Solution Brief

3rd Gen Intel® Xeon® Scalable Processor
Visual Cloud

Increasing Performance and Density for Real-Time Video Transcoding

Synamedia increases transcoding channels per node on 3rd generation Intel® Xeon® processor-based servers, including up to a 30 percent improvement for SD transcoding and up to 33 percent for FHD and UHD.[1]

Consumer expectations for media content continue to become more sophisticated, with demand for increasing screen resolutions, frame rates, and dynamic ranges that enable pristine video on any device. At the same time, the ability to deliver flawless personalized, real-time user experiences has also become a competitive imperative for video providers. In an increasingly crowded market, the margin for error is vanishingly small, and provider missteps can quickly erode subscriber sentiment.

Within that environment, providers must continually find ways to optimize dynamic balance among the interdependent factors shown in Figure 1. Higher resolutions and more immersive experiences increase data sizes, and therefore bandwidth requirements. Higher compression ratios are needed to meet that challenge, while maintaining video quality and the closely associated metric of network latency. The more complex transcoding algorithms involved increase computational requirements, so that more compute capacity per node is needed to maintain stream density for budgetary efficiency.

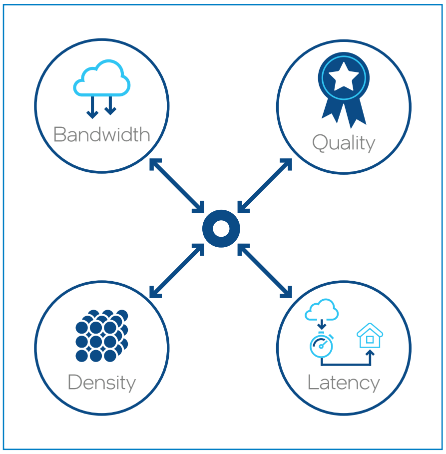

Figure 1. Dynamic balance among operational and user-experience factors.

Transcoding Innovations for Cost-Efficiency and User Experience

Industry standards are evolving rapidly to enable the delivery of next-generation experiences, but each new advance places new demands on the four-way balance described above. For example, the upcoming H.266/VVC standard will reduce bandwidth requirements for delivery of 4K (and eventually 8K) video to consumers, but with the added overhead of approximately seven times more encoder complexity and 1.5 times more decoder complexity.[2,3] That added complexity equates to more compute requirements, meaning that fewer streams can be processed per node; that reduced density directly increases server footprints, driving up both CapEx and OpEx.

With increased compute capacity per socket, the 3rd generation Intel® Xeon® Scalable processor is well-suited to this use case. Synamedia's software-defined Virtual Digital Content Manager (vDCM) demonstrates dramatic improvements in transcoding performance across workloads, enabling more cost-effective, scalable infrastructure to deliver next-generation visual media experiences.

Based on Synamedia tests, 21 servers using 3rd generation Intel® Xeon® Scalable processors are estimated to handle the same transcoding load as 27 servers based on the previous-generation platform.[1]

Synamedia vDCM

To help its customers keep pace with the rapid development of new standards, Synamedia builds compression technology that mitigates the heavier computational complexity associated with successive generations of codecs. These capabilities are crucial so that video providers can efficiently and cost-effectively adopt the latest technologies to deliver high-quality video at scale, while maintaining an excellent subscriber experience. Synamedia is a leading software provider for the video content industry, as shown in Figure 2.

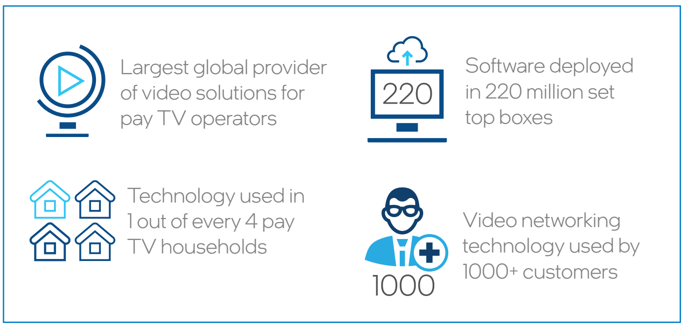

Figure 2. Facts and figures about Synamedia.[4]

Synamedia vDCM virtualizes the entire video headend, as illustrated in Figure 3, providing software-defined video processing built for use on Intel® architecture, flexibly deployed across bare metal or public, private, and hybrid cloud infrastructure. The solution enables providers to optimize video processing functions, such as live encoding and transcoding to multiple bit rates and formats, for the full spectrum of subscriber devices. It enables providers to seamlessly personalize video content, providing an outstanding subscriber experience with automated, repeatable workflows that drive 24/7 efficiency.

Implemented as a set of virtualized network functions, Synamedia vDCM is a cloud-native solution built to operate in software-defined networks, taking full advantage of that model's capabilities for agility and elasticity. In particular, this software architecture enables faster time to market for new software and services, as well as creating efficiencies by sharing resources across general-purpose Intel architecture-based servers.

Hardware Platform Advancements for Higher Video Throughput

Ongoing improvements to Intel-based server platforms are a critical factor for Synamedia as it drives adoption of emerging standards to enable best-in-class viewing experiences. The 3rd generation Intel Xeon processor delivers significant increases in performance per core over its predecessor platforms, and it is available in a flexible range of SKUs, with a wide range of core counts, frequencies, features, and power levels.

In addition to increased compute capacity and greater core counts at the high end, the new platform also benefits Synamedia vDCM with L1 caches of up to 48 KB (50 percent larger than the previous generation), which keeps more hot data close to the processor, helping accelerate execution for transcoding workloads. The processor also features increased memory bandwidth, with up to 4 TB capacity per processor socket. The I/O subsystem has been updated, including support for PCI Express Gen4, which provides double the bandwidth of PCI Express Gen3.

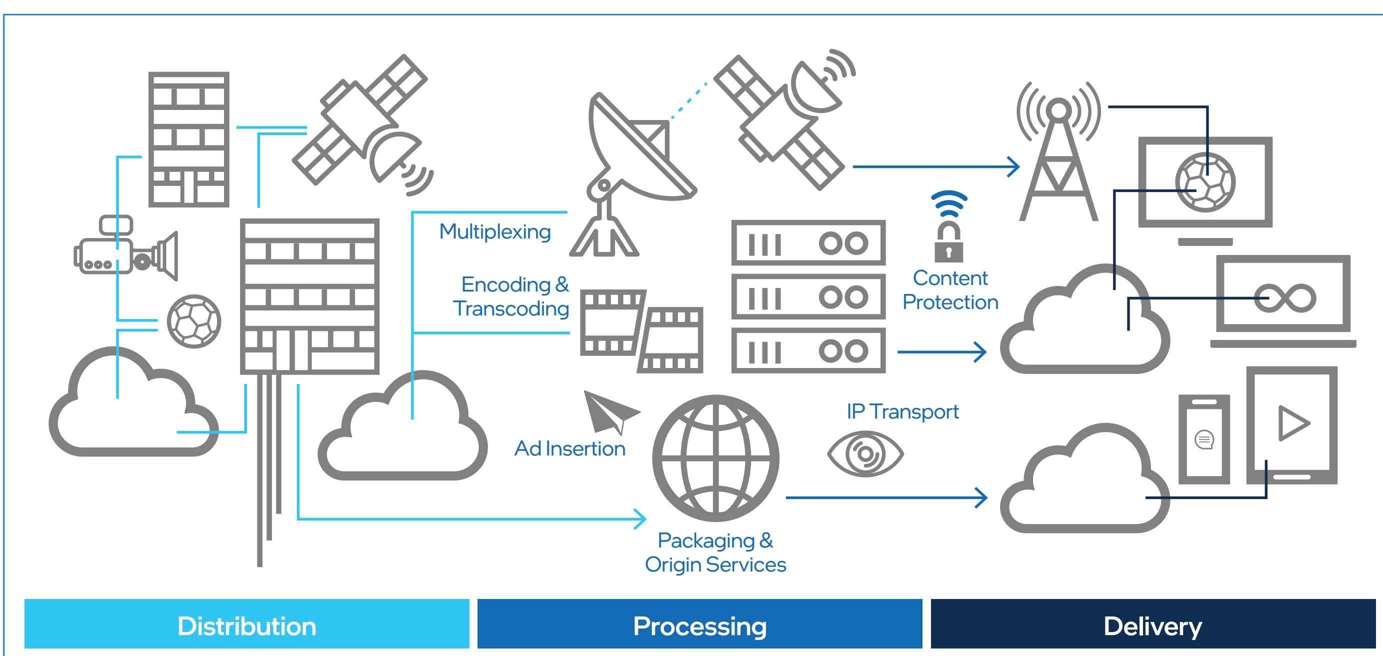

Figure 3. Synamedia vDCM virtualizes the entire video headend.

3rd Generation Intel Xeon Scalable Processors

- **Flexibility from the edge to the cloud**, bringing AI everywhere with a balanced architecture, built-in acceleration, and hardware-based security.
- **Part of a complete set of network technology from Intel**, including accelerators, Ethernet adapters, Intel® Optane™ persistent memory, FlexRAN, OpenNESS, Open Visual Cloud, and Intel® Smart Edge.
- **Engineered for modern network workloads**, targeting low latency, high throughput, deterministic performance, and high performance per watt.
- **Enhanced built-in crypto-acceleration** to reduce the performance impact of full data encryption and increase the performance of encryption-intensive workloads.
- **Hardware-based security** using Intel® Software Guard Extensions (Intel® SGX),[5] enhanced crypto processing acceleration,[5] and Intel® Total Memory Encryption.[5]

In the software-defined environment that Synamedia vDCM is built for, the 3rd generation Intel Xeon Scalable processor provides flexibility across workloads, optimized for multi-cloud deployments. The platform is built on open standards and APIs to enable infrastructures to scale up and out with ease, evolving for changing needs while delivering on throughput requirements that underlie high density per node in production.

Test Setup

Synamedia developed test routines to repeatably measure the number of channels that vDCM can transcode per computing node. The company used those test results to compare the channel density supported by servers based on the 3rd generation Intel Xeon Scalable processor compared to its predecessor.

Testing includes a range of workloads at a variety of resolutions (standard, high, and ultra-high definition) using a variety of compression standards (MPEG-2, H.264, and HEVC).

The devices under test (DUTs) were two servers, configured as follows:

- **DUT-1 (2nd Generation Intel Xeon Scalable processor)**: One node based on dual Intel Xeon Gold 6258R processors (28 cores, 56 threads per socket, $3,950)[6] with 96 GB RAM
- **DUT-2 (3rd Generation Intel Xeon Scalable processor)**: One node based on dual Intel Xeon Gold 6330 processors (28 cores, 56 threads per socket, $1,894)[6] with 256 GB RAM

Performance Outcomes: Higher Channel Density per Node

Testing by Synamedia of its vDCM platform confirms the real-world benefit of the increased compute performance of the 3rd generation Intel Xeon Scalable processor. Side-by-side, generation-to-generation testing shows that the number of streams that can be transcoded per node at a constant level of quality is dramatically better, compared with a CPU with the same core count (28 cores) from the previous generation. This improvement in streams-per-node density is observed across multiple transcoding workloads, a sample of which is shown in Figure 4:

- **Standard Definition video transcoding**: up to 30 percent more streams per node
- **High Definition video transcoding**: up to 33 percent more streams per node
- **Ultra-High Definition video transcoding**: up to 33 percent more streams per node

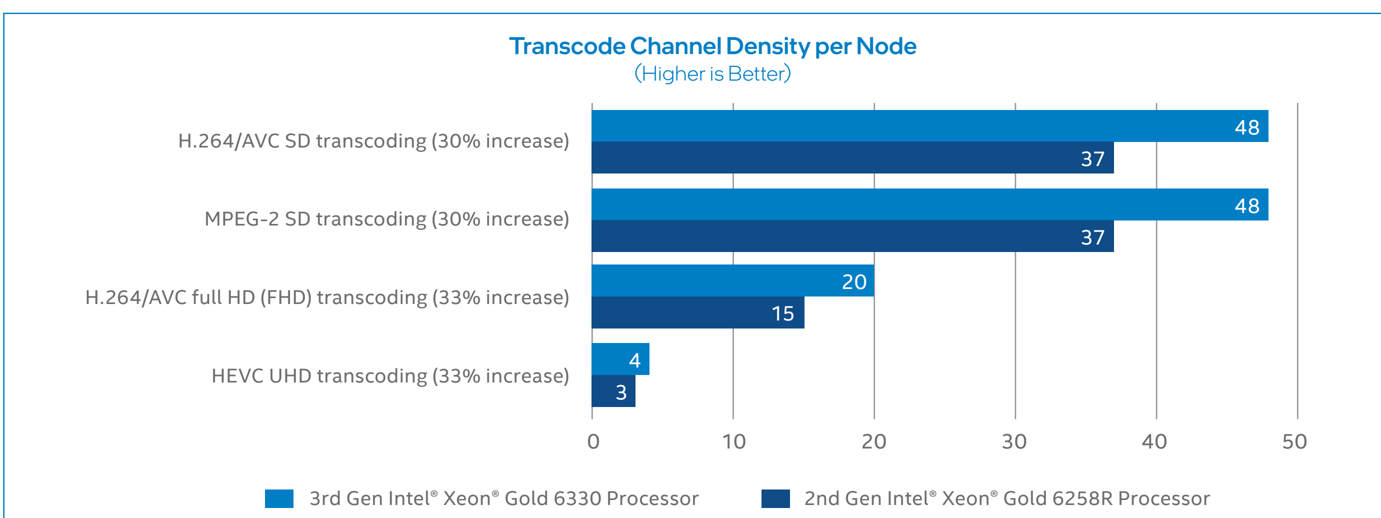

Figure 4. Improvements in channel density for various transcoding workloads.[1]

The increases in transcoding density per node directly translate to a reduction in the infrastructure requirements to support a given number of subscribers. For example, at the low end of those increases, both standard definition workloads achieved 48 streams per server based on the 3rd generation Intel Xeon Scalable processor, compared to 37 streams per server with the older platform. On those workloads, for every 1,000 streams being supported, a provider would need an estimated 21 newer servers rather than 27 of the older ones, delivering immediate and ongoing cost savings.

Conclusion

The 3rd generation Intel Xeon Scalable processor enables Synamedia vDCM customers to realize the CapEx and OpEx benefits of increasing transcode processing density, to support a given number of current or future subscribers with fewer servers. Video content providers can also accelerate their adoption of new architectures and video standards by delivering the throughput that underlies high densities of streams per node.

At the same time, operators achieve greater efficiencies and lower TCO across their infrastructures as they set ambitious goals for scaling distribution while delivering outstanding subscriber experiences. Synamedia vDCM will continue to be optimized for future Intel architecture-based cloud infrastructure, supporting agile changes and adaptability for unknown future needs.

Learn More

- Synamedia
- Virtual Digital Content Manager (vDCM)
- Intel® Network Builders
- 3rd generation Intel® Xeon® Scalable processors
- Intel® Visual Cloud

intel.

[1] Testing performed April 1, 2021, by Synamedia.

DUT-1 (2ND GENERATION INTEL XEON SCALABLE PROCESSOR): One node based on 2x Intel Xeon Gold 6258R processors (28 cores, 56 threads per socket); 96 GB RAM total (12 modules @ 8 GB each, 2933 MHz); Intel® Hyper-Threading Technology enabled; Intel® Turbo Boost Technology enabled; microcode 0x5002f01; BIOS version U32 v2.36; CentOS 7.9.2009; Kernel 3.10.0-1160.el7.x86_64; vDCM 20.1.2-117, compiler: GCC 8.4.

DUT-2 (3RD GENERATION INTEL XEON SCALABLE PROCESSOR): One node based on 2x Intel Xeon Gold 6330 processors (28 cores, 56 threads per socket); 256 GB RAM total (16 modules @ 16 GB each, 2933 MHz); Intel Hyper-Threading Technology enabled; Intel Turbo Boost Technology enabled; microcode 0x8d05a260; BIOS version 3021D40; CentOS 7.6; Kernel 3.10.0-957.el7.x86_64; vDCM 20.1.2-117, compiler: GCC 8.4.

WORKLOAD DETAILS:

H.264/AVC SD transcoding - H.264 (4:2:0) (8-bit) 1920x1080i@25 fps SDR 10000 kbps to H.264 Main (4:2:0) (8-bit) 720x576i@25 fps SDR 300 kbps

MPEG-2 SD transcoding - H.264 (4:2:0) (8-bit) 1920x1080i@25 fps SDR 10000 kbps to MPEG-2 Main (4:2:0) (8-bit) 720x576i@25 fps SDR 600 kbps

H.264/AVC full HD (FHD) transcoding - H.264 (4:2:0) (8-bit) 1920x1080p@50 fps SDR 15000 kbps to H.264 Main (4:2:0) (8-bit) 1920x1080p@50 fps SDR 1000 kbps

HEVC UHD transcoding - H.265 (4:2:0) (8-bit) 3840x2160p@59.94 fps SDR 15000 kbps to H.265 Main (4:2:0) (8-bit) 3840x2160p@59.94 fps SDR 25000 kbps

[2] Topiwala, Pankaj, Madhu Krishnan, and Wei Dai. “Performance comparison of VVC, AV1 and EVC.” Applications of Digital Image Processing XLII. Vol. 11137. International Society for Optics and Photonics, 2019.

[3] Pakdaman, Farhat et al. “Complexity analysis of next-generation VVC encoding and decoding” Proceedings of International Conference on Image Processing (ICIP), p. 3134-3138, 2020.

[4] Source: https://www.synamedia.com/about/.

[5] This technology is not supported when using Intel Optane persistent memory.

[6] Based on pricing as of April 20, 2021, from https://ark.intel.com/content/www/us/en/ark/products/199350/intel-xeon-gold-6258r-processor-38-5m-cache-2-70-ghz.html and https://ark.intel.com/content/www/us/en/ark/products/212458/intel-xeon-gold-6330-processor-42m-cache-2-00-ghz.html.

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