

Product performance

ARTPEC-3 case

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1. Introduction

Axis offers a broad portfolio of network cameras and video encoders based on its ARTPEC-3 chip. The performance of Axis products, in terms of streams and frame rate, is important, and we will focus on the performance of Axis network products based on ARTPEC-3 in this paper.

The intended audience of this document is technical personnel and system integrators.

2. Streams and frame rate

The performance of a video encoder/camera (video product) is often measured in a number of simultaneous, individually configured streams with certain resolutions and frame rates. Frame rate is measured in frames per seconds (fps). Each stream should be individually configured, namely, the clients should not access cached data. A video product can, in general, deliver many more streams that have an identical configuration, than individually configured streams.

Exactly how many simultaneous, individually configured streams with maximum resolution and full frame rate a video product will deliver in all situations is hard to predict. The overall performance depends on:

- > CPU load or video compression load (ARTPEC-3) in the video product.
- > Total data throughput (bandwidth) from the product and network infrastructure.
- > Client performance.

For a user, the following items are the most common parameters that could affect the overall performance negatively:

- > High image resolution
- > Low image compression level
- > Mixing Motion JPEG, MPEG-4 and H.264 streams
- > Number of clients accessing the server simultaneously
- > Clients accessing different image settings (resolution, compression, etc.) simultaneously
- > Heavy usage of event settings
- > Motion detection enabled
- > HTTPS
- > Poor performing client PC may not decode all images
- > Limited or poor network infrastructure. Frames will be dropped when network is congested.

There are also other factors in the monitored scene that could affect the performance:

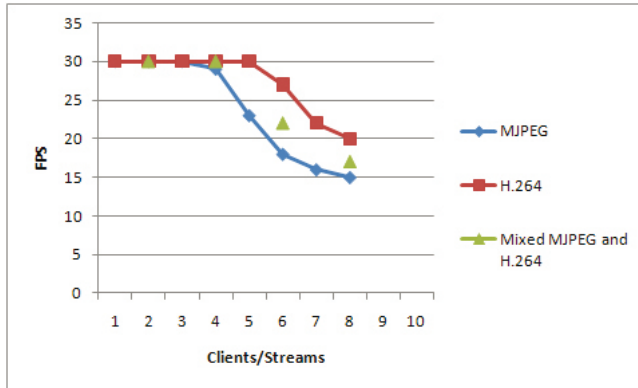
- > The image's complexity
- > The lighting conditions

3. Measurements

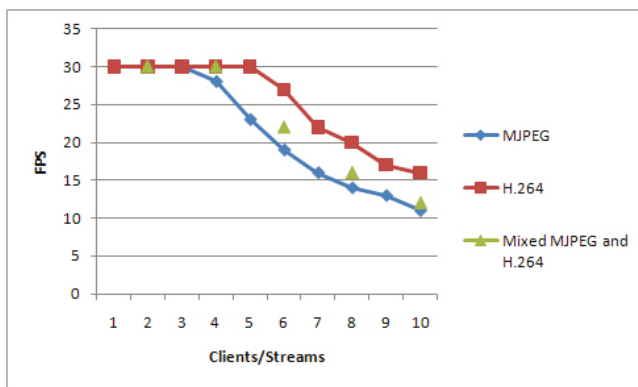
A measurement was done to establish performance. The following setup was used in the measurement:

- > Factory default values were used
- > Image complexity: Complex (this is the worst case test)
- > Each stream was unique, meaning that the clients should not access cached data. Therefore, the compression level varied from 30% to 39% (up to 10 different streams) for H.264 and Motion JPEG cases and 30% to 34% for mixed H.264 and Motion JPEG cases.

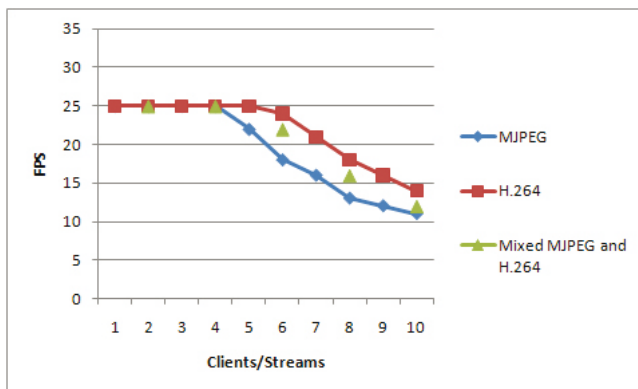
Resolution: 4CIF, NTSC (704x480)



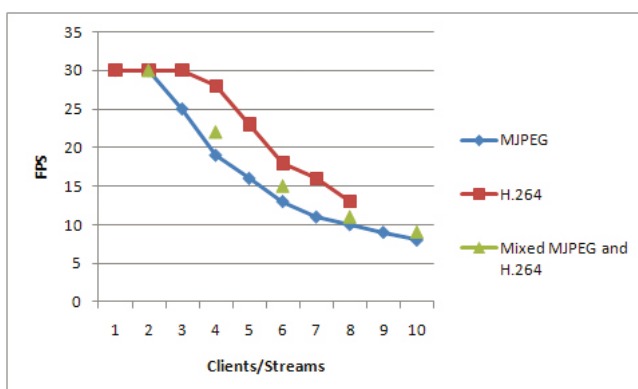
Resolution: D1, NTSC (720x480)



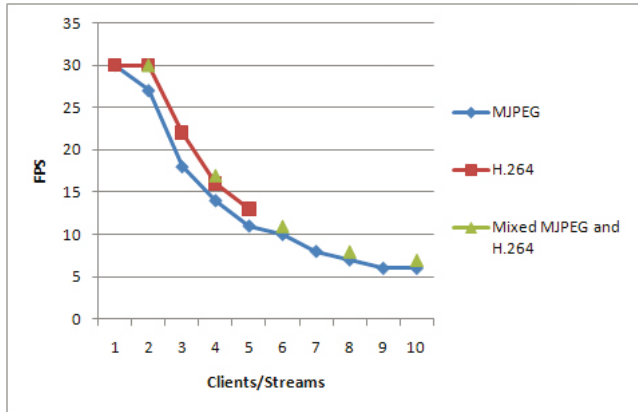
Resolution: D1, PAL (720x576)



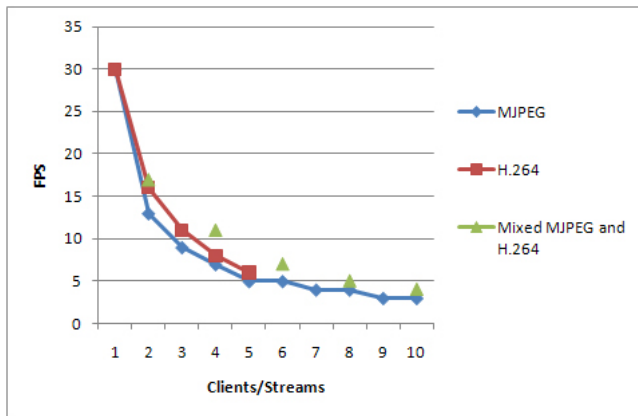
Resolution: SVGA (800x600)



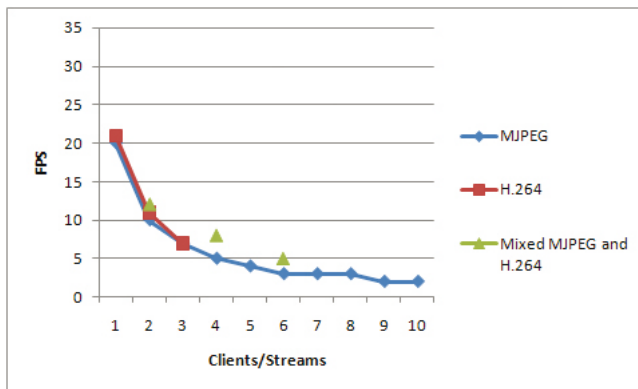
Resolution: HDTV 720P (1280x720)



Resolution: HDTV 1080P (1980x1080)



Resolution: 3Mpixel (2048x1536)



4. Discussion

The test result shows that we get lower full frame rate streams, or the frame rate per stream will decrease when the resolution is larger, under the condition the image scene, compression level, and compression method are selected.

The test results show that ARTPEC-3 is capable of delivering more full frame rate H.264 streams than Motion JPEG streams in D1 resolution. An H.264 encoder can, without compromising image quality, reduce the size of a digital video file by more than 80% compared with the Motion JPEG format, and as much as 50% more than the MPEG-4 standard.

This means that much less network bandwidth and storage space are required for a video file. Or seen another way, much higher video quality can be achieved for a given bit rate.

When the resolution is increased, for example, to HDTV 1080P, the frame rate will be dropped as the streams are increased. However both H.264 and Motion JPEG can still achieve full frame rate for one stream.

For a 3 Megapixel case, H.264 and Motion JPEG seem to have the same frame rate at different stream numbers. However, it is important to note that H.264 streams use much less network bandwidth and storage space.

The test shows that ARTPEC-3's processing power can reach 66 Mpixels/s. Therefore we may get the following formula for an H.264 case:

$$\text{Frame rate} = \frac{P_{\text{CPU}}}{\text{Resolution} * \text{Streams}}$$

where

Frame rate = 30 fps when the results ≥ 30 (NTSC case)

Frame rate = 25 fps when the results ≥ 25 (PAL case)

Frame rate: Frame rate of the streams, fps

P_{CPU} : ARTPEC-3 processing power, 60-66 Megapixels/s

Resolution: Image resolutions

Streams: Number of streams

5. Conclusion

Axis new generation network video products based on the ARTPEC-3 are very powerful in terms of performance. A typical Axis camera with D1 or SVGA resolution can, according to the datasheet, deliver 3 simultaneous, individually configured streams in D1 at 30/25 fps. In the setup in this paper, the measurements show that it can actually deliver 5 simultaneous individually configured H.264 streams in D1 at 30/25 fps, and 3 simultaneous individually configured H.264 streams in SVGA at 30 fps. For higher resolution products, we get a lower number of streams in maximum resolution and full frame rate.

This paper has discussed the product performance in general, in order to help you to understand Axis products systematically. It should be pointed out that the product datasheets are the official specification documents for Axis products.

6. Helpful links

- > Axis Communications: www.axis.com/products/video/
- > www.axis.com/files/whitepaper/wp_h264_31669_en_0803_lo.pdf

About Axis Communications

Axis is an IT company offering network video solutions for professional installations. The company is the global market leader in network video, driving the ongoing shift from analog to digital video surveillance. Axis products and solutions focus on security surveillance and remote monitoring, and are based on innovative, open technology platforms.

Axis is a Swedish-based company, operating worldwide with offices in more than 20 countries and cooperating with partners in more than 70 countries. Founded in 1984, Axis is listed on the NASDAQ OMX Stockholm under the ticker AXIS. For more information about Axis, please visit our website at www.axis.com