Preventing for the New Wave of On-Demand TV Services

Energy-efficient Intel® processors and solid-state drives deliver innovative VoD services while reducing power usage, space requirements, and costs

Overview

The TV on-demand generation expects access to TV programs at their convenience. Cable and telco companies are responding to consumer preferences with Video-on-Demand (VoD), Remote-Storage Digital Video Recorder (RS-DVR), and Time-Shifted Television (TSTV) services so that viewers can record and replay programs on their own schedules. These services are particularly compute- and I/O-intensive, requiring vast investments in storage, processing and networking equipment. The challenge for cable and telco operators is to deliver these services using less power and less equipment space, while controlling capital and operational expenditures (CapEx and OpEx).

Intel is investing heavily to address these needs with technologies that dramatically reduce power while increasing performance. To demonstrate these advances, Intel teamed with Espial*, a leading provider of digital TV software, to build a video streaming proof-of-concept. This showcased Espial VoD software along with several leading-edge Intel® products including the Intel® Xeon® processor C5500/C3500 series, Intel® Solid State Drives (Intel® SSD), and Intel® 10 Gigabit Ethernet Controllers. Working together, these components were shown to significantly lower the power and cooling requirements for commercial-off-the-shelf (COTS) servers and blades while delivering excellent performance in a small, 1RU rack-mount or blade form factor.
System Configuration and Results

This proof-of-concept is based on an Intel® reference board containing two Intel® Xeon® processors LC5518, each running at 1.73 GHz. The processor features an integrated I/O controller hub supporting PCI Express® 2.0. The PCI Express slots were populated with two Intel® 82599EB 10 Gigabit Ethernet Controllers—each with two ports—for 40 Gbps of total available bandwidth.

Espial MediaBase software streams high-definition video assets from DDR3 memory, running at 1066 GHz. The required memory capacity is defined by the size of the time-shift window, the bitrate of the content, and the number of TV channels. These parameters are configurable and can be defined on a case-by-case basis by the provider deploying the service. The server accomplishes all of this while running at an average of 12% utilization across all CPU cores, leaving substantial headroom for other potential software applications, such as video transcoding or digital rights management (DRM).

Beyond this memory-based proof-of-concept, another potential TSTV production configuration would be to stream videos from a combination of memory and SSDs. In this case, the server would contain two PCIe/SATA host bus adapters, each interfacing to eight Intel® X25-M Extreme SATA Solid-State Drives in a 7+1 RAID 5 array. In this configuration, the highest-demand video assets can stream from memory, with lower-demand content streaming from high-throughput SSDs.

Either of the above configurations is capable of delivering 376 Gbps of total video streaming throughput, which equates to 3,760 10 Mbps HD streams, all within a 180W system power envelope.

The combination of the Intel Xeon processor C5500/C3500 series and Espial MediaBase* software achieved a staggering 376 Gbps of video streaming throughput with an estimated 33% reduction in system power consumption (as compared to Intel® Xeon® processor 5500 series-based platforms). The power savings was achieved by the higher level of silicon integration offered by Intel Xeon processor C5500/C3500 series, which is optimized for the stringent requirements of communications, embedded, and storage applications. The cost-effectiveness of COTS servers and the increasing affordability of SSDs—combined with the OpEx savings of decreased power consumption—created a solution that is easily competitive with platforms based on purpose-built silicon.

Figure 1. Intel® Xeon® processor C5500/C3500 Series significantly improves performance-per-watt, driving OpEx savings
Technology Overview

The following section provides an overview of some of the technology used in this proof-of-concept.

- The Intel Xeon processor C5500/C3500 series is based on the Intel® microarchitecture, codenamed Nehalem. It maintains the same world-class performance as the Intel® Xeon® processor 5500 series while significantly reducing power consumption and integrating new features needed for many embedded, communications and storage applications.

- Espial MediaBase is an intelligent content delivery platform powering VoD, time-shifted TV (TSTV), network digital video recorder (nDVR), remote-storage digital video recorder (RS-DVR), and other lucrative services in the cable, telecommunications, enterprise, and hospitality industries. Combining multi-tiered networking, intelligent content delivery and wide ecosystem support, it ensures operators can deliver and maintain their VoD projects on-time and on-budget.

- The Intel X25-M Mainstream SATA Solid-State Drive, ideal for read-intensive applications, offers outstanding performance and reliability, delivering the highest input/output operations per second (IOPS) per watt for servers, storage and high-end workstations. Unlike traditional hard disk drives (HDD), Intel SSDs have no moving parts, resulting in a quiet, cooler storage solution with significantly higher performance than traditional server drives. SSDs also consume up to 90% less power than HDDs over their lifetime, providing additional cost savings.

Conclusion

Cable and telco operators are working to meet consumer demand by building VoD systems of unprecedented size and scale. Yet, to stay competitive companies must consider the capital costs of expanding their infrastructure as well as the operational expenses associated with running and maintaining equipment and services.

Intel® technology is poised to deliver considerable savings for next-generation VoD solutions. Commercial-off-the-shelf servers, generally available for a lower capital investment, are competitive with the performance and energy efficiency previously achievable only with proprietary hardware solutions. The newest Intel Xeon processors demonstrate significant savings with lower power and cooling requirements. By delivering excellent performance in a small form factor, operators can save on their real estate investment, as well. While initially more costly, solid-state drives consume significantly less energy than hard disk drives with dramatically higher data throughput performance.

To substantiate these benefits, Intel and Espial have developed a proof-of-concept that demonstrates delivery of 376 Gbps total video throughput at a 33% reduction in platform power consumption compared to prior generation Intel Xeon processor-based platforms. This allows cable and telco operators to deliver more service while using less power, less space, and less overhead than ever before.

Figure 2. Time-Shifted TV Server Production Configuration. The integrated I/O controller hub (IIO) in the Intel® Xeon® processor C5500/C3500 series saves board real estate and consumes less power due to the reduction in total chip count.
Benchmarks and Testing


Measured performance; estimated power based on expected production system configuration.

Expected Production System Configurations:

**Intel® Xeon® processor 5500 series + Intel® Solid State Drives**
- Intel® Xeon® processor X5550, 2.66GHz, 8MByte L3 Cache, Intel® QuickPath Interconnect 6.40 GT/s, dual-processor configuration
- Intel® 5520 chipset; 6x2GB DDR3-1066; 2x Intel® 82599 10 Gigabit Ethernet Controller; LSI* SAS 3081E-R Host Bus Adapter; 8x Intel® X25-M Solid State Drive 80GB;
- RedHat* Enterprise Linux* 5.4, kernel 2.6.18-164; Espial* Mediabase* MB-9.0-patch-3.

**Intel® Xeon® Processor C5500/C3500 Series + Intel® Solid State Drives**
- Intel® Xeon® processor LC5518, 1.73GHz, 8MByte L3 Cache, Intel QuickPath Interconnect 4.80 GT/s, dual-processor configuration; Intel® BD3420 PCH; 4x4GB DDR3-1066; 2x Intel® 82599 10 Gigabit Ethernet Controller; LSI SAS 3081E-R Host Bus Adapter; 8x Intel® X25-M Solid State Drive 80GB; RedHat Enterprise Linux 5.4, kernel 2.6.18-164; Espial Mediabase MB-9.0-patch-3.

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