Designing an IP Studio
Practical lessons from the field

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Scale

- Absolutely vital to have clear objectives here ☺

- Think - initial deployment >>>>>>> anticipated future needs
- Plan for 25/50/100Gbe capability – 2.5x more dense than 40Gbe

- 400Gbe provides 4x capacity for massive scale
- Beware feature / scale creep

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Scale – Rules of thumb

- Sometimes easier to start with "SDI" scale
- Overlay this with physical constraints
- Average "full duplex" use?
- Average planned BW usage %?
- Average flow size – Audio/SD/HD/UHD?
- Are you thinking ST2110, or ST2022-6?

- 576^2
- Centralized model
- 60% full duplex
- Max 75% BW usage
- 80% 1080p50, 20% UHD
- ST2110

- $576*(0.8*2 + .2*10)/(0.6 * 0.75)$
- 4.6 Tbps total throughput
- 46x 100Gbe host facing ports.

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Facility Geography

- Consider your workflows, how much BW is needed?
- Centralized, or more Campus like?
- Physical cabling lengths?
- Shared "virtual" facilities model?
- Think "failure domains"
  - Functional alignment
  - Resiliency alignment

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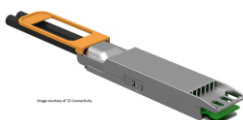Studio   Gallery

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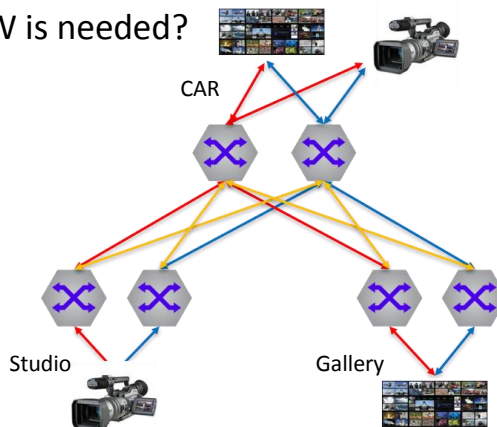
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Physical Cabling

- DAC - Direct Attach Copper.
  – 400Gbe @ 3m, 10/25/40/50/100Gbe @ **5m**
- AOC – Active Optical Cable.
  – 10/25/40/50/100Gbe 400Gbe @ **30m**. Can be broken out
- SR – Short reach
  – Typically **70-100m**, depending on OM3/OM4 MM fiber
- LR – Long reach
  – Typically **10km** over SM fiber

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Some thoughts on costs

- Don't forget Interconnect and fiber costs in your estimates
- MM vs SM Infrastructure? Is really cost vs simplicity
- Monolithic may look expensive if your initial scale is small - you're not using it all
- Monolithic often cheaper for comparable end point count

- Switching / connectivity costs are typically 10% of a green field DC installation – Does that feel right for Broadcast??
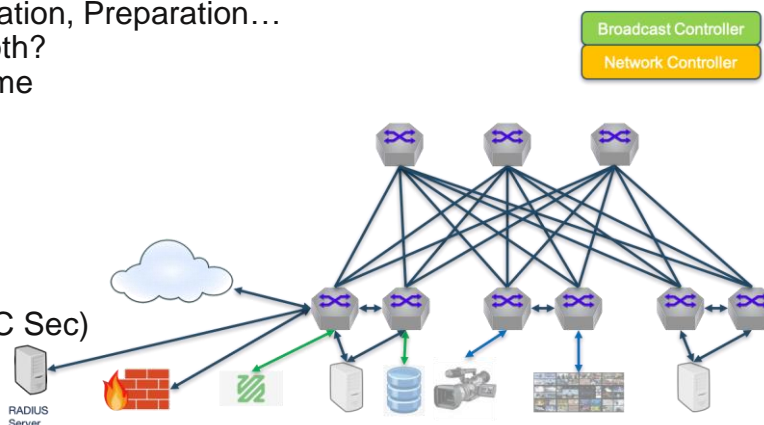
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Network Services

- Preparation, Preparation, Preparation…
- IGMP or SDN, or both?
- IP addressing scheme
- Dynamic Routing
- MLAG
- Firewalls
- Multi-Tenacy
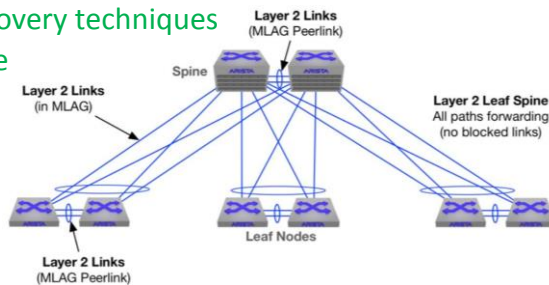- L2 mobility (VM's)
- NATing
- Encryption (IP / MAC Sec)

Broadcast Controller

Network Controller

RADIUS Server

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L2 vs L3

- Widely used in small Data Centers, Campus, etc

- L2 networks typically deployed for audio installations
  - Simple
  - Low bit rate flows, undersubscribed networks
  - Some control systems use L2 scoped discovery techniques
  - MLAG provides scale, and spine resilience
  - Limited to 2 spines
 - Large failure domains
  - Routing in the spine

Layer 2 Links
(MLAG Peerlink)

Spine

Layer 2 Links
(in MLAG)

Layer 2 Leaf Spine
All paths forwarding
(no blocked links)

Leaf Nodes

Layer 2 Links
(MLAG Peerlink)

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L2 vs L3

- L2 does not suit Live Production, high bit rate multicast
  - Flows originated in remote switches are flooded towards the querier
  - This potentially requires very large pipes!
  - Large failure domains
  - Limited scalability
- L3 is the way to go
  - "Switches" do routing these days & PIM allows multicast to be routed
  - Failure domains are now able to be much smaller
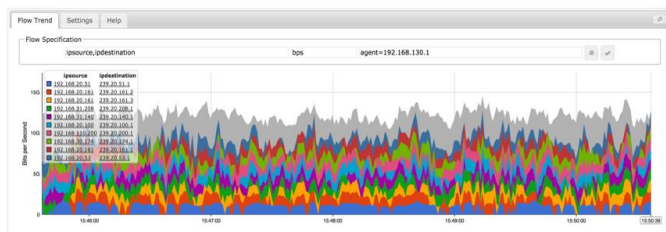 - Flooding towards the querier is no longer required
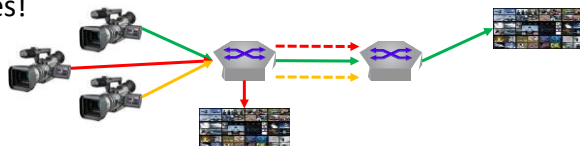
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Day one – standup tools

Make your life as easy as possible:

- Zero Touch Config
- Bash, tcpdump
- Script your configs
- Name your switches
- Enable LLDP
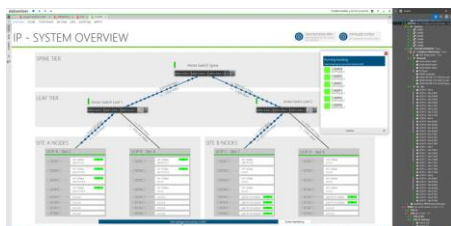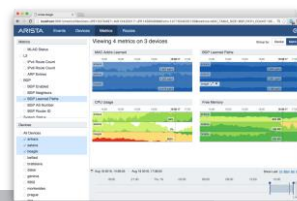- Provide port descriptions

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Day 2 – ongoing monitoring

Transparency and Visibility

- Plan it in!
- SNMP, Syslog, Telemetry
- Port Mirroring, Optical tapping
- Broadcast specific monitoring tools

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Summary

- You can't do too much planning and preparation
- Make sure your team is cross-functional
- If you don't have the in-house skills:
  - Bring in an experienced SI or
  - Engage AS/PS from the network vendor
  - Use the process to build your skills
- Treat Telemetry, Monitoring and Visibility as a 1st class citizen
  - Build it in from the beginning
  - You'll benefit straight away

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Thank you

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