White Paper

Communications Service Providers
Content Delivery Network

Varnish Enterprise Shows Up To 1.2 Tbps Data Rate, Up To 1.18 Gbps/Watt Efficiency[3]

Today's CDNs need to be fast and energy efficient. In tests with Intel® Xeon® CPU-based servers, Varnish demonstrates performance and power efficiency scalability for two real-world use cases at four deployment sizes with a maximum throughput of 1.2 Tbps[3]

The fast-growing global content delivery network (CDN) services market size was $19.65 billion in 2022 and is expected to grow to $105.5 billion in 2032[1], a compound annual growth rate of 18%. This growth is driven by the success of cloud services and streaming media services both of which experienced great growth in recent years. With this rate of growth, CDNs must increase performance to meet demand while remaining affordable and improving energy efficiency.

To deliver these services takes a CDN infrastructure with a nationwide network of content caching servers in the cloud and at network points of presence (PoPs), base stations and other network edge locations.

As this network grows so does its electricity consumption. According to the 2021 Carbon Trust report[2], one hour of video streaming emits between 50-60g of Co2. While that amount is lower than driving a car, reducing the impact of CDN services can have a significant impact on the environment due to the large size of the market. For this reason, CDN services providers are looking at ways to reduce their CDN energy consumption. We are measuring and reporting energy consumption in this paper, since associated energy costs and carbon emissions will vary greatly.

Achieving higher energy efficiency for CDN servers is particularly challenging as demand explodes for data rich content, AR/VR content and live streaming, such as gaming, live video on social media, and sports and large-scale event broadcasting. These use cases drive the need for high-performance servers running in many locations at all times of day, and thus consuming energy. The traditional balance between price and performance optimization for CDN caching software must now also accommodate software and server optimizations that improve energy efficiency, thereby reducing the cost and environmental impact associated with running the CDN.

For a CDN server, energy efficiency is typically measured in the amount of content delivered per Watt-hour of energy consumed,(bits per joule, bits per kWh) or in terms of throughput per watt of power (bits per watt).

Varnish Software is an Intel® Network Builder ecosystem member whose mission is to use its technology to help customers succeed by speeding up their digital content. Varnish has optimized its Varnish Enterprise CDN software to maximize efficiency, which yields improvements in both energy efficiency and performance. In the tests shown below, the two companies worked together on testing the scalability of both CDN edge node performance and energy efficiency across four different performance levels.

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Overall, the test results demonstrate outstanding performance per watt for the range of performance levels tested. This provides numerous options for CDN deployments of varying size and density. Partners and customers can cost-effectively reduce energy consumption by maximizing power efficiency, reducing operating cost and environmental impact, while delivering content at the performance levels their customers expect. For these tests, we are reporting the total power consumption of the servers, measured at the PSU inlets. This measurement will include consumption from electrical components in the server - from the processors to the status LEDs.

Varnish Tests Edge Content Delivery Software

The testing described in this paper used the Varnish Enterprise Content Delivery software which adapts the web cache and HTTP(s) features of Varnish Enterprise for deployment at the network edge. The benefits of deploying content delivery at the network edge include significantly reduced latency and reduced backhaul network traffic to origin or mid-tier servers.

Varnish Enterprise is a CDN software solution optimized for deployment on multi-access edge computing (MEC) servers or from a telco cloud data center, network aggregation site or wireless base stations. Varnish Enterprise can be deployed in virtualized, containerized, or bare metal environments. This deployment flexibility makes it an ideal solution for providing CDN services over 5G networks.

Varnish Enterprise is built on top of open source CDN frameworks with enterprise resiliency features and is enhanced with robust features for high performance and scalability. It allows companies to deliver low-latency, high bitrate content even during periods of peak demand. Varnish Enterprise provides capabilities for web and API acceleration, streaming, and private CDN deployments.

The software is also optimized for non-uniform memory access (NUMA) architectures. Historically, NUMA has been associated with multi-processor systems, but this is not its only use case. In modern processor architectures, single and dual processor systems may use NUMA, allowing the processor(s) and operating system to be aware of the relative distance between a CPU and memory or I/O. For these tests, all Intel® Xeon® Scalable CPU-based systems are leveraging sub-NUMA clustering (SNC) to split the CPU into two or four NUMA regions. This is beneficial as it allows the operating system to attempt to localize work so that this workload doesn't become bottlenecked by Linux page reclaim. By enabling SNC, it's possible to reduce the impact of that Linux behavior, enabling higher total throughput.

Varnish has also incorporated an in-core TLS implementation, built upon OpenSSL. This TLS implementation makes efficient use of standard OpenSSL APIs, and, when combined with the NUMA awareness features, VCL and threading model, results in more efficient caching software. When combined with the tight integration of Intel® Xeon® D processors or 4th Gen Intel® Xeon® Scalable processors with larger caches, greater memory bandwidth and greater PCIe bandwidth than the previous generation; and a well-designed server, an end user can observe excellent performance and energy efficiency.

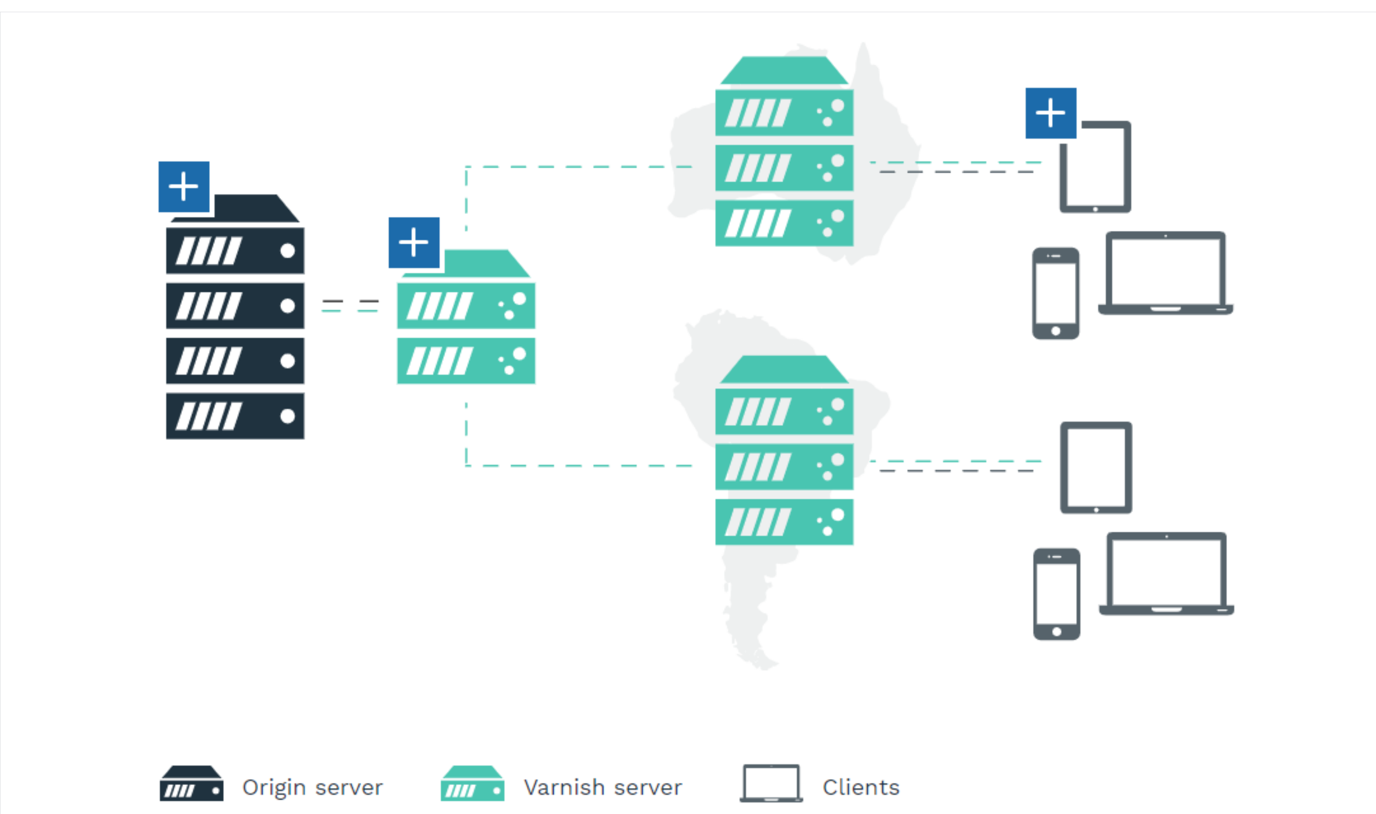

Figure 1. Varnish Enterprise deployment block diagram.

Systems Under Test Use Intel® Xeon® D and Intel® Xeon® Scalable CPUs

Systems under test (SUT) servers based on two families of Intel® Xeon® processors were used in tests of the Varnish Enterprise software, to demonstrate excellent performance and energy efficiency across a range of deployment sizes, power budgets, and performance levels.

The Intel® Xeon® D processor family delivers density-optimized performance, scalability, and value for space and power constrained environments. Intel® Xeon® D processors with integrated Ethernet and accelerators for the edge support networking, storage, industrial IoT, the data center edge, and more.

These innovative, system-on-chip processors support high-density, single-processor network, storage, and cloud edge computing solutions with a range of integrated security, network, and acceleration capabilities.

The Intel® Xeon® Scalable processor family offers flexible performance for a variety of applications, including content delivery, in a broad range of commercially available servers in standard form factors. The 4th Gen Intel® Xeon® Scalable® processors improve upon the prior generation with increased core count (up to 60 cores), increased memory speed (up to 8 channels of DDR5 4800), increased PCIe speed and fanout (up to 80 lanes of PCIe Gen5), and larger last level caches (up to 112.5MB).

The servers that these CPUs are installed in have been selected to enable excellent performance from the CPU, wide PCIe fan-out for both NICs and NVMe drives, and for the dual-processor systems, a NUMA balanced I/O configuration where equal NIC and NVMe devices are available local to each processor. All systems tested use 80 plus Platinum-Certified PSUs to help in achieving the best possible energy efficiency.

Test Setup

Intel and Varnish Software teamed up to test four network throughput levels, demonstrating excellent performance and efficiency for a range of deployment sizes. Depending upon the network data rate, the processor installed was selected to provide a good compromise between performance end energy efficiency.

The configurations selected for these tests demonstrate excellent performance and efficiency over a wide range of performance levels and power budgets, and all are commercially available. These configurations are only a subset of what is possible with Intel® Xeon® D and 4th Gen Intel® Xeon® Scalable based servers, with many more options available to tailor the solution to a particular deployment.

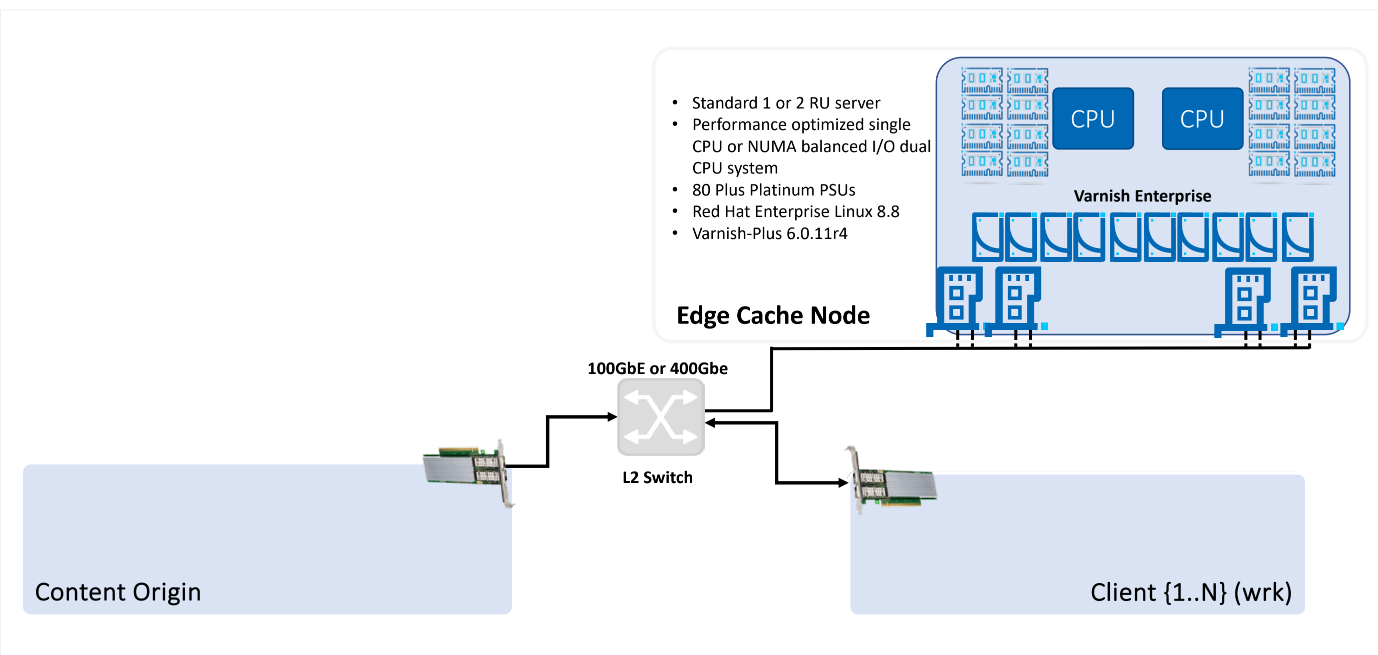

Figure 2. Varnish Enterprise CDN test configuration.

Network Line Rate	Processor(s)	Memory	Storage	Server
Up to 50Gbps (2x25GbE)	1 each Intel® Xeon® D-2733NT	128GB (4x32GB DDR4 3200 @ 2666MT/s)	2 each Intel® P5510 Gen4x4 3.84TB	1RU Supermicro SYS-110D-8C-FRAN8TP
Up to 400Gbps (1 each 2x200GbE)	1 each Intel® Xeon® Gold 5418N	512GB (8x64GB DDR5 4800 @ 4000 MT/s)	10 each Samsung PM1743 15.36TB	1RU Supermicro SYS-111C-NR
	1 each Intel® Xeon® Gold 6428N	512GB (8x64GB DDR5 4800 @ 4000 MT/s)	10 each Samsung PM1743 15.36TB	1RU Supermicro SYS-111C-NR
Up to 800Gbps (2 each 2x200GbE)	1 each Intel® Xeon® Platinum 8480+	512GB (8x64GB DDR5 4800)	10 each Samsung PM1743 15.36TB	1RU Supermicro SYS-111C-NR
	2 each Intel® Xeon® Gold 5418N	512GB (16x32GB DDR5 4800 @ 4000 MT/s)	12 each Samsung PM1743 15.36TB	2RU Supermicro 221H-TNR
	2 each Intel® Xeon® Gold 6428N	512GB (16x32GB DDR5 4800 @ 4000 MT/s)	12 each Samsung PM1743 15.36TB	2RU Supermicro 221H-TNR
	2 each Intel® Xeon® Gold 6438N	512GB (16x32GB DDR5 4800 @ 4000 MT/s)	12 each Samsung PM1743 15.36TB	2RU Supermicro 221H-TNR
Up to 1.6Tbps (4 each 2x200GbE)	2 each Intel® Xeon® Platinum 8480+	512GB (16x32GB DDR5 4800 @ 4000 MT/s)	12 each Samsung PM1743 15.36TB	2RU Supermicro 221H-TNR

Table 1. Test configurations listed by network data rate.

In each of the SUT configurations, all memory channels were populated, the optimal number of NVMe devices were installed, and networking cards commensurate with the line rate were installed, except in the Xeon® D-based system, which used its integrated networking. For additional detail on any or of the system configurations, please refer to system configuration footnote.

In all tests, network throughput was measured at the system under test with dstat and power consumption was measured at the PSU inlets with a Raritan iPDU, and includes all power consumed by the server, from the processors to the cooling fans. The systems were subjected to analogues of video on demand and live-linear workloads using WRK, an open source HTTP(S) benchmarking tool. In the live-linear tests, the NVMe drives were installed (and thus consuming power), but in an idle state as data was cached only in memory.

Test Results

Configuration 1 Up to 50 Gbps: The performance of this test showed throughput of up to 49 Gbps[3] with Varnish Enterprise on Intel® Xeon® D-2733NT based system. This 1RU short-depth configuration is excellent for space and power constrained environments that still require high performance and good efficiency.

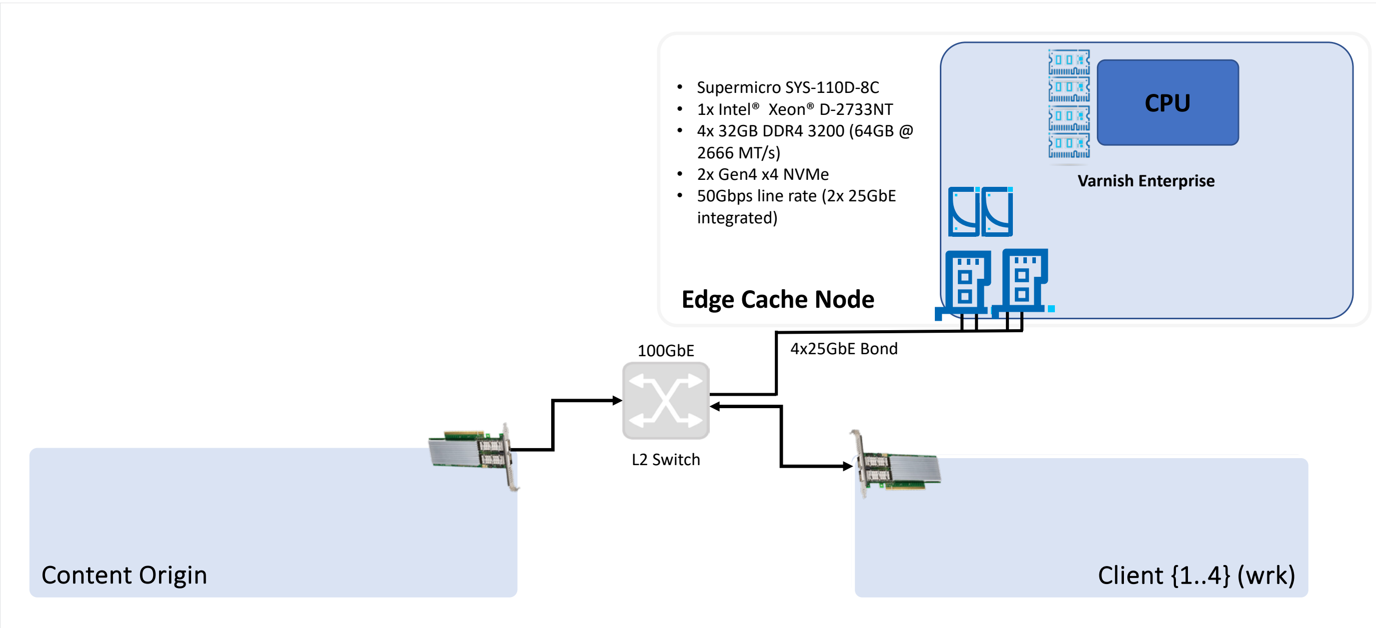

Figure 3. Intel® Xeon® D-2733NT test performance showed throughput of up to 49 Gbps and 0.3 Gbps/watt.[3]

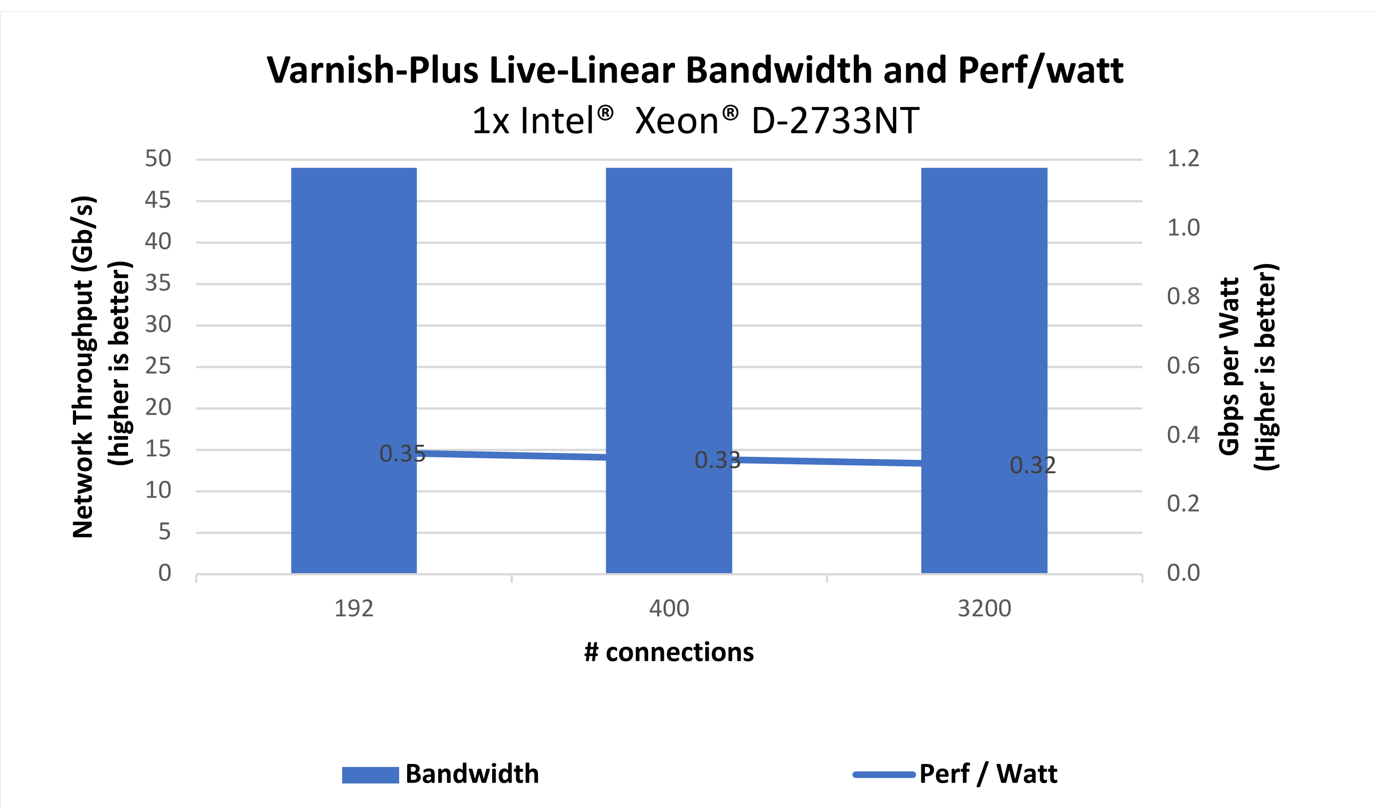

Figure 4. Intel® Xeon® D-2733NT live linear test results.[3]

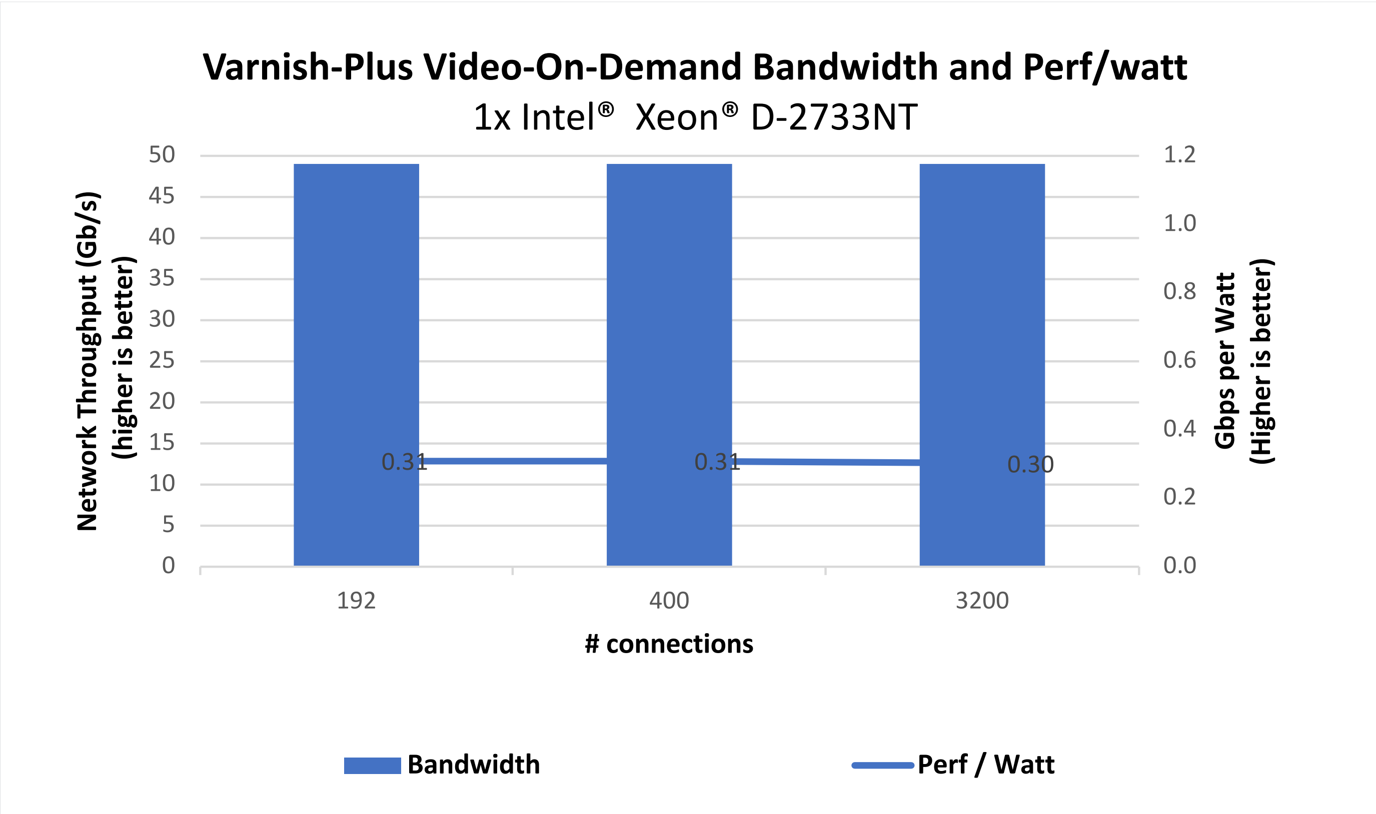

Figure 5. Intel® Xeon® D-2733NT video on demand test results.[3]

Configuration 2 Up to 400 Gbps: The performance of this test showed throughput of up to 303Gbps and 0.9 Gbps/watt with Varnish Enterprise on Intel® Xeon® 5418N-based system[3]. This 1RU dedicated single processor configuration is excellent for space and power constrained environments that require more capacity than a Xeon® D-based configuration can offer, but still need excellent efficiency and performance.

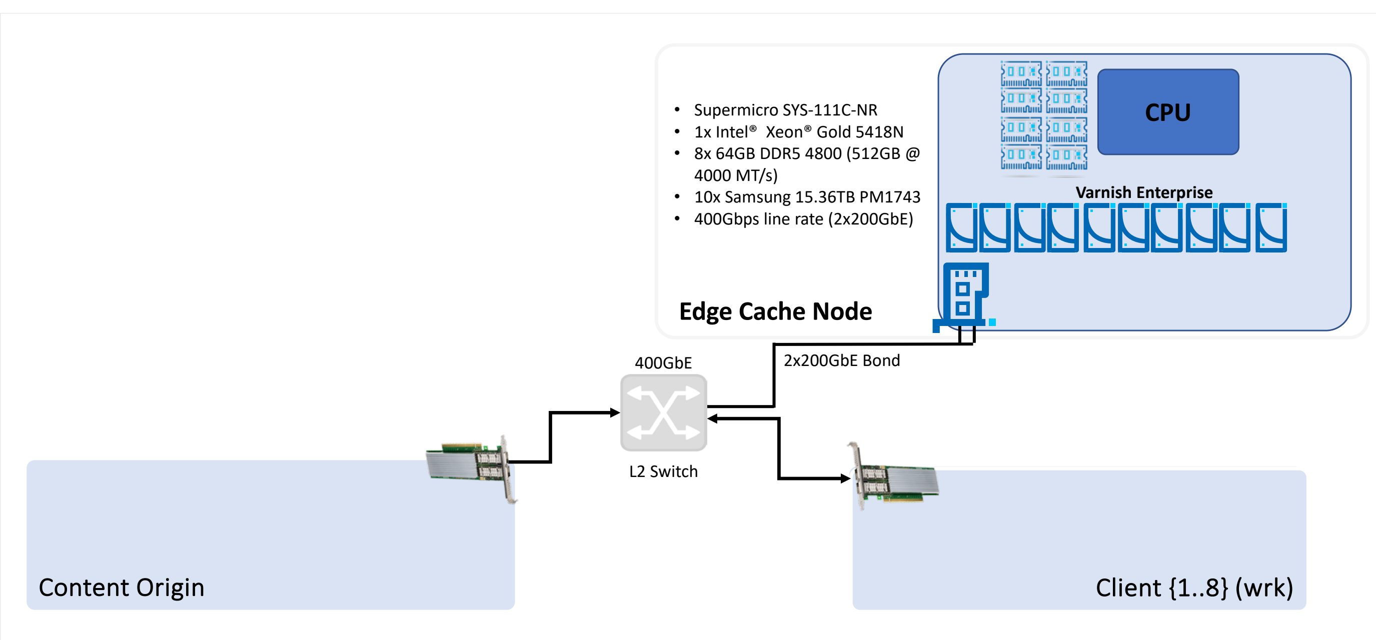

Figure 6. Intel® Xeon® 5418N test performance showed throughput of up to 303 Gbps and 0.9 Gbps/watt.[3]

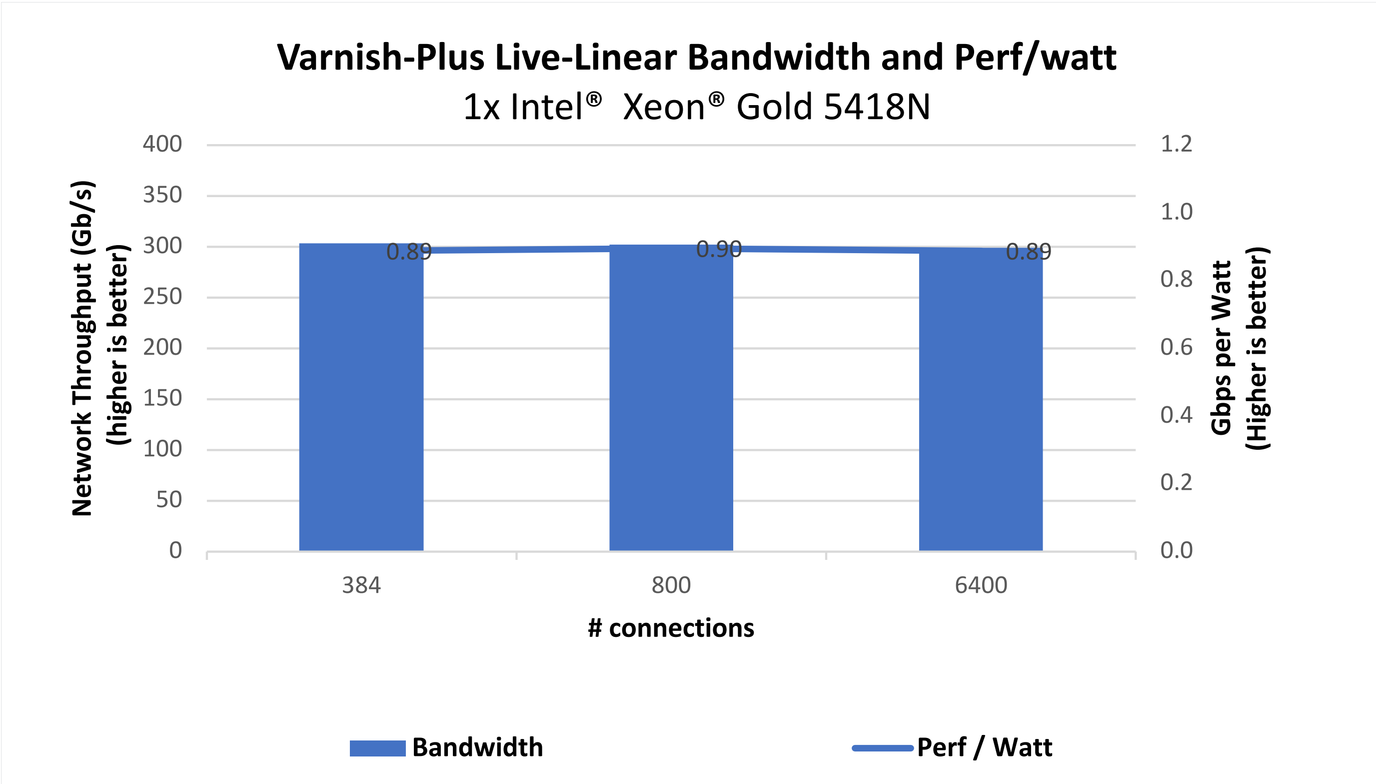

Figure 7. Intel® Xeon® 5418N live linear test results.[3]

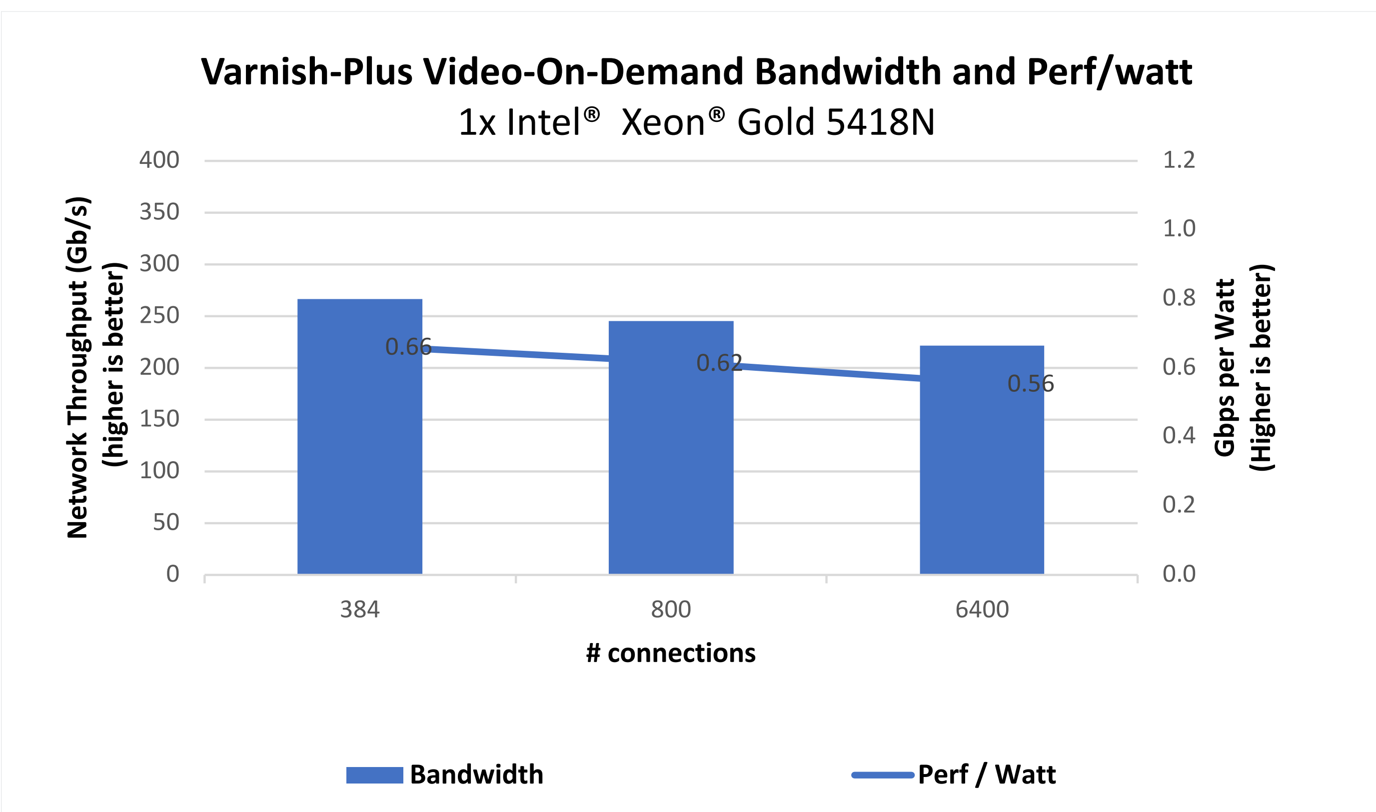

Figure 8. Intel® Xeon® 5418N video on demand test results.[3]

Configuration 2 Up to 400 Gbps: The performance of this test showed throughput of up to 383Gbps with Varnish Enterprise on Intel® Xeon® 6428N-based system.[3] This 1RU dedicated single-processor configuration is able to push the limits of 400GbE connectivity and is able to deliver efficiency of up to 1.03 Gbps/watt.[3]

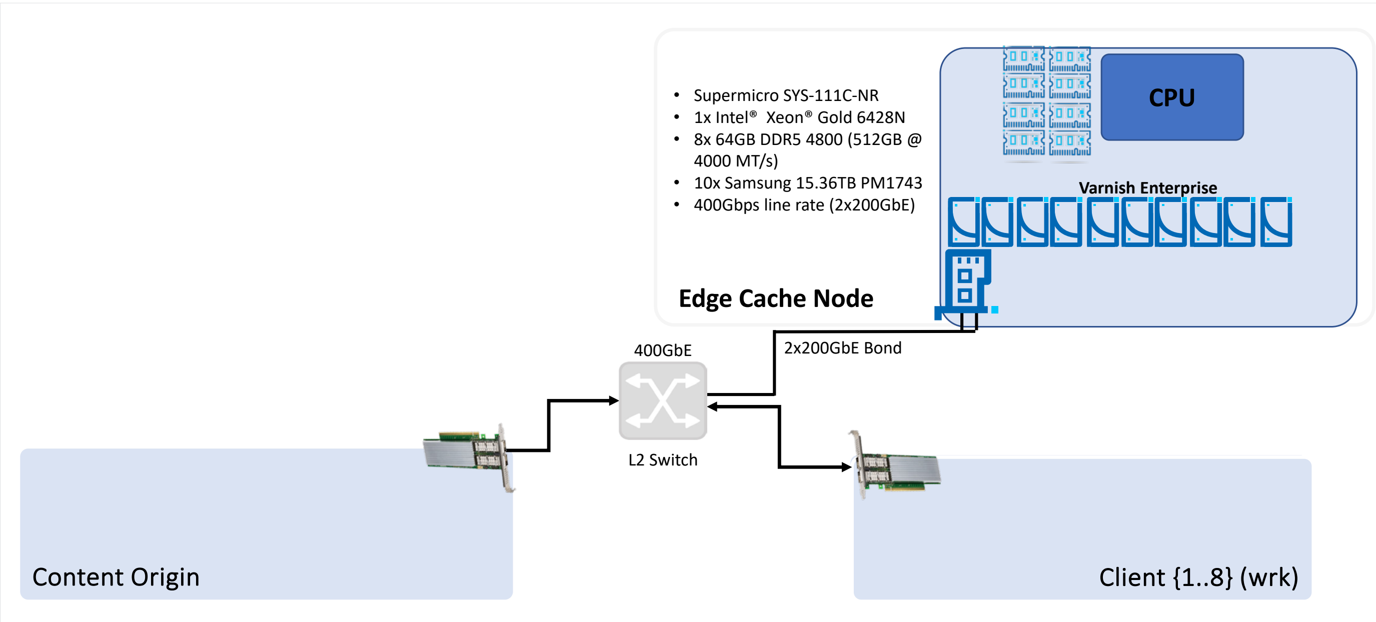

Figure 9. Intel® Xeon® 6248N test performance showed throughput of up to 383 Gbps and 1.03 Gbps/watt.[3]

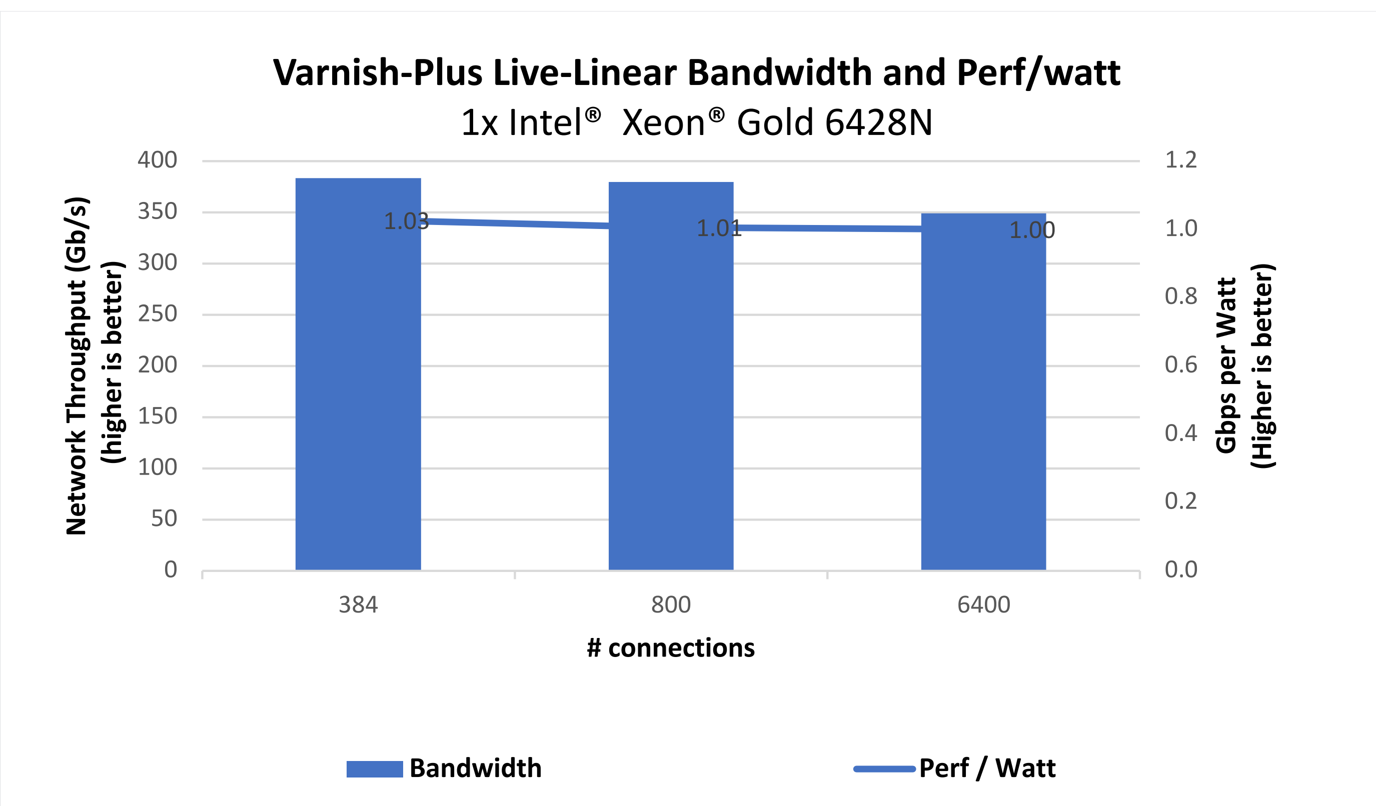

Figure 10. Intel® Xeon® 6248N live linear test results.[3]

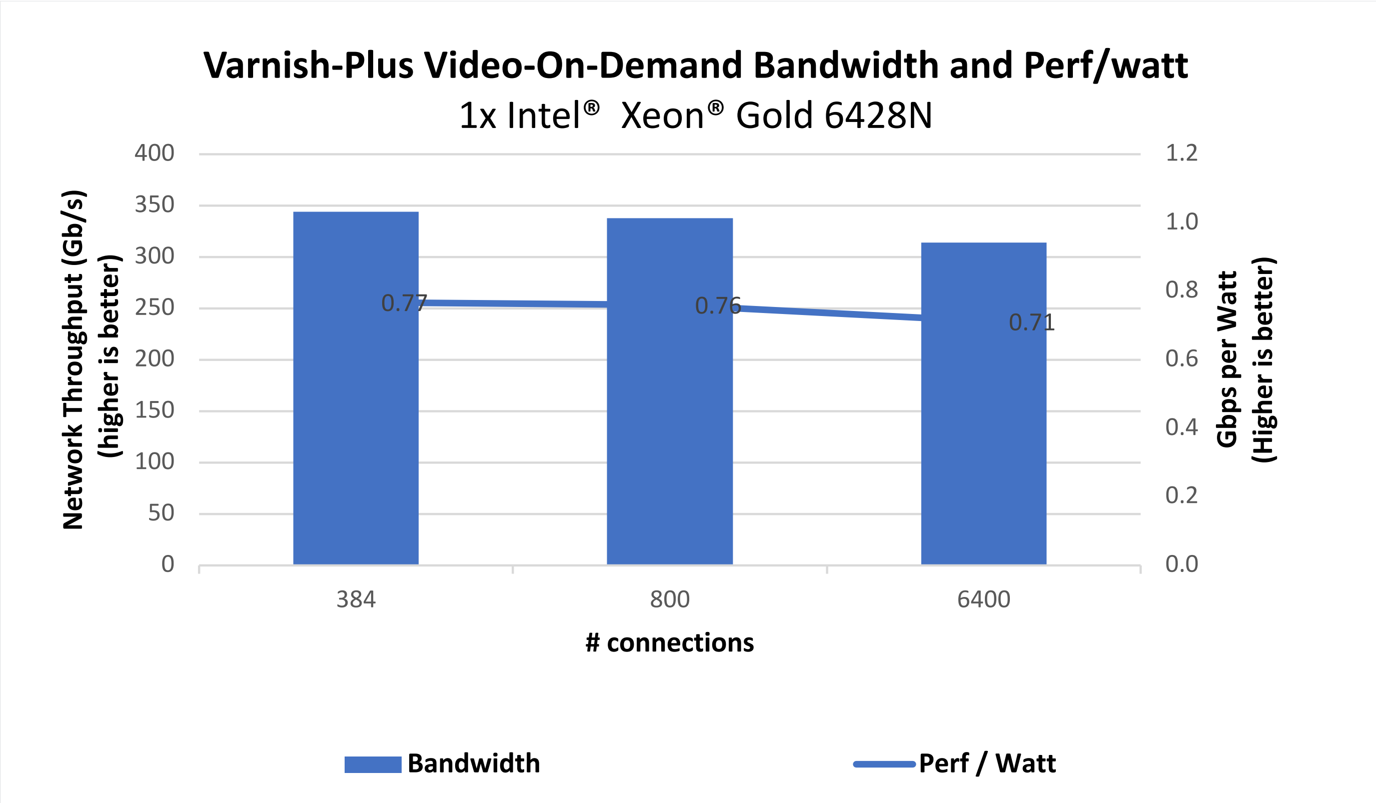

Figure 11. Intel® Xeon® 6248N video on demand test results.[3]

Configuration 3 Up to 800 Gbps: The performance of this test showed throughput of up to 662Gbps with Varnish Enterprise on Intel® Xeon® 8480+ based system.[3] This 1RU dedicated single processor configuration is able to push the limits of single processor CDN performance and delivered efficiency of up to 0.99 Gbps/watt.[3]

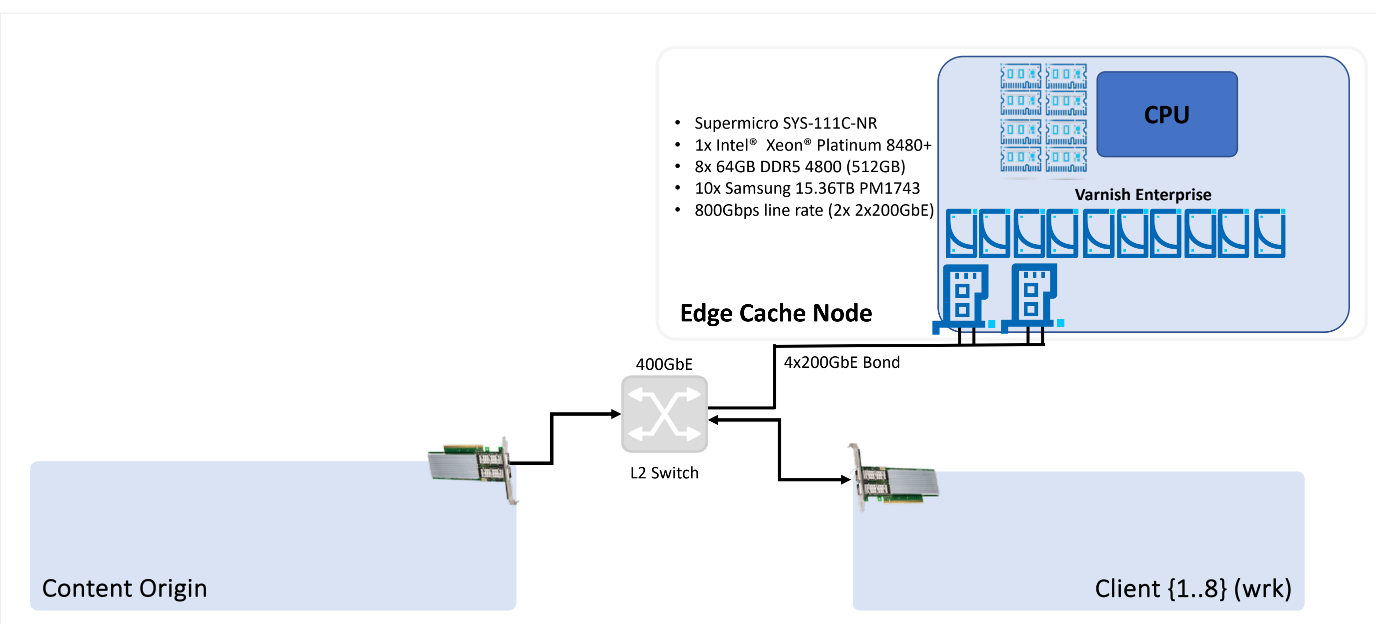

Figure 12. Intel® Xeon® 8480+ test performance showed throughput of up to 662 Gbps and 0.99 Gbps/watt.[3]

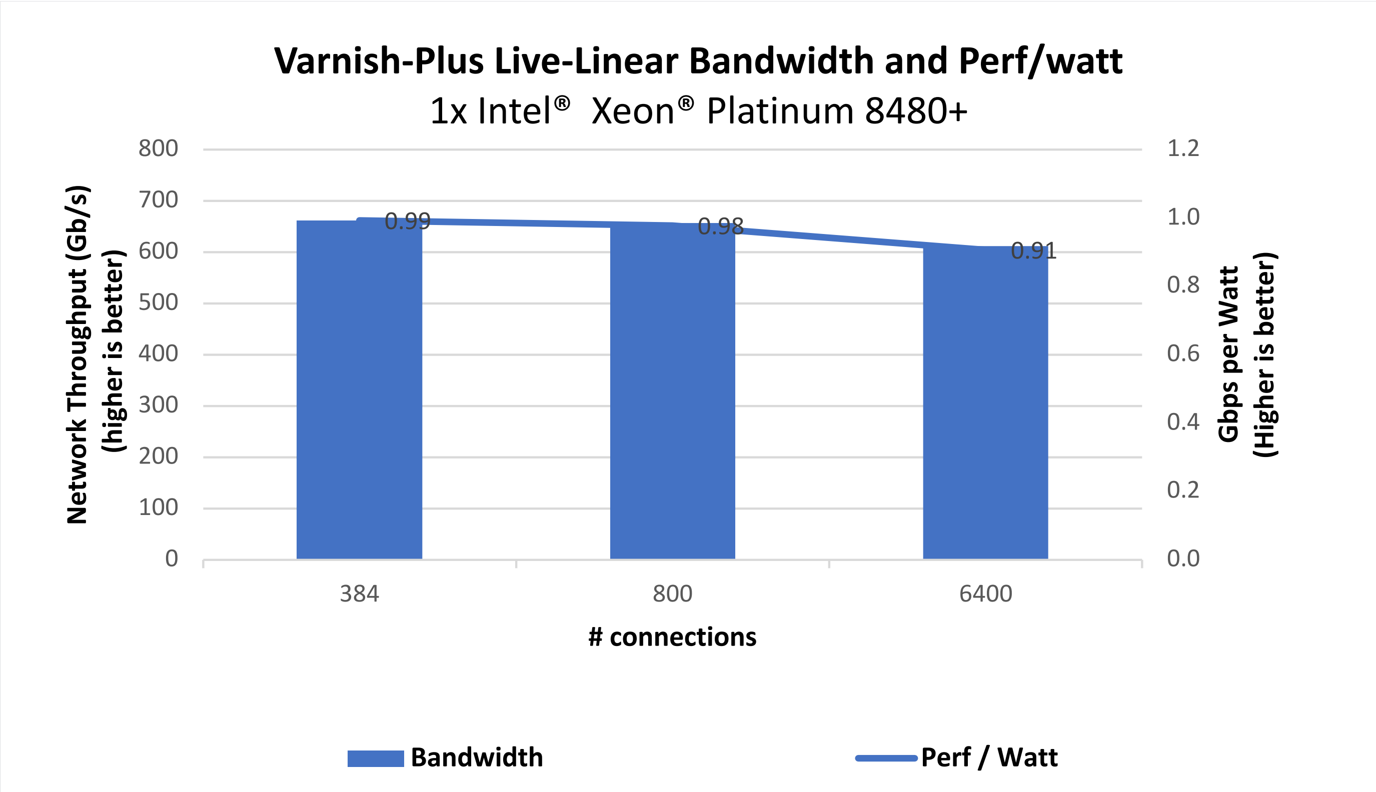

Figure 13. Intel® Xeon® 8480+ live linear test results.[3]

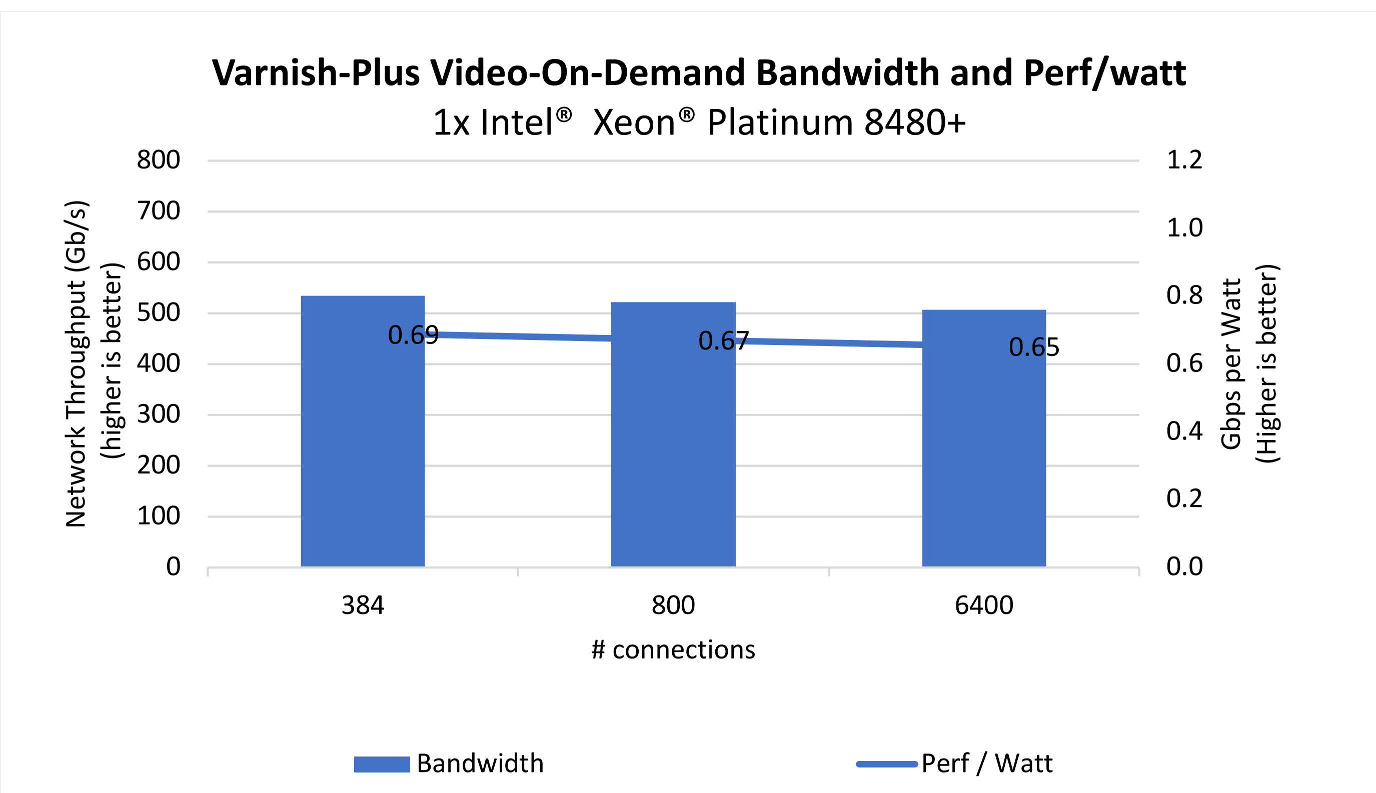

Figure 14. Intel® Xeon® 8480+ video on demand test results.[3]

Configuration 3 Up to 800 Gbps: For deployments where greater capacity or performance is required, dual processor configurations can satisfy both requirements. With Varnish Enterprise, expanding to a dual socket configuration does not require sacrificing energy efficiency. The performance of this test showed throughput of up to 517Gbps with Varnish Enterprise on a dual Intel® Xeon® 5418N-based system.[3] This 2RU dedicated dual processor configuration is able to offer an increased storage fanout and outstanding performance while delivering up to .98 Gbps/watt.[3]

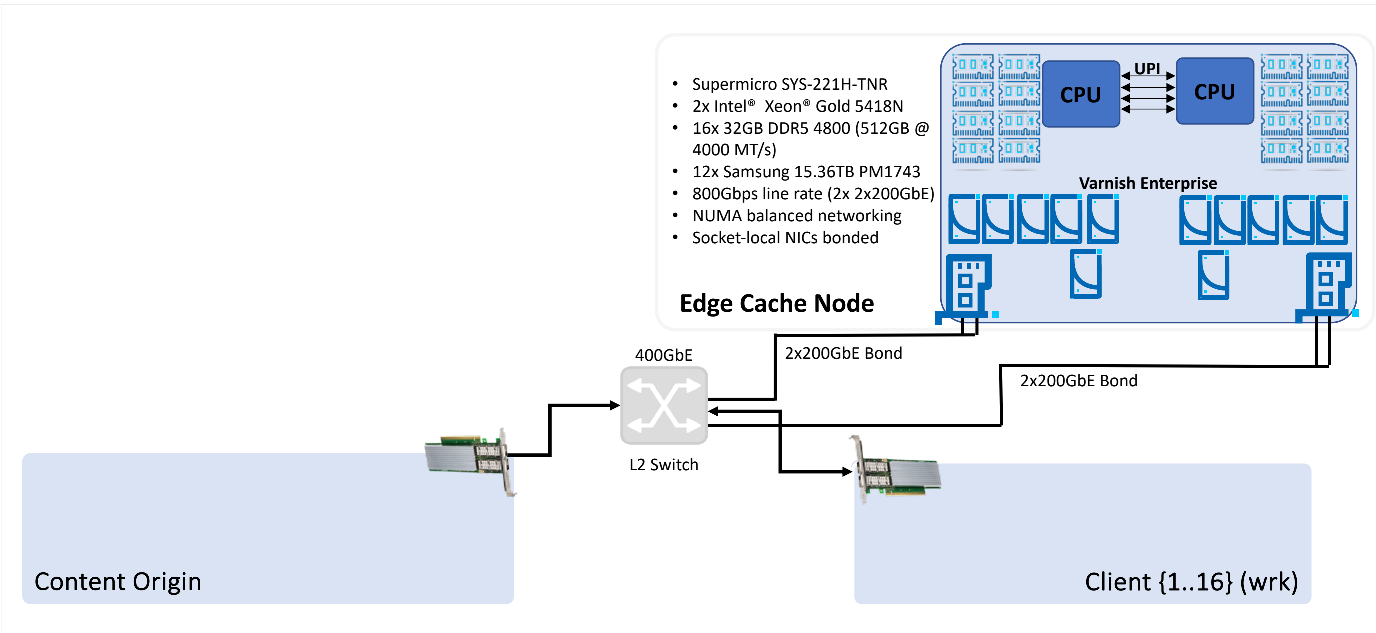

Figure 15. Dual Intel® Xeon® 5418N test performance showed throughput of up to 517 Gbps and 0.98 Gbps/watt.[3]

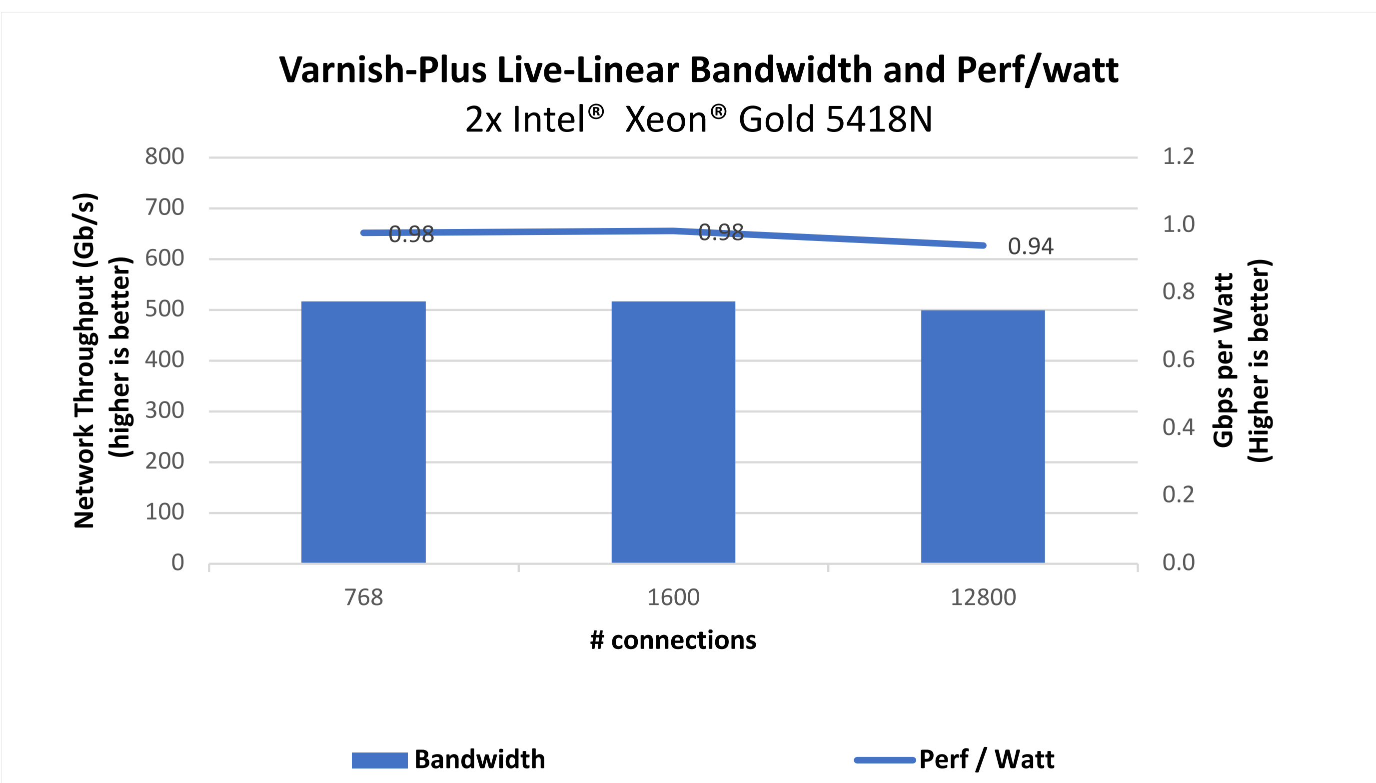

Figure 16. Dual Intel® Xeon® 5418N live linear test results.[3]

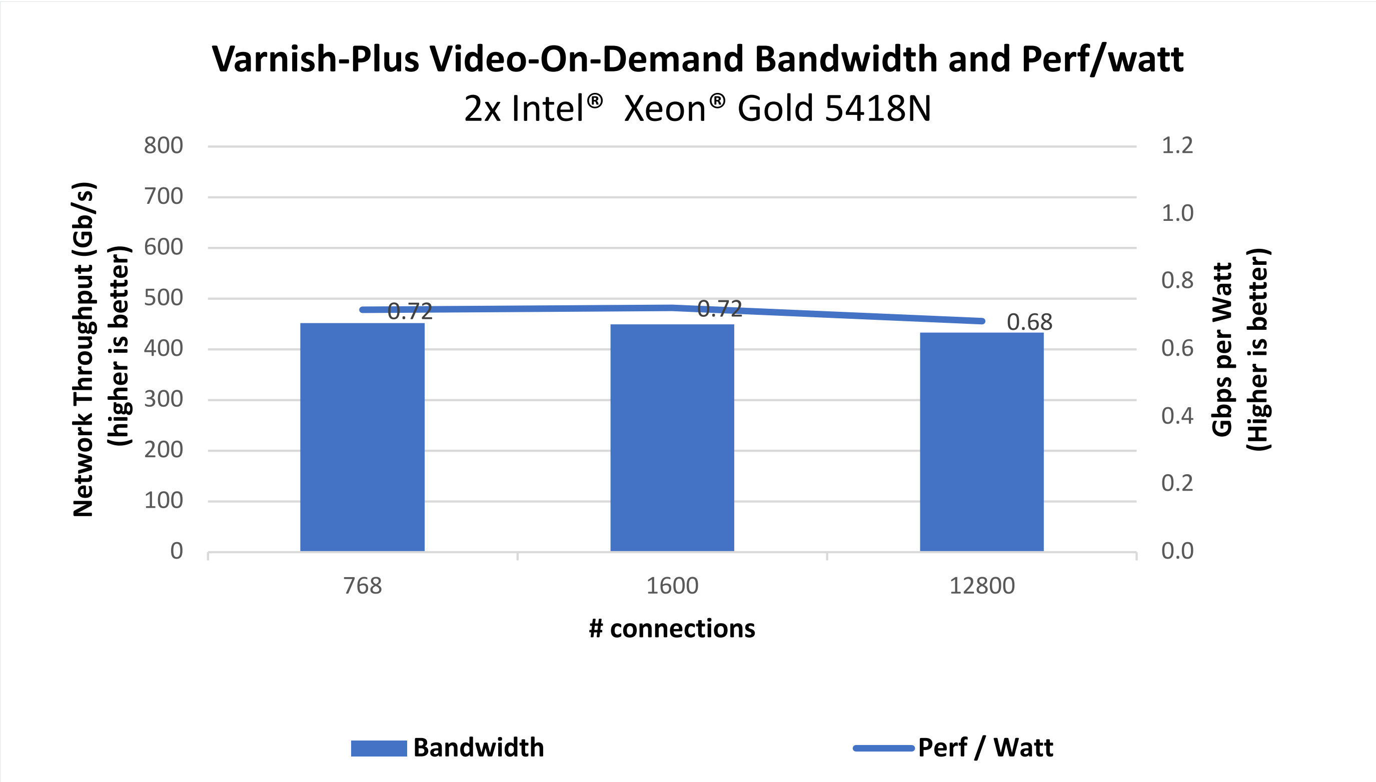

Figure 17. Dual Intel® Xeon® 5418N video on demand test results.[3]

Configuration 3 Up to 800 Gbps: The performance of this test showed throughput of up to 671Gbps and 1.16 Gbps/watt with Varnish Enterprise on a dual Intel® Xeon® 6428N-based system.[3]

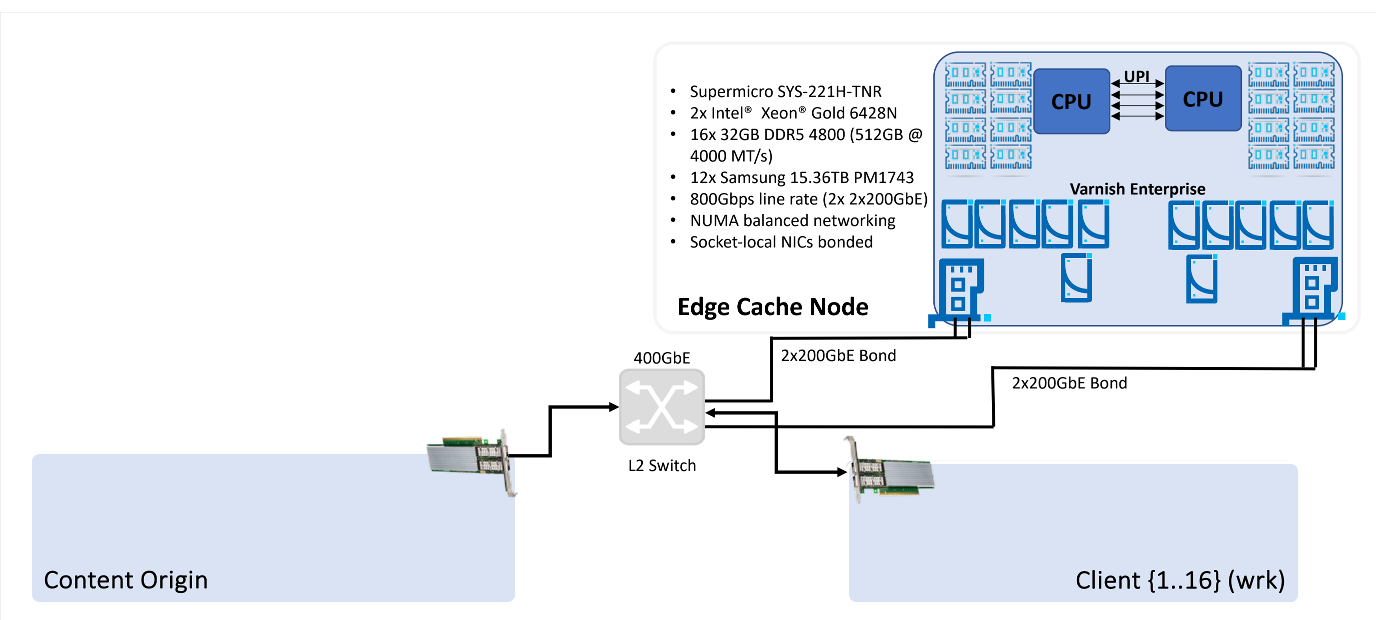

Figure 18. Dual Intel® Xeon® 6428N test performance showed throughput of up to 671 Gbps and 1.16 Gbps/watt.[3]

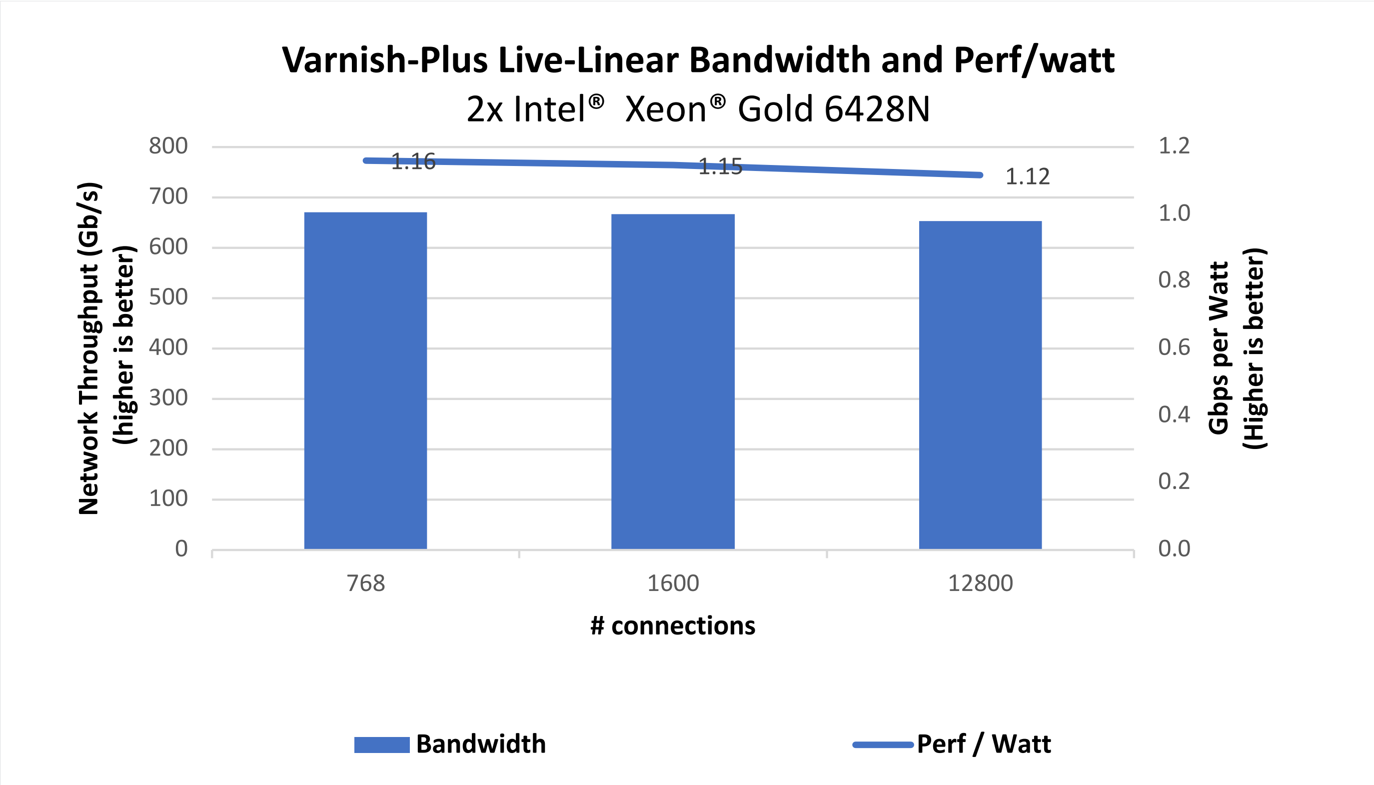

Figure 19. Dual Intel® Xeon® 6428N live linear test results.[3]

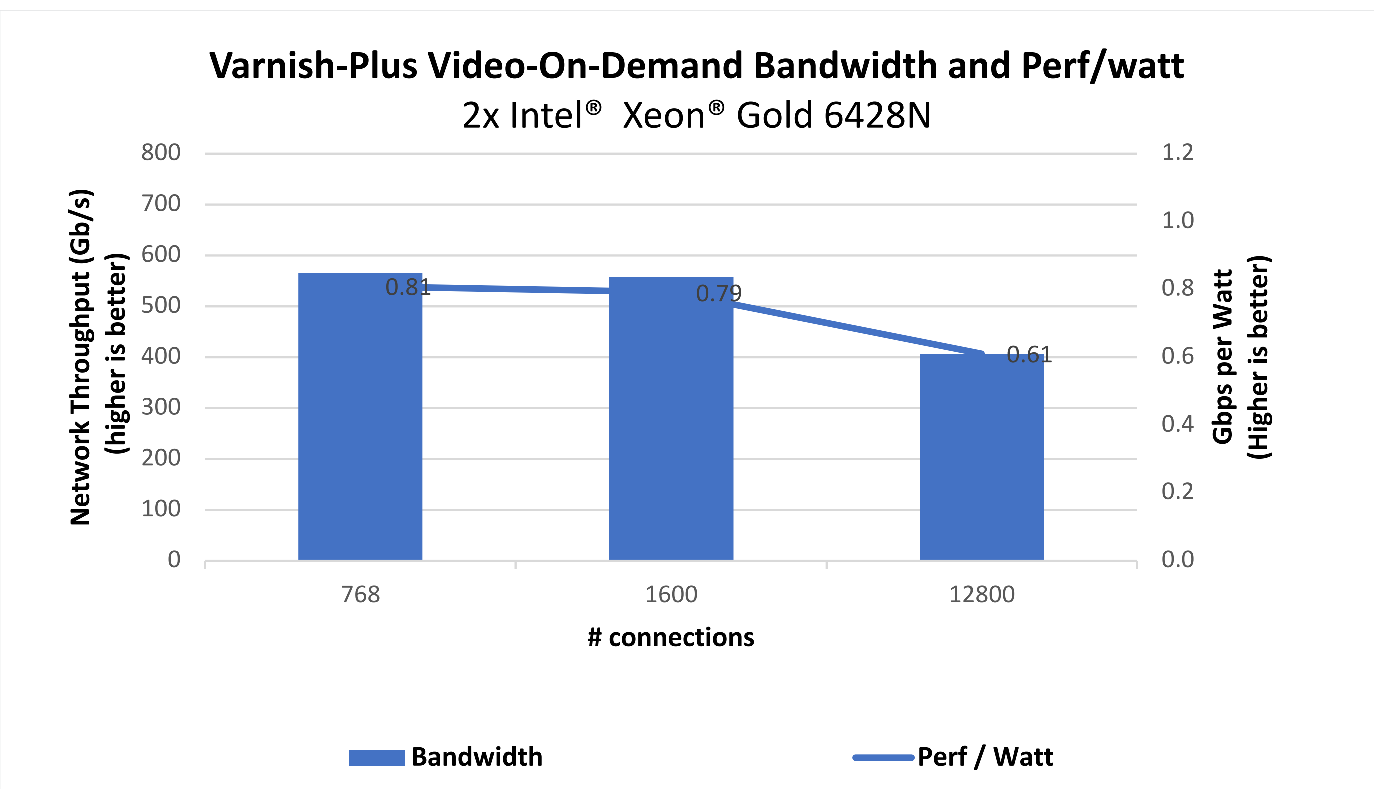

Figure 20. Dual Intel® Xeon® 6428N video on demand test results.[3]

Configuration 3 Up to 800 Gbps: The performance of this test showed throughput of up to 765Gbps and 1.19 Gbps/watt with Varnish Enterprise on a dual Intel® Xeon® 6438N-based system provides the highest efficiency of the systems tested in this document.[3]

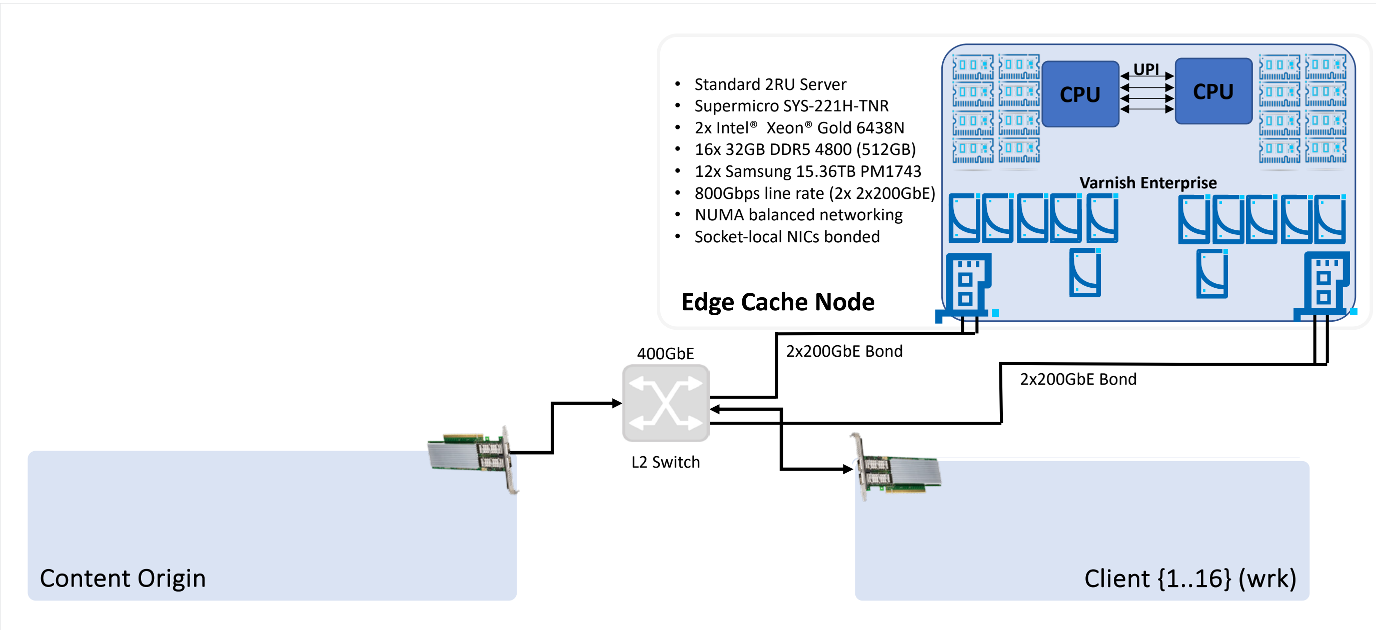

Figure 21. Dual Intel® Xeon® 6838N test performance showed throughput of up to 765 Gbps and 1.19 Gbps/watt.[3]

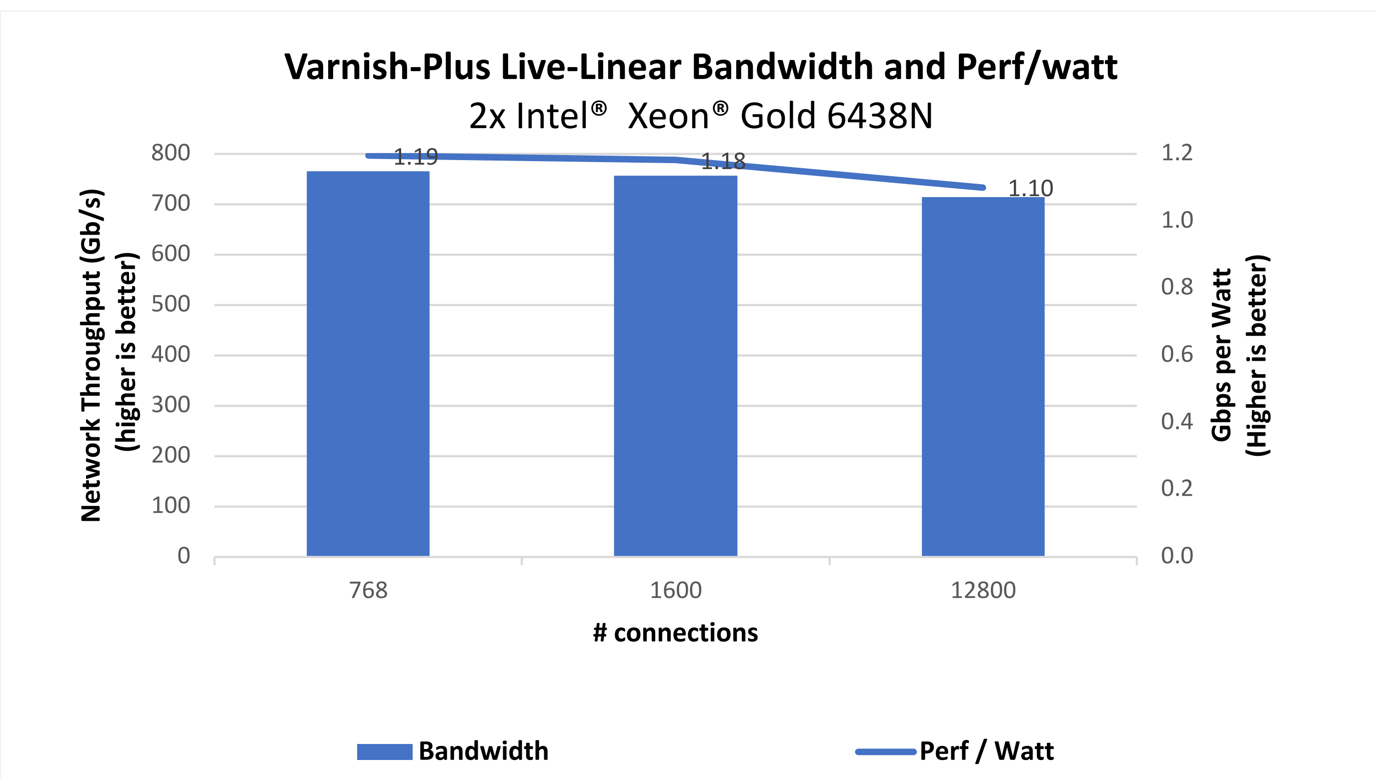

Figure 22. Dual Intel® Xeon® 6838N live linear test results.[3]

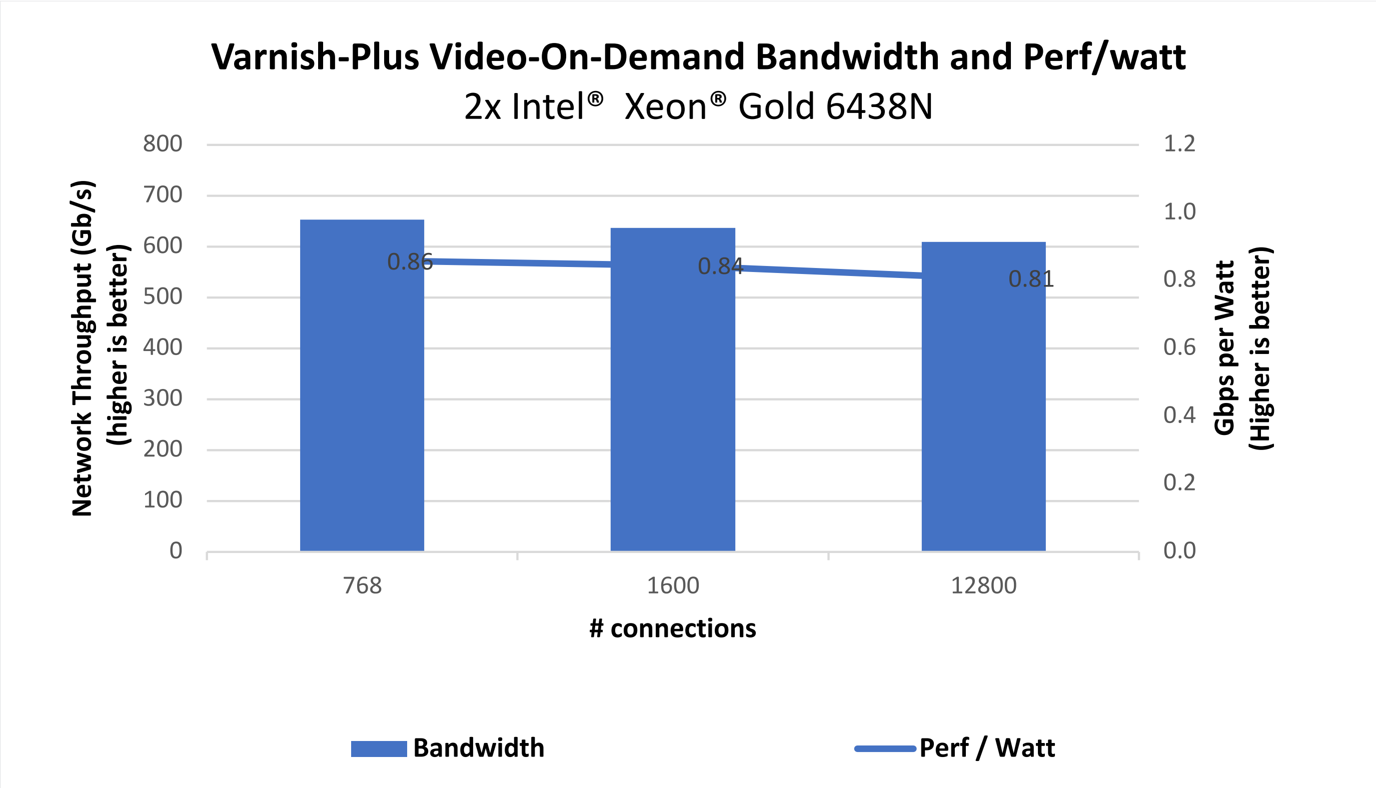

Figure 23. Dual Intel® Xeon® 6838N video on demand test results.[3]

Configuration 4 Up to 1.6 Tbps: The performance of this test showed throughput of up to 1.2Tbps and 1.18 Gbps/watt with Varnish Enterprise on a dual Intel® Xeon® 8480+-based system provides the highest throughput of the systems tested in this document.[3]

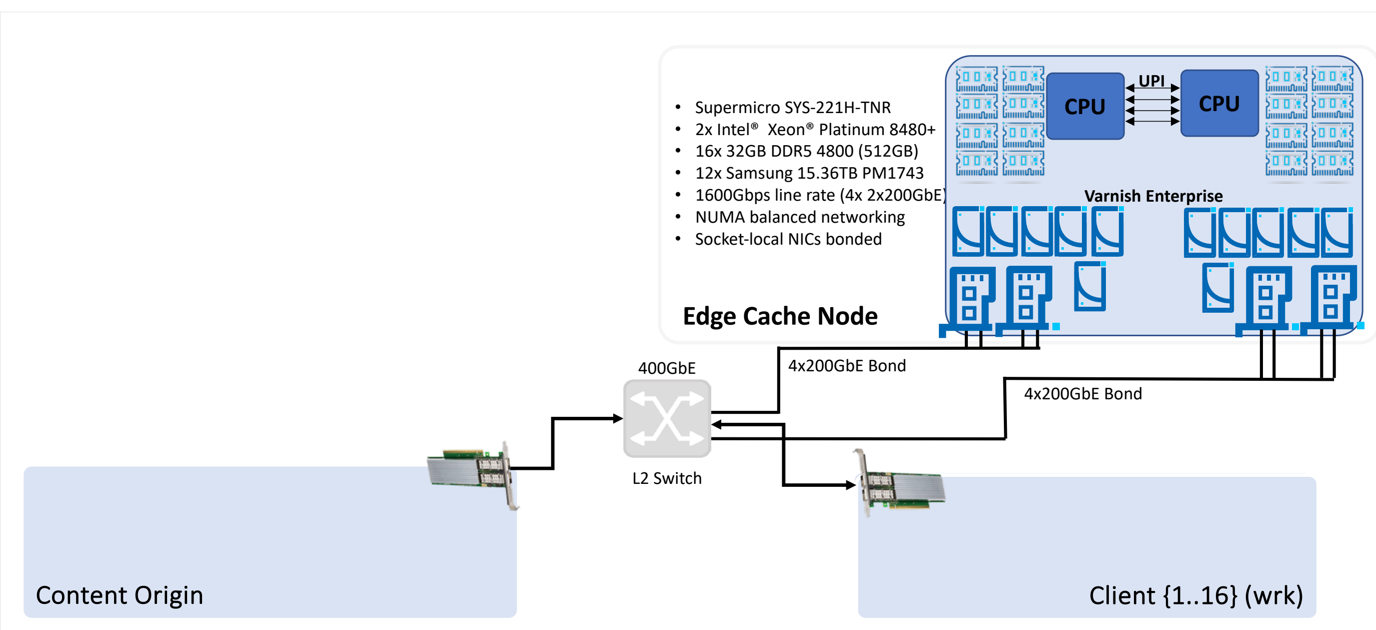

Figure 24. Dual Intel® Xeon® 8480+ test performance showed throughput of up to 1.2 Tbps and 1.18 Gbps/watt.[3]

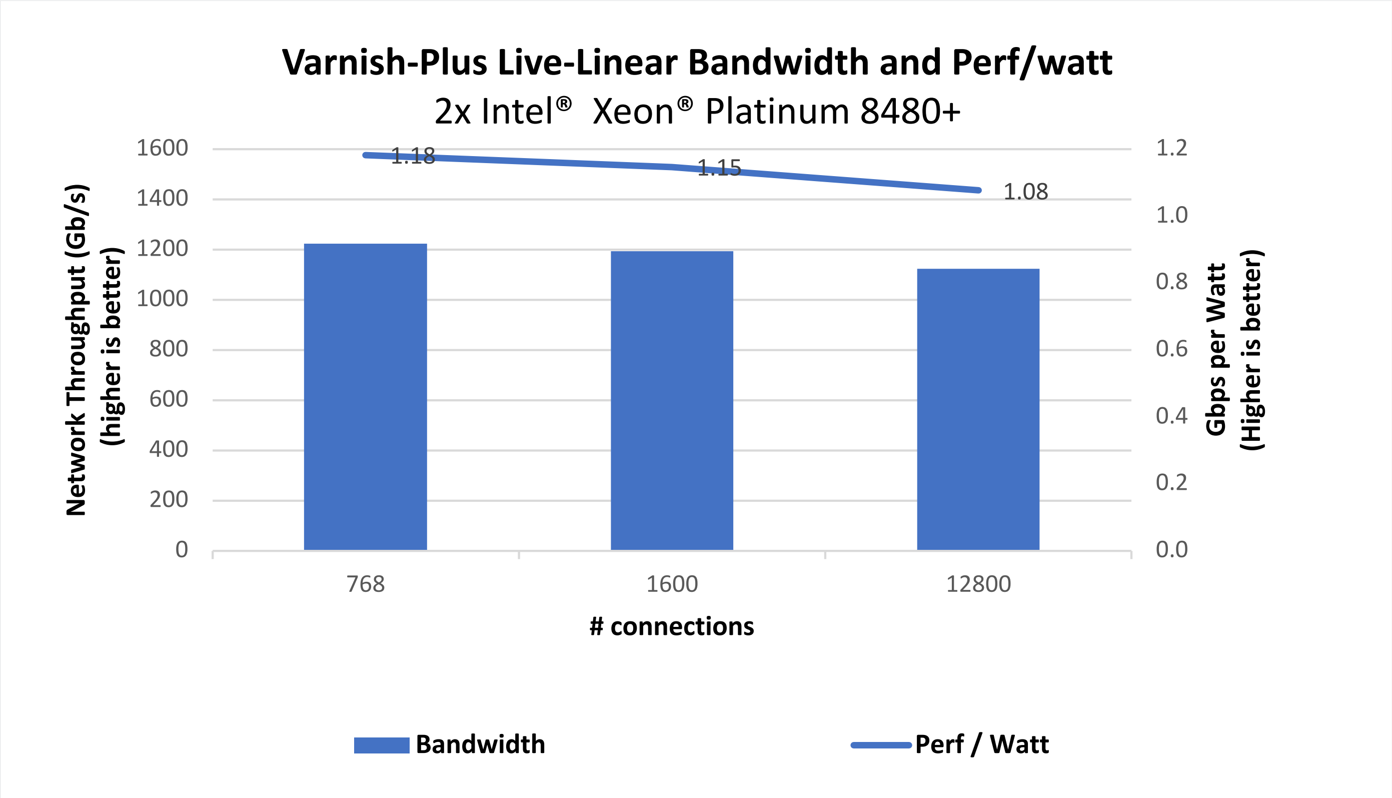

Figure 25. Dual Intel® Xeon® 8480+ live linear test results.[3]

Summary of All Configurations[3]

Workload	Configuration	WRK connections per client	Throughput (Gbps)	Efficiency (Gbps/W)
2MB Live Linear 98.8% Target Cache Hit Ratio	1x D-2733NT	48	49.00	0.35
		100	49.00	0.33
		800	49.00	0.32
	1x 5418N	48	303.04	0.89
		100	302.22	0.90
		800	299.07	0.89
	1x 6428N	48	383.42	1.03
		100	379.58	1.01
		800	348.80	1.00
	1x 8480+	48	662.33	0.99
		100	657.09	0.98
		800	611.33	0.91
	2x 5418N	48	517.02	0.98
		100	516.91	0.98
		800	498.84	0.94
	2x 6428N	48	666.16	1.15
		100	653.22	1.12
		800	575.76	1.00
	2x 6438N	48	764.98	1.19
		100	757.11	1.18
		800	714.11	1.10
	2x 8480+	48	1223.89	1.18
		100	1192.60	1.15
		800	1122.69	1.08

Workload	Configuration	WRK connections per client	Throughput (Gbps)	Efficiency (Gbps/W)
2MB Video On Demand	1x D-2733NT	48	49.00	0.31
		100	49.00	0.31
		800	49.00	0.30
	1x 5418N	48	266.40	0.66
		100	245.51	0.62
		800	221.40	0.56
	1x 6428N	48	343.76	0.77
		100	337.87	0.76
		800	313.87	0.71
	1x 8480+	48	533.62	0.69
		100	521.29	0.67
		800	506.40	0.65
	2x 5418N	48	452.24	0.72
		100	449.71	0.72
		800	432.91	0.68
	2x 6428N	48	565.44	0.81
		100	557.33	0.79
		800	406.36	0.61
	2x 6438N	48	652.76	0.86
		100	637.04	0.84
		800	609.09	0.81
	2x 8480+	48	864.71	0.73
		100	857.71	0.72
		800	861.09	0.73

Conclusion

With the continued growth in demand for streaming video, CDNs need to increase their performance to meet demands, but frequently need to do so in a largely fixed power and cost budget, which means they must find a way to do more work without more hardware resources. With built-in NUMA awareness, an efficient in-core TLS implementation, and highly configurable VCL, Varnish Enterprise offers CoSPs the ability to achieve outstanding levels of performance with incredible energy efficiency using well configured single and dual processor Intel® Xeon® based servers from Supermicro.

With the flexibility of software and the wide range of Intel® architecture processor-based configurations, Varnish Enterprise is able to offer solutions that cover deployment sizes up to 1.2Tbps for live-linear content with up to 1.19Gbps / watt efficiency[3] and up to 864Gbps for video on demand content at up to 0.73Gbps/watt efficiency[3]. Another benefit of a software-based solution is an ability to easily scale up or down to tailor the system to meet the needs of a variety of deployments.

These throughput and efficiency numbers illustrate what is possible with commercially available software and well-configured broadly available servers, without the use of accelerators that add cost.

With these results, CoSPs can be confident that Varnish Software and Intel can help them meet demand for both live and on-demand content with improved energy efficiency.

Learn More

Varnish home page

Varnish Enterprise

Intel® Network Builders

Notices & Disclaimers

[1] https://www.globenewswire.com/en/news-release/2023/03/10/2625153/0/en/Content-Delivery-Network-Market-Size-to-Hit-USD-105-55-BN-by-2032.html

[2] https://www.carbontrust.com/our-work-and-impact/guides-reports-and-tools/carbon-impact-of-video-streaming

[3] Single Intel® Xeon® D-2733NT Live-Linear: 1-node, 1x Intel® Xeon® D-2733NT, 8 cores, HT on, Turbo ON, Total Memory 128GB (4 slots / 32GB / 3200 MT/s @ 2666 MT/s), BIOS 1.2a, microcode 0x1000211, 2x Intel Ethernet (integrated), RHEL 8.8, 2x Intel P5510 SSDPF2KX038TZO 3.84TB, kernel 4.18.0-477.15.1.el8_8.x86_64, gcc (GCC) 8.5.0 20210514 (Red Hat 8.5.0-18), OpenSSL 1.1.1k FIPS 25 Mar 2021, mlx5_core 4.18.0-477.15.1.el8_8.x86_64, Varnish Enterprise 6.0.11r4 revision 676b15e5f7393eb5d5700df47ea504055db032d4, wrk master 02/07/2021 (keep alive, 192, 400 OR 3200total connections). Throughput measured with 100% Transport Layer Security (TLS) traffic with 100% target cache hit ratio. Test by Intel as of 8/22/2023.

Single Intel® Xeon® D-2733NT Video On Demand: 1-node, 1x Intel® Xeon® D-2733NT, 8 cores, HT on, Turbo ON, Total Memory 128GB (4 slots / 32GB / 3200 MT/s @ 2666 MT/s), BIOS 1.2a, microcode 0x1000211, 2x Intel Ethernet (integrated), RHEL 8.8, 2x Intel P5510 SSDPF2KX038TZO 3.84TB, kernel 4.18.0-477.15.1.el8_8.x86_64, gcc (GCC) 8.5.0 20210514 (Red Hat 8.5.0-18), OpenSSL 1.1.1k FIPS 25 Mar 2021, mlx5_core 4.18.0-477.15.1.el8_8.x86_64, Varnish Enterprise 6.0.11r4 revision 676b15e5f7393eb5d5700df47ea504055db032d4, wrk master 02/07/2021 (keep alive, 192, 400 OR 3200 total connections). Throughput measured with 100% Transport Layer Security (TLS) traffic with 100% target cache hit ratio. Test by Intel as of 8/22/2023.

Single Intel® Xeon® 5418N Live-Linear: 1-node, 1x Intel® Xeon® 5418N, 28 cores, HT on, Turbo ON, SNC 2, Total Memory 512GB (8 slots / 64GB / 4800 MT/s @ 4000 MT/s), BIOS 1.1, microcode 0x2b000181, 1x NVIDIA MCX755106AS-HEAT, RHEL 8.8, 10x Samsung PM1743 MZ-WL015T0 15.36TB, kernel 4.18.0-477.15.1.el8_8.x86_64, gcc (GCC) 8.5.0 20210514 (Red Hat 8.5.0-18), OpenSSL 1.1.1k FIPS 25 Mar 2021, mlx5_core 4.18.0-477.15.1.el8_8.x86_64, Varnish Enterprise 6.0.11r4 revision 676b15e5f7393eb5d5700df47ea504055db032d4, wrk master 02/07/2021 (keep alive, 384, 800 OR 6400 total connections) Throughput measured with 100% Transport Layer Security (TLS) traffic with 98.8% target cache hit ratio. Test by Intel as of 8/22/2023.

Single Intel® Xeon® 5418N Video On Demand: 1-node, 1x Intel® Xeon® 5418N, 28 cores, HT on, Turbo ON, SNC 2, Total Memory 512GB (8 slots / 64GB / 4800 MT/s @ 4000 MT/s), BIOS 1.1, microcode 0x2b000181, 1x NVIDIA MCX755106AS-HEAT, RHEL 8.8, 10x Samsung PM1743 MZ-WL015T0 15.36TB, kernel 4.18.0-477.15.1.el8_8.x86_64, gcc (GCC) 8.5.0 20210514 (Red Hat 8.5.0-18), OpenSSL 1.1.1k FIPS 25 Mar 2021, mlx5_core 4.18.0-477.15.1.el8_8.x86_64, Varnish Enterprise 6.0.11r4 revision 676b15e5f7393eb5d5700df47ea504055db032d4, wrk master 02/07/2021 (keep alive, 384, 800 OR 6400 total connections) Throughput measured with 100% Transport Layer Security (TLS) traffic with 100% target cache hit ratio. Test by Intel as of 8/22/2023.

Single Intel® Xeon® 6428N Live-Linear: 1-node, 1x Intel® Xeon® 6428N, 32 cores, HT on, Turbo ON, SNC 2, Total Memory 512GB (8 slots / 64GB / 4800 MT/s @ 4000 MT/s), BIOS 1.1, microcode 0x2b000181, 1x NVIDIA MCX755106AS-HEAT, RHEL 8.8, 10x Samsung PM1743 MZ-WL015T0 15.36TB, kernel 4.18.0-477.15.1.el8_8.x86_64, gcc (GCC) 8.5.0 20210514 (Red Hat 8.5.0-18), OpenSSL 1.1.1k FIPS 25 Mar 2021, mlx5_core 4.18.0-477.15.1.el8_8.x86_64, Varnish Enterprise 6.0.11r4 revision 676b15e5f7393eb5d5700df47ea504055db032d4, wrk master 02/07/2021 (keep alive, 384, 800 OR 6400 total connections) Throughput measured with 100% Transport Layer Security (TLS) traffic with 98.8% target cache hit ratio. Test by Intel as of 8/22/2023.

Single Intel® Xeon® 6428N Video On Demand: 1-node, 1x Intel® Xeon® 6428N, 32 cores, HT on, Turbo ON, SNC 2, Total Memory 512GB (8 slots / 64GB / 4800 MT/s @ 4000 MT/s), BIOS 1.1, microcode 0x2b000181, 1x NVIDIA MCX755106AS-HEAT, RHEL 8.8, 10x Samsung PM1743 MZ-WL015T0 15.36TB, kernel 4.18.0-477.15.1.el8_8.x86_64, gcc (GCC) 8.5.0 20210514 (Red Hat 8.5.0-18), OpenSSL 1.1.1k FIPS 25 Mar 2021, mlx5_core 4.18.0-477.15.1.el8_8.x86_64, Varnish Enterprise 6.0.11r4 revision 676b15e5f7393eb5d5700df47ea504055db032d4, wrk master 02/07/2021 (keep alive, 384, 800 OR 6400 total connections) Throughput measured with 100% Transport Layer Security (TLS) traffic with 100% target cache hit ratio. Test by Intel as of 8/22/2023.

Dual Intel® Xeon® 5418N Live-Linear: 1-node, 2x Intel® Xeon® 5418N, 28 cores, HT on, Turbo ON, SNC 2, Total Memory 512GB (16 slots / 32GB / 4800 MT/s @ 4000 MT/s), BIOS 1.3, microcode 0x2b000461, 2x NVIDIA MCX755106AS-HEAT, RHEL 8.8, 12x Samsung PM1743 MZ-WL015T0 15.36TB, kernel 4.18.0-477.15.1.el8_8.x86_64, gcc (GCC) 8.5.0 20210514 (Red Hat 8.5.0-18), OpenSSL 1.1.1k FIPS 25 Mar 2021, mlx5_core 4.18.0-477.15.1.el8_8.x86_64, Varnish Enterprise 6.0.11r4 revision 676b15e5f7393eb5d5700df47ea504055db032d4, wrk master 02/07/2021 (keep alive, 768, 1600 OR 12800 total connections). Throughput measured with 100% Transport Layer Security (TLS) traffic with 98.8% target cache hit ratio. Test by Intel as of 8/22/2023.

Dual Intel® Xeon® 5418N Video On Demand: 1-node, 2x Intel® Xeon® 5418N, 28 cores, HT on, Turbo ON, SNC 2, Total Memory 512GB (16 slots / 32GB / 4800 MT/s @ 4000 MT/s), BIOS 1.3, microcode 0x2b000461, 2x NVIDIA MCX755106AS-HEAT, RHEL 8.8, 12x Samsung PM1743 MZ-WL015T0 15.36TB, kernel 4.18.0-477.15.1.el8_8.x86_64, gcc (GCC) 8.5.0 20210514 (Red Hat 8.5.0-18), OpenSSL 1.1.1k FIPS 25 Mar 2021, mlx5_core 4.18.0-477.15.1.el8_8.x86_64, Varnish Enterprise 6.0.11r4 revision 676b15e5f7393eb5d5700df47ea504055db032d4, wrk master 02/07/2021 (keep alive, 768, 1600 OR 12800 total connections). Throughput measured with 100% Transport Layer Security (TLS) traffic with 100% target cache hit ratio. Test by Intel as of 8/22/2023.

Dual Intel® Xeon® 6428N Live-Linear: 1-node, 2x Intel® Xeon® 6428N, 32 cores, HT on, Turbo ON, SNC 2, Total Memory 512GB (16 slots / 32GB / 4800 MT/s @ 4000 MT/s), BIOS 1.3, microcode 0x2b000461, 2x NVIDIA MCX755106AS-HEAT, RHEL 8.8, 12x Samsung PM1743 MZ-WL015T0 15.36TB, kernel 4.18.0-477.15.1.el8_8.x86_64, gcc (GCC) 8.5.0 20210514 (Red Hat 8.5.0-18), OpenSSL 1.1.1k FIPS 25 Mar 2021, mlx5_core 4.18.0-477.15.1.el8_8.x86_64, Varnish Enterprise 6.0.11r4 revision 676b15e5f7393eb5d5700df47ea504055db032d4, wrk master 02/07/2021 (keep alive, 768, 1600 OR 12800 total connections). Throughput measured with 100% Transport Layer Security (TLS) traffic with 98.8% target cache hit ratio. Test by Intel as of 8/22/2023.

Dual Intel® Xeon® 6428N Video On Demand: 1-node, 2x Intel® Xeon® 6428N, 32 cores, HT on, Turbo ON, SNC 2, Total Memory 512GB (16 slots / 32GB / 4800 MT/s @ 4000 MT/s), BIOS 1.3, microcode 0x2b000461, 2x NVIDIA MCX755106AS-HEAT, RHEL 8.8, 12x Samsung PM1743 MZ-WL015T0 15.36TB, kernel 4.18.0-477.15.1.el8_8.x86_64, gcc (GCC) 8.5.0 20210514 (Red Hat 8.5.0-18), OpenSSL 1.1.1k FIPS 25 Mar 2021, mlx5_core 4.18.0-477.15.1.el8_8.x86_64, Varnish Enterprise 6.0.11r4 revision 676b15e5f7393eb5d5700df47ea504055db032d4, wrk master 02/07/2021 (keep alive, 768, 1600 OR 12800 total connections). Throughput measured with 100% Transport Layer Security (TLS) traffic with 100% target cache hit ratio. Test by Intel as of 8/22/2023.

Dual Intel® Xeon® 6438N Live-Linear: 1-node, 2x Intel® Xeon® 6438N, 32 cores, HT on, Turbo ON, SNC 2, Total Memory 512GB (16 slots / 32GB / 4800 MT/s), BIOS 1.3, microcode 0x2b000461, 2x NVIDIA MCX755106AS-HEAT, RHEL 8.8, 12x Samsung PM1743 MZ-WL015T0 15.36TB, kernel 4.18.0-477.15.1.el8_8.x86_64, gcc (GCC) 8.5.0 20210514 (Red Hat 8.5.0-18), OpenSSL 1.1.1k FIPS 25 Mar 2021, mlx5_core 4.18.0-477.15.1.el8_8.x86_64, Varnish Enterprise 6.0.11r4 revision 676b15e5f7393eb5d5700df47ea504055db032d4, wrk master 02/07/2021 (keep alive, 768, 1600 OR 12800 total connections). Throughput measured with 100% Transport Layer Security (TLS) traffic with 98.8% target cache hit ratio. Test by Intel as of 8/22/2023.

Dual Intel® Xeon® 6438N Video On Demand: 1-node, 2x Intel® Xeon® 6438N, 32 cores, HT on, Turbo ON, SNC 2, Total Memory 512GB (16 slots / 32GB / 4800 MT/s), BIOS 1.3, microcode 0x2b000461, 2x NVIDIA MCX755106AS-HEAT, RHEL 8.8, 12x Samsung PM1743 MZ-WL015T0 15.36TB, kernel 4.18.0-477.15.1.el8_8.x86_64, gcc (GCC) 8.5.0 20210514 (Red Hat 8.5.0-18), OpenSSL 1.1.1k FIPS 25 Mar 2021, mlx5_core 4.18.0-477.15.1.el8_8.x86_64, Varnish Enterprise 6.0.11r4 revision 676b15e5f7393eb5d5700df47ea504055db032d4, wrk master 02/07/2021 (keep alive, 768, 1600 OR 12800 total connections). Throughput measured with 100% Transport Layer Security (TLS) traffic with 100% target cache hit ratio. Test by Intel as of 8/22/2023.

Dual Intel® Xeon® 8480+ Live-Linear: 1-node, 2x Intel® Xeon® 8480+, 56 cores, HT on, Turbo ON, SNC 4, Total Memory 512GB (16 slots / 32GB / 4800 MT/s), BIOS 1.3, microcode 0x2b000461, 4x NVIDIA MCX755106AS-HEAT, RHEL 8.8, 12x Samsung PM1743 MZ-WL015T0 15.36TB, kernel 4.18.0-477.15.1.el8_8.x86_64, gcc (GCC) 8.5.0 20210514 (Red Hat 8.5.0-18), OpenSSL 1.1.1k FIPS 25 Mar 2021, mlx5_core 4.18.0-477.15.1.el8_8.x86_64, Varnish Enterprise 6.0.11r4 revision 676b15e5f7393eb5d5700df47ea504055db032d4, wrk master 02/07/2021 (keep alive, 768, 1600 OR 12800 total connections). Throughput measured with 100% Transport Layer Security (TLS) traffic with 98.8% target cache hit ratio. Test by Intel as of 8/22/2023.

Dual Intel® Xeon® 8480+ Video On Demand: 1-node, 2x Intel® Xeon® 8480+, 56 cores, HT on, Turbo ON, SNC 4, Total Memory 512GB (16 slots / 32GB / 4800 MT/s), BIOS 1.3, microcode 0x2b000461, 4x NVIDIA MCX755106AS-HEAT, RHEL 8.8, 12x Samsung PM1743 MZ-WL015T0 15.36TB, kernel 4.18.0-477.15.1.el8_8.x86_64, gcc (GCC) 8.5.0 20210514 (Red Hat 8.5.0-18), OpenSSL 1.1.1k FIPS 25 Mar 2021, mlx5_core 4.18.0-477.15.1.el8_8.x86_64, Varnish Enterprise 6.0.11r4 revision 676b15e5f7393eb5d5700df47ea504055db032d4, wrk master 02/07/2021 (keep alive, 768, 1600 OR 12800 total connections). Throughput measured with 100% Transport Layer Security (TLS) traffic with 100% target cache hit ratio. Test by Intel as of 8/22/2023.

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