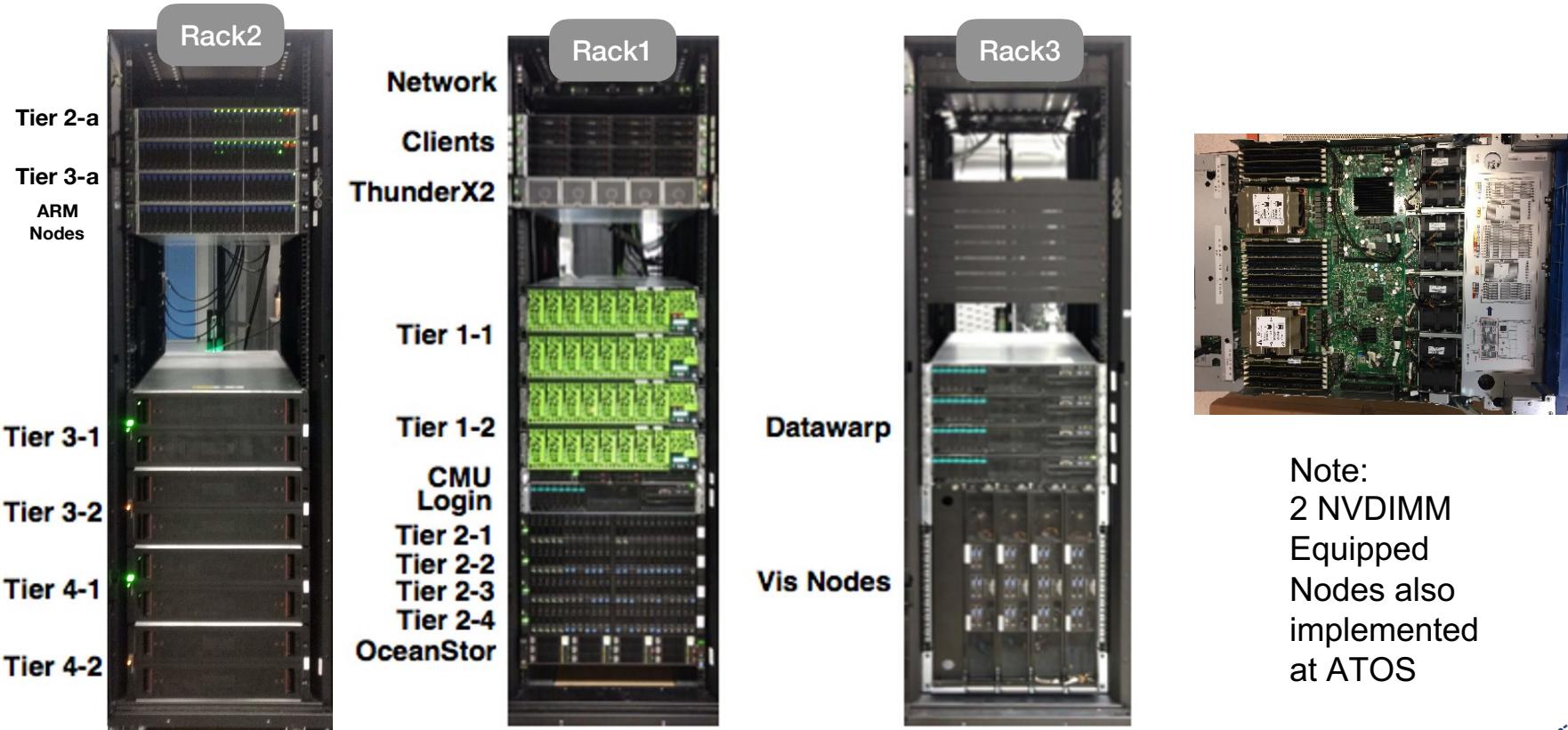
[4] Radio Astronomy Data Analysis



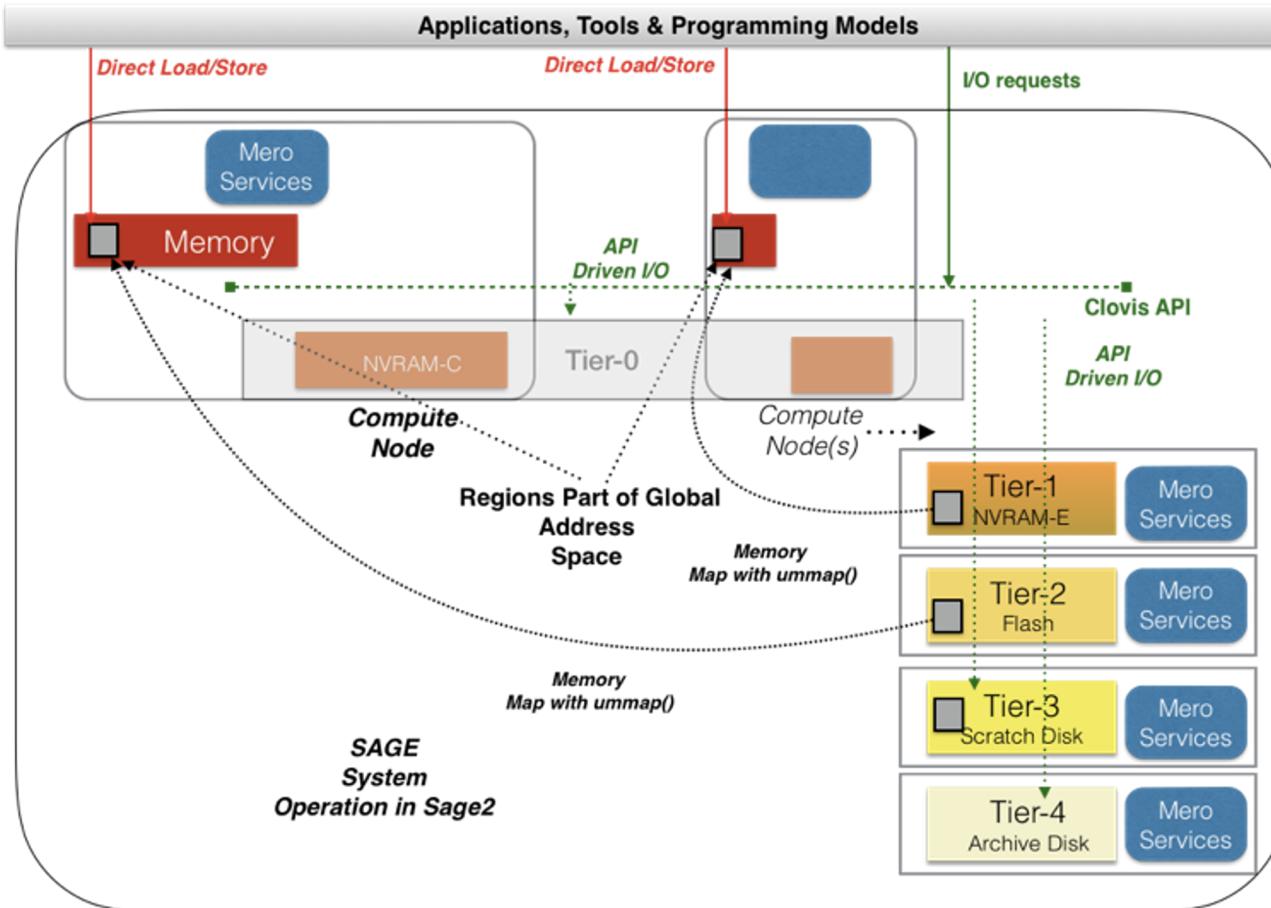
[7] Classic HPC Applications



SAGE Prototype at Juelich



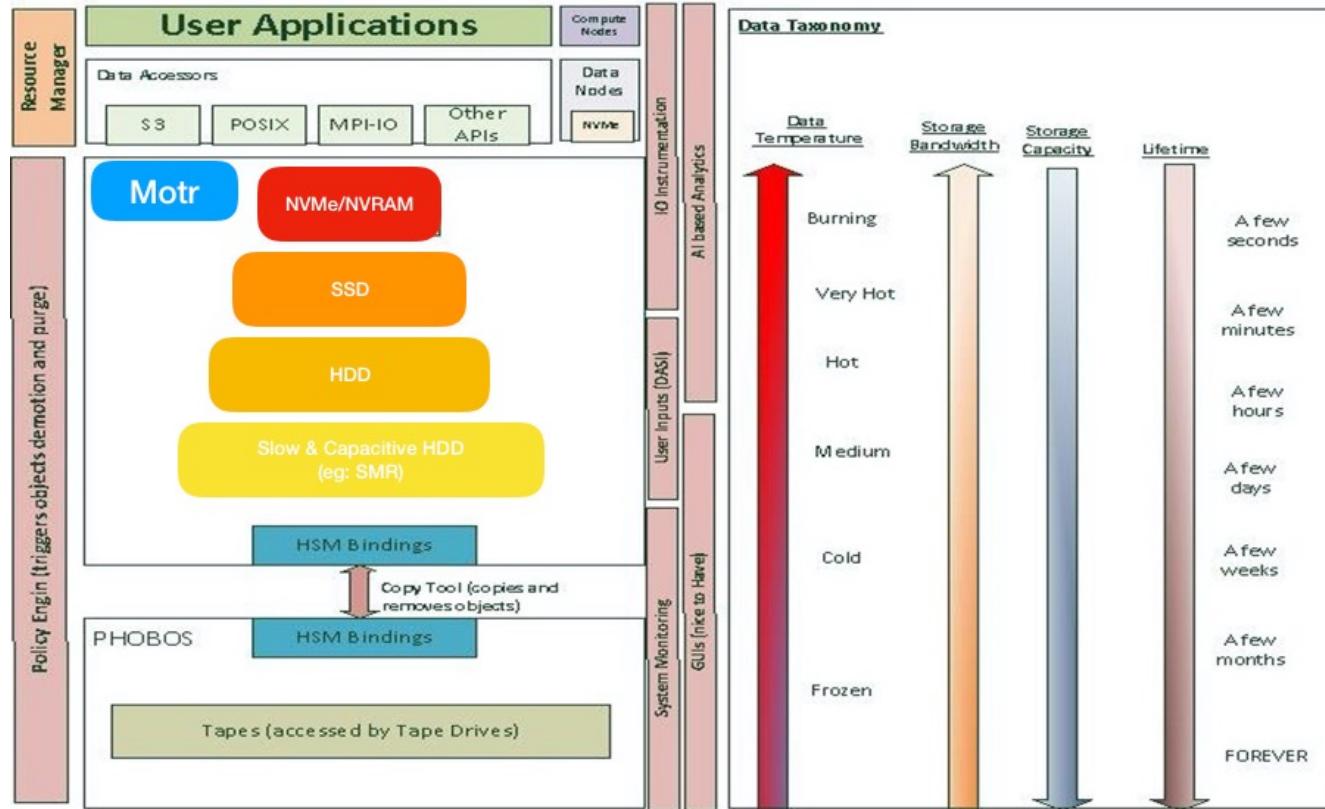
Sage2 System Operation with Motr



Please note NVRAM-C & NVRAM-E are Sage2 specific terms



Going forward – Motr in the IO-SEA Project



Sage2 Status – July 2021

- **Application Porting on Motr on the SAGE platform in progress**
- **Implementation of the Motr components & GMA & ARM porting**
- **Ecosystem tools – Implementation & Porting**
- **Performance Analysis**

Interested to test drive Motr/CORTX?

<https://github.com/Seagate/cortx>

Interested to test drive SAGE?

info@sagestorage.eu

Hackathons actively in progress, where we invite external community



Thank You

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