DUAL AMD EPYC™ PROCESSORS RUNNING BEAMR 5 DELIVER SIX (6) BROADCAST QUALITY, REAL-TIME 4KP60 HEVC ENCODES

The Beamr 5 HEVC software encoder takes advantage of several key features of the new AMD EPYC™ processor architecture to deliver high quality, high density, high performance, high dynamic range (HDR) in a simple to use, easy to deploy and flexible software component. On a dual socket AMD EPYC 7601 processor-based system, Beamr 5 is capable of encoding up to six channels of 4Kp60 HDR 10-bit video, at a quality level suitable for live linear distribution of broadcast and premium entertainment content.

Encode up to six HEVC UHD HDR 10-bit live channels on a dual socket AMD EPYC 7601 processor-based system with Beamr 5

For real-time live streaming services which require the highest resolution and frame rates, the greater performance envelope means less equipment, smaller racks, reduced power and cooling requirements.

The performance benefits of Beamr 5, running on the AMD EPYC™ processor architecture, extend from live linear to VOD file-to-file video encoding applications where shorter wall clock times mean more titles may be encoded in the same period of time. These benefits are of particular interest to entertainment services that must meet day and date content availability, when often the source file is received mere hours before the service publishing target.

The AMD EPYC™ Performance Advantage

Based on a new microarchitecture, built using state-of-the-art process technology, the AMD EPYC processors represent the most significant set of platform improvements in a decade. A completely redesigned architecture delivers more throughput per execution core. As a result, hardware parallelism is significantly increased, with up to 32 cores per socket contributing to increased encoding density, allowing the AMD EPYC 7601 SoC to deliver high density video processing within a 180W TDP envelope.
Executive Summary

New service capabilities and advanced video formats such as Cloud DVR, UHD, High Dynamic Range (HDR), High Efficiency Video Coding (HEVC), and VR are becoming key requirements in the subscriber growth race. While at the same time, Internet video to the TV is projected to expand 3.6-fold by 2021 with streaming content to the TV comprising 26 percent of fixed consumer Internet video traffic. Meanwhile, the volume of Video On Demand traffic is set to nearly double by 2021, amounting to an equivalent of 7.2 billion DVDs viewed every month.

As 4K Ultra-High Definition (UHD) display and capture capabilities appear on more smartphones, wireless service providers are finding their networks increasingly congested. Demand for video services is increasing even as content costs are rising while customer revenue is under competitive pressure. These trends mean operators cannot afford to invest in fixed function, inflexible video infrastructure that does not scale economically.

The old days of purpose built, dedicated hardware are behind us, as only software can meet the architectural flexibility required for today’s modern video workflow. Beamr 5, operating on the new AMD EPYC processor, directly supports this objective by combining class-leading performance with flexible system architecture.

Modern Video Workflow Flexibility

Many options exist for Service Operators, Video Platforms, CDNs, and Broadcasters to use Beamr 5 across public cloud and on-premises data centers with AMD EPYC™ processors. Workflows based on Beamr 5 span VOD file transcoding and real-time video encoding for real-time live streaming TV applications, and premium SVOD and VOD file delivery.

Figure 1. Video distribution from content owner to subscriber

Beamr Advanced Video Encoding Technology

At the base of the Beamr 5 technology is years of advanced codec development which has resulted in ten International patents for innovations securing Beamr’s density, efficiency
and quality advantage. The combination of Beamr software and AMD-based hardware provides key benefits, which position providers for the successful delivery of video as summarized in Figure 2.

Services wishing to adapt to the latest content formats will appreciate the power of operating the Beamr 5 HEVC encoder on the AMD EPYC 7601 processor for its ability to scale cost effectively as a result of Beamr 5’s unique capability to split and re-deploy video encoding workflows, resulting in content processing and delivery flexibility for operators needing to dynamically configure their workflows. Ongoing joint improvements from Beamr and AMD will contribute further to an expanded value proposition of Beamr’s industry leading HEVC encoding solution.

![Figure 2. Benefits of the Beamr 5 4K HEVC Encoder on AMD EPYC™ processors](image)

**Beamr Encoder Performance**

Beamr 5 achieves its benchmark performance through two-level motion estimation and micro-level parallelization. A two-level motion estimation process allows incoming frames to be analyzed by the encoder, which in turn determines the scene complexity and calculates initial motion vectors while estimating with a high degree of precision, the bit demand of the frame. Using this estimate guides a second stage where the encoder directs encoding activities on the most meaningful aspects of each frame refining the previous estimate. By partitioning the encoding process, unproductive calculations are avoided, and a significant speedup results. As proof of performance, in testing, Beamr 5 encoded a 4Kp60 clip at the same quality with up to 50% higher throughput (60fps vs 40fps) while utilizing only 25% of the CPU resources as compared with x265.3

Micro-level parallelization technology plays an important role in the amazing speed of Beamr 5. This innovative technology was developed from the software engineering lessons learned from earlier generations of Beamr’s real-time software encoders, where portions of the encoding tasks are staggered in a controlled manner, such that each micro task starts only when its data becomes available, and while the data is still resident in the cache. This means the system does not waste power and CPU cycles repeatedly writing and fetching data to and from memory.

Careful design of the micro tasks assures they can execute efficiently across the whole frame, in a perfectly balanced manner, so all cores are kept uniformly busy, and none are left waiting for the next task. It’s important to note that software optimizations like this
have been engineered directly into the encoder implementation and they do not depend on using a specific OS or special API processor access. Beamr 5 also makes extensive use of AVX2 instructions.

To illustrate the effectiveness of Beamr 5’s optimization, Beamr utilized a dual-socket board with AMD EPYC 7601 processors to encode six (6) 4Kp60 10-bit live channels where Beamr 5 successfully loaded 128 threads all at an impressive 90% or higher utilization, demonstrating the effectiveness of Beamr’s micro-level task parallelization.¹

The AMD EPYC™ Performance Advantage

Based on a new microarchitecture built using the latest process technology, the AMD EPYC processors represent the most significant set of platform improvements in a decade. A completely redesigned architecture delivers more throughput per execution core. As a result, hardware parallelism is significantly increased, with up to 32 cores per socket contributing to increased encoding density allowing the AMD EPYC 7601 SoC to deliver high density video processing within a 180W TDP envelope¹. Performance contributors of the AMD EPYC processors include the following:

- **High core count** - efficient thread management maximizes utilization of CPU cycles for production

- **Efficient Power Advantage** - 32 cores deliver their compute results within a 180W TDP envelope, enabling dense rack packing

- **Ample memory channels** – eight memory channels increase the memory throughput that is one of the main performance factors for video workloads.

- **A large, low-latency L1/L2 cache hierarchy** improves efficiency of on-die data handling, supporting memory intensive video workloads.

- **Support for high-speed memory** - DDR4-2666 increases data throughput.

- **AVX2 256 bit parallel instructions**

**Conclusion**

Increasing video processing density in video transcoding infrastructures is required to secure a competitive advantage for video platforms, multi-service operators, over-the-top (OTT) streaming services, and online video distribution networks. Video architects must design workflows that are adaptable and able to deliver advanced entertainment content. The combination of Beamr’s class-leading video technology and encoder software implementation framework, with AMD processors, provides video services the ability to meet customer expectations and perfectly compliment the density, efficiency, quality, and flexibility of video-encoding operations.
79% of industry professionals reported that they see HEVC as a viable replacement for H.264 for 4K and 77% reported the same for HD\textsuperscript{4}. In combination with a growing number of 4K capable devices in the consumers’ home, and with almost every smartphone now supporting HEVC natively, video services not planning a move to HEVC will find themselves at a competitive disadvantage compared with those who do.

The opportunity that Beamr 5 running on AMD EPYC processors provides to all video distributors is a robust solution, able to meet technical and business requirements, while providing a meaningful improvement to the video processing capabilities of any video encoding and streaming application.

Footnotes

1. Beamr 5 (version 4.2) 4K HEVC encoding tested by Beamr - August, 2018. Data reflects performance measurements on a two-socket system using AMD EPYC™ 7601 processors @ 2.2GHz, 32 cores. These results have not been independently verified by AMD.


3. Beamr internal testing: http://beamrvideomedia.s3.amazonaws.com/pdf/Beamr_How_to_Encode_Video_for_the_Future.pdf These results have not been independently verified by AMD.