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Building Scalable Media Systems using JT-NM TR-1001

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Imagine Communications

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Scalable Media Systems ? What?

- Building IP-based media systems is a lot of work
  - Multi-Vendor systems even harder
  - Multi-Format systems even harder
  - Bigger Systems are harder than Small Systems

- How do we get to where we can
  - leverage the scale needed in large facilities,
  - with mixed formats, UHD, HDR,
  - and the scale available in the large IP switching cores ?
- How do we get there on-budget and on-schedule?

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Standards are Great…
(insert joke here)

- As an industry, we have build a good stack of standards for these IP Systems
  - 2110 specifies the bits on the wire PUBLISHED
  - IS-04 organizes the devices PUBLISHED
  - IS-05 controls the streams PUBLISHED
  - IS-07 adds tally and event streams PUBLISHED
  - IS-08 manages the audio channels PUBLISHED
- What is missing?

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Each of those specs is very flexible… -- (maybe too flexible)

- Not always clear what is normative
- No profiles or levels spec in 2110-20
- Several ways to find the registry
- Audio streams organized a lot different ways
- How do senders know their TX multicasts?
- How are PTP details distributed to devices?

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Design Phase – How to Read a Product Spec

- A product says it complies to SMPTE ST 2110
  - What does that mean?
  - What formats of video/audio can it speak?

- 2110-30/31 define profiles & Levels of audio
- 2110-21 defines some nomenclature (-N, -W, …)
- 2110-20 allows for countless variety of video
  - VSF TR-05 provides some additional language for categorizing those formats into meaningful groupings
  - Additional work underway to enumerate the realistic universe of formats

Nobody Likes to Configure things by hand

- We need to specify what to do instead

- What Needs to be configured ?
  - Host IP, CIDR mask, gateway, for each interface
  - PTP Details (domain, announce timeout)
  - Where are the registries? What is the timeout?
  - Transmit address details for every sender
  - Plus all the normal stuff

Persistent Settings are Good (?)

- Tradition in television equipment is to store the current settings, and use them whenever a device starts up.
  - Good – leads to a fast recovery after reset

- This can cause problems in IP Systems
  - Rental equipment might come up with the transmit information leftover from last job
  - Spares from the closet have a similar problem

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Seven slides in, time for the good news

- Fall 2018, the JT-NM created and published TR-1001-1, in order to address these device behaviors that affect building large-scale systems

- It was a very fast process
  - Drafting Group formed just after IBC
  - Good cross-industry representation
  - Document published end of November

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What is covered in TR-1001-1 ? (1)

- Use the Standards from SMPTE and AMWA
  - SMPTE ST 2110-10/20/21/30/31/40
  - AMWA NMOS IS-04, IS-05, BCP-002
- Use the Standards in a specific way
  - In some cases this TR constrains the standards
- How devices start-up and integrate into systems
  - This TR specifies some start-up behaviors and network services, so that device makers and system builders have a common expectation about the system

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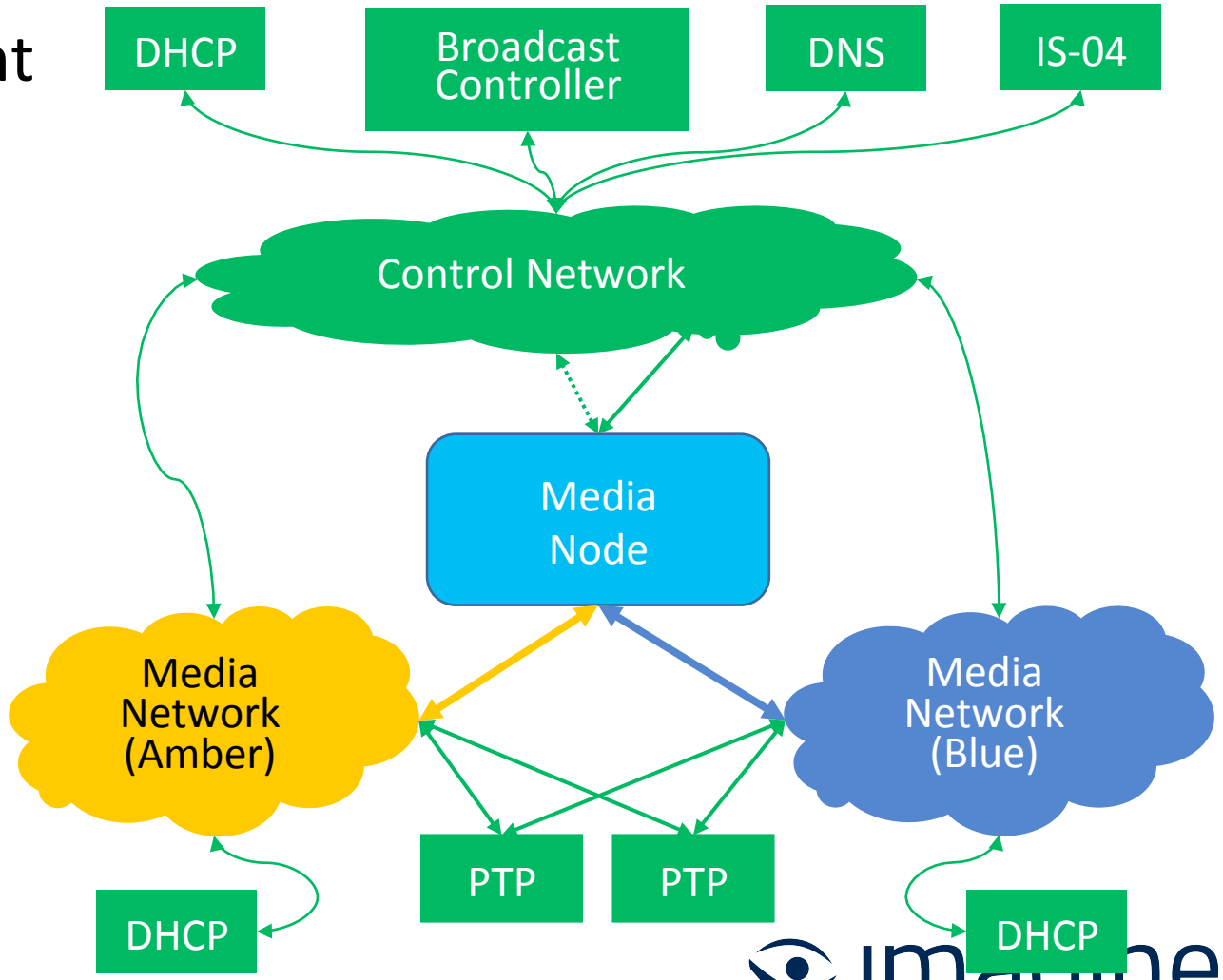
Network Architecture Flexibility

- Unicast Routing between Management and Media Networks
  - Enables a mix of devices, some with management on the media networks, and others with separate management networks
- Separate Subnets for Main and Protect Media Nets
- Specific “Network Hygiene” rules
  - Every interface has unique MAC
  - Every interface has its own Host IP
  - Must support Echo-Request (ping)



Network Services – DHCP and DNS

- DHCP for Management and Media Networks
  - Eliminates the need to set host IP addresses by hand
  - Avoids errors and duplications
  - Tells the nodes how to find the DNS servers
  - Can securely register the node's hostnames into DNS

- DNS (Domain Names Service)
  - Nodes use DNS Service Discovery (DNS-SD) to find the IS-04 registration service and the system resource
  - Finding the System Resource and Registration Service are vital system startup and system resiliency

Network Services – System, NMOS, and PTP

- System Resource Service (provides global system constants)
  - Includes the PTP domain number and other PTP constants
  - Includes the registry timeout settings
  - Avoids needing to configure these by hand for every device in the system

- IS-04 (NMOS) Registration and Query Services
  - Nodes find the Registration Service using DNS-SD (not MDNS)
  - Nodes must register into the IS-04 Registry
  - Nodes should use the BCP-002 “grouphint” to signal natural groupings
  - Controllers look in the IS-04 Registry to find the nodes
  - Nodes update the Registry to signal switching events and other changes

- Precision Time Protocol (PTP)
  - as required by SMPTE ST 2110

Device – Startup Behavior

- TR-1001 specifies some “Out-of-Box” behavior
  - How nodes find their network details (via DHCP)
  - How nodes find the System Resource (via DNS-SD)
  - How nodes find the IS-04 Registry (via DNS-SD)
  - How nodes suggest grouping using BCP-002-01
  - How to identify if the current configuration is valid, out-of-date, or out-of-place (via System Resource)
  - How senders get their TX information (via IS-05)

System Startup Behaviors

- How nodes find the System Resource
  - Look up "**_nmos-system._tcp**" using DNS Service Discovery (DNS-SD)

- How nodes find the IS-04 Registration Service
  - Look up "**_nmos-registration._tcp**" using DNS Service Discovery (DNS-SD)

- How nodes identify if their current config is valid, or out-of-date, or out-of-place
  - Check the stored "system-ID" against the current system resource (to figure out if this is a new system and the configuration is invalid)
  - Check the time of the last saved configuration against the current system resource version (in case the node spent a long time in storage)

System Startup Behaviors - Senders

- How senders get their transmit configuration
  - If the config is current and from the same system ID, use the settings you have stored and start up
  - If the config is out of date or it's a new system:
    - Mute the transmitters
    - Disconnect the receivers
    - Wait for instructions
- Nodes shall support TX configuration via IS-05
  - A controller will configure new nodes

Industry Benefits of TR-1001-1

- Add New Media Nodes to a System Easily
  - DHCP (automatically) provides network addresses
  - DNS-SD (automatically) discloses the services
  - Devices follow specified configuration start-up behaviors
  - IS-04 registration and IS-05 controls integrate the system

- Gives Users a uniform set of requirements language
  - TR-1001-1 should be referred to in RFI, RFP, RFQ
  - Eliminates customers needing to create their own unique requirements documents covering these system basics

- Gives vendors a consistent set of requirements to develop against when making IP Media System products

Future Work:
Subjects in future versions/parts

- Security of the Control APIs
  - Building on the work of AMWA BCP-003
- Audio Channel-level Manipulation
  - Building on the work of AMWA IS-08
- Event Flows and Tally Handling
  - Building on the work of AMWA IS-07

Questions?

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