

# Tintri Operating System

The only operating environment designed for virtualization and flash

## At a Glance

The Tintri OS that runs on Tintri VMstore appliances is purpose-built to accelerate virtualization, delivering VM and vDisk-level management and metrics. The Tintri OS is also designed from the ground up to intelligently and cost-effectively leverage multilevel cell (MLC) flash storage to provide unparalleled performance to thousands of VMs.

## Highlights

### Radically simplified VM-level management

- Diagnoses VM performance issues instantly with bottleneck visualization
- Performance isolation and QoS at the VM and vDisk level
- Simplified management with advanced per-VM snapshots and clones
- Plug-and-play configuration and support

### Intelligent performance and scalability

- 99 percent of IO from flash for hundreds of VMs on a single appliance
- Efficient use of flash with inline deduplication and compression and working-set analysis
- Scalable storage to support thousands of VMs

### Unparalleled data integrity

- Continuous operation even with two failed drives
- Real-time correction and continuous verification for data integrity

As virtualization becomes the new normal, every aspect of IT is adapting. However, general-purpose shared storage, designed 20 years before mainstream adoption of virtualization, is poorly adapted to both flash and virtualization, inhibiting the fundamental IT goals of lower cost and greater business agility. This new VM-aware storage operating environment — that uses flash intelligently, and uses VMs and virtual disks as management entities — can overcome the cost, performance and complexity challenges that traditional shared-storage systems create in virtual environments.

The Tintri OS that runs on VMstore appliances radically simplifies storage management and uses flash intelligently to deliver cost-effective performance in VM environments. The Tintri OS includes a robust multilayered approach to protect against all manner of hardware and software errors.

## Radically simplified VM-level management

The Tintri OS uses VMs and vDisks as primary management abstractions; there are no LUNs, volumes or other storage objects to manage. It's easy for both VM and storage administrators to get immediate insight in to the virtual environment.

### Diagnose VM Performance Issues Instantly

Performance troubleshooting is one of the most tedious management tasks for VM and storage administrators. It is difficult to pinpoint where in the infrastructure — host, network, storage or somewhere else — the problem lies. With the Tintri OS, administrators have instant visibility, from the guest OS layer to the storage layer. They can see per-VM or per-vDisk latency in real-time across the infrastructure, identify the source of performance issues, and take immediate action. The Tintri OS also maintains historical data to give administrators a graphical view of performance trends.

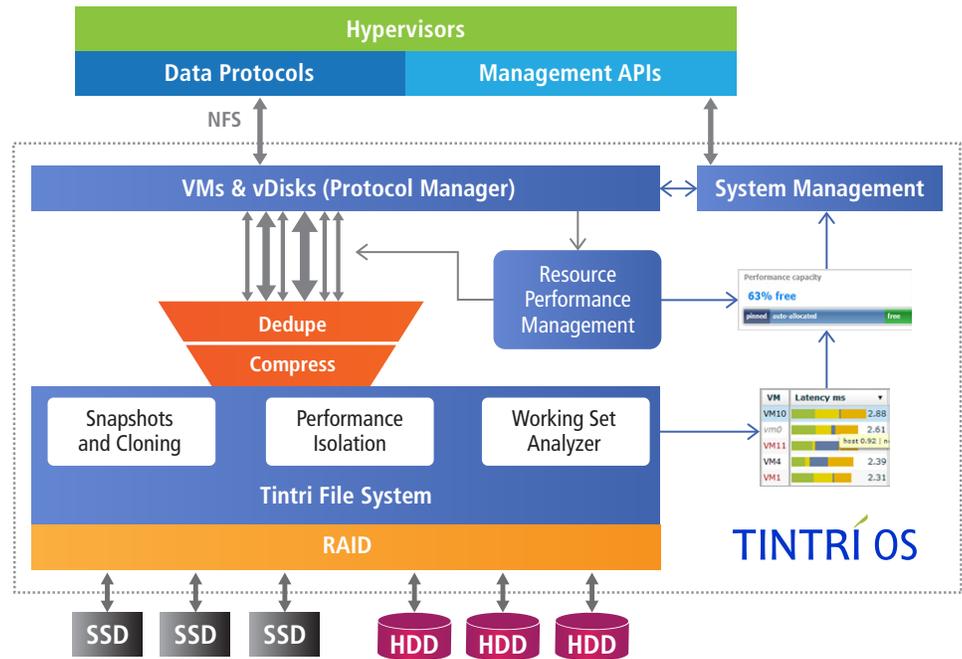
### Performance Isolation and QoS for VMs

The Tintri OS uses VM abstractions — VMs and virtual disks — in place of conventional storage abstractions such as volumes, LUNs or files. The Tintri OS monitors and controls IO for each vDisk, providing performance isolation and QoS at the VM and vDisk level. Each IO request — read, write or metadata operation — maps directly to the virtual disk on which it occurs. With its virtual disk-level



## Tintri OS Architecture

The Tintri OS is the industry's first and only hypervisor agnostic VM-aware storage OS. It was purpose-built for flash and virtualization. It provides performance isolation for each VM's working set by prioritizing the active data, and does all monitoring and management at the VM and vDisk level.



understanding of IO, the Tintri OS does automatic VM alignment to eliminate tedious management tasks and provides performance gains of from 10 percent to 30 percent.

### Advanced Per-VM Snapshots and Clones

The Tintri OS provides per-VM data protection with space-efficient snapshots that have no performance impact. Default snapshot schedules protect every VM automatically, while custom schedules allow users to meet their specific data protection needs. The Tintri OS uses space-efficient clones at the VM level so clones are immediately visible to the hypervisor management console. Advanced cloning can be used to create hundreds of clones to support VDI, instant provisioning, and test and development environments.

### Plug-and-Play Configuration and Support

VMstore appliances running the Tintri OS can be set up in minutes to run VMs. The Tintri OS includes nonintrusive data collection capabilities for automated and user-initiated notification of complete system status to Tintri support, enabling proactive support and service without administrator intervention, further simplifying ongoing management.

## Intelligent Performance and Scalability

### Ninety-Nine Percent of IO from Flash

The Tintri OS integrates flash into its architecture as a first-class storage medium rather than as bolt-on cache. Tintri's unique working-set analysis intelligently assigns flash where it will provide the most benefit — to the VMs that need it. Technologies like inline deduplication, compression, garbage

collection, and hardware monitoring of flash drives maximize the performance and durability of MLC flash.

### Scale to Thousands of VMs

The Tintri OS is designed to scale to support thousands of VMs by leveraging inline data reduction and automatic data placement to deliver 99 percent of IO from flash. Expanding storage is simple. Each VMstore appliance appears as a single datastore in VMware vCenter, making it easy to scale and manage each node as part of a VMware Storage DRS cluster.

## Unparalleled Data Integrity

### Double Drive Failure Protection

RAID 6 on SSD and HDD provides continuous system operation even when two drives fail simultaneously. Application performance impact is also minimal, as background reconstruction in flash has outstanding performance.

### Real-Time Correction and Continuous Verification

The Tintri OS RAID 6 software detects and self-heals errors in real-time on every read from disk. Ongoing background processes periodically reverify data to ensure integrity.

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