Intel Select Solutions for Visual Cloud Delivery Network

Intel Select Solutions for Visual Cloud Delivery Network (VCDN) provide pre-validated configurations based on 3rd Generation Intel Xeon Scalable processors to accelerate delivery of visual services in service provider networks, with the choice of either CentOS or Red Hat Enterprise Linux.

Introduction

Consumer streaming media consumption is growing exponentially and evolving to richer dynamic and ephemeral content. This rapid growth in demand and the changing nature of visual content is an opportunity for communications service providers (CoSPs) to add visual services in the network, as they have the network and the customer relationships that make them uniquely poised to offer these services. Emerging visual services like cloud gaming, virtual reality, and volumetric video are driving need for more capacity, high bandwidth, and ultra-low latency. There is also an additional business opportunity for CoSPs to open their network to content providers and over-the-top (OTT) service providers and meet their Quality of Experience (QoE) and Quality of Service (QoS) needs. Delivery of visual services using virtualized network solutions can help CoSPs to deploy their infrastructure with fast time to market and low total cost of ownership (TCO) while ensuring high-quality services for consumers.

To support CoSPs, Intel and its solution definition partners have developed the Intel Select Solutions for Visual Cloud Delivery Network. These Intel Select Solutions are based on a hardware and software reference design that reduces development time for ecosystem partners and streamlines procurement and deployment of solutions for CoSPs.

Solution Overview

The Intel Select Solutions for Visual Cloud Delivery Network consist of optimized hardware resources and an open-source software stack residing within a virtualized infrastructure. The solution stack uses 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. Acceleration is built into the system for key functions such as cryptography, data compression, and transcoding.

To refer to a solution as an Intel Select Solution, a vendor must:

1. Meet the software and hardware stack requirements outlined by the solution's reference-design specifications

2. Replicate or exceed established reference-benchmark test results

3. Publish solution content to facilitate customer deployment

Solution providers can also develop their own optimizations in order to give end customers a simpler, more consistent deployment experience.

Intel Select Solutions for Visual Cloud Delivery Network provide high-performance, well-balanced systems along with flexible configuration options to meet different requirements. The solutions utilize NUMA-balanced I/O for maximum throughput and consistent latency. They also feature new memory and storage solution options for improved scalability, reduced latency, and cost savings.

Intel Platform Technologies

The Intel Select Solutions for Visual Cloud Delivery Network integrate a number of advanced Intel technologies for their performance, data security features, and other functionality.

3rd Generation Intel Xeon Scalable processors are the foundation for all hardware configurations used in the solutions. These CPUs are available in configurations optimized for cloud, enterprise, network, security, and IoT workloads, in a wide range of frequency, feature, and power levels. The following platform characteristics and technologies are particularly valuable to the Intel Select Solutions for Visual Cloud Delivery Network:

- **New balanced, scalable architecture** enhances per-core performance, increases memory bandwidth, and provides PCIe Gen4 support for twice the I/O bandwidth and density, to accelerate diverse workloads from the edge to the data center.

- **Increased core count and cache**, available in a flexible range of SKUs with 8 to 40 powerful cores and CPU caches up to 50 percent larger than the previous generation, helping drive up the number of streams that can be handled per node.

- **New extensions to Intel Advanced Vector Extensions 512 (Intel AVX-512) instructions** accelerate bit-processing kernels that move and reorder blocks of data within the wireless signal processing pipeline.

- **Intel Software Guard Extensions (Intel SGX)** provides protected execution enclaves that isolate and help protect application code and data while in use and enable new ways to collaborate using shared data without compromising privacy.

Intel Optane™ persistent memory 200 series helps to address memory constraint challenges for latency-sensitive CDN use cases. With the latest 3rd Generation Intel Xeon Scalable processors and the latest Intel Optane persistent memory, you can get up to 1.63x higher throughput and 1.33x more memory capacity,[1] enabling you to serve the same number of subscribers at higher resolution, or a greater number of subscribers at the same resolution. For CDN applications, the ability to provision content closer to the consumer for a faster, better user experience is critical. Operators are increasingly hosting rich content in memory to make it faster and more accessible. But large capacity memory DIMMs can be cost-prohibitive to scale. The Intel Optane persistent memory 200 series helps to address this challenge because it can offer lower per-gigabyte memory cost, and similar performance as DRAM. Higher memory density enables operators to host more channels per node at similar cost. Intel Optane persistent memory modules are available in per module capacities of 128 GB, 256 GB and 512 GB per module.

Intel Server GPU, based on Intel's Xe architecture, enables infrastructure that increases the density of streams per server, while helping ensure high quality and availability. This discrete graphics solution is well suited to accelerating high-density, low-latency CDN use cases in support of Android cloud gaming and media streaming, with a low cost per stream. It can be paired with Intel Xeon Scalable processors to help providers rapidly scale out new offerings to meet customer demands. For more information, visit the Intel Server GPU product page.

Intel Solid State Drive Data Center Family (Intel SSD DC Family) includes the NVMe-based Intel SSD Data Center P5500 and P5300 Series, which is designed for cloud infrastructures and offers outstanding quality, reliability, advanced manageability, and serviceability to minimize service disruptions. The Intel 3D NAND Technology-based SSDs provide high-capacity storage. The Intel Optane DC SSD P5800X Series supports fast caching and fast storage at low latency and high endurance compared to traditional NAND and hard disk drives. When used for caching, Intel Optane DC SSDs help to increase scale by accommodating more capacity than alternative DRAM-based memory technologies typically used for caching.

Intel® Ethernet 800 Series Network Adapter delivers efficient, workload-optimized performance at Ethernet speeds up to 100 Gbps. These adapters accelerate the Intel Select Solutions for Visual Cloud Delivery Network with packet-classification sorting optimizations for high-bandwidth workloads. Enhanced Dynamic Device Personalization (DDP) uses the fully programmable pipeline to enable frame classification for advanced and proprietary protocols on the adapter, to increase throughput, lower latency, and reduce host CPU overhead. Multiple DDP profiles specify workload-specific optimizations, add protocols where they can improve efficiency, and define parameters for packet handling and processing.

Two-Socket and One-Socket Base and Plus Configurations

Intel and its solution definition partners have carefully designed the hardware platform requirements of the Intel Select Solutions for Visual Cloud Delivery Network to deliver performance and efficiency for CDN applications. Reflecting the flexibility of platforms based on the 3rd Generation Intel Xeon Scalable processor, both two-socket and one-socket configurations are available, with both Base and Plus configurations available for each of the processor counts. The breadth of configurations included within the Intel Select Solutions for Visual Cloud Delivery Network gives customers control over value-performance tradeoffs for different use cases.

Figure 1 demonstrates the software stack and some of the available configuration options for the solutions. Tables 1 and 2 outline some of the high-level hardware requirements for Base and Plus configurations of two-socket and one-socket servers.
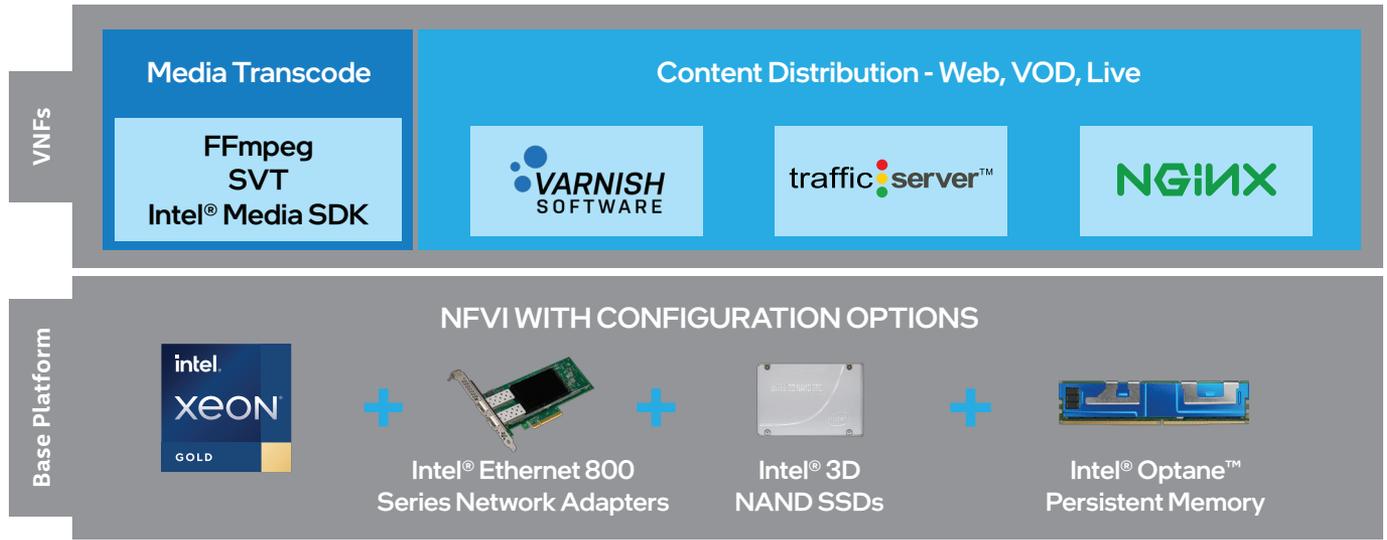

Figure 1. Built-in application layer for CDN services and hardware configuration options.

Table 1. Hardware configurations for two-socket Intel Select Solutions for Visual Cloud Delivery Network.

Ingredient	Base Configuration (2S)	Plus Configuration (2S)
Processor	2 x Intel Xeon Gold 5318N processor (2.1 GHz 24C/48T, 150 W), or 20C/40T @135 W, or Higher core count/frequency	2 x Intel Xeon Gold 6338N processor (2.2 GHz 32 C/64T, 185 W), or Higher core count/frequency
DRAM	256 GB – Required	
Intel Optane Technology	2-1-1-1 128 GB (512 GB Total) – Recommended, or 3x Intel Optane SSD DC P5800X Series (400 GB) – Recommended	2-2-1-1 128 GB (1 TB Total) – Required
Intel® Ethernet Network Adapters	2 x 50 GbE Intel Ethernet 800 Series Network Adapters – Total: 100 Gbps	2 x 100 GbE Intel Ethernet 800 Series Network Adapters – Total: 200 Gbps
Accelerator	1 x Intel Server GPU – Recommended	
Storage Capacity	6 x Intel SSD D7-5510 Series (3.84 TB) – Required[2], or 6 x Intel SSD P5-P5316 Series (7.68 TB) – Required[2]	10 x Intel SSD D7-5510 Series (7.68 TB) – Required, or 10 x Intel SSD P5-P5316 Series (15.36 TB) – Required
Storage Boot Drive	2 x SATA SSD S5510 @480 GB – Required	

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Table 2. Hardware configurations for one-socket Intel Select Solutions for Visual Cloud Delivery Network.

Ingredient	Base Configuration (1S)	Plus Configuration (1S)
Processor	1 x Intel Xeon Gold 6312U processor (2.4 GHz 24C/48T, 185 W), or Higher core count/frequency	1 x Intel Xeon Gold 8351N processor (2.4 GHz 36 C/72T, 225 W), or Higher core count/frequency
DRAM	256 GB – Required	
Intel Optane Technology	1 x 400 GB P5800x Intel Optane SSD – Recommended	4 x 400 GB P5800x Intel Optane SSD – Required[2]
Intel® Ethernet Network Adapters	1 x 50 GbE Intel Ethernet 800 Series Network Adapter – Total: 50 Gbps	1 x 100 GbE Intel Ethernet 800 Series Network Adapter – Total: 100 Gbps
Storage Capacity	4 x Intel SSD D7-5510 Series (3.84 TB) – Required[2], or 4 x Intel SSD P5-P5316 Series (7.68 TB) – Required[2]	6 x Intel SSD D7-5510 Series (3.84 TB) – Required, or 6 x Intel SSD P5-P5316 Series (7.68 TB) – Required
Storage Boot Drive	2 x SATA SSD S5510 @480 GB – Required	

Software Stack

The Intel Select Solutions for Visual Cloud Delivery Network are designed to offer an optimized and validated software stack to allow CoSPs to deploy their preferred CDN software. CoSPs have the flexibility to use either open source CDN software or commercial CDN software. This stack includes media frameworks, operating system and drivers, and BIOS recommendations. The frameworks supported include the following (see also Tables 3 and 4):

- **Video-on-Demand (VoD) and Live/Linear Streaming:** HLS and DASH are recommended for live streaming benchmarking as they are used worldwide and have been well supported by the NGINX and Apache Traffic Server (ATS) framework.

- **Web Content Caching:** The Intel Select Solutions for Visual Cloud Delivery Network support NGINX, ATS and Varnish Software. By supporting the most popular caching software, Intel covers the CoSP market with support for the most popular frameworks.

- **Media Transcode:** FFmpeg is a widely used framework for media processing and media transcoding applications. Intel provides a highly optimized software development kit (SDK) for HEVC encoding and also for media transcoding using the Intel VCA 2 hardware accelerator card.

- **Media Solution Development:** Intel Media SDK is supported on the solution to provide software development tools and libraries needed to develop, debug, and deploy enterprise-grade media solutions on Intel Server Graphics. The tool set supports development of tools for transcoding live, over-the-top broadcasting, and streaming video, as well as for cloud gaming, virtual desktop infrastructure (VDI), and video conferencing.

Table 3. Media platform components.

Media Acceleration Library		Intel Media SDK
Media Framework		FFmpeg
Containers Platform		KVM
OS Support		Linux
Media Codecs	Encode and Decode	AVC, HEVC, MPEG2, VP9

Caching and media open source library frameworks deployed with the Intel Select Solution for Visual Cloud Delivery Network include the following:

- Caching Frameworks:
  - Apache Traffic Server (ATS)
  - NGINX
  - Varnish Software
- Media Libraries:
  - FFmpeg
  - Scalable Video Technology

Operating Systems, Drivers, and Firmware

The Intel Select Solutions for Visual Cloud Delivery Network include a comprehensive, optimized software and firmware stack based on either CentOS or Red Hat Enterprise Linux. Contact your Intel representative for access to a detailed design specification for each configuration. These specifications and associated test plans are posted to the Intel Resource and Design Center.

The solution details each software stack component in order to reduce chances for incompatibilities, eliminate errors and provide for reliable and high-performance operation. Variables specified include minimum supported versions of following key items:

- Intel processor microcode update versions
- UEFI firmware (BIOS)
- Host and guest operating system versions
- Intel Ethernet 800 Series Network Adapters
- Intel Optane SSD and persistent memory firmware and drivers

Verified Performance through Benchmark Testing

To validate the performance of Intel Select Solutions for Visual Cloud Delivery Network, Intel has devised a series of key performance indicator (KPI) targets for both the Base and the Plus configurations. Table 4 highlights some of these KPI benchmarks.

Table 4. Key KPI targets.[3]

Benchmark	Key Performance Indicator	1S Plus (Actual Recorded KPIs)		2S Plus (Actual Recorded KPIs)	
		90% Cache Ratio	99% Cache Ratio	90% Cache Ratio	99% Cache Ratio
VOD Keepalive on 512 Conns 100% TLS 90% - 99% Cache Hit Ratio (Cache on NVMe)	HTTPS reqs/s (1MB)	10898	11389	17239	21368
	Latency (Time to last Byte, ms)	62 (avg)	64 (avg)	33 (avg)	41 (avg)
		130 (p90)	144 (p90)	75 (p90)	84 (p90)
		443 (p99)	513 (p99)	223 (p99)	330 (p99)
	HTTPS Throughput (Gbps)	89.6	94	152.8	178
Media Transcoding (Intel® Xeon® Processors Only)	H.265 to H.265 (1080p 30fps) # of streams	18 streams		32 streams	
	H.265 to H.265 (4K 60fps) # of streams	5 streams		8 streams	
Web Asset Caching Keepalive Off 512 Conns 100% TLS >99% Cache Hit Ratio	HTTPS req/s (10 KB)	35000		38008	
	Latency (Time to Last Byte, ms)	2.85 (avg)		2.72 (avg)	
		6.43 (p90)		6.77 (p90)	
		12.05 (p99)		12 (p99)	
Live Linear Keepalive on 512 Conns 100% TLS 93% Cache Hit Ratio (Cache in Persistent Memory and DRAM)	HTTPS req/s (1MB)	11542		19213	
	Latency (Time to Last Byte, ms)	62 (avg)		31 (avg)	
		127 (p90)		66 (p90)	
		569 (p99)		178 (p99)	
	HTTPS Throughput (Gbps)	94.9		161.2	

Conclusion

CDN services are a rapidly growing market opportunity, and the evolution to virtualized CDN platforms gives CoSPs new capabilities and business models. To help their partners develop and deploy these services, Intel and its solution definition partners have specified the Intel Select Solutions for Visual Cloud Delivery Network that deliver optimized performance for a wide range of CDN implementations built on the 3rd Generation Intel Xeon Scalable processors.

Learn More

Intel Select Solutions: **intel.com/selectsolutions**

3rd Generation Intel Xeon Scalable processors:
intel.com/content/www/us/en/products/processors/xeon/scalable.html

Intel Select Solutions are supported by the Intel Network Builders Program:
networkbuilders.intel.com/intelselectsolutions/network

Intel Visual Cloud: **intel.com/visualcloud**

Intel Ethernet 800 Series Network Adapters: **intel.com/ethernet**

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