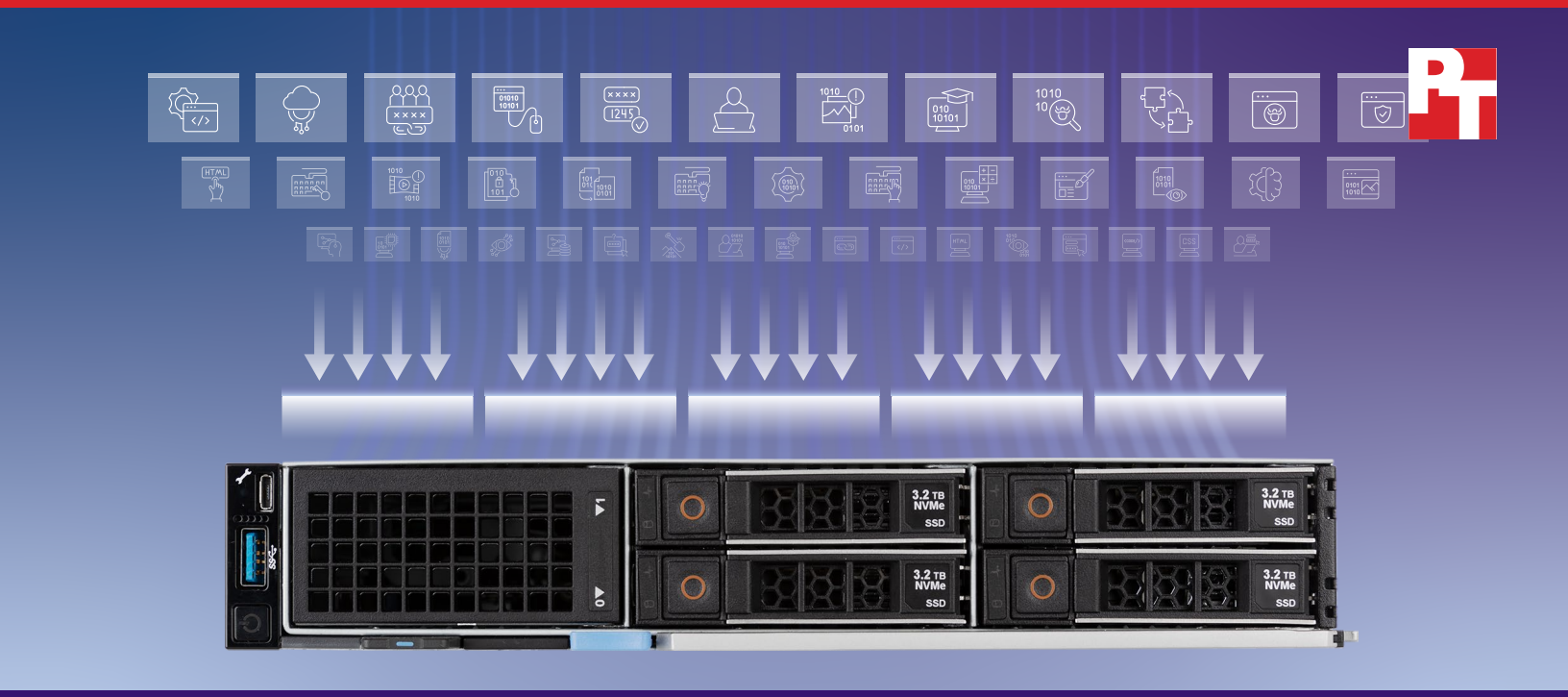


Quickly modernize legacy apps in **<1 hour of hands-on admin time**

Achieve 47% more MySQL new orders per minute per host

16 containers vs. 12 VMs

Easily consolidate your VMs and modernize aging environments by upgrading to new Dell PowerEdge MX750c compute sleds with VMware Tanzu Kubernetes Grid

Migrating MySQL workloads from an older PowerEdge MX740c environment can let you consolidate hardware while reaping the benefits of Kubernetes containers

If the hardware your company uses to support OLTP databases for retail, customer relationship management, or other business applications is still functional, upgrading may not yet be on your radar. But modernizing can be an easy process that lets you take advantage of a new environment that includes updated hardware and Kubernetes containers.

To help companies understand the value of refreshing their older Dell™ PowerEdge™ hardware to newer 15G compute sleds with VMware® Tanzu Kubernetes Grid (TKG) containerization, we conducted a series of tests. First, we measured the OLTP performance of MySQL™ virtual machines from a legacy PowerEdge MX740c compute sled running VMware vSphere® 7.0 Update 3. Next, we recorded the amount of time necessary to migrate and containerize those VMs to a new Dell PowerEdge MX750c compute sled running the same version of vSphere with VMware Tanzu for Kubernetes. Finally, we measured OLTP performance and looked at how it would allow consolidation in the new, containerized MySQL environment.

We learned that migrating VMs to containers on VMware TKG was a quick and straightforward process. And after we upgraded the environment, performance improved by 47 percent. Migrating to containerized Kubernetes on 15G nodes could also allow for hardware consolidation, which could provide room to grow within a Dell PowerEdge MX enclosure environment, lead to data center space savings, and reduce associated power and cooling costs.

Modern hardware + containerization using VMware TKG

The new Dell PowerEdge MX750c compute sled in our study used 3rd Generation Intel Xeon Scalable processors, which provided additional cores to help support the higher app density, as well as faster memory and 4th generation PCIe, which can boost I/O and improve database performance. Containerization brings additional benefits, such as efficient resource utilization and reduced storage requirements.

Our test approach: An overview

The goal of our testing was to learn about the process of migrating MySQL virtual machines from a legacy Dell PowerEdge MX environment to a modern one using pods, or groups of containers, and the benefits of doing so. To this end, we determined how many VMs the legacy solution could support and then how many containers with the same performance level the modern solution could support. Our testing comprised the following stages:

1. **Measure OLTP performance in the legacy environment (14G with VMs)**
   - Set up virtualized MySQL instances on a legacy PowerEdge MX740c compute sled.
   - Measure performance using an OLTP workload from the HammerDB TPROC-C benchmark.
2. **Migrate the workload**
   - Capture the time and steps necessary to migrate and convert the MySQL VMs from the legacy solution to containers in a modern environment with a PowerEdge MX750c compute sled and VMware TKG.
3. **Measure OLTP performance in the modern environment (15G with containers)**
   - Measure performance using the same OLTP workload from the HammerDB TPROC-C benchmark.

A note on terminology: *Kubernetes runs a workload by placing containers into pods, which run on nodes.[1] In our containerized solution, each MySQL deployment consisted of a single container per pod, and a single pod per virtualized TKG node. We use "containers" in this report rather than "pods" because it is the more recognizable term.*

Table 1: The table below shows key hardware spec differences between the older Dell PowerEdge MX740c compute sled and the Dell PowerEdge MX750c we tested.

Compute sled comparison	Dell PowerEdge MX740c	Dell PowerEdge MX750c
Processor		
Vendor and model	2 x Intel® Xeon® Gold 6230	2 x Intel Xeon Gold 6330
Core count (per processor)	20	28
Core frequency (GHz)	2.1	2.0
Memory		
Total memory in system (GB)	192 (12 x 16GB DIMMs)	384 (12 x 32GB DIMMs)
Type	DDR-4 2666MHz Dual-Rank	DDR-4 3200MHz Dual-Rank
Speed (MHz)	2666	3200
Data storage		
Number of drives	4 x Samsung® PM1735	4 x Samsung PM1735
Drive size (TB)	1.6	3.2
Drive information (speed, interface, type)	NVMe SSD	NVMe SSD
Network adapter (type 1)		
Vendor and model	Intel Ethernet 25G 2P XXV710 Mezz	Broadcom 25G 4P BCM57504 Mezz
Number and type of ports	2x 25GbE	2x 25GbE

About the Dell PowerEdge MX solution, featuring the PowerEdge MX750c compute sled

According to Dell, PowerEdge MX is a "[m]odular, 7U integrated solution designed for enterprise data center density with easy deployment, management, and maximum longevity."[2]

We tested the two-socket, single-width PowerEdge MX750c compute sled, up to eight of which can fit in each PowerEdge MX7000 chassis. The PowerEdge MX750c compute sled is available with up to two 40-core 3rd Generation Intel Xeon Scalable processors, and each sled can support eight channels per CPU with up to 32 DDR4 DIMMs at 3,200 MT/s DIMM speed. The PowerEdge MX750c compute sled uses PCI Express 4 and provides greater NVMe support than its predecessor.[3]

Learn more about the PowerEdge MX and the PowerEdge MX750c compute sled at https://www.dell.com/en-us/dt/servers/modular-infrastructure/poweredge-mx/index.htm#tab0=0&tab1=0&accordion0.

What we learned

Finding 1: Migrating MySQL VMs was a quick and easy process

Migrating the MySQL virtual machines on the legacy Dell PowerEdge MX740c compute sled to VMware TKG containers on a new Dell PowerEdge MX750c compute sled was a straightforward process that took only 3 hours and 7 minutes, less than an hour of which involved active, hands-on work from an administrator. In this section, we break down the process we followed.

Please note that our migration focused on a simplified approach to convert the VMs to containers using a database backup-and-restore method as part of a performance and consolidation comparison. Companies executing database migrations of this type in production environments should select the best migration method to meet individual uptime requirements, test and dev processes, and validating data integrity, and should ensure proper functionality of user-defined functions (UDFs) and stored procedures.

Figure 1 summarizes the steps necessary to migrate VMs from the legacy PowerEdge MX740c compute sled running VMware vSphere 7.0 Update 3 to a new Dell PowerEdge MX750c compute sled running the same version of vSphere and VMware Tanzu. In terms of hands-on time, the most demanding tasks were installing the prerequisite software on the utility VM, which required 23 steps and just under 14 minutes, and deploying the MySQL containers, which required 12 steps and just over 16 minutes.

Time and steps to configure TKG and migrate the MySQL workload

	Task description	Admin time H:MM:SS	Total time H:MM:SS
1	Creating the utility VM 11 steps	0:02:42	0:08:57
2	Installing prerequisite software on the utility VM 23 steps	0:13:54	0:19:31
3	Deploying the management cluster via UI 22 steps	0:03:00	0:13:06
4	Creating the Kubernetes workload cluster 4 steps	0:02:49	0:10:01
5	Updating and configuring the workload cluster nodes 5 steps	0:07:33	0:28:37
6	Migrating the MySQL backup from 14G bare VMs to 15G nodes* 5 steps	0:02:23	0:33:01
7	Deploying the MySQL containers 12 steps	0:16:06	0:16:06
8	Restoring backup from zip file 5 steps	0:01:15	0:58:36
	Total time	0:49:42	3:07:55

Figure 1: Tasks required to migrate to a VMware vSphere 7.0 Update 3 environment on Dell PowerEdge MX750c compute sleds from a legacy VMware vSphere 7.0 Update 3 environment on Dell PowerEdge MX740c compute sleds. Source: Principled Technologies.

**Note: In our testing, we used the same database for each MySQL app instance and therefore required only a single transfer to the utility VM. Real-world scenarios could use different databases in each instance, in which case the transfer time to the utility VM would increase by a factor corresponding to the number of unique databases.*

Finding 2: MySQL performance improved significantly in the modern, containerized environment on the new Dell PowerEdge MX750c compute sled

By moving VMs from the legacy Dell PowerEdge MX740c compute sled to the new Dell PowerEdge MX750c compute sled, workloads can achieve an immediate performance improvement due to hardware differences. The new compute sleds feature 3rd Generation Intel Xeon Scalable Processors, faster memory, and 4th generation PCIe, all of which contribute to better performance. We then added VMware TKG to the equation, bringing the benefits of containerization. As we discuss in more detail on the next page, improved performance can translate to consolidation: doing more work with the same number of compute sleds or the same amount of work with fewer compute sleds.

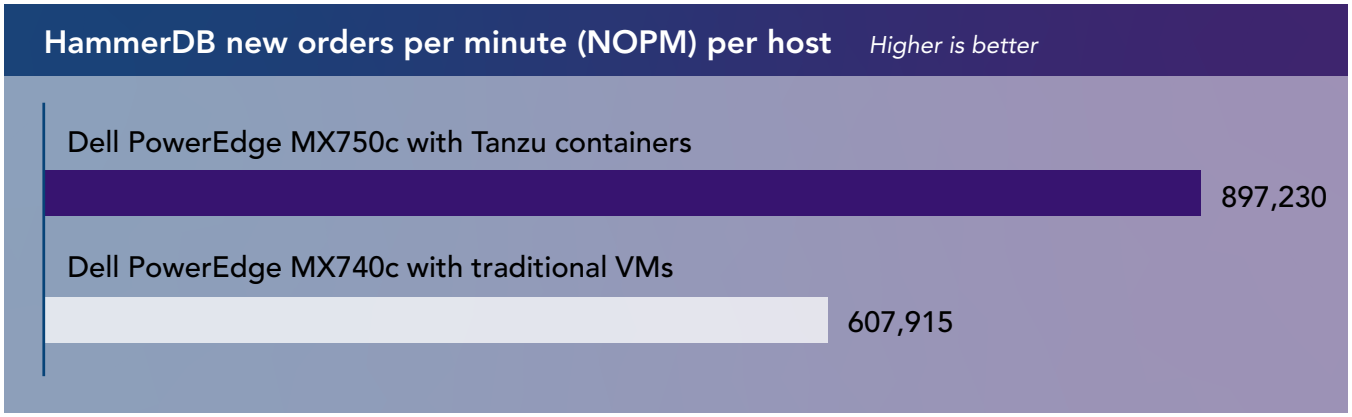


Figure 2: OLTP performance in total MySQL NOPM that all VMs on the legacy solution and all containers on the modern solution achieved on the HammerDB TPROC-C benchmark. Higher is better. Source: Principled Technologies.

Figure 2 illustrates the performance of the two test environments. To measure the maximum performance of both compute sleds, we added VMs or containers until we fully utilized the processors. Across the maximum 12 VMs, the legacy Dell PowerEdge MX740c compute sled solution achieved 607,915 new orders per minute (NOPM). Across the maximum 16 containers on the new Dell PowerEdge MX750c compute sled with a single MySQL container per node, the solution achieved 897,230 NOPM, 47 percent more than the older environment. Each individual VM on the older solution achieved an average of 50,659 NOPM per VM while each container on the new solution achieved an average of 56,076 NOPM, an improvement of 10.6 percent.

About VMware Tanzu Kubernetes Grid

VMware states that TKG is a "CNCF-certified, enterprise-ready Kubernetes runtime that streamlines operations across a multi-cloud infrastructure"[4] and also "provides a consistent, upstream-compatible implementation of Kubernetes, that is tested, signed, and supported by VMware."[5]

TKG is part of the VMware Tanzu portfolio, which enables organizations to "build, run and manage modern apps on any cloud," as well as "simplify multi-cloud operations and free developers to move faster with easy access to the right resources," according to VMware.[6]

For more information, visit https://tanzu.vmware.com/tanzu.

Finding 3: Improved MySQL performance and greater node density on the PowerEdge MX750c means that you could consolidate compute sleds

On the previous page, we showed how running your MySQL workloads on a new 15G compute sled with 3rd Generation Intel Xeon Scalable processors, faster memory, and 4th generation PCIe storage would improve performance over running them on legacy compute sleds. We also noted that the legacy solution supported 12 VMs while the 15G solution supported 16 nodes. Here, we show how the performance increase and node density from updated hardware could support workload consolidation. To extrapolate to a larger environment with 10 compute sleds, we took the total number of NOPM a single Dell PowerEdge MX750c with Tanzu could deliver and multiplied it by 10. Obviously, it would take 10 of these compute sleds to meet this level of demand. Given the performance achievement of a single virtualized Dell PowerEdge MX740c, it would take 14.76 of these legacy compute sleds to complete this number of NOPM. Because you can't have a partial compute sled, we round this number to 15 in Figure 3. This illustrates the potential value of upgrading: you could consolidate multiple older compute sleds onto fewer new ones while maintaining room for future growth. In a Dell PowerEdge MX environment, this extrapolation would mean freeing up over half of an MX enclosure for consolidating additional workloads on new compute sleds, added storage, or a combination of the two.

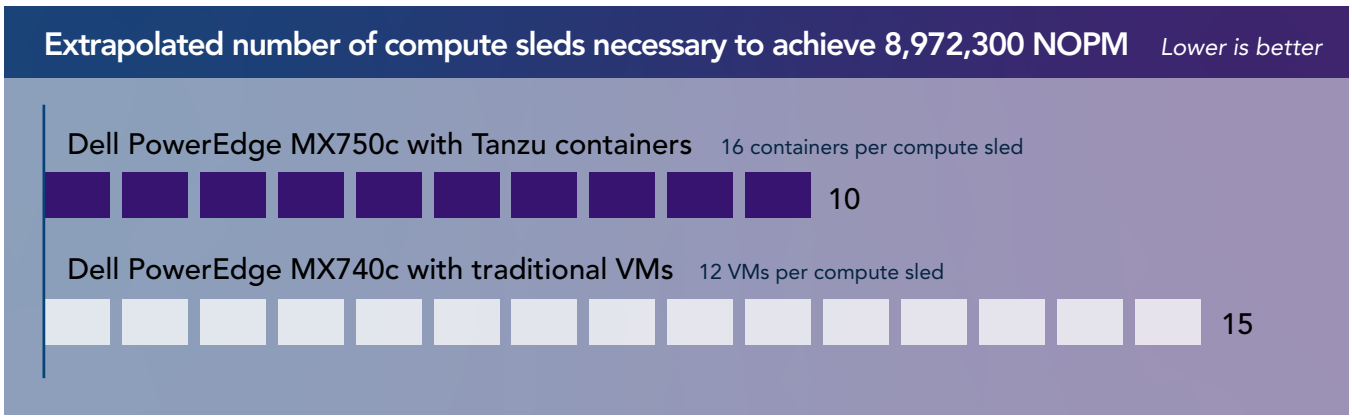
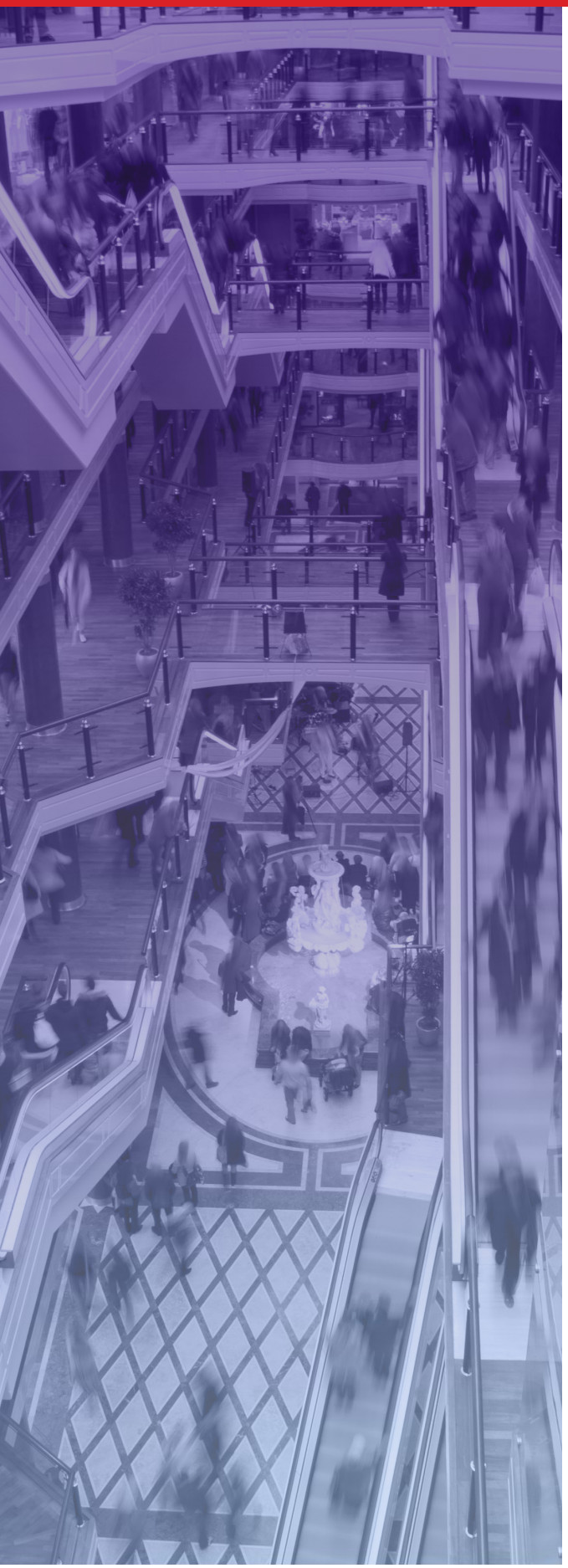


Figure 3: Extrapolated number of compute sleds necessary to complete 8,972,300 total MySQL OLTP NOPM. Fewer necessary compute sleds is better. Source: Principled Technologies.



Conclusion

Migrating your existing MySQL workloads from a virtualized environment running on legacy hardware to a containerized environment on the new, modern Dell PowerEdge MX750c compute sled has the potential to help your business in several ways. In our tests, we found that the updated hardware in the new compute sled—including 3rd Generation Intel Xeon Scalable processors, faster memory, and 4th generation PCIe—led to a total performance improvement in new orders per minute of 47 percent. Using rough numbers, a company choosing to perform this migration could replace three virtualized older compute sleds with two containerized Dell PowerEdge MX750c compute sleds. This migration and containerization effort took only three hours, less than an hour of which was active administrator time. Given the simplicity of carrying out this effort, coupled with the performance advantages of modernization, migrating to Dell PowerEdge MX750c compute sleds with TKG containers could be well worth pursuing.

1. Kubernetes Documentation, accessed August 12, 2022, https://kubernetes.io/docs/concepts/architecture/nodes/.
2. Dell, "PowerEdge MX," accessed June 28, 2022, https://www.dell.com/en-us/dt/servers/modular-infrastructure/poweredge-mx/index.htm#tab0=0&tab1=0&accordion0.
3. Dell, "PowerEdge MX."
4. "VMware Tanzu Kubernetes Grid," accessed June 28, 2022, https://d1fto35gcfffzn.cloudfront.net/tanzu/tkg/TKG-Solution-Overview.pdf.
5. "VMware Tanzu Kubernetes Grid Documentation," accessed June 28, 2022, https://docs.vmware.com/en/VMware-Tanzu-Kubernetes-Grid/index.html.
6. "VMware Tanzu," accessed July 1, 2022, https://d1fto35gcfffzn.cloudfront.net/tanzu/VMware-Tanzu-Solution-Brief-0121.pdf.

Read the science behind this report at https://facts.pt/Kff2j67 ▶

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