

新型广播电视技术的特点及其应用的探讨

谭嘉良

2015年6月 北京

大纲

1. IP技术方面

1. JPEG2000 减少视频带宽用量的重要性
2. 无缝切换Seamless Switching
3. NAT
4. 分散式矩阵 (De-Centralize)

2. 光纤&IP

1. 光纤组成的多节点 比对 IP网组成的多节点
2. 远程演播室
3. 异地大楼信号交换
 - 重庆广电集团（总台）IP总控项目

大纲

3. 控制方面

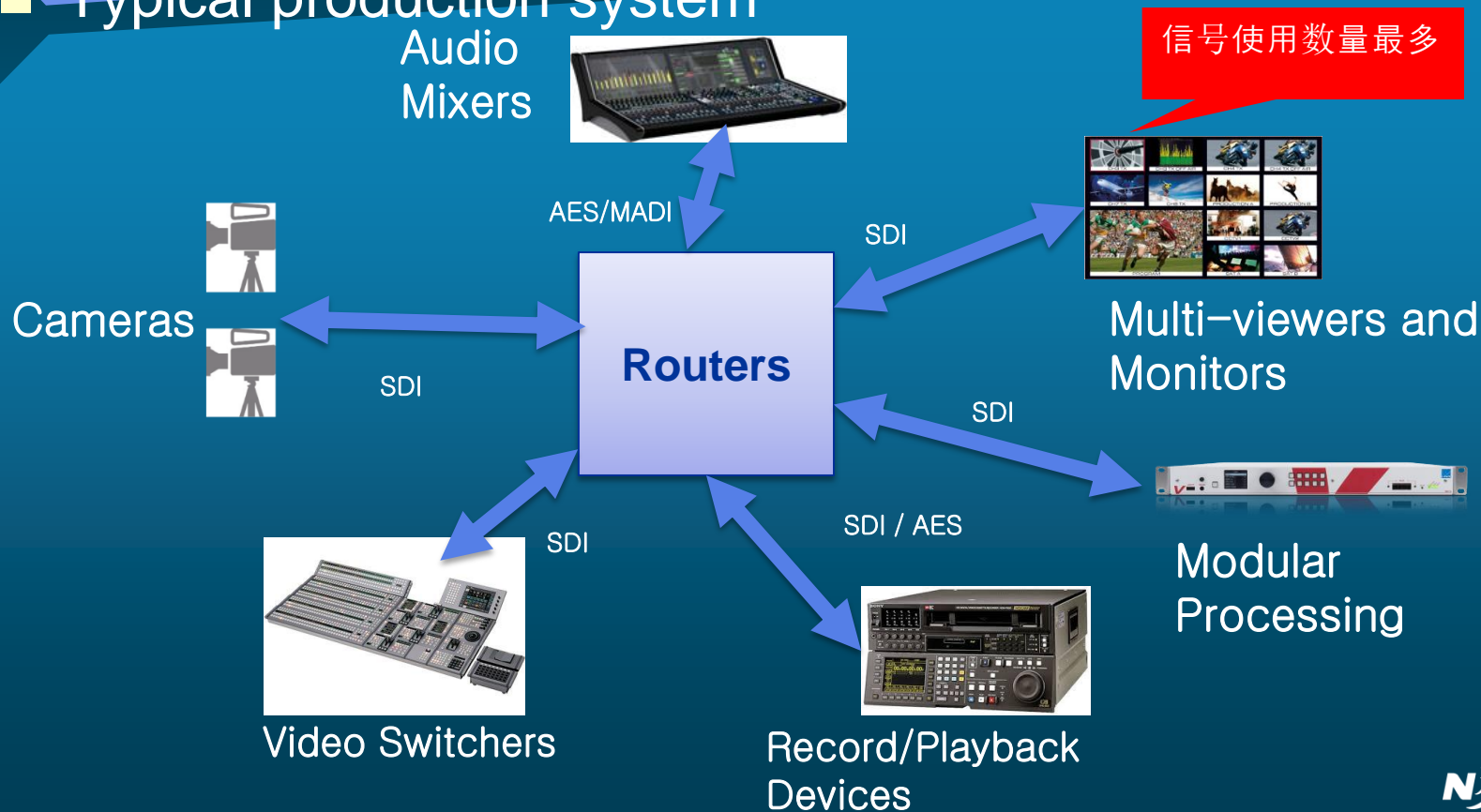
1. VSM在江苏省广播电视总台（集团）4K转播车的应用
2. VSM转播车集联的应用

4. IP应用IP案例：

- Game Creek Encore OB Van A,B,C

IP技术方面 – Motion Jpeg2000

■ Typical production system



IP技术方面 – Motion Jpeg2000

10Ge >> 6 HDSDI (1080i)

- 8分割 : 2 x 10Ge
 - 32分割 : 6 x 10Ge
 - 8 x 32分割 : 48 x 10Ge
 - 不算信号源的话也用了交换机的48个10Gb
 - Cat6e 走10Ge : 10m 至15m
 - 一般只能走光纤
- 为了能利用IP化的优点，至少在监看平台上，应考虑一方面能满足使用需求，但同时能减少带宽使用的IP视频流格式
 - 理想中要求是：
 - 低延时，压缩比足以让HD视频用千兆以太网走，高画质

IP技术方面 – Motion Jpeg2000

- 视频标准 : **ISO/IEC 15444-3:2002/Amd 2:2003** in terms of the ISO Base format, **ISO/IEC 15444-12** and in ITU-T Recommendation T.802.
- 文件标准 : on ISO base **media file format (ISO 15444-12)**. Filename extensions for Motion JPEG 2000 video files are **.mj2 and .mjp2** according to RFC 3745.

IP技术方面 - Motion Jpeg2000

- 不使用帧间编码 **did not involve inter-frame coding.**
- 容错, 扩展性更好
- **更适合于网络 & 点对点传输**
- 更好的随机框架存取
- 低延迟 **小于 1.5 帧 编码 and/or 解码**
- 保持音频视频同步

IP技术方面 – Motion Jpeg2000

Performance comparison

Recently, the performance of JPEG 2000 and MPEG-4/AVC under multigeneration encoding was evaluated using a single vendor's encoders and decoders. (See Figure 3.) Video quality was measured in terms of PSNR for different HD interlaced sequences at the operating points of the encoders. The streams were encoded at 90Mb/s for JPEG 2000 and 45Mb/s for MPEG-4/AVC streams. These bit rates were used throughout the testing because they are common operating points.

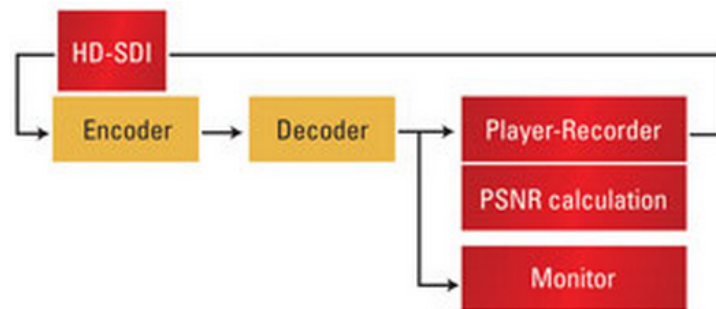


Figure 3. PSNR simulation setup

MPEG-4/AVC provided high-quality video at 45Mb/s. Under multigeneration encoding and decoding, the PSNR reduction was sharp — roughly 2.2dB after the fourth generation. (See Figure 4.) JPEG 2000 also delivered high-quality video (at 90Mb/s), but it had less than 0.5dB loss after the fourth generation of encoding and decoding, which was less than one quarter of the reduction experienced by MPEG-4. In addition, the predictive coding of MPEG resulted in an end-to-end latency of approximately 1 second, which is roughly 10 times more than the latency experienced with JPEG 2000.

Approx 0.1 sec

IP技术方面 – Motion Jpeg2000

■ Compare MPEG2 vs JPEG 2000

	MPEG-4/AVC	JPEG 2000
Quality (image to image)	Varying	Same
Latency	High	Low
Visual impairments	Blocking	Blur
Operating point for HD video format	15Mb/s-60Mb/s	60Mb/s-125Mb/s

IP技术方面 – Motion Jpeg2000

- Compare MPEG2 vs JPEG 2000
 - 理论无损时所用带宽用千兆网已可以走

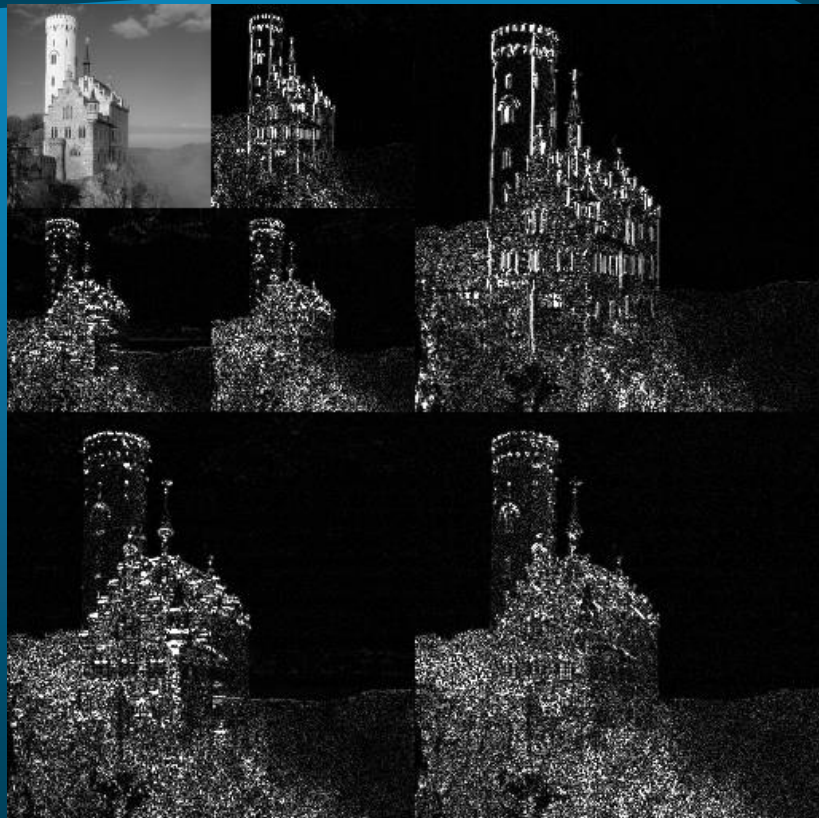
Video format requirements	Typical IP bandwidth
HD-SDI uncompressed	1.5Gb/s
HD-SDI mathematically lossless JPEG 2000 mode	600Mb/s
HD-SDI visually lossless JPEG 2000 mode	120Mb/s-150Mb/s

IP技术方面 – Motion Jpeg2000

- The original JPEG used discrete cosine transform (DCT), the same techniques used in MPEG, to reduce data into blocks of 8 x 8 pixels. JPEG 2000 uses **discrete wavelet transform (DWT)**, which performs simultaneous multiresolution image analysis.
- Wavelet compression provides the same processing for all pixels, and with each video frame being compressed individually, there is no error propagation from one picture to the next. As a result, there is **no macroblocking at low bit rates; instead, there is blurring on the images.**

IP技术方面 – Motion Jpeg2000

- 小波压缩 (Wavelet compression)



IP技术方面 – Motion Jpeg2000

■ Supported by popular editing

- e.g. Avid Media Composer
 - 1080i, 10 bit, 150 Mbit/s
 - 1080i, 10 bit, 110 Mbit/s
 - 1080p, 10 bit, 160 Mbit/s
 - 1080i, 10 bit, 125 Mbit/s

IP技术方面：无缝切换Seamless Switching

■ 基带和IP路由器的区别

+ IP路由器没有传统的交叉点状态

- 信息包交换，而不是电路交换
- 不一定是一个视频一根网线

+ 单独IP交换机上的物理端口不代表信号能力

- 源视频IP包选送至某一输出网口，不等於接收端的设备会自动改为使用这路信号，不等於原来在用的信号的相关IP包会自动停止输出至网口

+ 源和目标不一定在设计时建立 —— 而是在运行时！

+ 带宽不是物理分配

+ 利用信号的压缩格式可获得更多信号

IP技术方面：无缝切换Seamless Switching

- Switching between two SDI sources must be executed according to **RP168-2009** for the downstream devices to handle the change seamlessly. Both signals must be synchronized and the actual switch-over must occur within line 6 (for PAL), 10 (for NTSC) or 7 (for HD).
- To know the correct switching position, one needs to know the **exact SDI format (which is referenced as Video Source Format in the HBRMT header)** to calculate the packet in which to switch over.
- This has advantages for hardware and software implementations as **only the headers need to be manipulated**; no copy operation from one packet's payload to another is ever required.

IP技术方面：无缝切换Seamless Switching

- + 路由定时交换 (Switch Timed Switching)
- + 目标定时交换 (Destination Timed Switching)
- + 源定时交换 (Source Timed Switching)

IP技术方面：Seamless Switching

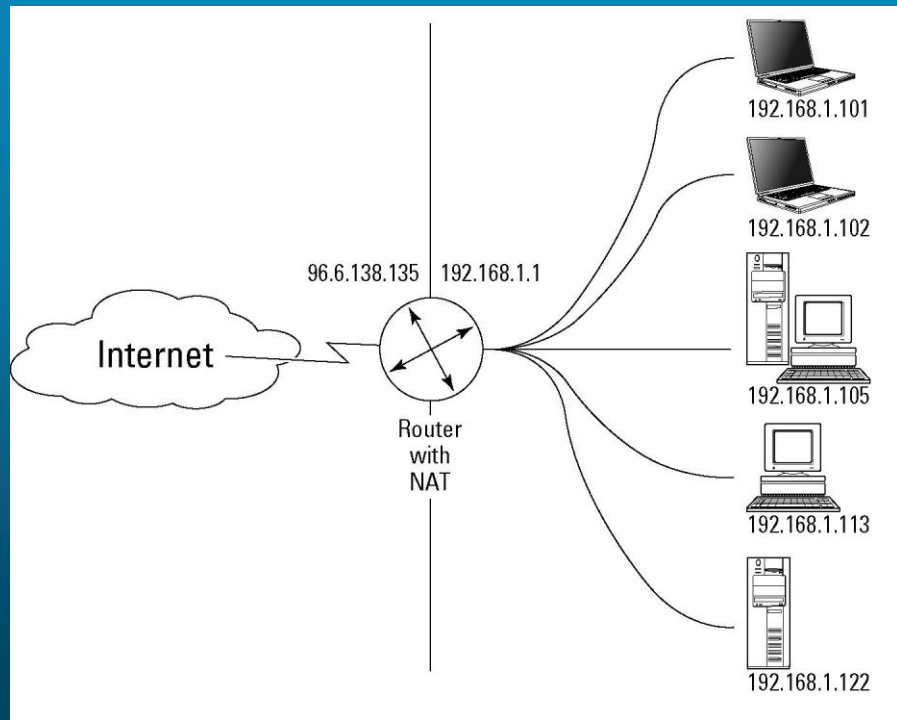
■ 3种方案都曾经被测试而且都可行

- <http://www.tvtechnology.com/article/switching-to-ip/272651>

	交换定时交换	目标定时交换	源定时交换
采用带宽			
多层次扩展			
制造商捆绑			

IP技术方面：NAT

■ NAT (Network Address Translation, 网络地址转换)



IP技术方面：NAT

■ Case 1



xxx.xxx.xxx.1



xxx.xxx.xxx.2



xxx.xxx.xxx.1
xxx.xxx.xxx.2



受控，接收的IP可改

192.168.0.3

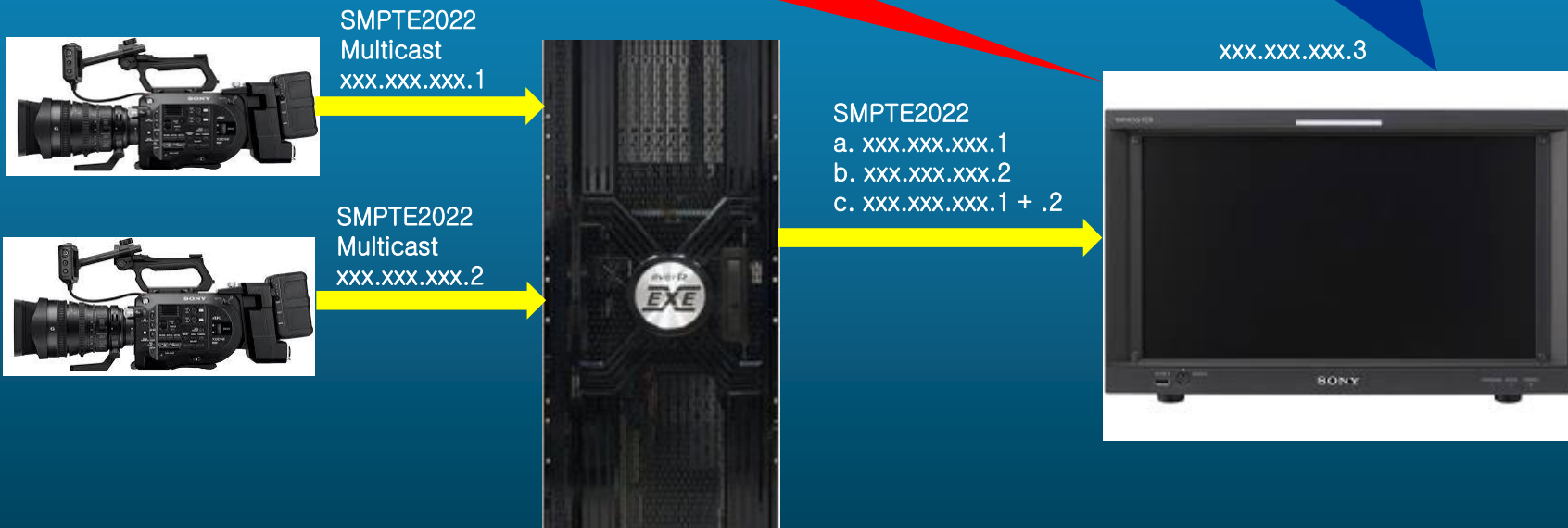


IP技术方面：NAT

Case 2

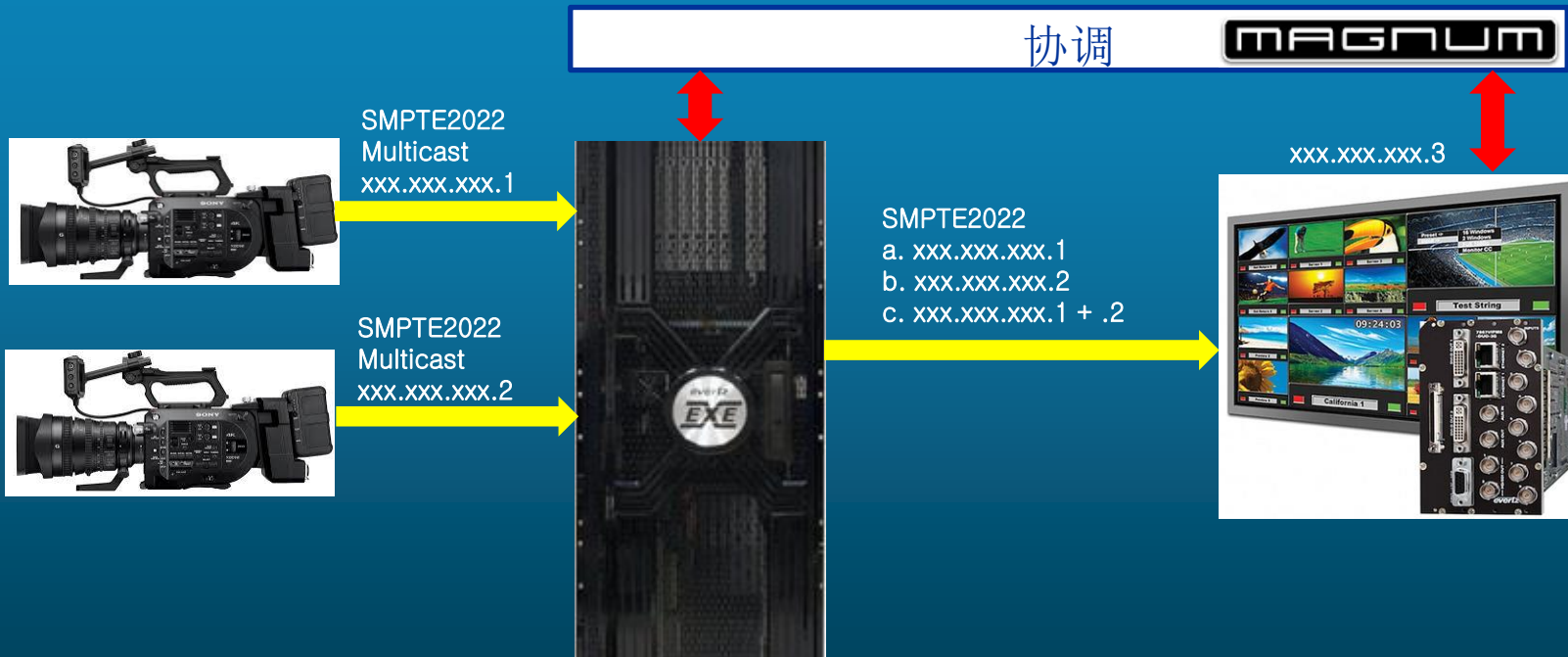
矩阵选信号不等于监视器会看这信号
源端Multicast Ip视频本身无指向性
接收端对ip视频有指向性，并不是单
由矩阵决定

以往信源选择是sdi1,sdi2,4k1,4k2...
信源选择是IP清单



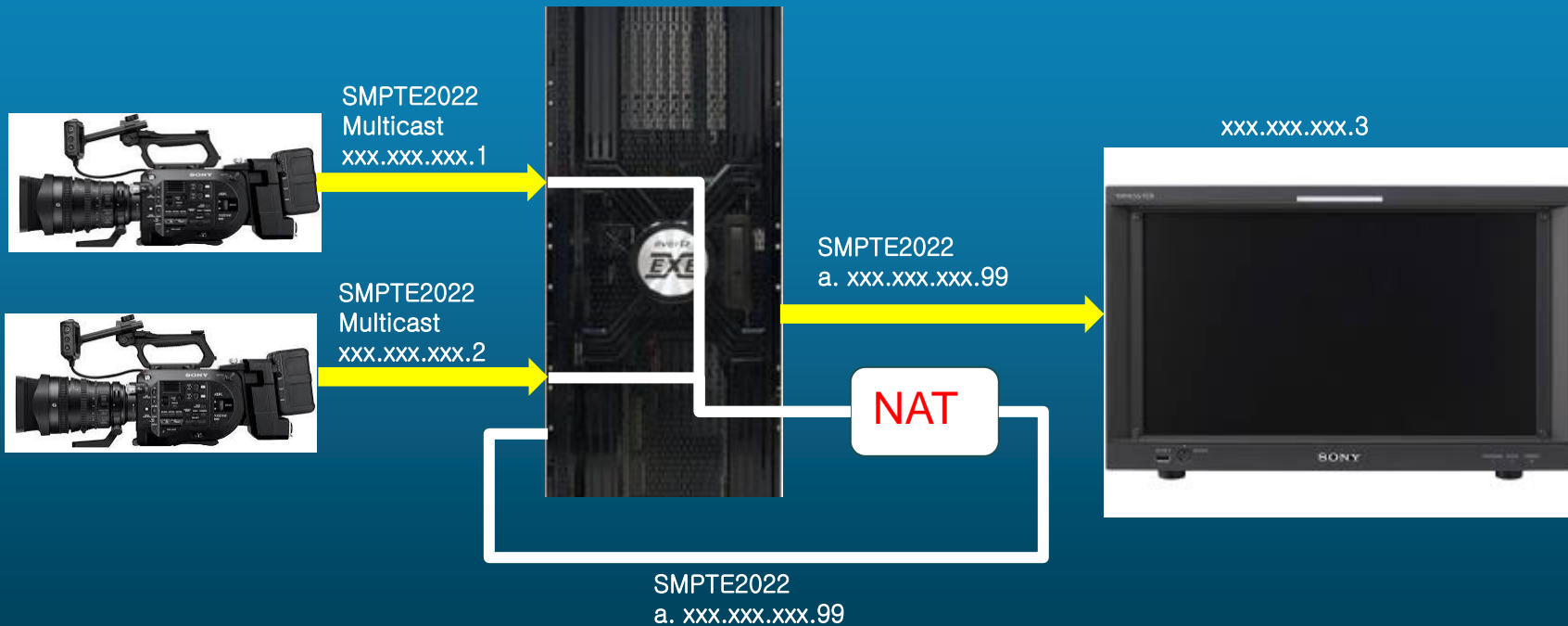
IP技术方面：NAT

■ Case 4



IP技术方面：NAT

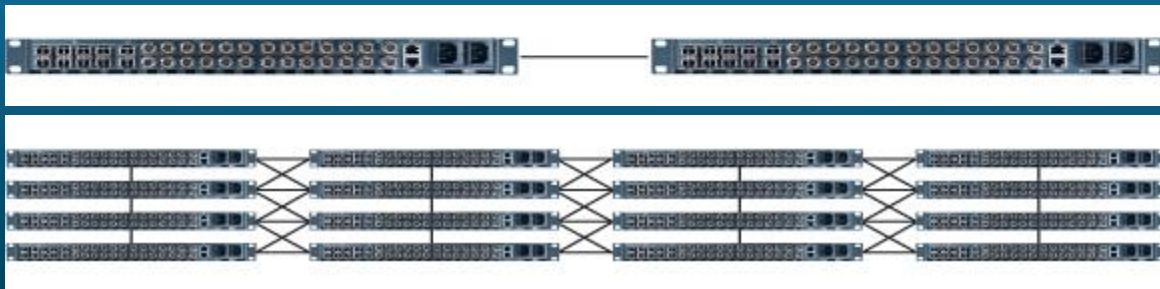
■ Case 4



IP技术方面：分散式矩阵

Riedel MicroN

- Max up to 192x192
- 分散式矩阵 decentralized video router
- 24 SD/HD/3G-SDI I/Os, two MADI optical digital audio ports, a Gigabit Ethernet port, two sync reference I/Os, and eight 10G SFP+ high-speed ports



IP技术方面：分散式矩阵

Me

■ F
■ (E
■ 1
■ L

CONNECTIONS PARAMETER ALARM

SOURCE

T1 Eins [754]	2 MN-XSS	2.1 AES3 754.2.Artist BNC 1 (in)
T2 Zwei [B85]	5 MN-HD4I	2.2 AES3 754.2.Artist BNC 2 (in)
T3 Drei [5D0]		2.3 MADI 754.2.MADI 1 In (SFP)
T4 Vier [71A]		2.4 MADI 754.2.MADI 2 In (BNC)
T5 Fuenf [1D7]		2.5 ETH 754.2.Network
T6 Sechs [5FF]		5.1 HD 754.5.In 1
T7 Sieben [6A3]		5.2 HD 754.5.In 2
		5.3 HD 754.5.In 3
		5.4 HD 754.5.In 4

DESTINATION

T1 Eins [754]	2 MN-XSS	2.1 AES3 754.2.Artist BNC 1 (out)
T2 Zwei [B85]	6 MN-HD4O	2.2 AES3 754.2.Artist BNC 2 (out)
T3 Drei [5D0]	9 MN-HD4O	2.3 MADI 754.2.MADI 1 Out (SFP)
T4 Vier [71A]		2.4 MADI 754.2.MADI 2 Out (BNC)
T5 Fuenf [1D7]		2.5 ETH 754.2.Network
T6 Sechs [5FF]		6.1 HD 754.6.Out 1
		HD 754.6.Out 2
		HD 754.6.Out 3
		HD 754.6.Out 4

TOPOLOGY

View

T1 Eins [754] T2 Zwei [B85] T3 Drei [5D0] T4 Vier [71A] T5 Fuenf [1D7] T6 Sechs [5FF] T7 Sieben [6A3]

T1 Eins [754] / MN-XSS

NAME: 754.5.In 1

TEST PATTERN: Off

FORMAT GROUP: SD HD ASI FHD

AUDIO DE-EMBEDDER

SAC On	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Channel	1	2	3	4	5	6	7
Group 1.1							
Group 1.2							
Group 2.1							
Group 2.2							
Group 3.1							
Group 3.2							
Group 4.1							
Group 4.2							

T2 Zwei [B85] / MN-HD4O

NAME: 885.9.Out 1

TEST PATTERN: Off

OSD ON:

VIDEO OFF:

FRAME SYNCHRONIZER

Manual Freeze:

VIDEO DELAY:

Plugged Source Signal: none

Frame (max. 5): 0

Line (max. 1125): 0

Pixel (max. 4125): 0

OUTPUT ON TRS ERROR:

Freeze: Black:

AUDIO EMBEDDER

Include Embedded Data:

GROUP 1: embed Audio Delay (ms): 0

GROUP 2: embed Audio Delay (ms): 0

SWITCH X 16

LOW 6 SPEED	9	10
5	6	7
LOW 3 SPEED	PRDC 4 CARD	POWER SUPPLY
1	2	

14:36:01 New frame 'T7 Sieben [6A3]':192.168.225.127.

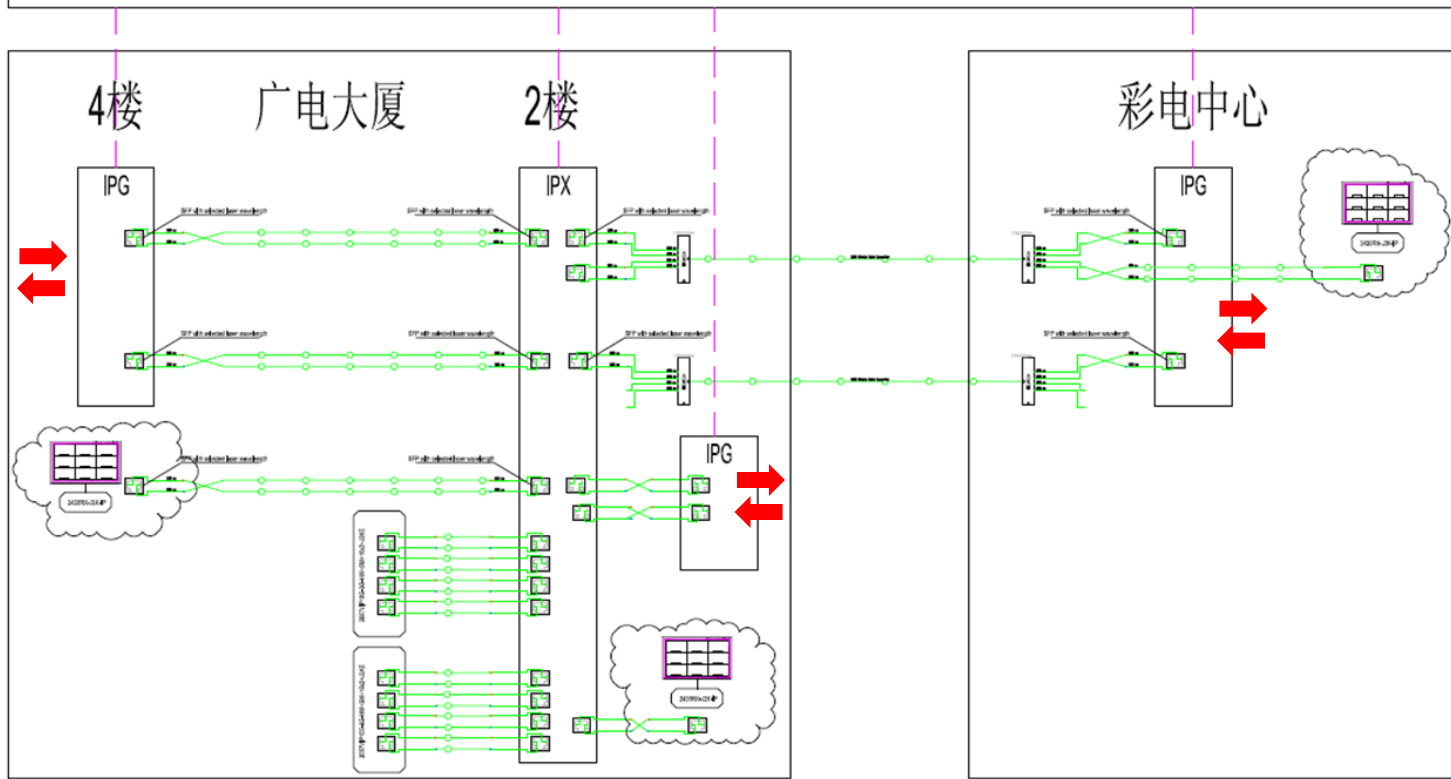
可視化监控

自动化方案

状态报警

带宽管理

SDVN CONTROL

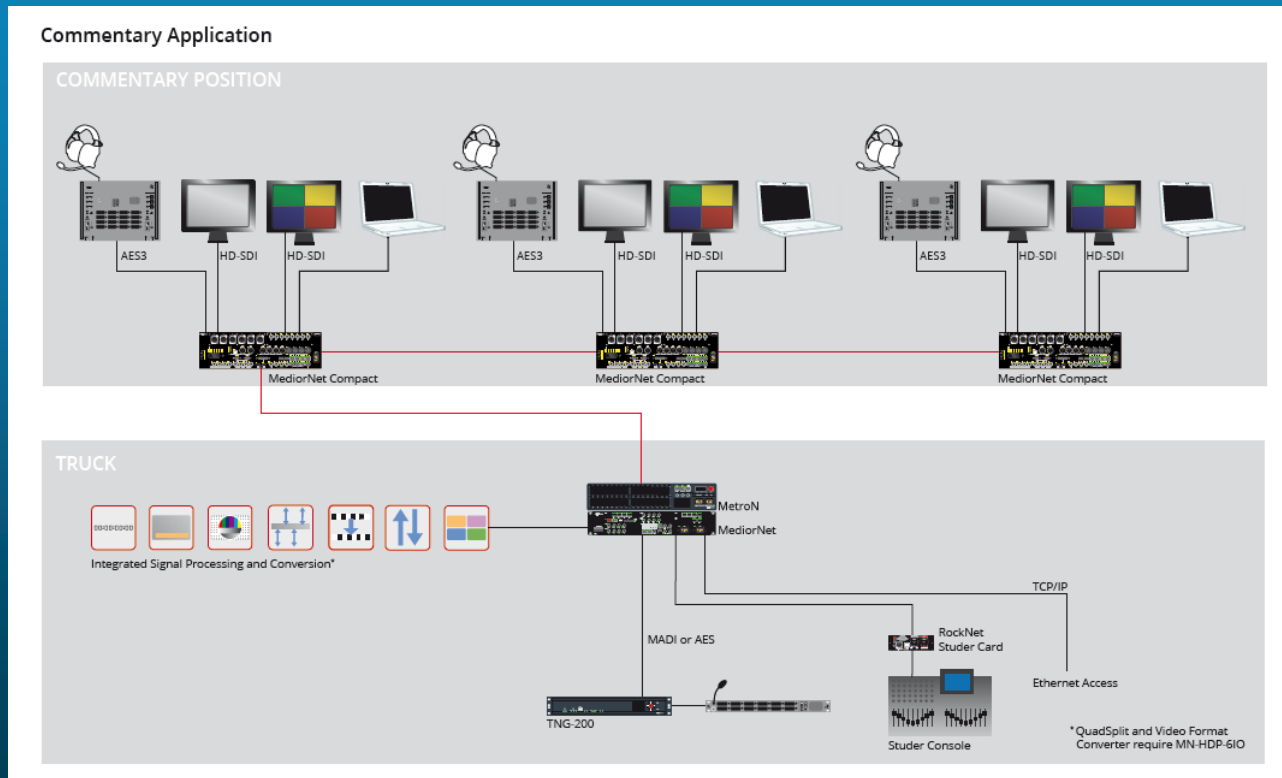


- 重庆
- 彩电
- 不同
- 做合
- 中央
- 中央
- 基於
- 置及

光纤&IP: 多节点 光纤 vs IP网

光纤多节点组成的评论系统 (Commentary)

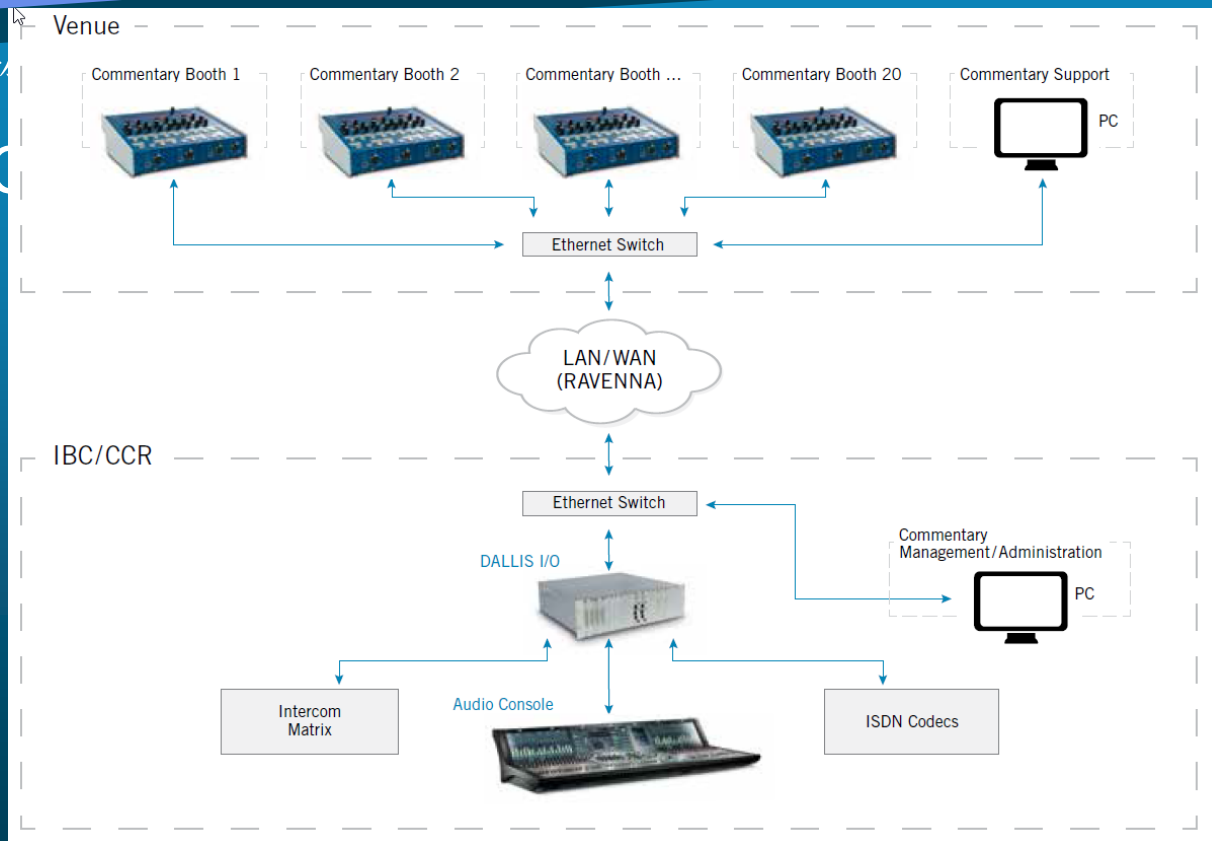
■ MediorNet



光纤&IP: 评论系统

IP网多节点组成的

■ Audio : Lawo C



光纤&IP: 评论系统

IP网多节点组成的评论系统 (Commentary)

- Jpeg2000 encoder
- Jpeg2000 to HDMI



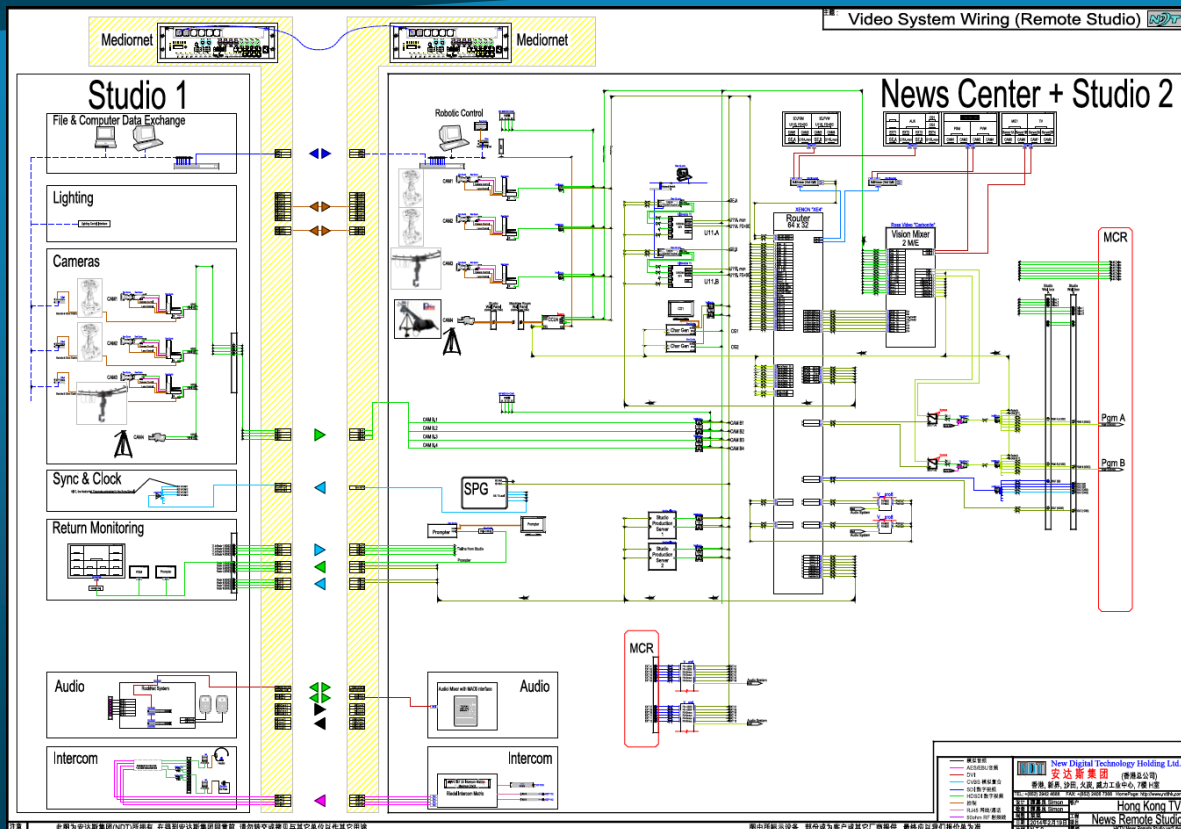
The 2430RX-J2K-IP is a versatile JPEG2000 to HDMI/DVI/DisplayPort processing converter. The 2430RX-J2K-IP is used in applications where delivery of J2K encoded video is to be displayed on a DVI/HDMI monitor.

This self contained module accepts up to two JPEG2000 over IP streaming inputs. It decodes, processes, color corrects and converts the output to a DVI/HDMI signal. With integrated auto scaling the 2430RX-J2K-IP device can drive resolutions up to WUXGA (1920x1200).



光纤&IP: 远程演播室

MediorNet



光纤&IP: 远程演播室

Lawo V_Link4

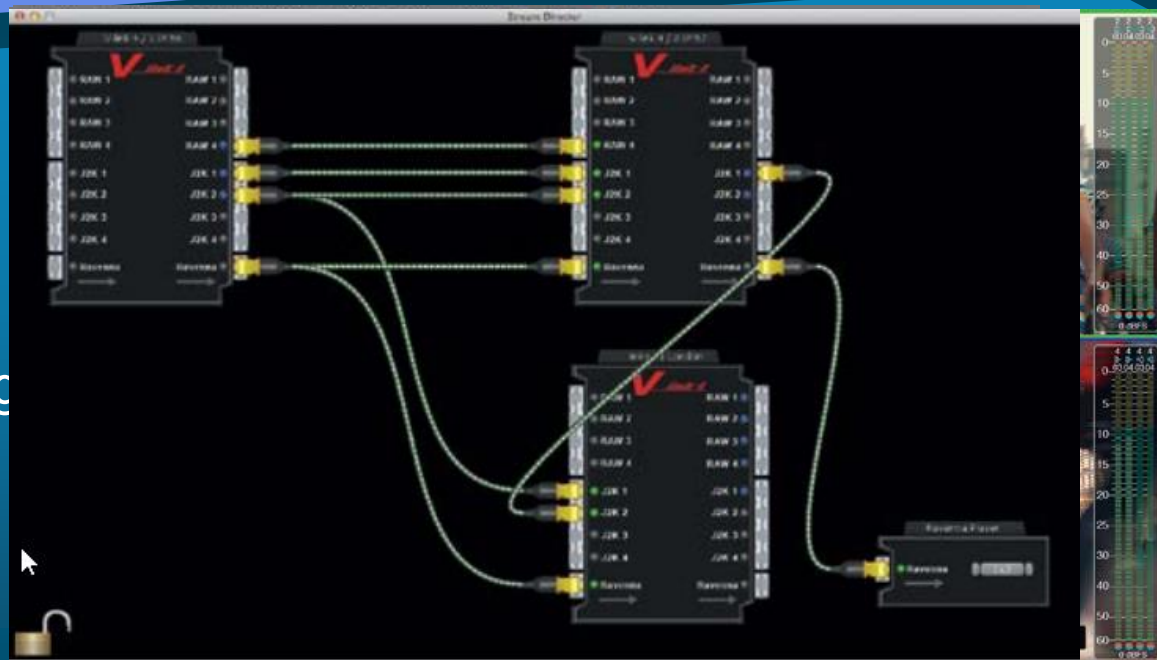
- 2x 10G Ethernet and 4x 1G
- Ethernet ports (2x PoE) for any network application.
- Encoding : H264 , JPEG2000, MJPEG, Thumbnail, PPM
- Latency : 100 pixels



光纤&IP: 远程演播室

Lawo V_Link4

- auto-discovery
- 自带信号管理
- QuadSplit monitoring

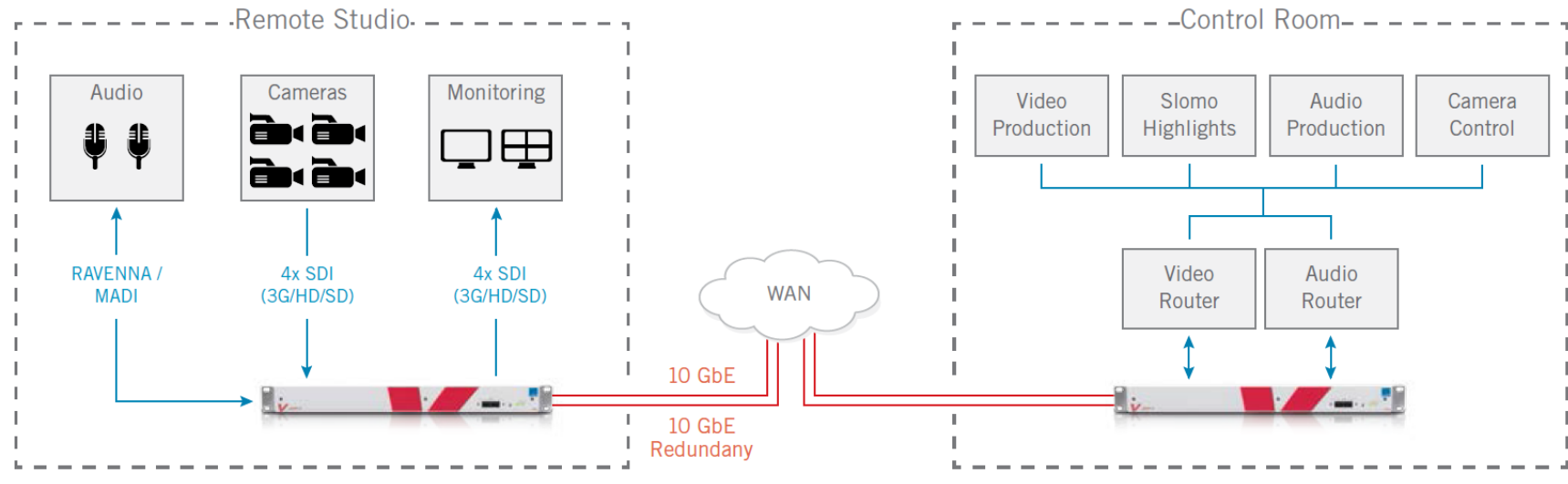


光纤&IP:远程演播室

Lawo V_Link4

V_link4 IN ACTION

REMOTE PRODUCTION



3. 控制方面 – 江苏电视台4K转播车

切换台AUX切换



3. 控制方面 – 江苏电视台4K转播车

Pseudo Devices

Direction	Nr	Trigger	Dependent on	Video	4k.B	4k.C	4k.D	Audio 1	At
Target	71	>VTR1 ch1						● >VTR1 ch1	
Target	72	>VTR2 ch1						● >VTR2 ch1	
Source	26	4K PGM A>		● 4K PGM A>	4K PGM B>	4K PGM C>	4K PGM D>		
Source	27	4K PVW A>		● 4K PVW A>	4K PVW B>	4K PVW C>	4K PVW D>		
Source	18	>4k CAM 1 A>		● >4k CAM 1 A>	>4k CAM 1 B>	>4k CAM 1 C>	>4k CAM 1 D>		

Control Panel (vrmPanel 3.4.2.0@192.168.3.1)

Buttons: Prod 1, GPI, GPO, RCP, STORE, VTR EVS, Speaker, XY, SW A Aux, SW B Aux, MW Layout, Escape, 0, Back

Buttons: CAM 5 4K WFM A, CAM 1 PWS 1, CAM 5 PWS 2, CAM 9 PWS 3, PWS 2: 4K MON 1 A, PWS 2, PWS 2, PWS 2, Back

Buttons: CAM 17, CAM 18, CAM 19, CAM 20, SR1k, PWS 2, PWS 4, 4K PGM, 4K PVW, 4k.CAM 1, 4k.CAM 2, 4k.CAM 3, 4k.CAM 4, 4k.In 1, 4k.In 2, 4k.In 3, Back

Source	11	>CAM 16 A>		● >CAM 16 A>	CAM 16 B>	CAM 16 C>	CAM 16 D>		
Source	12	>CAM 19 A>		● >CAM 19 A>	CAM 19 B>	CAM 19 C>	CAM 19 D>		
Source	13	>CAM 20 A>		● >CAM 20 A>	CAM 20 B>	CAM 20 C>	CAM 20 D>		
Source	81	>CDR L>						● >CDR L>	
Source	73	>EVS 1.ch1>						● >EVS 1.ch1>	
Source	74	>EVS 2.ch1>						● >EVS 2.ch1>	

3. 控制方面 – 江苏电视台4K转播车

■ Store : 状态记存及召出



3. 控制方面 – 江苏电视台4K转播车

■ 监听音量， 音频信号电平调整



3. 控制方面 – 江苏电视台4K转播车

- 视频音频矩阵调度，信号分类



3. 控制方面 - 江苏电视台4K转播车

- 调动外接口板上外来的GPI，选入车内Tally系统
- 调动车内Tally系统，选至车外外接口板送出的GPO



3. 控制方面 – 江苏电视台4K转播车

- Joystick Override : with selection of PGM from 切换台 1 or 2
- 双切换台+2个矩阵应急切换之间Tally切换
- 第一制作区可由切换台1切换至切换台2
- 各区控制面板对本区监看作信号调配，并可作多种状态记忆
- 各区控制面板对本区监听信源选择，音量调整
- 方便更改源名的操作面板
- SNMP报警收集及记录
- AFV音随视动
- 平板电脑控制介面

VSM NAB 2015 演示

控制面板



VSM控制系统



IP应用IP案例- Game Creek Encore转播车队

- NAB 2015
- 海市蜃楼酒店拉斯维加斯
- Mirage Hotel Las Vegas
- 宴会厅



IP应用IP案例- Game Creek Encore转播车队

Game Creek OB Van

- Encore A, B, C



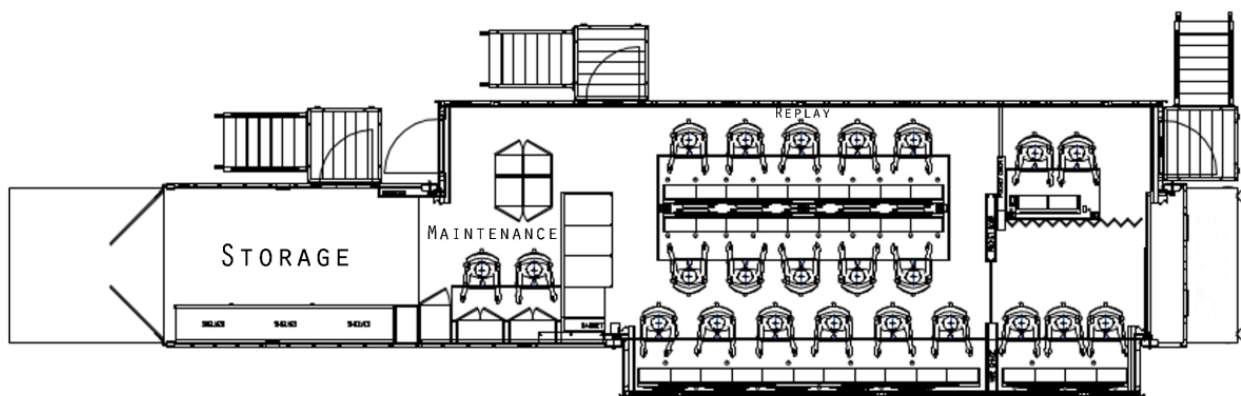
IP应用IP案例- Game Creek Encore转播车队

Encore A, B, C

ENCORE C

22

WORKING AREA LENGTH 72'



WORKING AREA WIDTH 22'

WORKING AREA WIDTH 28'

PLEASE CALL TO DISCUSS SPECIAL PARKING SITUATIONS. 603-882-5222

VTR & EVS

PLEASE SPECIFY EXACT NEEDS WHEN BOOKING

- 6 - EVS 6 CHANNEL HD XT3 LSM WITH HIGH-SPEED XNET NETWORK

- 3 - EVS 6 CHANNEL HD XT3 RO WITH HIGH-SPEED XNET NETWORK

- 1 - EVS 6 CHANNEL HD XT3 SPOTBOX W/ LANCE TDC 100 CONTROLLER

- 10GBE NETWORK INFRASTRUCTURE

- 6 - XHUB3

- 9 - LSM CONNECT TABLETS

- 2 - EVS IP DIRECTOR

- 1 - EVS C-CAST AGENT

- 1 - EVS DATABASE SERVER

- 1 - EVS XT ACCESS

- 2 - EVS X-FILE3

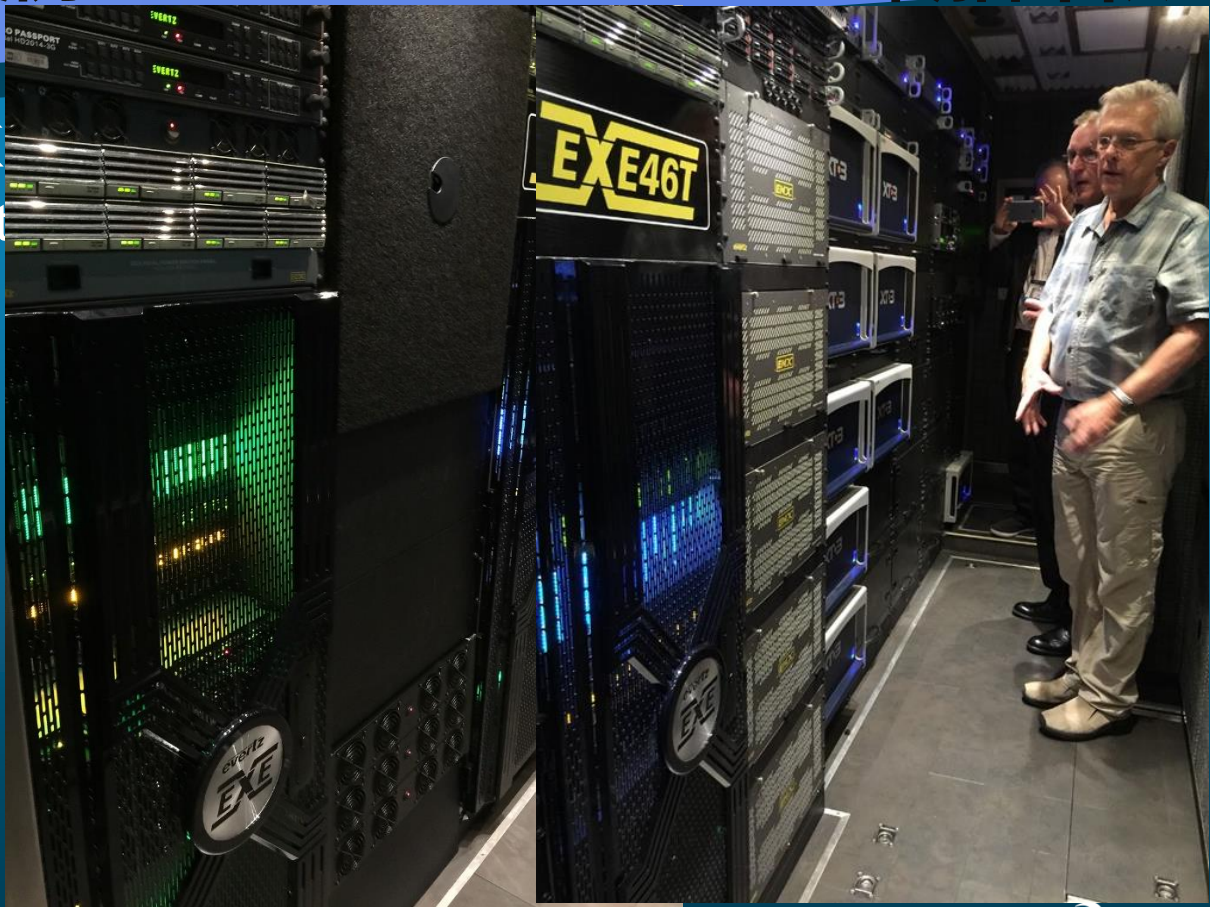
- 3 - LGZ BROADCAST USB RECORDERS

- 1 - 10GBE NETWORK

IP投入使用案例- Game Creek Encore转播车队

Game Creek OB

- 2 x EXE IP短
- 46Tb/s of swit
- Max 13,800 u



Thank You