



*JPEG2000 for
video contribution
over IP*

T·NIPS

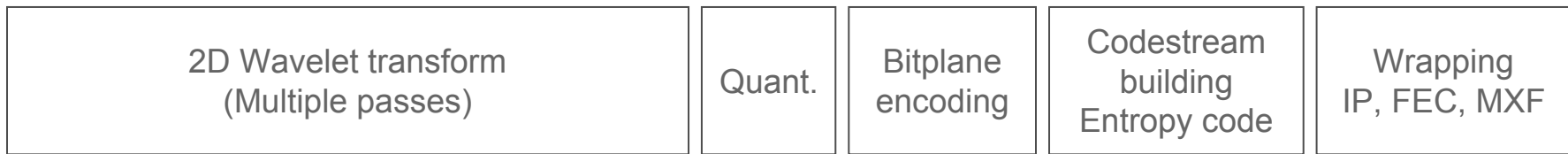
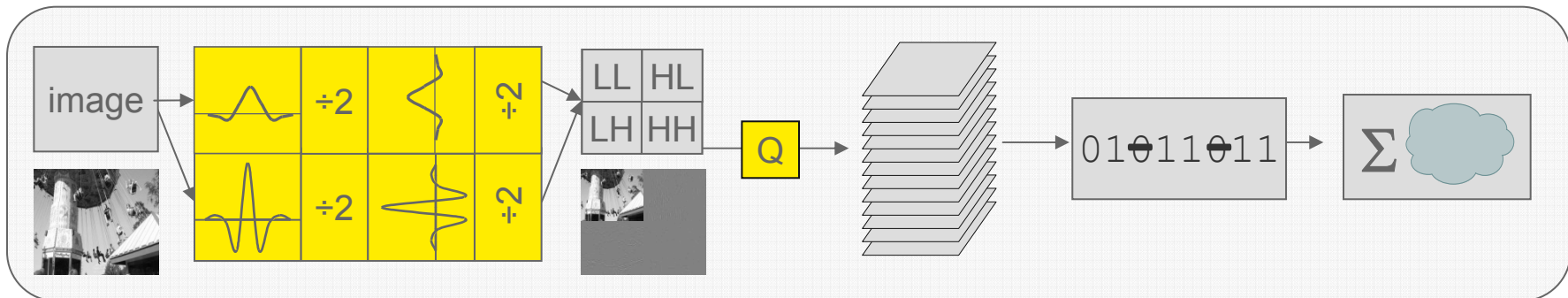
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COO

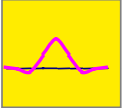

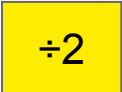
JPEG2000 for video contribution over IP

- JPEG2000 Characteristics
 - Benefits
 - Basic properties
 - Operational modes and bitrates
- Transport and wrapping
 - IP Protocols
 - Wrapping solutions
 - Standardisation
- JPEG2000 Applications in broadcasting
- Case Studies



JPEG2000 Use Wavelet Compression



-  Low pass filter
-  High pass filter
-  ÷2 Down sampling

JPEG2000 is a wavelet-based image compression standard. The standard supports two filter sets:

- (9,7) Floating point filter (Low loss compression)
- (5,3) Integer filter (Lossless compression)



JPEG2000 for Broadcasting

JPEG2000 Characteristics	JPEG2000 Benefits
Picture by picture compression	<ul style="list-style-type: none"> • All images has same quality • Low latency
Wavelet transform	<ul style="list-style-type: none"> • All pixels subject to same processing • High compression efficiency
Compression range	<ul style="list-style-type: none"> • High compression – high quality - lossless
Visual impairments	<ul style="list-style-type: none"> • 10 bits video range • Blur (no blocking on low rate)
Layered codestream	<ul style="list-style-type: none"> • Remote edit on low quality layer
Multi generation	<ul style="list-style-type: none"> • Low loss
Symmetrical	<ul style="list-style-type: none"> • Same hardware for encoder and decode



JPEG2000 Bitrates

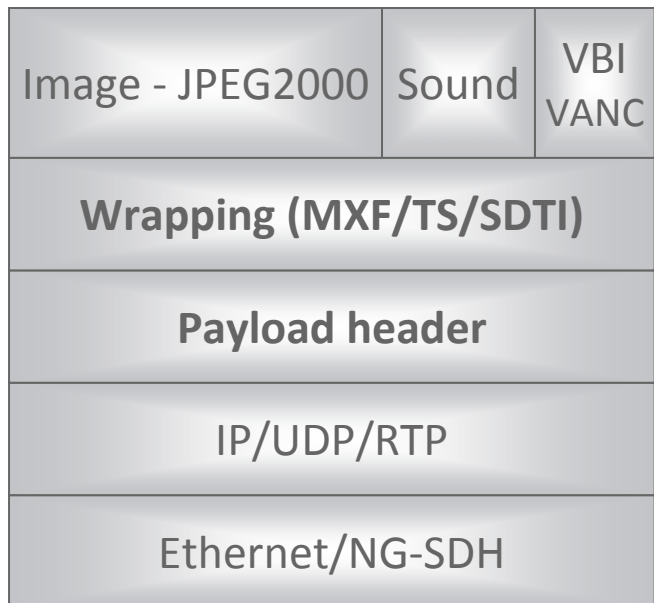
- Normal compression mode (5-10% of original rate)
 - SDI 270 Mbps 15 - 35 Mbps
 - HD-SDI 1.5 Gbps 60 - 125 Mbps
 - 3G-SDI 3 GBps 150 - 300 Mbps

- Lossless mode (25-50% of original rate)
 - SDI 100 - 115 Mbps
 - HD-SDI 400 - 500 Mbps
 - 3G-SDI 800 - 1000 Mbps



JPEG2000 Transport Solution

3G/HD/SD - SDI



IP/UDP/RTP

- Versatile (Sonet, DTM, NGN, metro Ethernet, VLAN)
- Layer 2 and Layer 3
- Cost effective (CAPEX and OPEX)
- Established technology for television transport

IP QOS

- Managed network
- Prioritising
- Forward error correction

Alternatives:

- 270 Mbps SDI/ASI – Restricted reach and connectivity
- ATM - Expensive



Standardisation

- Video Services Forum
 - IP encapsulation
 - Forward Error Correction
- JPEG2000/ MPEG-2 Systems
 - JPEG2000 Broadcast profile
 - PES stream
 - MPEG-2 system amendments
- SMPTE
 - 31 FS AHG Low Latency Streaming MXF Roster
 - 32 NF IP Encapsulation
 - 32 NF Forward Error Correction
- JPEG2000 Alliance
 - Currently evaluating possibility for interoperability testing



JPEG2000 encapsulation for Broadcasting

MXF	MPEG-2 Transport Stream
Commonly used format for studio production	Common format for video transport
Perfect lip sync	Lip sync is ok, but...
Support for Metadata	Possible
No bit rate limit	ASI limited to 213 Mbit/s
Frame aligned wrapping	TS packets are interleaved
Direct ingestion is simple	Direct ingestion not frame accurate
No latency on FEC	Considerable latency for FEC



Advantages and Disadvantages



Feature	JPEG2000	MPEG-4 4:2:2	MPEG-2 4:2:2	Benefit
Latency	Low	High	High	Low end-to-end delay Interaction and live
Bitrate	High	Low	Medium	Network capacity savings Availability of connections
Frame aligned	Yes	No	No	Editing and storage
Multi-generation	Low loss	Loss	Loss	Several compression stages
Lossless	Yes	No	No	No quality loss
Visual artifacts	Blur	Blur Blocking	Blocking	Adapted to human visual system
Symmetrical	Yes	No	No	Same hardware for encoder and decoder
Complexity	Medium	High	High	Price Power consumption Ease of use



JPEG Primary Applications

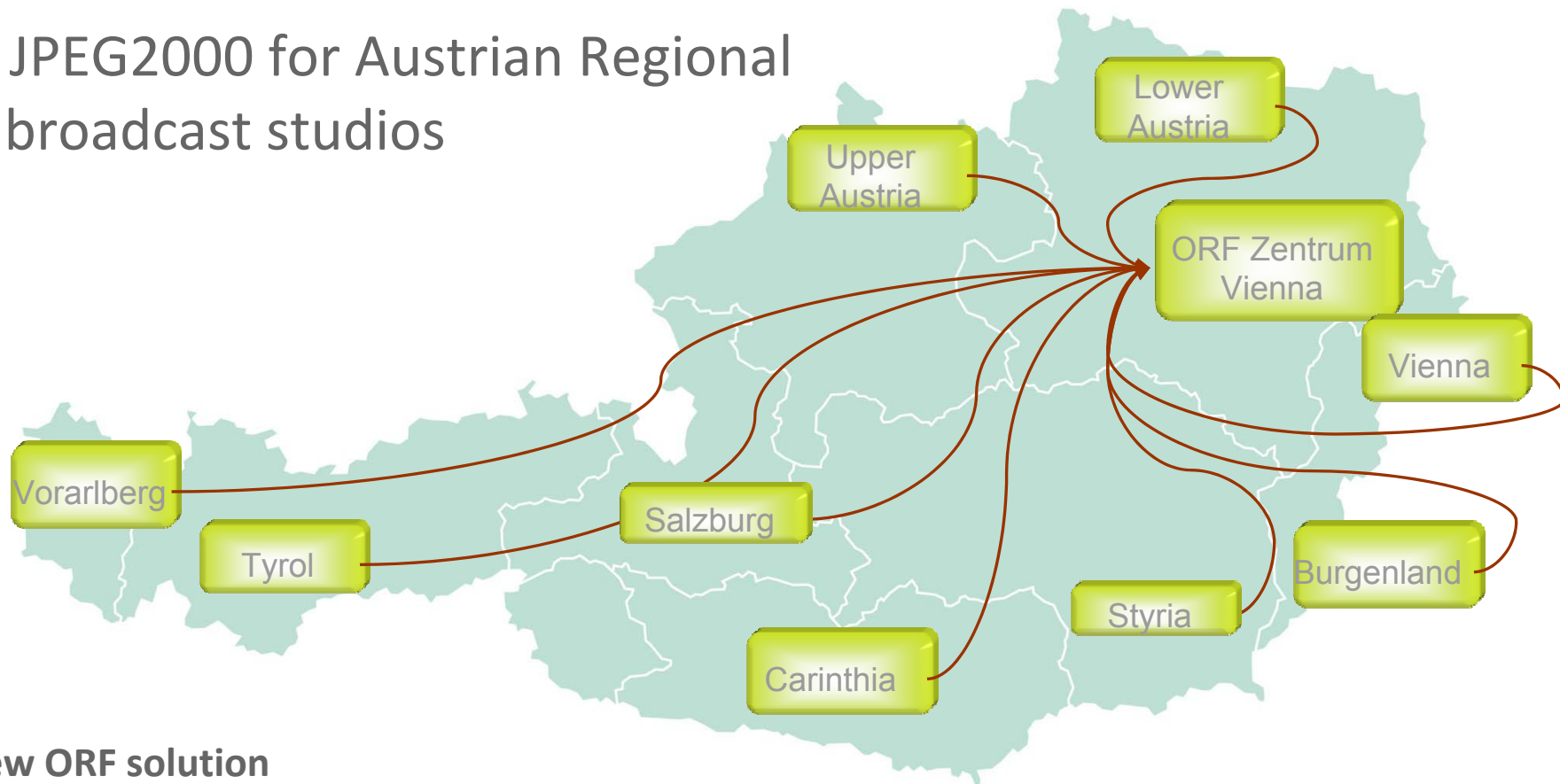
- **Event Contribution**
 - Maintain a high quality and low latency
- **Multi-site broadcasting / interviews**
 - Low latency on bidirectional links
 - Studio to Studio program exchange
- **Primary distribution**
 - Feed to DTT/ satellite / cable and IPTV compression head-end



Next generation 3G contribution network



JPEG2000 for Austrian Regional broadcast studios

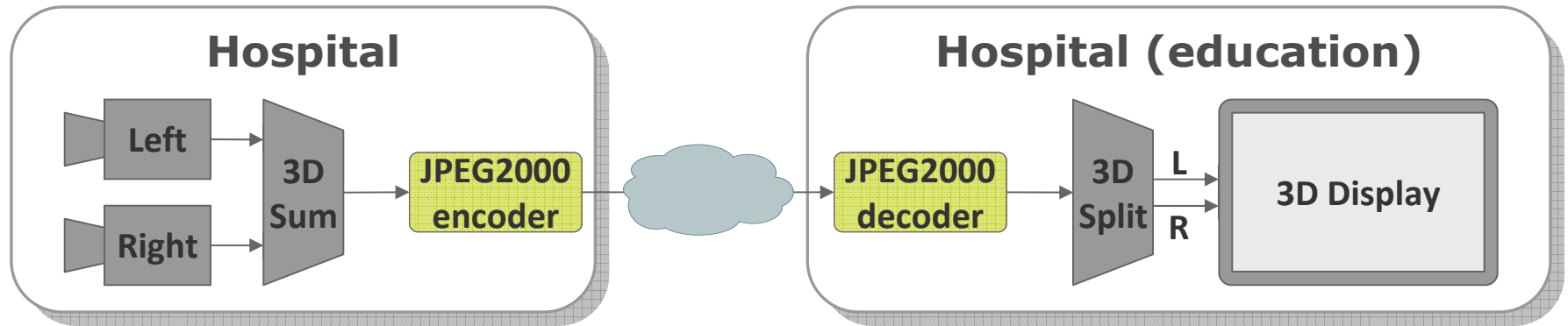


New ORF solution

- 1080p/50 Compatible MPLS Contribution Network
- Replacement of old ATM Network
- Combined SDI/ASI/HD SDI/3G – Bi-directional
- Integrated with Dimetis control system



Performing the transmission of stereo image on robot surgery by JPEG2000



Using the hyper research network (KOREN) Dr. Young-woo Kim, Head of Gastric Cancer Center is performing the transmission of stereo image on robot surgery for gastric cancer at the 9th Scientific Conference of Laparoscopic Gastrointestinal Surgery Group on 23 May 2009 at the NCC.

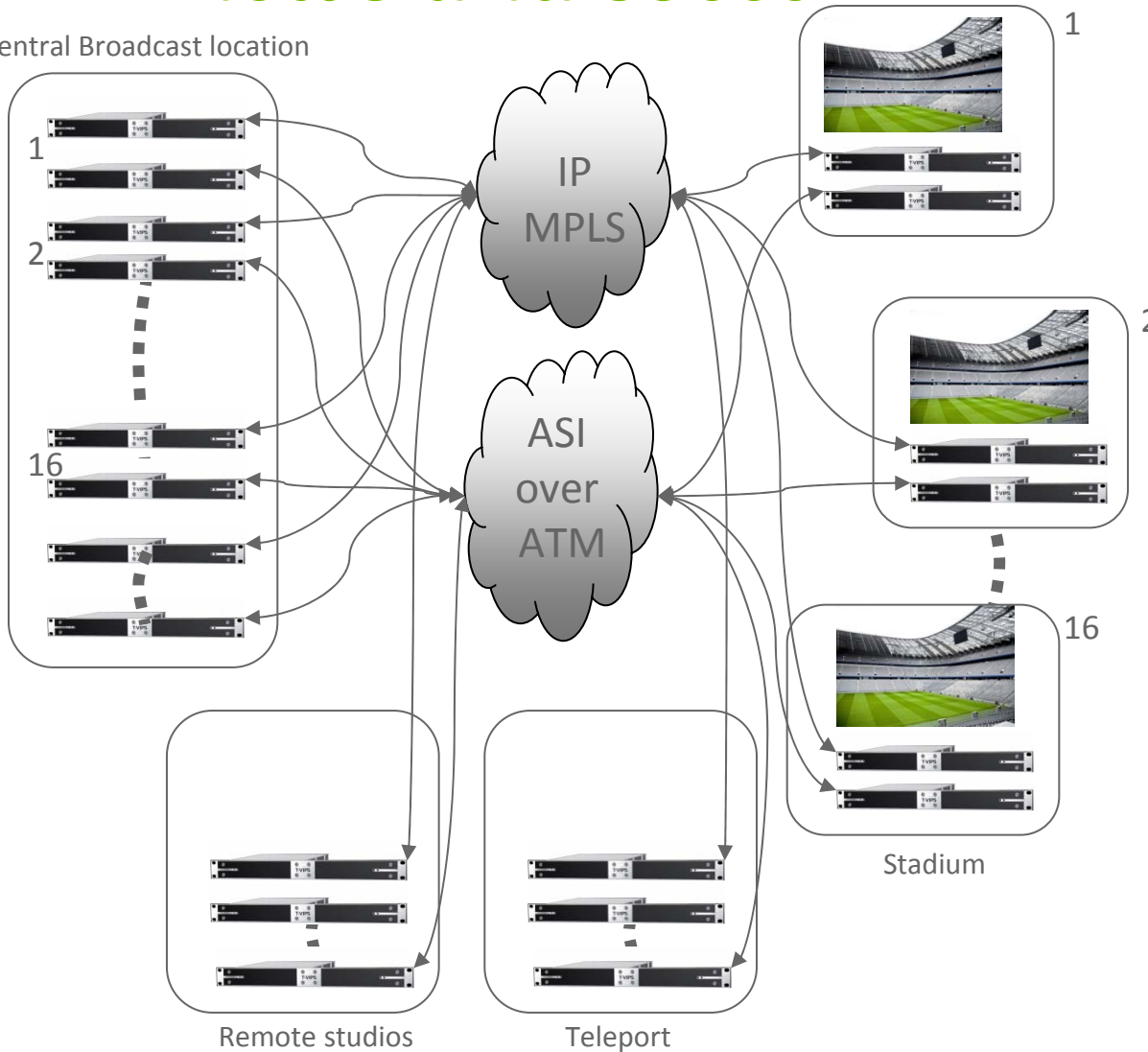




Contribution network for news and soccer



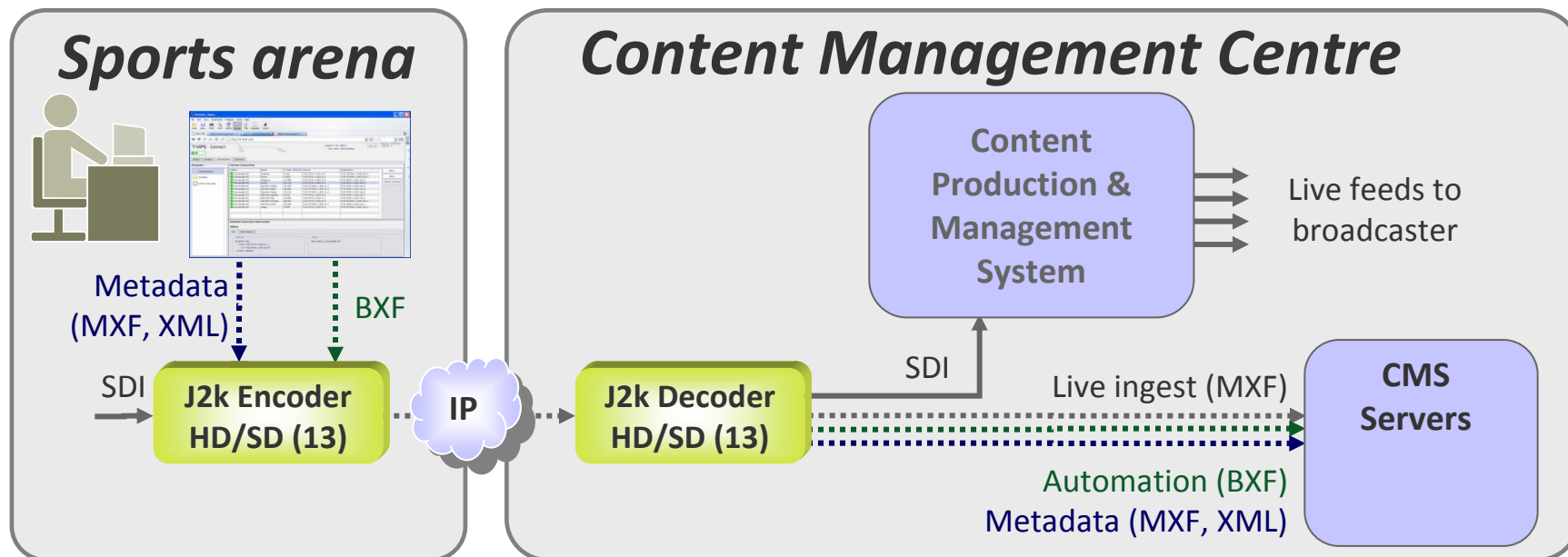
Central Broadcast location



- Soccer contribution from 16 stadiums
- Contribution between studios
- Fixed contribution to teleport
- JPEG2000 selected thanks to quality, latency and price



Future Solution with JPEG2000 wrapped in MXF



- Ingestion without decoding – encoding
 - Include meta data
 - Include remote control



T-VIPS JPEG2000 solutions

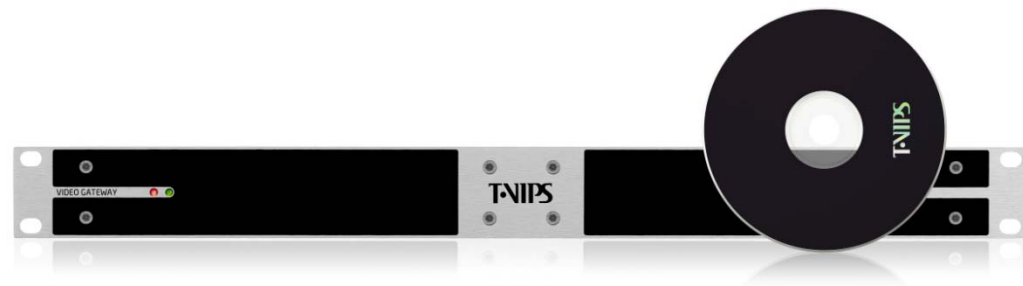
More than 1200 units deployed

TNIPS

- TVG415 SD JPEG2000
TVG430 SD/HD JPEG2000
 - Configurable as encoder or decoder
- TVG450 SD/HD/3G-HD JPEG2000
 - Bidirectional, configurable as encoder, decoder or mixture
 - Up to 4 SD, 2 HD or 1 3G-HD in one unit
 - Upgradable from SD to HD or 3G-HD
- Features:
 - JPEG2000 video compression
 - Transparent audio
 - Extensive VBI handling
 - MXF over IP or ASI transport
 - Integrated frame store
 - Compact with low power consumption (less than 10W per SD channel)

“We have evaluated compression technologies for a next generation MPLS based network to replace our existing ATM infrastructure. **JPEG2000 over MXF** format came out as the clear winner after we had evaluated different compression technologies”

DI Alexander Hetfleisch, ORF's project manager



Thank you for your attention!



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