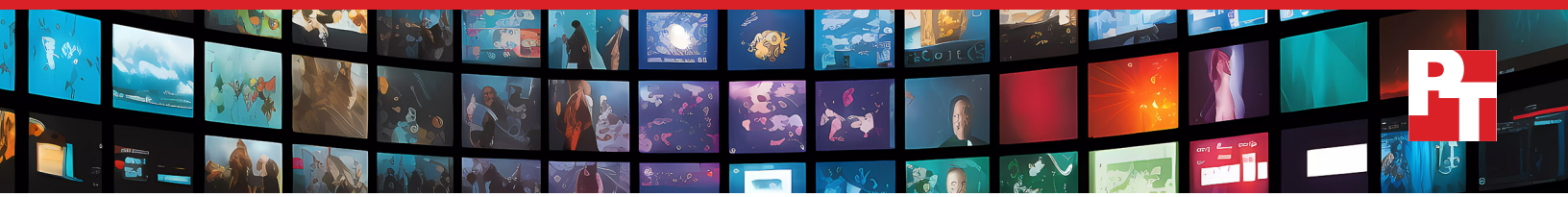

Boost networking performance for video by configuring Dell PowerEdge R750 servers with Broadcom 57508 Dual Port 100Gb NICs

In hands-on tests, the PowerEdge R750 server with a single 100Gb NIC provided better and more consistent performance than it did with four 25Gb NICs

Overview

As our world grows more and more interconnected, video is playing an ever-greater role in personal, societal, and commercial spheres. In 2022, YouTube received more than 500 hours of video uploads every minute.[1] In the 2019–2020 school year, 91 percent of public school surveyed used security cameras.[2] And this year, over 90 percent of businesses have utilized video for marketing.[3] From kids live-streaming their Minecraft games to hospital safety and security systems, video is ubiquitous.

With increasing reliance on video comes greater demands for high-performance technology. Video editors at marketing agencies, stores capturing video of customers, and streaming video providers all require high bandwidth to keep business running smoothly. So, too, do all organizations using video. For any organization selecting new data center solutions to support video, strong bandwidth capabilities should be a top consideration.

Here at Principled Technologies (PT), we used the Frametest tool to test the maximum available bandwidth of two solutions: a Dell™ PowerEdge™ R750 server with a Broadcom® 57508™ Dual Port 100Gb network interface card, and the same PowerEdge R750 server with four 25Gb NICs. (See later in this report for more about Frametest, and note that we used two dual-port NICs to achieve our 4x 25Gb NIC configuration.) We tested with multiple numbers of instances, or data streams, to represent both lighter and heavier workloads. Across all the instance counts we tested, the solution with the 100Gb Broadcom 57508 NIC delivered higher frames-per-second (FPS) rates and more consistent bandwidth performance than the four-NIC solution. This better, more consistent bandwidth makes the PowerEdge R750 server with 100Gb Broadcom 57508 NIC an appealing choice for organizations relying on video for their everyday operations.

Up to 31% more FPS on average at 8 instances

Better frame rate consistency across instances

How we tested

Four times 25 equals 100, so four 25Gb network cards should deliver the same performance as a single 100Gb network card—right?

Only in theory. In reality, a multi-NIC solution must use some overhead to work together, and the often unpredictable nature of balancing multiple network streams across different network interfaces means that performance may not always be what you'd expect. With our testing, we aimed to quantify the improvement in bandwidth you might see by equipping a Dell PowerEdge R750 server with a single Broadcom 57508 Dual Port 100Gb NIC instead of four 25Gb NICs.

To do this, we tested a single Dell PowerEdge R750 server in two configurations—one with a single Broadcom 57508 Dual Port 100Gb network interface card, and one with four 25Gb NICs (two Intel® XXV710-DA2T 2-port 25Gb Ethernet Controllers). The server also contained:

- Two 28-core Intel Xeon® Gold 6330 processors
- 24 3.2TB PCIe Gen 4 NVMe™ SSDs
- 256 GB of DDR4 memory
- A Broadcom® PEX880xx PCIe Gen 4 switch

For more details about our configuration, see the science behind the report.

Video for safety and security

The safety and security market is large and growing, starting at your front door with smart doorbells and moving up to video surveillance at airports, sports arenas, and shopping malls. Revenue for smart home security in the U.S. tops $4 billion, while the size of the global surveillance market was over $130 billion last year.[4,5] The backbone of many of those safety and security solutions? Video.

For these video solutions, the stakes are high. When you have multiple security cameras transmitting data constantly to your servers, each data stream needs to arrive quickly, without dropped frames or bandwidth constraints. If data streams place too much load on the network and make data transfer inconsistent for even a single streaming source, such as a camera, you may lose moments vital to safety. High quality video streams that provide undisturbed monitoring can better keep your assets secure.

To set up our solution for testing, we first installed and configured Red Hat Enterprise Linux (RHEL) 8.6 as our operating system and then configured the networking. For the configuration with the Broadcom 100Gb NIC, we used just the first port; for the other configuration, we combined the four Intel 25Gb NIC ports into an Link Aggregation Control Protocol (LACP) network bond in Linux with layer 3+4 load balancing. We configured an additional PowerEdge R750 server with a single 100Gb Broadcom dual-port NIC to operate as a load generating client. We connected everything to a single Dell Networking S5048F-ON switch using direct-attached cables, configuring the four 25Gb ports used by the system under test as an active (LACP) port-channel on the switch.

We then ran multiple instances of the Frametest utility. Frametest is a tool that simulates reads and writes of raw still frames or frames such as video post-processing or 3D rendering software might generate. It measures throughput in terms of frame rates, or the number of video frames a solution can successfully transfer per second, both reads and writes. Frame rates are a measure of video quality—the more frames per second that a solution can handle, the clearer the information displayed on screen.

In this study, we report the average number of FPS for each number of instances we tested as well as the way the FPS rates varied across the multiple test runs we did. Frametest allows the testing engineer to customize a variety of elements. We chose a 4K frame size, a target FPS count of 24, and a run count of 15, meaning that each time we ran the test, it would run 15 times in a row.

We started by running a single instance of Frametest. We repeated this test 11 more times, adding an instance of the benchmark each time, ultimately running one through 12 instances simultaneously using containers. Running more than one instance of the utility simultaneously simulates increasingly heavy video-processing workloads. In a real-world context, this might mean a large team of videographers editing video at the same time or multiple cameras in a shopping mall streaming video to a security office.

While many factors, including internet speed, protocols, and encoder setup, can impact throughput and bandwidth consistency in real-world streaming scenarios, our tests controlled for those variables. To see the scripts we used in testing, read the science behind the report.

Video in retail

While consumers might typically think of video for retail in terms of online advertising, video is also increasingly a part of in-store shopping experiences. Grocery stores use video screens to advertise sales, and in-store cameras can map where customers are lingering over products or when a line is getting too long.[6, 7] Some of this video returns to company data centers for artificial intelligence (AI) analysis of which customers engage with the screens, where and how shoppers navigate a store, and the demographics of the store's customers.

From providing a more compelling experience to customers in store to delivering more granular insights on shopper behavior, all of these use cases benefit from higher video quality and faster file transfer.

Achieve higher and more consistent bandwidth for streaming video workloads with a Broadcom 57508 NIC

Here, we report the average throughput in FPS that our two solutions achieved running one through 12 instances of the Frametest utility. In addition to the average read and write FPS of both solutions, we also show a theoretical target of 24 FPS per instance of Frametest. We selected 24 FPS as the target in Frametest because it is a high enough standard to cover multiple common use cases: It is the universal norm for movies[8] and is well above the average surveillance industry frame rate of approximately 15 FPS.[9] It is common for a solution to miss that theoretical target, especially under heavier workloads, but the closer it gets, the better the performance.

Figures 1 and 2 show the average frames per second for reads and writes that both solutions achieved. While both the Broadcom 57508 solution and the four-NIC solution handled lighter loads with similar throughput, the four-NIC solution dropped well below target as the video load increased. The Broadcom 57508 solution continued to keep pace with the target frame rate until reaching the heaviest workloads of 11 and 12 instances; in contrast, the four-NIC solution started to drop off as early as five instances.

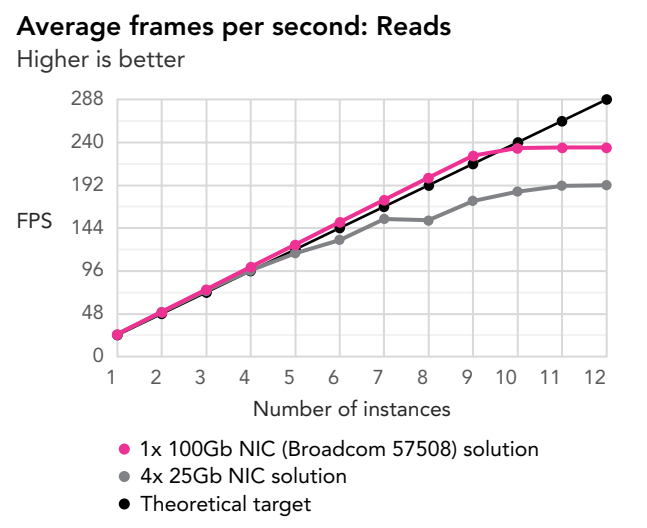

Figure 1: Frametest results, in average read frames per second, for the two NIC solutions from 1 to 12 instances. Higher numbers are better. Source: Principled Technologies.

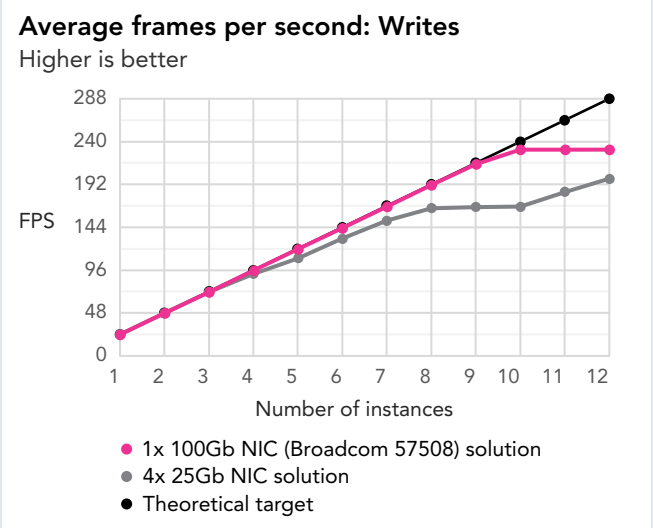

Figure 2: Frametest results, in average write frames per second, for the two NIC solutions from 1 to 12 instances. Higher numbers are better. Source: Principled Technologies.

At these heavier loads, the Broadcom 57508 solution delivered consistently higher throughput. At eight instances, it achieved a 31 percent higher rate of frames per second than the four-NIC solution. We saw differentials through 12 instances, where the Broadcom 57508 solution achieved a 22 percent higher rate.

In addition to looking at the average bandwidth each solution achieved, we also assessed read bandwidth consistency across the 15 test runs of Frametest at each instance count. When bandwidth consistency is high, no one data stream has priority over the others, allowing for fast, smooth video transfer. The more consistent bandwidth is—or the less variance there is from the average—the better the end-user experience will be, and the lower the likelihood of issues with the video.

As Figures 3 and 4 show, the two solutions delivered similar consistency at one and two instances.

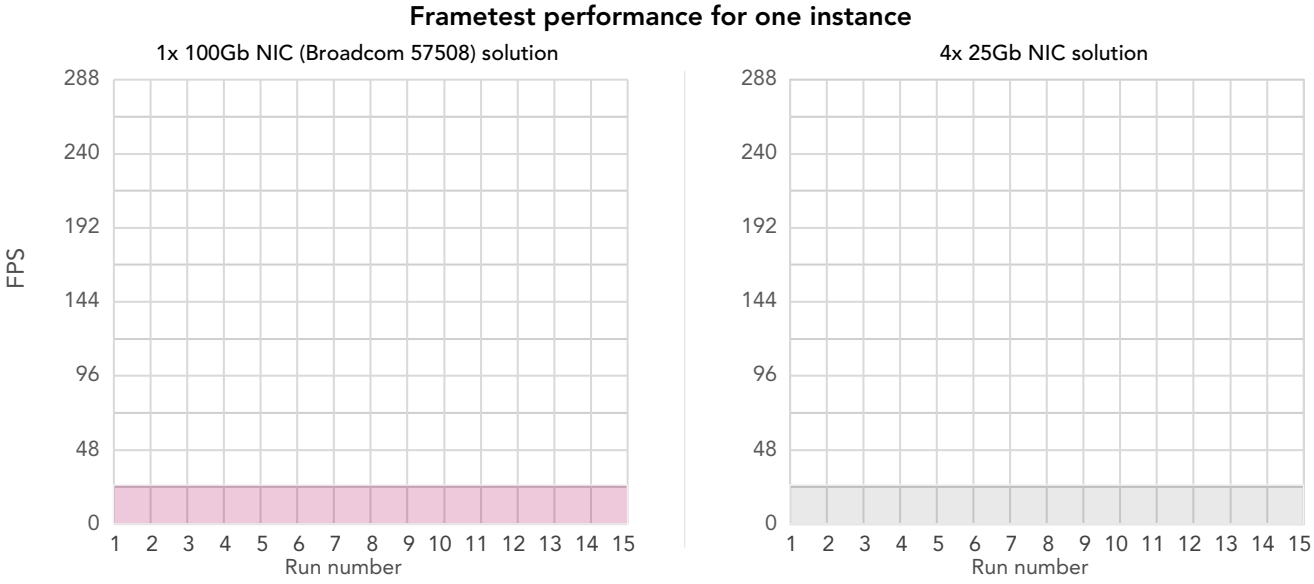

Figure 3: Frametest results, in frames per second, for one instance. Higher rates and greater consistency are better. Source: Principled Technologies.

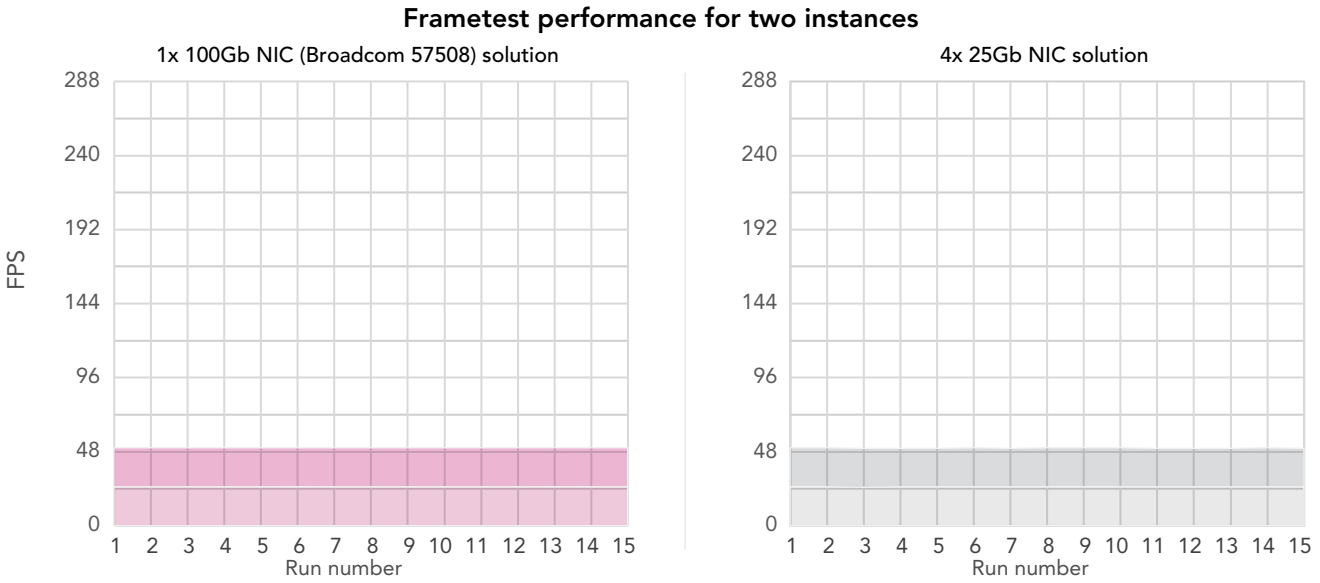

Figure 4: Frametest results, in frames per second, for two instances. Higher rates and greater consistency are better. Source: Principled Technologies.

At as few as three instances, however, the four-NIC solution began to display some inconsistency, as we see in Figure 5.

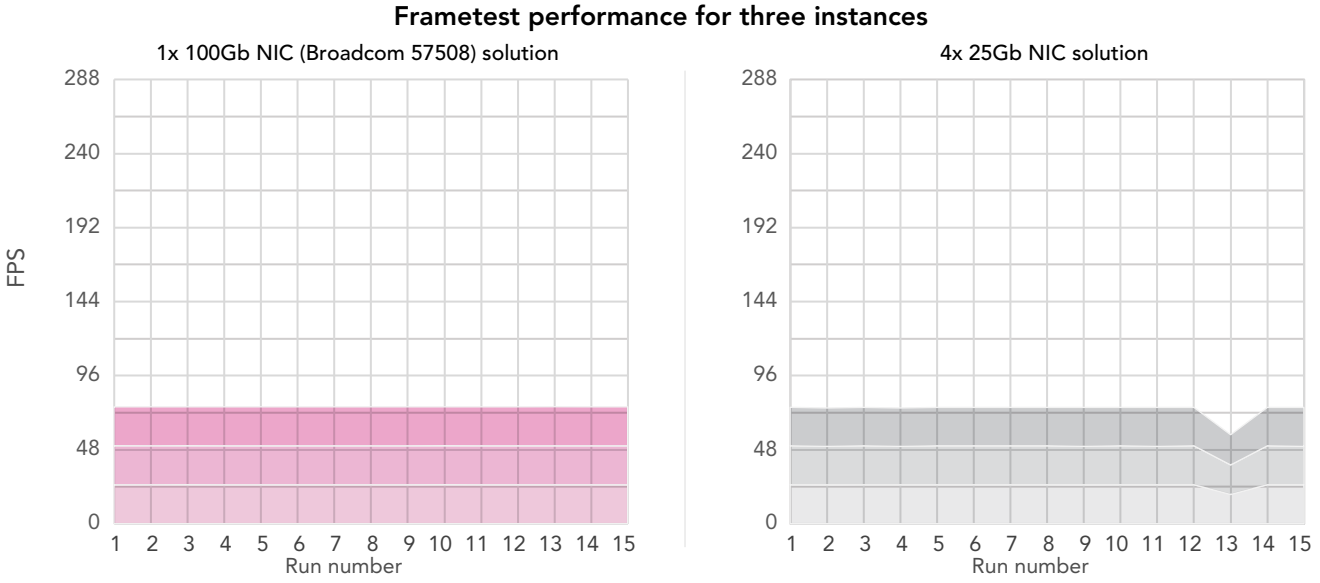

Figure 5: Frametest results, in frames per second, for three instances. Higher rates and greater consistency are better. Source: Principled Technologies.

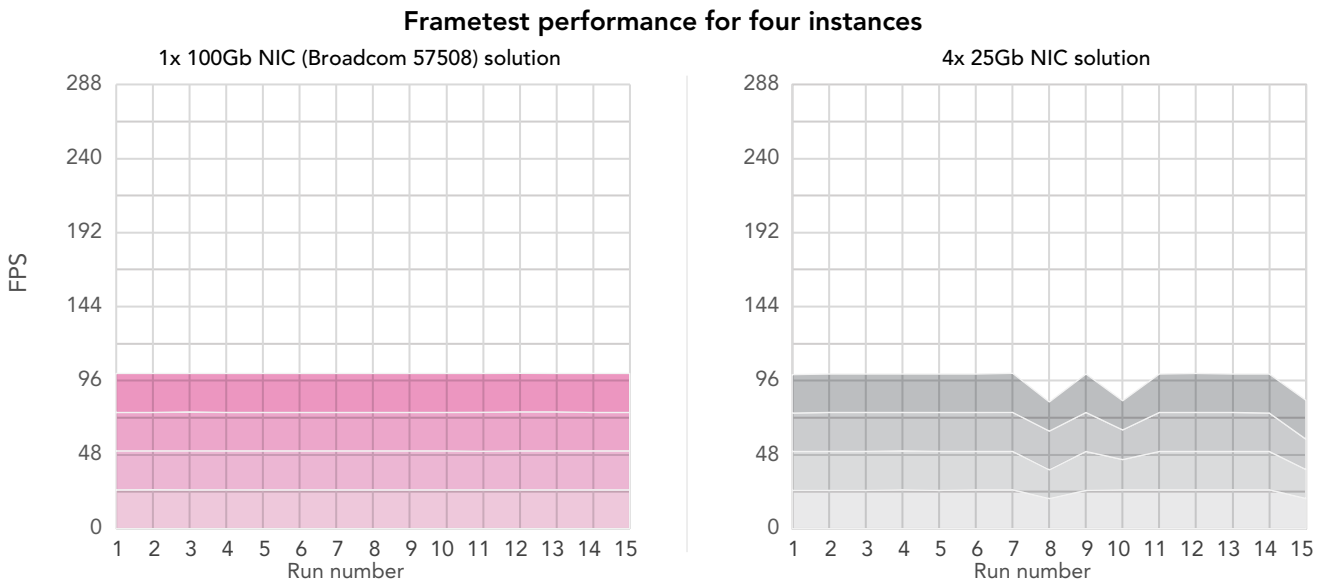

Figure 6: Frametest results, in frames per second, for four instances. Higher rates and greater consistency are better. Source: Principled Technologies.

This problem gets markedly worse as we add instances and the workload grows heavier (Figures 6 through 14). While a solution of four 25Gb NICs theoretically should be able to achieve the same results as one with a single 100Gb NIC, it cannot. This is due to the nature of the LACP load-balancing algorithm.

The Broadcom 100Gb solution, in contrast, is much more consistent at every instance count above the first two, with minimal variance even at the heaviest workload of 12 instances.

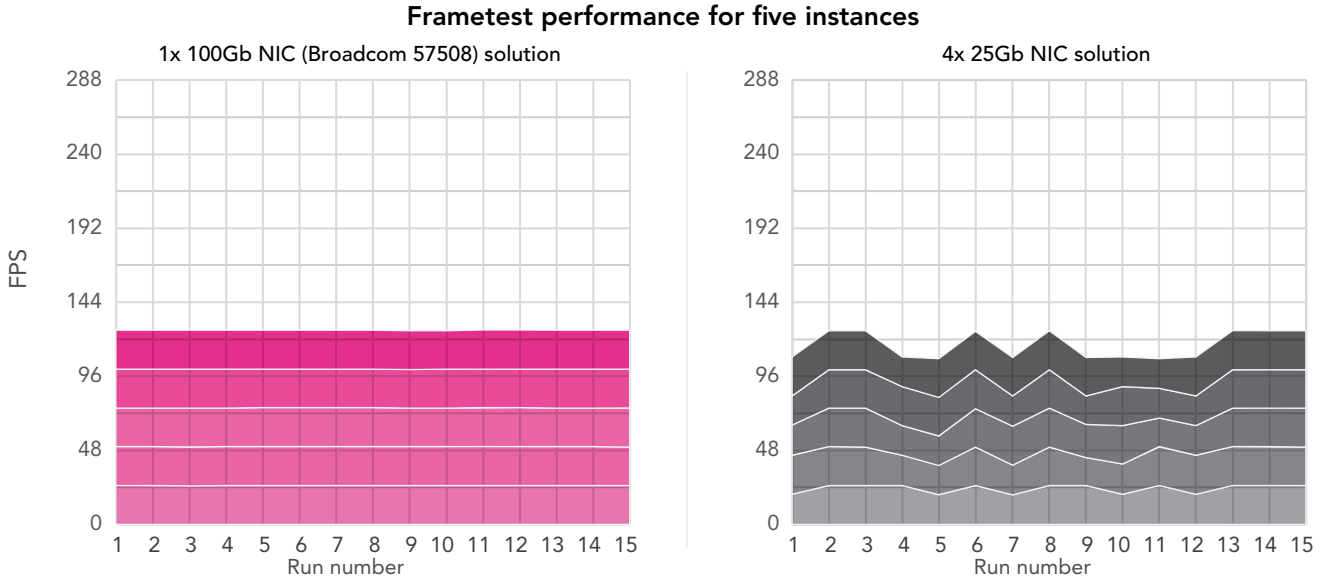

Figure 7: Frametest results, in frames per second, for five instances. Higher rates and greater consistency are better. Source: Principled Technologies.

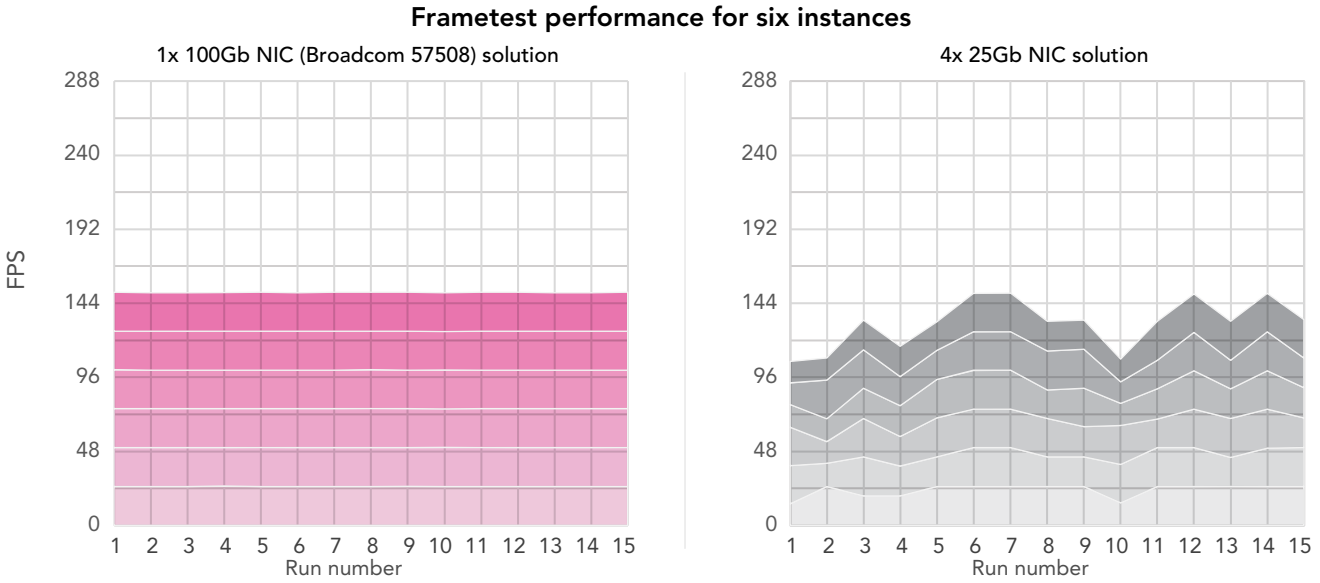

Figure 8: Frametest results, in frames per second, for six instances. Higher rates and greater consistency are better. Source: Principled Technologies.

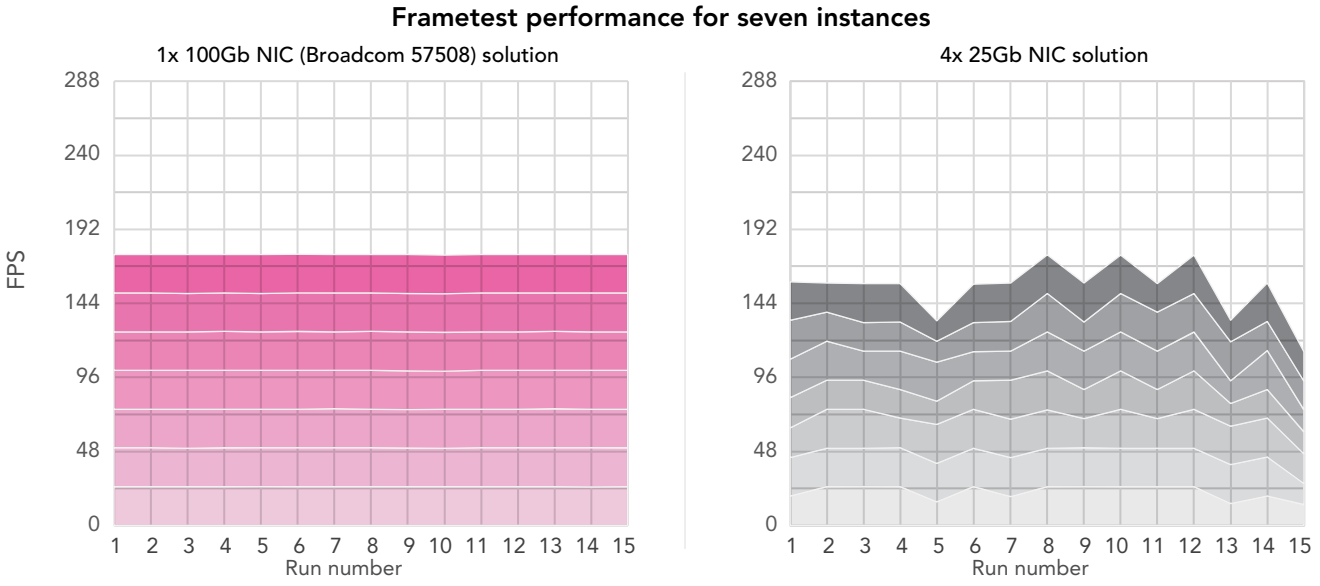

Figure 9: Frametest results, in frames per second, for seven instances. Higher rates and greater consistency are better. Source: Principled Technologies.

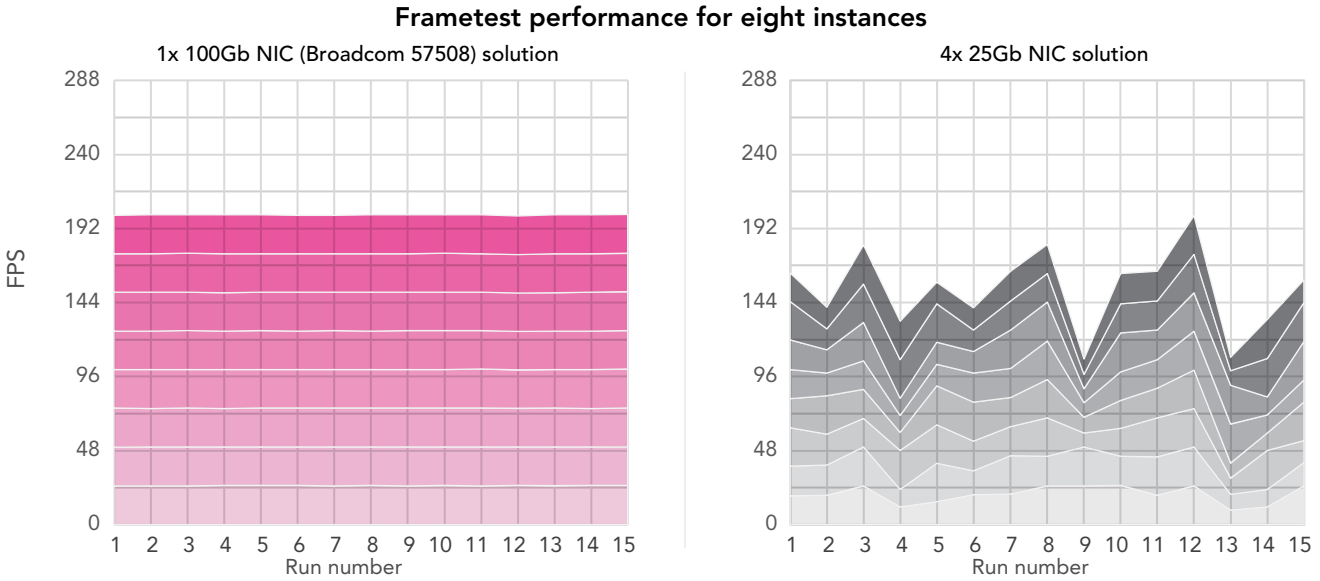

Figure 10: Frametest results, in frames per second, for eight instances. Higher rates and greater consistency are better. Source: Principled Technologies.

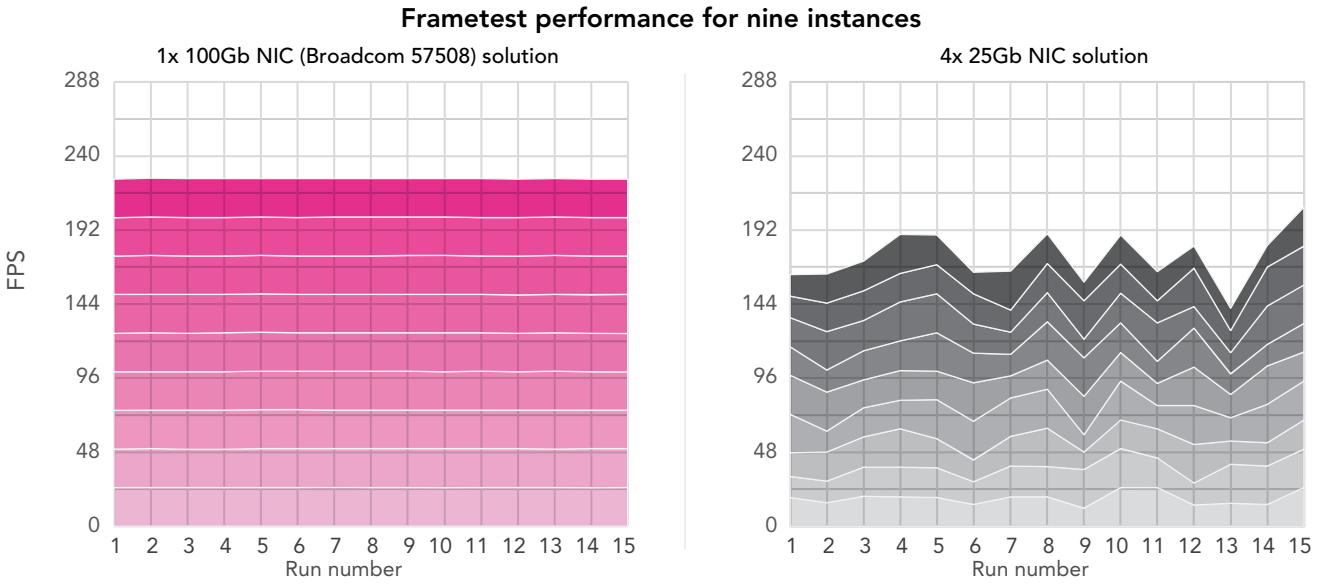

Figure 11: Frametest results, in frames per second, for nine instances. Higher rates and greater consistency are better. Source: Principled Technologies.

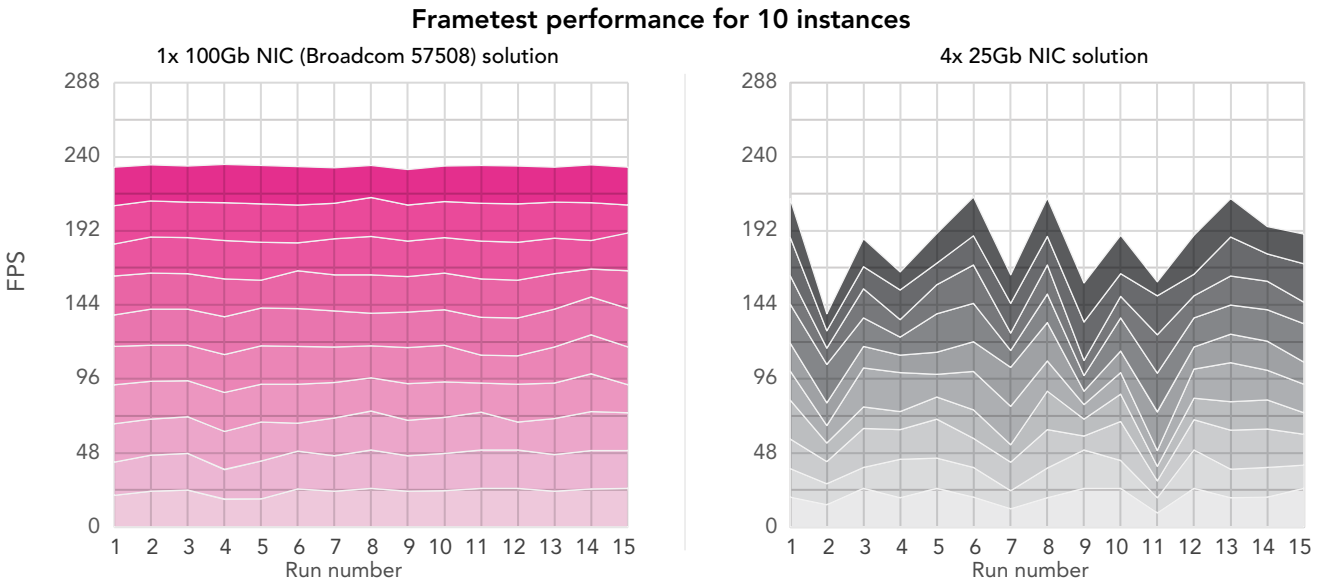

Figure 12: Frametest results, in frames per second, for 10 instances. Higher rates and greater consistency are better. Source: Principled Technologies.

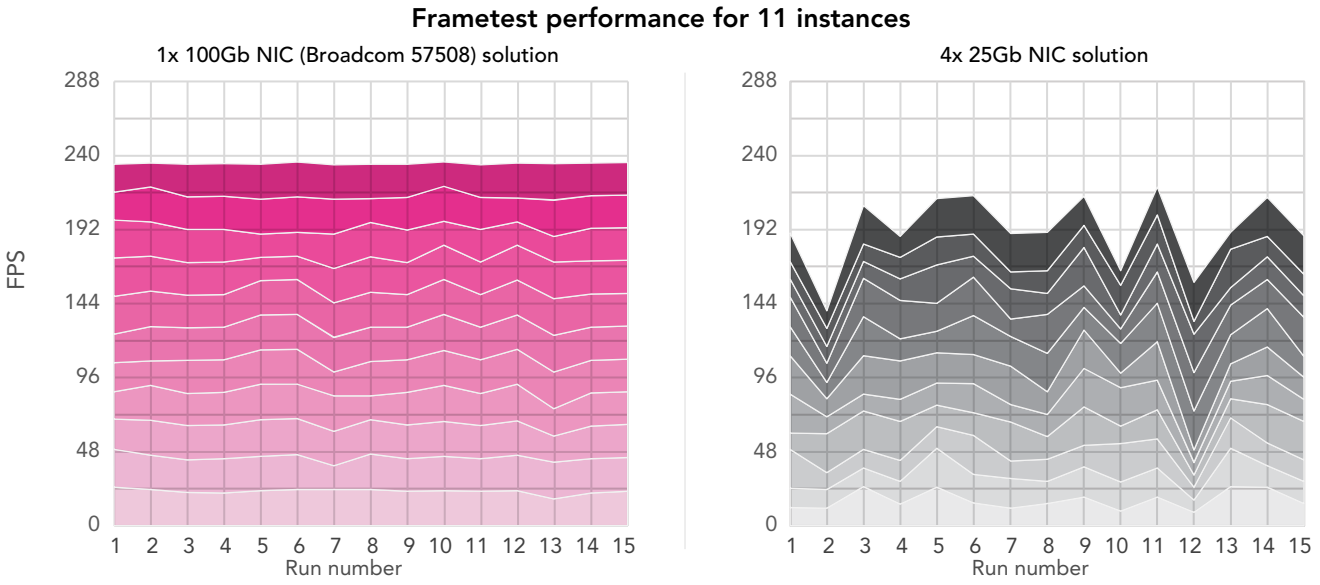

Figure 13: Frametest results, in frames per second, for 11 instances. Higher rates and greater consistency are better. Source: Principled Technologies.

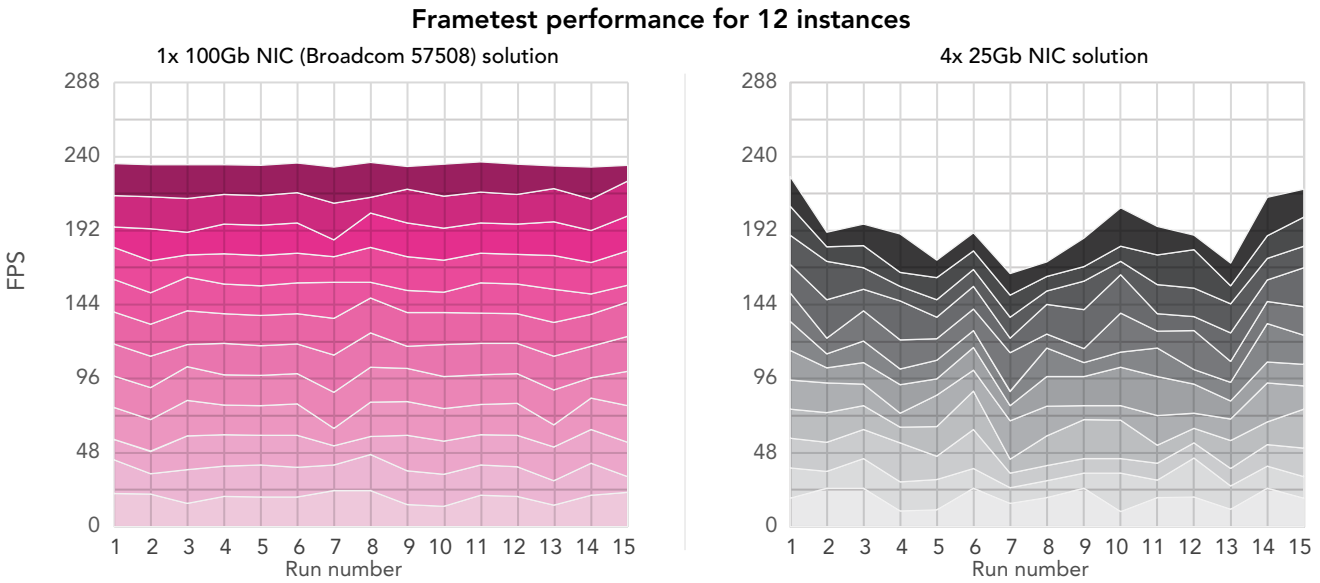

Figure 14: Frametest results, in frames per second, for 12 instances. Higher rates and greater consistency are better. Source: Principled Technologies.

Higher bandwidth and greater consistency decrease the chance of frustrating buffering times and can allow for faster video startup and smoother playback. These benefits could in turn improve user experience, leading to the potential for greater user satisfaction, improved customer retention, and increased productivity.[10] Lower-performing networking, in contrast, can cause videos to drop frames or lead to long, frustrating buffering times. A fast back-end networking solution is especially critical for organizations that serve people or locations with more limited internet bandwidth—users with slower connections won't have the same experience as those with fast connections, but a more consistent video stream can help mitigate the difference.

About the Dell PowerEdge R750 server

The Dell PowerEdge R750 is a full-featured, general-purpose 2U rack server featuring 3rd Gen Intel Xeon Scalable processors. According to Dell, the PowerEdge R750 is purpose-built to optimize application performance and acceleration with PCIe Gen 4.0 compatibility, eight channels of memory per CPU, and up to 24 NVMe drives.[11] It also includes "I/O bandwidth and storage to address data requirements – ideal for: traditional corporate IT, database and analytics, virtual desktop infrastructure, AI/ML, and HPC."[12] PT has tested the Dell PowerEdge R750 from many different angles, assessing its performance on multiple workloads. In studies from the past several years, we've found that the PowerEdge R750:

- Processed more storage requests and sustained more storage throughput than a previous-gen server[13]
- Delivered strong image-classification performance in a configuration with GPUs and vSphere with Tanzu[14]
- Improved analytics performance versus older servers while keeping CPU utilization below 70 percent[15]
- Completed Hadoop workloads faster than an older server[16]
- Supported thousands of web app users while meeting quality-of-service requirements in a VMware vSphere with Tanzu environment[17]

To learn more about the Dell PowerEdge R750, check out the spec sheet at https://i.dell.com/sites/csdocuments/Product_Docs/en/poweredge-R750-spec-sheet.pdf. For more PT studies on the PowerEdge R750, as well as other servers in the PowerEdge line, visit https://www.principledtechnologies.com/portfolio-marketing/Dell/2023.

About the Broadcom 57508 Dual Port 100Gb network interface card

Compatible with a wide range of PowerEdge servers, the 57508 Dual Port 100GbE network interface card features Broadcom BroadSAFE® technology and multi-host support and is compliant with PCI Express 4.0 and the SFF-8402 standard.[18] According to Dell, this PCIe adapter is "ideal for high-performance network applications."[19]

To learn more, read the data sheet at www.broadcom.com.

Conclusion

Video has never been more important or more omnipresent than it is today. Organizations putting video to work in ever more critical ways need to invest in server solutions with fast, high-performance networking.

In our data center, we found that a Dell PowerEdge R750 server with a single Broadcom 57508 Dual Port 100Gb NIC offered higher and more consistent bandwidth than the same server with four 25Gb NICs. Four times 25 equals 100. However, because of the overhead a multi-NIC solution requires and the realities of balancing multiple network streams across different network interfaces, the solution with a Broadcom 100Gb NIC performed better on both reads and writes running lighter and heavier workloads. If video plays an important role in your business, consider selecting Broadcom 57508 Dual Port 100Gb NICs for your Dell PowerEdge R750 servers.

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Read the science behind this report at https://facts.pt/Y6dW6vL ▶

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This project was commissioned by Dell Technologies.