Camera Training Center
Breda The Netherlands

June 2016

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Jan Paul Campman

- **Your Host for this session**
- *Training Manager*
- *Trainer*
- *Acceptance Engineer*
- *Demo specialist*
- *Web master*

- your guide for this **INTERACTIVE** session.
- **Welcome to the LDX Series WEB-Training**

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IP XCU 10G Fiber (basics)

This part gives you some more details about the IP Connection between XCU and the world

In this session:

- **IP XCU introduction**
- **XCU IP connections**
- **IP basics + test**
- **Settings with MCP450**
- **XCU New**

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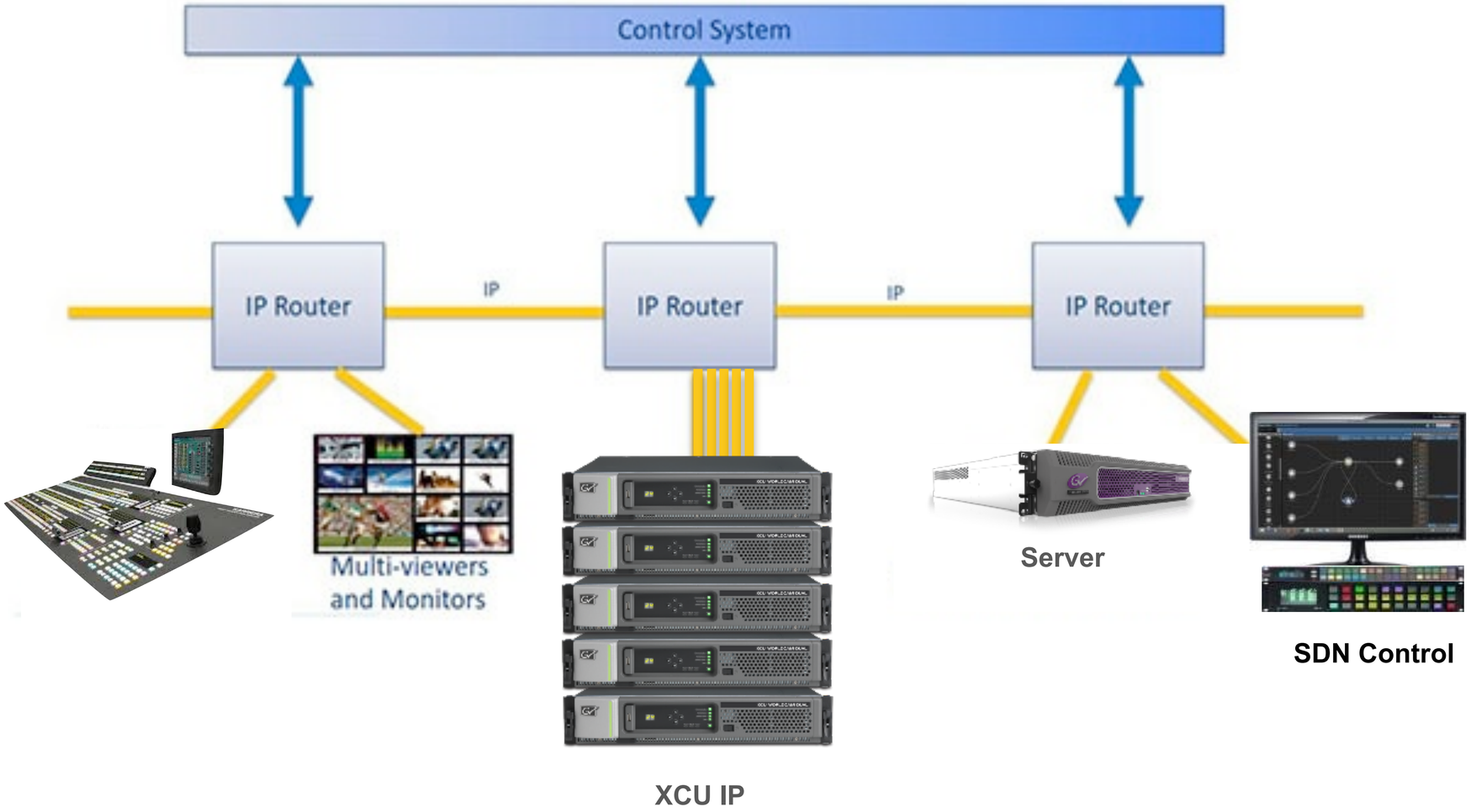
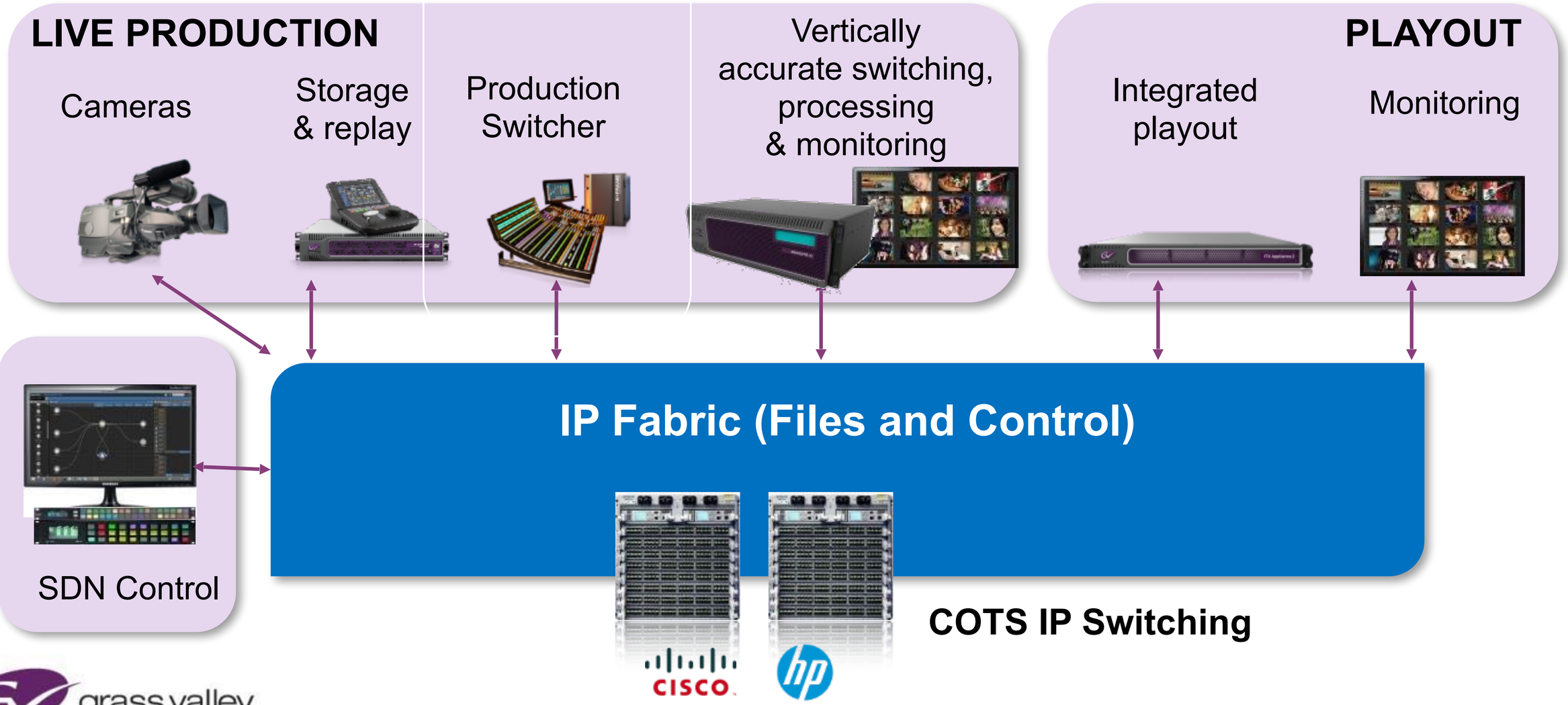
XCU HD/4K IP – Workflow overview



XCU HD/4K IP – Workflow overview



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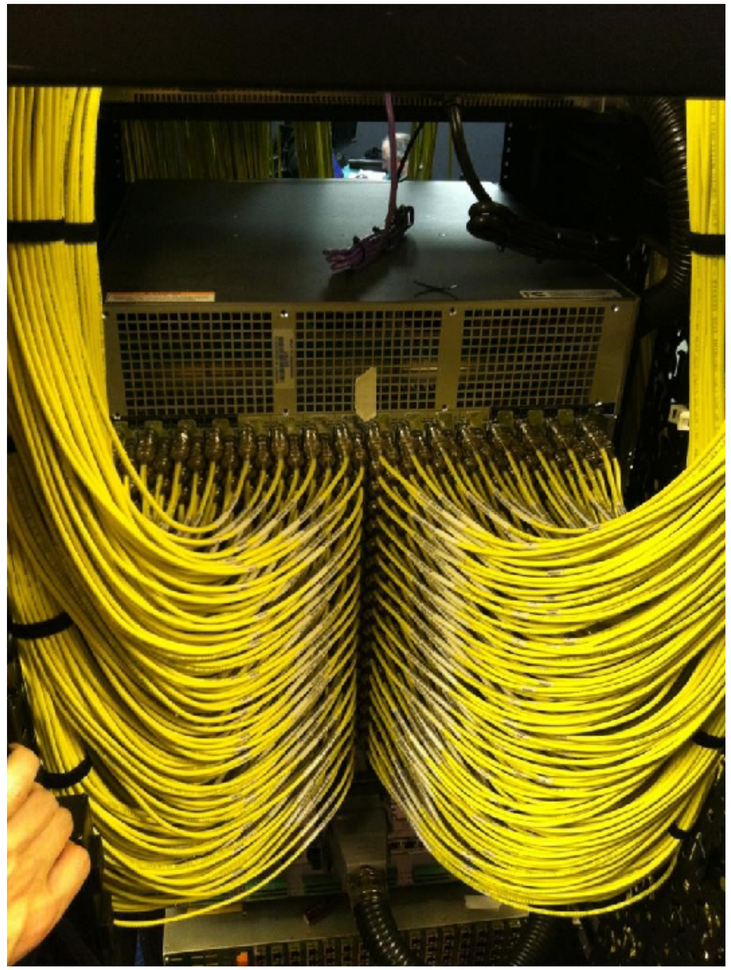
XCU HD/4K IP

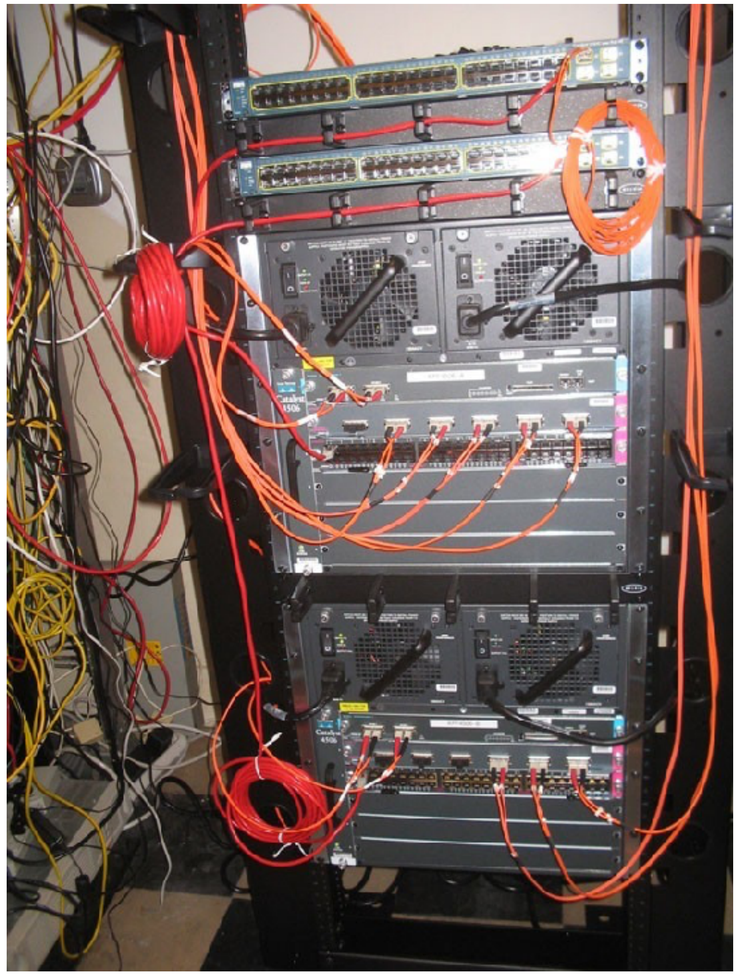
IP delivers *more flexible, more streamlined & scalable* live production infrastructures – ready for 4K / UHD and beyond

IP

The End Result: Dramatic Reduction in Cabling



Before IP



After IP

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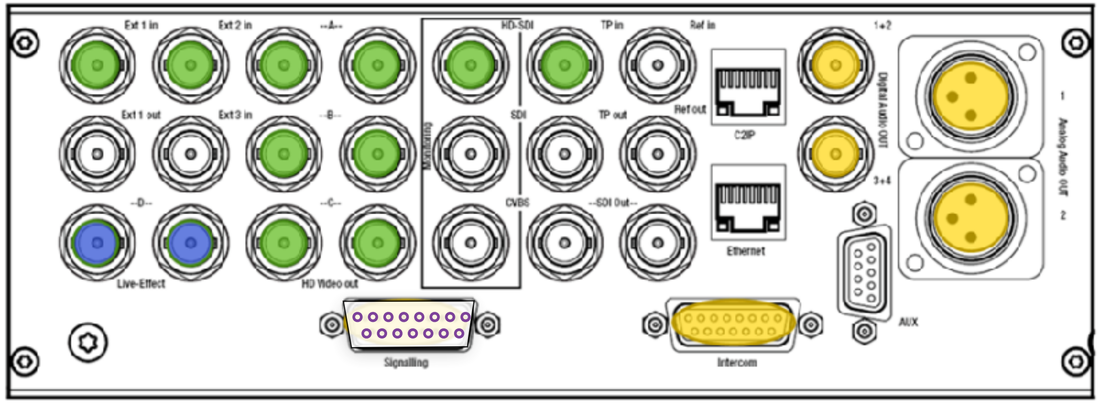
XCU HD/4K IP – Connectivity

10 GigE IP Fiber connectivity
- Scalable from "just" Video to a full IP production
- 4K over 1 wire with TICO

SMPTE hybrid Fiber connection for camera

All the traditional baseband connections from regular XCU's while transitioning to IP

Capabilities – In addition to Baseband



Available in IP

Available inside the SMPTE 2022-6

Available in 4K operation only

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IP

XCU HD/4K IP – Connectivity

UNCOMPRESSED

SMPTE 2022-6 IP I/O (HD)

Or

COMPRESSED

4K / UHD one-wire (TICO)

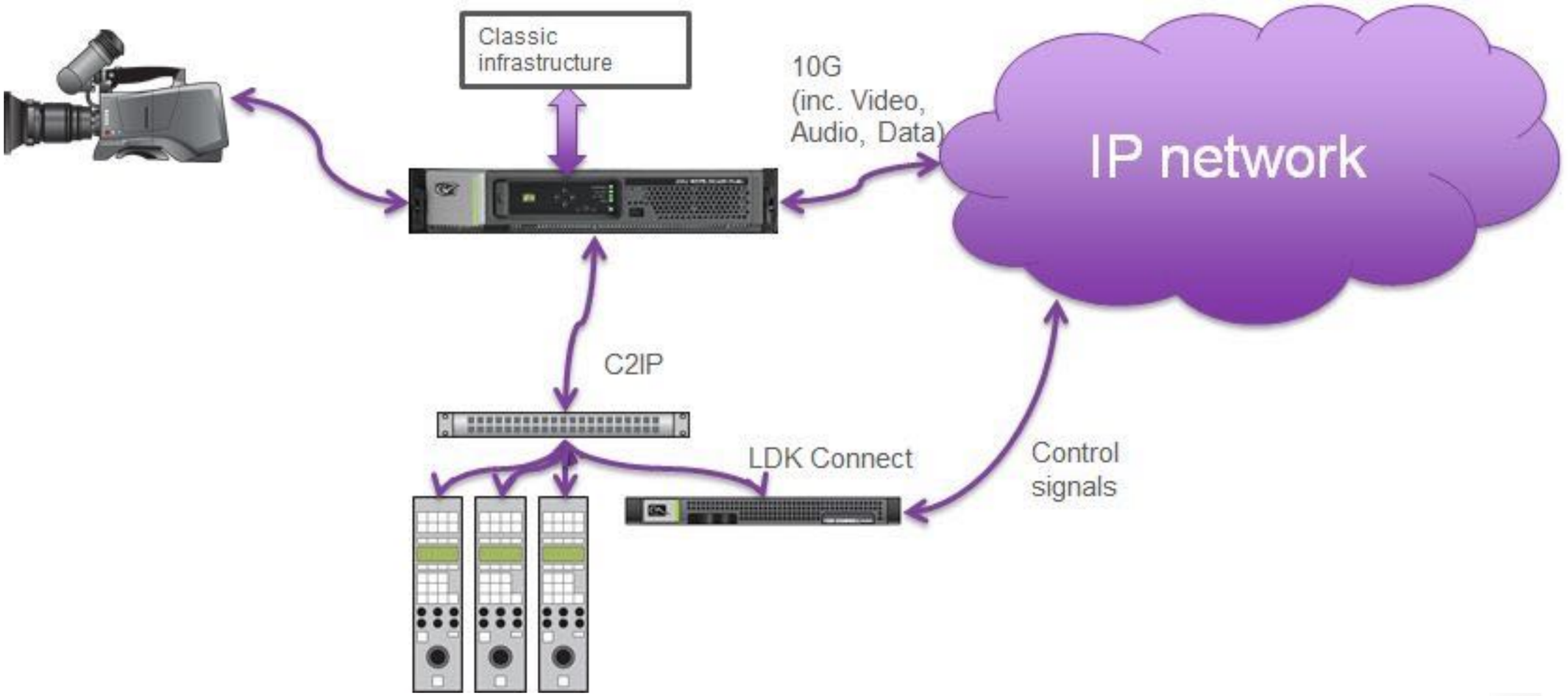
2 pixel Interleave

One bi-directional IP signal

All existing baseband signals

IP

XCU IP – C2IP connection standard



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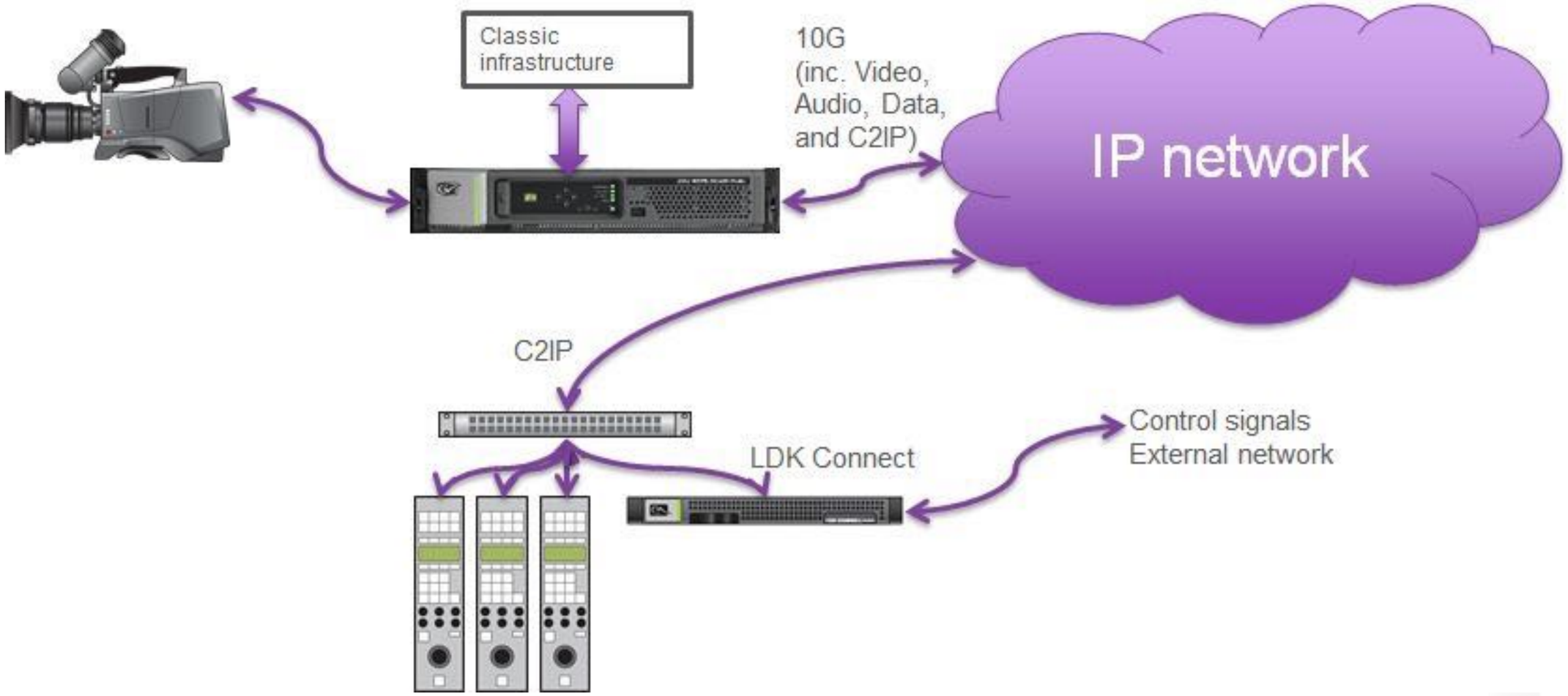
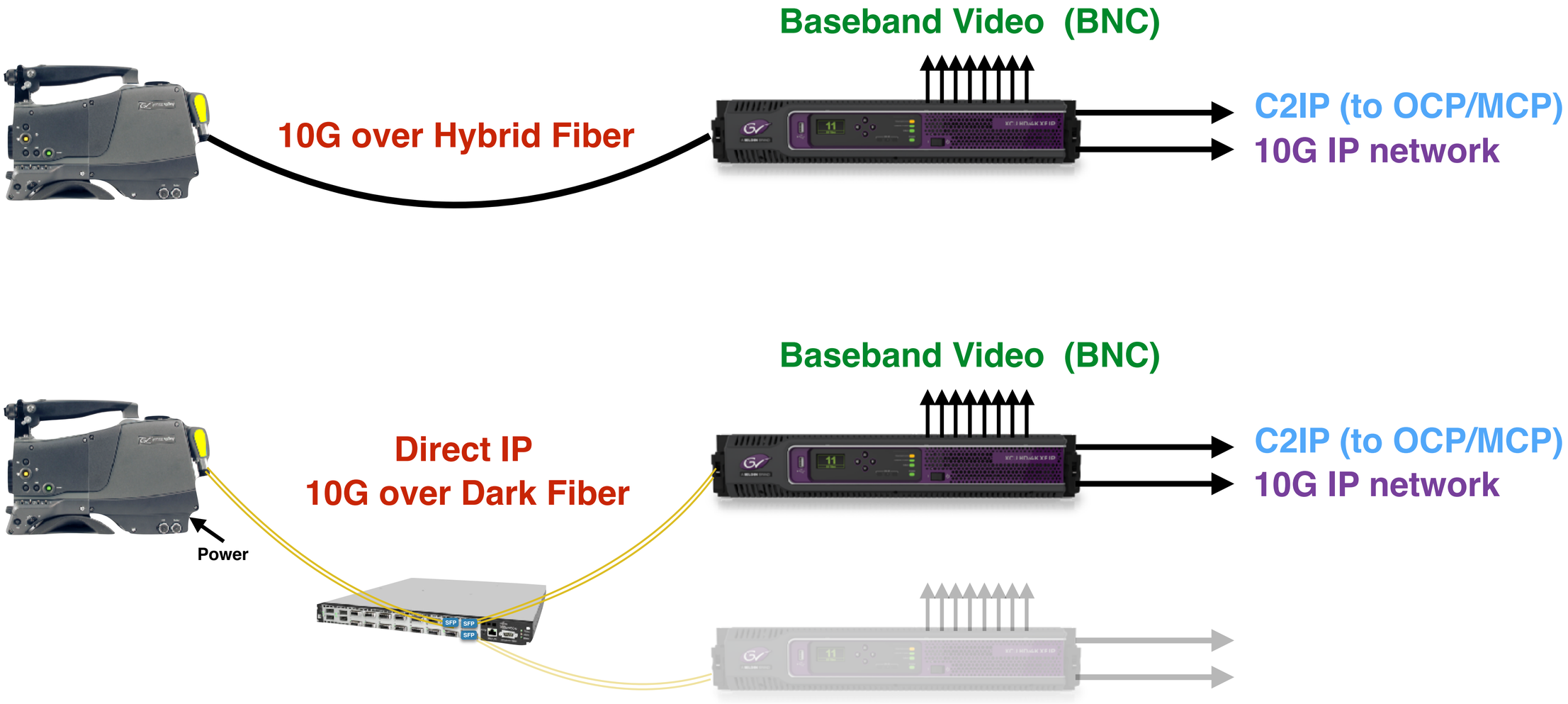
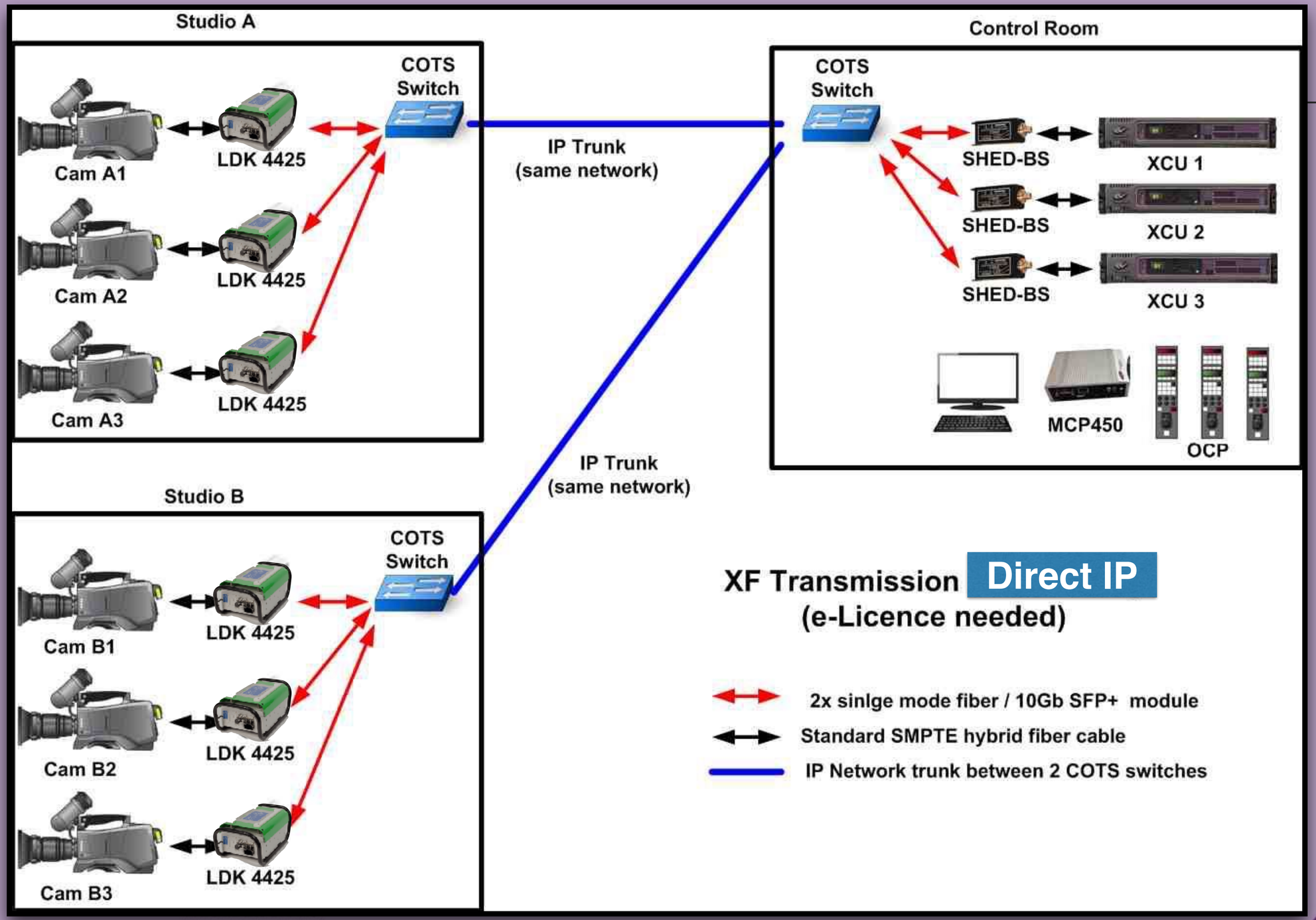
IP

XCU IP – C2IP connection via external IP network



Camera link to XCU

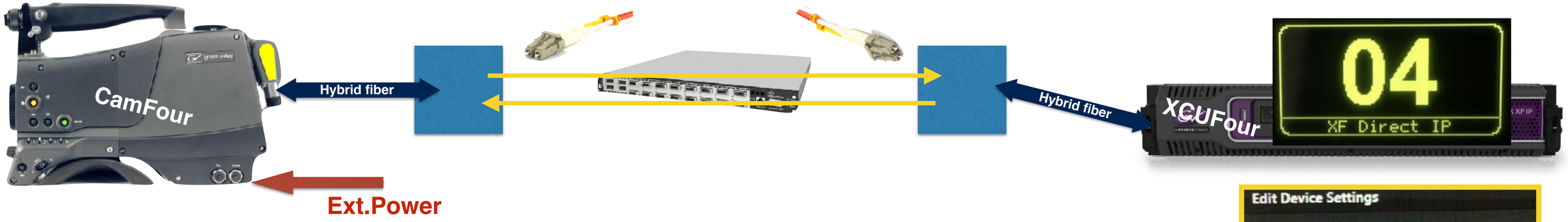


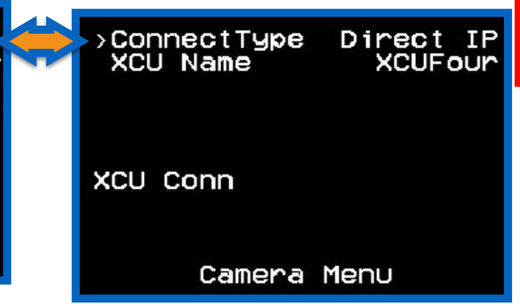


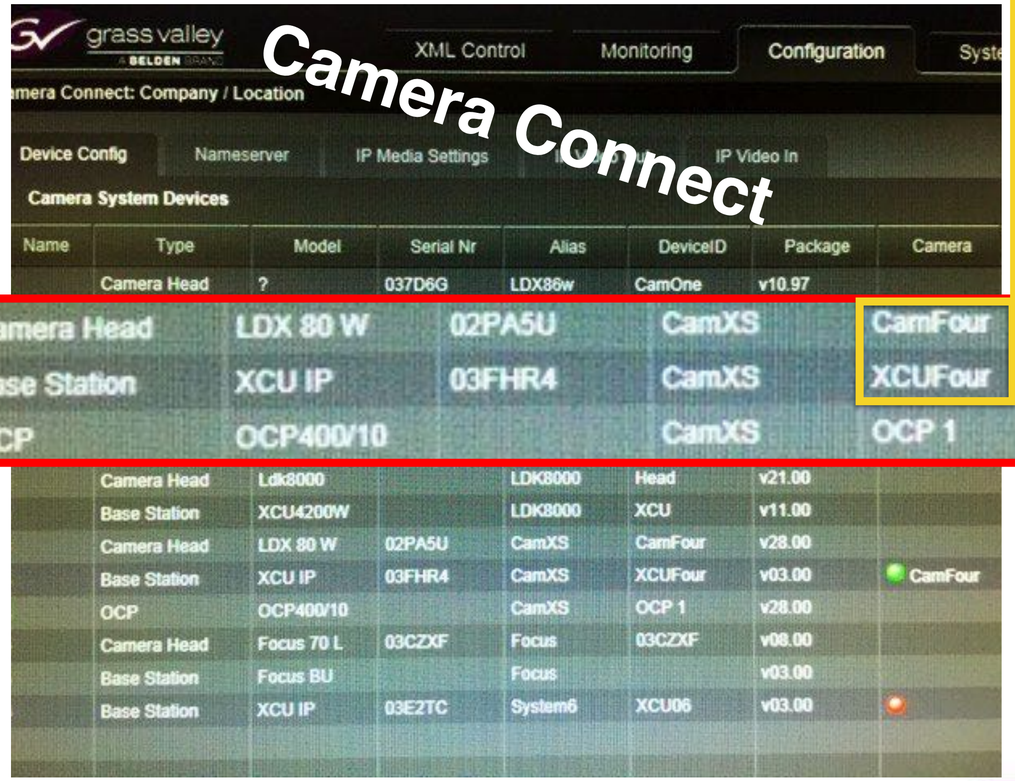
IP Trunk

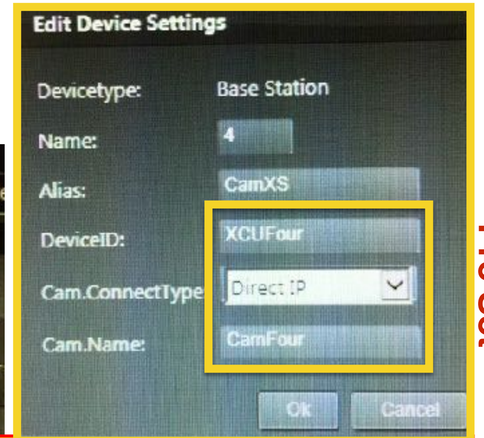
Example DutchView

XCU IP Direct









Pre Set

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IP

SMPTE 2022 standards

ST 2022-1:2007 “Forward Error Correction for Real-Time Video/Audio Transport Over IP Networks”
defines row/column FEC (Forward Error Correction) for IP video streams. Along with Section 2, this standard has been widely implemented. Row/Column FEC works by grouping IP video packets into logical rows and columns, and then appending one FEC packet to each row and each column. In the event that one packet is lost from a row or a column, the data in that packet can be perfectly recreated using the contents of the FEC packet in conjunction with the other packets in the row or column. This method works quite well, and allows the packet stream to survive lengthy bursts of lost packets.

ST 2022-2:2007 “Unidirectional Transport of Constant Bit Rate MPEG-2 Transport Streams on IP Networks”
specifies how constant bit rate compressed video signals that are encoded within MPEG-2 transport streams are encapsulated into IP packets. This standard covers the transport layer (RTP and UDP) as well as comments about timing and buffer sizes.

ST 2022-3:2010 “Unidirectional Transport of Variable Bit Rate MPEG-2 Transport Streams on IP Networks”
defines IP packets for variable bit-rate MPEG-2 TS streams that are constrained to have a constant bit rate between PCR messages (called piecewise-constant).

ST 2022-4:2011 “Unidirectional Transport of Non-Piecewise Constant Variable Bit Rate MPEG-2 Streams on IP Networks”
is similar to Section 3, except that it removes the constraint on bit rates.

ST 2022-5:2012 “Forward Error Correction for High Bit Rate Media Transport Over IP Networks”
expands on Section 1 to allow larger row/column FEC combinations to support signals with bit rates up to 3 Gbps and beyond. A minor revision to this standard is scheduled to be published in 2013 by SMPTE.

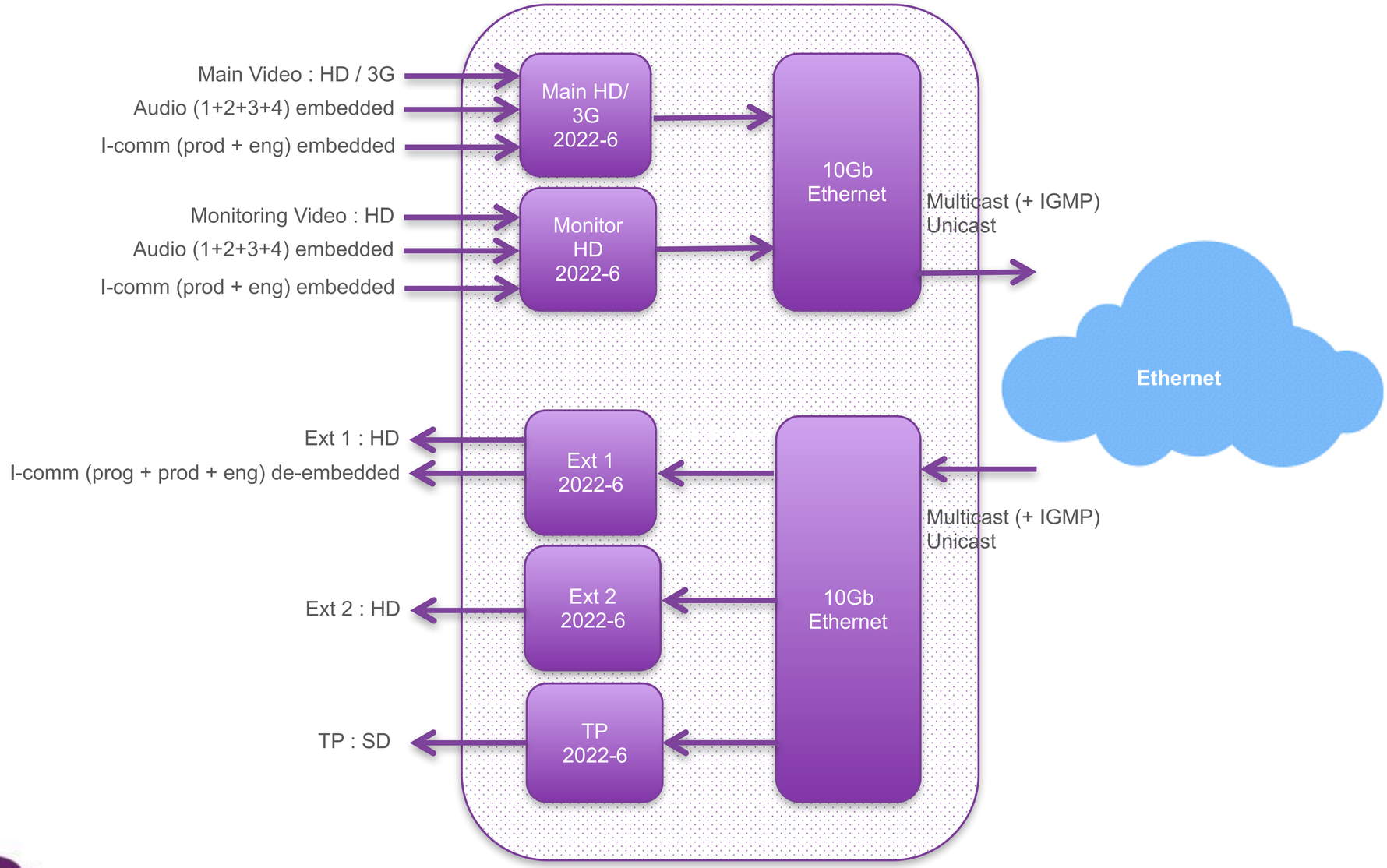
Today

ST 2022-6:2012 “Transport of High Bit Rate Media Signals over IP Networks (HBRMT)”
specifies a way to transport high bit-rate signals (including uncompressed 3 Gbps 1080p video) that are NOT encapsulated in MPEG-2 transport streams.

See UXF-XCU

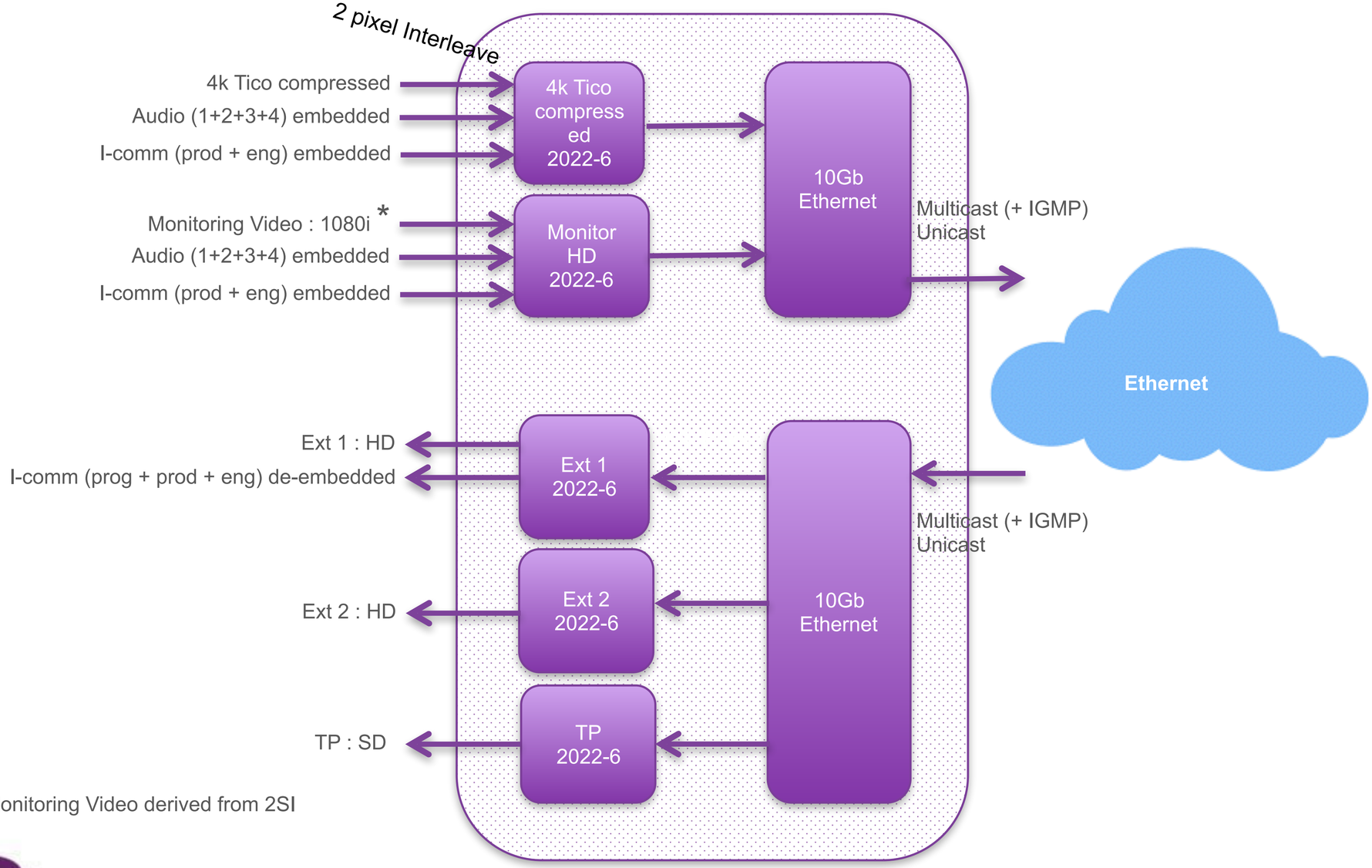
2022-7 (approval pending) “Seamless Protection Switching of SMPTE ST 2022 IP Datagrams”
describes a way to send two matching streams of packets from a source to a destination over different paths, and have the receiver switch automatically between them. This allows a perfect video signal to be reconstructed at the receiver as long as both paths do not fail simultaneously.

XCU IP – Streams (HD) Uncompressed



IP timing can be delayed / advanced with respect to the main Gen-lock (BNC)

XCU IP – Streams (4K) TICO Compressed



* : 1080i Monitoring Video derived from 2SI

IP timing can be delayed / advanced with respect to the main Gen-lock (BNC)

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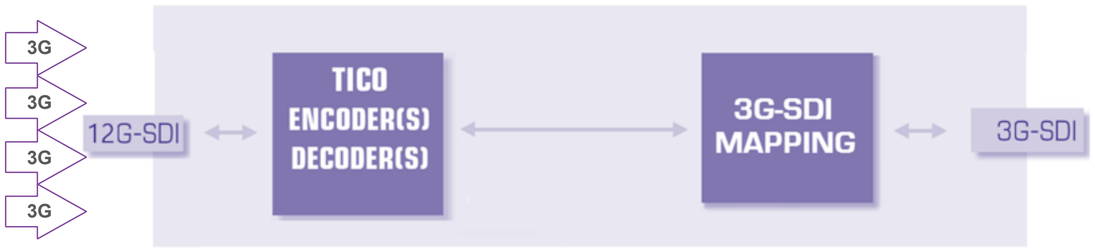
IP

XCU IP – Streams (4K)

4K 50/59 p over a single 3G-SDI



2 sample interleave

IP

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IP XCU 10G Fiber (basics)

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XCU HD/4K IP – Connections (Fiber or Coax)

Switch
or
Router

10G Base network

XF Fiber =>

10GBase-CX1/10GBase-CU:

10GBase-SR:

10GBase-LR:

Passive
Dark Fiber
Single mode or Multi mode

XF Fiber
Hybrid

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XCU HD/4K IP – Connections

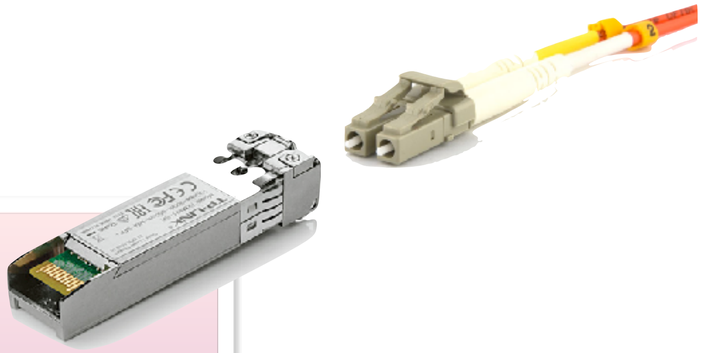
10GBase-CX1/10GBase-CU:
Passive Copper cable with on both sides SFP+interface
Length max 7 meters (specified < 5m)
Details visible in I2C (type,lenght)

Used for short connections
Used inside XCU (from Muxboard to Output)

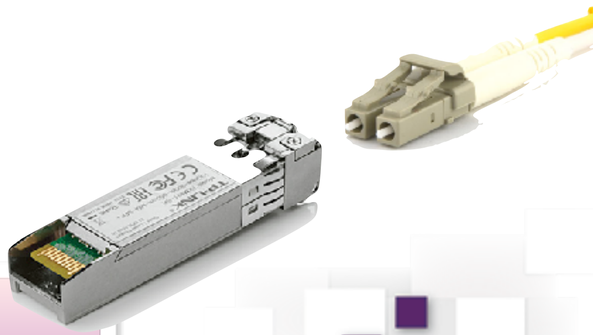
10GBase-SR:
Multi-mode, 850 nm optische transceivers.
Two versions:

1 **SFP+ module**, placed in a SFP+ cage (in XCU) and then connect with LC fiber cables to Multimode transceiver in a switch
Take Care! It important to use matching optical wavelengths
OM3 recommend

2 **AOC: Active optical cable**.
Here both Optical Receivers and Transceivers are integrated in a case assembly.



10GBase-LR:
Single-mode 1310nm optical transceivers also used in our LDX fiber transmission



IP

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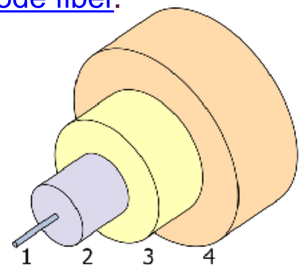
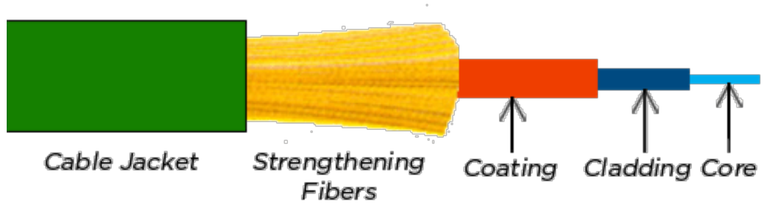
XCU HD/4K IP Multi-Mode Vs. Single Mode Fiber

The structure of a typical single-mode fiber.

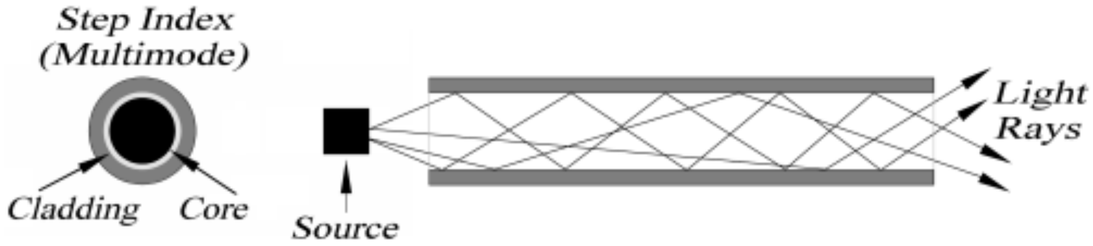
1. Core 8 µm diameter
2. Cladding 125 µm dia.
3. Buffer 250 µm dia.
4. Jacket 400 µm dia.





Multi-Mode Fiber

62.5 Micron
50 Micron



Single Mode Fiber

8 Micron
The thickness of a human hair

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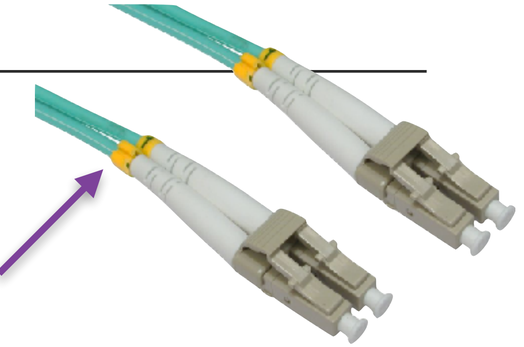
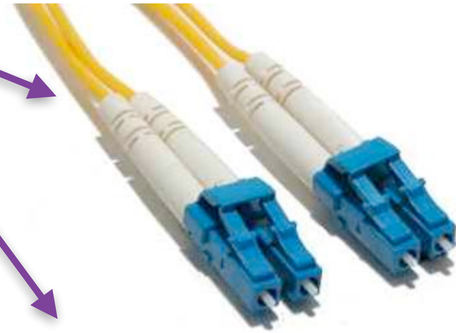
XCU HD/4K IP Cable Colors

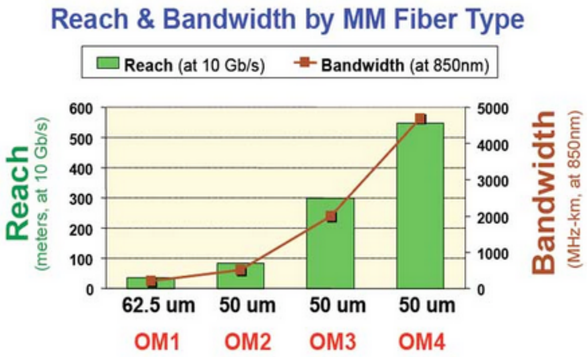
Color	Type	Application (connections may by through patch panels)	
Aqua	OM3 fiber	LAN/SAN device to device	MultiMode 850nm
Yellow OS1/OS2	Single Mode Fiber	LAN/SAN device to device over long distance	SingleMode 1310nm
Orange	OM1 or OM2 fiber	LAN/SAN device to device	MultiMode 850nm





Cable Type	Color	
Multimode 50 µm and 62.5 µm (OM1, OM2)	Orange	
Multimode 50 µm, laser optimized (OM3)	Aqua	
Single-mode (OS1/OS2)	Yellow	

Reach and modal bandwidth



Transmission Standards (core/cladding size µm)		Jacket Color (non-military)	Jacket Color (military)
Multimode	100 / 140 µm	Orange	Green
OM1	62.5 / 125 µm	Orange	Slate
OM2	50 / 125 µm	Orange	Orange
OM3	50 / 125 µm	Aqua	N/a
OM4	50 / 125 µm	Aqua	N/a
OS1	~8-10 / 125 µm	Yellow	Yellow
OS2	~8-10 / 125 µm	Yellow	Yellow

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XCU HD/4K IP – Connections

SFP+ modules *Small Form Factor*

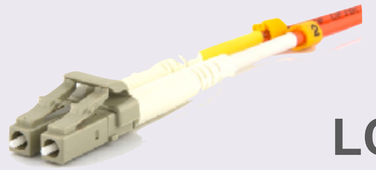
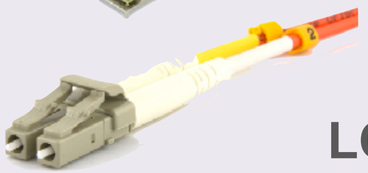
Integrated I2C functionality
with following details:

- **Type number**
- **Light indication (yes/no)**
- **Send and Receive power level**
- **Temperature**

Most SFP+ modules use transceivers with less then 1 Watt (Power level II)

SFP+ module maximum power consumption shall meet one of the following power classes:
Power Level I modules - Up to 1.0 W
Power Level II modules - Up to 1.5 W
Power Level III modules - Up to 2.0 W

XCU HD/4K IP – Connections

	optical freq.	XCU inside SFP+ Case	Interface	Cable
Passive Copper	low power			 SFP+
Fiber MultiMode SFP+ module	850nm		 SFP+	 LC
Fiber MultiMode Active Optical Case	850nm			 AOC
Fiber SingleMode also in LDX fiber	1310nm (10km)		 SFP+	 LC

IP

IP XCU 10G Fiber (basics)

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- XCU IP connections
- **IP basics + Test**
- Settings with MCP450

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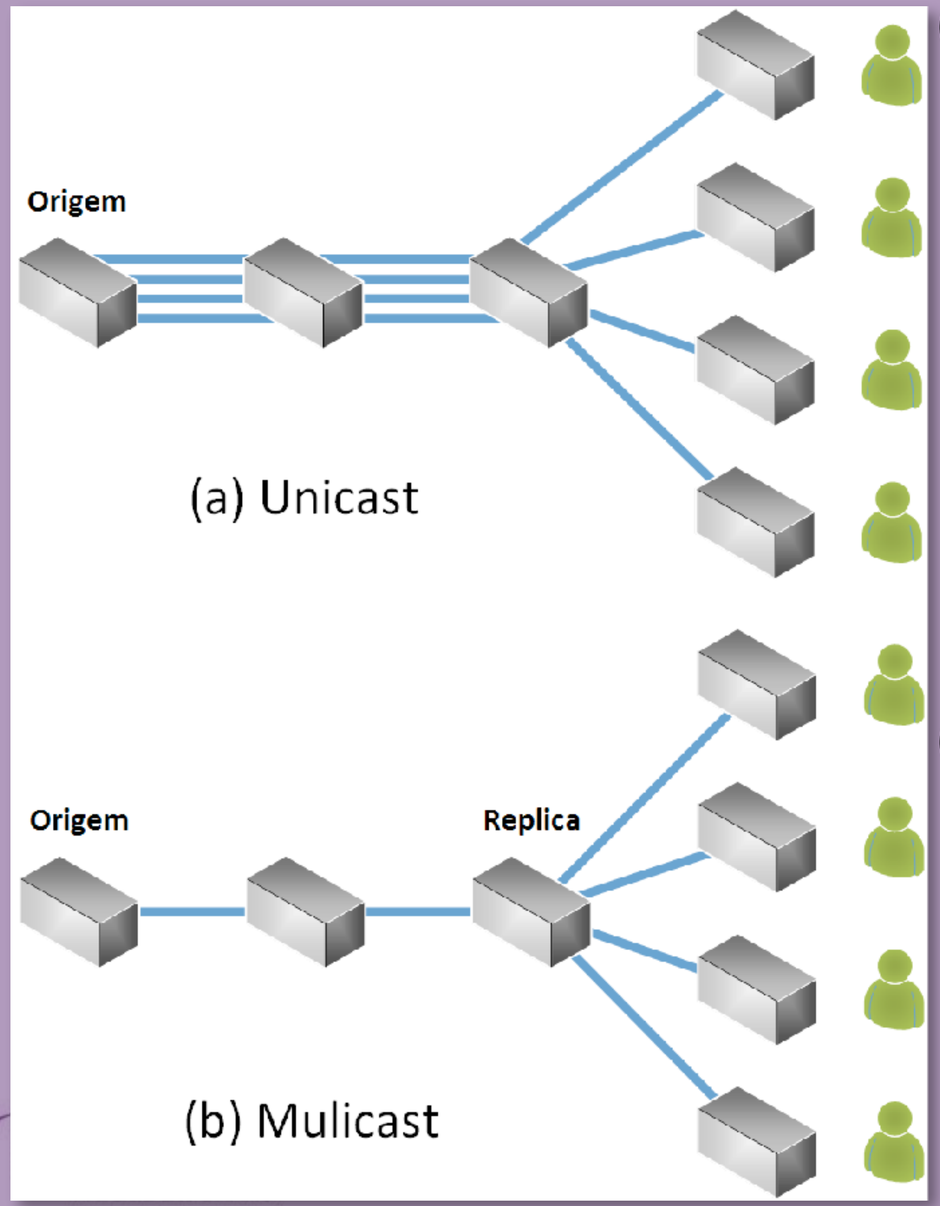
XCU HD/4K IP – Settings Explained



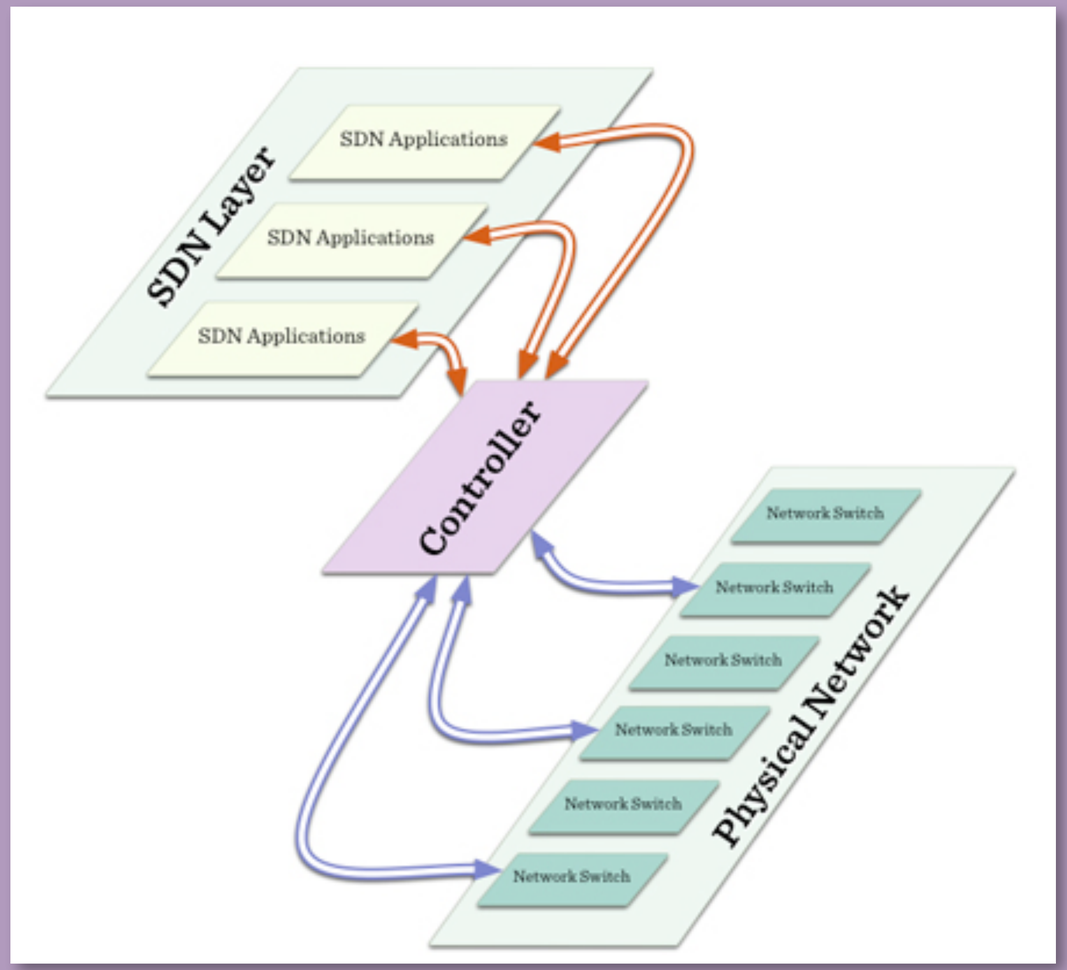
(a) Unicast is the term used to describe communication where a piece of information is sent from one point to another point.
In this case there is just one sender, and one receiver.

Broadcast is the term used to describe communication where a piece of information is sent from one point to all other points. In this case there is just one sender, but the information is sent to all connected receivers.

(b) Multicast is the term used to describe communication where a piece of information is sent from one or more points to a set of other points. In this case there is may be one or more senders, and the information is distributed to a set of receivers (there may be no receivers, or any other number of receivers).

IP

XCU HD/4K IP – Settings Explained



Software-defined networking (SDN)
is an approach to computer networking that allows network administrators to manage network services through abstraction of higher-level functionality

not *yet* used this moment in GV products

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IP

XCU HD/4K IP – Settings

TEST Before connection to the world !

With 2x IP XCU

Set IP STEP 1

Set IP STEP 2

IP adress 10.11.5.51
SubnMask 255.255.252.0
Default GW 10.11.5.1

Main Video 10.11.5.54 port 1000
Mon Video 10.11.5.54 port 1001
Ext 1 port 1000
Ext 2 port 1001

IP adress 10.11.5.54
SubnMask 255.255.252.0
Default GW 10.11.5.1

Main Video 10.11.5.51 port 1000
Mon Video 10.11.5.51 port 1001
Ext 1 port 1000
Ext 2 port 1001

< IP Stream >
package

Main Video 10.11.5.54:1000
Mon Video 10.11.5.54:1001
10.11.5.51

Ext 1 port 1000
Ext 2 port 1001
TP not used
10.11.5.51

Main Video 10.11.5.51:1000
Mon Video 10.11.5.51:1001
10.11.5.54

Ext 1 port 1000
Ext 2 port 1001
TP not used
10.11.5.54

This is an example to test the system. 2x IP XCU needed. All setting in UNICAST

IP

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See setup with MCP 450 on next pages

XCU HD/4K IP – Settings

TEST Before connection to the world !

With 1 IP XCU

Set IP
STEP 1

Set IP
STEP 2

IP adress 10.11.5.51
SubnMask 255.255.252.0
Default GW 10.11.5.1

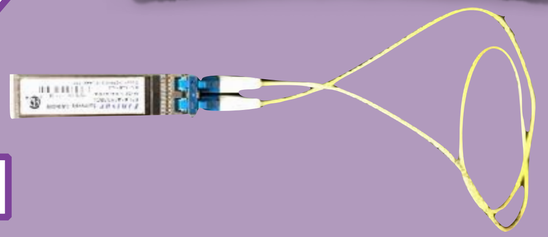
Main Video 10.11.5.51 port 1000
Mon Video 10.11.5.51 port 1001
Ext 1 port 1000
Ext 2 port 1001

< IP Stream >
package

Main Video | Mon Video
10.11.5.51:1000 | 10.11.5.51:1001
10.11.5.51

Ext 1 | Ext 2 | TP
port 1000 | port 1001 | not used
10.11.5.51

This is an example to test the system.
1 IP XCU needed.
All setting in UNICAST



See setup with MCP 450 on next pages

All IP UniCast

10.11.**5**.1 XCU
10.11.**7**.1 Summit
10.11.**8**.1 Kframe

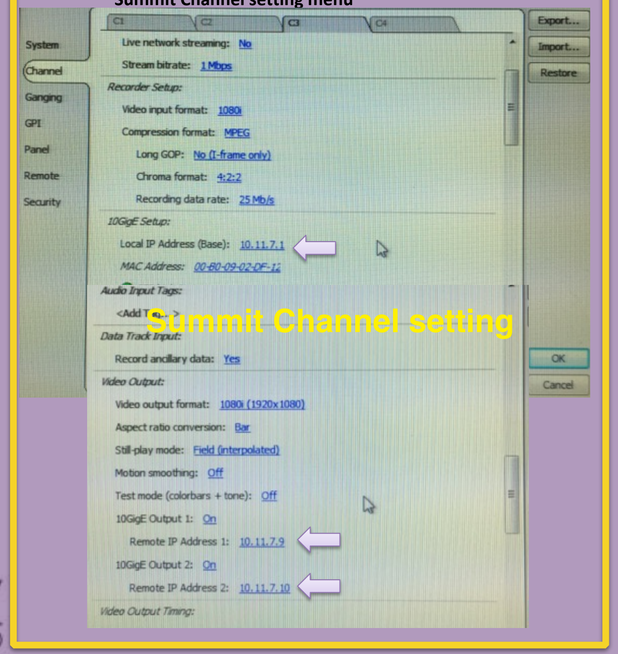



INPUTS XCU IP	OUTPUTS XCU IP	MCP 450 Camera connect			fiber link	INPUTS KFRAME	OUTPUTS KFRAME			
							Modulair I/O		*Config I/O Kframe*	
		Default GateWay	Sent IP	port				Local IP	Recieve IP	port
	Cam 4 Main Video	10.11.5.1	10.11.8.4	1000	→	M5 (IP)		10.11.8.1	10.11.8.4	1000
	Cam 4 Mon Video	10.11.5.1	10.11.8.4	1001		M6 (IP)		10.11.8.1	10.11.8.4	1001
Cam 4 Ext 1		auto	auto	1000	←		your choise	10.11.8.1	10.11.5.4	1000
Cam 4 Ext 2		auto	auto	1001			your choise	10.11.8.1	10.11.5.4	1001
	Cam 6 Main Video	10.11.5.1	10.11.8.6	1000	→	M7 (IP)		10.11.8.1	10.11.8.6	1000
	Cam 6 Mon Video	10.11.5.1	10.11.8.6	1001		M8 (IP)		10.11.8.1	10.11.8.6	1001
Cam 6 Ext 1		auto	auto	1000	←		your choise	10.11.8.1	10.11.5.6	1000
Cam 6 Ext 2		auto	auto	1001			your choise	10.11.8.1	10.11.5.6	1001

Camera Connect (MCP450)

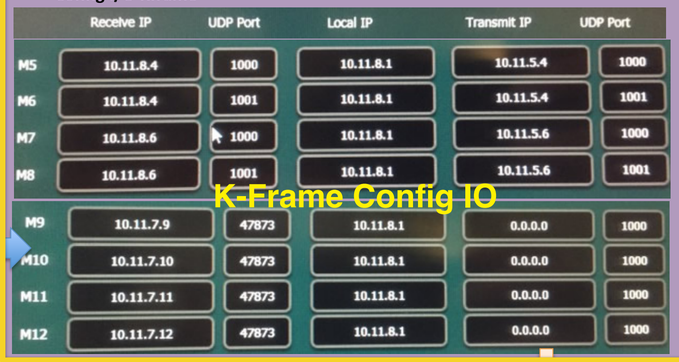
OUTPUTS Summit	Summit Channel settings					
	Local IP	Vid OUT IP				Recieve IP	port
Sum Channel 3	10.11.7.1	10.11.7.9	→	M9 (IP)		10.11.7.9	47873
Sum Channel 3	10.11.7.1	10.11.7.10		M10 (IP)		10.11.7.10	47873
Sum Channel 4	10.11.7.1	10.11.7.11	→	M11 (IP)		10.11.7.11	47873
Sum Channel 4	10.11.7.1	10.11.7.12		M12 (IP)		10.11.7.12	47873

Summit Channel setting menu

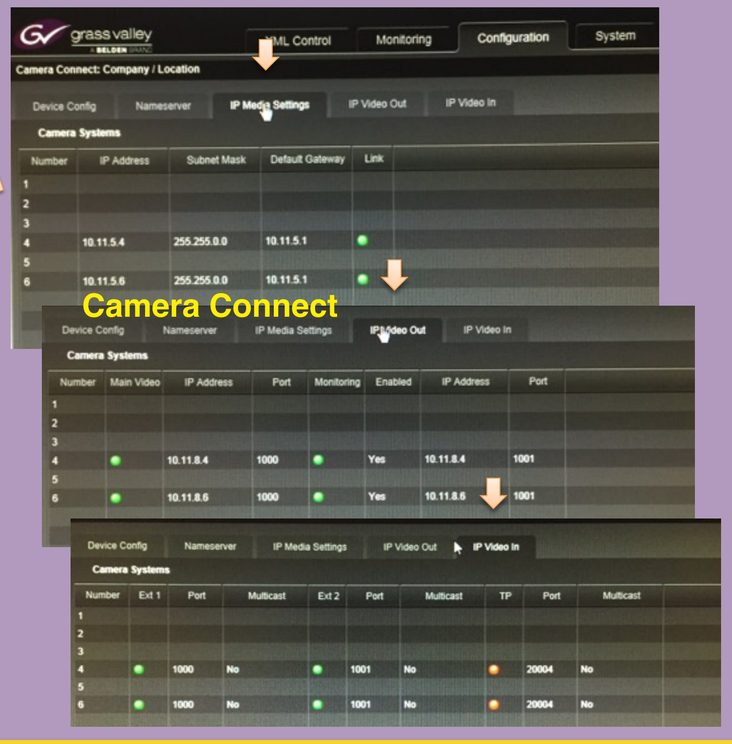


Camera Connect (MCP450)

Config I/O Kframe



MCP 450 Camera Connect CONFIGURATION settings



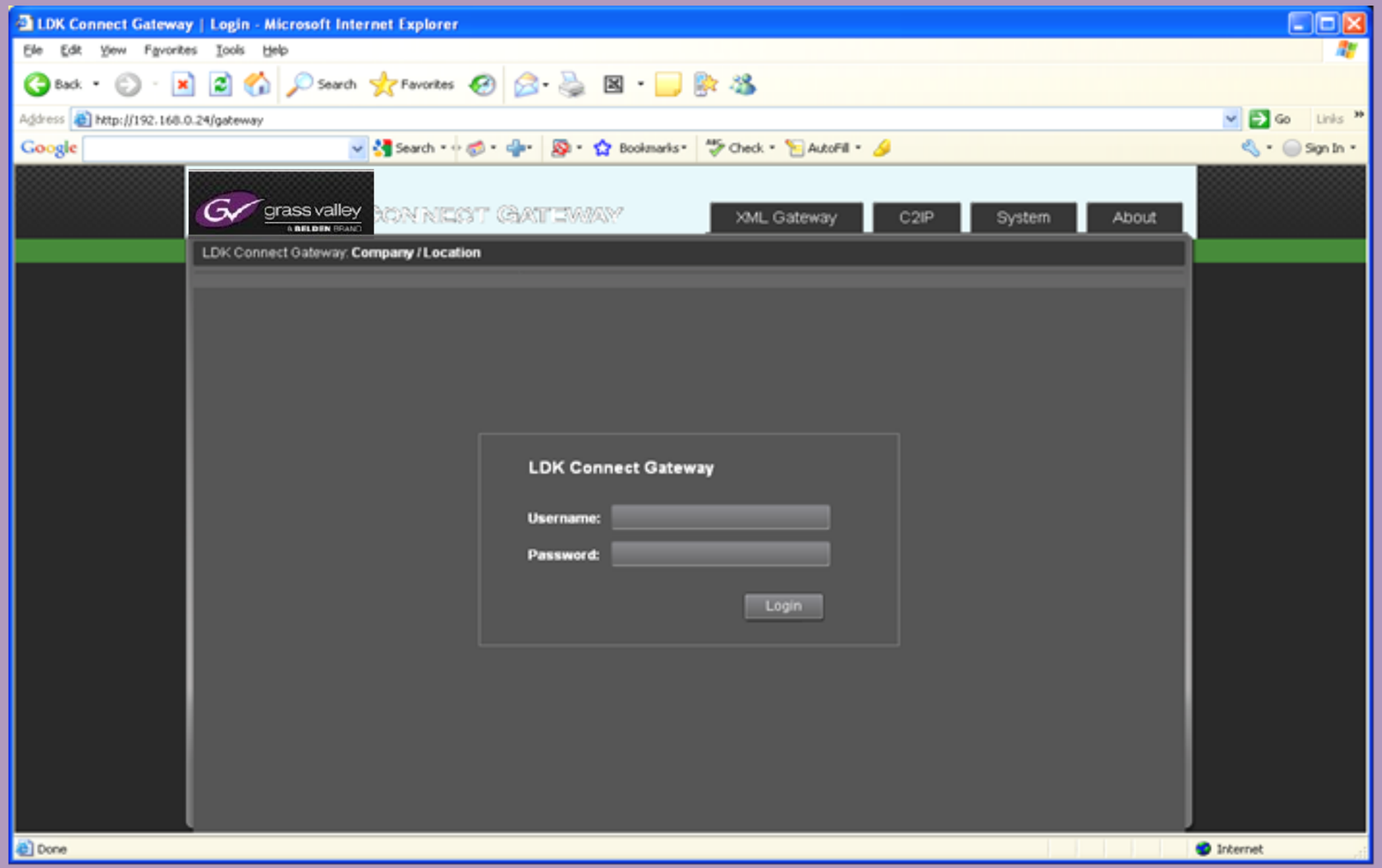
IP XCU 10G Fiber (basics)

This part gives you some more details about the
IP Connection between XCU and the world

In this session:

- IP XCU introduction
- XCU IP connections
- IP basics + test
- **Settings with MCP450**

XCU HD/4K IP – Settings with MCP 450



IP

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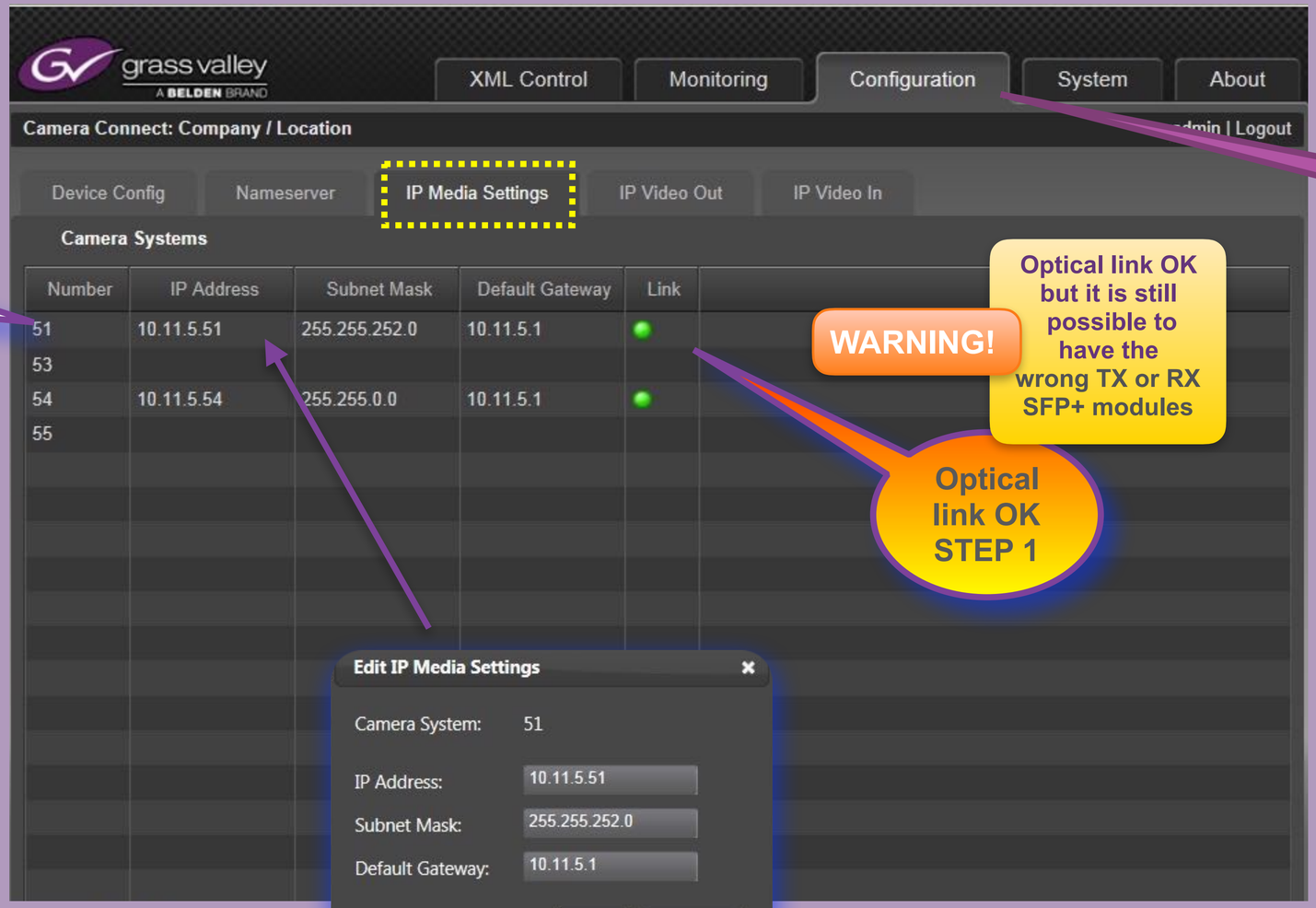
XCU HD/4K IP – Settings with MCP 450



Camera 51 details

Configuration Main IP adress

WARNING!

Optical link OK but it is still possible to have the wrong TX or RX SFP+ modules

Optical link OK STEP 1

IP Range defined by GV for cameras

UniCast 10.11.5.x

MultiCast 224.1.0.x

IP

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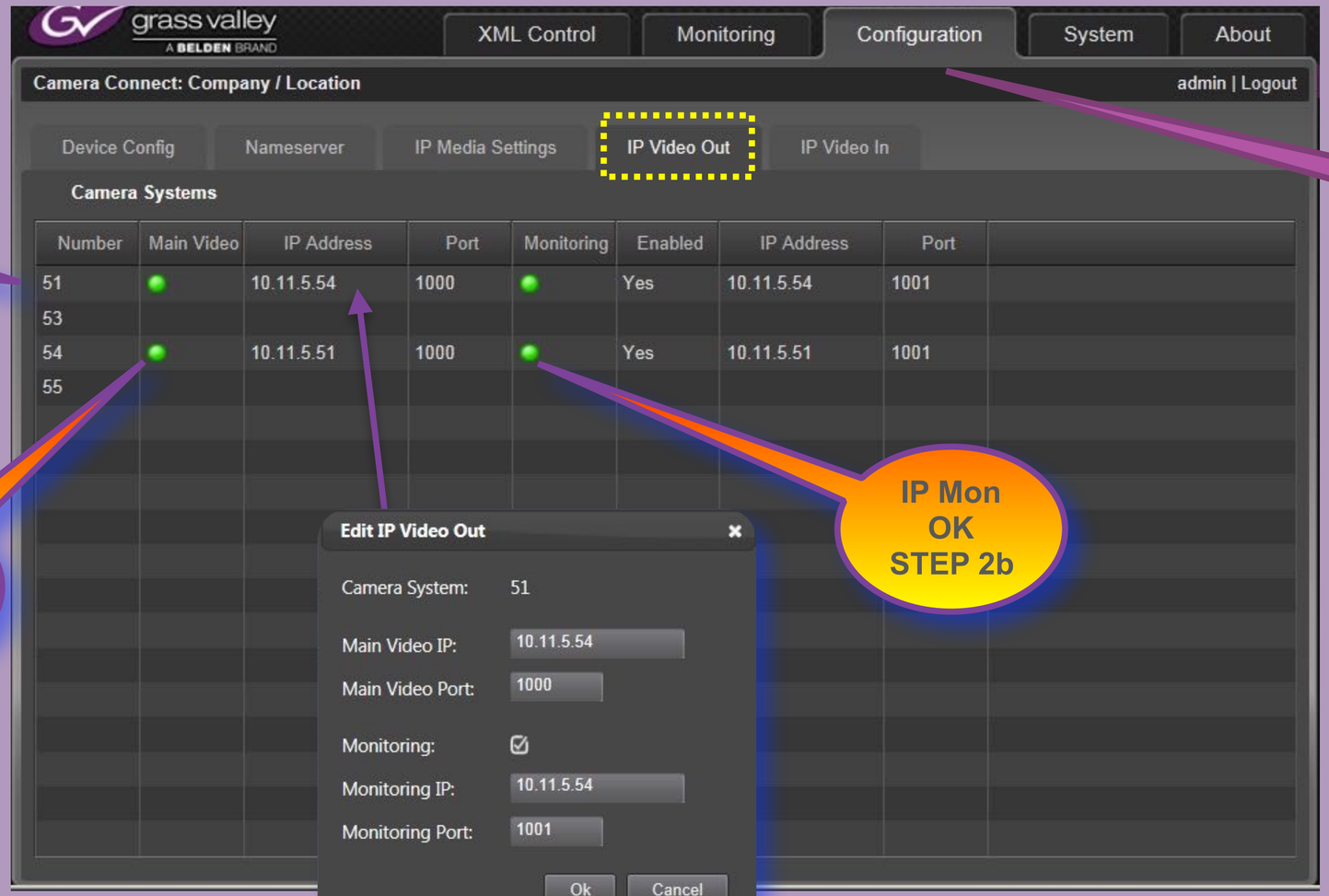
XCU HD/4K IP – Settings with MCP 450



Camera
51 details

Configuration
Main IP adress

IP Main
OK
STEP 2a

IP Mon
OK
STEP 2b

UniCast

IP Range defined by GV for cameras

UniCast 10.11.5.x

MultiCast 224.1.0.x

IP

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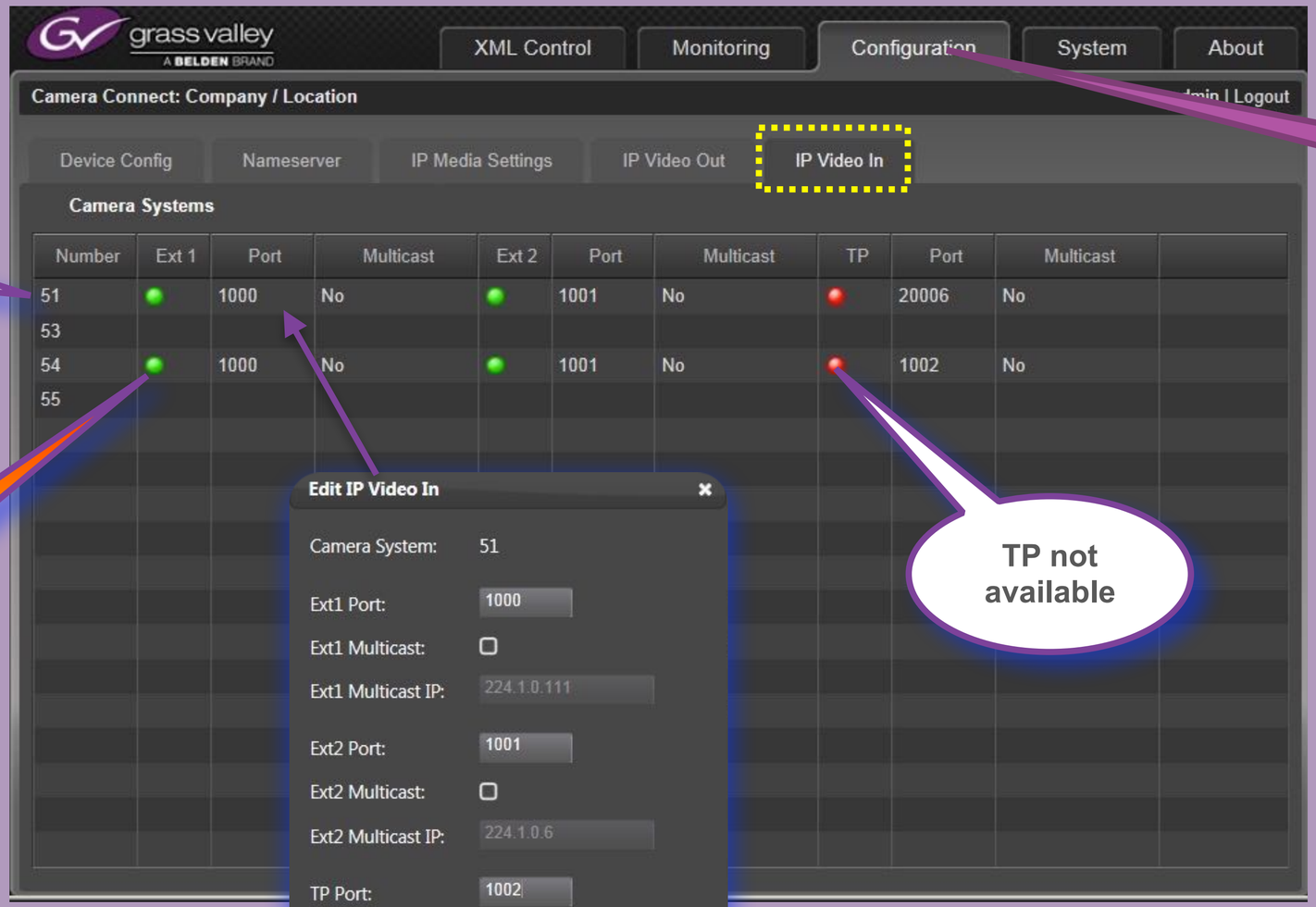
XCU HD/4K IP – Settings with MCP 450



Camera 51 details

IP Ext 1,2 OK STEP 3

TP not available

Configuration Poort settings

IP Range defined by GV for cameras

UniCast 10.11.5.x

MultiCast 224.1.0.x

IP

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IP XCU 10G Fiber (basics)

This part gives you some more details about the
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- IP basics + test
- Settings with Menu XCU

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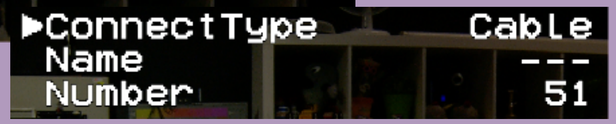
XCU HD/4K IP – Settings with Menu XCU



Cable is Standard
Network is (DutchView)

Standard (Cable)

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IP

XCU HD/4K IP – Settings with Menu XCU

Cable is Standard
Network is (DutchView)

DutchView (Network)

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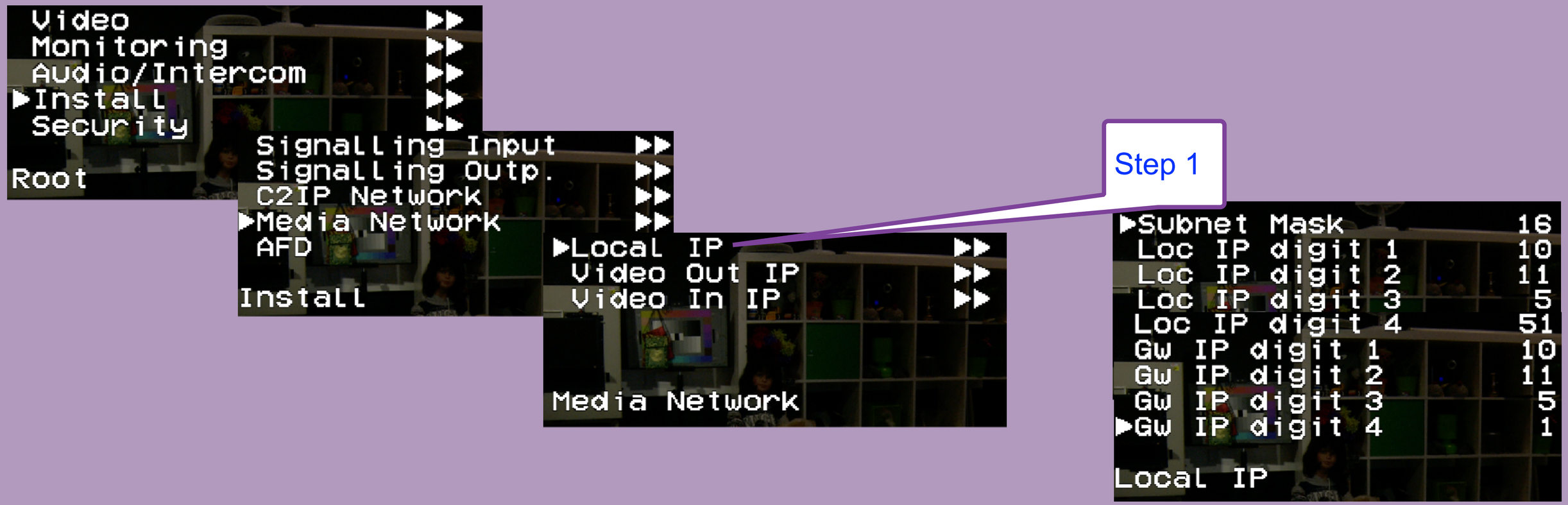
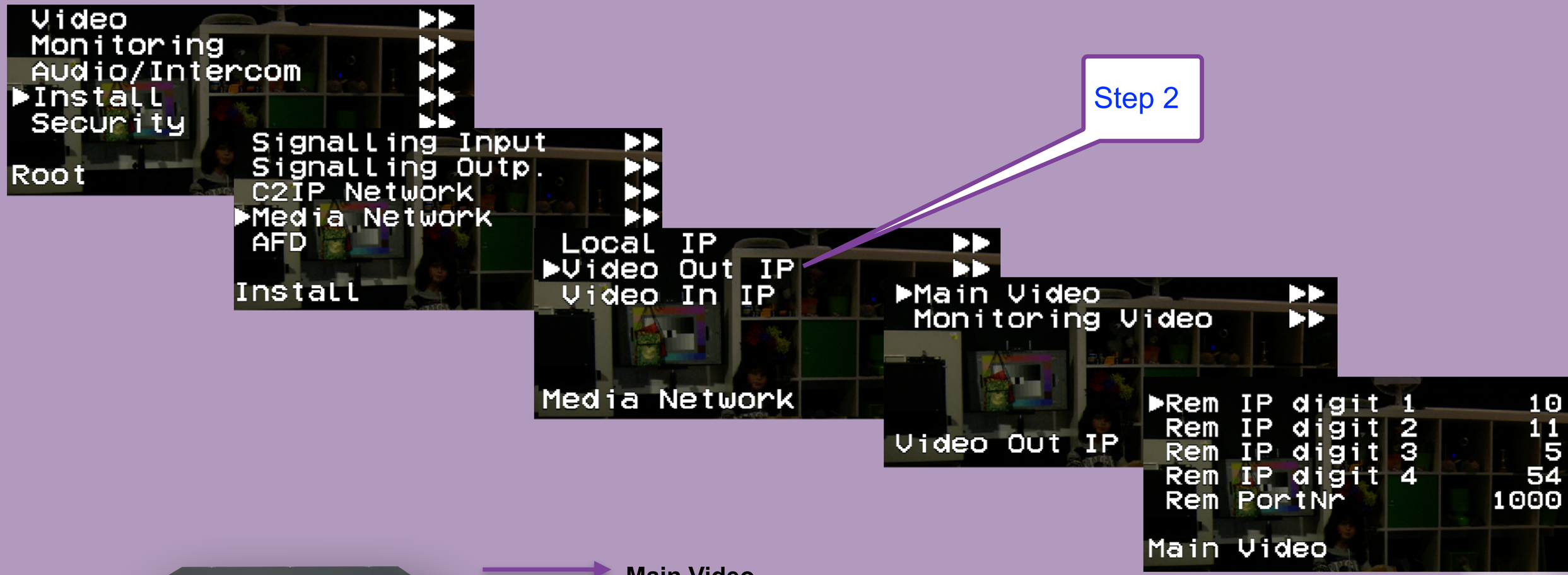
IP

XCU HD/4K IP – Settings with Menu XCU



XCU HD/4K IP – Settings with Menu XCU



Main Video

Monitoring Video

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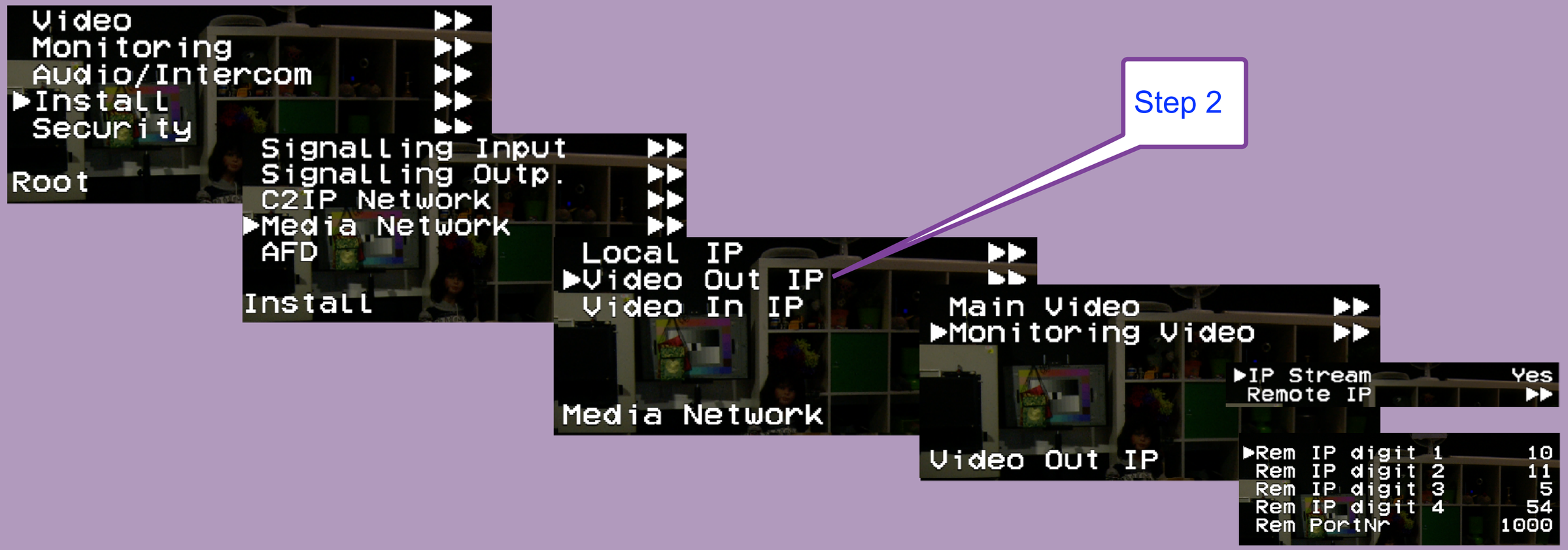
IP

XCU HD/4K IP – Settings with Menu XCU



→ Main Video

→ Monitoring Video

IP

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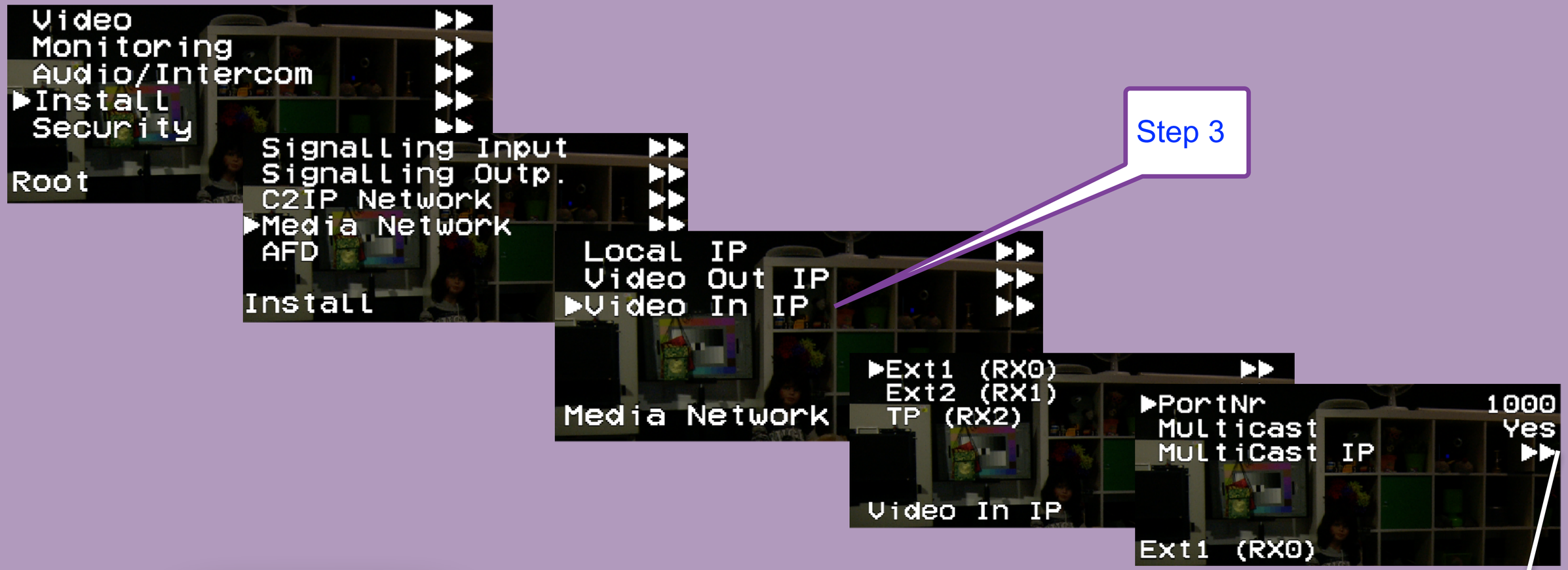
XCU HD/4K IP – Settings with Menu XCU



Ext 1 Video

Ext 2 Video

TP

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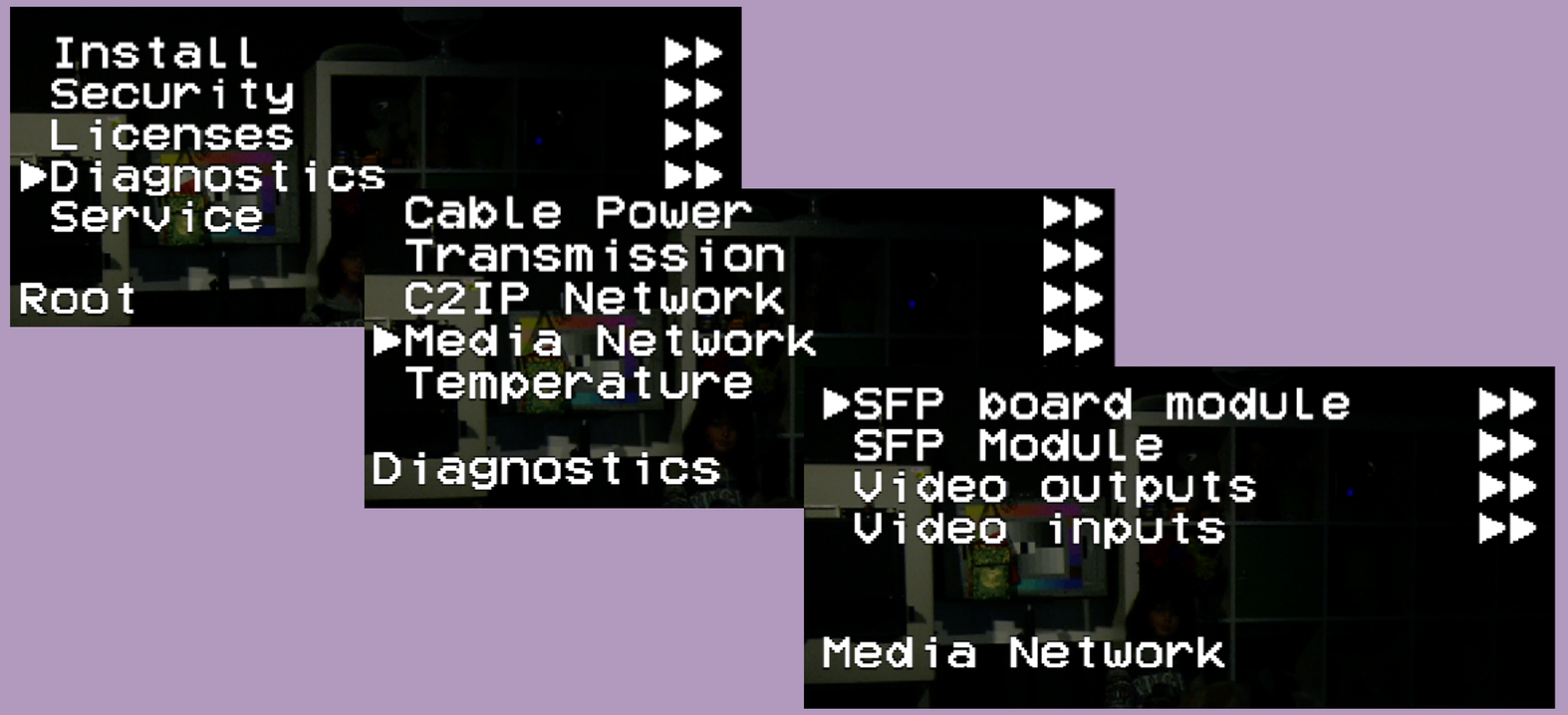
XCU HD/4K IP – Settings with Menu XCU



→ Details FSP modules

→ Details Video In/Out

IP

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IP XCU 10G Fiber (basics)

This part gives you some more details about the IP Connection between XCU and the world

In this session:

- IP XCU introduction
- XCU IP connections
- IP basics + test
- Settings with MCP450
- **XCU New**

IP

Grass Valley Cameras
XCU UXF details

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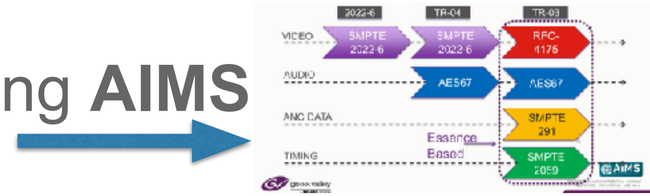
New IP XCU : Why ?

- Market is moving towards IP-solutions in LIVE-broadcast
  - Evertz is pushing **ASPEN** ; Sony is pushing **NMI** ; GV is pushing **AIMS**
  - Last 2 years ; Many POC's with different standards



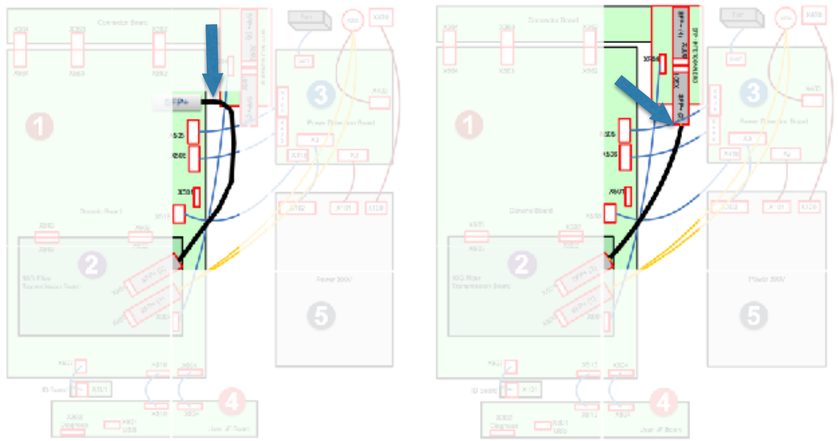
- ☑ All broadcast companies feel the need to cooperate on one standard
- ☑ **SMPTE 2110** will (AIMS) be the new IP standard for LIVE broadcast

- HD/4k XF IP XCU (Today's IP XCU ; supporting 86 / 86N)
- ☑ First OB's / studio's equiped with HD/4k XF IP XCU (ArenaTV / BCE / etc.)
- ☑ 4k demand is increasing (e.g. Sky is pushing the market)
- ☑ HD/4k XF IP XCU supports 2022-6 standard……..

but…….

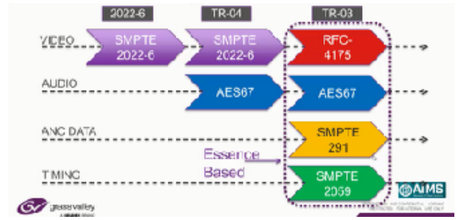
New IP XCU : Why ?

- HD/4k XF IP XCU is GREAT today but has
  HW/SW limitations for future IP-demands



no 4K BNC =>
HS and HDR limitations

- New XCU development should support ;
  - ☑ “UNIVERSE” functionality over IP (and SDI, inc. Redundancy, PTP, etc.)
  - ☑ Support of SMPTE 2110 (AIMS roadmap)
  - ☑ New Cradle (inc. 4x10Gb ports, backwards compatible)



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Introduction plan

NAB ‘17

- ☑ 1x Universe UXF XCU
  - UNIVERSE functionality(SDI) + IP support* (SMPTE2110)

XCU UNIVERSE UXF
XF FIBER

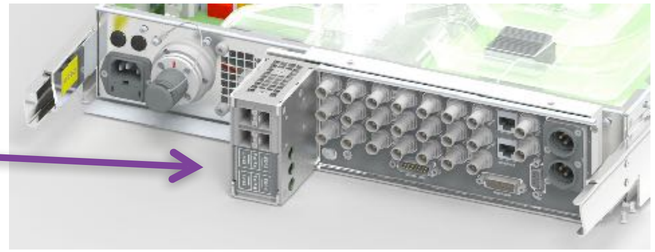
- ☑ 1x Enterprise UXF XCU
  - All Single Speed video formats (SDI) + IP support* (SMPTE2110)

XCU ENTERPRISE UXF
XF FIBER

- ☑ 1x Cradle UXF
  - Current Cradle + 4x 10Gb IP ports

HW available at introduction with TR04+

* SW Increment plan to implement full SMPTE2110



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Differences UNIVERSE <-> UNIVERSE UXF

UNIVERSE

- Full SDI connectivity
- HD/3G/4K/HDR/HS/XS support
- Direct IP support (XF Fiber)
- Cradle

UNIVERSE UXF

- Full SDI connectivity
- HD/3G/4K/HDR/HS/XS support
- Direct IP support (XF Fiber)
- Cradle including 4x10Gb IP ports
- Full IP for HD/3G/4K/HDR/HS/XS
- Full IP for Audio
- Full IP for Intercom
- PTP
- Redundancy (2x 10Gb ports)
- SMPTE2110 support*

* SW Increment plan to implement full SMPTE2110

Differences HD/4k XF IP <-> ENTERPRISE UXF

HD/4k XF IP

ENTERPRISE UXF

- Limited SDI connectivity
- HD/3G/4K/HDR support
- Direct IP support (XF Fiber)
- Cradle (Separate 1x10Gb IP port)
- Limited IP for HD/3G/4K/HDR (2022-6)
- Embedded Audio over IP (2022-6)
- Embedded I-comm over IP (2022-6)
- No PTP (BNC ref.)
- No Redundancy

- Full SDI connectivity
- HD/3G/4K/HDR support
- Direct IP support (XF Fiber)
- Cradle including 4x10Gb IP ports
- Full IP for HD/3G/4K/HDR (2110*)
- Full IP for Audio (2110*)
- Full IP for Intercom (2110*)
- PTP (2059*)
- Redundancy* (2x 10Gb ports)
- SMPTE2110 support*

* SW Increment plan to implement full SMPTE2110

Introduction plan

NAB ‘17

UNIVERSE

Phase out

Intro

UNIVERSE UXF

new

Cradle

Remains available
for 3G Fiber/Triax

Cradle UXF

Intro

new

HD/4k XF IP

Phase out

Intro

ENTERPRISE UXF

new

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Camera Support

XF Fiber

ENTERPRISE UXF

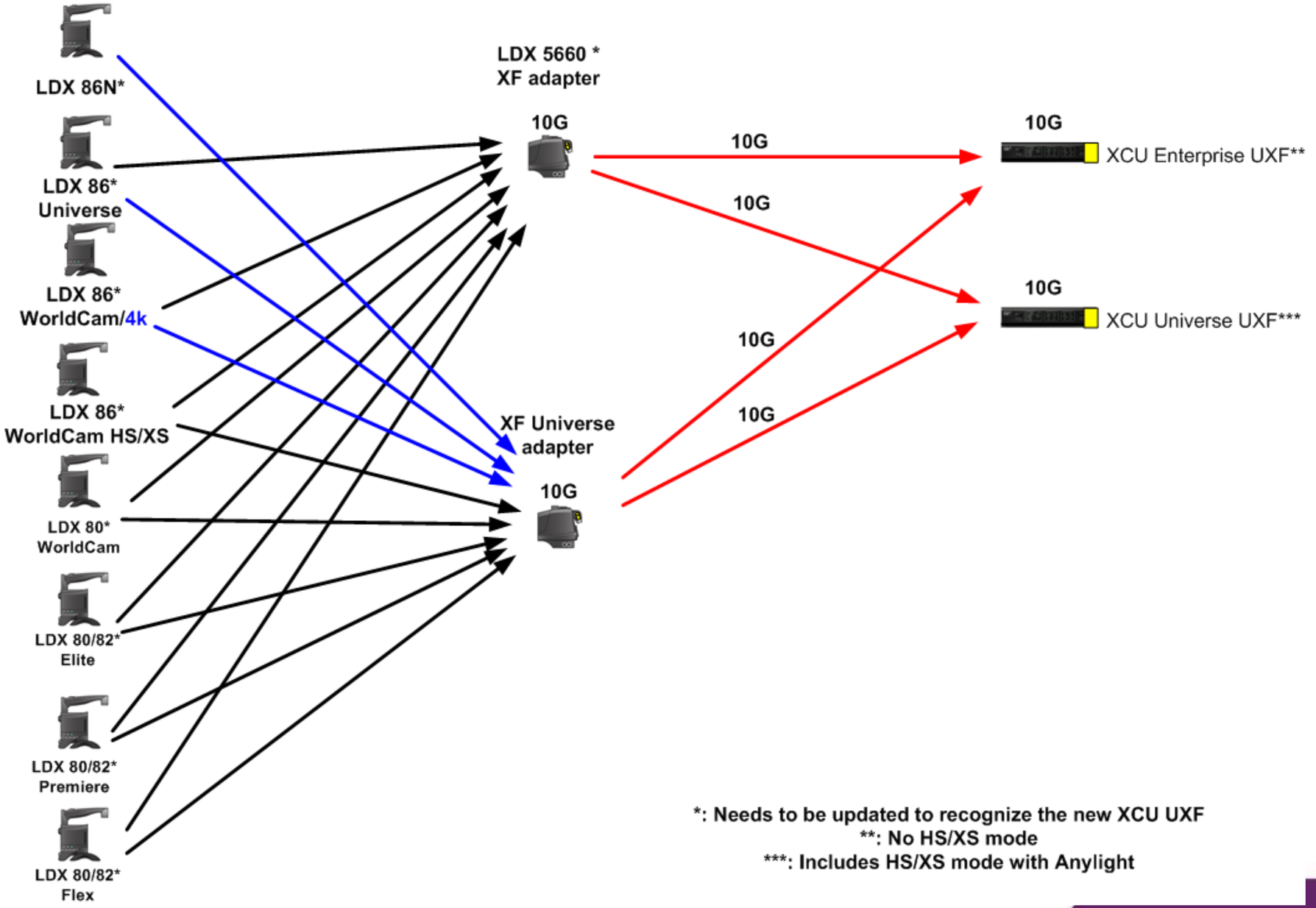
UNIVERSE UXF

LDX86 + UNIVERSE adapter
LDX86N + UNIVERSE adapter
LDX80/82 + UNIVERSE adapter

- XF fiber transmission is supported by ;
  - UNIVERSE adapter
  - ENTERPRISE UXF XCU
  - UNIVERSE UXF XCU

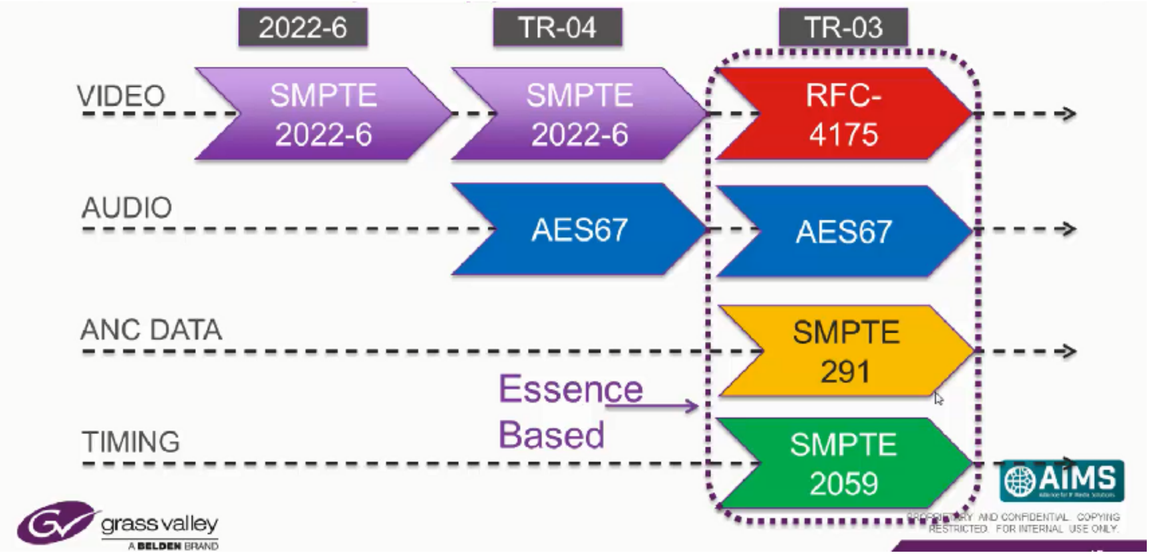
XF Fiber transmission supports video formats ; HD/3G/4K/HDR/HD-HS/HD-XS

Camera interoperability with the XCU UXF



Features / Benefits

- Support all “UNIVERSE” video formats
- Full Hybrid XCU (SDI and IP)
  - Creating Maximum Production Flexibility, Safe Transition from SDI to IP
- Supporting SMPTE2110
  - Interoperability over IP with other brands secured (AIMS roadmap)
- New Cradle (inc. 4x10Gb SFP+ ports)
  - Backwards compatible
  - Redundancy
- XF Fiber transmission (cam-xcu)
  - Support of Direct IP



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How to find out what's is the new Cradle

Special ridge for New Cradle

☑ **New Cradle (front view)**
- Text inside (left/right)
- Mechanical changes
-

☑ **New Cradle (back view)**
- LED lights
- SFP docking
- Text colours (see Densite rack)
  - Orange = 3G SDI
  - Blue Ring = Analog

☑ **SFP** bay with **4 SFP slots**
-

Compatibility **OLD <=> NEW** see next page

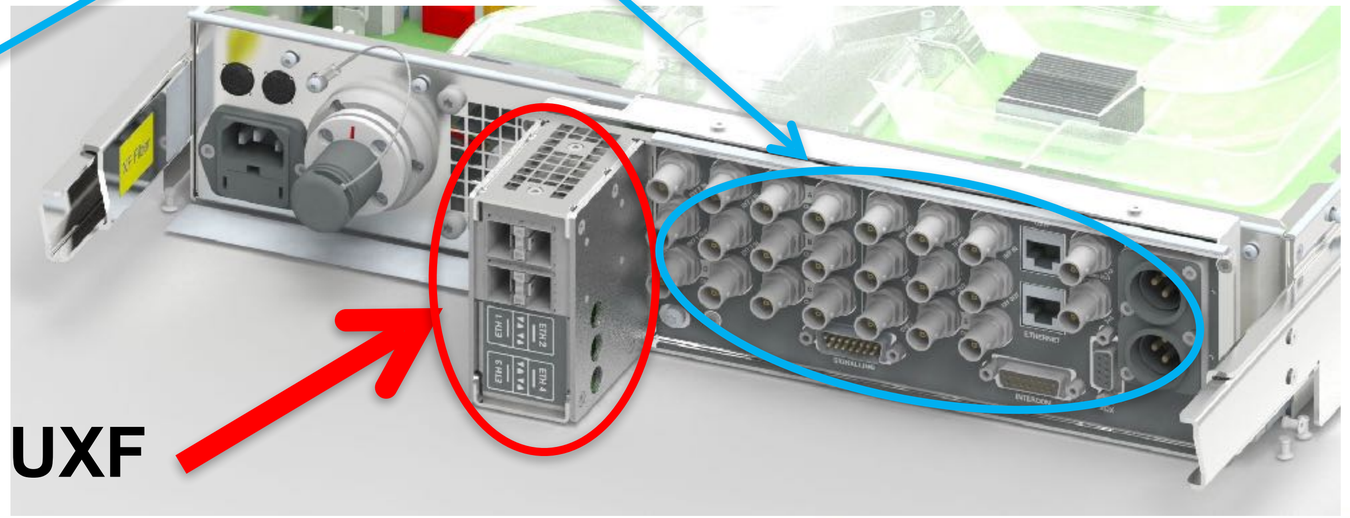
UXF ; interface to the IP network

Cradle type	XCU type	IP connection	SDI connection
UXF Cradle	UNIVERSE UXF	Yes	Yes
UXF Cradle	UNIVERSE	No	Yes
Cradle	UNIVERSE UXF	No	Yes
Cradle	UNIVERSE	No	Yes

Cradle

SDI (BNC)
Baseband

UXF Cradle



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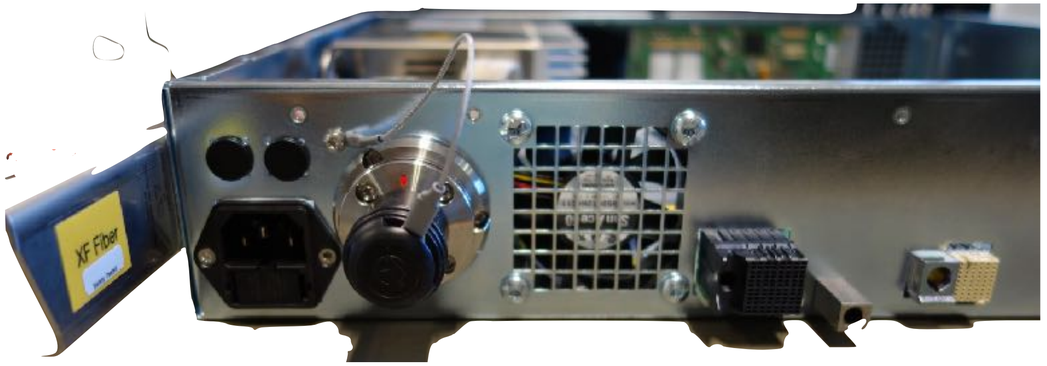
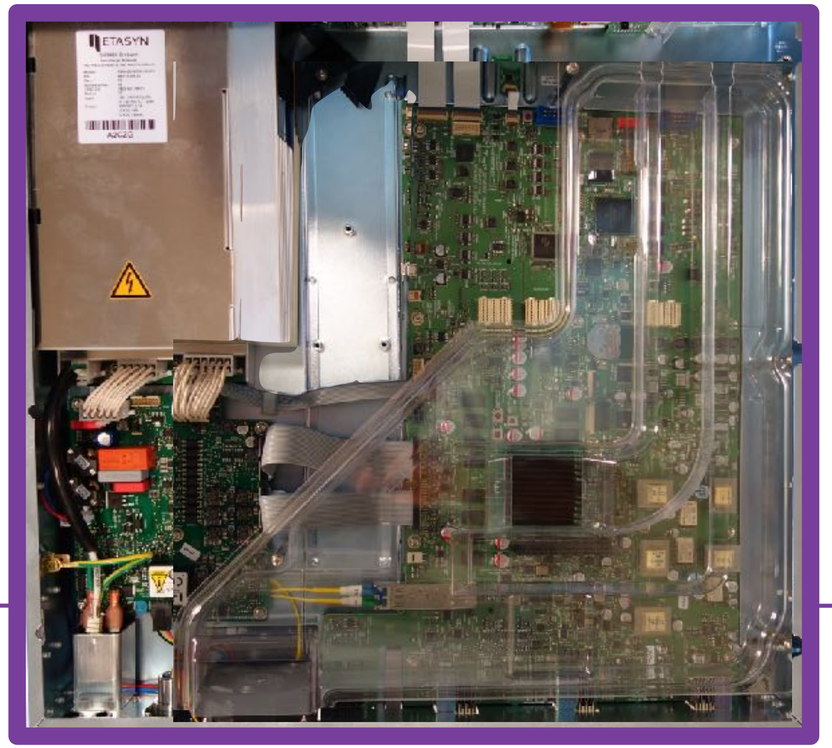
What’s is the new and different in the XCU UXF

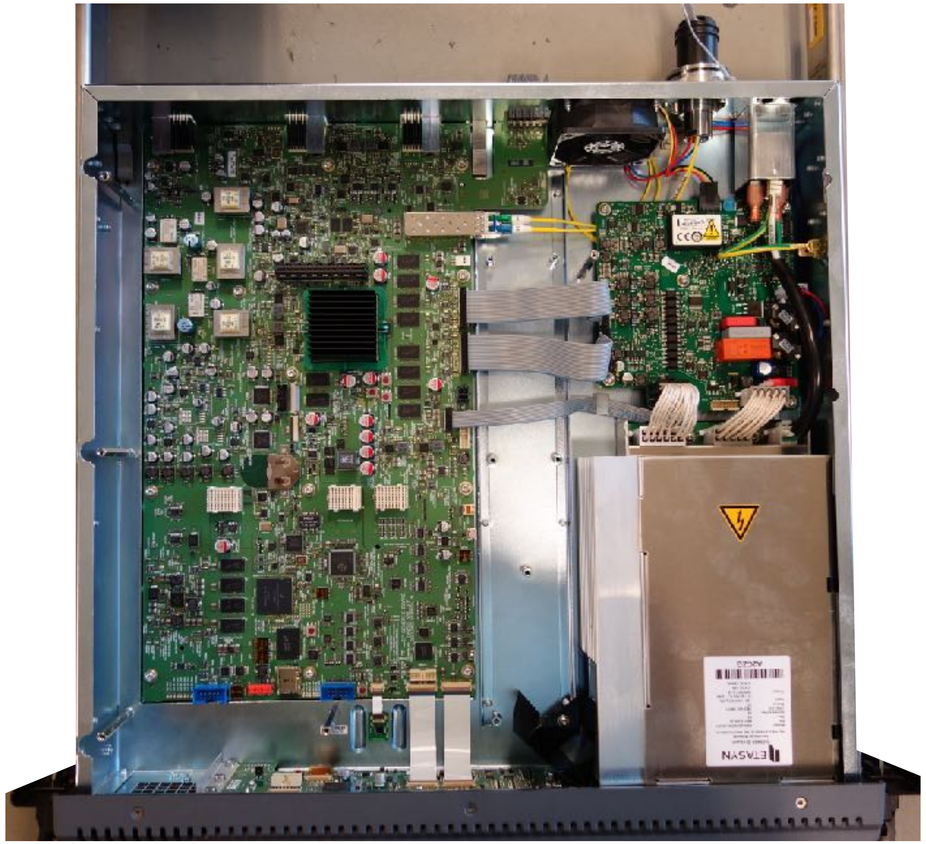


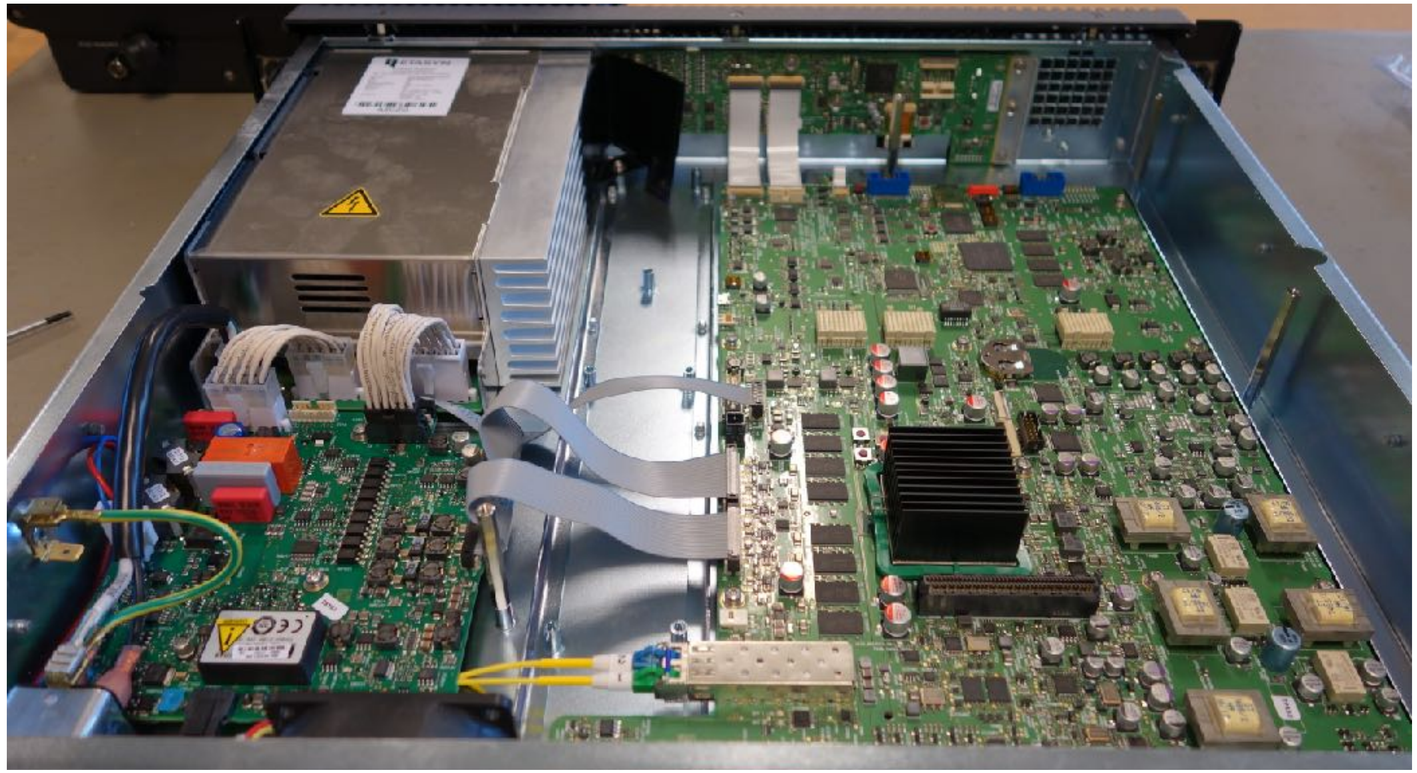
☑ Extension for SFP modules on board (see IP generic board)
- Fan is moved and with better capacity.
- No space for a DUAL XCU version.

☑ Old and new CRADLE compatibility is required. (see previous page)
- New air guide for enhanced cooling.
- New Generic board.

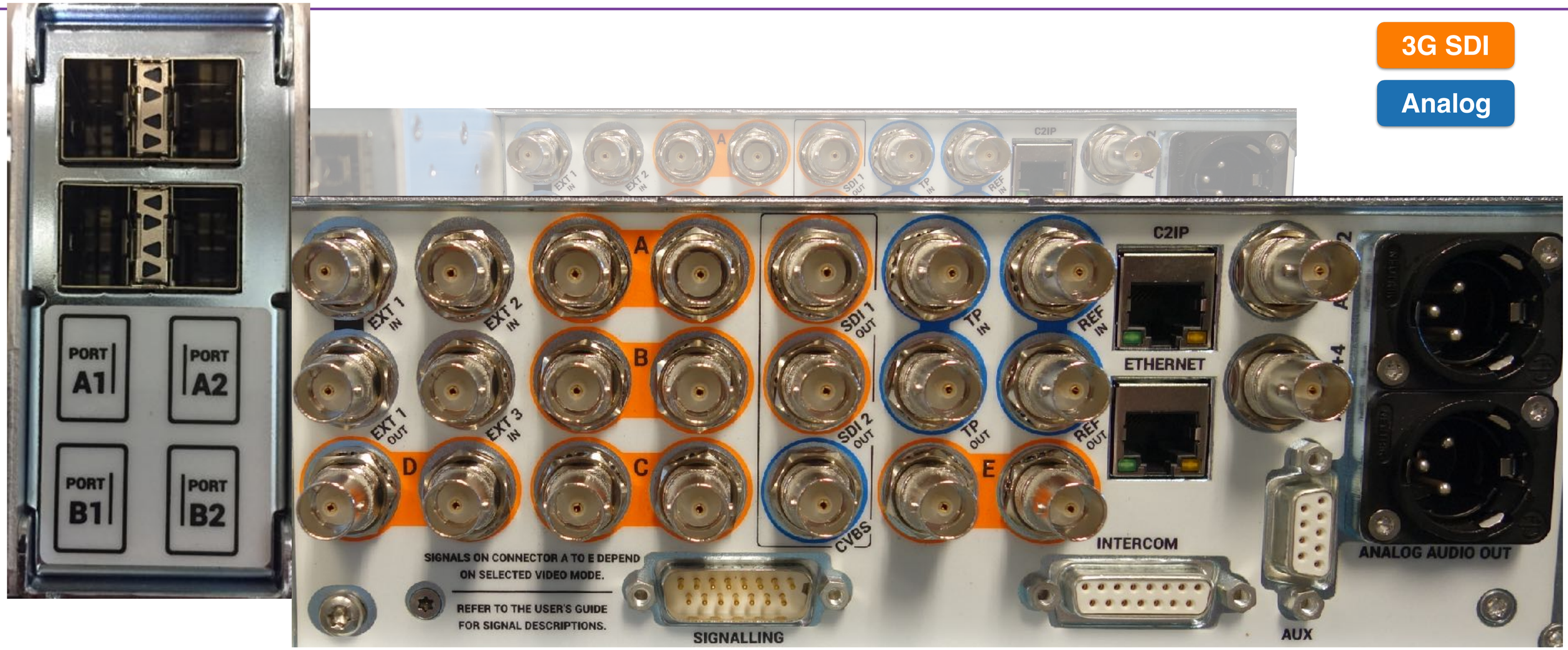


What’s is the new and different in the XCU UXF



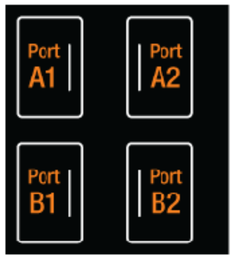


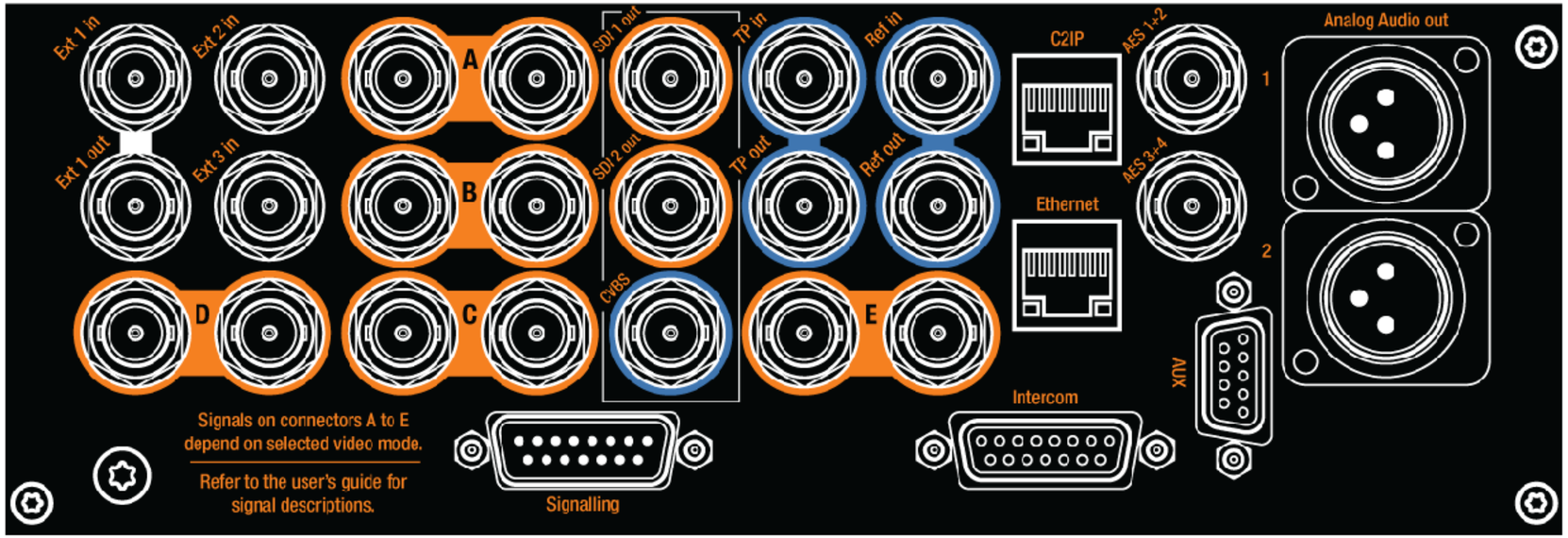
OUTPUTS (baseband) from the XCU UXF



Connections UXF Cradle (improved)

- SDI positions remain as is
  - Colour-identification in line with Densité (**SDI=orange** / **Analog=Blue**)
  - SDI outputs (A,B,C,D,E) have different signals per video mode (HD / 4K / HDR / XS)
- IP ports (4x 10Gb)
  - Port A for main signals
  - Port B for redundancy





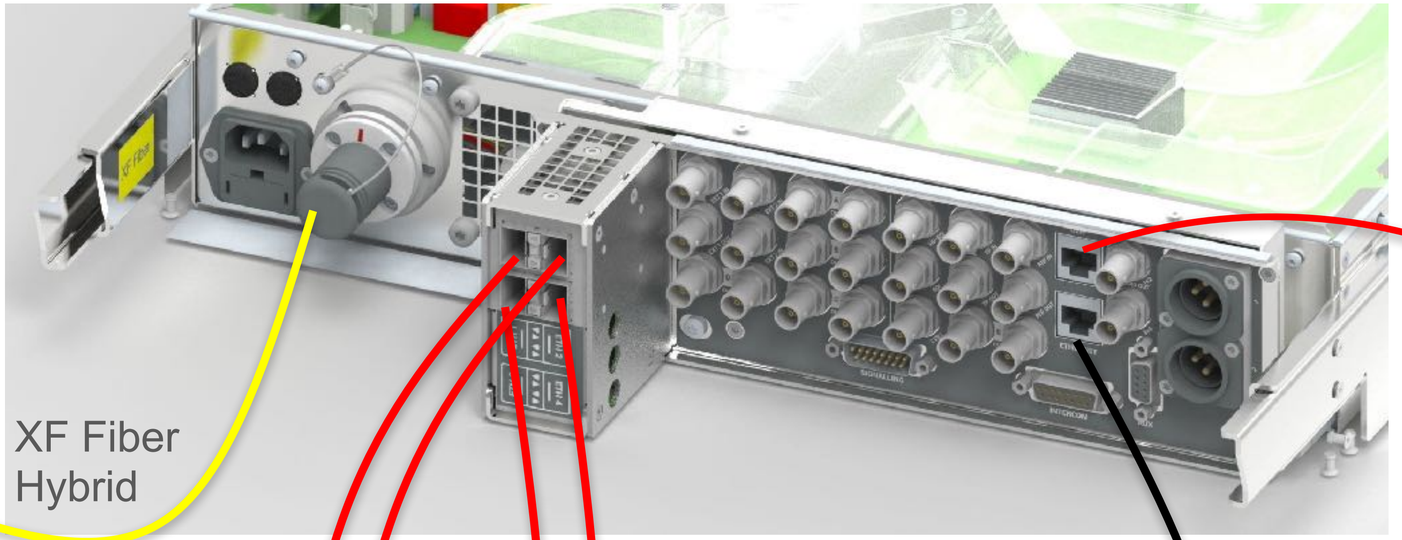
SFP Case configuration from the XCU UXF

4 Functional SFP Cages

A1 A2 for different signals (live)
B1 B2 for high speed / or redundancy

also 12G-SDI will be possible
with a Embrionix module

IP-XCU connections



XF Fiber
Hybrid

C2IP
10/100Mb

2x10Gb

2x10Gb

Main
IP Network

Redundant
IP Network

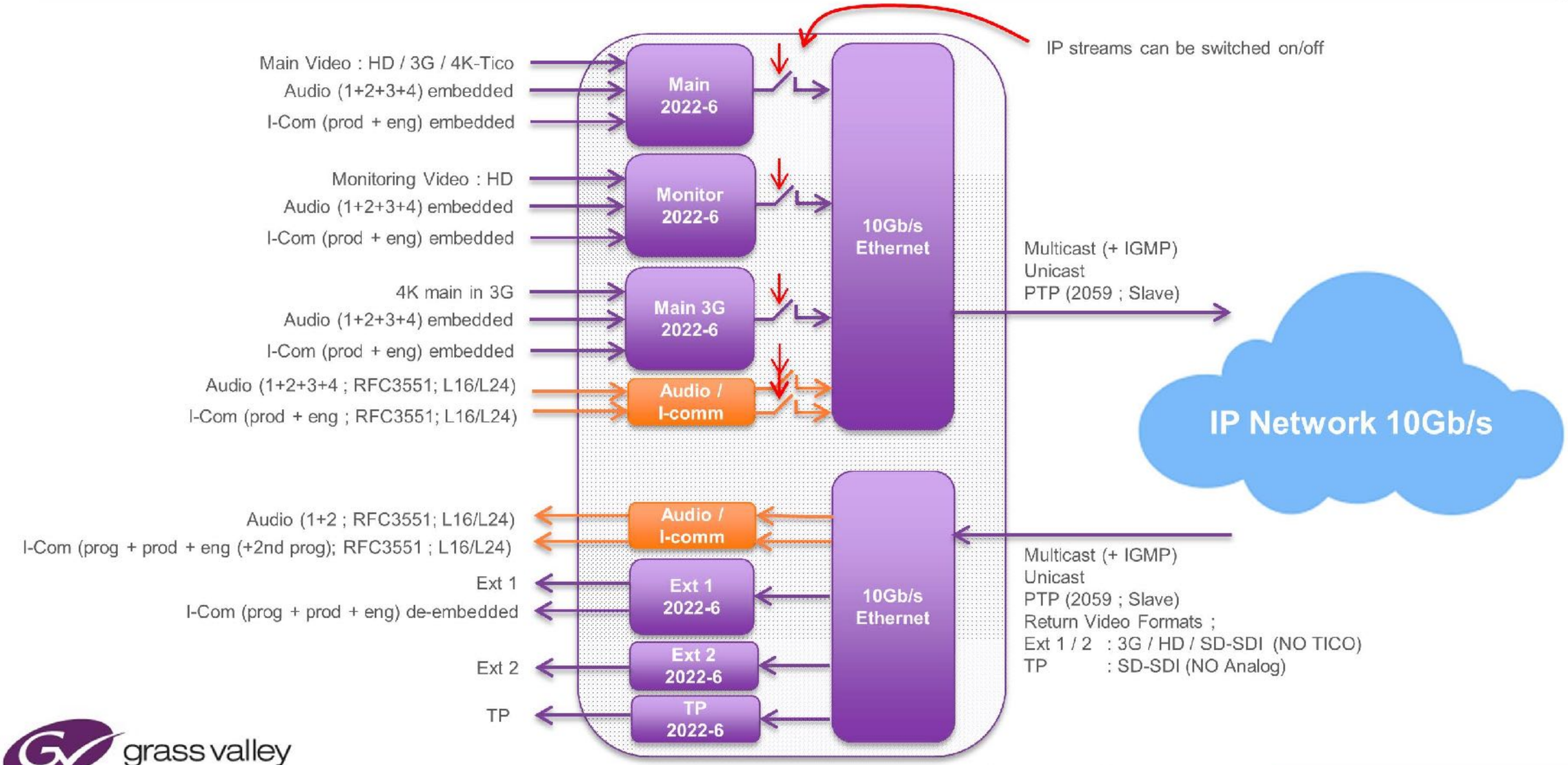
IP Trunk
10/100/1000Mb

IP Trunk
10/100/1000Mb

MCP450

OCP's

New XCU UXF – IP Media streams: Video & Audio & I-Com



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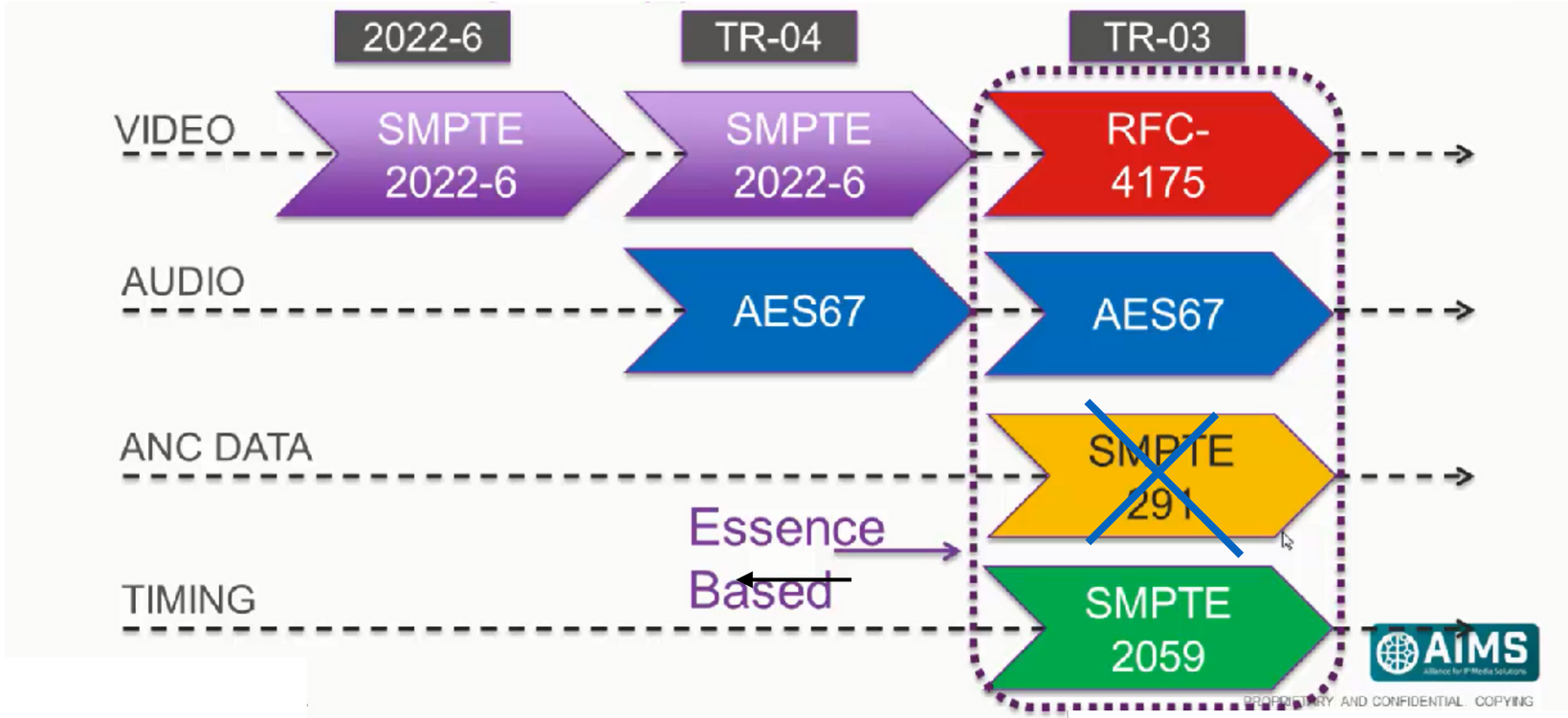
AIMS Roadmap → SMPTE 2110

2016 **2017 (UXF)** **2017 (IBC)**

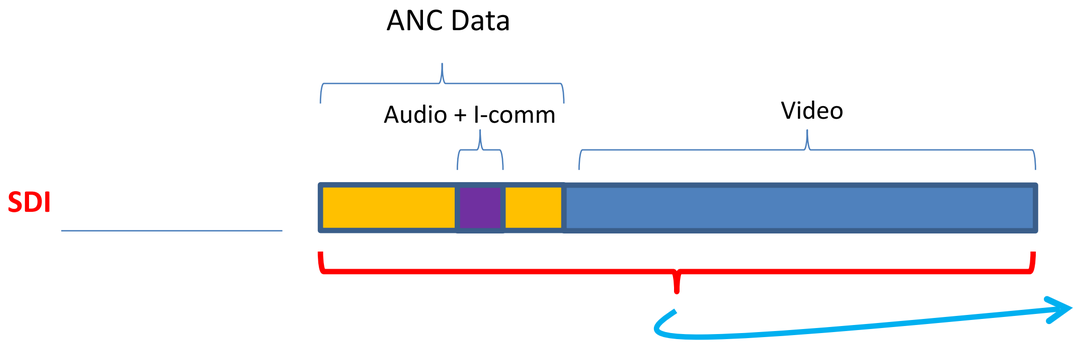


Abstract / high level view

SDI → SMPTE 2022 -6

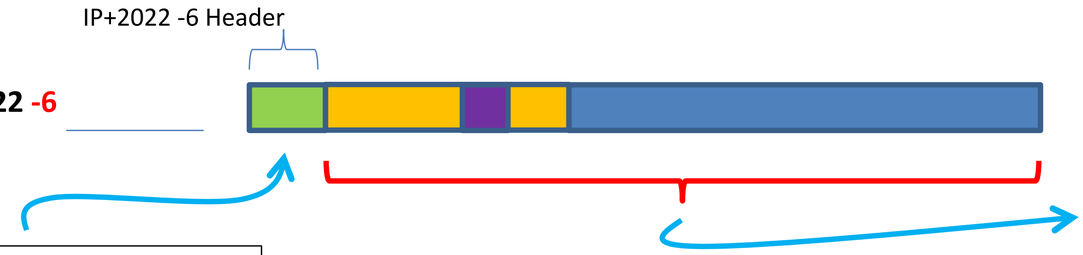
IP header
Video 2110 -20
Audio AES67 2110 -30
SDP-file
ANC Data

SDI - World



All “info” available in the SDI stream about video, audio, etc.

IP / SDI - World



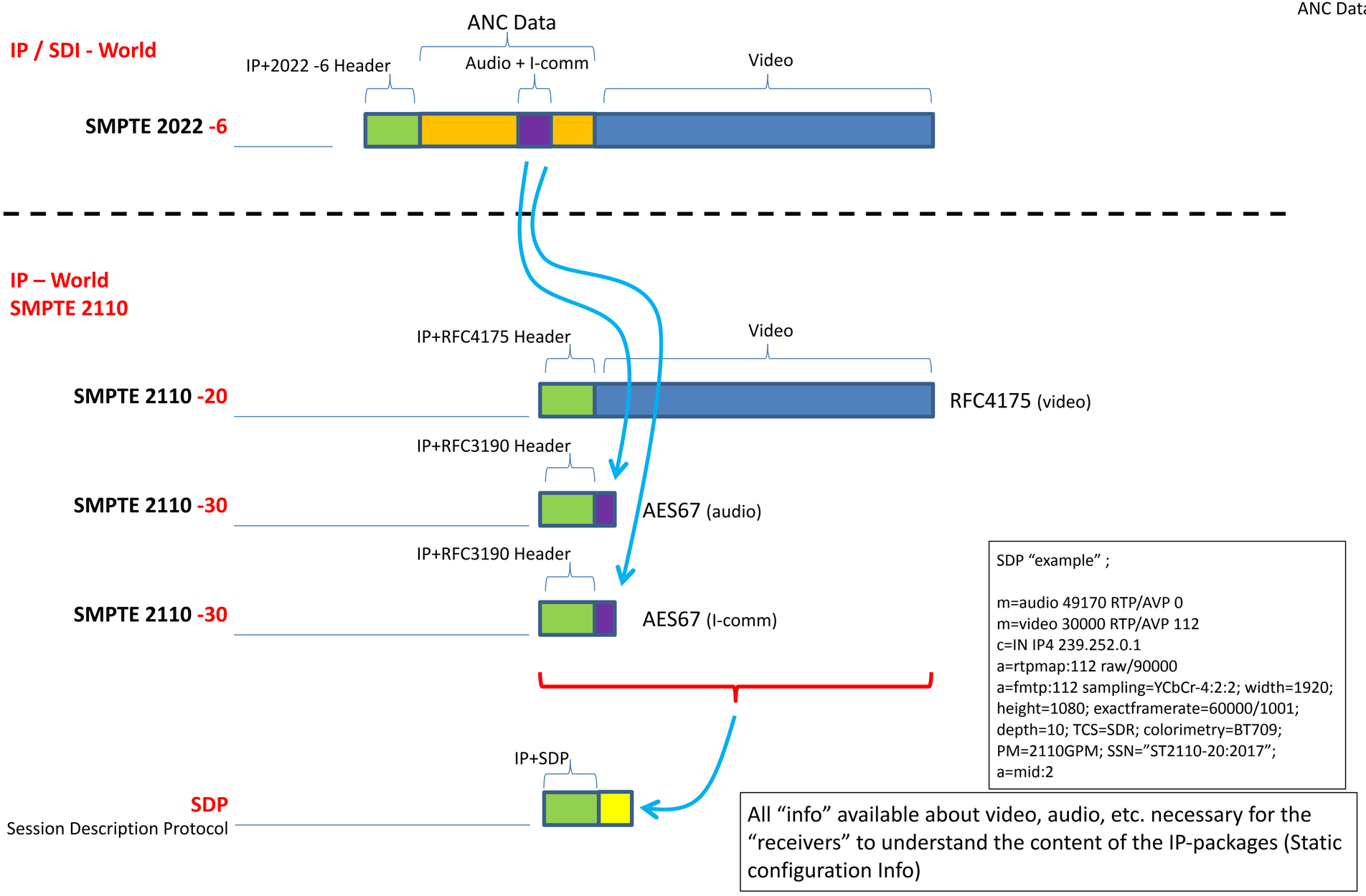
Additional IP+2022-6 header

All “info” available in the SDI stream about video, audio, etc.

Abstract / high level view

SMPTE 2022 -6 → SMPTE 2110

IP header
Video 2110 -20
Audio AES67 2110 -30
SDP-file
ANC Data

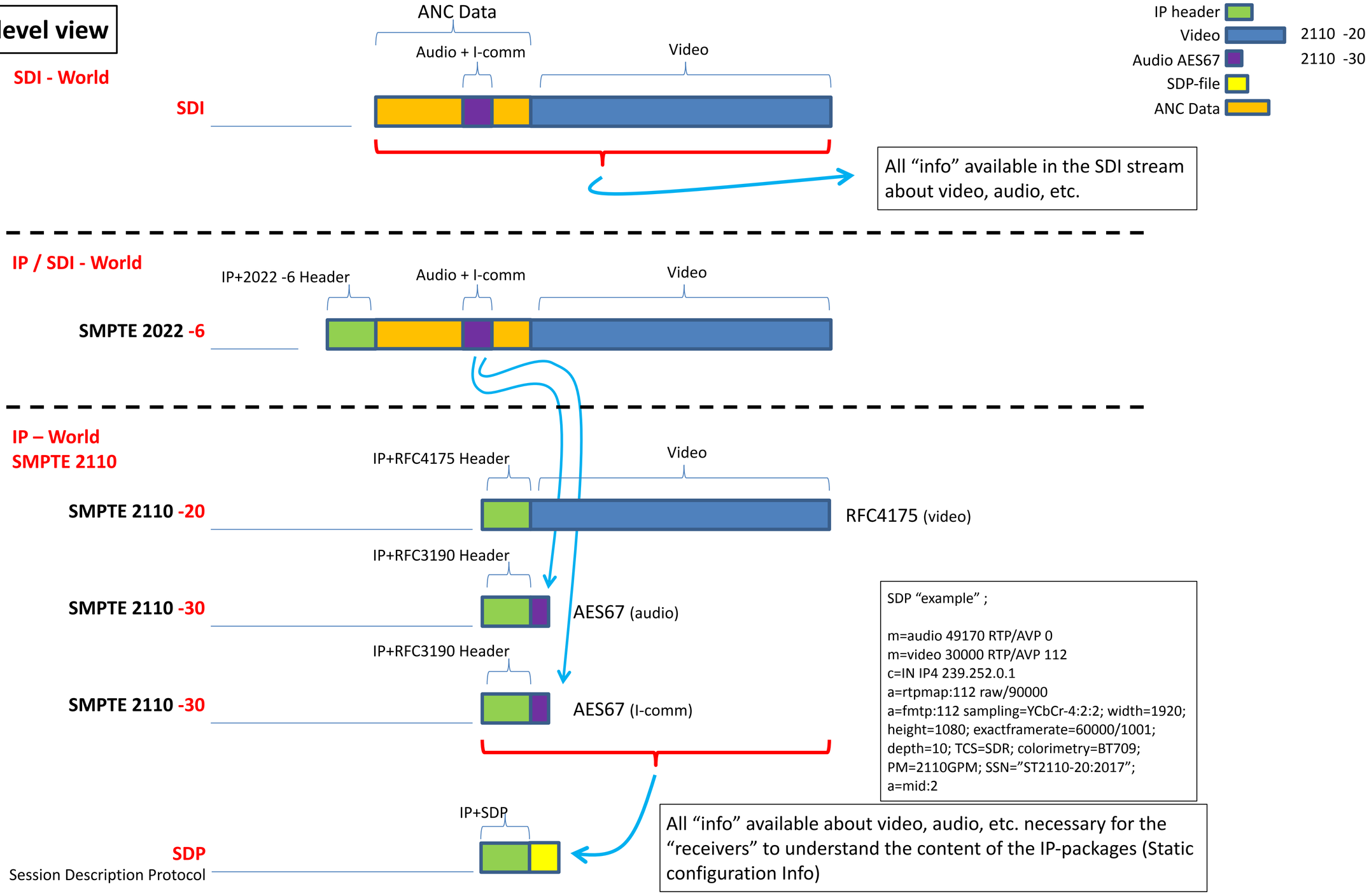


SDP “example” ;

m=audio 49170 RTP/AVP 0
m=video 30000 RTP/AVP 112
c=IN IP4 239.252.0.1
a=rtpmap:112 raw/90000
a=fmtp:112 sampling=YCbCr-4:2:2; width=1920;
height=1080; exactframerate=60000/1001;
depth=10; TCS=SDR; colorimetry=BT709;
PM=2110GPM; SSN=”ST2110-20:2017”;
a=mid:2

All “info” available about video, audio, etc. necessary for the “receivers” to understand the content of the IP-packages (Static configuration Info)

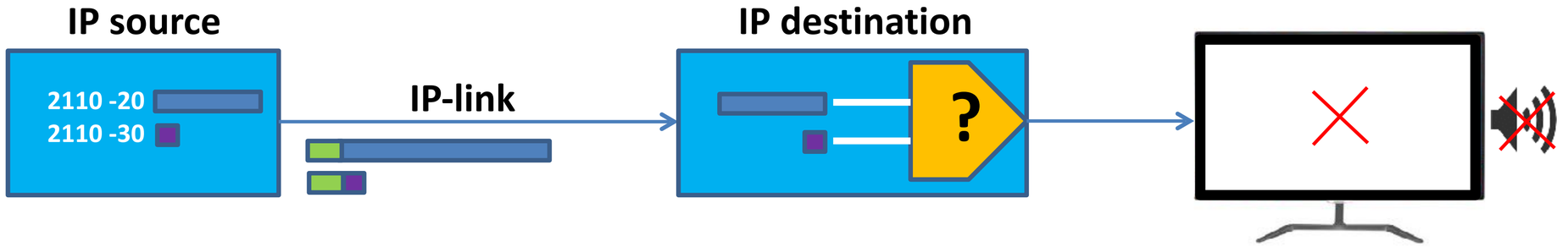
Abstract / high level view



IP – SMPTE 2110

Why SDP file ?

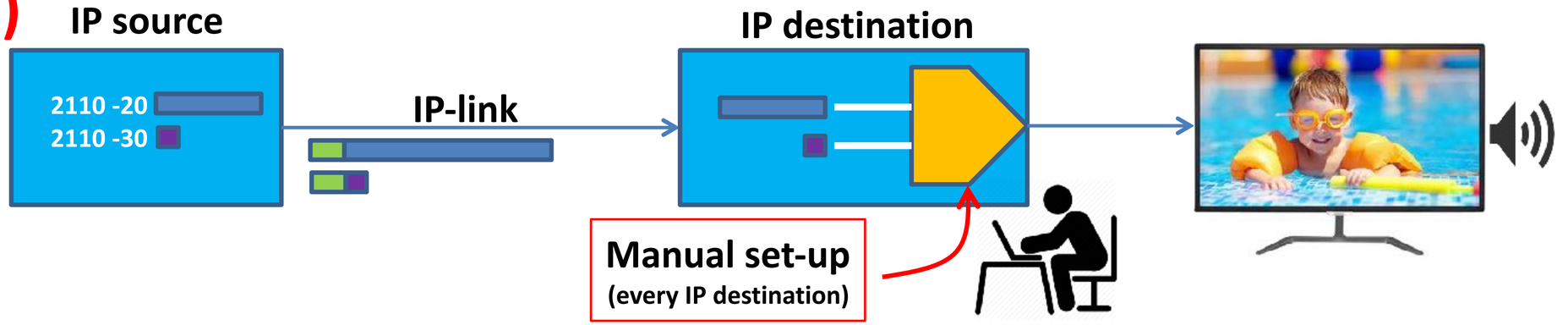
IP header
Video 2110 -20
Audio AES67 2110 -30
SDP-file
ANC Data



In the SMPTE 2110 standard the IP streams are called essence. This means only video but no “discriptive information” like video format, framerate, etc. The same is applicable for the Audio as AES67.
Video is 2110 -20
Audio is 2110 -30
The “discriptive information” has to be known at the “IP-destination” !!! If this is not the case, the IP destination will not understand the content of the IP packages as it doesn’t know how to interpret the stream of bits. This means; no video and no sound.

There are 2 ways to get that “other additional information” at the IP-destination
1) Manually via local set-up, where you simply tell the destination what it is and therewith how to interpret
2) Automatically via SDP file-transfer, sent with the essences

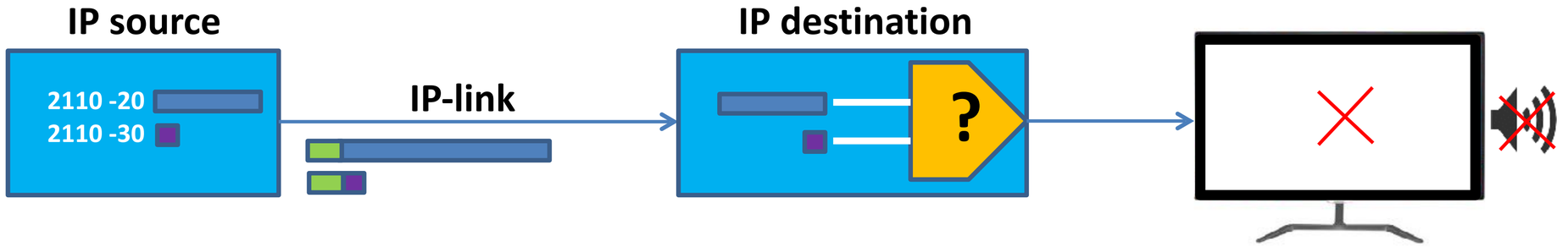
1)



IP – SMPTE 2110

Why SDP file ?

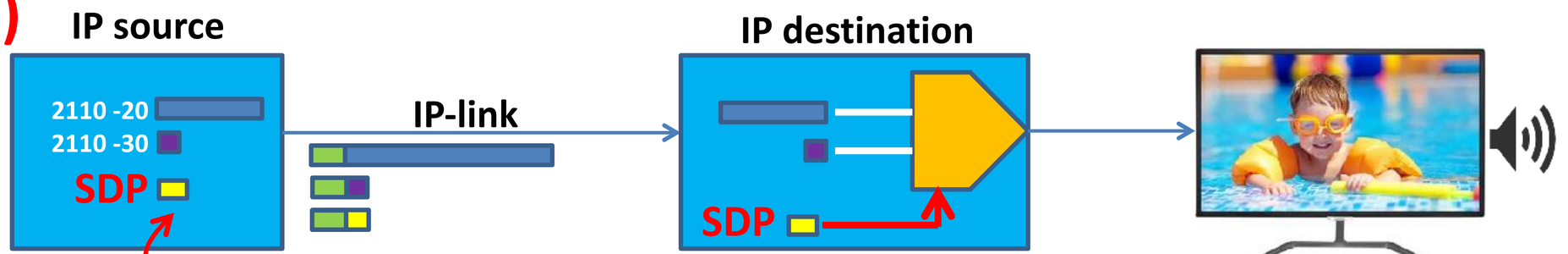
IP header
Video 2110 -20
Audio AES67 2110 -30
SDP-file
ANC Data



In the SMPTE 2110 standard the IP streams are called essence. This means only video but no “discriptive information” like video format, framerate, etc. The same is applicable for the Audio as AES67.
Video is 2110 -20
Audio is 2110 -30
The “discriptive information” has to be known at the “IP-destination” !!! If this is not the case, the IP destination will not understand the content of the IP packages as it doesn’t know how to interpret the stream of bits. This means; no video and no sound.

There are 2 ways to get that “other additional information” at the IP-destination
1) Manually via local set-up, where you simply tell the destination what it is and therewith how to interpret
2) Automatically via SDP file-transfer, sent with the essences

2)

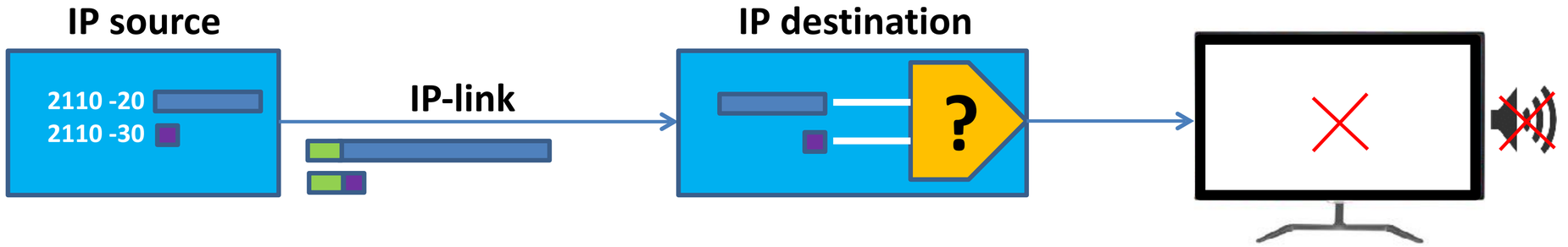


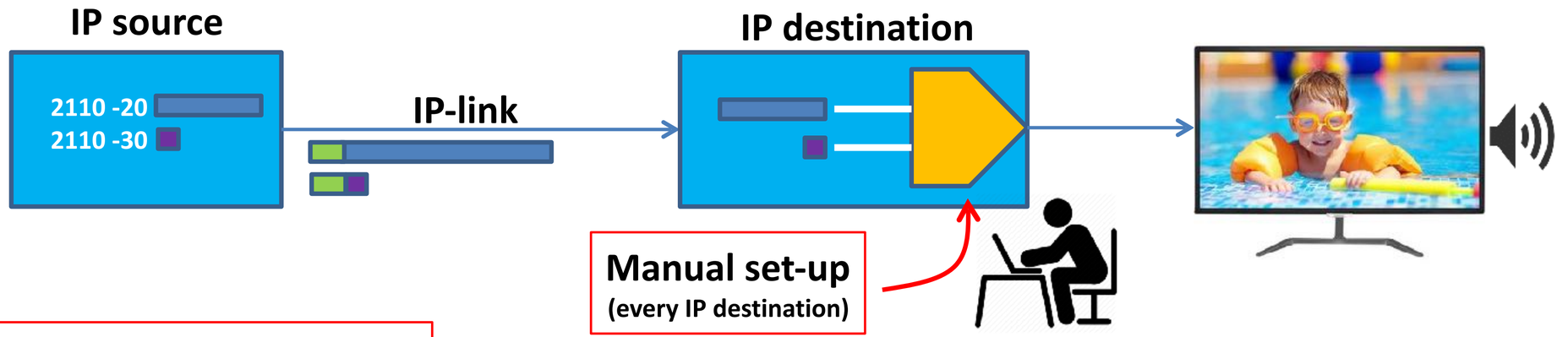
Automatic set-up via SDP
Generated by IP source

IP – SMPTE 2110

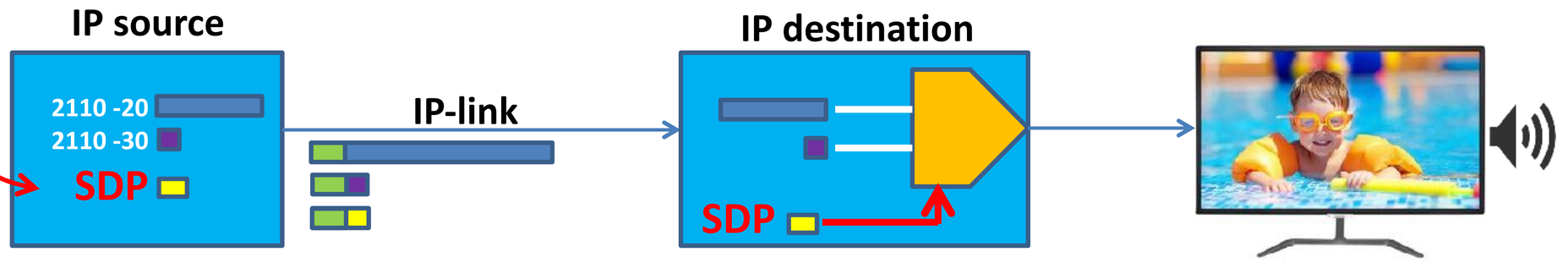
Why SDP file ?
Additional info needed for each receiver to "understand" the content of the IP packages

IP header
Video 2110 -20
Audio AES67 2110 -30
SDP-file
ANC Data





Automatic set-up via SDP
Generated by IP source

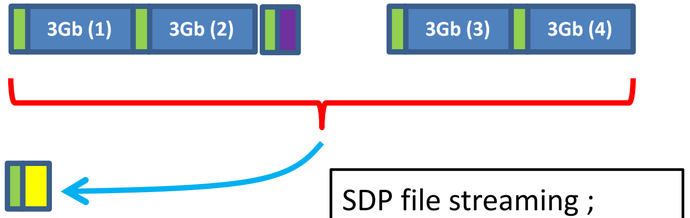


Abstract / high level view

4K uncompressed SMPTE 2110 (2 options)

IP header
Video 2110 -20
Audio AES67 2110 -30
SDP-file
ANC Data

2x 10 Gb



SDP file streaming ;
Audio info + Video info +
“Group info” ; 1+2+3+4

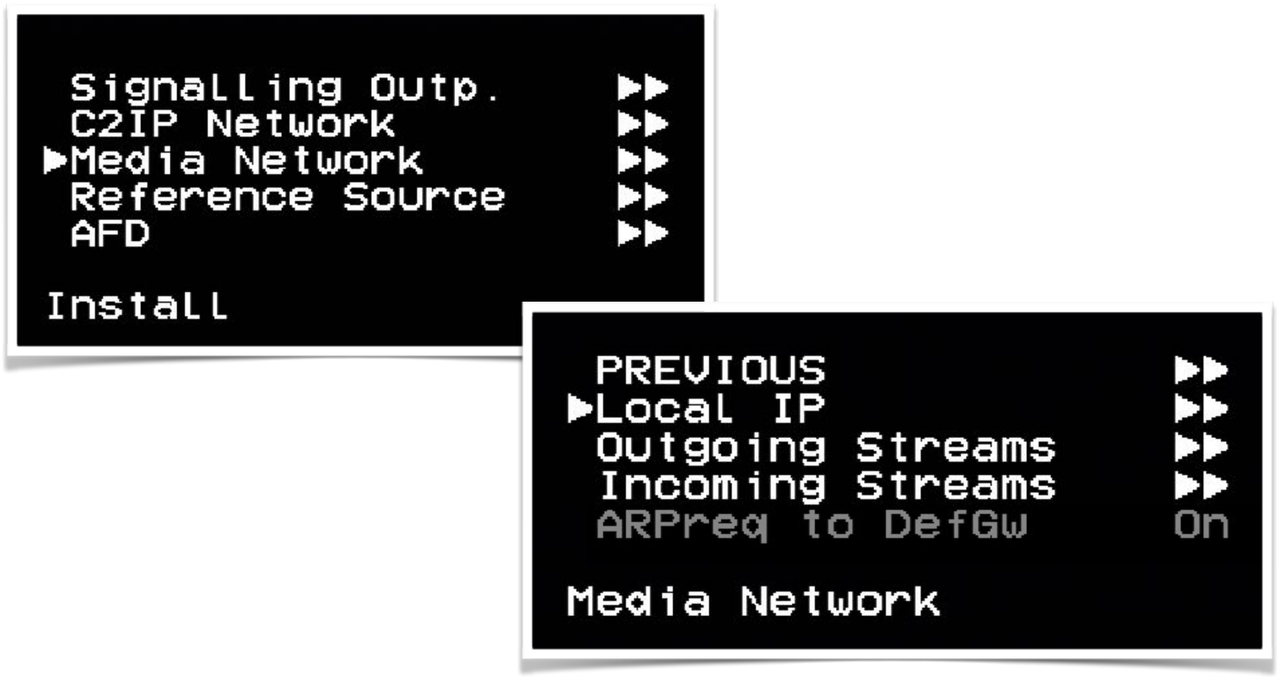
4K uncompressed = 4x 2SI/SDQS stream ; 2110 -20)

1x 25 Gb

SDP file streaming ;
Audio info + Video info

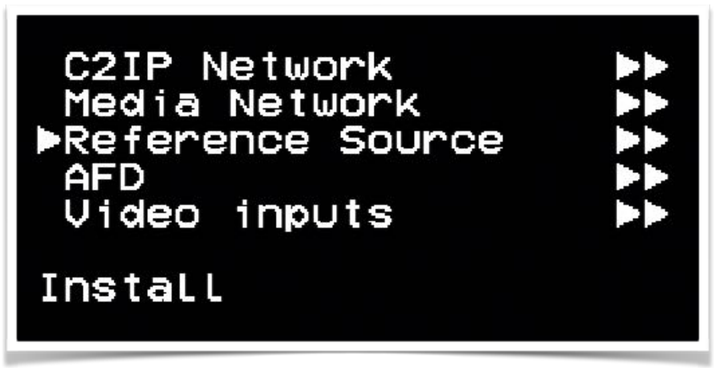
4K uncompressed = 1x stream ; 2110 -20)

Media Network XCU Menu items (Video Streams) IP settings



=> Local IP settings
- => Outgoing Streams from XCU to Cloud
- => Incoming Streams to XCU (Ext 1/2 TP)

Media Network XCU Menu items (Reference Source)



Set-up with Connect gateway

Main 10Gb IP Network

10Gb

Redundant 10Gb IP Network

10Gb

Media Streams

Main 10Gb IP Network

Main 10Gb IP Network

Camera Control Streams

C2IP

C2IP Camera control Network

<xml />

VSM control Network

AMWA/NMOS

OCP's

Connect Gateway

External control Streams

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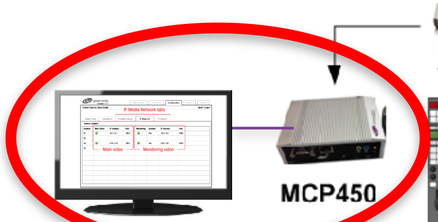
Set-up via Connect gateway

10Gb

Redundant IP Network

10Gb

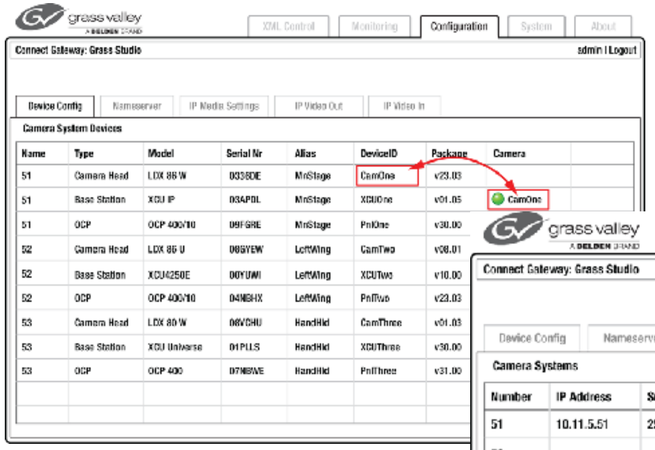
Main IP Network

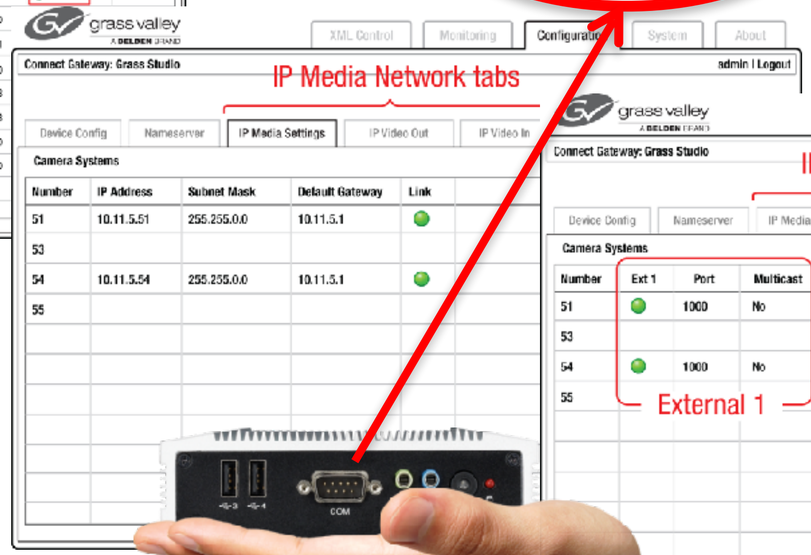


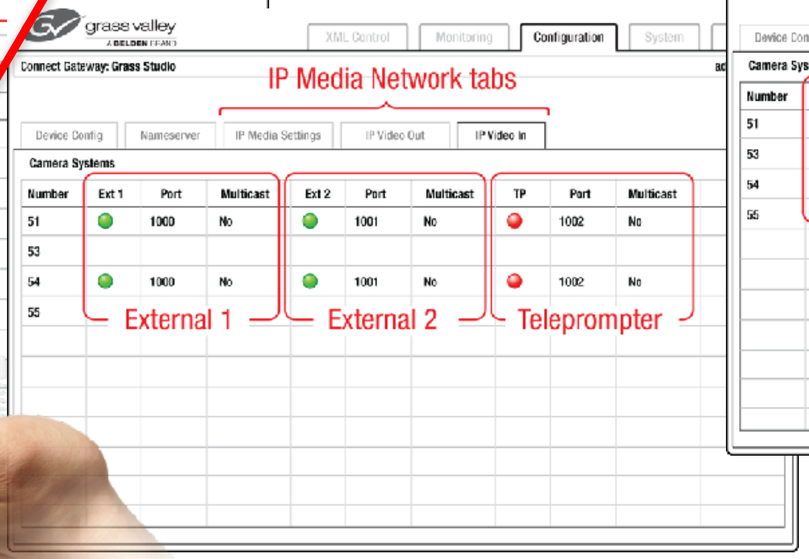
C2IP

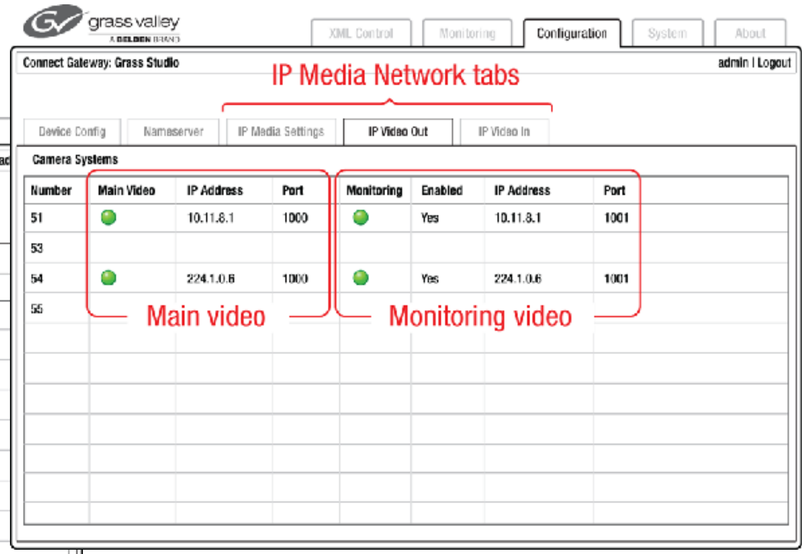
MCP450

OCP's









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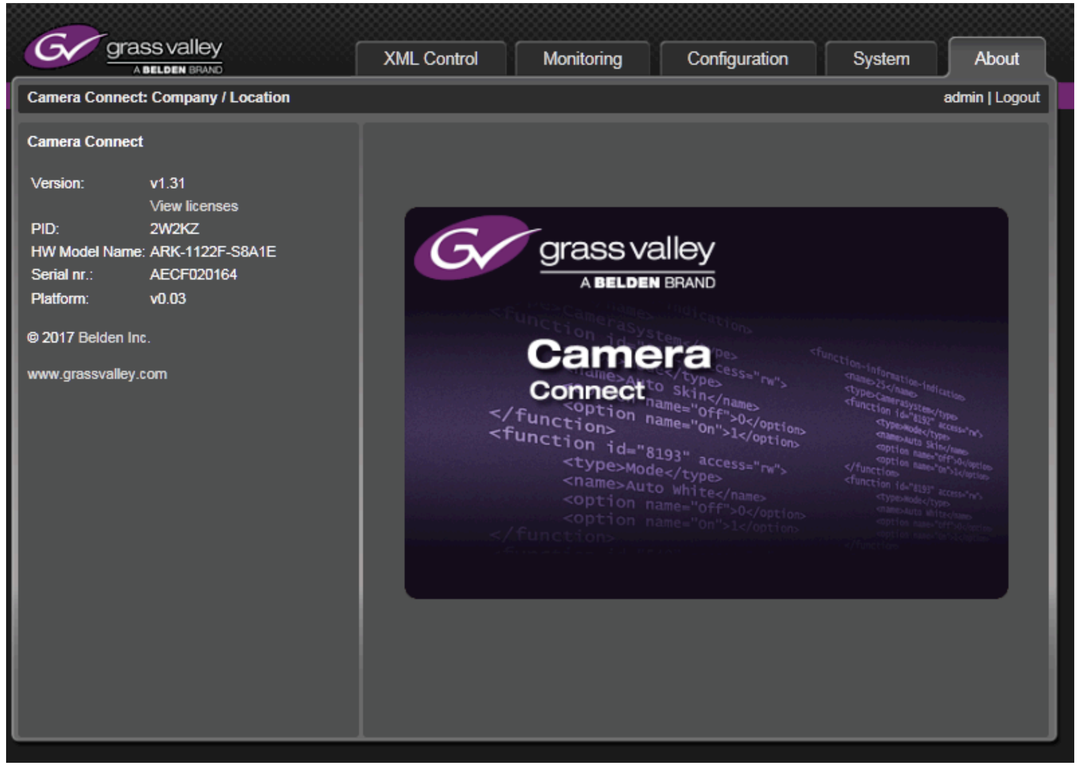
CAMERA CONNECTED changes

Live session



PTP:
Precision Time Protocol

FUTURE-READY

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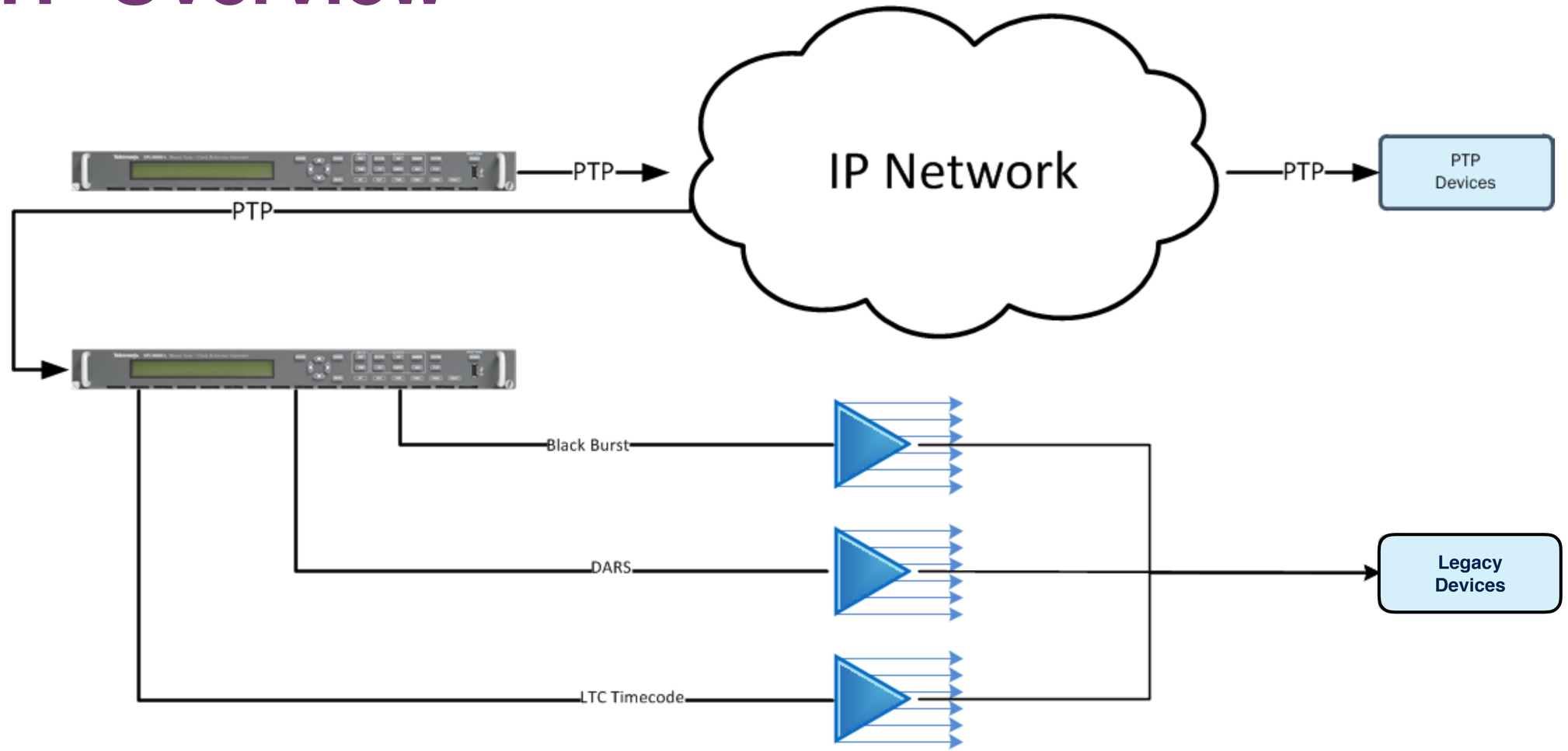
Etienne Brule

January 2017

PTP Overview

- PTP - Precision Time protocol will replace traditional analog reference.
  Since we move the Data link transport over IP it make sense to migrate the synchronize information over the same data plane.
- PTP is the new “BLACK”.
- PTP is a more accurate version of NTP – Network Time Protocol, which controls the synchronizing and timing of data packets in the IP environment. In the world of bits and bytes, locking each bit to a slice of time is highly accurate or should be.

PTP Overview



PTP Standards

- IEEE Standard 1588-2008 Precision Time Protocol
- •SMPTE ST 12-1:2014, Time and Control Code
- •SMPTE ST 2059-1:2015x Generation and Alignment of Interface Signals to the SMPTE Epoch
- •SMPTE ST 2059-2:2015x SMPTE Profile for use of IEEE-1588 Precision Time Protocol in Professional Broadcast Applications
- •SMPTE ST 2059-2:201X, SMPTE Profile for use of IEEE-1588 Precision Time Protocol in Professional Broadcast Applications — Amendment 1
- •AES67-, AES Standards Report PTP parameters for AES67 interoperability
- •AES-R16-2016, AES Standards Report PTP parameters for AES67 and SMPTE ST 2059-2 interoperability

PTP Standards (Clock Types)

- **Ordinary Clock**
  End Device on a network (not a switch or router)
  Slave only Clock (never acts as a Master)
  Preferred Grandmaster (never acts as a Slave)
  Master/Slave Clock (can be either)
- **Transparent clock**
  Accounts for queueing delays in switches or routers
  Hardware time stamps Sync and Delay Request messages on arrival and departure and adds the difference to a correction field in the message header
- **Boundary Clock**
  Receives time from a Master on one Slave port
  Provides Multiple Master (not Grandmaster) ports to downstream Slaves in a domain
  Removes the effect of its own queue

PTP Overview

Ordinary Clock
Communicates with the network based on a single physical port, similar to an end host. An ordinary clock can function as a grandmaster clock.

SPG 8000 Tektronix

PTP Overview

Boundary clock

- Typically has several physical ports, with each port behaving like a port of an ordinary clock. However, each port shares the local clock, and the clock data sets are common to all ports.
- Each port decides its individual state, either master (synchronizing other ports connected to it) or slave (synchronizing to a downstream port), based on the best clock available to it through all of the other ports on the boundary clock.
- Messages related to synchronization and establishing the master-slave hierarchy terminate in the protocol engine of a boundary clock and are not forwarded.

PTP Process

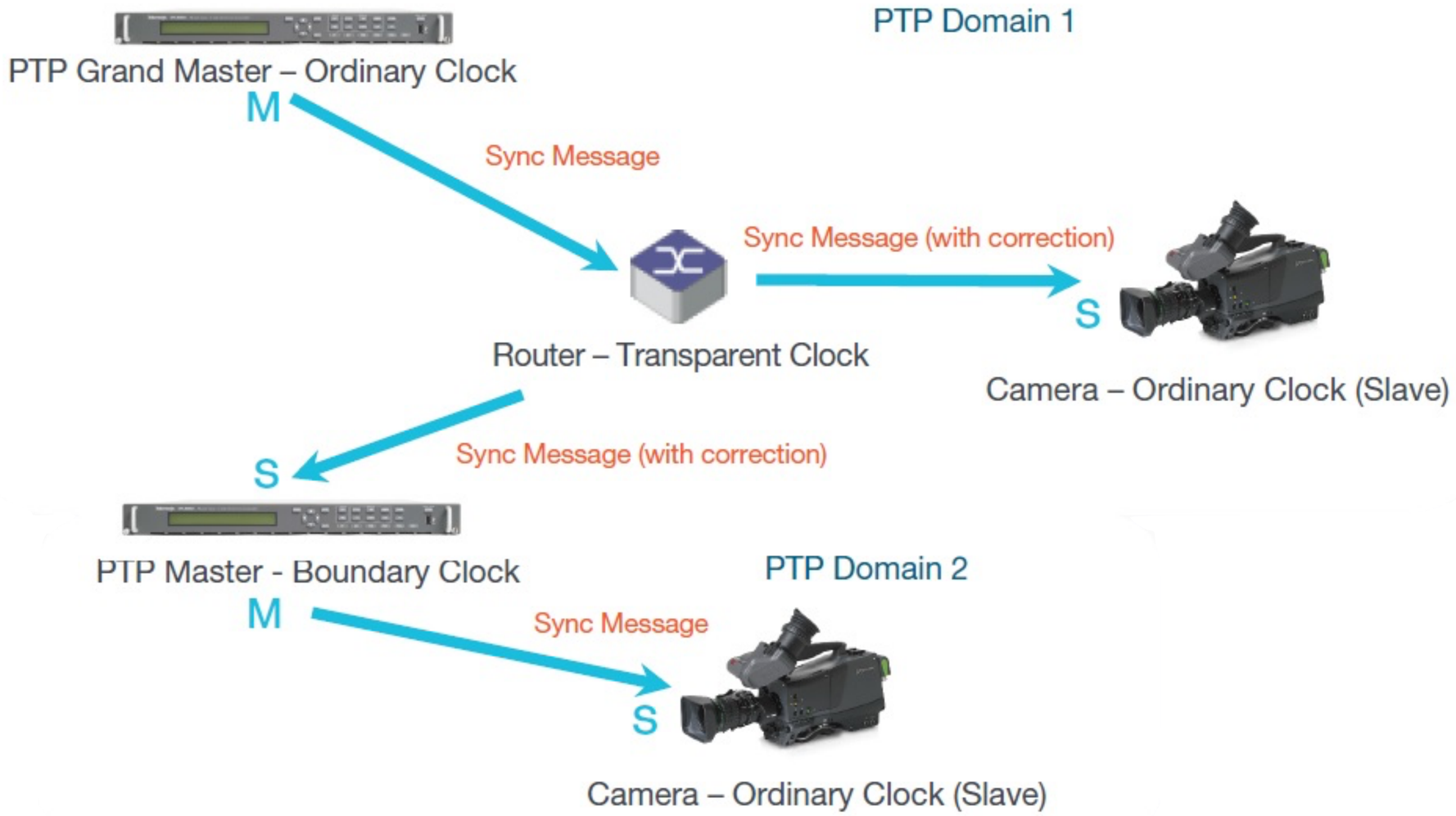
The PTP process consists of two phases:

Establishing the master-slave hierarchy and
synchronizing the clocks.

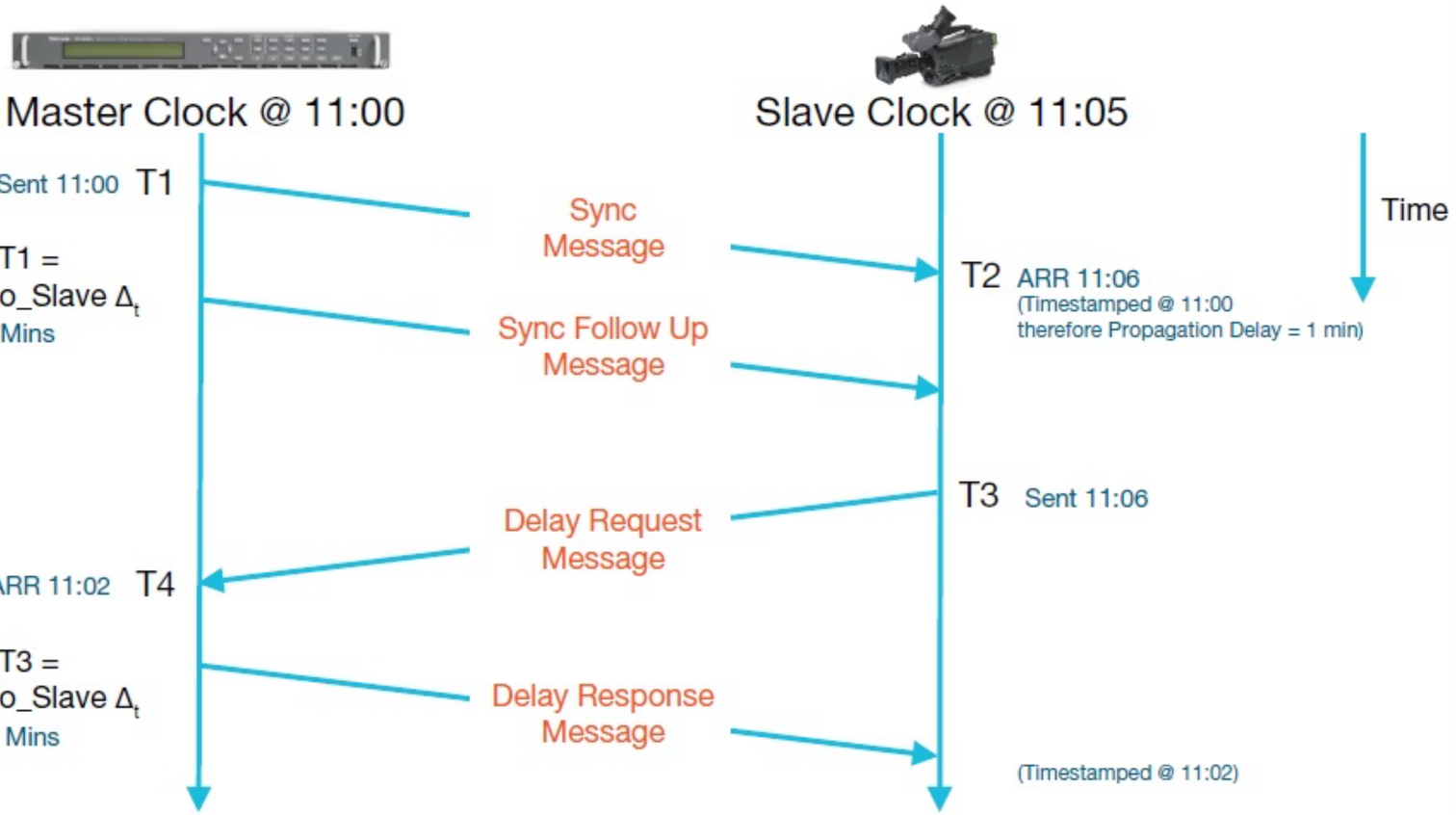
Within a PTP domain, each port of an ordinary or boundary clock follows this process to determine its state:

Examines the contents of all received announce messages (issued by ports in the master state)
Compares the data sets of the foreign master (in the announce message) and the local clock for priority, clock class, accuracy, and so on
Determines its own state as either master or slave

PTP Process


PTP Domain 1
PTP Grand Master – Ordinary Clock
M
Sync Message
Sync Message (with correction)
S
Router – Transparent Clock
Camera – Ordinary Clock (Slave)
S
Sync Message (with correction)
PTP Master - Boundary Clock
PTP Domain 2
M
Sync Message
S
Camera – Ordinary Clock (Slave)

PTP Process



Offset = (Master_To_Slave Δ_t – Slave_To_Master Δ_t)/2 = **5 Mins**

Oneway Delay = (Master To Slave Δ_t + Slave To Master Δ_t)/2 = **1 Min**

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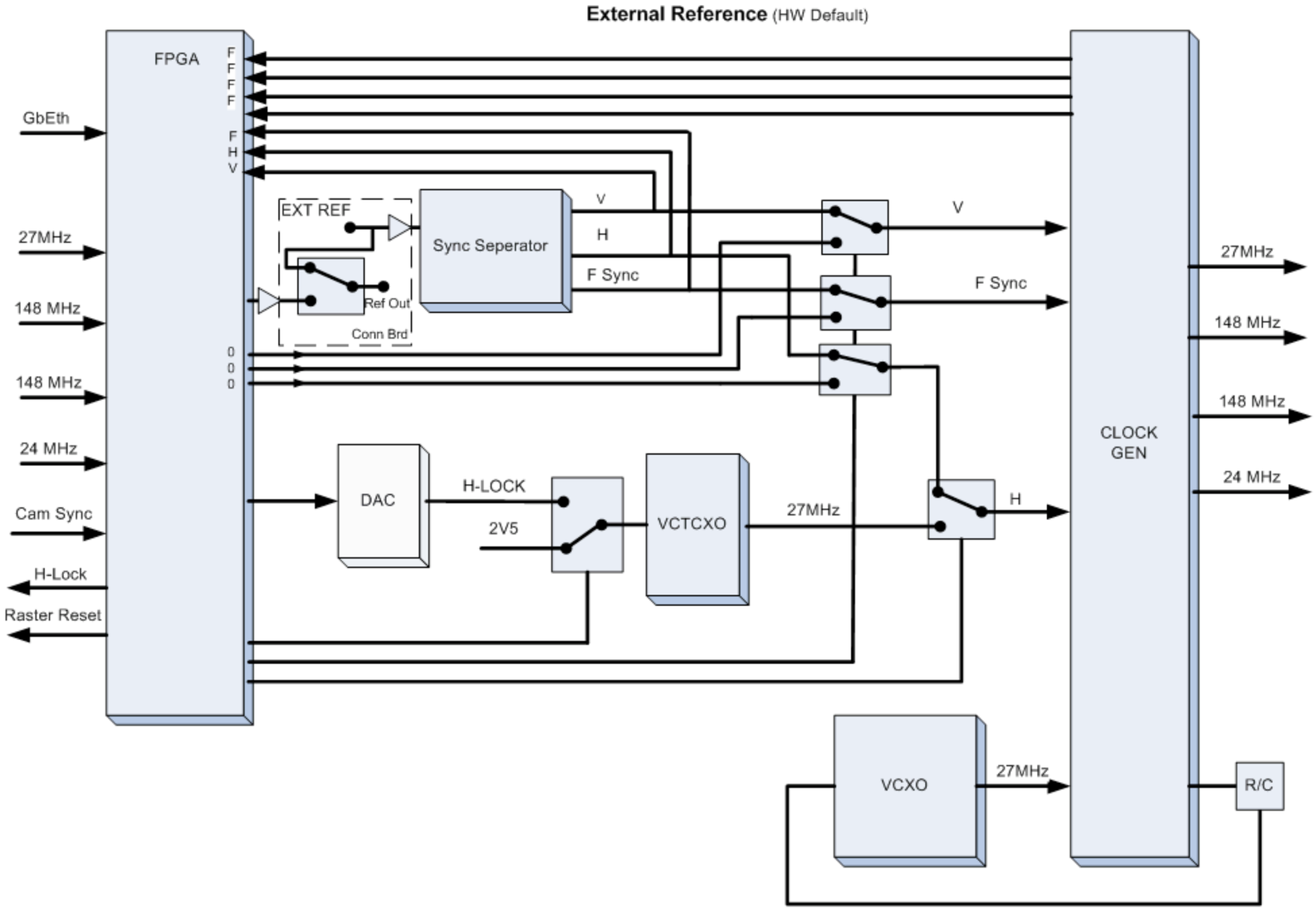
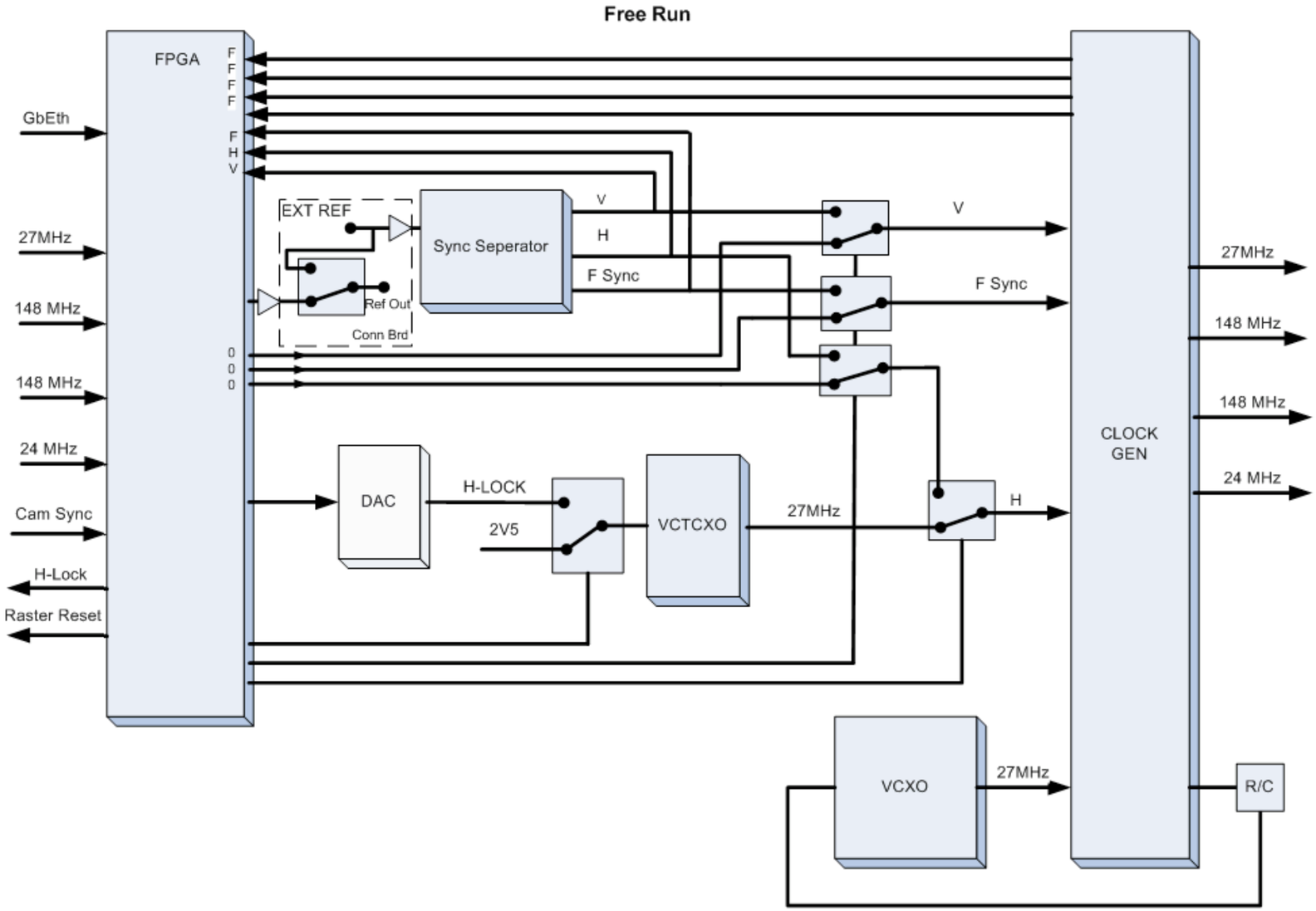
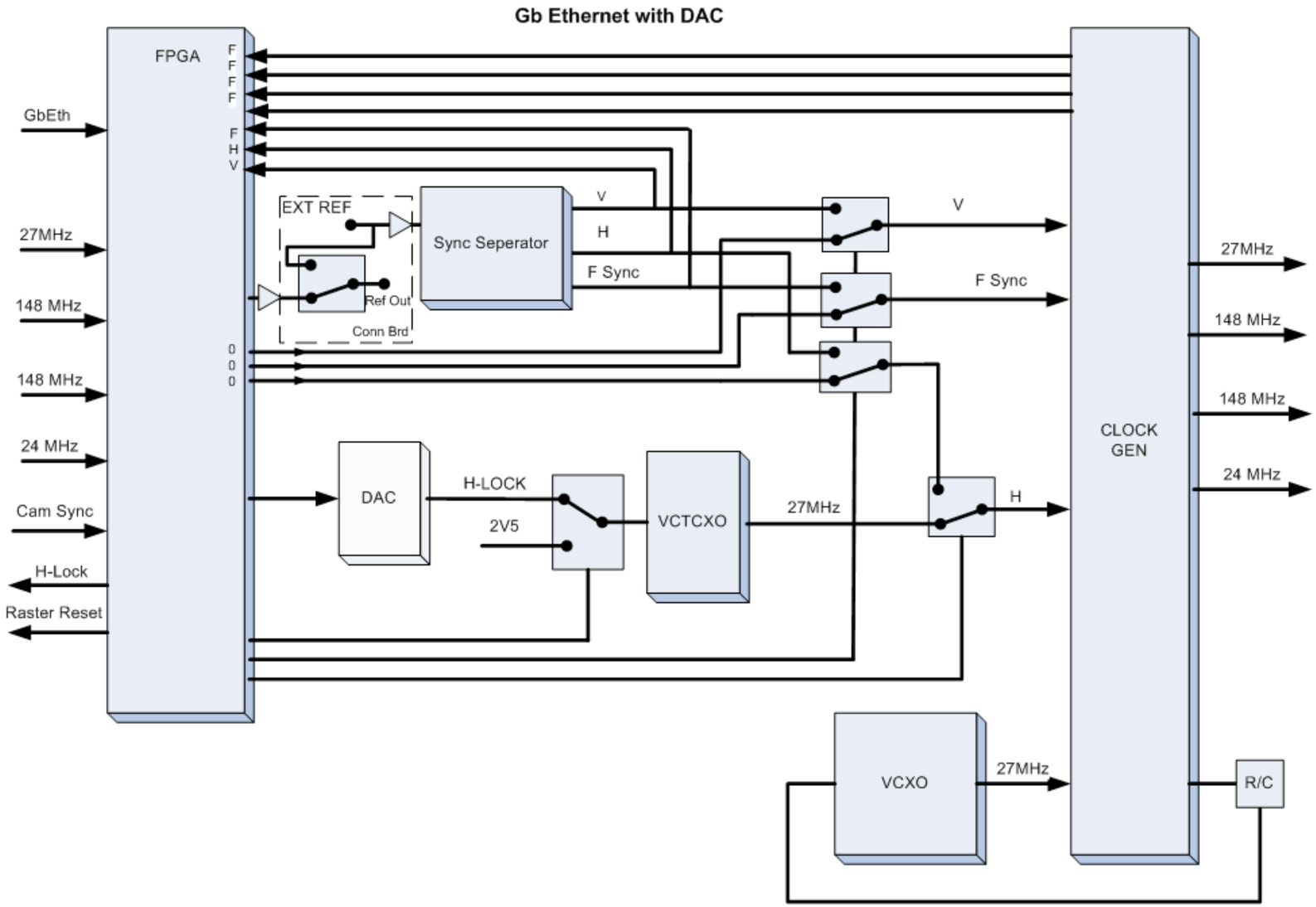
PTP Overview Ext Ref (BB or TL)



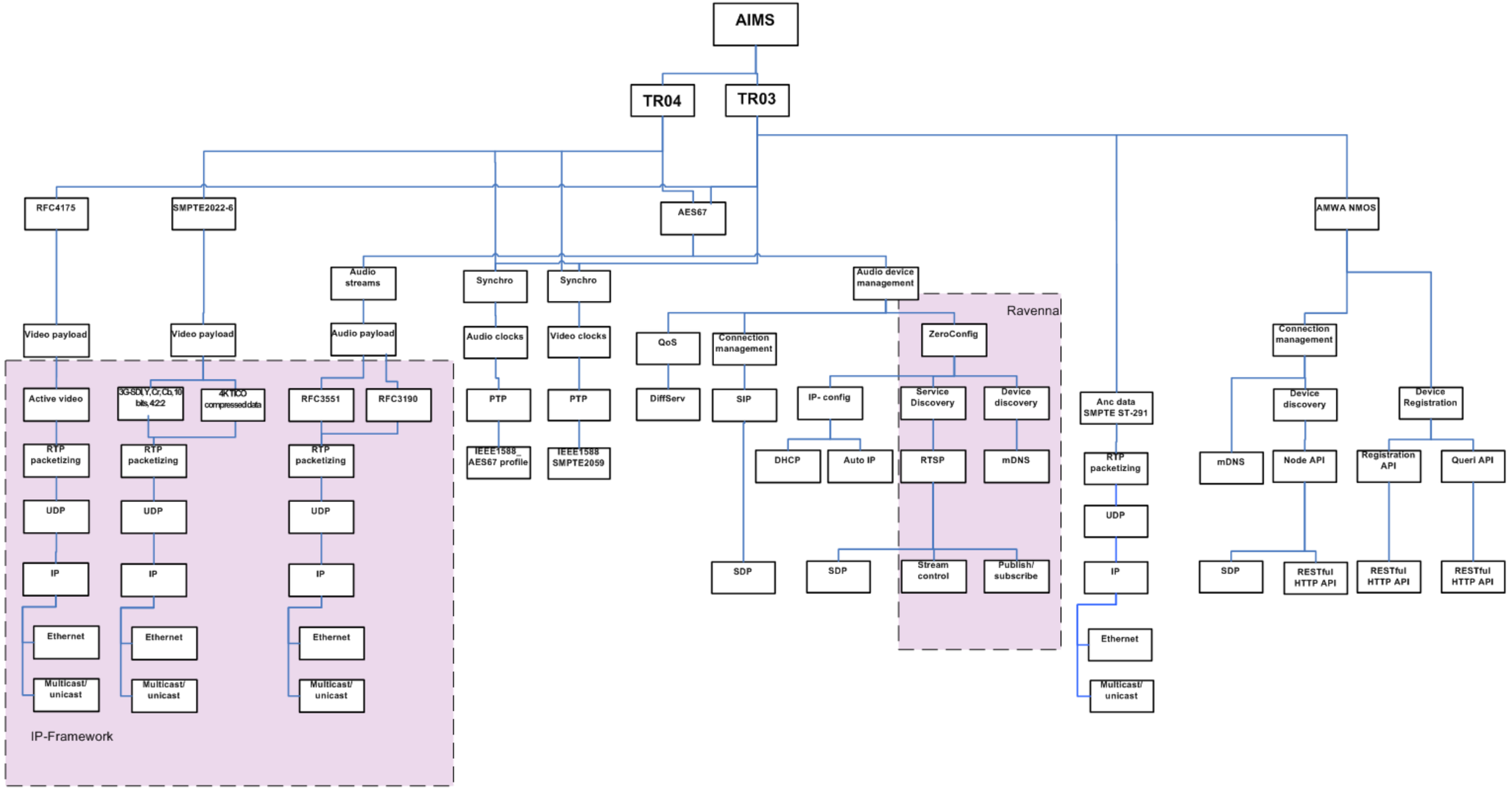
PTP Overview Ext Ref (Free Run)



PTP Overview Ext Ref (PTP)



AIMS IP layer overview



Thanks for your attention.