PROWESS

Processor Choice Matters for VDI Economics

Servers powered by AMD EPYC® processors can reduce total cost of ownership (TCO) and cost per user for virtual desktop infrastructure (VDI) deployments compared to those running competing processors.

Increasing numbers of employees started working remotely during 2020. That switch has forced IT organizations to elevate remote-productivity solutions—such as VDI—as a priority. As VDI grows in operational importance for organizations, TCO and cost questions, in addition to availability and security concerns, have grown more prominent for IT.

Evaluation by Prowess Consulting shows that the foundation that powers servers—their processors—can have an outsized impact on VDI deployment cost. Our evaluation shows that building VDI systems around AMD EPYC® processors rather than Intel® Xeon® processors can reduce three-year server TCO by as much as 68 percent, and it can decrease the cost per user per month by as much as 59 percent. Just in terms of power consumption and cooling, the servers powered by AMD EPYC processors that we evaluated were 44 to 53 percent more efficient than those powered by Intel Xeon processors.

Beyond the cost factors, AMD EPYC processors provide reliability, availability, and serviceability (RAS) features, in addition to security capabilities, which can increase server uptime and help protect data on virtual desktops. Independent of the processors powering them, the Lenovo® servers examined in this study also have additional performance, reliability, and customer-satisfaction features that can qualitatively improve VDI deployments for IT organizations and that can help reduce the complexity of the server infrastructure that undergirds such deployments.

As much as
68%
lower three-year TCO*

As much as
59%
lower cost per user per month*

43–53%
lower power and cooling costs*

*On VDI systems built with AMD EPYC® processors, compared to systems with Intel® Xeon® processors.

Market Trend: The Necessity of Increased Security and Efficiency to Support Remote Work

The need to support end-user productivity from anywhere went from “important” to “critical” in a matter of weeks for most IT organizations in 2020. Simply and securely supporting employees when they access their work-related desktops and apps from home or other remote locations became crucial in the face of government-mandated lockdowns and social distancing during the COVID-19 pandemic and for the foreseeable future. IT organizations had to support a ballooning number of remote workers while ensuring no downtime for business operations.

While IT organizations have always been tasked with looking for ways to reduce security risks associated with end-user computing, the explosive growth of remote work has made finding solutions a top priority. VDI deployments have traditionally been a means of mitigating the security and compliance risks associated with endpoint data loss and image drift by moving desktop assets into the data center and managing them there. VDI can enable IT to improve overall security and compliance, protect corporate intellectual property (IP), avoid costly audits, and support secure access regardless of the device used. Centralized management of desktop assets from the data center through VDI can also simplify the release of software, firmware, and security updates and upgrades to all users.

Comparing Processors for VDI

Because VDI deployments have become increasingly important for many IT organizations due to both immediate and longer-term impetuses, we researched hardware platforms to assess to what extent the processors that power servers could impact TCO for VDI. Specifically, we quantitatively assessed the TCO of servers powered by AMD EPYC processors and servers running Intel Xeon processors that supported comparable numbers of virtual desktops (looking at both capital expenditures [CapEx] and power and cooling costs). We also examined the cost per user for these servers, in addition to qualitative differentiators that were specific to the Lenovo servers we compared, such as high availability and security. We conducted our detailed comparison on Lenovo servers, but we also examined some costs for Dell Technologies servers to see how our findings held up across manufacturers. (For details on our assumptions and methodology for this comparison, see the "**Comparison Overview**" section and the **appendices**.)

Evaluation Results

In our testing, we compared a Lenovo® ThinkSystem™ SR665 powered by two AMD EPYC 7452 processors versus a Lenovo ThinkSystem SR850P powered by four Intel Xeon Platinum 8260 processors. Our evaluation showed that for single, large-capacity servers, the deployment based on the AMD EPYC processor cost 68 percent less over three years than the Intel Xeon processor–based alternative (see the Large configuration in Figure 1).

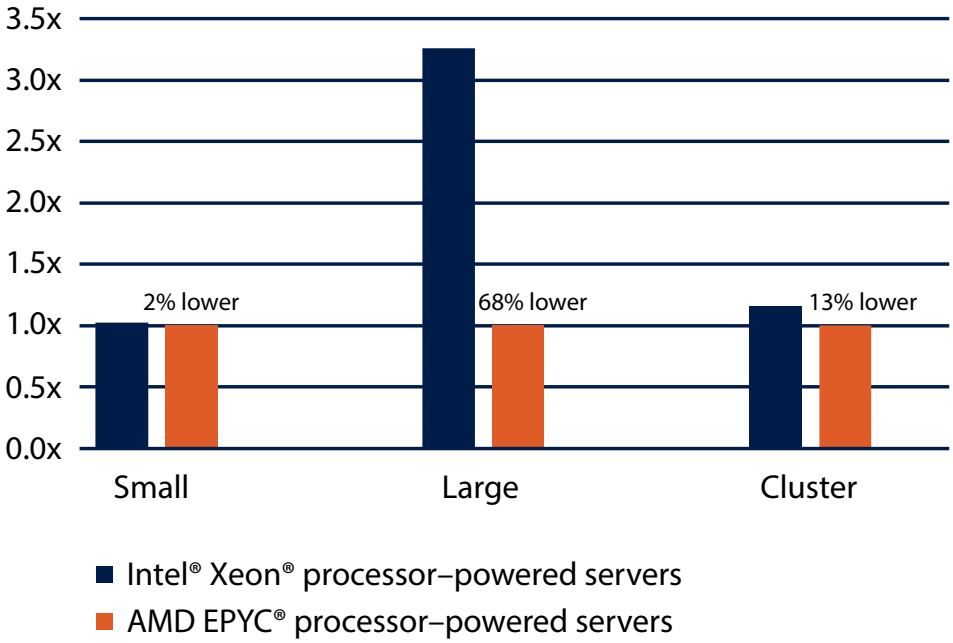

Figure 1. Normalized comparison of three-year TCO for a single-node AMD EPYC® processor–powered Lenovo® ThinkSystem™ SR655 compared to an Intel® Xeon® processor–powered Lenovo ThinkSystem SR630 ("Small"), a single-node AMD EPYC processor–powered Lenovo ThinkSystem SR665 compared to an Intel Xeon processor–powered Lenovo ThinkSystem SR850P ("Large"), and four-node AMD EPYC processor–powered Lenovo ThinkSystem SR655 servers compared to Intel Xeon processor–powered Lenovo® ThinkAgile™ VX3320 appliances ("Cluster") (lower is better)

Even scaling out in four-node clusters, four Lenovo ThinkSystem SR655 servers powered by four AMD EPYC 7452 processors were 13 percent less expensive to own and operate over three years than four Lenovo® ThinkAgile™ VX3320 appliances powered by eight Intel Xeon Gold 6230 processors (see the Cluster configuration in Figure 1).

Smaller stand-alone configurations did not produce the same kind of dramatic difference between a Lenovo ThinkSystem SR655 powered by a single AMD EPYC 7452 processor versus a Lenovo ThinkSystem SR630 powered by two Intel Xeon Gold 6230 processors (see the Small configuration in Figure 1). The AMD EPYC processor–powered server evaluated at the small end had relatively more memory compared to its Intel Xeon processor–powered counterpart (1,024 GB versus 768 GB), which made it more expensive. That said, the additional memory in the smaller AMD EPYC processor–powered server could prove beneficial for smaller IT organizations looking to keep the door open to scaling out their VDI infrastructures in the future.

For VDI deployments, the number of virtual desktops that can be run—and the cost for each desktop—is also essential. While the examined servers powered by Intel® processors all hosted more virtual desktops than the servers powered by AMD® processors, the lower TCO of the servers running AMD processors still made them more affordable on a per-user basis. Looking at cost per user per month, the Lenovo ThinkSystem SR665 powered by two AMD EPYC 7452 processors was 59 percent less expensive than the Lenovo ThinkSystem SR850P powered by four Intel Xeon Platinum 8260 processors (see the Large configuration in Figure 2).

For clusters, four Lenovo ThinkSystem SR655 servers powered by four AMD EPYC 7452 processors represented a 4 percent lower cost per user per month than four Lenovo ThinkAgile VX3320 appliances powered by eight Intel Xeon Gold 6230 processors (see the Cluster configuration in Figure 2).

The smaller stand-alone configuration of a Lenovo ThinkSystem SR655 powered by a single AMD EPYC 7452 processor actually produced a slightly worse cost-per-user-per-month figure than the Lenovo ThinkSystem SR630 powered by two Intel Xeon Gold 6230 processors (see the Small configuration in Figure 2). As with the TCO, this is a product of the additional cost for the AMD EPYC processor–powered server coupled with the lower number of virtual desktops it was benchmarked running (an average of 218.5 versus 241.25; see **Appendix A** for details). That said, the greater quantity of memory in the AMD EPYC processor–powered server might prove worth the additional costs for IT organizations that want to start small but scale in the future.

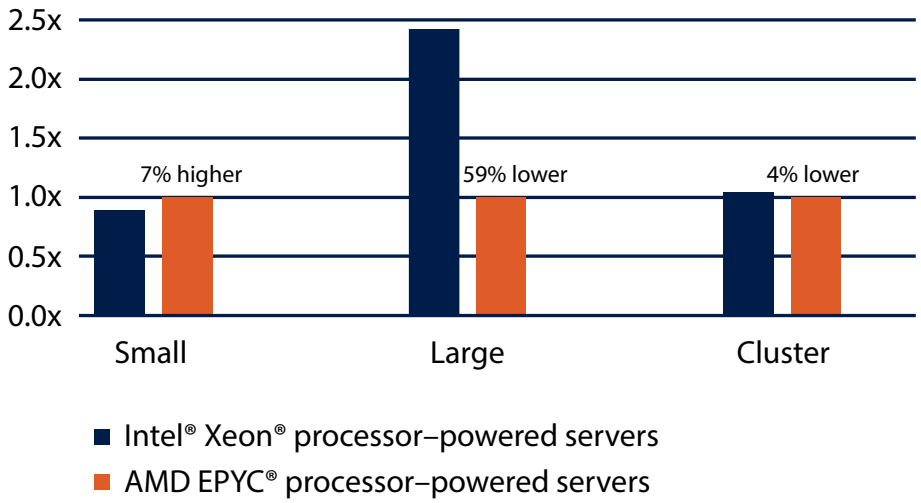

Figure 2. Normalized comparison of cost per user per month for a single-node AMD EPYC® processor–powered Lenovo® ThinkSystem™ SR655 compared to an Intel® Xeon® processor–powered Lenovo ThinkSystem SR630 ("Small"), a single-node AMD EPYC processor–powered Lenovo ThinkSystem SR665 compared to an Intel Xeon processor–powered Lenovo ThinkSystem SR850P ("Large"), and for four-node AMD EPYC processor–powered Lenovo ThinkSystem SR655 servers compared to Intel Xeon processor–powered Lenovo® ThinkAgile™ VX3320 appliances ("Cluster") (lower is better)

Inter-OEM Comparison

Choice of processor is certainly not the only driver of server price for VDI. In order to see how pricing trends hold up between manufacturers, Prowess also examined server CapEx for comparable Lenovo and Dell Technologies servers running the same Intel Xeon processors with the same amounts of memory and storage. List prices for the Lenovo servers powered by Intel Xeon processors were 17 to 31 percent lower than the Dell EMC™ PowerEdge™ servers powered by the same Intel Xeon processors. (See **Appendix B** for details.)

Comparison Overview

For performance and virtual-desktop density, we referred to benchmark testing conducted using the Login VSI® 4 benchmark package. Our testing included separate runs for knowledge-worker and power-worker workloads, both in stateless and persistent configurations (see **Appendix A** for details and full results).

CapEx and OpEx Assumptions

In order to compare the relative cost of servers powered by AMD EPYC processors and Intel Xeon processors, we calculated both the CapEx and three-year operating expenses (OpEx) for the systems. For CapEx, we used the list prices for all servers.

Given that VDI software (VMware Horizon® 7.11, in the case of this benchmark testing) can constitute a major portion of the cost of a VDI deployment that would be essentially identical for the AMD processor–based and Intel processor–based systems, we did not include it in the OpEx calculations. That reasoning also applies to labor costs for administering the systems, which we have also not included due to negligible differences between the systems. OpEx calculations in this study do include power and cooling costs for the servers for three years (see **Appendix C** for details).

Hardware Specifications

As stated above, our evaluation compared Lenovo ThinkSystem SR655 and ThinkSystem SR665 servers powered by AMD EPYC 7452 processors to ThinkSystem SR630, Lenovo ThinkSystem SR850P, and Lenovo ThinkAgile VX3320 servers powered by Intel Xeon Platinum 8260 processors and Intel Xeon Gold 6230 processors (Table 1).

Table 1. Server and processor pairings used in TCO in evaluation

Server	Processor
Lenovo® ThinkSystem™ SR655	AMD EPYC® 7452 processor
ThinkSystem SR665	AMD EPYC 7452 processor
ThinkSystem SR630	Intel® Xeon® Gold 6230 processor
ThinkSystem SR850P	Intel Xeon Platinum 8260 processor
Lenovo® ThinkAgile™ VX3320	Intel Xeon Gold 6230 processor

The test configurations were constructed to arrive at a similar number of maximum virtual desktops on the AMD processor–powered and Intel processor–powered systems to facilitate comparisons of cost. For full details of system processors, memory, and storage, see **Appendix B**.

Key AMD EPYC Processor Differentiators from Intel Xeon Scalable Processors

AMD prides its AMD EPYC processors on their core counts and security features, such as encrypted virtual machines (VMs) and Platform Secure Boot. The servers powered by AMD EPYC 7452 processors in our evaluation had nearly the same number of cores (and maximum virtual desktops) as their counterparts running two Intel Xeon Gold 6230 processors. AMD EPYC 7452 processors also support higher memory bandwidth than competing x86 processors, which helps enable VDI deployments to avoid bottlenecks with memory that could reduce the total number of desktops able to run on servers.

Beyond performance characteristics, AMD EPYC processors are tuned for power efficiency. The servers powered by AMD EPYC processors that we evaluated consistently used 45 to 53 percent less power, with less waste-heat output, than the servers we evaluated that ran Intel Xeon processors (see **Appendix C** for details).

AMD EPYC Processor Security

AMD EPYC processors also provide additional security for VDI through AMD EPYC Hardware Memory Encryption. This feature takes advantage of new security components available in AMD EPYC processors to protect information in use, including:

- AMD AES-128 encryption engine embedded in the memory controller, which automatically encrypts and decrypts data in main memory when an appropriate key is provided
- AMD Secure Processor, which provides cryptographic functionality for secure key generation and key management

The hardware-accelerated memory encryption in AMD EPYC Hardware Memory Encryption helps secure VDI in three ways:

1. **AMD Secure Memory Encryption (SME)** uses a single key to encrypt system memory. The key is generated by AMD Secure Processor at boot. AMD SME requires enablement in the system BIOS or operating system. When enabled in the BIOS, memory encryption is transparent and can run with any operating system.
2. **AMD Secure Encrypted Virtualization (SEV)** uses one key per VM to isolate guests and the hypervisor from one another. The keys are managed by AMD Secure Processor.
3. **AMD Secure Encrypted Virtualization-Encrypted State (SEV-ES)** encrypts all CPU register contents when a VM stops running. This prevents the leakage of information in CPU registers to components like the hypervisor, and it can even detect malicious modifications to a CPU register state.

These advanced encryption features help protect virtual desktops and the data on them against modern hardware attacks that have become prevalent in the enterprise.

Lenovo® Systems Overview and Differentiators

In addition to the TCO benefits provided by AMD EPYC processors, Lenovo servers themselves provide numerous qualitative benefits for VDI. Unique among server vendors, Lenovo can provide end-to-end VDI solutions on a range of form factors: laptops, mobile, thin clients, and workstations. Lenovo also works closely with Citrix and VMware; as a result of these partnerships, Lenovo has an extensive catalog of VDI documentation and implementation guides that cover deployments for the majority of the VDI market. Lenovo is also a leader in services for VDI, having deployed hundreds of implementations.

Performance, Reliability, and Customer Satisfaction

Independent of the processors that power them, Lenovo ThinkSystem servers provide a host of benefits for business operations, including VDI. Lenovo is known for its high-performance servers, and it currently holds 200 world records for performance.[1] Per Information Technology Intelligence Consulting's (ITIC's) 2020 Global Server Hardware, Server OS Reliability Report, Lenovo ThinkSystem servers are also ranked number one for x86 server uptime for the last seven consecutive years, with less than 1 percent downtime throughout the year.[2]

Lenovo ThinkSystem SR655 servers and ThinkSystem SR665 servers feature a number of RAS features. Chief among these features is Predictive Failure Analysis (PFA), which alerts administrators to impending failure of processors, memory, power-supply units (PSUs), system fans, adapter slots, hard-disk drives (HDDs), solid-state drives (SSDs), and voltage-regulator modules (VRMs). These predictive alerts enable servicers to schedule planned downtime rather than reacting to sudden failure. Lenovo ThinkSystem servers also feature independently

powered light-path diagnostic LEDs, which light up beside a failing component for instant identification in order to enable fast servicing and reduce downtime.

Lenovo ThinkSystem servers also feature the Lenovo® XClarity® Controller, a hardware-embedded management engine that enables faster boot-times and firmware updates.[3] In addition to speeding booting and patching, Lenovo XClarity Energy Manager provides power and thermal monitoring to help IT organizations achieve lower heat output and reduced cooling needs. The Lenovo XClarity Administrator also provides central management of ThinkSystem servers, storage, and networking in scale-out scenarios. Lenovo XClarity Administrator also integrates with higher-level systems-management software, including VMware vCenter®, to reduce complexity, speed responses, and enhance the availability of Lenovo server systems.

Finally, Lenovo consistently ranks high for customer satisfaction for products and services. For example, Lenovo Premier Support met or exceeded competitors in 20 of 21 attributes of the support experience in a March 2020 study by research firm Technology Business Research.[4]

Choice of Processor Matters: Choose Wisely

As this study details, the choice of processor can matter a great deal for TCO and the cost per user for VDI deployments. Prowess Consulting's evaluation indicates that building VDI systems around AMD EPYC processors rather than Intel Xeon processors can reduce three-year server TCO by as much as 39 to 68 percent and the cost per user per month by as much as 33 to 59 percent. Beyond the cost factors, AMD EPYC processors provide RAS and security features that can increase server uptime and help protect data on virtual desktops. Independent of processor capabilities, Lenovo servers bring their own performance, reliability, and customer-satisfaction features that can qualitatively improve VDI deployments for IT organizations and reduce the complexity of the server infrastructure that undergirds them. 2020 has been a year of tremendous upheaval for IT organizations, but smart hardware decisions starting with the processor can lead to outsized results for organizations looking to change or build out their VDI infrastructures.

Appendix A: Performance and VDI Density

Test Software Configuration

Knowledge-worker profile	2 vCPU + 2 GB memory
Power-worker profile	3 vCPU + 2 GB memory
VMware ESXi™ version	6.7.0, Build 15160138, 16075168
Operating system	Windows 10, version 1909
VDI software	VMware Horizon® 7.11
Benchmark software	Login VSI® 4

Lenovo Servers (AMD EPYC Processors)[5]

Server Configuration	Workload Profile	Login VSI® VSImax (at 100% CPU) Max # of desktop sessions reached		
		Stateless	Persistent	Average
Small	Knowledge worker	239	237	218.50
	Power worker	205	193	
Large	Knowledge worker	496	499	461.00
	Power worker	421	428	
Cluster	Knowledge worker	879	880	796.50
	Power worker	710	717	

Lenovo Servers (Intel Xeon Processors)[5]

Server Configuration	Workload Profile	Login VSI® VSImax (at 100% CPU) Max # of desktop sessions reached		
		Stateless	Persistent	Average
Small	Knowledge worker	245	257	241.25
	Power worker	227	236	
Large	Knowledge worker	618	639	602.75
	Power worker	564	590	
Cluster	Knowledge worker	890	935	877.25
	Power worker	827	857	

Appendix B: Hardware Specifications

Lenovo Servers (AMD EPYC Processors)

Configuration	Small	Large	Cluster
Chassis	1 x Lenovo® ThinkSystem™ SR655	1 x Lenovo ThinkSystem SR665	4 x Lenovo ThinkSystem SR655
Processors	1 x AMD EPYC® 7452 processor (32 cores total at 2.35 GHz)	2 x AMD EPYC 7452 processor (64 cores total at 2.35 GHz)	4 x AMD EPYC 7452 processor (128 cores total at 2.35 GHz)
Memory	16 x ThinkSystem 64 GB TruDDR4 2,933 MHz (2Rx4 1.2V) RDIMM-A (1,024 GB total)	16 x ThinkSystem 64 GB TruDDR4 3,200 MHz (2Rx4 1.2V) RDIMM-A (1,024 GB total)	64 x ThinkSystem 64 GB TruDDR4 2,933 MHz (2Rx4 1.2V) RDIMM-A (4,096 GB total)
Storage	2 x ThinkSystem M.2 5300 240 GB Serial ATA (SATA) 6 gigabits per second (Gbps) non-hot-swap SSD	2 x ThinkSystem M.2 5300 240 GB SATA 6 Gbps non-hot-swap SSD	16 x ThinkSystem 2.5-inch 5200 1.92 TB entry SATA 6 Gbps hot-swap SSD
			8x ThinkSystem 2.5-inch PM1645a 800 GB mainstre am SAS 12 Gbps hot-swap SSD
			8 x ThinkSystem M.2 5300 240 GB SATA 6 Gbps non-hot-swap SSD
List price	**$26,815.01**	**$30,048.01**	**$207,856.08**

Lenovo Servers (Intel Xeon Processors)

Configuration	Small	Large	Cluster
Chassis	1 x Lenovo® ThinkSystem™ SR630	1 x Lenovo ThinkSystem SR850P	4 x Lenovo® ThinkAgile™ VX3320 Appliance
Processors	2 x Intel® Xeon® Gold 6230 processor (40 cores total at 2.10 GHz)	4 x Intel Xeon Platinum 8260 processor (96 cores total at 2.40 GHz)	8 x Intel Xeon Gold 6230 processor (160 cores total at 2.10 GHz)
Memory	12 x ThinkSystem 64 GB TruDDR4 2,933 MHz (2Rx4 1.2V) RDIMM (768 GB total)	48 x ThinkSystem 64 GB TruDDR4 2,933 MHz (2Rx4 1.2V) RDIMM (3,072 GB total)	48 x ThinkSystem 16 GB TruDDR4 2,666 MHz (2Rx8 1.2V) RDIMM (768 GB total)
Storage	2 x ThinkSystem M.2 5300 240 GB SATA 6 Gbps non-hot-swap SSD	2 x ThinkSystem M.2 5300 240 GB SATA 6 Gbps non-hot-swap SSD	8 x ThinkSystem 2.5-inch SS530 800 GB performance SAS 12 Gbps hot-swap SSD
			8 x ThinkSystem 2.5-inch 2.4 TB 10K SAS 12 Gbps hot-swap 512e HDD
List price	**$26,244.01**	**$99,153.00**	**$236,196.04**

Dell Technology Servers (Intel Xeon Processors)

Configuration	Small	Large	Cluster
Chassis	1 x Dell EMC™ PowerEdge™ R640 rack server	1 x Dell EMC PowerEdge R840 rack server	4 x Dell EMC PowerEdge R640 rack server
Processors	2 x Intel® Xeon® Gold 6248 processor (40 cores total at 2.50 GHz)	4 x Intel Xeon Platinum 8260 processor (96 cores total at 2.40 GHz)	8 x Intel Xeon Gold 6248 processor (160 cores total at 2.50 GHz)
Memory	12 x 64 GB RDIMM, 3,200 megatransfers per second (MT/s), dual rank (768 GB total)	48 x 64 GB RDIMM, 3,200 MT/s, dual rank (3,072 GB total)	48 x 64 GB RDIMM, 3,200 MT/s, dual rank (3,072 GB total)

Storage	1 x 480 GB SSD SATA read-intensive 6 Gbps 512 2.5-inch hot-plug AG drive, 1 drive write per day (DWPD), 876 terabytes written (TBW)	1 x 480 GB SSD SATA mixed-use 6 Gbps 512 2.5-inch hot-plug AG drive, 3 DWPD, 2,628 TBW	4 x 480 GB SSD SATA read-intensive 6 Gbps 512 2.5-inch hot-plug AG drive, 1 DWPD, 876 TBW
List price	**$38,518.00**	**$141,519.17**	**$284,864.00**

Appendix C: Comparison Parameters and Assumptions

Server TCO in this study is computed by taking the list price of the server and adding three years' power and cooling using the U.S. Energy Information Agency average for commercial electricity prices in the United States (Equation 1).[6]

Equation 1

Server TCO = cost of server + hardware and cooling wattage estimate × 26,298 hours × U.S.average commercial power rate ($/kWh)

Cost per user per month is calculated by taking server three-year TCO and dividing it by the average benchmark results for the server and by 36 months (Equation 2).

Equation 2

$$\textit{Cost per user per month} = \frac{\textit{Server TCO}}{\textit{Average of knowledge worker/power worker,stateless/persistent Login VSI VSImax} \times \textit{36 mo.}}$$

Lenovo Servers (AMD EPYC Processors)

Configuration	Small	Large	Cluster
Chassis	1 x Lenovo® ThinkSystem™ SR655	1 x Lenovo ThinkSystem SR665	4 x Lenovo ThinkSystem SR655
List price	$26,815.01	$30,048.01	$142,460.08
Total input system power (85% load)[7]	225.2 W/server	552.8 W/server	225.2 W/server
Heat production (85% load)[7]	768.5 BTU/h/server	1,886.1 BTU/h/server	768.5 BTU/h/server
Total wattage estimate (hardware + cooling)[7]	**450.4 W/server**	**1,105.6 W/server**	**450.4 W/server**
Average U.S. commercial electricity price, July 2020[6]	$0.1089/kWh	$0.1089/kWh	$0.1089/kWh
Hours per three years	26,298	26,298	26,298
Three-year TCO total	**$28,104.89**	**$33,214.28**	**$213,015.60**
Average max desktop sessions (Login VSI® VSImax benchmark)	218.5	461.0	796.5
Cost/user/mo.	**$3.57**	**$2.00**	**$7.43**

Lenovo Servers (Intel Xeon Processors)

Configuration	Small	Large	Cluster
Chassis	1 x Lenovo® ThinkSystem™ SR630	1 x Lenovo ThinkSystem SR850P	4 x Lenovo® ThinkAgile™ VX3320 Appliance
List price	$26,244.01	$99,153.00	$236,196.04
Total input system power (85% load)[7]	442.6 W/server	1,186.9 W/server	407.8 W/server
Heat production (85% load)[7]	1,510.1 BTU/h/server	4,049.6 BTU/h/server	1,391.5 BTU/h/server
Total wattage estimate (hardware + cooling)[7]	**885.2 W/server**	**2,373.8 W/server**	**815.6 W/server**
Average U.S. commercial electricity price, July 2020[6]	$0.1089/kWh	$0.1089/kWh	$0.1089/kWh
Hours per three years	26,298	26,298	26,298
Three-year TCO total	**$28,779.09**	**$105,951.21**	**$245,539.07**
Average max desktop sessions (Login VSI® VSImax benchmark)	241.25	602.75	877.25
Cost/user/mo.	**$3.31**	**$4.88**	**$7.77**

[1] As of September 1, 2020. Source: Lenovo. "Lenovo ThinkSystem Servers Continue to Lead the Industry in Performance and Customer Value." October 2020. https://lenovopress.com/lp1145-lenovo-thinksystem-continues-to-lead-the-industry-in-performance.

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[3] Lenovo. "Lenovo XClarity Controller." www.lenovo.com/us/en/data-center/software/systems-management/xclarity-controller/.

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[5] Lenovo. "Reference Architecture: Lenovo Client Virtualization with VMware Horizon on ThinkSystem and ThinkAgile VX Servers." November 2020. https://lenovopress.com/lp0663-reference-architecture-lenovo-client-virtualization-vmware-horizon-thinksystem.

[6] U.S. Energy Information Administration. "Table 5.6.A. Average Price of Electricity to Ultimate Customers by End-Use Sector." July 2020. https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_5_6_a.

[7] Per the Lenovo Capacity Planner. https://datacentersupport.lenovo.com/us/en/products/solutions-and-software/software/lenovo-capacity-planner/solutions/ht504651.