

## OpenFlex™ Composable Architecture

### The Foundation for Open, Scalable, Composable IT Infrastructure

With the exponential growth in data, along with the increasing diversity of workflows and demands on IT infrastructure, businesses need to increase speed, agility, and time-to-value for their customers. Emerging as a solution for this, composable infrastructure is a new architectural approach that—using NVMe™-over-Fabrics (NVMe-oF™)—will vastly improve server and storage utilization, performance, and agility in the data center.

#### Enabling Fast Data to Live Outside the Server

Western Digital's OpenFlex composable IT infrastructure vision brings the benefits of Composable Infrastructure to data centers using standards-based elements with built-in composability. It leverages a common Application Programming Interface (API) for orchestrating any and all fabric-attached elements, including both flash- and disk-based storage pools and configurable network components, as well as heterogeneous compute resources. What it does is:

- Leverages Western Digital's Silicon to Systems Design™ approach across disk and flash to deliver a **scalable, modular** set of storage fabric devices—both flash and disk—with a common interface
- Offers an **Open Composable API and storage abstraction layer** that can be used for all managed elements in a data center to accelerate time to value
- **Reduces performance bottlenecks**, complexity, and inefficiencies of current storage offerings to deliver optimum cost-performance

The Western Digital implementation of NVMe-oF is over Ethernet, which is ubiquitous in the data center and is low-cost to deploy.

#### Multiple storage tiers over the same wire—disk and flash accessed via NVMe-oF

Western Digital has enabled disk-based storage to be accessed via NVMe-oF so that all data center storage can be addressed in the same way. The OpenFlex NVMe-oF architecture is a huge step towards the software-defined data center—allowing storage to be assigned to applications without regard for where it is physically located. This is the essence of "composable infrastructure" where physical resources (compute, networking, storage) can be logically configured and treated as a resource for a specific application without the need for physical configuration.

Western Digital will initially offer composable storage options for multiple media types—NAND flash for high-performance, mission critical apps, and data as well as disk for high-capacity tiering, data protection and disaster recovery.

#### Key Benefits

- Improved business agility and time to market
- Improved utilization of compute and storage resources
- Improved IT staff productivity
- Open architecture based on industry standards to remove vendor lock-in

#### Open Composable API

Western Digital's Open Composable API enables a Unified Fabric Control Plane. This allows for composing disaggregated system resources—compute, networking, storage—into virtual systems. These virtual systems are now dynamically provided to the right application at the right time, ensuring SLAs can be automatically met. The OpenFlex API also works with legacy Western Digital and non-Western Digital storage platforms which offer SES and/or NVMe in-band connectivity.

Capabilities of the Open Composable API include:

- Volume management (create/modify/delete namespaces, format media)
- Monitor hardware sensors (temperatures, voltages, fan speeds, hardware state)
- Configure hardware (update firmware, reboot individual components or systems, assert LEDs, set fan speeds)
- Monitor performance (statistics, bandwidth, IOPS, latency, QoS)
- Capture inventory data (serial number, part number, etc.)
- Capture log information
- Configure policies (user access lists, authentication, LUN masking, encryption/security or key settings)
- Configure alerts (notifications, corrective action behavior)
- Virtual system configuration (collection of elements that form a virtual system)
- Self-discovery of other locally available resources configurable using the Open Composable API

# Open Composable Application Programming Interface (API)

## What is it?

The Open Composable API is designed for data center composability. The Open Composable API is a RESTful API that builds upon existing industry standards such as HTTP, CIM, REST, and JSON, utilizing the best features of those standards as well as practices from other captive management protocols used in the industry.

The Open Composable API is different from existing management frameworks because it was designed for an environment where key data center resources are peer elements that cooperate to achieve a desired business objective. For example, historically, storage resources existed as slave devices within a server and were managed as a component 'within' or 'behind' that server. With disaggregated resources, storage is no longer a sub-component but a core element on the network that can be widely shared.

The Open Composable API is intended to orchestrate all data center elements: compute, flash, disk, network, accelerators, and disaggregated memory (when it is available). It is designed to be as flexible as possible and the Western Digital architecture is extensible to support future data center elements as they become available.

Western Digital's objective with the Open Composable API is that it will be an open industry standard. We are currently proposing it to Opencompute.org Storage Project as a specification.

To demonstrate the use of the Open Composable API, Western Digital will initially provide a management plugin for OpenStack™ software. This will serve as an open source example implementation of how it can be used. Since the Open Composable API is based on RESTful technologies that use standard HTTP commands to exchange data, it will scale to multiple implementations within a single data center or across multiple data centers.

## More Information

For information about Western Digital's Composable Infrastructure products, visit [westerndigital.com](http://westerndigital.com). To participate in the Open Composable API community, please visit [opencomposable.com](http://opencomposable.com) or send an email to [OpenComposableAPI@wdc.com](mailto:OpenComposableAPI@wdc.com)

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