THE GREENING OF STREAMING

HOW ASICS CAN DELIVER ENVIRONMENTAL SUSTAINABILITY FOR VIDEO ENCODING.

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Future Streaming Projection Underscores The Urgency Of Adopting Green Video Encoding

Accelerated growth of streaming media demands consideration of the environmental impact of encoding. An ASIC-based strategy reveals the path to a greener encoding future with a 10x reduction in power and a 20x reduction in carbon emissions.

For services that have a corporate mandate to reduce their carbon footprint, accommodations for growth in concurrent video encodes in a way that minimizes environmental impact should be a priority.

Over-the-top services experienced dramatic growth in 2020, driven in large measure by the COVID-19 pandemic and the desire of people to be entertained at home.

A recent forecast from research organization Statista anticipates continued robust growth in the number of OTT video users worldwide. In July 2021, the research organization projected the total this year to reach nearly 2.3 billion people. To put that in perspective, the same research revealed there were 1.65 billion OTT video users worldwide in 2017 and that in 2025 the number is expected to exceed 2.7 billion.

Figure 1. Growth in Global OTT Users 2017 to 2025. Source: Statista Forecast.

Growing OTT demand will propel a corresponding increase in the number of concurrent HD and Ultra HD streams that must be encoded to deliver television and movies over the top. Today, millions of video streams are encoded concurrently, and it is expected by 2025 that this figure will grow by an order of magnitude.

While OTT operators, cloud vendors, Content Delivery Networks (CDNs) and the technology solution providers responsible for streaming infrastructure often think of meeting this demand growth in terms of compute cycles, bandwidth utilization and total cost of ownership, there's an equally–if not more important–consideration that must be factored in: the environment.

Encoding and The Environment

For cloud services that place a priority on reducing their carbon footprint and promoting green strategies, providing for this massive growth in concurrent video encodes in a way that minimizes environmental impact should be a priority.

In a larger sense, however, all cloud service providers should be focused on encoding in a way that's as environmentally friendly as possible since ultimately whatever can be done in this regard reduces human pressure on the planet.

When it comes to cloud-based encoding, the efficiency of the technique and the technology used to encode video play determinative roles in the carbon footprint of the process. Three cloud encoding options are available, each having its own environmental impact characteristics.

They include software-based encoding operating on general purpose CPUs, GPU-based encoding using hardware like the NVIDIA T4, and ASIC-based solutions, such as the NETINT Codensity family of U.2 and PCIe video transcoders.

TIRIAS Research compared the three—regarded as best in class—to illustrate overall environmental impact based on CO2 emissions linked to electrical generation of the power needed to transcode 1,000 channels of 1080p HD.

The researcher's findings show software-based Intel SVT encoding to be the largest CO2 generator at 217 metric tons per 1,000 transcode channels; GPU-based encoding with the NVIDIA T4 generating 41.1 metric tons per 1,000 transcode channels; and the NETINT Codensity G4 ASIC producing 11.7 metric tons per 1,000 transcode channels. Looked at another way, the NETINT G4 generates about 20 times less carbon than the software-based approach and about 3.5x less than the best GPU.

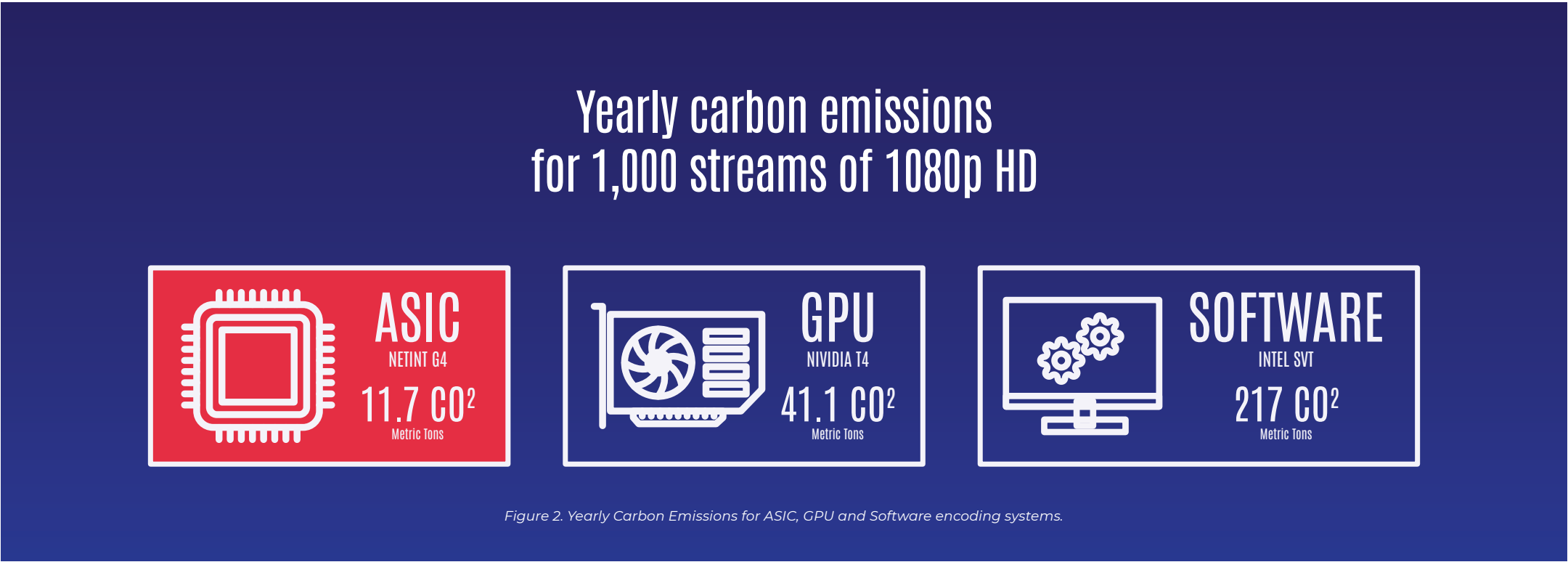

Figure 2. Yearly Carbon Emissions for ASIC, GPU and Software encoding systems.

Taken together with the forecasted growth in concurrent encoded streams expected over the next few years, these carbon footprint estimates point to the likely magnitude of the environmental effect of delivering TV and movies over the top.

Consider x86 CPUs performing the software encoding needed to deliver, for example, 40 million concurrent streams. Generation of electricity to power the servers running those CPUs would produce at least 8.68 million metric tons of CO2 in a single year. That's about the same amount of carbon emitted by 1 million conventional automobiles in a year's time.

ASIC-based encoding for that number of concurrent streams, on the other hand, would generate only about as much carbon as 54,000 fossil-fuel-burning cars, TIRIAS Research found.

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Impact of Next-Gen Codecs

Between now and 2025, it's likely a new, more efficient coding algorithm will break into the mainstream of OTT delivery. AV1, first announced in 2015 and launched in June 2018, is the likely candidate. A royalty-free video coding format, AV1 promises significant bandwidth savings and no licensing fees— both of which are appealing characteristics to many in the OTT delivery chain.

Recent testing found AV1 to reduce bitrate by more than 30 percent when encoding 1080p HD as compared to High Efficiency Video Coding (HEVC/H.265). The percentage savings in bitrate is far greater when compressing Ultra-HD 2160p. AV1 encoded Ultra-HD is nearly 44 percent more efficient than HEVC, the testing revealed.

While, it's too soon to determine the precise environmental impact of encoding AV1 video with an ASICbased solution versus x86 software-based encoding, it is reasonable to expect the reduction in electricity needed to power encoding as well as to cool server racks will translate into a far smaller carbon footprint for ASIC-based encoding.

AV1 offers other opportunities to reduce environmental impact largely due to its bandwidth efficiency.

Fewer bits per any given piece of video content means lower bandwidth requirements, which in turn means the percentage of any given network devoted to video transport, including switches, routers, fiber, copper and wireless, will be lower when compared to less-efficient encoding techniques.

Less real estate will also be required. For example, encoding HEVC video using a software-based solution running on a 2x Xeon Gold 6148 platform requires 1 RU of space to produce eight concurrent streams of video. That compares with 80 concurrent streams in a single rack using NETINT's ASIC-based HEVC encoding, according to TIRIAS Research. Similar real estate savings are expected for AV1.

Figure 3. Number of streams encoded in 1RU utilizing ASIC based encoding compared to software.

With a massive increase in the volume of concurrent encodes of HD and UHD video streams right around the corner, there is no time to waste in developing a strategy to lessen the environmental load of streaming video content.

The Future of Green in the Data Center

It is clear that transitioning to an ASIC-based video encoding model will offer the greatest benefits in reducing carbon emissions when compared to GPU-based alternatives and software solutions running on x86-based servers. Running on a parallel track is the inevitable adoption of AV1 encoding to meet the streaming video demands of the forecasted 400 million more OTT users by 2025 than exist today.

Given the magnitude of concurrent encodes needed to service the projected 2.7 billion OTT viewers in four years, it is self-evident that the only environmentally sound path forward is ASIC-based AV1 video encoding. To do otherwise, simply is not a sustainable alternative.