Vidyo™
Personal Telepresence

WHITE PAPER

Operational Cost Advantages of H.264 SVC

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H.264 SVC Operational Cost Advantages

H.264 SVC technology as implemented by Vidyo has demonstrated its ability to provide personal telepresence over ordinary internet connections. Quoting from the paper entitled "H.264 SVC: A Technical Assessment" published by Wainhouse Research in 2009:

> The market's acceptance of a new technology typically relates to the ability of that technology to a) provide a new and useful service, b) improve an existing function, or c) improve one-time and/or recurring costs. Our conclusions are that when properly implemented and used in the proper situation, H.264 SVC represents a major evolutionary improvement over H.264 BP for most videoconferencing users. An H.264 SVC system can provide:
>
> - Equal video quality over non-lossy networks
> - Dramatic improvements in the ability to host high quality, artifact-free video calls on lower cost, loss-prone IP networks, including the Internet
> - Noticeable and measureable shorter delays (and higher interactivity) on both point-to-point calls and multipoint calls between H.264 SVC-compliant systems
> - Impressive reduction in the cost of infrastructure hardware to support multipoint
> - Ability to support video calls between endpoints with widely varying processor power and network performance characteristics

Not discussed anywhere in the report, however, is the significant impact on infrastructure power consumption that a complete SVC implementation may provide. This advantage stems from the "Impressive reduction in the cost of infrastructure hardware to support multipoint" as cited in the report.

This paper will detail why this is the case and show the significant impact on real world power consumption that an SVC router based approach provides over a traditional AVC transcoder based MCU.

Continuous Presence Multipoint Call Defined

When three or more parties want to participate in a video call they mainly choose a continuous presence multipoint call. That is all parties are visible on each participant's screen. In order to construct this video each party calls into a MCU (Multipoint Control Unit) where the video streams are reassembled and sent to the appropriate client. So for example in a three way call terminal A would see a combination of terminal B & C and terminal B would see terminal A and C etc.

It is the fundamental difference in how these streams are processed in the AVC vs. the standards compliant approach Vidyo was able to implement in the SVC world that accounts for the difference in MCU vs. VidyoRouter™ costs and power consumption.

Brief Review of H.264 AVC MCU Fundamentals

In the AVC world putting together MCU streams is very straight forward but compute intensive. The streams from each client are decoded, combined into the appropriate images, re-encoded and shipped out. As resolutions increase, this transcoding process becomes more compute intensive. In essence every video pixel gets touched by the hardware three times; once when it is decoded, once when it is combined with other images to form the final image and lastly when it is re-encoded.

The Wainhouse Report correctly demonstrated how much additional delay this causes in constructing an MCU video stream. Also mentioned was the large amount of high speed computing components (typically high end DSPs) required by AVC MCUs. Those components use power, take up space and weight.

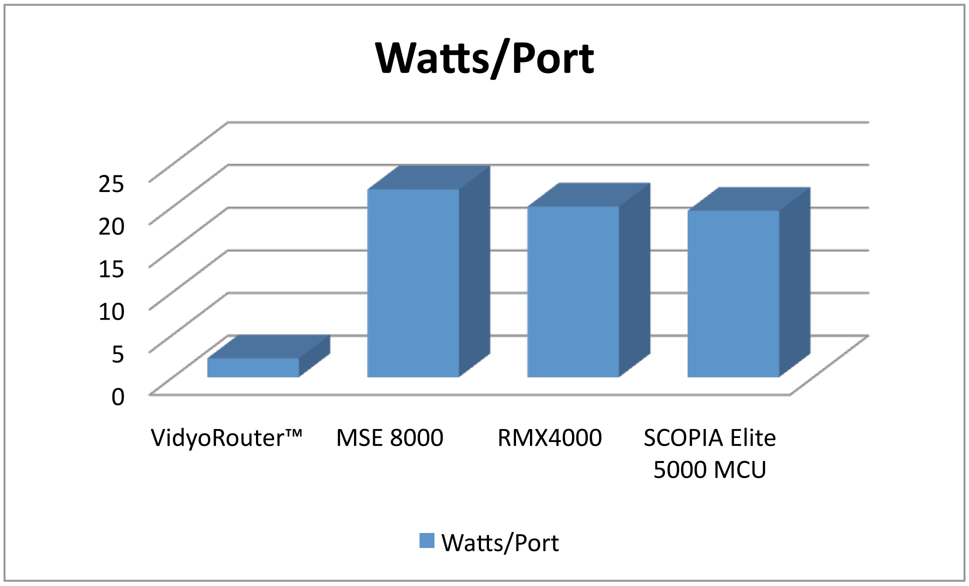
Brief Review of H.264 SVC VidyoRouter Fundamentals

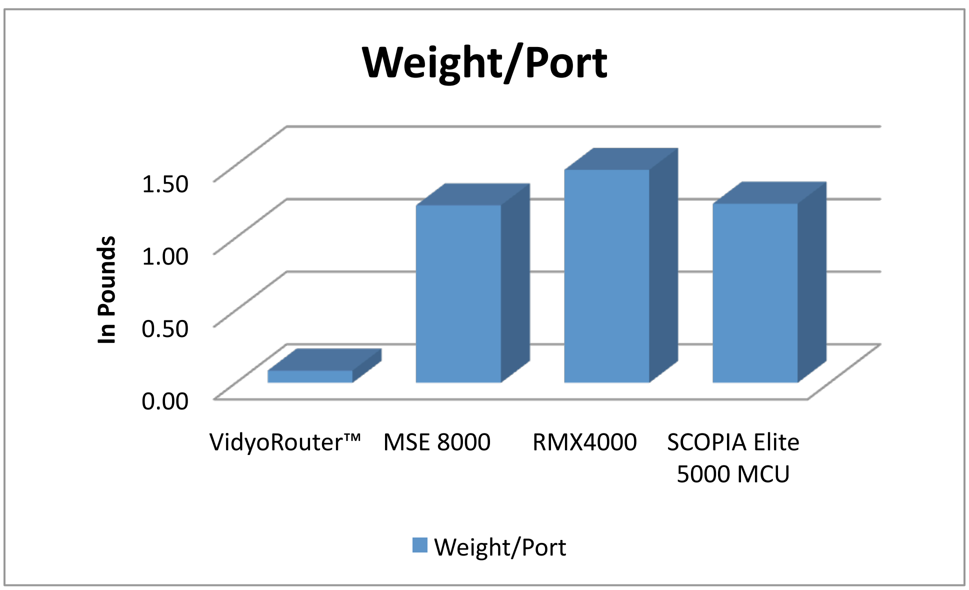
In the SVC world, video streams are composed of several layers. (For additional detailed explanation please see this white paper on www.vidyo.com.) SVC encoders compress the video into temporal streams (streams with different frame rates), spatial streams (streams with different resolutions) and quality (streams with different details). These streams are reassembled into a single high frame rate high resolution high quality video by the decoder. We will not go into all the benefits that this split approach provides except for the ability, if properly architected, to produce a continuous presence multipoint call without the need to transcode the media streams.

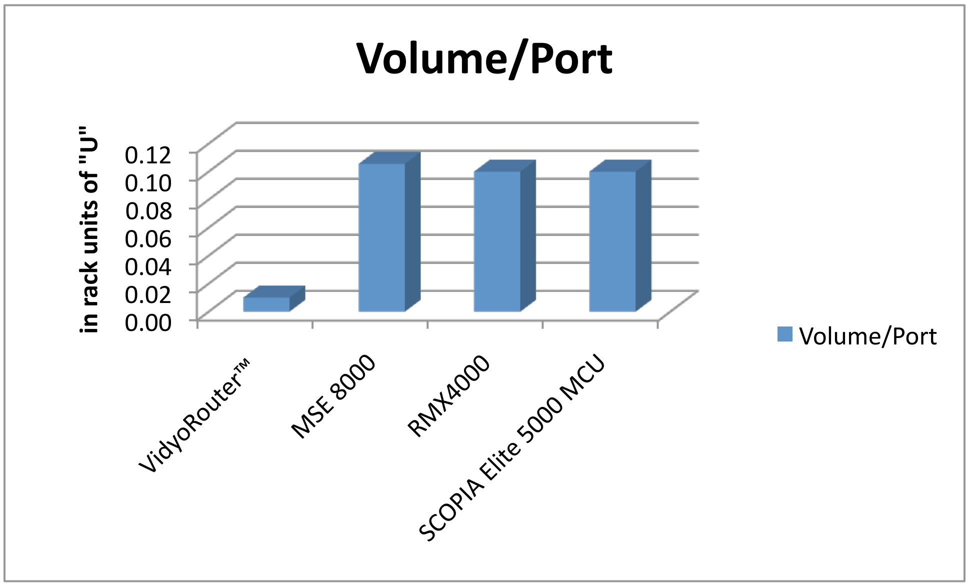
Working strictly within the parameters of the H.264 SVC specification, Vidyo developed a router architecture which does not rely on transcoding to provide continuous presence. Essentially what the VidyoRouter™ does is route the encoded packets so that the appropriate layers are delivered to each participant in a call. The router never decodes a single pixel. This allows the router to be constructed using a medium end server with no special acceleration hardware because there is no extremely compute intensive transcoding function.

Power Consumption Comparison

Given the fundamental differences in how each continuous multipoint solution operates one would expect Vidyo's SVC router to be smaller, lighter and use less power. Using the published specifications of the leading products in the field we calculated the watts used for each 1080p HD terminal supported. As the following graphs indicate the differences are dramatic; consistent and almost an order of magnitude more favorable for the SVC router.



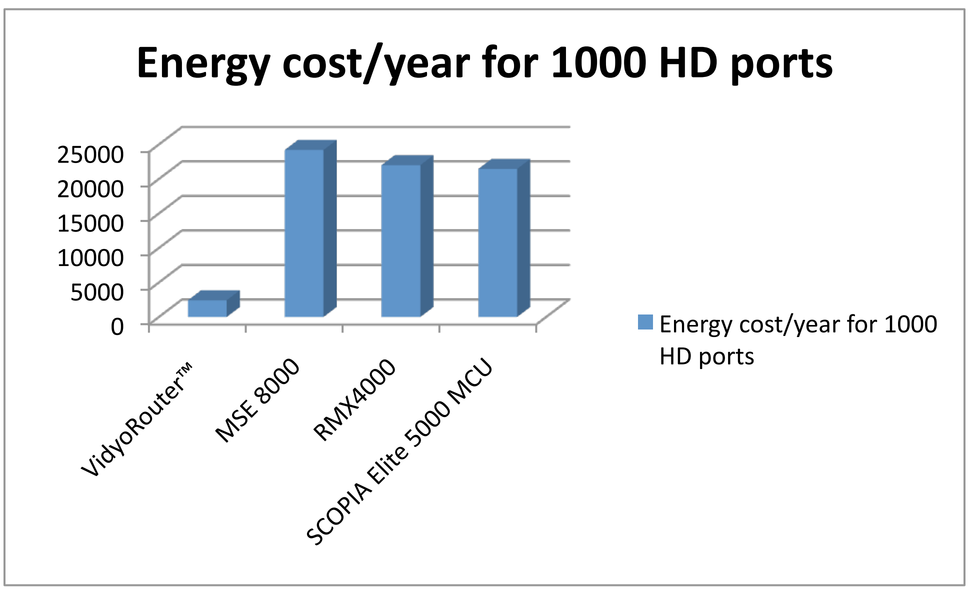




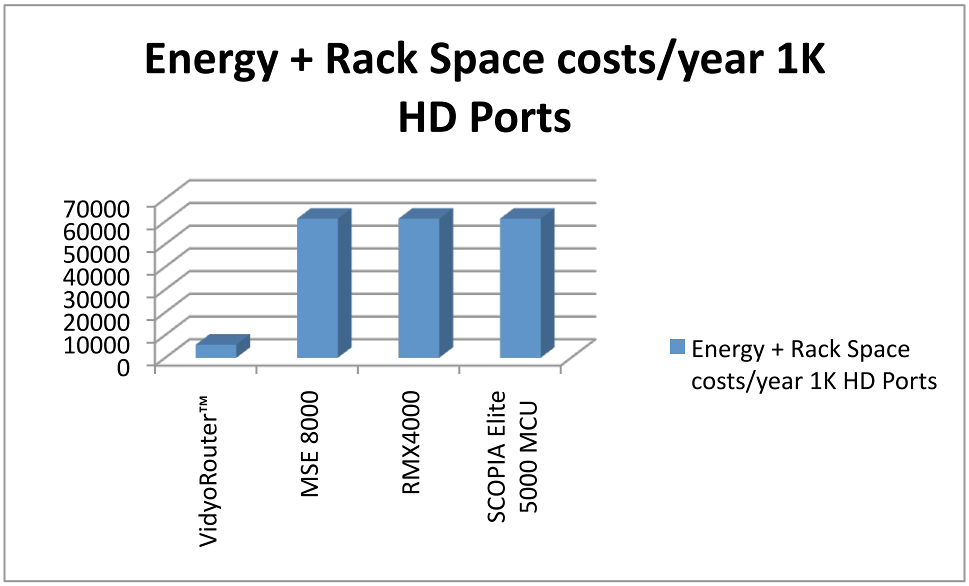
The charts clearly illustrate the simple fact that by eliminating transcoding functionality the VidyoRouter consumes far fewer resources to create a continuous presence display. The near factor of ten advantage in power consumption size and weight is consistent.

Usage Cost Comparisons

The cost per watt of server usage has been documented in several places in the literature[i,ii] as $1.10/year. So for a thousand port MCU center the energy costs are:



Depending on the product replaced by the VidyoRouter an annual energy cost savings of nearly an order of magnitude can be realized. The 10X advantage also continues in rack space and co-location costs as seen in the chart below. A standard rack provides 42U slots. Using the VidyoRouter, only 10 U slots would be required. Any of the transcoding based MCUs require almost 3 full racks to host the same number of ports.



Conclusions

Power consumption and rack utilization in server farms has become a major issue. The rising cost of energy and real estate can no longer be ignored when selecting infrastructure equipment. Every watt of power consumption requires some amount of cooling wattage as well. Inefficient server architectures compound the problem because of power and footprint issues.

The H.264 SVC routing server as implemented by Vidyo provides nearly a 10 times improvement in port density as compared to traditional MCU-based solutions using transcoding.

About the Author

Seymour A. Friedel is Managing Director of Phoenix-Hawke LLC. Mr. Friedel is an innovative, results oriented, executive level technologist, with 35 years of experience in corporate, technical and product management. Products developed span a wide variety of technologies to include: videoconferencing, communications, image processing, machine vision and robotics, embedded controllers, interactive terminals, industrial controls, facsimile, printers, medical instrumentation, and scientific computing. Strong skills include: software hardware and industrial product management, strategic corporate and product planning, the ability to bring a product from idea, through design, development and production to a market solution. Years of hands on experience, combined with "out of the box" thinking result in novel solutions. Reputation for rapidly getting to the heart of an issue and producing reliable, easy to use products. Contact: saf@phoenix-hawke.com.

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[i] X Wang and M Chen. Cluster-level Feedback Power Control for Performance Optimization. 14th IEEE International Symposium on High-Performance Computer Architecture (HPCA 2008), February 2008

[ii] U.S. Environmental Protection Agency. EPA report on server and data center energy efficiency. 2007.