



# SUPERMICRO SOLUTION FOR HIGH-PERFORMANCE VISUAL CLOUD DELIVERY NETWORK

*X12 Single-Socket All-Flash NVMe Storage 1U System SSG-110P-NTR10 Verified as an Intel® Select Solution for Visual Cloud Delivery Network (VCDN)*

## TABLE OF CONTENTS

Summary.....	1
Introduction.....	2
Supermicro X12 Platform.....	2
Benchmarking.....	4
Performance Benchmark Summary.....	5
Conclusion.....	7

## SUPERMICRO

Supermicro is a global leader in high-performance, green computing server technology and innovation. We provide our global customers with application-optimized servers and workstations customized with blade, storage, and GPU solutions. In addition, our products offer proven reliability, superior design, and one of the industry's broadest array of product configurations, to fit all computational needs.

## Summary

Consumer streaming media use is growing exponentially and evolving to richer content. This rapid growth in demand is an opportunity for communication service providers, cloud service providers, and enterprise infrastructure companies to expand or add visual services to their networks.

Supermicro has partnered with Intel to develop a first-in-class cloud services delivery platform based on industry leading SuperStorage technologies to support this rapid growth. Using this innovative solution, communication service providers, cloud service providers, and enterprise infrastructure companies can efficiently utilize their networks to drive advanced visual services innovations.

The Supermicro X12 single-socket all-flash NVMe storage 1U system featuring 3<sup>rd</sup> Generation Intel® Xeon® Scalable processors with versatile and upgradeable processors and storage is verified as an Intel Select Solution for VCDN.

This system features high-performance, flexible configurations, well-balanced and optimized hardware for maximum throughput and lowest latency. It also features support for Intel® Optane™ SSD technologies and NVMe storage for reduced latency and highest performance. In addition, the efficient thermal balancing allows the system to support up to 270-watt processors.

## Introduction

The global market for visual content continues to grow exponentially as video content from satellite and cable networks, video on demand (VOD), live streaming, visual gaming, and virtual reality shifts to the internet. Communication service providers, cloud service providers, and enterprise infrastructure companies anticipate this video traffic means their content delivery network (CDN) must push further to the edge using distributed groups of servers working together to meet increasing bandwidth demands, deliver the best Quality of Service (QoS) and Quality of Experience (QoE), with a fast time to market (TTM) and low total cost of ownership (TCO).

To support these needs, Supermicro has partnered with Intel to develop a server platform for the Intel Select Solutions for VCDN. This solution is based on a hardware and software reference design architected to reduce development time and streamline procurement and deployment solutions for network and infrastructure operators. High-quality services are ensured while the risk of introducing advanced technologies is reduced with a proven hardware and software reference design. This reference design focuses on the four primary VCDN applications of web caching, VOD, live streaming, and media transcoding.

## Solution Overview

The Supermicro solution platform that was verified as an Intel Select Solution for VCDN consists of high-performance, flexible configurations, well-balanced, and optimized hardware resources verified with a software stack residing either on virtualized infrastructure or bare metal. The solution stack can use the most common and popular open-source CDN caching frameworks such as NGINX, Apache Traffic Server (ATS), and Varnish. It also leverages open source media libraries such as FFmpeg and Scalable Video Technology for media transcoding. In addition, acceleration is built into the system for key functions such as cryptography, data compression, and transcoding. The Supermicro platforms meet the software and hardware stack requirements outlined by the solution reference design specs in an easy, consistent deployment experience.

## Supermicro X12 Platform

The Supermicro X12 single-socket all-flash NVMe storage 1U system (Figure 1) supports the following features:

- 3<sup>rd</sup> Generation Intel Xeon Scalable processor series provides 64 lanes of PCIe Gen4, improving I/O throughput while reducing latency.
- System to support higher core density processors up to 270W TDP.
- Eight direct channel DIMM slots support a variety of DDR4-3200/2933/2666MHz ECC DIMM, offering the best cost-per-performance.
- Supports 10 Hot-swap 2.5" tool-less drive bays for NVMe drives with onboard RAID controller for RAID 0, 1, 5, and 10, onboard two NVMe/SATA M.2 slots with RAID 1 support for boot OS (NVMe RAID requires an additional VROC module).
- Two Intel® Ethernet X550 10GbE RJ45 ports and one dedicated BMC RJ45 LAN port.
- PCIe Gen4 x16 (FHHL) expansion slot.
- Hot-swappable redundant Platinum Level 860W power supplies.
- Root-of-Trust implementation for enhanced security.

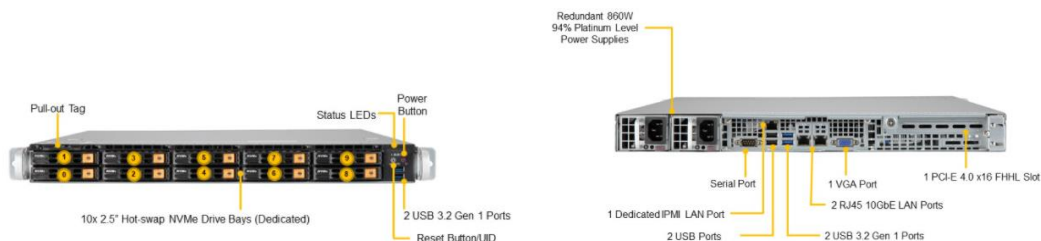


Figure 1: X12 Single-Socket All-Flash NVMe Storage 1U System SSG-110P-NTR10 (Front and Rear Views)

With these advanced features, this system offers many benefits for VCDN. For example, it can efficiently support live video web caching with its large high-speed DDR4 memory complement, deliver video on demand effectively by utilizing all-flash NVMe storage resources, offer video streaming live with high-bandwidth networking, and provide rapid media transcoding with the latest high-performance processors.

## VCDN Configuration Test Environment

Supermicro hardware used for one-socket Plus Configuration testing – Intel Select Solutions for Visual Cloud Delivery Network (Figure 2):

Ingredient	Configuration
Server	Supermicro X12 single-socket all-flash NVMe storage 1U system SSG-110P-NTR10
Processor	1x Intel® Xeon® Platinum processor 8360Y (2.4GHz, 36C/72T, 250W)
Memory	8x 32GB DDR4-3200, Total 256GB
Network Adapters	1x 100GbE Intel® Ethernet Network Adapter E810-CQDA2, Total 100 Gbps
Storage	6x Intel® Solid State Drive (Intel® SSD) D7-P5510 series (3.84TB), 4x Intel® Optane™ SSD P5800X (400GB)
Boot Drive	1x M.2 NVMe SSD 1.92TB

Figure 2: Supermicro VCDN Single-Socket Configuration

This white paper outlines the benchmarking setup for the four different VCDN use cases: Web Caching, VOD, Live Streaming, and Media Transcoding. The setup consists of an Origin content node, two client nodes as load generators, and an X12 single-socket all-flash NVMe storage 1U system as System Under Test (SUT), connected via a Supermicro 100GbE L2/L3 Ethernet switch (as shown in Figure 3). To establish true benchmark value, all of these systems were run on bare metal, although virtualized or containerized environments could also be used depending on requirements.

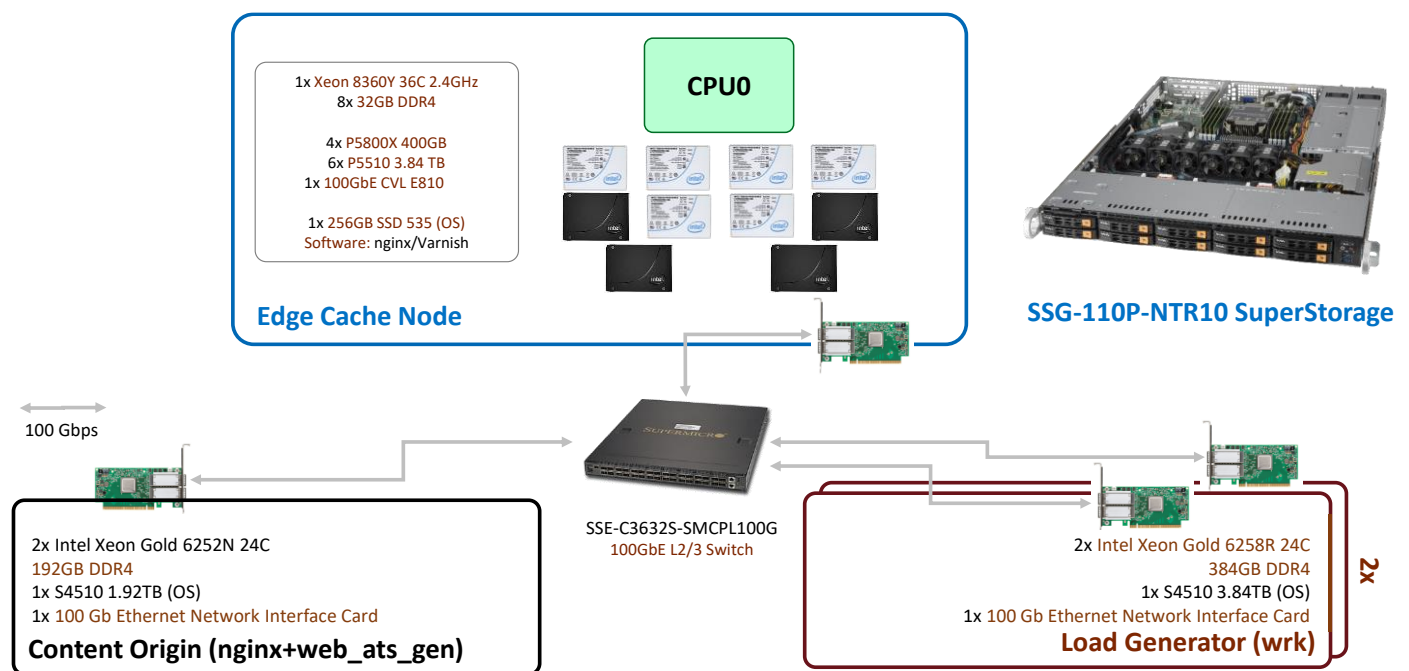


Figure 3: Reference Design Test Architecture

## Benchmarking

The following describes the benchmarking tests for Web Caching, VOD and Live Streaming. The software stack for these Supermicro reference design benchmarking tests utilizes the NGINX framework based on testing software availability. However, the same tests can be run using other popular open-source CDN caching frameworks such as Apache Traffic Server (ATS) or Varnish Plus software.

- Origin Server running NGINX 1.16.1 serving the requested files.
- SUT running NGINX Stack 1.16.1 which acts as an edge content caching server.
- Two client nodes running wrk, a modern HTTP benchmarking tool capable of generating significant load to simulate HTTPS request traffic sent to the SUT edge content caching server.
- The tests were established to measure and characterize the most relevant criteria and performance parameters for a real-world content delivery network.
- The tests measure and demonstrate the number of HTTPS requests per second, the response latency, and throughput the SUT can sustain with the given connections at:
  - 99% cache hit ratio for Web Caching
  - 90% to 99% cache hit ratio for VOD
  - 93% to 95% cache hit ratio for live stream video

Figure 4 outlines how the end user experience could significantly improve with the low latency and faster response time served by these geographically distributed groups of VCDN servers working together. Further, this is an ideal distributed computing architecture that makes it more valuable for customers to consider and implement.

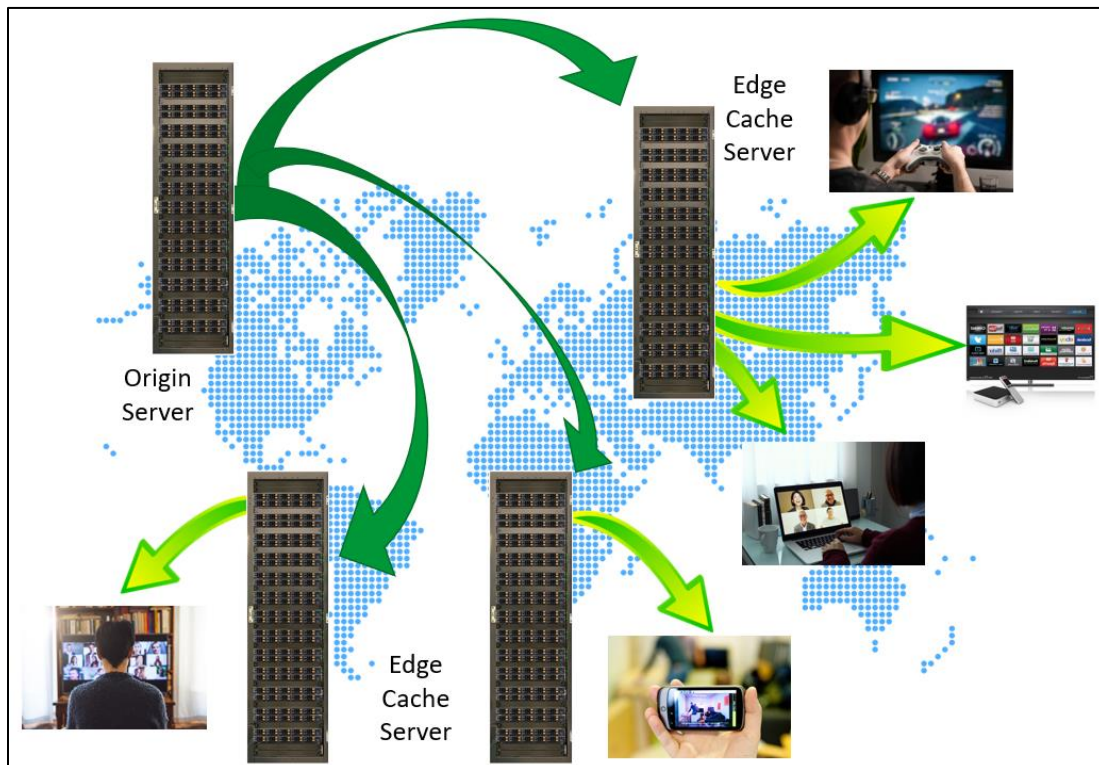


Figure 4: Value of VCDN Cache Servers

## Media Transcoding

Media Transcoding measures the maximum number of simultaneous transcoding streams that the SUT can sustain at the target frame rates. The 1:1 video transcoding performance benchmark was performed using FFmpeg with the SVT-HEVC codec plugin, which is highly optimized for Intel Xeon processors. The test clips used for benchmarking the video transcoding test were 4K 60 FPS and 1080P 30 FPS H.265. The video transcoding test was run on the SUT itself and did not require a client.

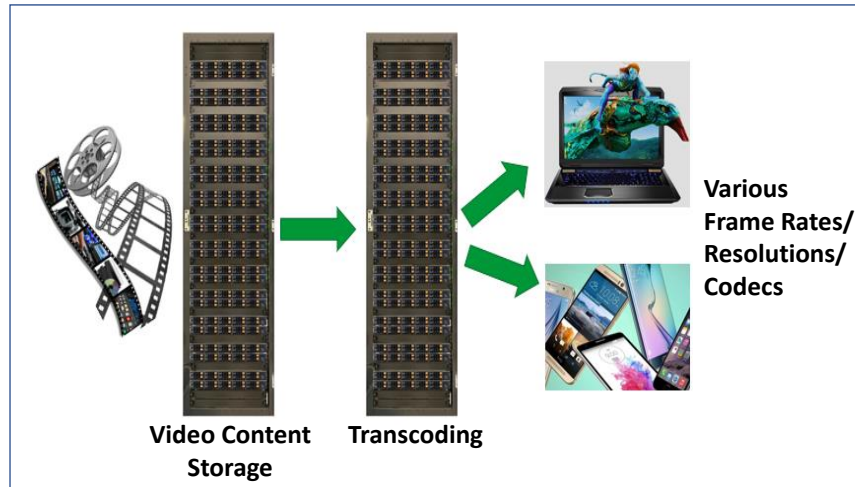


Figure 5: Media Transcoding Example

## Performance Benchmark Summary

The four tables below show the benchmark results of the Supermicro X12 single-socket all-flash NVMe storage 1U system measured against a series of key performance indicators (KPI) set by the Intel Select Solutions for VCDN. On each test case, the Supermicro X12 single-socket all-flash NVMe storage 1U system meets and exceeds the requirements for these reference design performance benchmarks for the Intel Select Solutions for VCDN.

Benchmark	Key Performance Indicators	X12 single-socket all-flash NVMe storage 1U system SSG-110P-NTR10
<b>Web Asset Caching</b>  Keepalive off 512 conns 100% TLS >99% cache hit ratio	HTTPS req/s (10 KB)	31,650
	Latency (Time to last Byte) ms	2.72 (avg)
		6.28 (p90)
		12.06 (p99)

Table 1: Web Asset Caching Benchmark Performance Results

Benchmark	Key Performance Indicators	X12 single-socket all-flash NVMe storage 1U system SSG-110P-NTR10	
<b>VOD</b>  Keepalive on 512 conns 100% TLS 90%-99% cache hit ratio (cache on NVMe)		90% Cache Hit Ratio	99% Cache Hit Ratio
	HTTPS req/s (1MB)	12,030	12,035
	Latency (Time to last Byte) ms	43 (avg)	39 (avg)
		97 (p90)	80 (p90)
	HTTPS Throughput (Gbps)	185 (p99)	122 (p99)
	91.84	91.84	

Table 2: Video on Demand Benchmark Performance Results

Benchmark	Key Performance Indicators	X12 single-socket all-flash NVMe storage 1U system SSG-110P-NTR10	
<b>Live Linear</b>  Keepalive on 512 conns 100% TLS 93% cache hit ratio (cache in Intel® Optane™ SSD)	HTTPS req/s (1MB)	12,025	
	Latency (Time to last Byte) ms	39 (avg)	
		78 (p90)	
	HTTPS Throughput (Gbps)	131 (p99)	
		91.76	

Table 3: Live Streaming Benchmark Performance Results

Benchmark	Key Performance Indicators	X12 single-socket all-flash NVMe storage 1U system SSG-110P-NTR10	
<b>Media Transcoding</b> (Intel Xeon only)	H.265 to H.265 (1080p 30fps) # of streams	24 streams	
	H.265 to H.265 (4K 60fps) # of streams	6 streams	

Table 4: Media Transcoding Benchmark Performance Results

## Performance Discussion

Optimized for VCDN, the Supermicro X12 single-socket all-flash NVMe storage 1U system (Figure 6) meets and exceeds the reference design performance benchmarks for the Intel Select Solutions for VCDN:

- Web asset caching hit ratio reached 31,650 HTTPS requests per second
- Video On Demand HTTPS throughput at 99% cache hit rate measured at 91.84 Gbps
- Live streaming HTTPS throughput achieved 91.76 Gbps with an average latency of 39ms
- 24 simultaneous Media Transcoding streams of H.265 to H.265 (1080p @30 frames per second)



Figure 6: X12 Single-Socket All-Flash NVMe Storage 1U System SSG-110P-NTR10 (Angled View)

## Conclusion

The global market for visual services continues to grow exponentially, offering challenges and opportunities throughout the IT visual services delivery industry. To support this rapid growth, Supermicro has partnered with Intel to develop a reference design-based SuperStorage cloud services delivery platform to empower communication service providers, cloud service providers, and enterprise infrastructure customers to efficiently drive advanced visual service innovations. Comprised of geographically distributed Supermicro servers working together to meet increasing bandwidth demands, these Visual Cloud Delivery Networks (VCDN) deliver the best Quality of Service (QoS) and Quality of Experience (QoE) for customers.

The Supermicro X12 single-socket all-flash NVMe storage 1U system is optimized for consistent high throughput and low latency, featuring new memory and storage solution options for improved performance, scalability, and cost savings. Signature Supermicro benefits with this proven storage platform include the highest quality components delivering maximum energy savings to reduce the customer's total cost of ownership (TCO).

This Supermicro system has been verified as an Intel Select Solution for VCDN, enabling customers to eliminate expensive and time-consuming testing, certification, and qualifications to speed deployment and time-to-revenue while reducing the risk of advanced technology. These advantages make this Supermicro platform an ideal VCDN solution.

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