



Casting the Net: Scaling Management of Storage and Fabrics

Composable resource management for disaggregated infrastructures

Live Webinar

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About the Presenters



Phil Cayton

Senior Staff Engineer, Intel

Phil Cayton is a Senior Staff Engineer at Intel where he has spent 28 years researching and developing scalable non-volatile local and remote storage, distributed compute infrastructure management, and HPC fabrics technologies.

Phil drives enablement of new technologies and standards strategies; he has been developing architecture and prototypes for both InfiniBand and NVMe/NVMe-oF since their inception. Phil has been involved with industry standards and initiatives for many years and has worked on, and developed industry prototypes for, multiple industry specifications including most members of the NVMe family of specs, the SNIA Swordfish specification, and several OpenFabrics Alliance initiatives.

He currently serves as the OFA Vice-Chair, OFA Marketing Working Group Co-Chair, Co-Chair of the NVMe Consortium Boot Task Group, a technical lead for SNIA SSM, and he sets the agenda for the NVMe Consortium Technical Working Group, helping drive the NVMe specification family forward.

About the Presenters



Richelle Ahlvers

Storage Technology
Enablement Architect, Intel

Richelle is a Storage Technology Enablement Architect at Intel, where she promotes and drives enablement of new technologies and standards strategies. Richelle has spent over 25 years in Enterprise R&D teams in a variety of technical roles, leading the architecture, design and development of storage array software, storage management software user experience projects including mobility, developing new storage industry categories including SAN management, storage grid and cloud, and storage technology portfolio solutions.

Richelle has been engaged with industry standards initiatives for many years and is actively engaged with many groups supporting manageability including SNIA, DMTF, NVMe, OFA and UCle. She is Vice-Chair of the SNIA Board of Directors, Chair of the Storage Management Initiative, leads the SSM Technical Work Group developing the Swordfish Scalable Storage Management API, and has also served as the SNIA Technical Council Chair and been engaged across a breadth of technologies ranging from storage management, to solid state storage, to cloud, to green storage. She also serves on the DMTF Board of Directors as the VP of Finance and Treasurer.

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Agenda

- Composable Disaggregated Systems and Infrastructures Explained
- Resource Management In Heterogenous Infrastructures
- How standards-based management helps solve large scale problems
- Architecture and deep-dive - OpenFabrics Management Framework
- Call to Action

Composable Disaggregated Infrastructures

Traditional compute clusters are created by combining compute servers over network fabrics

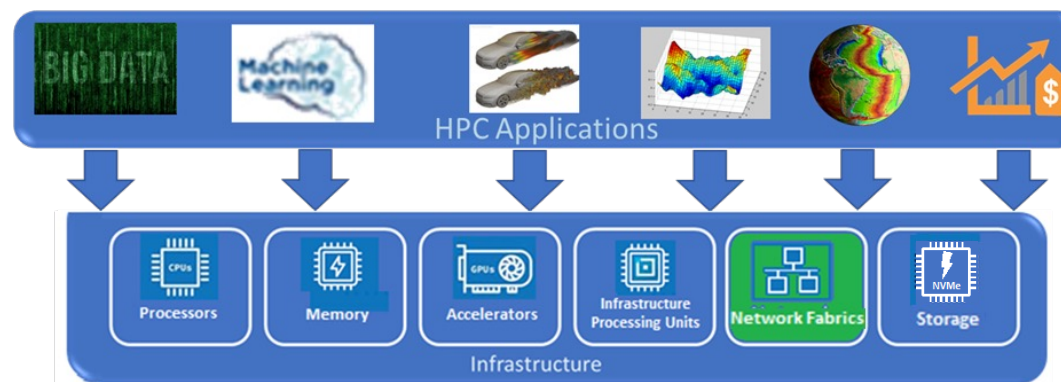
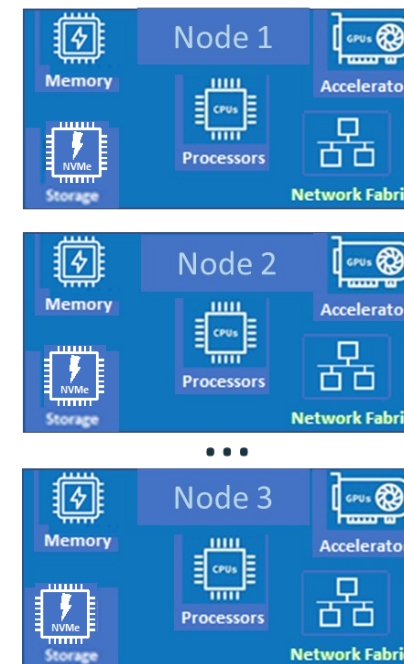
- individual compute servers are statically provisioned
- often results in overprovisioning or stranded resources

Composable Disaggregated Infrastructure (CDI)

- Computational resources are physically separated over high-speed/low-latency fabrics
- Computational resources are dynamically composable, as needed, into a computer system

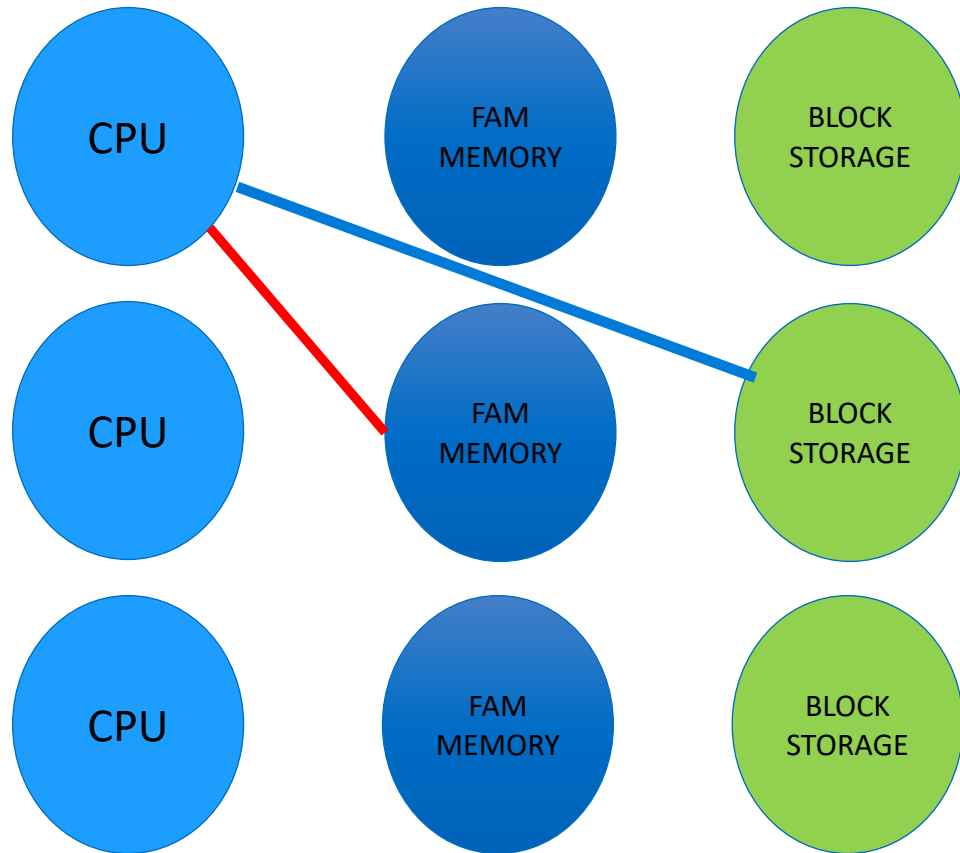
Composable HPC and Enterprise Computing Systems:

- Enable efficient usage of available hardware resources by provisioning it where it is needed
- Mitigate the need for hardware overprovisioning
- Reduce electricity consumption and cooling costs

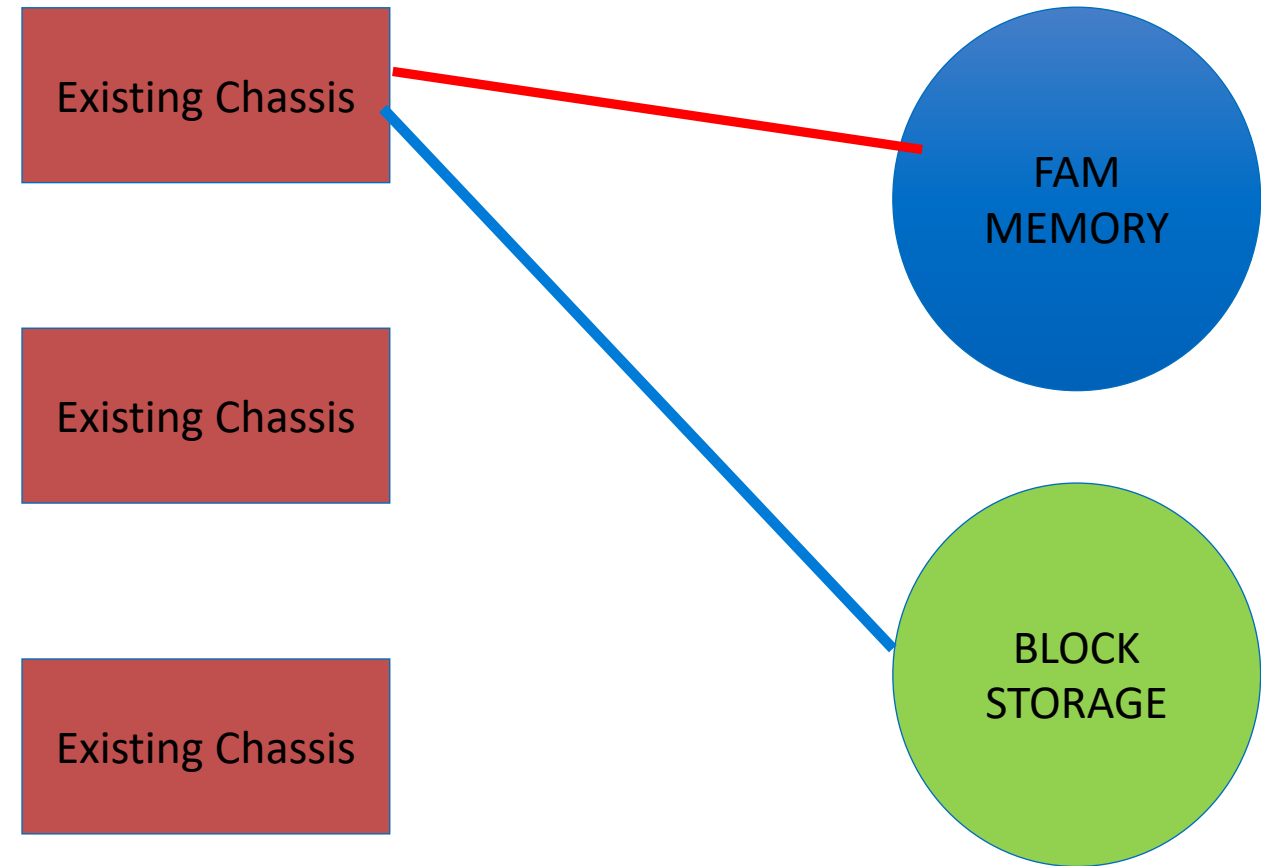


What are Composable Disaggregated Systems?

SPECIFIC OR CONSTRAINED COMPOSITION

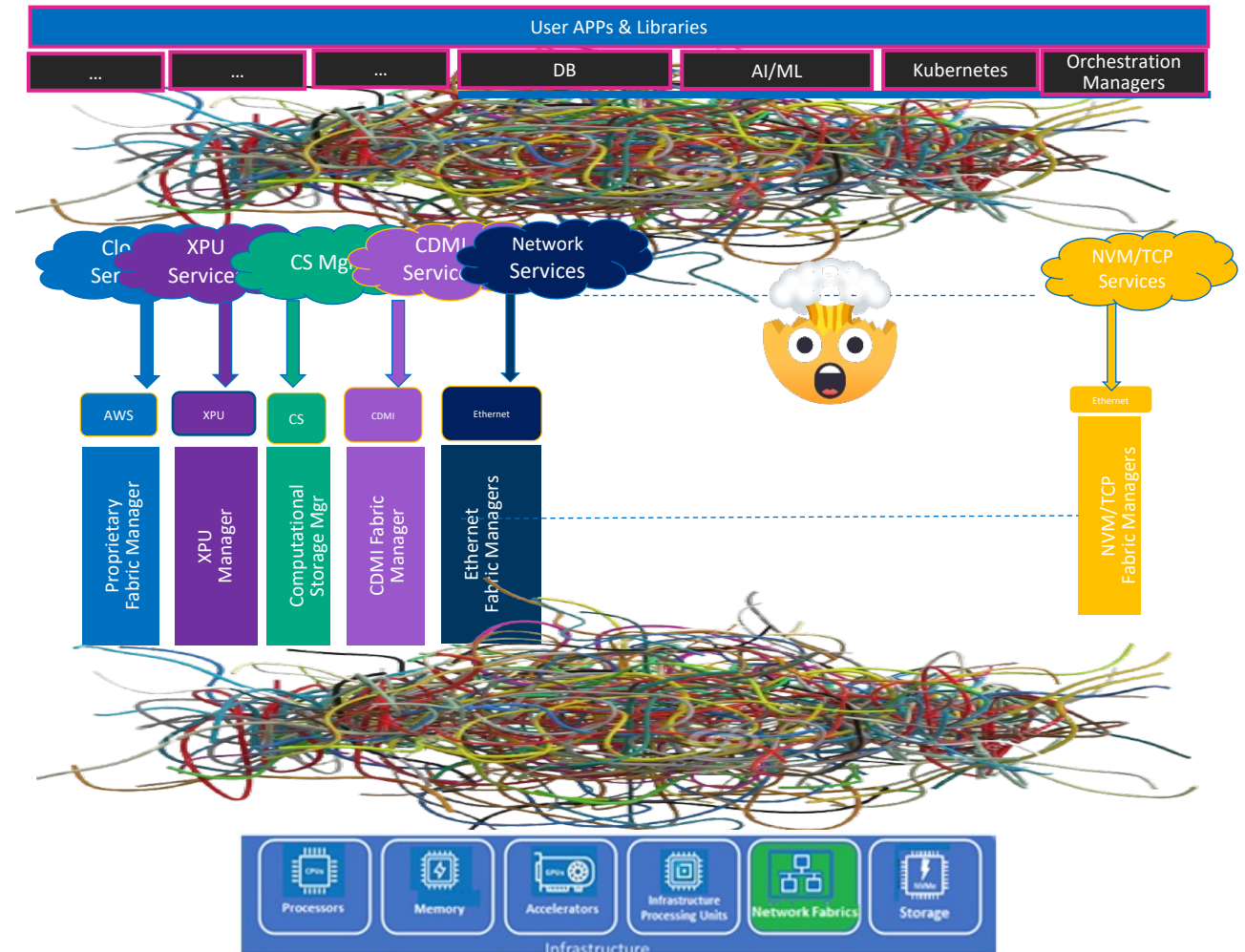


EXPANDABLE COMPOSITION

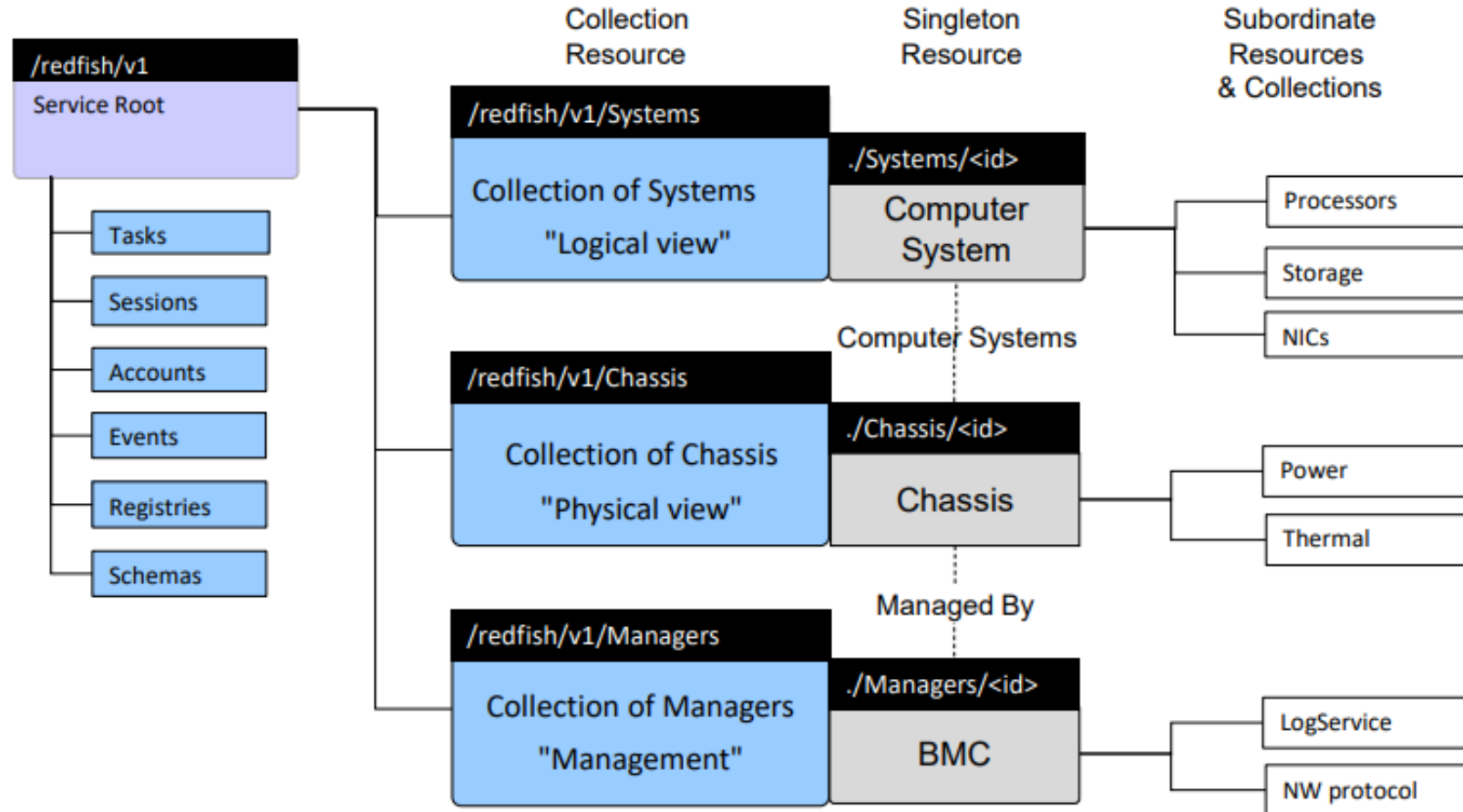


These Trends Lead to ... a Manageability Headache

- Adding additional virtualization and acceleration technologies presents more flexibility and options to build a custom configuration but doing so increases the management challenges exponentially.
- Workload management and optimization is different for each type of technology, device, and vendor. Sometimes, even per version.
- Administrators are being asked to manage an increasingly heterogeneous device and network infrastructure, each with its own management standard and model. DevOps, instead of specialized management domains.
- With the proliferation of different technologies and multiple vendors, standards-based management is more critical than ever to successfully develop, integrate, deploy, and manage systems and storage at scale



Redfish RESTful Resource Map

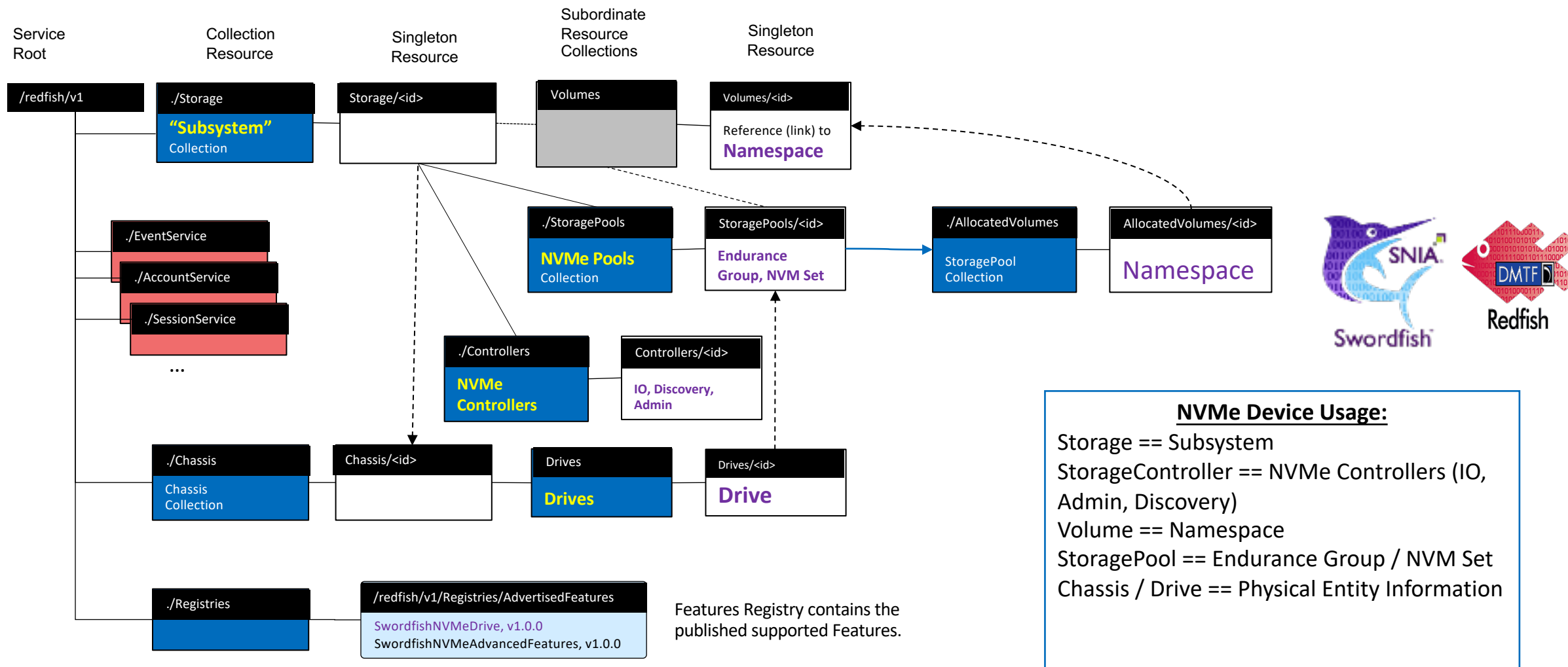


GET `http://<ip-addr>/redfish/v1/Systems/{id}/Processors/{id}`

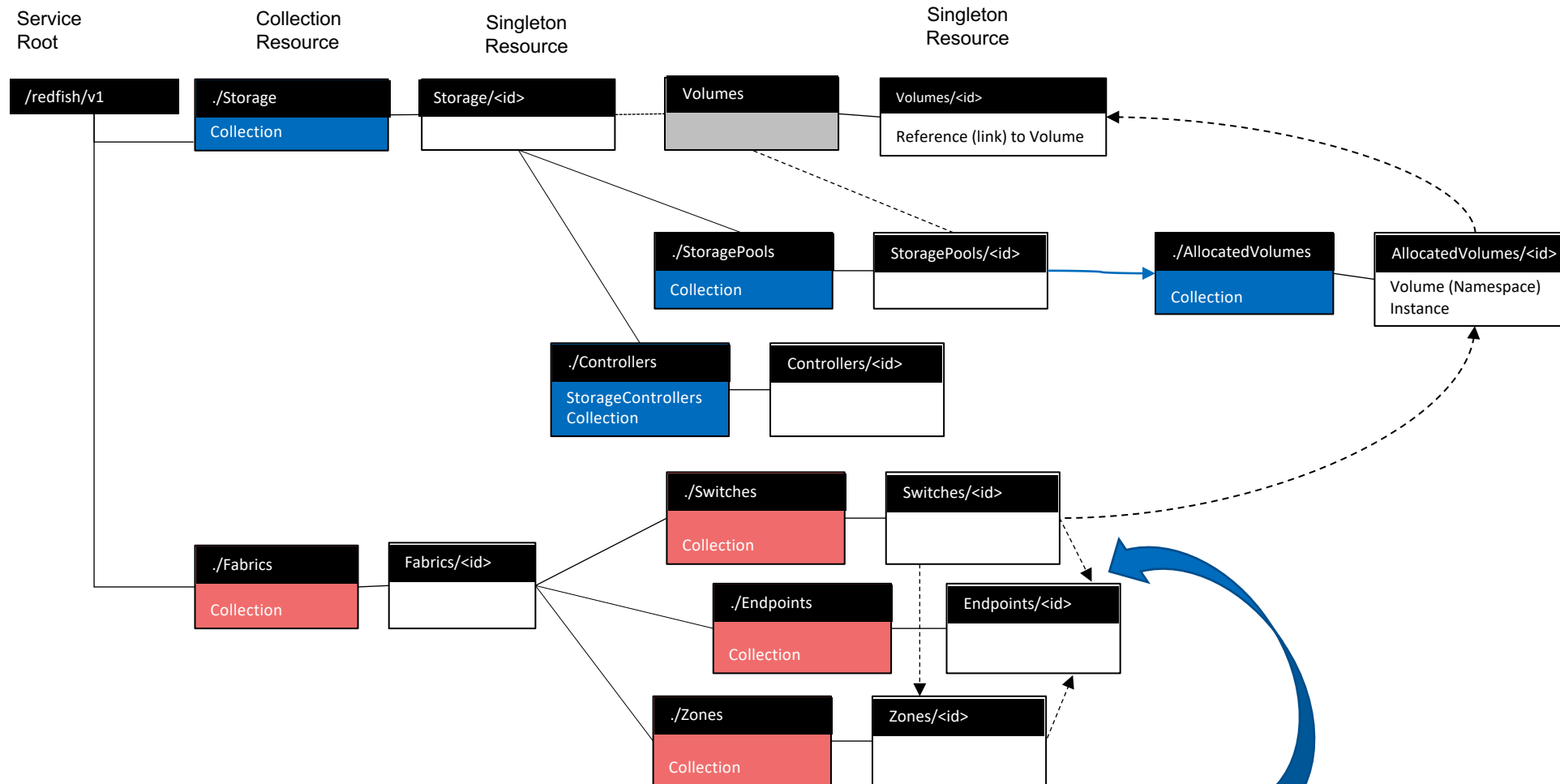
Use the Redfish Resource Explorer (redfish.dmtf.org) to explore the resource map

Swordfish: Extending Redfish

Example: NVMe Drive Model



Extending Fabric Management with Redfish and Swordfish Interfaces



Redfish



Swordfish



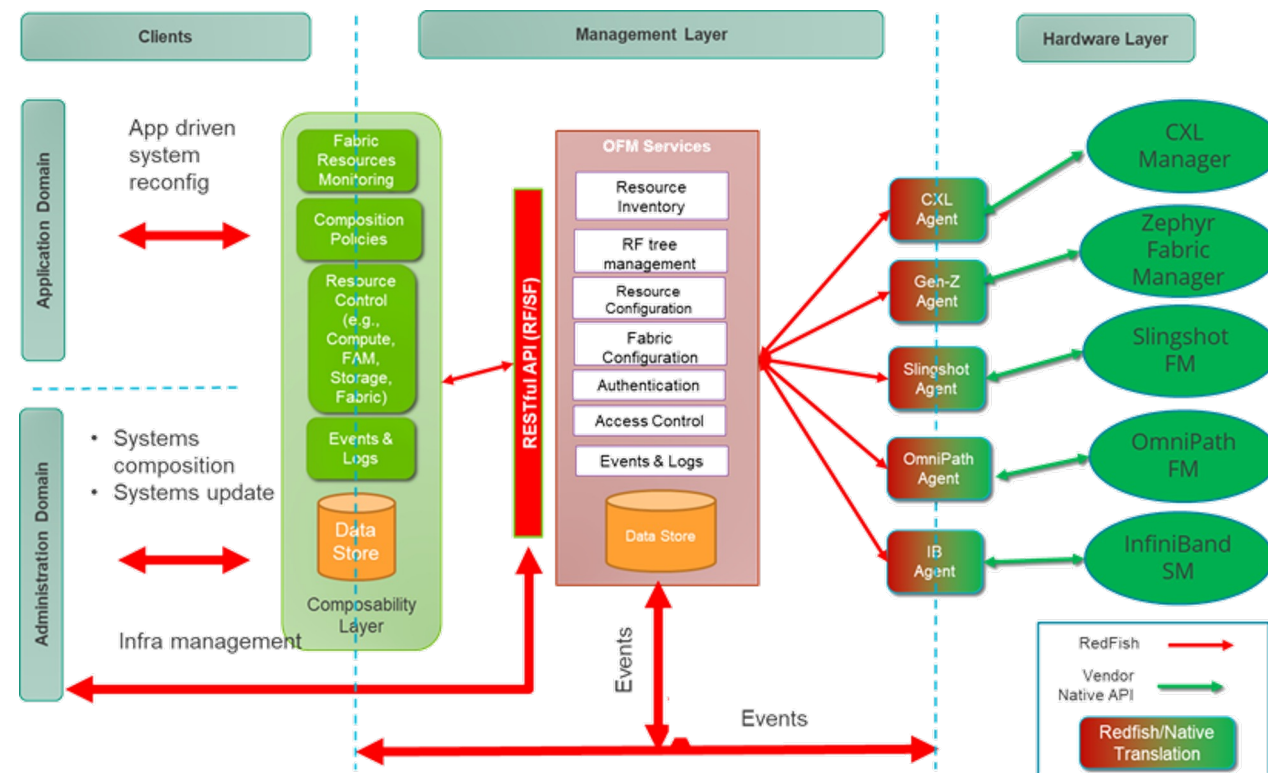
OPENFABRICS
ALLIANCE

OpenFabrics Management Framework

Open Fabric Management Framework (OFMF)

Open, centralized, composable resource management interface to efficiently connect workloads with disaggregated resources over dynamic fabric infrastructure

- Provides a common set of network and resource configuration, management, orchestration functions
- Simplifies the API for users, administrators, and client applications
- Provides a management security framework
- RESTful interface based on DMTF Redfish
- Enables common fabric services to monitor, aggregate, and subdivide resources and network fabrics
- Clients can use their own policies for composing and reconfiguring infrastructure according to workload needs
- Fabric specific providers make the actual changes

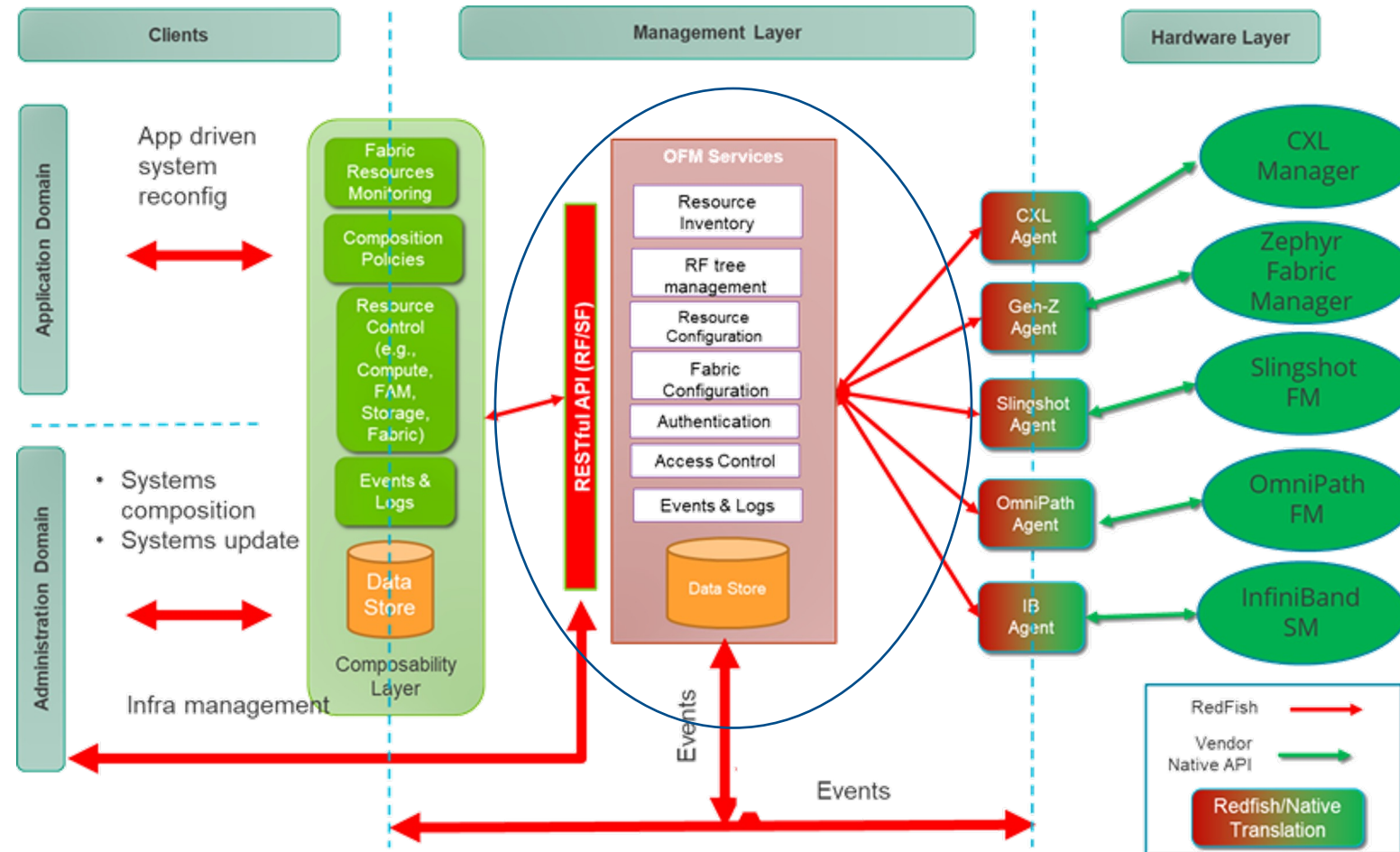


- Enables clients to apply their own policies to monitor, compose, and reconfigure their provisioned resources according to current workload needs.
- Allows fabric vendors to keep their fabric management intelligence proprietary and maintain their value-add / market advantage

Open Fabric Management Framework: OFMF Services

OFMF Services

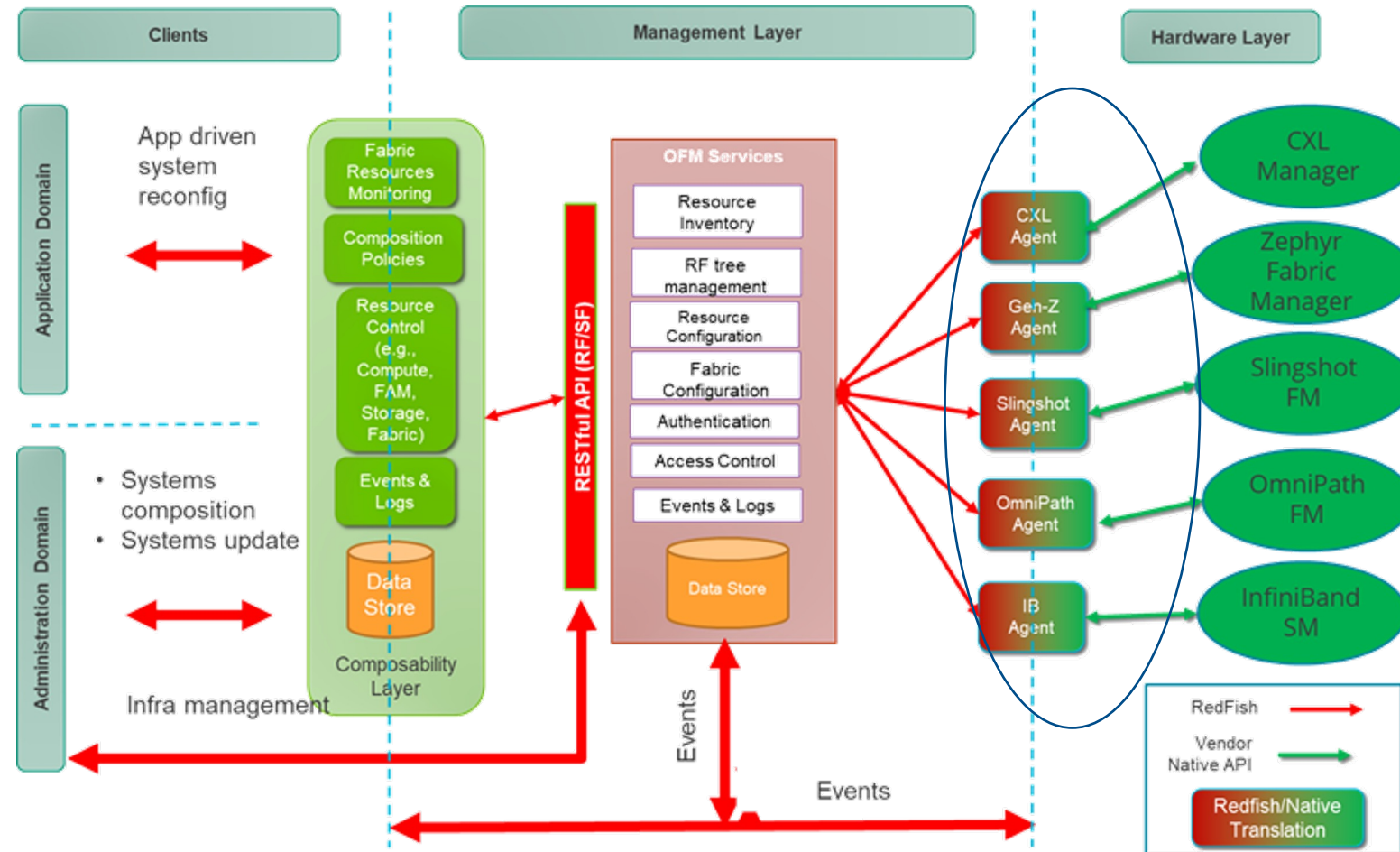
- Resource Inventory
- Resource Configuration
- Fabric Configuration
- Access Control
- Performance Monitoring
- Events and Logs



Open Fabric Management Framework: Technology-Specific Agents

Agents act as translators

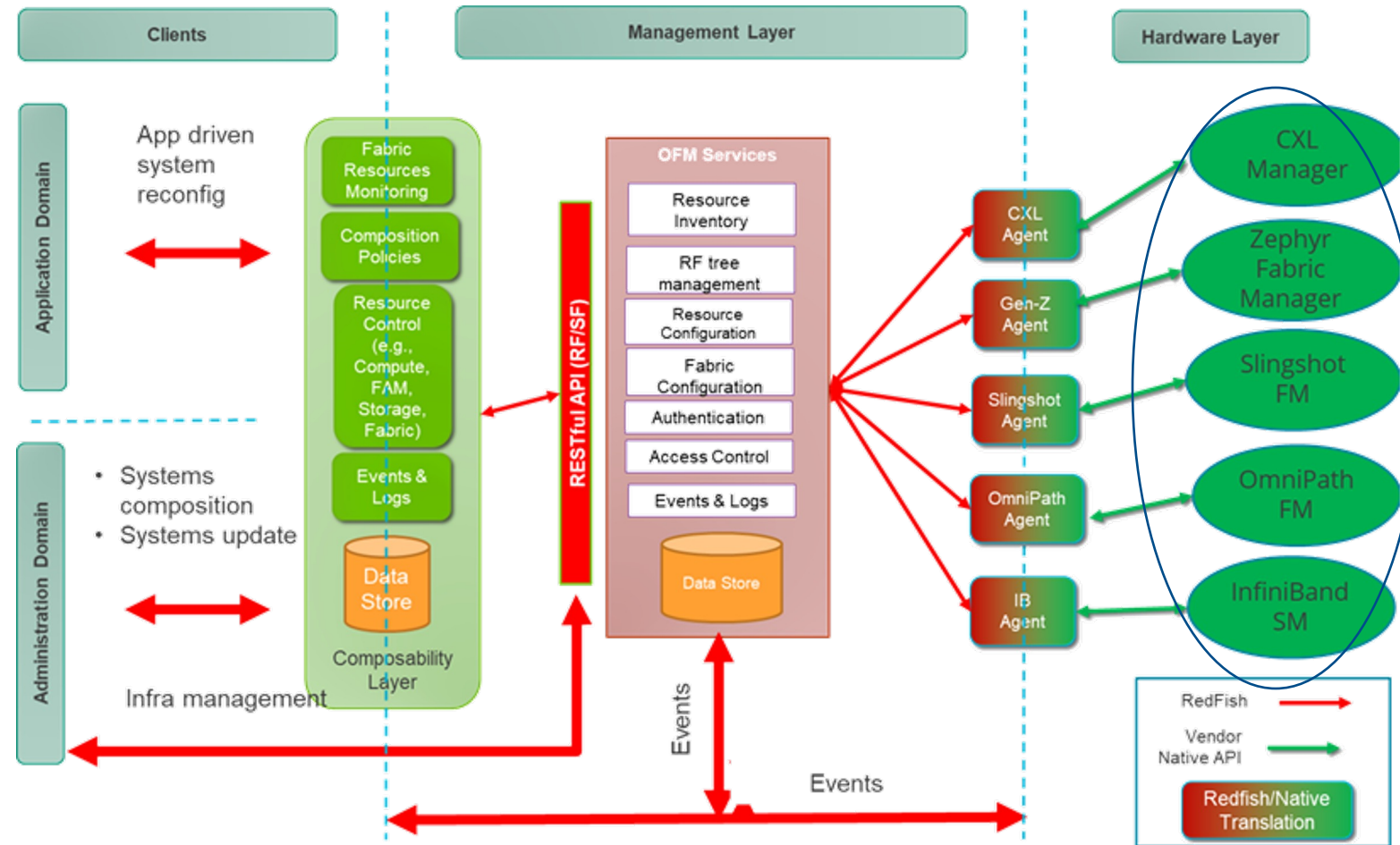
- Parse requests from the 'OFMF Redfish Format'
 - Send requests for info to the HW Manager
 - Send configuration updates to its HW Manager
 - Send Fabric Manager responses to the OFMF in the OFMF Redfish Format
- Parse notifications & events from the Manager
 - Hot plug events
 - Errors
 - Link transitions



Open Fabric Management Framework: Hardware Managers

Hardware Fabric Managers

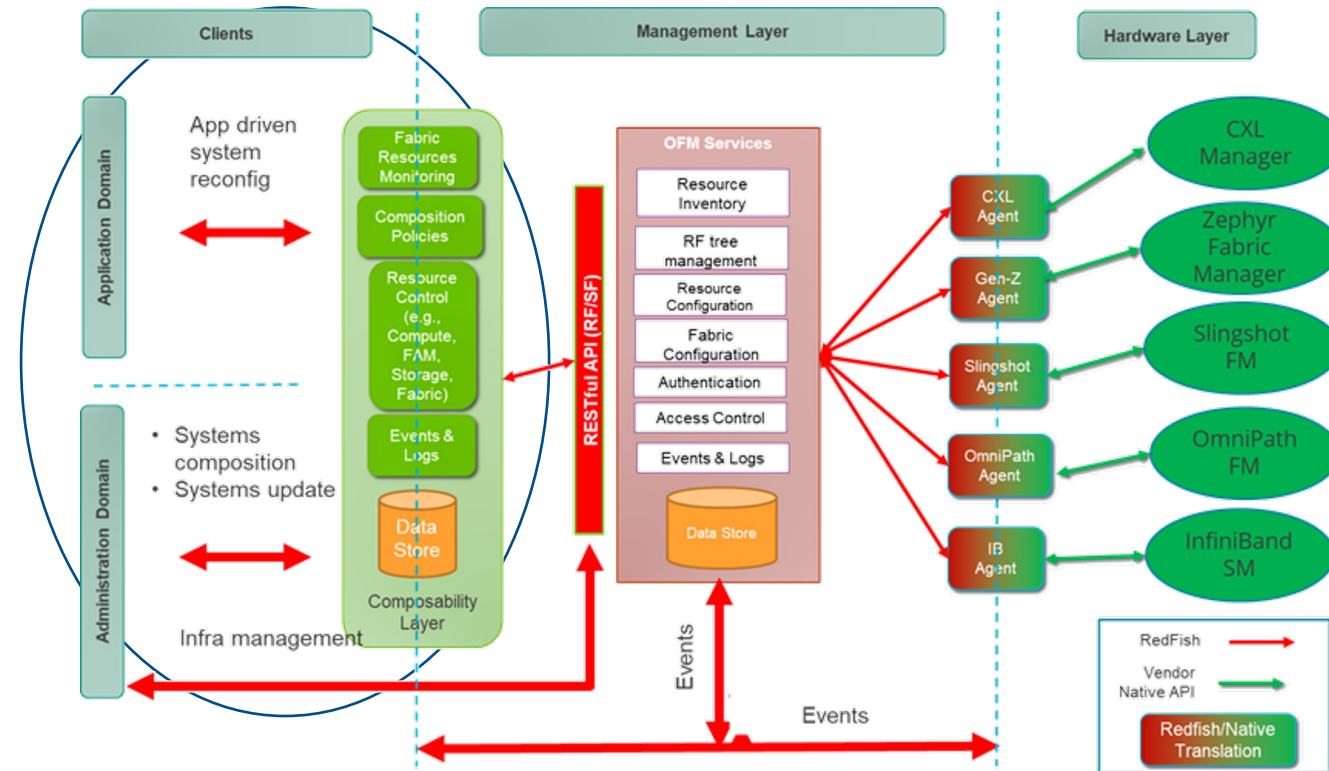
- Entities with:
 - physical access to the control space of fabric resources
 - the authority to modify those settings
- Responsible for:
 - Performing a fabric crawl
 - Taking inventory of fabric resources
 - Configuration of such resources



Open Fabric Management Framework: Clients

Open, centralized, composable resource management interface to efficiently connect workloads with disaggregated resources over dynamic fabric infrastructure

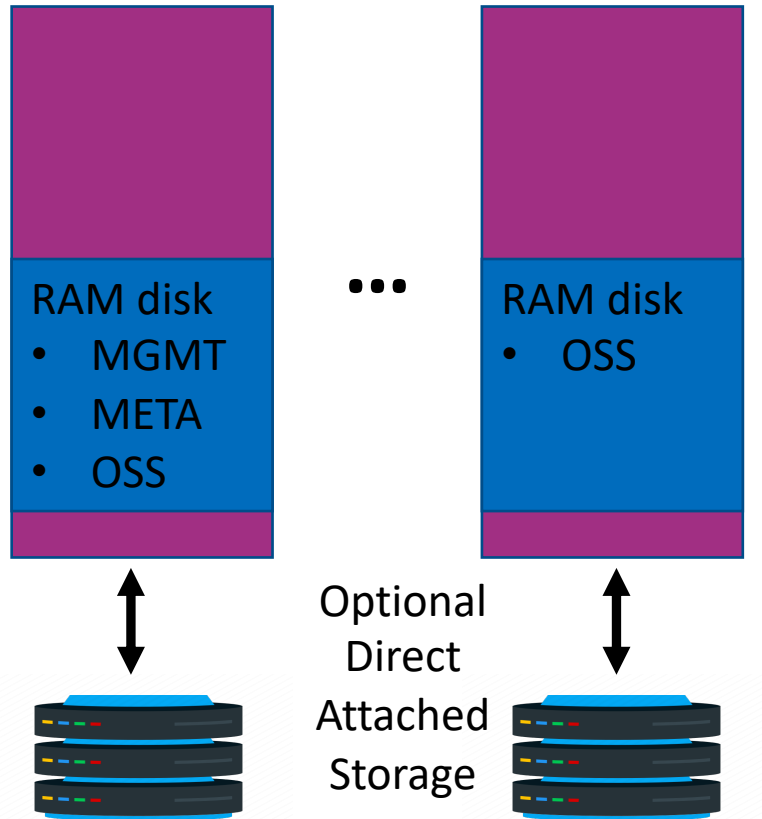
- Application domain
 - Workloads/applications requiring hardware resources
- Administrative domain
 - System composition
 - Systems updates
- Composability layer
 - Application libraries
 - Resource managers
 - Orchestration managers



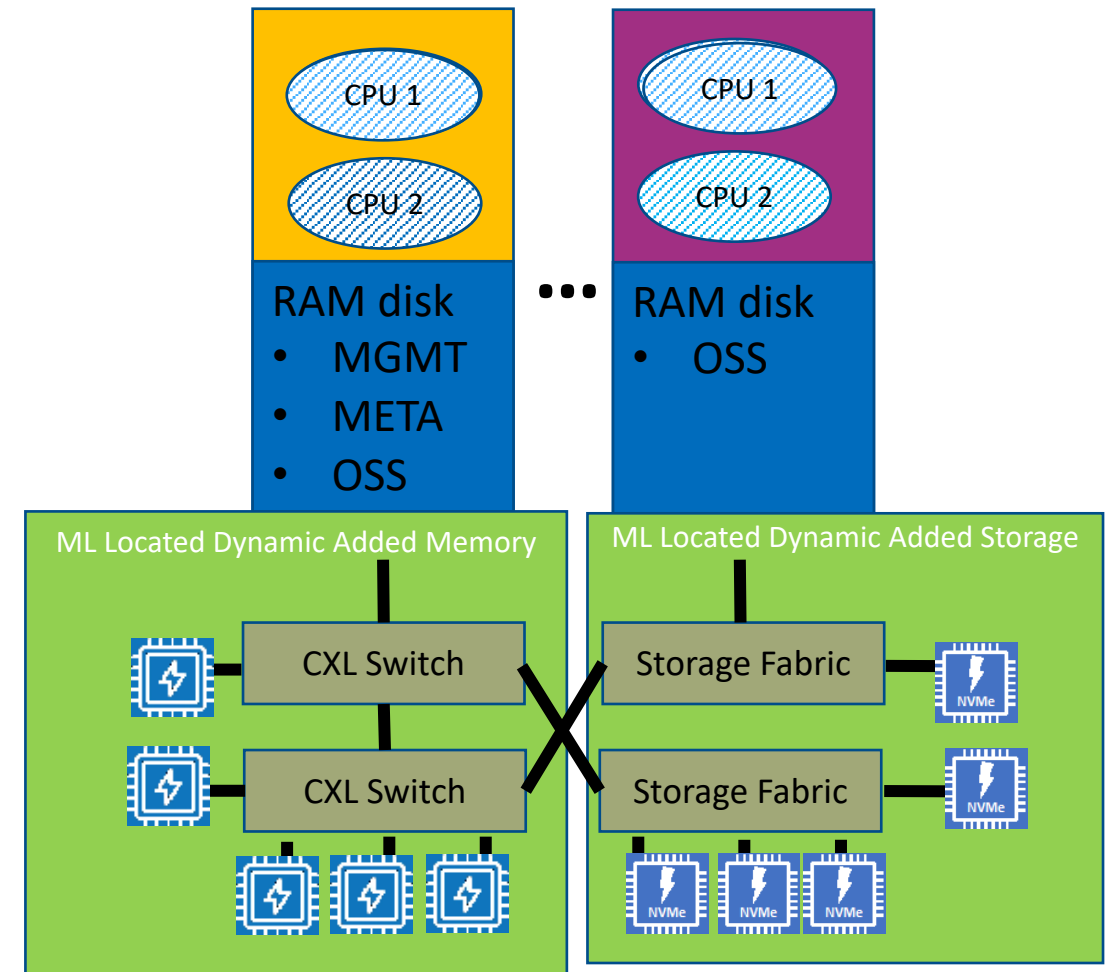
- Clients Query the OFMF Redfish Service for resource availability and Issue updates to modify Redfish fabric model

Composability Example 1: On-Demand Node-Local Parallel File System

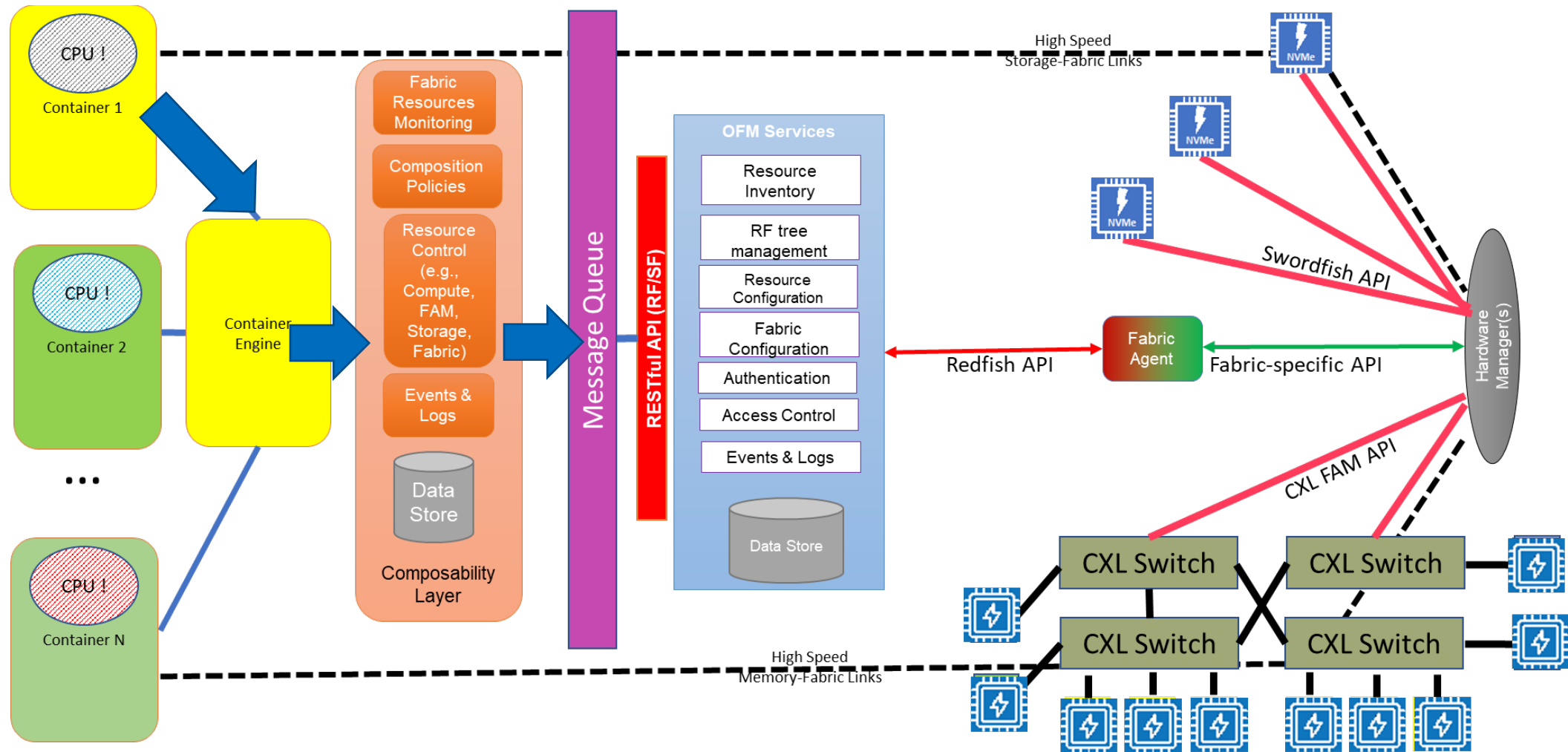
Current On-Demand Ephemeral Filesystems



Composable On-Demand Filesystems



Composability Example 2: Memory & Storage Resource Allocation for Container Provisioning



OFMF: Current Project Status

Contributors: A partnership between:



Current status:

A reference OFMF implementation is nearing release. We are working on Composability Managers, network resource Agents, Monitoring solutions, and Security solutions to take advantage of the OFMF.

Participation are we looking for:

- Input from fabrics technology providers on best methods and rules to take advantage of a composable computing system
- Input from HPC/Enterprise Application developers on client application requirements
- How to best take advantage of CXL-3.0 based CPU designs, memory resources, and accelerator cards.

Best ways to contribute to the project:

Work with the OFA to build upon current work efforts

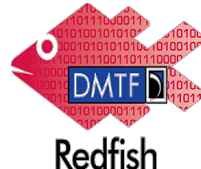
Where to Find More Info...

SNIA Swordfish™

- **Swordfish Standards**
 - Schemas, Specs, Mockups, User and Practical Guide`s, ...
<https://www.snia.org/swordfish>
 - **NVMe Mapping Guide**
- **Swordfish Specification Forum**
 - Ask and answer questions about Swordfish
 - <http://swordfishforum.com/>
- **Scalable Storage Management (SSM) TWG**
 - Technical Work Group that defines Swordfish
 - Influence the next generation of the Swordfish standard
 - Join SNIA & participate: https://www.snia.org/member_com/join-SNIA
- **Join the SNIA Storage Management Initiative**
 - Unifies the storage industry to develop and standardize interoperable storage management technologies
 - <https://www.snia.org/forums/smi/about/join>

DMTF Redfish™

- **Redfish Standards**
 - Specifications, whitepapers, guides,...
<https://www.dmtf.org/standards/redfish>



Open Fabric Management Framework

- **OFMF Working Group (OFMFWG)**
 - Description & Links <https://www.openfabrics.org/working-groups/>
- **OFMFWG mailing list subscription**
 - <https://lists.openfabrics.org/mailman/listinfo/ofmfwg>
- **Join the Open Fabrics Alliance**
 - <https://www.openfabrics.org/membership-how-to-join/>

