ERICSSON

INTRODUCING AVP 3000 VOYAGER

JPEG 2000 IN DSNG

EXECUTIVE SUMMARY

Compelling live News, Events and Sports is key to audience share. In a fragmented multi channel, multi platform market, live content continues to deliver viewers and drive revenue through commercials, sponsorship and subscriptions.

DSNG is a constantly evolving business, which has already seen transitions from analogue to digital, 4:3 to 16:9 and increasingly SD to HD. New transitions are underway, including increased use of fibre as a complementary backhaul technology to satellite. Other emerging trends are use of 1080P (or even resolutions above 1080P) to ensure best quality.

The Voyager name has been synonymous with high quality DSNG for more than a decade. Voyager and its predecessors have consistently lead the market in providing Truck and Van operators with advanced, robust products that are in day to day use, across all aspects of live DSNG.

Now, Ericsson is introducing the sixth generation of Voyager product – AVP 3000 Voyager – designed for new business opportunities and new technical challenges.

AVP 3000 Voyager inherits all the capabilities of the Voyager II and adds additional capability to address legacy, current and future workflows.

GPI and Analogue interface option cards are available on AVP 3000 Voyager to help operators improve their interface into traditional workflows. 1080p is available as an option for emerging high quality services. All existing Voyager II owners can retrospectively add these new options to their current platforms.

However, the most innovative new development is an optional JPEG 2000 encoding module, which is now available both on new AVP 3000 Voyager systems and existing Voyager II units. This new development allows truck operators to increase revenue through offering new services, reduce HD satellite costs and maximize truck utilization, all with minimal capital investment.

Ericsson AVP 3000 Voyager

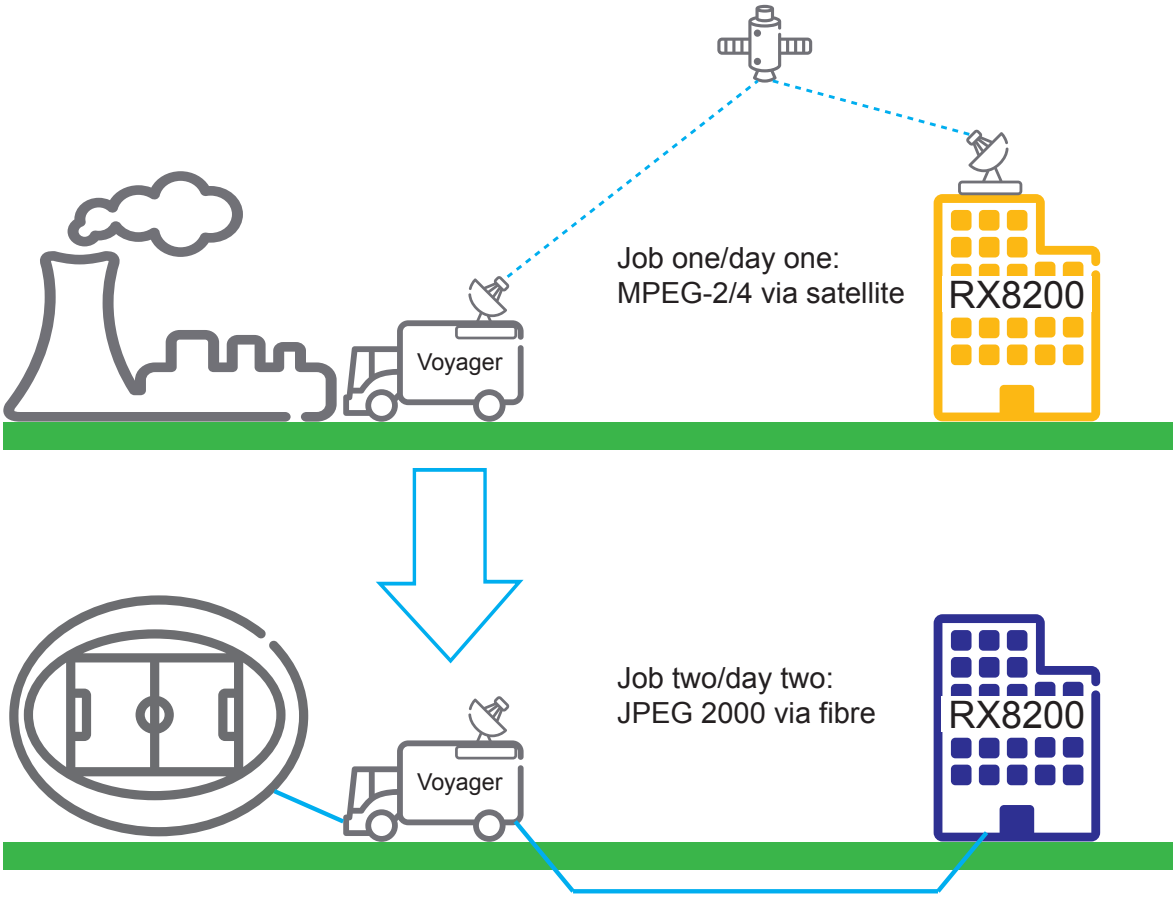
ABOUT JPEG 2000

JPEG 2000 Headlines
HD content, with over five times the original resolution of SD, has a quality and immediacy that viewers appreciate but poses the challenge of higher cost of sending HD over satellite.

Today, MPEG-4 AVC long GOP, rather than MPEG-2, is typically used to give an optimal balance between HD quality versus bandwidth. This keeps satellite costs down but the trade off can be high latency. Some truck operators now have the opportunity to use IP via Fibre links as well as (or instead of) satellite. Sports stadia, entertainment venues, conference centres and public buildings increasingly have fibre connectivity, which truck operators can use as a lower cost alternative to satellite.

JPEG 2000 equipped trucks can now take advantage of widely available telecommunication links (Ethernet, IP) which are increasingly common at sports stadia, entertainment venues, conference centers and government buildings. This provides a very low cost solution, compared to uncompressed HD transport or HD MPEG contribution over satellite.

Mobile News, Sport, Entertainment



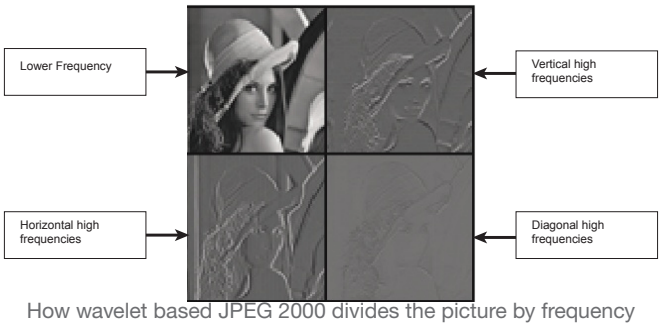
Simple scheduling: One Voyager equipped truck can now be used on a wider variety of work, increasing ROI with minimal additional Capex or Opex.

Fibre delivers better bandwidth vs. cost performance than satellite but still requires compression - non compressed HD will not fit down a fibre link.

JPEG 2000 Basics

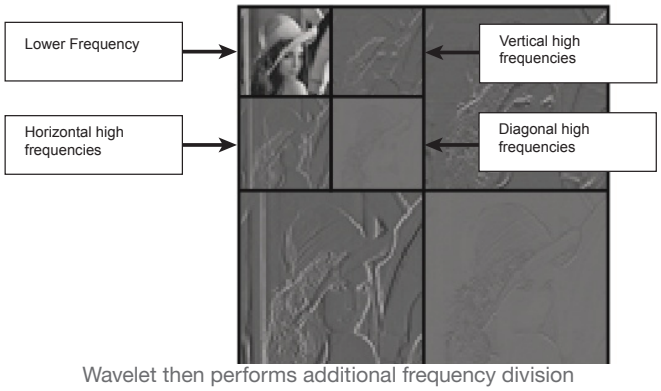
JPEG 2000 is an increasingly popular DWT (discrete wavelet transform) compression method. Most DSNG workflows used only DCT (discrete cosine transform) compression, such as MPEG-2 or MPEG-4 AVC . DCT is not 'better' or 'worse' than DWT in DSNG but there are fundamental differences.

DCT compression is based on spatially dividing pictures into blocks. As compression increases, the blocks eventually become visible. JPEG 2000 does not use blocking[1] . In JPEG 2000, which uses wavelet compression, the whole image is analyzed and then compressed, decomposing picture information by resolution, rather than by blocks:



How wavelet based JPEG 2000 divides the picture by frequency

The lower frequencies then have additional decompositions applied:



Wavelet then performs additional frequency division

This process results in a multi resolution representation of the original image, which has profound operational differences from DCT based systems – as compression levels increase, JPEG 2000 compressed images gradually lose resolution bands, rather than show blocks. So, while DCT compression increasingly shows blocks, JPEG 2000 increasingly softens.

When does JPEG 2000 look better than DCT compression?

There is no simple answer to this question, without understanding the use case.

In HD DSNG, an original uncompressed HD-SDI 10 bit signal is more than five times the data of SD (nominally around 1.4 Gbit/s). For most DSNG operations, it is commercially impractical to send this amount of data back to a studio. MPEG-2 was the original codec used for satellite new gathering and is available on AVP 3000 Voyager to allow users to interface to older workflows.

More recently, the more bandwidth efficient MPEG-4 AVC long GOP largely replaced MPEG-2, especially for HD contribution, delivering good HD picture quality at satellite friendly data rates, typically in the range of 40 Mbit/s to 10 Mbit/s depending on bit depth and color sampling.

However, part of the picture quality advantages of long GOP can be at the expense of latency. Latency can be critical for certain kinds of DSNG programming, especially two way interviews (where long pauses between a question and an answer can look awkward) or sports events where immediacy is everything (imagine two apartments next to each other watching the same big soccer game, one on a high latency long GOP feed wondering why their neighbours on an analogue feed are cheering).

JPEG 2000 is 'I' frame only; there is no group of pictures, so it offers much lower latency than MPEG-2 or MPEG-4 AVC long GOP. Latency, quality and bitrate are all part of the equation but a useful 'rule of thumb' is that a very good looking HD JPEG 2000 link can be achieved around 100 Mbit/s with around 100 ms end to end latency.

Quality, latency and bandwidth have interdepedencies, changing one will tend to change others. AVP 3000 Voyager gives operators the widest range of choices of operating modes to suit their requirements.

Depending on a number of variables, lower bitrates or lower latencies are possible in MPEG-4 AVC, (for example AVP 3000 Voyager future developments will allow lower latencies in MPEG-4 using new kinds of refresh modes) but there is always an interdependency between quality, bitrate and latency.

JPEG 2000 Editing

JPEG 2000 has other useful attributes, especially if content is going to be edited.

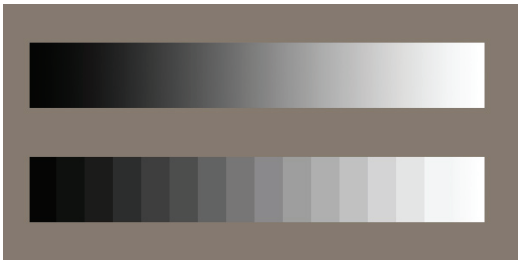
As an 'I'-frame only codec, JPEG 2000 is inherently easier to edit than GOP based encoding – any frame can be cut to any other. That can be especially useful in sports, when a live transmission is going to be followed by an edited highlights package.

1 However some implementations of JPEG 2000 may use image tiling, for example dividing the whole screen into quarters, eights and so on.

JPEG 2000 10 Bit operation

JPEG 2000 is 10 bit, so has 1024 quantisation steps to describe a scene from the very darkest to the very lightest with head room to avoid clipping highlights and foot room to avoid lifting shadows. MPEG-2 is only 8 bit, so has only 256 quantisation steps. 10 bit provides many benefits:

-Greater latitude when changing camera setups.
-More precision when selectively colour correcting.
-Less problems with image 'banding' on skies, cycloramas and gradients

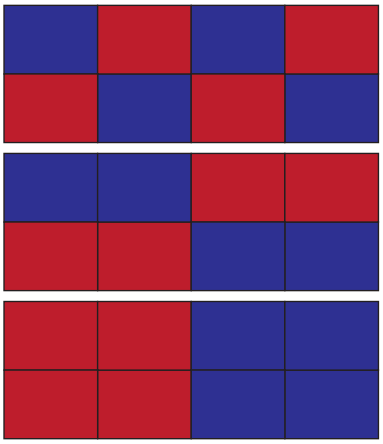


10 Bit grayscale (above) versus 8 bit grayscale (below). Note the 'steps' on the 8 bit grayscale

JPEG 2000 4:2:2 operation

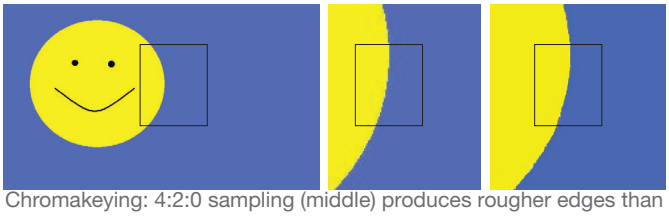
JPEG 2000 uses color 4:2:2 sampling[2], whereas many MPEG-2 implementations use 4:2:0 sampling.
When digitally representing a picture, each pixel can have a luma value (how bright or dark) and chroma (what color)[3]. Every pixel needs to have luma data but you can reduce data rates by not always storing a pixel's chroma value. Storing every second pixel's color data on a line is called 4:2:2

•Storing every fourth pixel's color data on a line is called 4:1:1
•Storing every second pixel's color data on a line and the same value as the line below is called 4:2:0



4:4:4 sampling (top) 4:2:2 sampling (middle) 4:2:0 sampling (bottom)

So, the higher 4:2:2 color sampling precision of JPEG 2000 can be important especially when images need subsequent manipulations, such as chroma keying, where a clean edge is required.



Chromakeying: 4:2:0 sampling (middle) produces rougher edges than 4:2:2 sampling (right)

4:2:2 color sampling also gives JPEG 2000 advantages in complex production signal chains involving multiple encodes and decodes. If 4:2:0 MPEG-2 signals pass through 4:2:2 devices (most production and post production technology is 4:2:2) then the re-sampling process involved causes progressive color inaccuracies which result in colors looking blurred.

Concatenation: 4:2:0 sampling (left) shows more multi generation blurring than 4:2:2 (right)

AVP 3000 Voyager

RX8200 Advanced Modular Receiver

2 Or 4:4:4 for digital Cinema

3 Full quality sampling stores luma and chroma for every pixel. This is known as 4:4:4 and is mainly used for high end post production, as it is a data intensive way of working.

DEPLOYING JPEG 2000 IN VOYAGER II AND AVP 3000 VOYAGER

The huge worldwide fleet of Voyager II equipped trucks now has an opportunity for an easy and cost effective way of adding JPEG 2000 services without the cost, complexity, training issues and rack space hassles of buying a dedicated JPEG 2000 encoder box.

Any new AVP 3000 Voyager or any existing Voyager II with a spare slot, can be fitted with a new CE-aJ2K card, which is easy to install and very easy to operate – little or no retraining is needed as operational logic closely follows the existing Voyager II operational philosophy. Furthermore, no extra rack space, power or air conditioning is needed.

All this means Truck operators can now add profitable JPEG 2000 services without the costs associated with a 'mix and match' multi vendor approach.

Easy upgrades: Simply adding a CE-aJ2K card plus latest software to an existing Voyager II chassis allows a simple and low cost entry into JPEG 2000 use

JPEG 2000 is a useful compression technology for contribution and backhaul applications involving sending HD at good quality and low latency over IP. Where fibre is available, JPEG 2000 can deliver lower costs and better looking pictures than Satellite links.

Ericsson is the first vendor to offer DSNG operators an easy to deploy, cost effective entry into the emerging JPEG 2000 market. Compared to buying multiple systems from multiple vendors, the AVP 3000 Voyager multi codec approach saves truck space, simplifies training and support and offers great ROI.

Americas

Ericsson Television Inc.
4500 River Green Parkway
Duluth, GA 30096
USA

Telephone: +1 678 812 6300
Fascimile: +1 678 812 6400

Email:
tvsalesamericas@ericsson.com
tvsupportamericas@ericsson.com

Asia Pacific

Ericsson Television Limited
12/F Devon House
Taikoo Place
Quarry Bay
Hong Kong

Telephone: +852 2590 2388
Fascimile: +852 2590 9550

Email:
tvsalesapac@ericsson.com
tvsupportapac@ericsson.com

Australasia

Ericsson Television Pty Limited

Building C, 11 Talavera Road
North Ryde NSW 2113
Sydney
Australia

Telephone: +61 2 9111 4999
Fascimile: +61 2 9111 4949

Email:
tvsalesanz@ericsson.com
tvsupportanz@ericsson.com

Europe, Middle East, India and Africa

Ericsson Television Limited
Strategic Park
Comines Way
Hedge End
Southampton
Hampshire
SO30 4DA
United Kingdom

Telephone: +44 (0)23 8048 4666
Fascimile: +44 (0)23 8048 4667

Email:
tvsalesemea@ericsson.com
tvsupportemea@ericsson.com