sage [1] (sāj)
n.
One venerated for experience, judgment, and wisdom.
adj. **sag·er, sag·est**
1. Having or exhibiting wisdom and calm judgment.
2. Proceeding from or marked by wisdom and calm judgment: *sage advice.*

Percipient **S**tor**AG**e for **E**xascale Data Centric Computing

Project Summary and Overall Strategy

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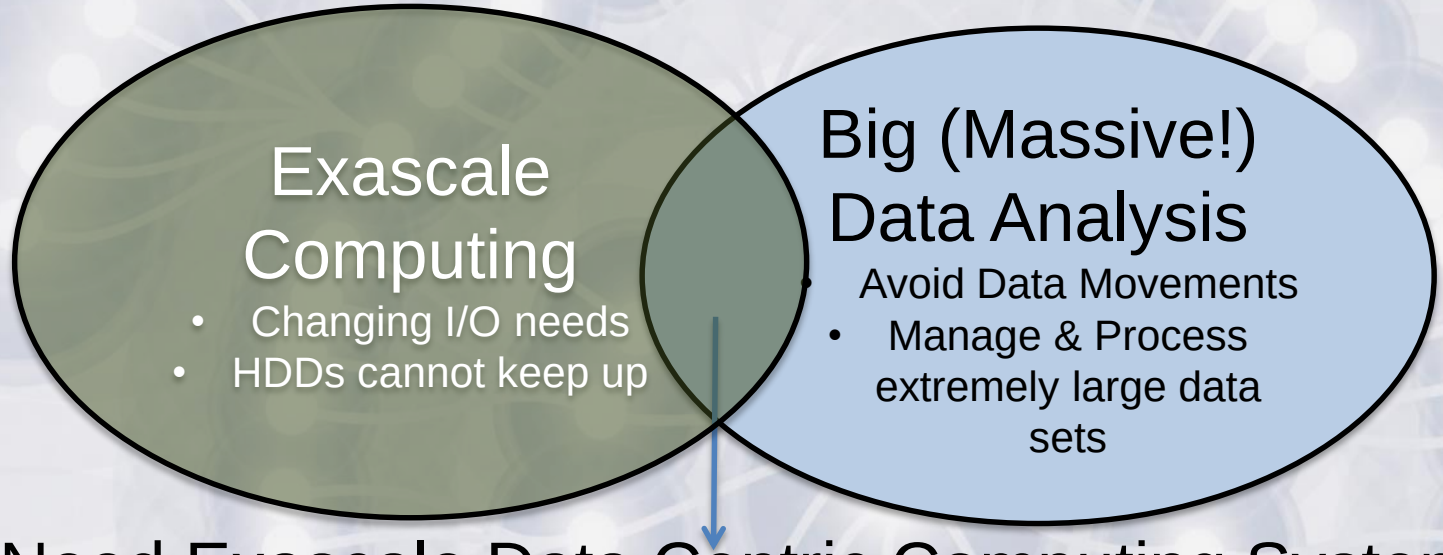
Seagate Systems UK

EXDCI Prague 2016 –10/05/2016

Per-cip-i-ent (pr-sp-nt)
Adj.
Having the power of perceiving, especially perceiving keenly and readily.
n.
One that perceives.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 671500



Need Exascale Data Centric Computing Systems

Big **D**ata **E**xtreme **C**omputing (*BDEC Systems*)

SAGE Validates a BDEC System which can Ingest, Store, Process and Manage extreme amounts of data

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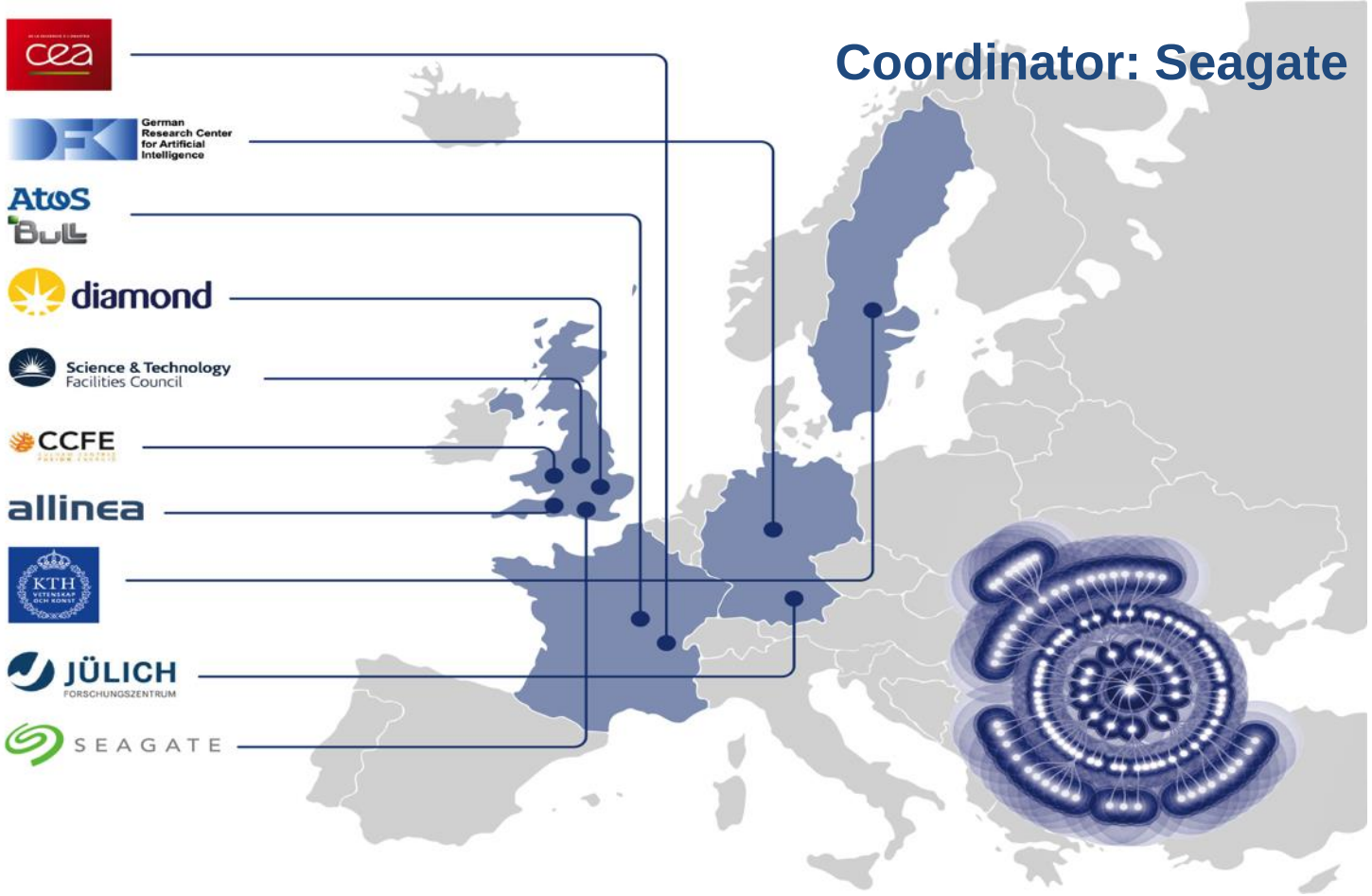
Project Goal

Coordinator: Seagate



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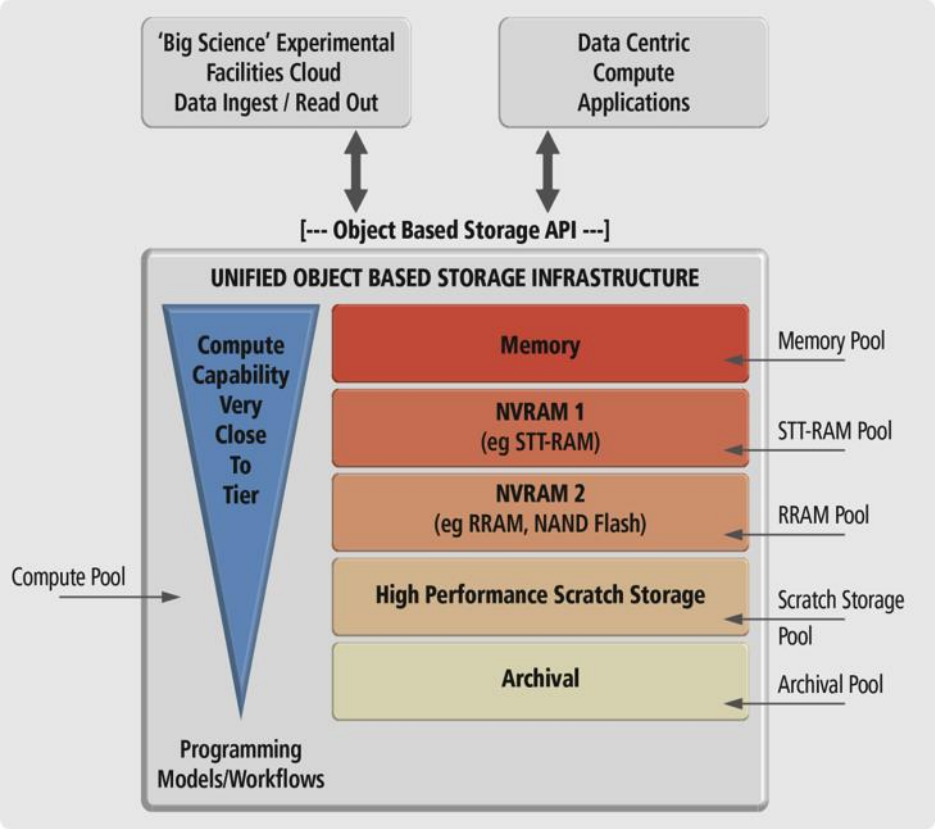
Consortium



- **Goal**
  - Build the data centric computing platform
- **Methodology**
  - Commodity Server & Computing Components in I/O stack
  - **New NVRAM Technologies** in I/O stack
  - **Ability for I/O to Accept Computations**
    - Incl. Memory as part of storage tiers
  - **API** for massive data ingest and extreme I/O

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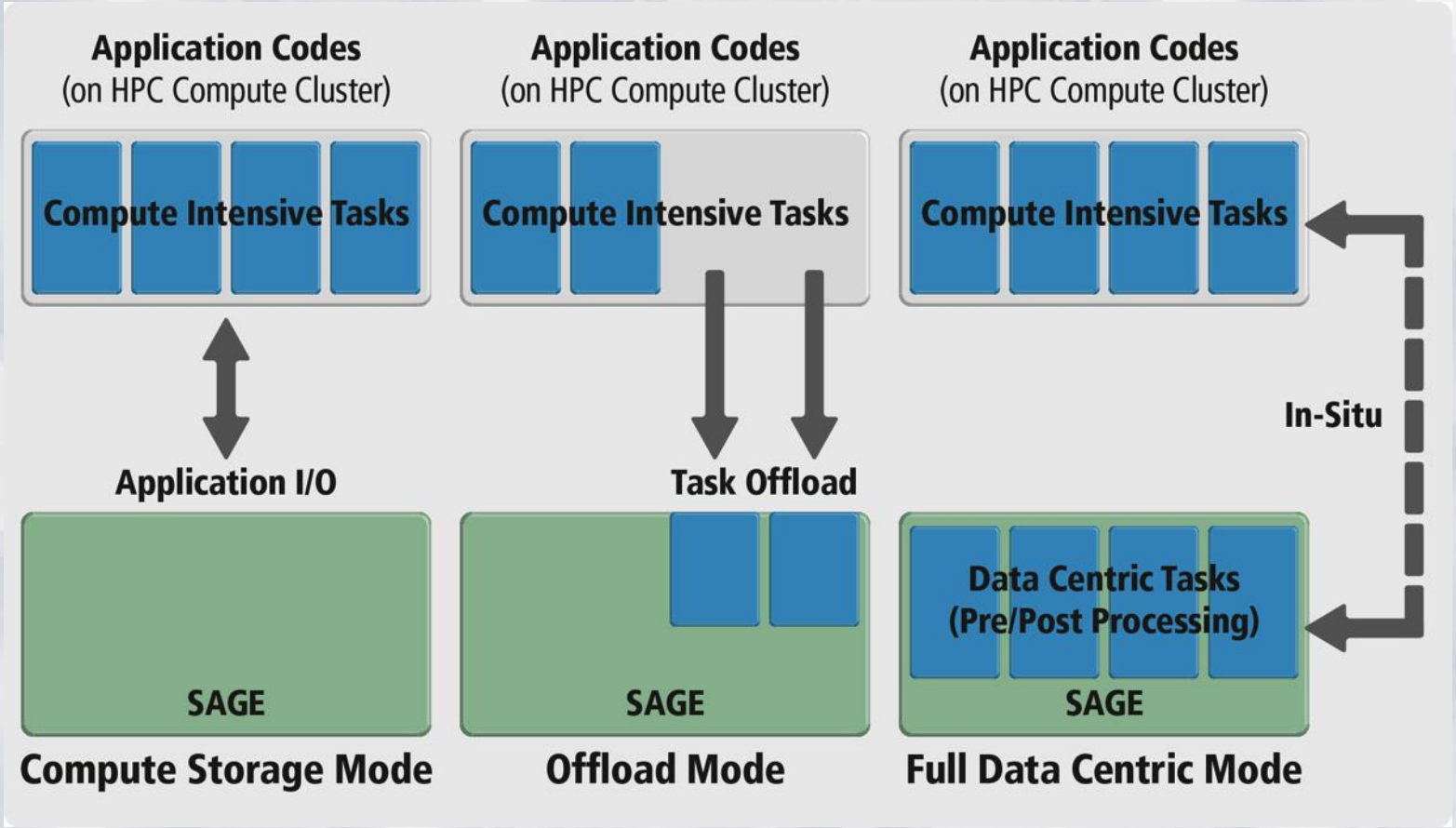
"Percipient Storage": Architecture Overview



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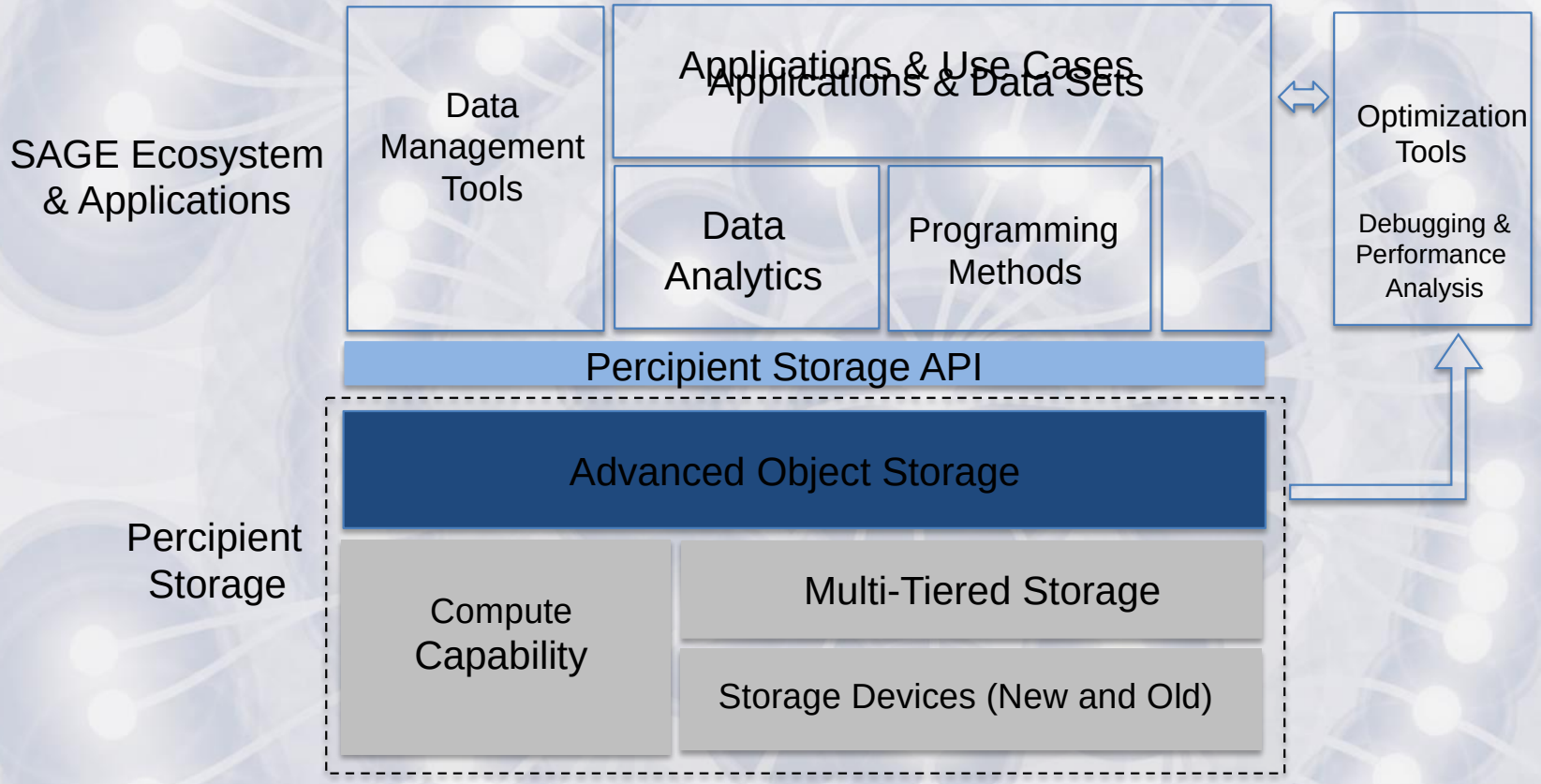
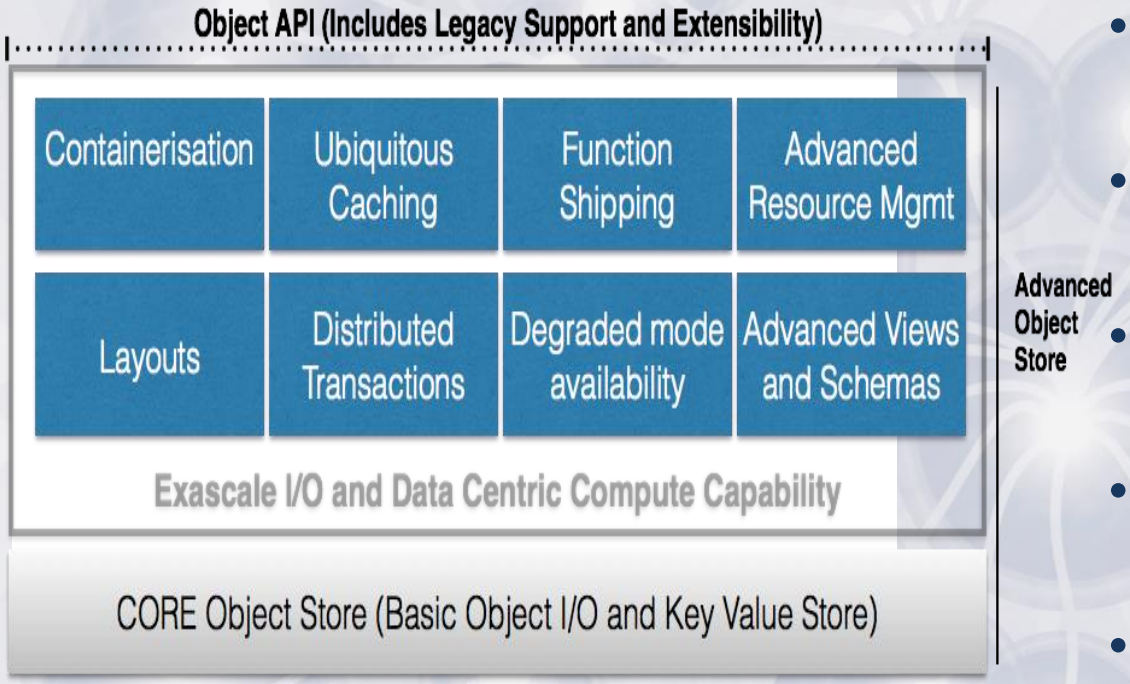
Percipient Storage Usage: Vision



Percipient Storage System Stack



- Extreme I/O handling
- Infrastructure fault handling
- Enable Application Resiliency
- Handle Computations from apps
- Different views to same data
- Complex data layouts & caches in I/O hierarchy

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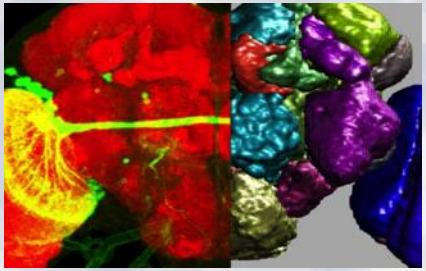
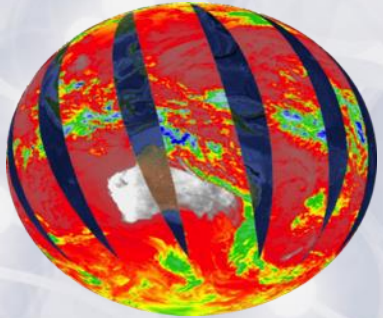
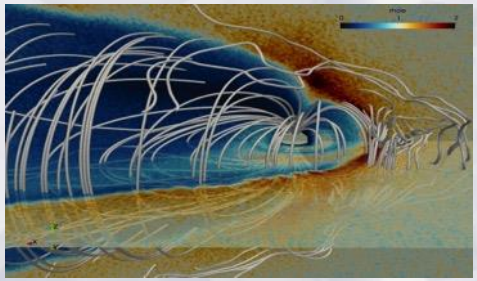
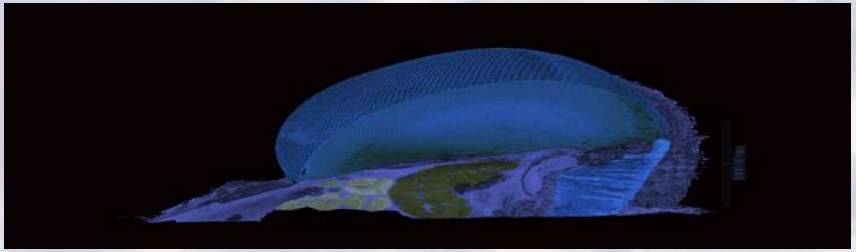
Advanced Object Storage (w/ Clovis API)









- **Overall Goal**
  - Demonstrate value with SAGE at Juelich Supercomputing Center
- **Methodology**
  - Obtain Requirements from:
    - Visualization
    - Satellite Data Processing
    - Bio-Informatics
    - Space Weather
    - Nuclear Fusion (ITER)
    - Synchrotron Experiments
  - Extrapolate needs to Exascale

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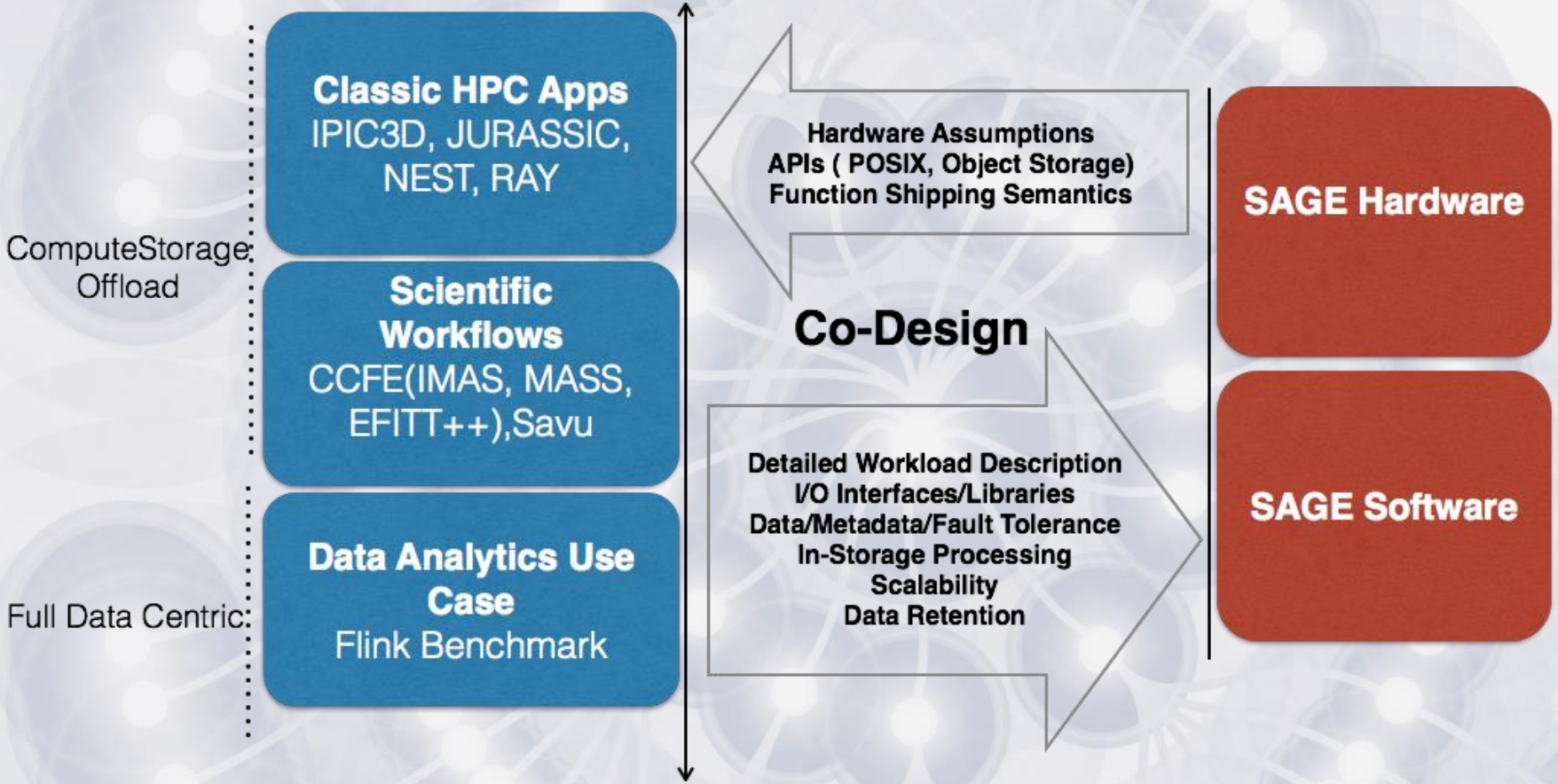
Applications & Co-Design



Co-Design in SAGE

Rack 1

Rack 2

Tier	H/W Tier	Storage Technologies	Storage Enclosure
Local compute/GPU/ visualization (Not part of the core SAGE storage system)	0	N/A	 Bull RX
Memory	1a	RAM	 Bull Bullion S
NVRAM 1	1b	NVRAM (NVDIMM / new tech)	
NVRAM 2	1c	NVRAM - FLASH NVMe	
	2	NVRAM – FLASH 2.5" SSD	 Seagate OneStor 2U24
Scratch or Archive (optional)	3 /4	Tier 3: Fast 3.5" SAS disk Tier4: Cost optimised 3.5" SATA disk	 Seagate OneStor 5U84

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Validation System

- Application Analysis, Co-Design Inputs & Platform definition Complete
- Function Shipping Extensions Design Complete
- HSM Tools Design Complete
- Integrity Checking tools Design Complete
- Data Analytics Tools Interface Design Complete
- Legacy Parallel File System Access Design Complete

Current Progress & Outlook

- M-BIO-1: Tightly coupled **Storage class memory io systems** demo
- M-BIO-3: **Multi-tiered** heterogeneous storage system demo
- M-BIO-5: **Big data analytics tools** developed for hpc use
- M-BIO-6: '**Active Storage**' capability demonstrated
- M-BIO-8: Extreme scale **multi-tier data management** tools available
- M-ARCH-3: New compute nodes and **storage architecture use nvram**
- M-ENER –X: Addresses **Energy goals** by avoiding data movements
  - 100x more energy to move data compared to compute!!
- M-ENER-FT-10: Application survival on unreliable hardware

SRA2 Alignment

- Co-operation
  - Links with CoE: EsiWACE
  - FP7 Project(s): EpiGRAM
  - Other International: Nuclear Fusion Community - ITER
  - Planning to explore bringing Analytics & HPC community together
- Leveraging EXDCI
  - Better homogenization of European HPC players towards common solutions
- Role in Extreme scale demonstrators
  - We expect SAGE to be the foundation for at least 1 ESD – where Data Centric Operational characteristics are critical!

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International Co-operation

Questions ?

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