

Achieving Next Generation VDI Performance

HiveIO Hive Fabric* and Intel® Optane™ Persistent Memory

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Hive Fabric, the patented all-in-one virtualization platform from HiveIO, provides the ease of use, ease of management and the lowest cost of ownership to deliver highly performant Virtual Desktop Infrastructure (VDI) across an entire spectrum of desktop users. With the adoption of Intel® Optane™ Persistent Memory and the latest Intel® Xeon® Scalable processor technologies on Intel® Server Systems, Hive Fabric can enable businesses to deliver higher performance virtual desktops at lower cost than when deployed on traditional DRAM memory configurations.

Introduction

Similar to other technology transformations of the past, Virtual Desktop technology is currently experiencing a global resurgence, and with adoption accelerated by the 2020 pandemic, it has become a priority for many public and commercial organizations. However, with all of the momentum in the marketplace, choosing the 'right' or 'best' VDI poses several challenges:

1. The cost of deployment
2. The complexity involved in deploying and managing a solution
3. The need for a good "End User Experience"

This last one is critical. A poor End User Experience can often derail VDI adoption and, more importantly, can disrupt productivity. Although End User Experience can be affected by a combination of factors, typically it's directly related to poor technology performance.

A poor End User Experience in a hospital, for example, could impact the number of patients that could be onboarded in a day or delay the number of images a radiologist might review in an hour. A call center business, meanwhile, is dependent on a growing remote workforce with varying degrees of technical experience. Here, a poor End User Experience can impact application performance or VoIP quality, reducing the number of customers served in a day.

In education, VDI is widely deployed from elementary/primary levels to universities as a vehicle to improve learning. Many institutions depend on a variety of applications to achieve this goal. Professors and teachers alike cannot tolerate poor performing applications, especially when their students rely on them to complete lessons and labs.

These examples represent a fraction of the disruption and productivity loss that can be caused by poor End User Experience. Yet in most cases, the concept of End User Experience is completely subjective. The majority of end users don't

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understand the intricacies of delivering VDI – they just want high speed access to their desktop when they need it.

Seeking higher performance VDI

Virtual desktop infrastructure (VDI) enables businesses to deliver desktops, applications, and data securely from managed data centers or from a cloud as Desktop-as-a-Service (DaaS). As more employees work remotely or at home, and as organizations strive to reduce desktop CapEx and Op Ex costs, VDI provides the ability to provision end user desktops and the digital tools they need to work from anywhere, on any device. It can simplify management, enhance flexibility, and reduce costs.

Virtual desktops for end user computing need to be flexible and agile to support the various needs of users. While some users spend most of their day using typical applications, such as office productivity products and web browsers (e.g. to access SaaS platforms), other users can have more demanding needs. Graphically intensive applications, for example, require fast I/O and users are generally sensitive to lag and slow computing performance.

One of the biggest challenges with deploying virtual desktops has been storage. VDI technology typically uses either hyperconverged storage or network attached storage (NAS) to deploy desktop VMs. The performance and latency from the storage used will directly impact the end user experience. HiveIO has had the ability to turn RAM into storage for a number of years. This has provided the best possible end user experience, but at the cost of giving up memory that could be otherwise utilized to run desktops.

With the introduction of Intel Optane Persistent Memory, Hive Fabric can provide the very best End User Experience leveraging the next generation of in-memory storage. This solution delivers the industry's most performant VDI experience at costs that have not previously been attainable. It also helps provide greater freedom of choice with positive price/performance metrics against existing public cloud-based solutions.


About Intel® Optane™ Persistent Memory

Intel Optane Persistent Memory is an innovative memory technology that delivers a unique combination of affordable

large capacity and support for data persistence. Based on a revolutionary non-volatile memory technology from Intel – and offered in a DIMM Form Factor – the technology combines the best of memory and storage traits into one transformative product.

 **Up to 512 GB per DIMM**
Higher capacities than DRAM

 **Full data persistence**
Unlike volatile DRAM

 **Low-latency performance**
Approaches that of DRAM (which averages about 70 nanoseconds) and much better than the performance of NAND SSDs

Historically, memory and storage products have been limited by density, performance, and cost. Intel Optane Persistent Memory fills the gaps by affordably expanding memory capacity and adding low-latency access to persistent data. Using Intel Optane Persistent Memory can help businesses fuel innovation, crunch more data and make quicker decisions, all while lowering overall TCO, and keeping data secure with automatic hardware-level encryption.

About Hive Fabric

HiveIO develops Hive Fabric, a tightly integrated all-in-one virtualization platform for VDI – providing an unparalleled End User Experience, while delivering on the promise of a complete VDI solution.

HiveIO has helped hundreds of organizations reduce the complexities of VDI management, by leveraging swarm theory – how decentralized, self-organized systems come together. HiveIO has applied this theory to its Hive Fabric Cluster technology to develop the next generation of distributed computing, which enables users to intelligently utilize resources, scale their IT infrastructure, and simplify its ongoing management.

The benefits of Hive Fabric and Intel® Optane™ Persistent Memory together

Hive Fabric is unique in the market in being able to utilize RAM as a primary storage pool for the deployment of non-persistent VDI. As a result, the platform is ideally positioned to take advantage of Intel Optane Persistent Memory due to:

- Proven performance with Intel® Optane™ Persistent Memory
- The ability to leverage Intel Optane Persistent Memory in Memory Mode
- Increased server/host densities with Hive Fabric and Intel technologies
- Easily adjustable RAM storage pool
- Perfect pairing / out-of-the-box ready
- Ideally suited for high density, high specification VMs

Test platforms and configurations

The following tests were run on Intel Server Platforms configured with 2nd Generation Intel Xeon Scalable Processors with various disk and memory combinations including: Intel® SSD P3700 Series, Intel® Optane™ SSD DC P4800X Series and Intel® SSD P4600 Series NVMe, as well as Intel Optane Persistent Memory modules.

For the purposes of this paper, HIVEIO configured two stateless virtual desktop specification VMs: 2vCPU with 4GB RAM (recommended minimum W10 specification) and a higher 2vCPU/8GB RAM specification deployed from a

local SSD disk (considered as the standard benchmark for VDI deployment). This was subsequently compared with the same VM deployed to a NVMe SSD, an Intel Optane SSD and finally deployed to RAM with Intel Optane Persistent Memory as the primary storage pool.

Testing methodology and outcomes

Hive performed two industry benchmark tests, specifically the PassMark Disk Test and Iometer, to assess the overall storage performance of the VMs.

PassMark Disk Test (Figure 1)

The PassMark Disk Test is an industry recognized test that measures the data transfer speed when reading or writing data to one or more disks. The speed that data can be transferred between memory and a hard disk drive is one of a system's most important performance aspects.

The PassMark Disk Score (Disk Mark) shows that using Intel Optane Memory as a primary storage pool has a score almost 3x that of a standard SSD. Also, it is almost 65% and 96% higher than a NVMe and Optane SSD respectively.

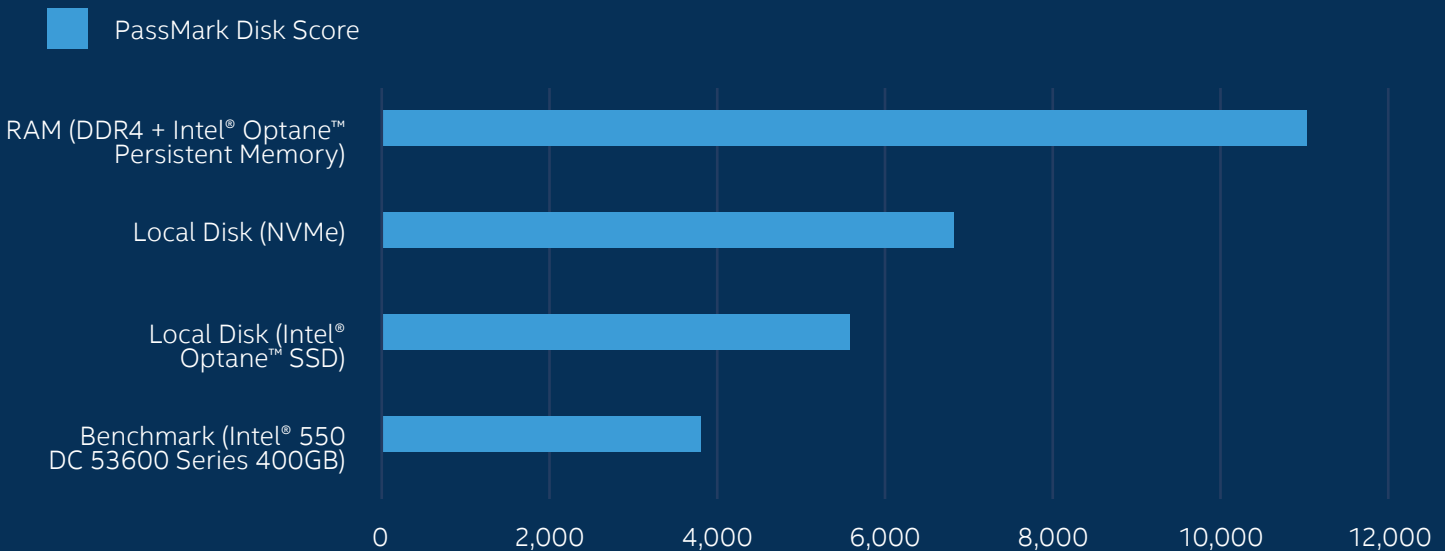
Note: PassMark Disk Test Results for the stateless VDI 2vCPU 8GB RAM configuration are available for review in the full technical report on the HIVEIO website¹.

Iometer Test (Figure 2, next page)

Iometer is an I/O subsystem test that measures the performance of storage subsystems. Tests were conducted using a 0.5GB and 10GB file to assess the read, write and overall IOPs obtained from the VM.

Figure 1

PassMark Disk Score – Stateless VDI 2vCPU 4GB RAM



Iometer (IOPs) – Stateless VDI 2vCPU 4GB RAM with 10GB Test File

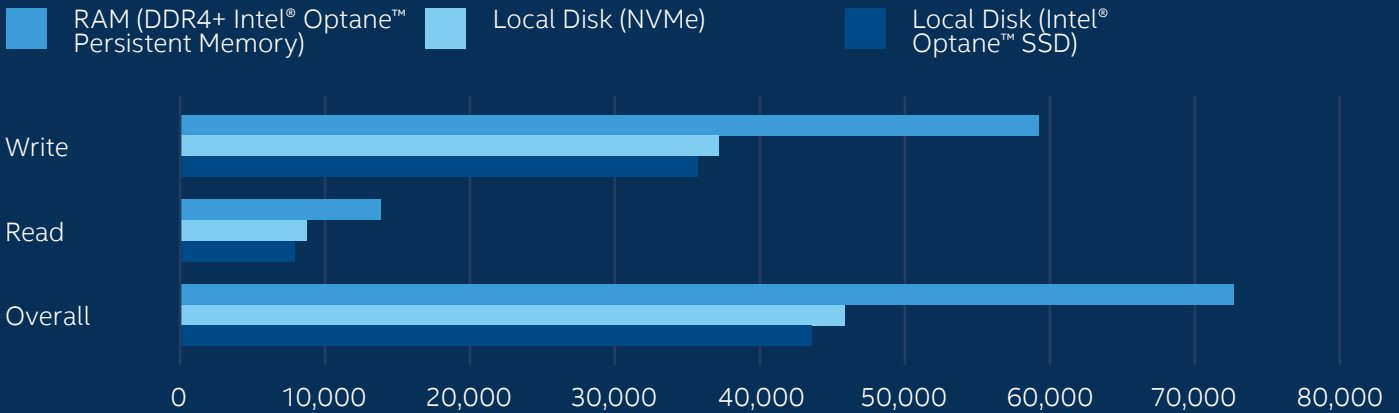


Figure 2

Intel® L9 server costs (\$)

Server Spec – Dual Intel® Xeon® Gold 6230R, 1024GB Memory, 2x 240GB SSD

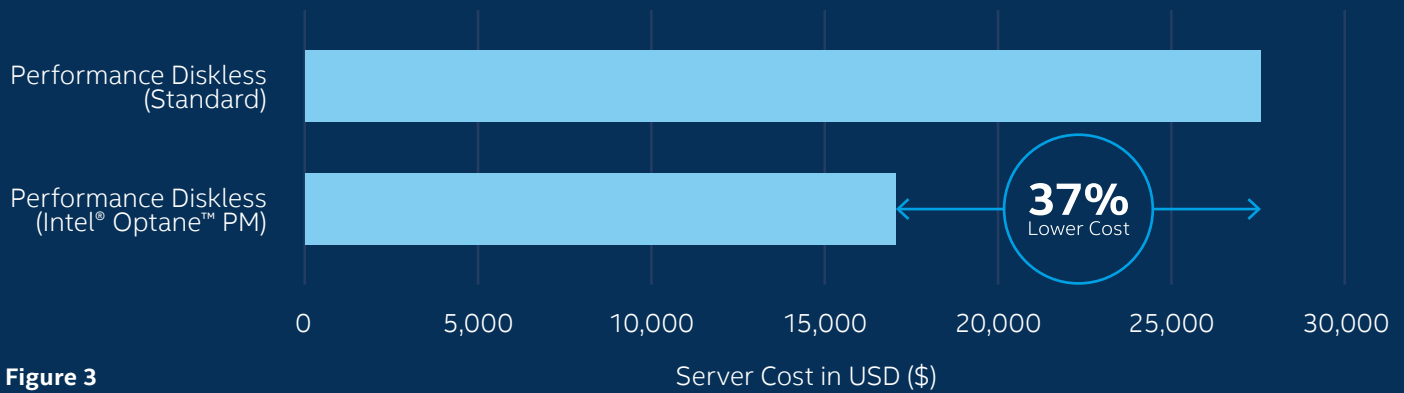


Figure 3

The Iometer tests show that VMs deployed to Intel Optane Persistent Memory produced in excess of 70,000 combined IOPs, which was almost double that of VMs deployed to NVMe and Intel Optane SSDs.

Note: Iometer Test Results for stateless VDI 2vCPU 8GB RAM configuration are available for review in the full technical report on the HIVEIO website¹.

Results summary (Figure 3)

The latest Intel Xeon processors enable high density VDI workloads on each server. But to support this, memory needs to be increased proportionally and the costs for traditional memory when deployed at scale is expensive.

Intel Optane Persistent Memory offers higher capacity DIMMS (available in 128, 256 and 512GB modules, while DRAM tops out at 128GB) at a lower price per GB than traditional DDR4. This convergence of memory and storage offers low latency and high bandwidth, better utilizing CPU resources to deliver greater performance at a lower cost.

This key performance and cost advantage can be summarized with the data below:

65% Disk performance improvement over NVMe

37% Lower cost than servers with standard DDR4 RAM

In summary, HIVE Fabric VDI desktops deployed with Intel Optane Persistent Memory have the potential to deliver greater performance, in greater densities, at costs significantly lower than VMs deployed on standard DDR4 memory. Crucially, with the additional capacity that's possible with this technology combination, the overall cost per VM is almost the same as when deployed to servers with standard SSD disks. Consequently, this can deliver exceptional performance and value to the business, while still providing the best End User Experience.



Higher performance VDI

Hive Fabric, combined with Intel's latest technologies across compute, memory and storage, enables organizations to leverage the performance benefits for all users, including those with heavy compute and memory requirements.

Intel® Fabric L9 Performance Servers can be purchased pre-installed with Hive Fabric. A range of servers are available for every workload type with standard diskless servers, disk-backed servers, and range-topping performance servers deployed with Intel Optane Persistent Memory.

The key features of Intel® L9 Fabric Performance 2 Servers include the following:

- Unparalleled End User Experience with VDI performance 65% greater than VDI deployed to local disk (NVMe)
- A single host supporting 120 high-spec VMs or 145 standard VMs
- 100% linear scaling with Hive Fabric's unique peer-to-peer architecture.
- 37% lower cost than a server with standard DDR4 RAM

Working with a solution provider

Arrow's Virtual Desktop Infrastructure portfolio draws on deep expertise in software, infrastructure and next

generation technology, to identify with the leading vendors in the VDI marketplace.

HiveIO is unique in its position in the VDI ecosystem with the ability to deploy its AI- and ML-ready intelligent VDI solution on industry-leading infrastructure.

Next steps

Learn more about Intel Optane Persistent Memory <http://www.intel.co.uk/content/www/uk/en/architecture-and-technology/optane-technology/optane-for-data-centers.html>

Discover the power of Hive Fabric running on Intel <https://www.hiveio.com/hive-fabric/>

Read more about Intel L9 Configure-To-Order Servers <https://www.intel.com/content/www/us/en/products/servers/data-center-blocks.html>

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Read the full technical report on the HiveIO website <https://www.hiveio.com/IntelOptane>

