# Opt for modern 100Gb Broadcom 57508 NICs in your Dell PowerEdge R750 servers for improved networking performance

Compared to enabling the same bandwidth capability using four 25Gb NICs, a PowerEdge R750 server with one 100Gb Broadcom 57508 NIC delivered not only more throughput, but also better consistency

## Overview

Our world has never been more interconnected than it is today. People expect fast response times from the technologies with which they interact, and enterprises also demand speed as they deliver services and receive data from edge locations across vast geographic distances. Call and chat support centers require fast and consistent network connections to keep customers happy; restaurants rely on strong networks for payment and online ordering; streaming video services could not exist without fast networking; and data centers serving businesses of all kinds need high-performing networking to keep the information they contain safe, secure, and accessible. Network outages and slowdowns can cause data loss, delays in services, and frustrated customers, ultimately leading to the risk of revenue loss. Networking speed has never been more important.

If you're considering purchasing new servers to upgrade or expand your data center's capabilities, you must decide both what servers to buy and how to configure them. The network interface controller (NIC) configuration you choose is a key factor in the networking performance of the server. In our data center, we tested a Dell™ PowerEdge™ R750 server in two configurations, one with a single 100Gb Broadcom® 57508 NIC and the other with four 25Gb NICs. Though both configurations theoretically enable 100Gbps of bandwidth capability, the solution with the single Broadcom NIC achieved substantially better and more consistent throughput. This report explains our findings and details how the Broadcom and Dell solution can help your business.

### Achieve up to 2.3x the throughput

at two instances over an average of 15 runs compared to the four-NIC solution

### 100% bandwidth consistency

at four TCP streams, compared to the four-NIC solution, which achieved maximum throughput only twice over 15 runs

## How we tested

Let's do some quick math. Four times 25 equals 100. That means four 25Gb network cards should deliver the same amount of throughput as a single 100Gb network card—right?

Only in theory. In reality, a multi-NIC solution must use some overhead to make the NICs 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.

We tested the Dell PowerEdge R750 server in two configurations—one with a Broadcom 57508 Dual Port 100Gb network interface card, and one with four 25Gb NICs (two Intel® XXV710-DA2T two-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

To set up our solution for testing, we first installed and configured Red Hat Enterprise Linux 8.6 and then configured the networking. For the configuration with the Broadcom 100Gb NIC, we used only the first port; for the other configuration, we combined the four Intel 25Gb NIC ports into a 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 test server as an active LACP port channel on the switch.

We used iPerf to measure bandwidth. We created custom scripts and ran the tests with six different Transmission Control Protocol (TCP) stream counts (1, 2, 4, 8, 16, and 32) to learn how adding traffic affected bandwidth performance. (For more on TCP, see "Why test with TCP?") We completed 15 test runs for each stream count because NIC load balancing usually accounts for a number of variables that change each time a new network connection is established. By running multiple tests, we simulated a real-world scenario where the load balance is randomly distributed during the initial connection and remains static until the connection drops.

iPerf is an industry-standard tool for actively measuring maximum bandwidth on IP networks. It allows users to set parameters—including timing, buffers, and network protocols—create TCP and UDP data streams, and measure throughput between two ends of a network.[1] Such tests help identify potential bottlenecks and problems, such as high latency or significant packet loss, and they assist users in optimizing network configurations, hardware, and performance settings.[2] By simulating different network conditions, organizations can predict performance under varying loads.[3]

## What we found: Better and more consistent networking performance with a Dell PowerEdge R750 server with Broadcom 57508 Dual Port 100Gb NIC

Using the data we collected from iPerf, we looked at the performance of the two solutions from two perspectives: average bandwidth, or throughput, and consistency of bandwidth.

Bandwidth refers to the amount of data a solution transfers over the network within a specific time period. In our testing, we measured this in gigabits per second (Gbps). Figure 1 compares the average bandwidth that the two solutions achieved over 15 test runs using 1, 2, 4, 8, 16, and 32 TCP streams. In theory, both solutions have a network capacity of 100 Gbps, which means that when they are receiving or transmitting a sufficient amount of network traffic from multiple sources, they should both achieve a rate of throughput at or near 100 Gbps.

Across all TCP stream counts, the Dell PowerEdge R750 server with Broadcom 57508 Dual Port 100Gb NIC achieved higher bandwidth than the same server with four 25Gb NICs. Even with a single TCP stream, when there wasn't enough network traffic to make full use of the 100Gb capacity, the configuration with the single Broadcom 57508 delivered more than twice the bandwidth of the four-NIC solution. At all other stream counts we tested, the server with the 100Gb Broadcom 57508 NIC achieved almost full utilization of its theoretical bandwidth rate, averaging over 99 Gbps.

In contrast, the four-NIC solution—which should theoretically deliver the same rate as the Broadcom solution—averaged only 42 Gbps with two streams, 65 Gbps with four streams, and 81 Gbps with eight streams. Only at the two highest stream counts did the four-NIC solution approach the consistent 99 Gbps bandwidth rate of the Broadcom configuration, achieving 97 Gbps with 16 streams and 98 Gbps with 32 streams.

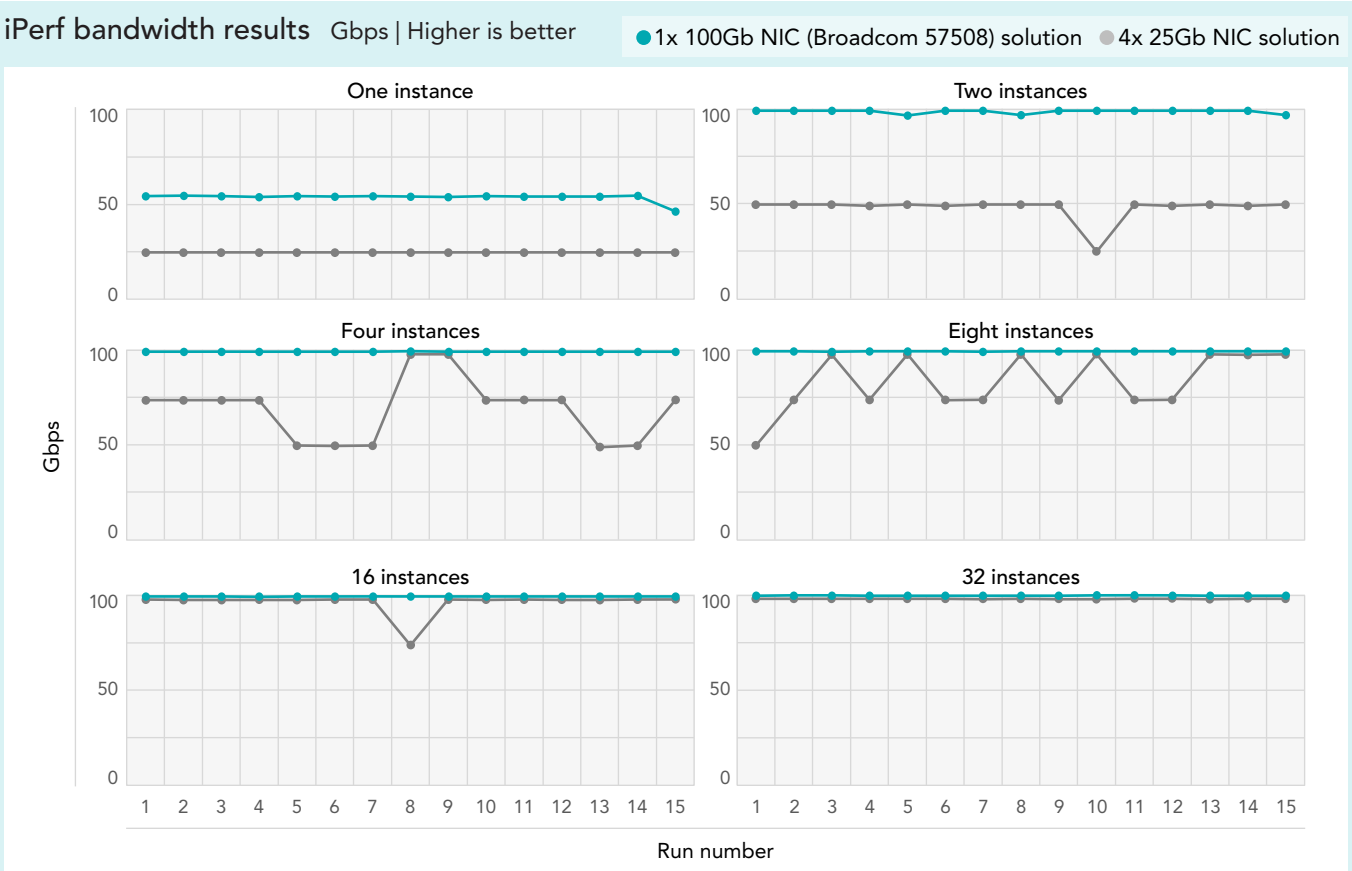


Figure 1: iPerf bandwidth results, in Gbps, for the two NIC solutions. Higher numbers are better. Source: Principled Technologies.

Another important component of networking performance is consistent distribution of bandwidth across the streams. In an ideal scenario, a solution should fully utilize its theoretical maximum bandwidth—in our case, 100Gbps—and portion that bandwidth evenly across the multiple TCP streams coming through the network. Over the course of multiple test runs, that even division should stay consistent. Having predictable and consistent throughput rates across different streams could allow applications to provide more reliable service.

Figures 2 through 6 show the performance of each TCP stream over the 15 test runs, with each shade representing a data stream.[4] As these figures highlight, the PowerEdge R750 server with Broadcom 57508 NIC achieved near-complete utilization of its 100Gbps capacity and delivered highly consistent performance through 16 instances. We see slight variance only at 32 streams.

With the four-NIC solution, however, streams traveled at inconsistent rates at every instance count, and the server achieved near-complete utilization of its 100Gbps capacity only at 32 streams. Figure 3, which shows performance of the two solutions at four instances, illustrates this contrast well. While the Broadcom 57508 solution fully utilized its 100Gbps capacity and distributed the capacity evenly across the four data streams, the four-NIC solution rarely utilized its theoretical 100Gbps maximum, and the four streams traveled at inconsistent rates.

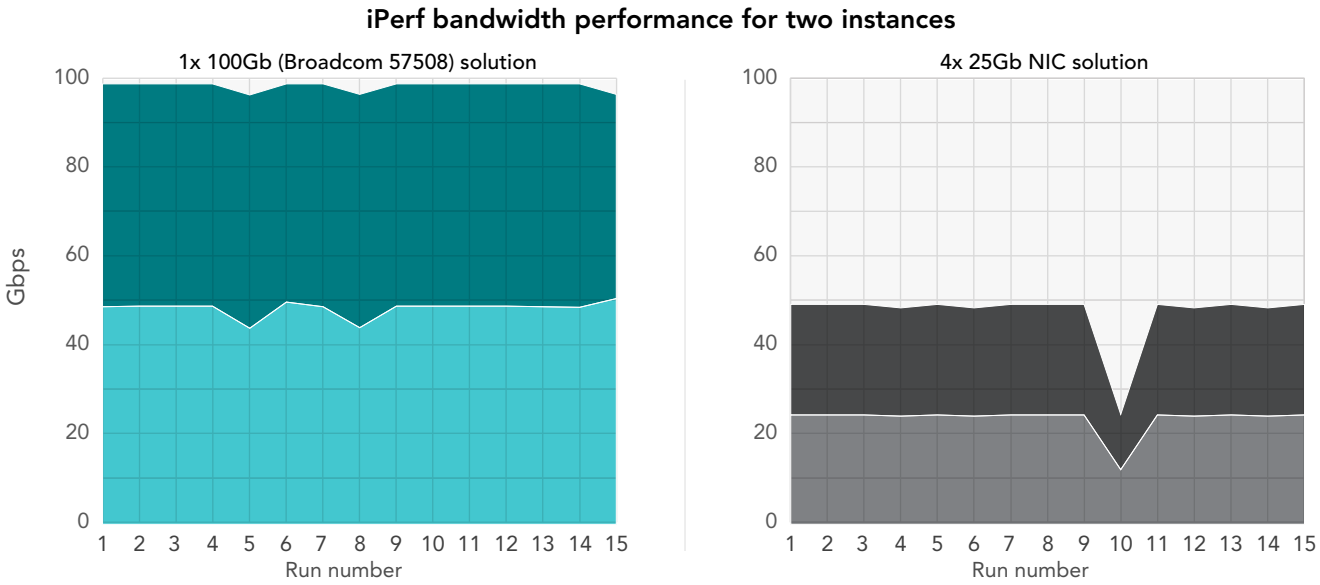


Figure 2: iPerf results, in Gbps, for two TCP streams. Higher rates and greater consistency are better. Source: Principled Technologies.

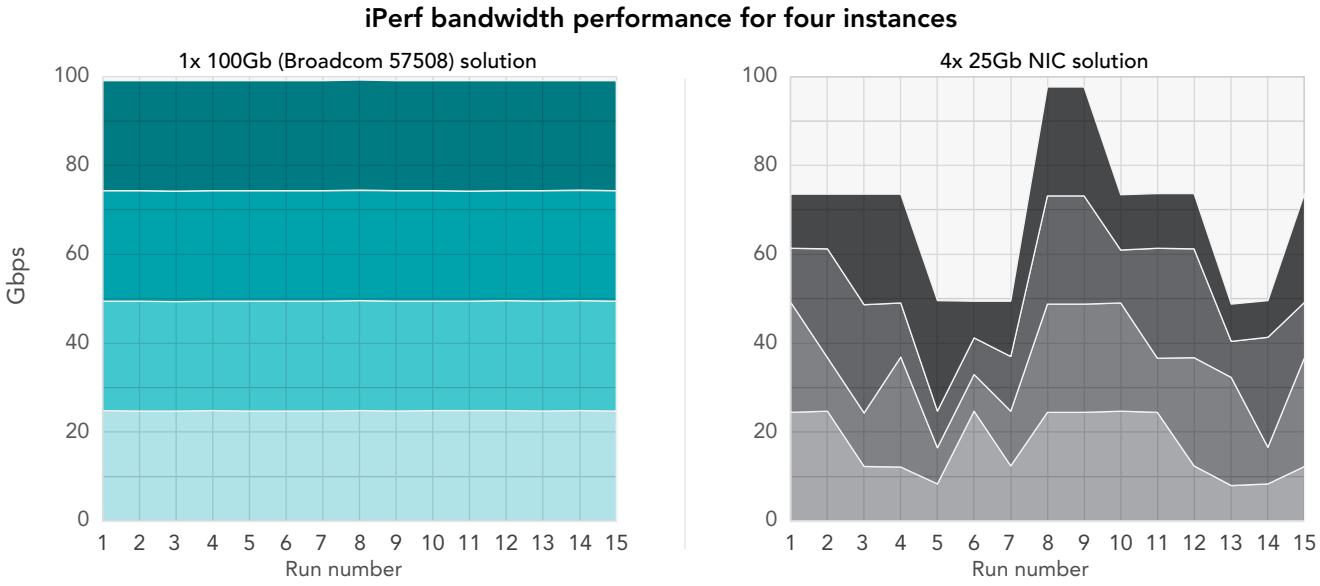


Figure 3: iPerf results, in Gbps, for four TCP streams. Higher rates and greater consistency are better. Source: Principled Technologies.

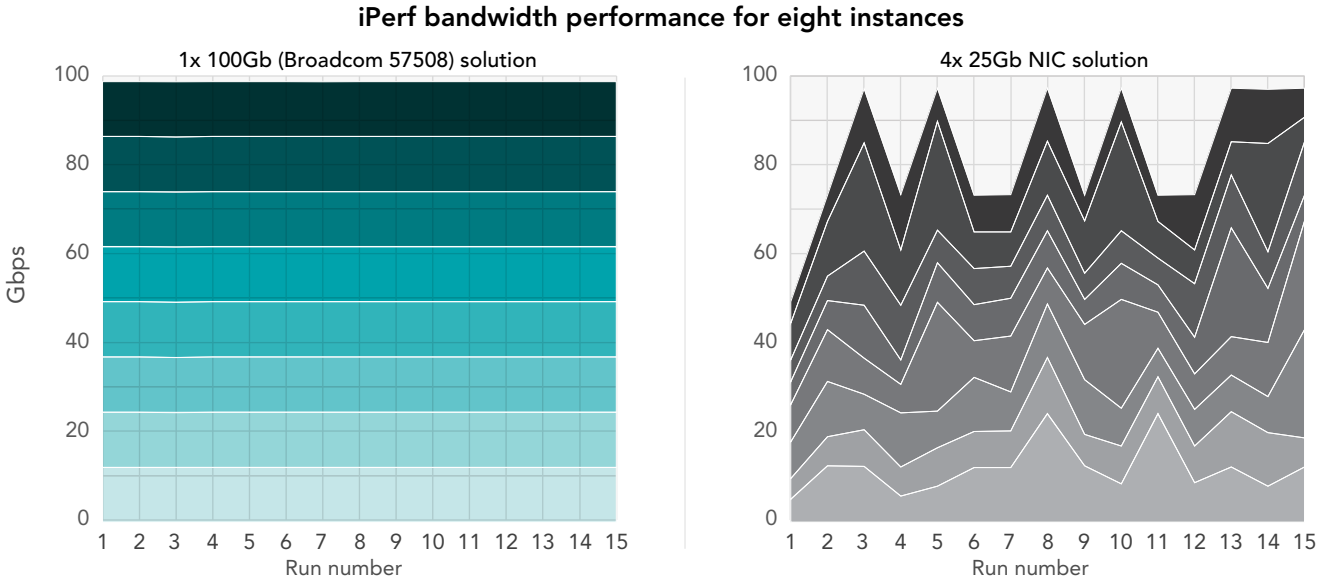


Figure 4: iPerf results, in Gbps, for eight TCP streams. Higher rates and greater consistency are better. Source: Principled Technologies.

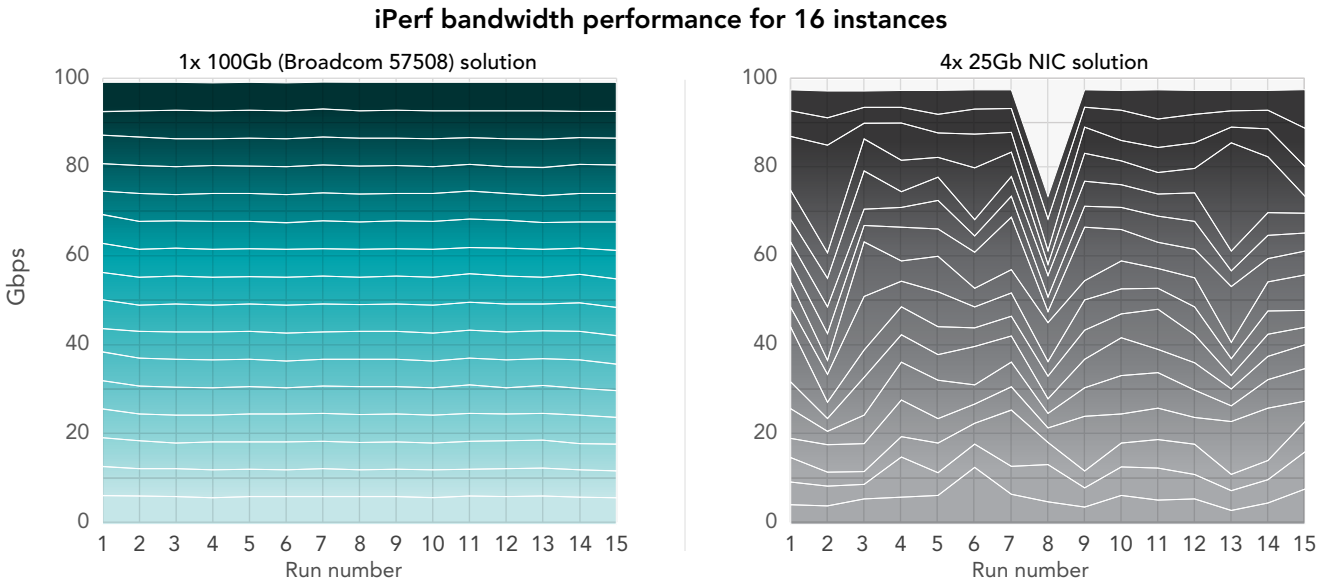


Figure 5: iPerf results, in Gbps, for 16 TCP streams. Higher rates and greater consistency are better. Source: Principled Technologies.

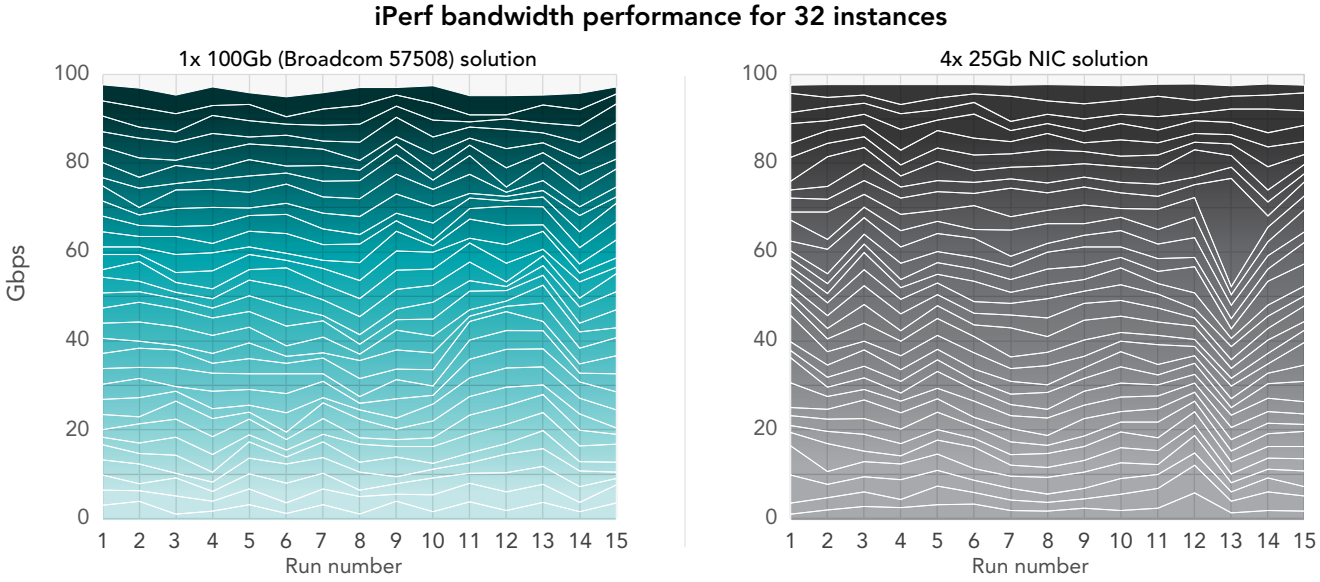


Figure 6: iPerf results, in Gbps, for 32 TCP streams. Higher rates and greater consistency are better. Source: Principled Technologies.

On the solution with four 25Gb NICs, the inconsistencies are quite noticeable, particularly with four, eight, and 16 streams. Applications using this network configuration would experience significant variation in available bandwidth, potentially causing jittery or interrupted service to multiple streams.

## Why test with TCP?

Just as two people must speak the same language to communicate, two devices exchanging data must use a common network protocol. Network protocols are sets of rules that determine all aspects of data communication. There are three primary groups of protocols:[5]

- Communication protocols set the rules for how information moves through the network. Hypertext Transfer Protocol (HTTP) is an example of a communication protocol. HTTP uses Transmission Control Protocol (TCP).
- Management protocols help in maintaining and monitoring a network as well as troubleshooting connection issues. Examples of management protocols include Simple Network Management Protocol (SNMP) and Internet Control Message Protocol (ICMP).
- Security protocols ensure the safety of data transferring within a network and determine some of the reactions to attempts to gain unauthorized access to a network. Examples of security protocols include Secure Sockets Layer (SSL), Secure File Transfer Protocol (SFTP), and Secure Hypertext Transfer Protocol (HTTPS).[6]

Our testing used TCP streams. We selected TCP because it is one of the most common protocols in networking today, underlying many widely used applications. The TCP protocol is designed to allow devices to reliably transmit data across a network. It does this by establishing a reliable connection between applications and servers and then separating data into small chunks, called packets, that devices such as switches and routers can send and receive. TCP can detect when a packet gets lost or corrupted in transit and solve the problem by resending any missing data packets. It can also manage the flow of data within a network so as not to cause congestion and overwhelm the receiver.[7]

## 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.[8] 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."[9]

We've assessed the performance of the Dell PowerEdge R750 on multiple workloads. Over the past several years, we've found that the PowerEdge R750:

- Processed more storage requests and sustained greater storage throughput than a previous-gen PowerEdge R740xd[10]
- Delivered strong image-classification performance in a configuration with NVIDIA GPUs and VMware vSphere with Tanzu[11]
- Improved data analytics performance compared to older servers while keeping CPU utilization below 70 percent[12]
- Completed Hadoop workloads faster than an older server[13]
- Supported thousands of web app users while meeting quality-of-service requirements in a VMware vSphere with Tanzu environment[14]

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. To see 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, is compliant with PCI Express 4.0 and the SFF-8402 standard and offers "advanced congestion avoidance."[15] According to Dell, this PCIe adapter is "ideal for high-performance network applications."[16]

Broadcom claims that this NIC achieves better network performance and server efficiency by combining high-bandwidth Ethernet controller architecture with hardware acceleration engines. Their new PCIe NIC adapter targets mega-scale data center networks, offering high throughput and advanced flow processing. Additionally, it includes new features such as TruFlow, to improve VM density, as well as "on-chip tunneling protocol processing for Geneve, VXLAN, and NVGRE," which aims to improve throughput and reduce CPU utilization.[17]

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

## Conclusion: The real-world benefits of fast networking

High-performing server networking enables servers and other devices on a network to communicate and share data and resources. As our world grows increasingly interconnected and organizations offer more and more services remotely, fast networking becomes more important for enterprises in every industry.

Let's consider healthcare. Hospital systems, pharmaceutical companies, and doctors' offices rely heavily on fast and consistent networking for everyday functions. Being able to transfer patient health records and other large files—such as CT scans, X-rays, and MRIs—between facilities quickly and easily is vital. When a provider needs a real-time update on patient status or new imaging, seconds matter, and a constant and stable connection can help save lives. The growth of telemedicine and remote patient monitoring also require high-performing backend networking solutions. Faster networking can allow specialists to connect and help patients more quickly.

Financial organizations also rely on speedy networking for critical everyday work. High-speed networks for trading provide real-time access to market data and can allow traders and decision-makers in financial institutions to make informed choices and execute trades more quickly. On a consumer level, fast networking lets users access their banking and credit card accounts without delays. A widespread networking issue could prevent users from being able to log into their accounts, creating enormous dissatisfaction and potentially the loss of customers for that bank.[18]

These two examples illustrate something that is true in every industry: Fast networking helps enterprises deliver services and accomplish critical everyday work, improving the experience of every person who interacts with their technology. In tests with the iPerf tool using multiple TCP streams, a server solution with a 100Gb Broadcom 57508 NIC delivered higher and more consistent throughput rates than a solution with four 25Gb NICs. By selecting Dell PowerEdge R750 servers with 100Gb Broadcom 57508 NICs over the servers with four-NIC solution we tested, you can offer your organization speedier, more consistent networking performance.

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2. "How to test available network bandwidth using 'iperf'," accessed July 25, 2023, https://www.dell.com/support/kbdoc/en-us/000139427/how-to-test-available-network-bandwidth-using-iperf.
3. "Iperf for Bandwidth Testing," accessed July 25, 2023, https://www.sd-wan-experts.com/blog/iperf-bandwidth-testing/.
4. Note that at just one instance, both solutions delivered consistent performance, with a small dip from the Broadcom and Dell solution on the 15th run. Because one instance represents such low network traffic that neither solution comes close to achieving its 100Gb theoretical maximum bandwidth, we do not show these results, but you can see them in the science behind the report.
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17. "P2100G - 2 x 100GbE PCIe NIC," accessed July 28, 2023, https://www.broadcom.com/products/ethernet-connectivity/network-adapters/p2100g.
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**Read the science behind this report at https://facts.pt/60kJ64W ▶**

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