RAVENNA 2020 Webinar Series

AES67 Practical: Configuring Switches

Tue, June 23, 2020
15:00 h (CEST)

Claudio Becker-Foss, DirectOut

Bart Swinnen, Luminex

Nicolas Sturmel, Merging

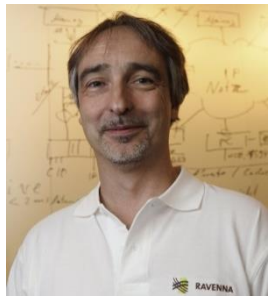
Andreas Hildebrand, ALC NetworX

DirectOut TECHNOLOGIES

Luminex NETWORK INTELLIGENCE

MERGING AUDIO FOR THE NETWORKING AGE

ALC NetworX



Andreas Hildebrand, RAVENNA Technology Evangelist

- more than 25 years in the professional audio / broadcasting industry
- graduate diploma in computer science
- R&D, project & product management experience
- member of AES67 TG and ST2110 DG

ALC NetworX GmbH, Munich / Germany

- established 2008
- R&D center
- developing & promoting RAVENNA
- Partnerships with > 40 manufacturers

RAVENNA

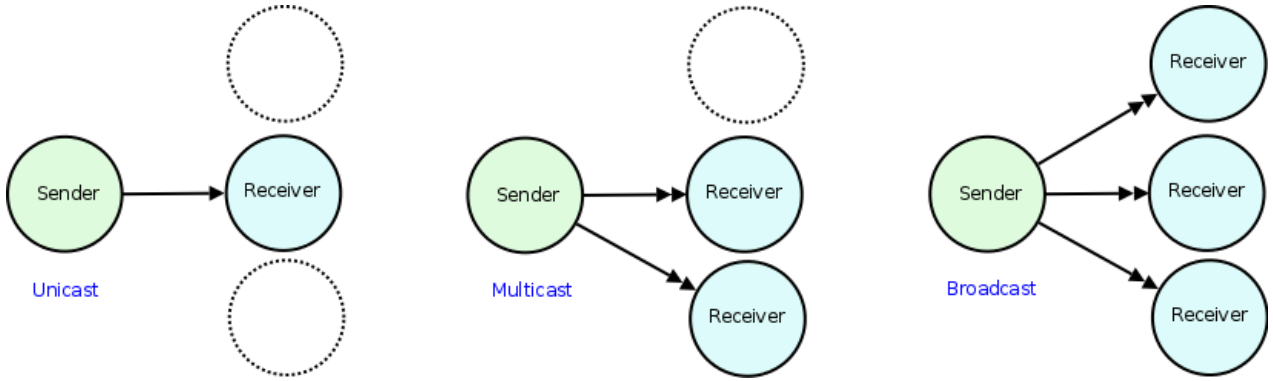
- IP media networking technology
- designed to meet requirements of professional audio / broadcasting applications
- open technology approach, license-free
- fully AES67-compliant (*built-in*)

Agenda

- Overview on important network configuration aspects
  - Multicast / IGMP
  - QoS
  - VLAN
  - PTP
- Practical hints
  - Nicolas Sturmel, Merging: **Cisco SG350**
  - Bart Swinnen, **Luminex**: **GigaCore** switch
  - Claudio Becker-Foss, DirectOut: **Artel Quarra**
- Q&A

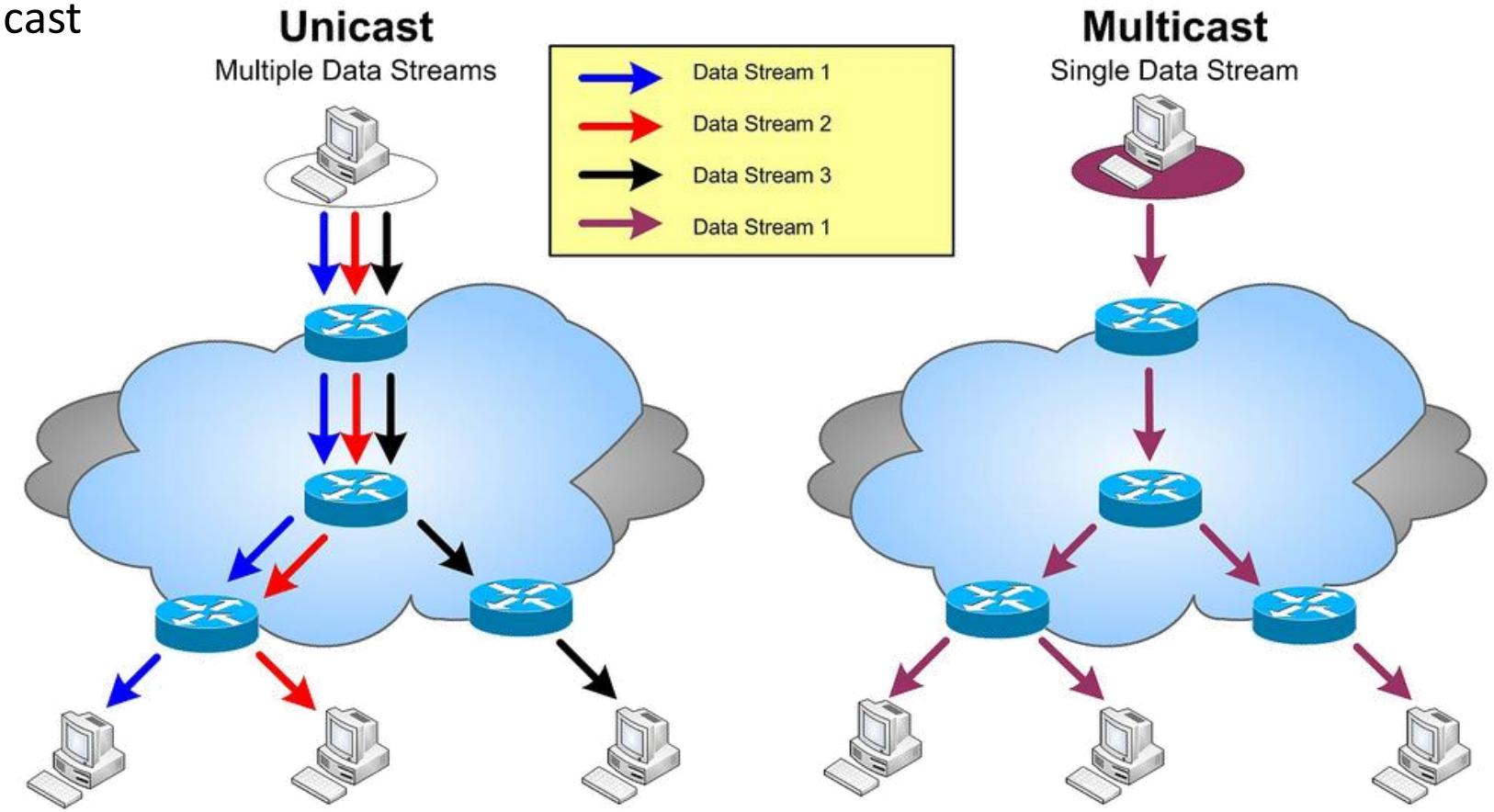
Managing Multicast Traffic

- Multicast: packet distribution 1-to-many
  - Multicast ≠ broadcast



Managing Multicast Traffic

- Multicast: packet distribution 1-to-many
  - Multicast ≠ broadcast
- It scales!



Managing Multicast Traffic

- Multicast: packet distribution 1-to-many
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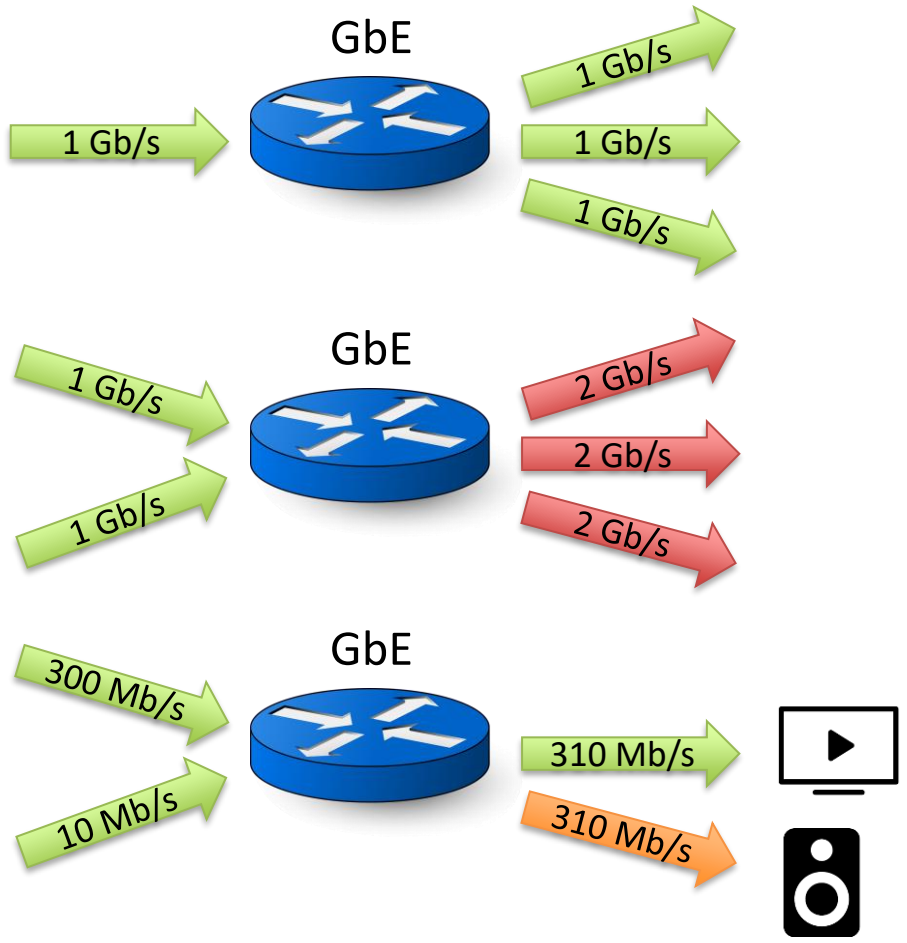
- It scales!
- It floods!

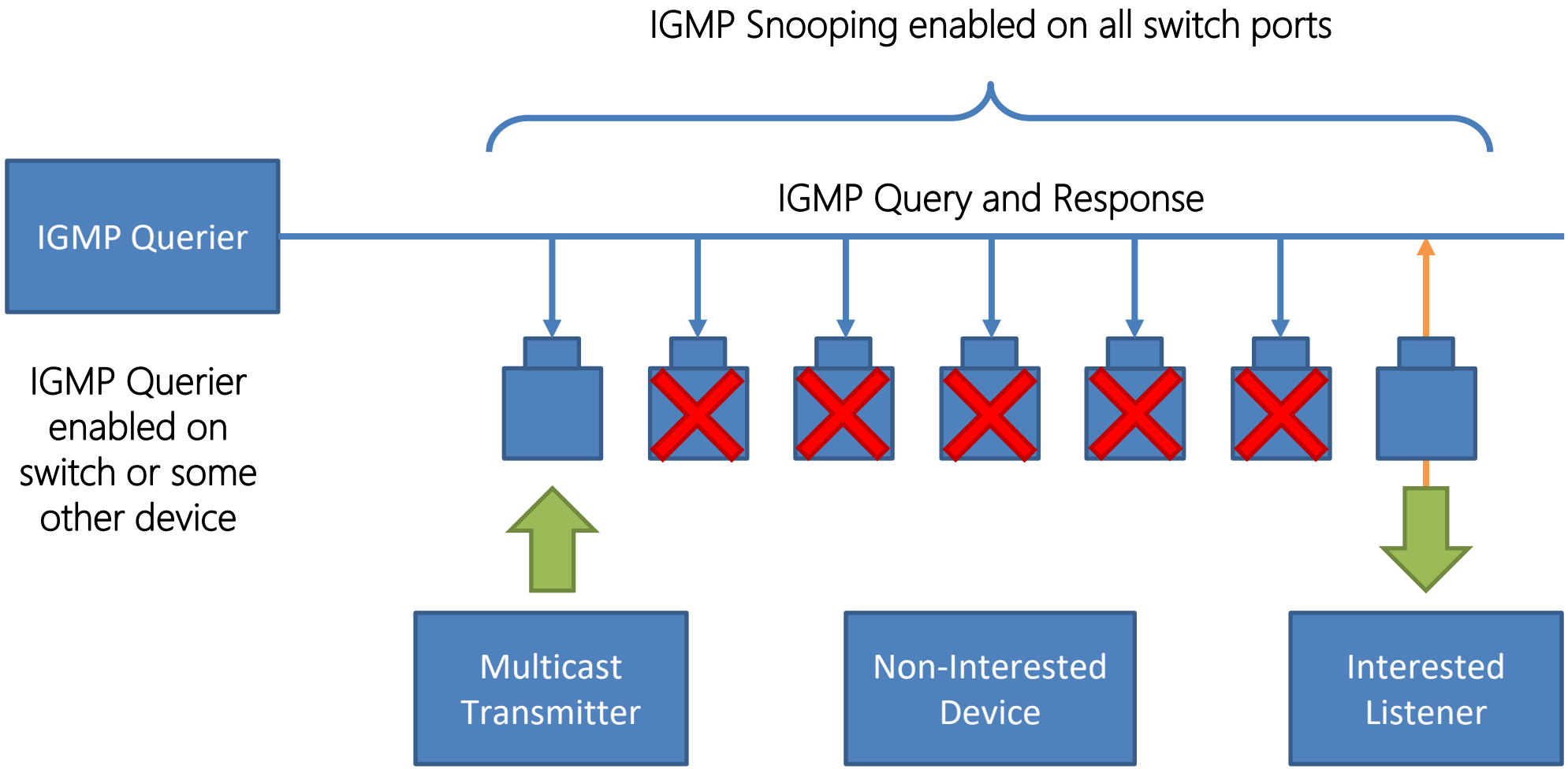
Managing Multicast Traffic

- Multicast: packet distribution 1-to-many
  - Multicast ≠ broadcast
- It scales!
- It floods!
  - unmanaged multicast = broadcast!
  - may overload links
  - may overload end devices
- AES67 uses multicast for streaming (and PTP!)

  ⇨ manage multicast!



Managing Multicast Traffic - IGMP



IGMP – required to manage multicast traffic on a network

- Avoids network flooding
- AES67 devices support IGMPv2
- The network switches must also support and enable this feature
- IGMPv3 could be used, automatic fall-back to IGMPv2 (if used by at least one device)

IGMP Snooping

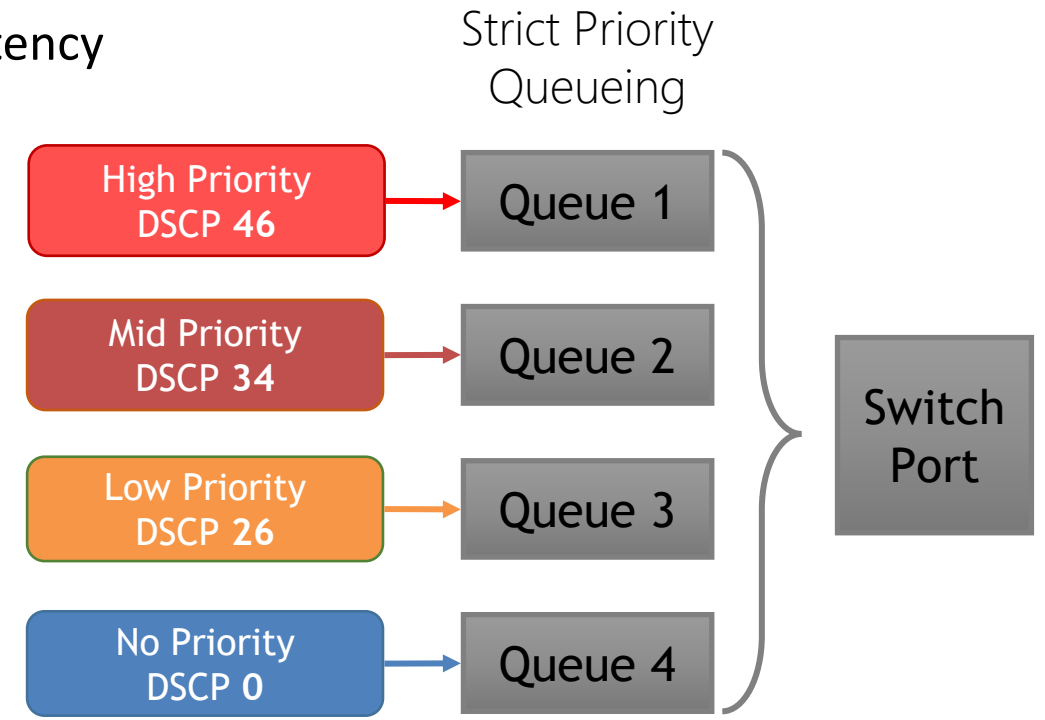
- Switches identify IP multicast traffic by „snooping“ into IP header
- multicast forwarded to registered receivers only, blocks unconditional forwarding
- Beware of unregistered multicast traffic (may result in flooding)!

IGMP Querier

- Sends out periodic query messages, need to be answered by receivers
- Allows the switch to build a table of registered flows and their respective receivers
- Ensure that only one querier is elected (by configuration or dynamically)

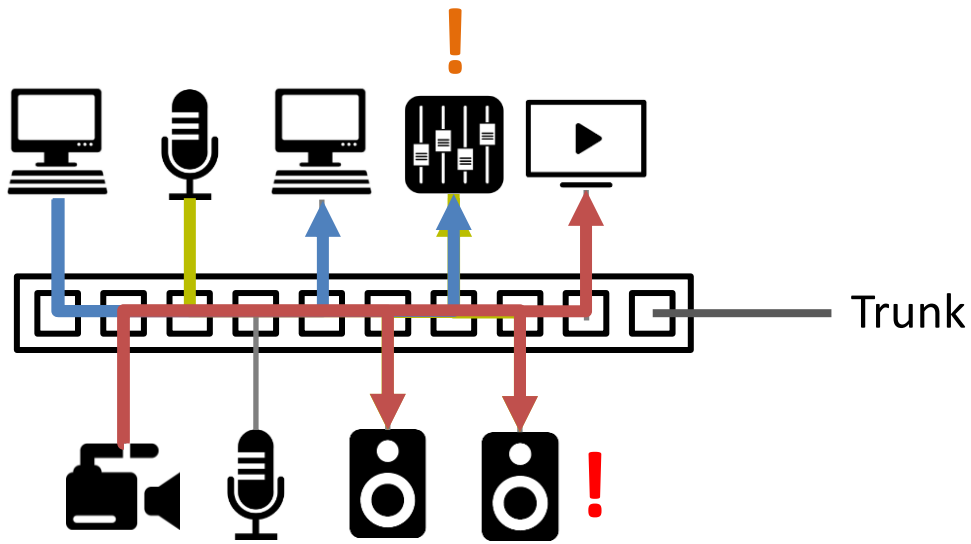
Quality of Service (QoS)

- Transport media and PTP packets with lowest possible latency
  - Minimize packet jitter
  - Expedited forwarding
- Switches are not aware of traffic type
  - IP packets look all the same
- IP-based QoS – Differentiated Services (DiffServ)
  - IP packets receive traffic class tag (DSCP)
  - Switches identify DSCP tag
  - Store packets in prioritized forwarding queues
  - Use strict priority scheduling on egress
- May also avoid packet drops (of prioritized packets) on highly loaded networks or during peak overloads
  - But no guarantee!



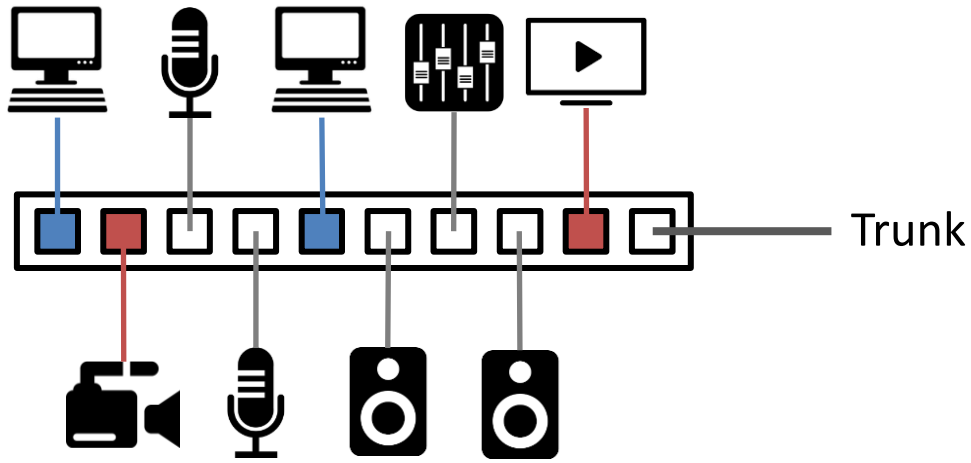
Quality of Service (QoS)

VLAN – Separating Devices and Traffic



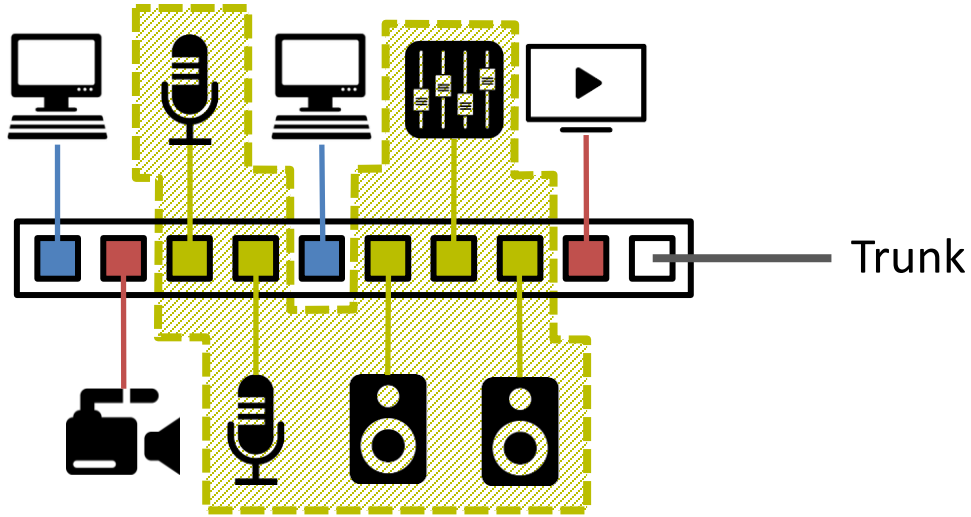
VLAN – Separating Devices and Traffic

- Create private (virtual) LANs on the network



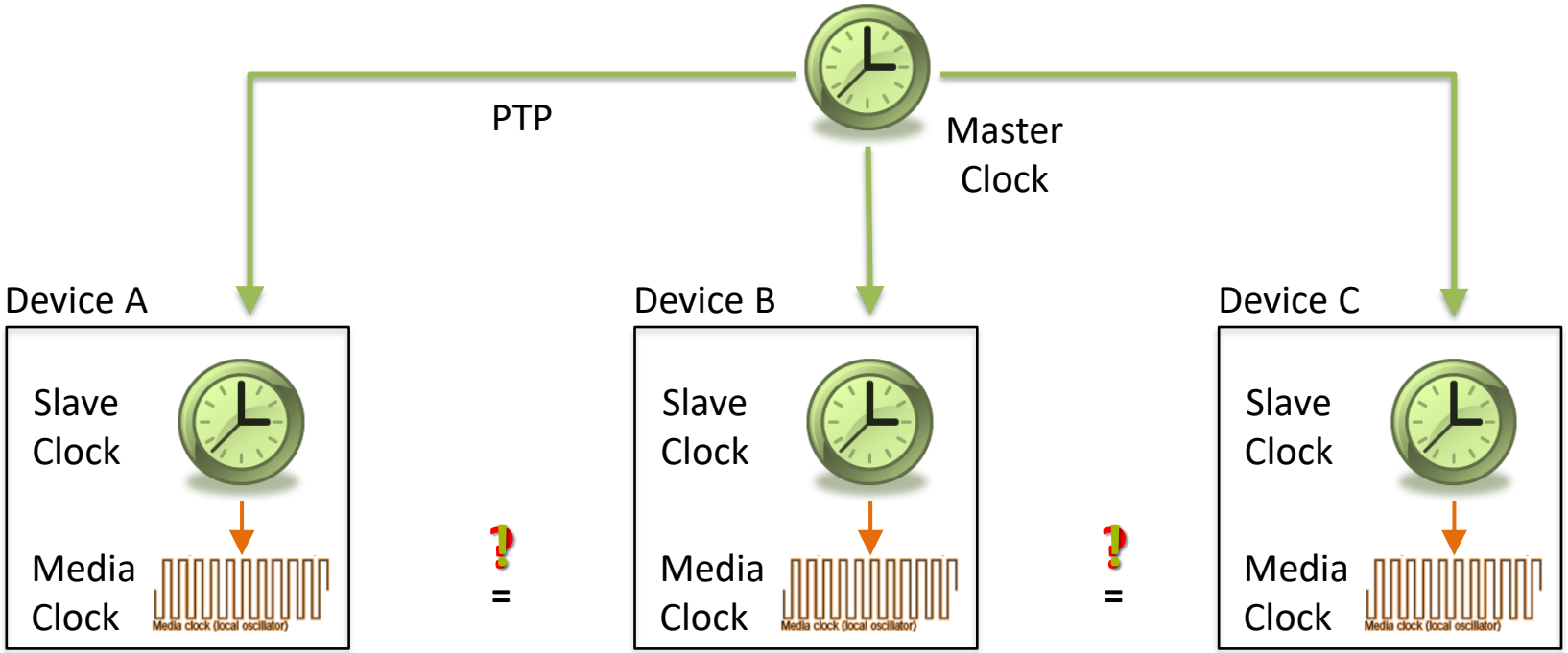
VLAN – Separating Devices and Traffic

- Create private (virtual) LANs on the network
- Isolates traffic among ports
  - No traffic interference between various services
- Requires routing capability for cross traffic
- Does not save network from bandwidth overload (backplane switching capacity, trunk)



PTP – Network Clock Synchronization

– IEEE1588-2008 (PTPv2) is used by AES67



PTP – Network Clock Synchronization

- IEEE1588-2008 (PTPv2) is used by AES67
- Common Grandmaster for all connected devices selected by BMCA
  - Requires matching configuration for announce_msg interval
- Choose whether to use a dedicated Grandmaster device
  - Could be synchronized by GPS (i.e. Meinberg LANTIME, Sonifex AVN-GMCS)
- …or a GM-capable AES67 device (that is always powered on)
  - Raise its priority status higher than other devices
- Make sure that PTP packets travel with least amount of jitter
  - Assign high DSCP value to PTP packets, configure switches accordingly
  - Use PTP-aware switches (BC or TC) in larger or heavily-loaded environments

Nicolas Sturmel

"Avoid flooding and how to hit the right lane"

Nicolas Sturmel, PhD

ENS Cachan, IRCAM, Paris VI and XI universities graduate
Member of the SC-02-12 (Audio Network) standard committee,
Especially active on AES67 testing, plug fests, dirty hands events
Passionate on both audio and network

Media Network and Interoperability expert at Merging Technologies
ANEMAN product owner
@nicolassturmel, www.linkedin.com/in/nicolassturmel

Merging Technologies

Designer of some of the best Analog to AES67 conversion
Editor of the Pyramix DAW
Celebrating 30 years in 2020 !

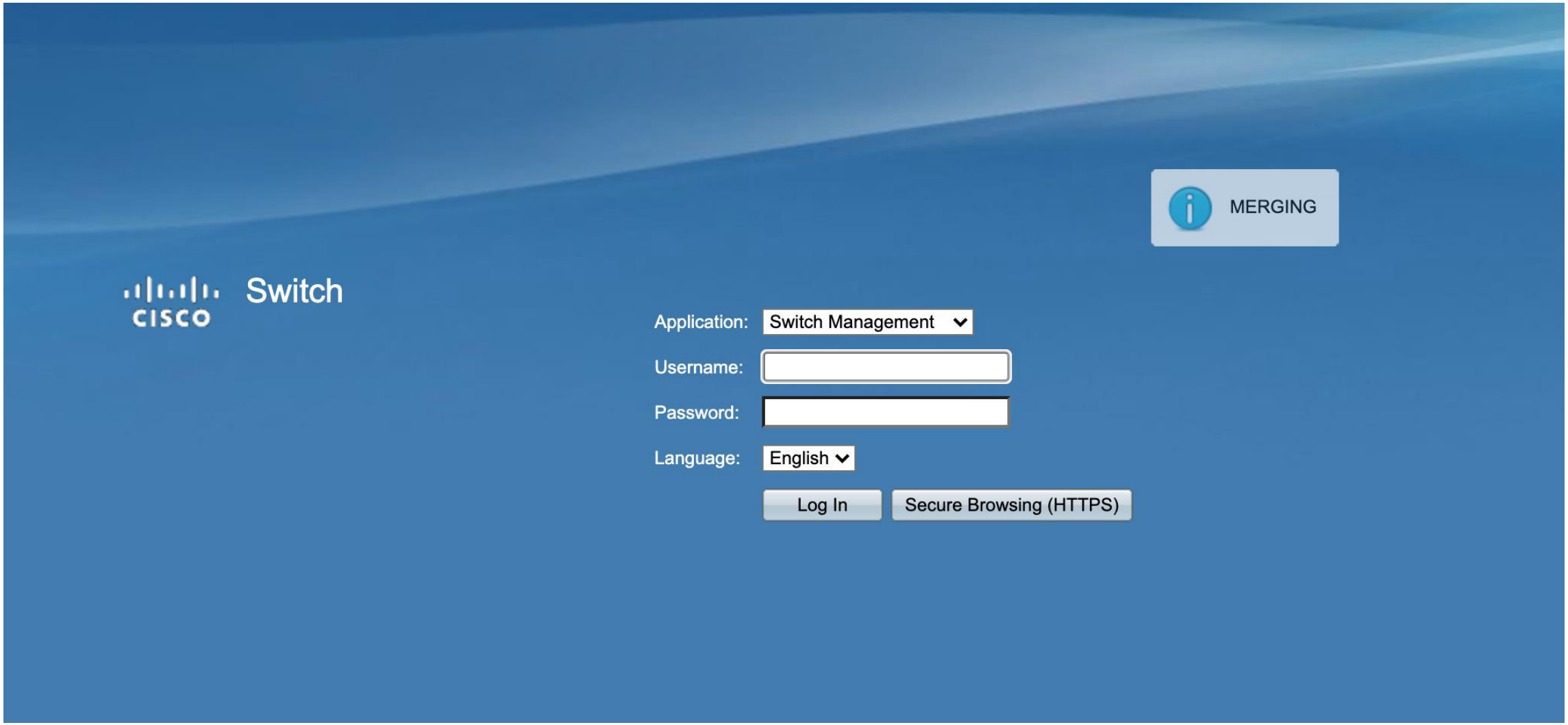
Cisco: the cheap entreprise switch reference
What's the catch ?

Everybody knows Cisco ... And Cisco does everything ...

The SG350 (and 300 and 500) series are cheap and powerful enterprise switchs (even called routers because the can !)

- Cisco style configuration, watch out for the missing tick box !
- High versatility, you go far and do complicated stuff
- Takes time to setup, a really long time

AES67 Practical: Configuring Switches


MERGING
Switch
Application:
Switch Management
Username:
Password:
Language:
English
Log In
Secure Browsing (HTTPS)

Do I need to have a degree in networking to configure it ?

PTP

STP IGMP

QoS VLAN

IP Routing

ARP DHCP

LLDP

Thankfully, on most small and some medium network, a simple switch configuration file does the trick

3 ways of approaching the problem

- Using a premade configuration file (set and forget) https://confluence.merging.com/pages/viewpage.action?pageId=29556774
- Using a network design tool (great when you know where you are going)
- Hand configuration and continuous changes for the venues, broadcast, sedentary setups

Cisco is by far not the best brands when you easy and fast setups on multi protocols network. There are other solutions for that

And focus into those points:

We will go trough the configuration on all those points, in real time on the switch.

- Switch IP
- IGMP
- QoS
- Power Saving
- VLANS
- IGMP with multiple switches

IGMP

When transporting more than 32 channels at 48kHz, it's a must have !

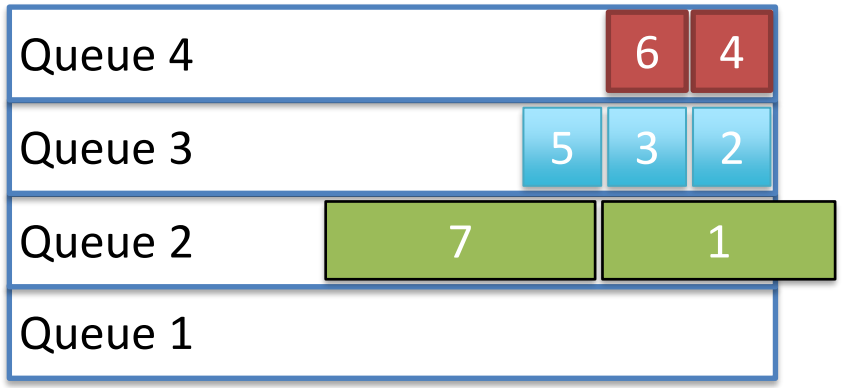
IGMP allows distribution of a multicast stream only the branches of the network where it is needed.

QoS

Do I really need this ?

QoS is like a seat belt or an insurance:
You need it to have it on
So that damage get reduced when things go wrong

QoS and traffic shaping



High priority packets first

But will never interrupt the sending of a packet

Packet ideal size:
Induced jitter is not null !

DSCP : Ravenna, AES67 and Dante

	Ravenna	AES67	Dante
PTP	CS6 (56)	EF (46)	CS6 (56)
Audio	EF (46)	AF31 (34)	EF (46)

Most RAVENNA/AES67 are configurable to a certain extent

AES67 Practical: Configuring Switches

<demo>

Cisco SG350 switches: pros and cons

Pros
- Cheap
- Fits in larger infrastructures
- Highly customizable , you can do almost anything

Cons
- Takes time and skill to configure
- No PTP support
- Limited resources (solved by going the range above)

My opinion is that such switches are best used in long term installations or pre-configured setups

Bart Swinnen

Luminex NETWORK INTELLIGENCE

"Easy configuration and VLANs"

Bart Swinnen, LUMINEX Network Intelligence

- More than 20 years experience in lighting, audio and video control
- Master diploma in elctronics and IT
- Founder of Luminex Network Intelligence
- CEO / Product manager

LUMINEX Network Intelligence

- Established 2002
- Belgian-based manufacturer of data distribution equipment for professional lighting, audio and video applications, mainly for the entertainment industry.
- Validation with multiple manufacturers in different markets

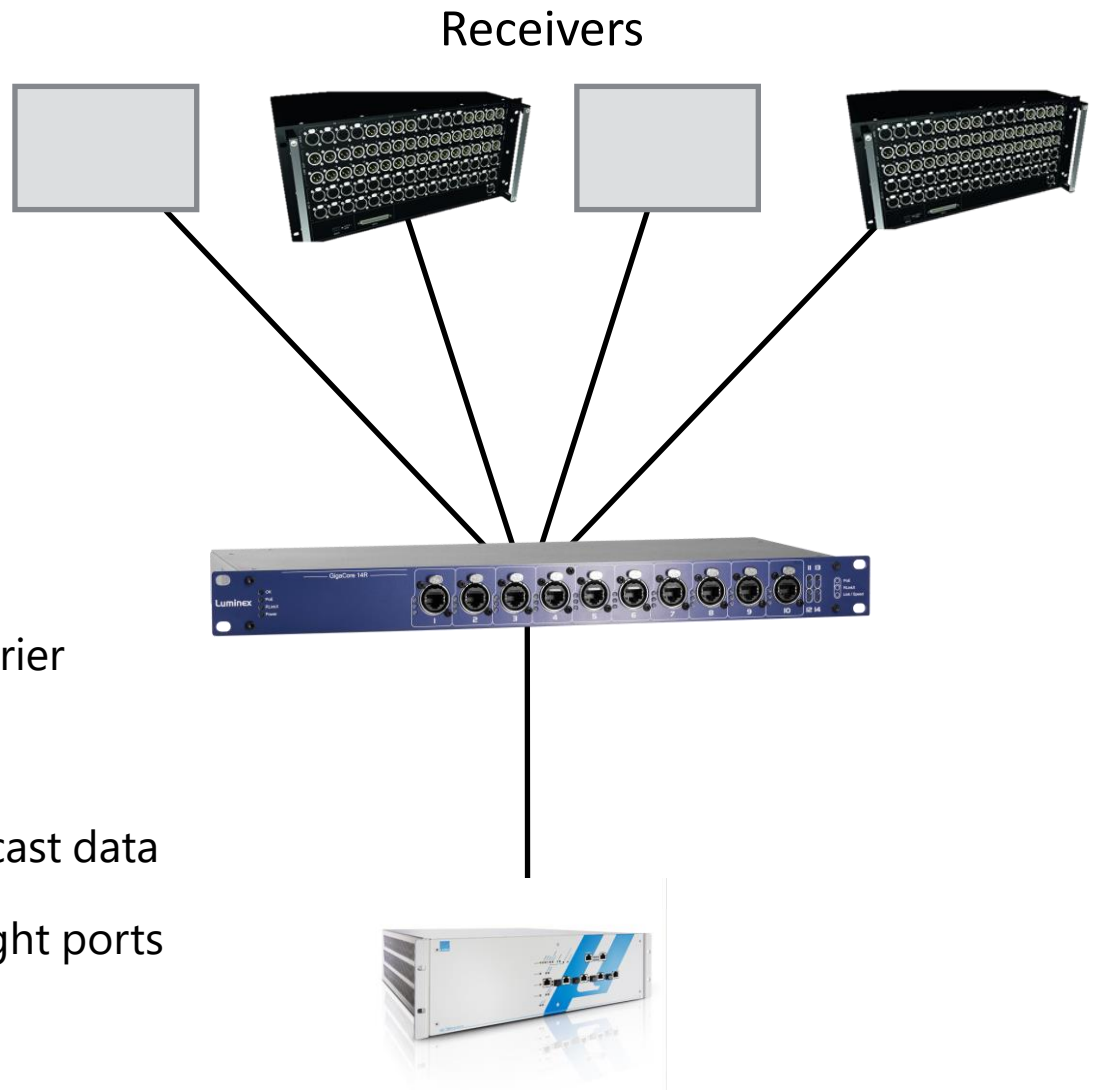
Luminex GigaCore switches

- Pre-configured
- Validated with multiple protocols
- No IT knowledge needed
- Intuitive interface
- Silent design
- Robust enclosure

IGMP / snooping / flooding

GigaCore defaults:

- IGMP querier enabled in every group (VLAN)
- Snooping enabled
- Flooding bit disabled



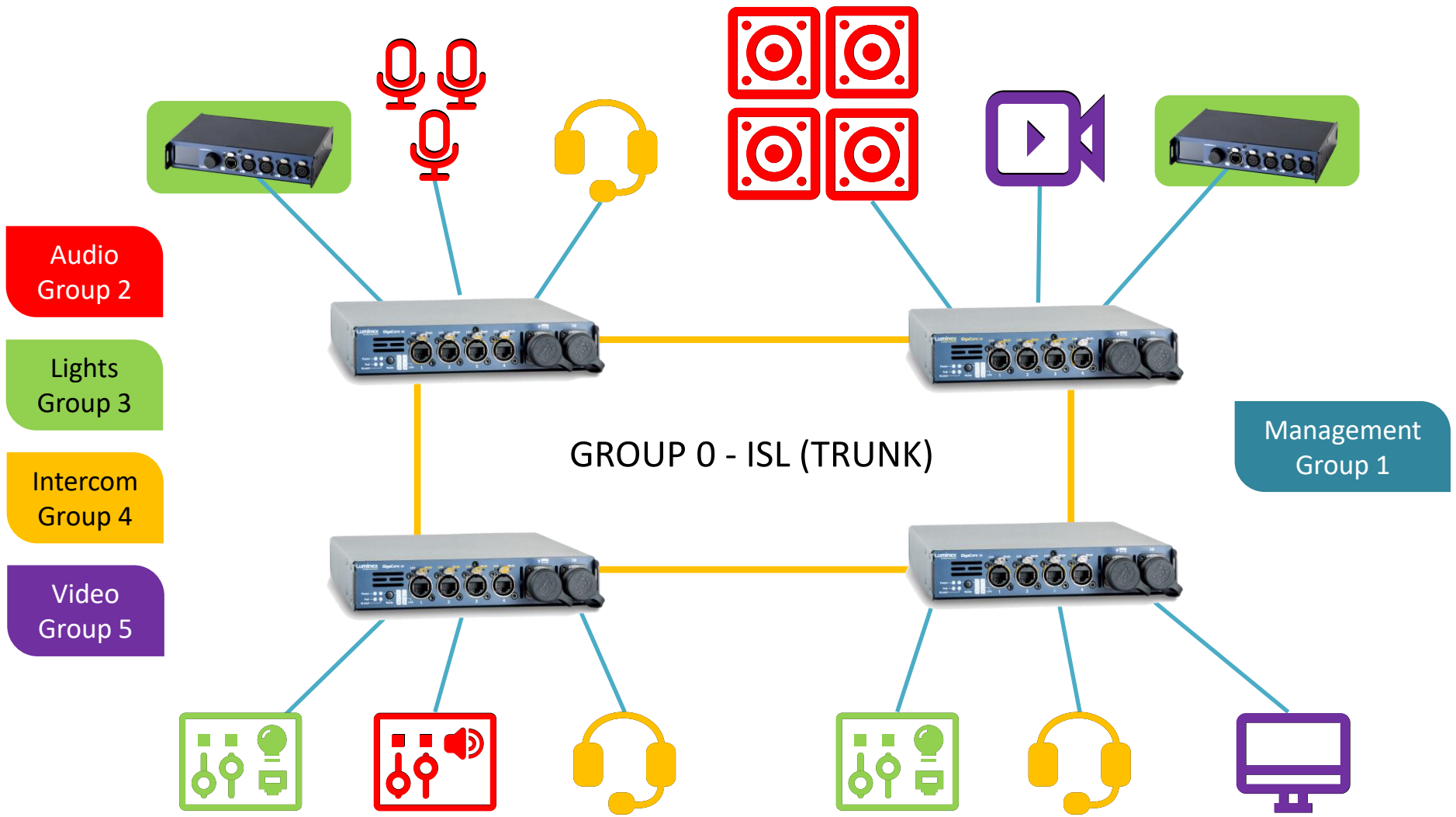
1. Switch announced as a Querier
2. End devices ask to join
3. Source sends out the Multicast data
4. GigaCore switches to the right ports

DiffServ & QoS

- GigaCore product family has pre-defined mapping of Diffserv values toward 8 egress queues
- Switch need to be a PtP V2 switch or QoS settings might have to be customized when combining protocols.

	DSCP/Class		Queue		DSCP/Class		Queue
MRP	63		7		31		3
	62		7		30	AF33	3
	61		7		29		3
	60		7		28	AF32	3
	59		7		27		3
	58		7		26	AF31	3
	57		7		25		3
Dante PtP	56	CS7	7		24	CS3	3
	55		6		23		2
	54		6		22	AF23	2
	53		6		21		2
	52		6		20	AF22	2
	51		6		19		2
	50		6		18	AF21	2
	49		6		17		2
	48	CS6	6		16	CS2	2
	47		5		15		1
Dante RTP / AES67 PtPV2	46	EF	5		14	AF13	1
	45		5		13		1
	44		5		12	AF12	1
	43		5		11		1
	42		5		10	AF11	1
	41		5		9		1
	40	CS5	5	Dante reserved	8	CS1	1
	39		4		7		0
	38	AF43	4		6		0
	37		4		5		0
	36	AF42	4		4		0
	35		4		3		0
AES67 RTP	34	AF41	4		2		0
	33		4		1		0
	32	CS4	4		0		0

VLANs…. Groups



AES67 Practical: Configuring Switches

<demo>

Claudio Becker-Foss

DirectOut TECHNOLOGIES

“Taking PTP to the boundaries”

Claudio Becker-Foss, CEO/CTO of DirectOut

- studied Audio Engineering at the Institute of Music and Media in Dusseldorf, Germany
- co-founder of DirectOut GmbH in 2008
- freelance broadcast engineer for WDR in Cologne
- recording producer
- network audio specialist
- member of AES67 standards committee

DirectOut GmbH, Mittweida / Germany

- founded in 2008
- manufacturer of professional audio and broadcast equipment
- early adopter of RAVENNA, AES67 and SMPTE ST 2110

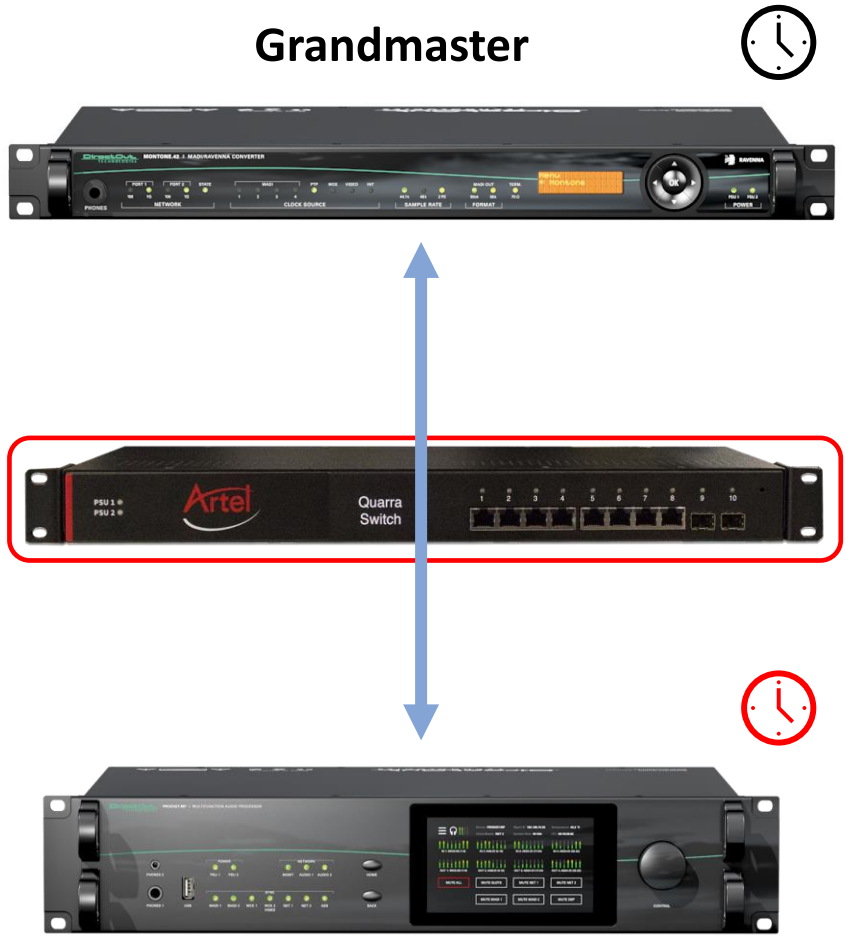
RAVENNA Partner

- since 2009 (early adopter)

Non-PTP-aware switch

Time t

t + Processing time p

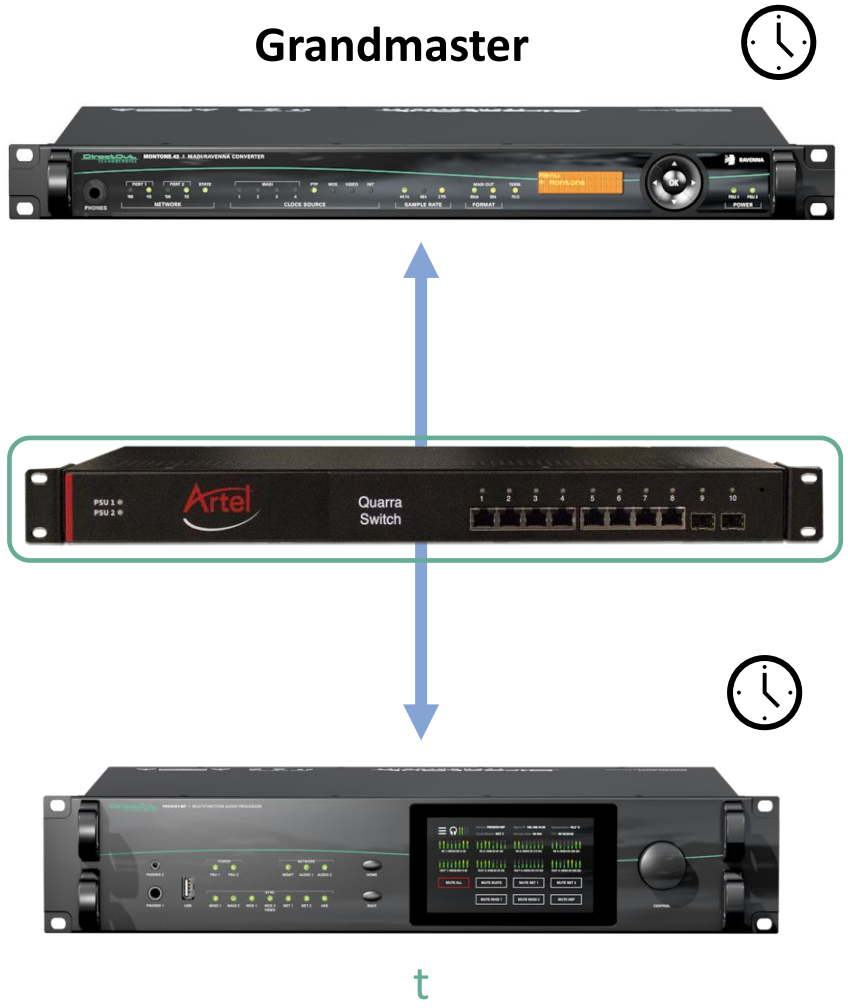


E2E Transparent Clock

Time t

t + Processing time p

t + p - p

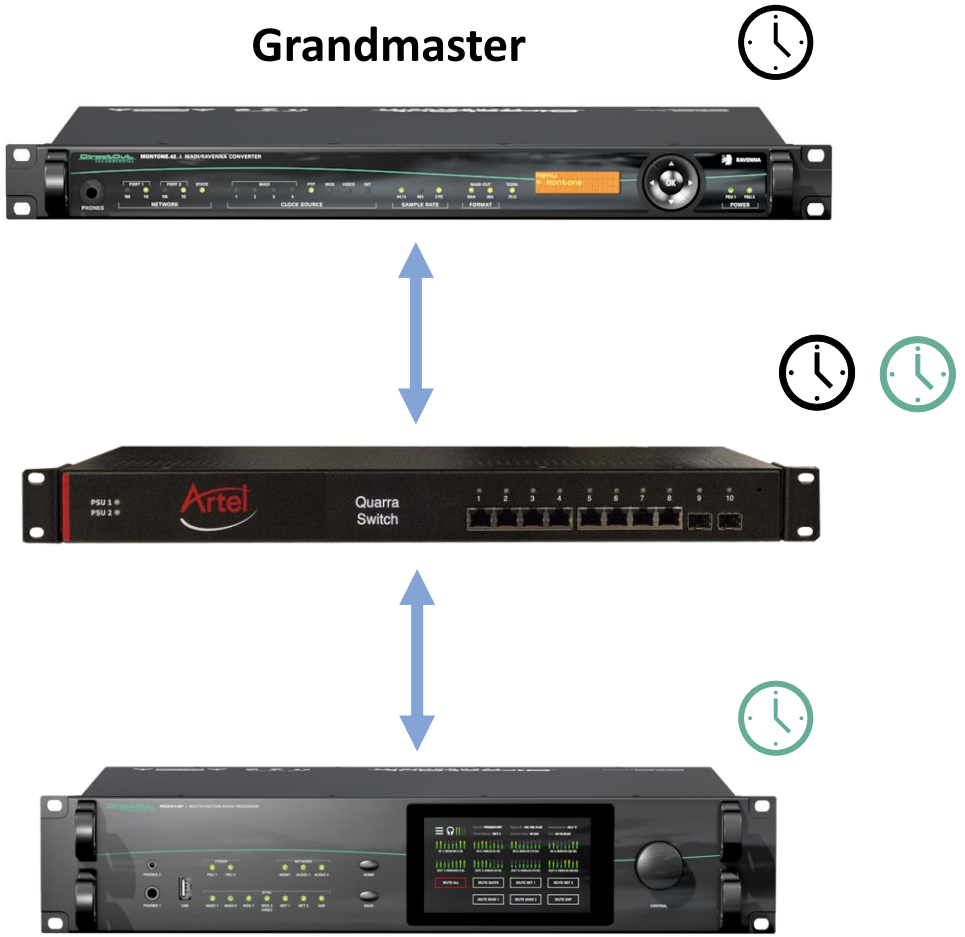


Boundary Clock

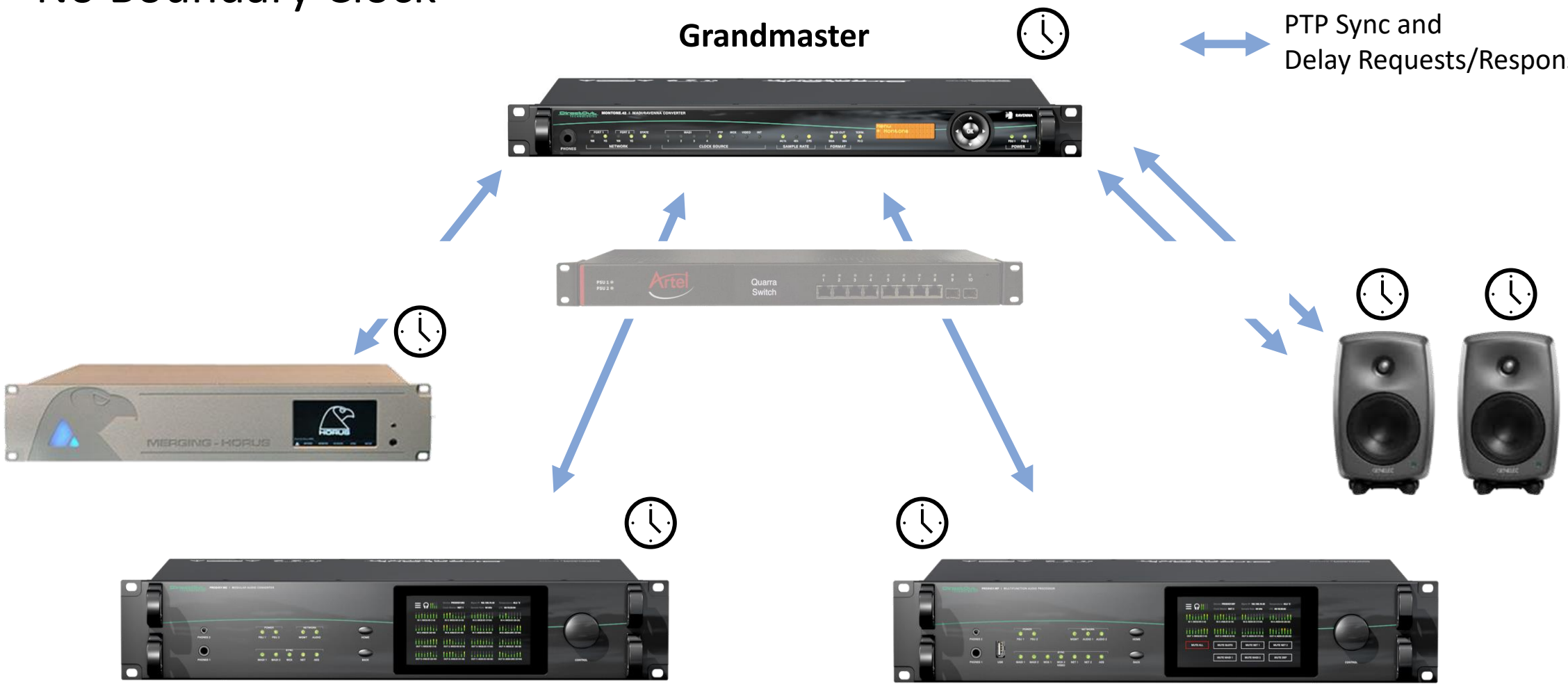
Time t

t

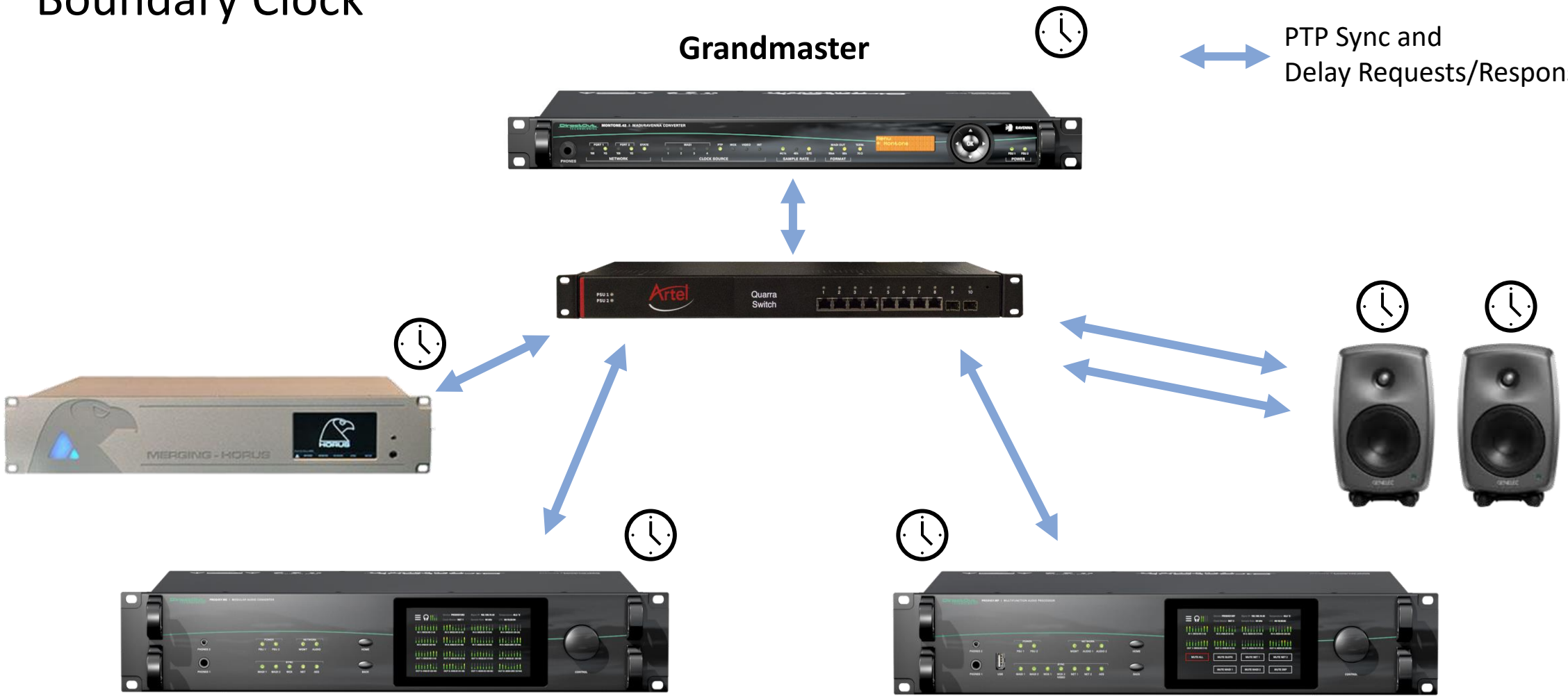
t (b)



No Boundary Clock



Boundary Clock



AES67 with Dante

- TX up to 8 channels, RX up to 64 channels
- Multicast only (no Unicast)
- Restricted Multicast IP-Range: 239.**p**.x.y

  Default Prefix: 239.69.x.y
- Encoding: L24 (24 Bit)
- Packet time: 1ms TX / 1ms, 125µs, 250µs, 333µs RX
- Non-Standard DSCP Markings
- Dante Redundancy mode not available
- Dante Virtual Sound Card does not support AES67

! Multicast Prefix !

AES67	**Dante** (AES67)
PTP: EF	PTP: CS7
Media: AF41	Media: EF

A final tip at the end:

EEE

- Energy Efficient Ethernet (or “Green Ethernet”)
- Unfortunately, it‘s evil for real-time media
- Data transmission is frequently paused to save energy
- Ruins clock sync
- Must be disabled in network switches

More answers…

RAVENNA / AES67 / SMPTE ST 2110 Resources:

RAVENNA AES67 & ST 2110 built-in

www.ravenna-network.com/resources

Network Requirements

You've made it!

Contact information:

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ALC NetworX GmbH

ravenna@alcnetworx.de

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RAVENNA
AES67 & ST 2110 built-in

www.ravenna-network.com