The "Full Stack" for ST2110 Media Systems

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What is a "Full Stack" in this context?

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- The "Full Stack", for a specific ***domain of use***, describes the requirements on the ***devices,*** and the ***environment*** they live in, including ***standards and behaviors***, so that…

- A customer can take delivery of a new audio/video endpoint device, attach it to the network, and have a straightforward workflow leading to using the device

- Key Terms:
  - Domain of Use
  - Devices and Environments
  - Standards and Behaviors
  - Straightforward Workflow

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Domain of Use

- SMPTE ST 2110, AMWA IS-04/05, SMPTE ST 2059 were all written to be very flexible and cover a lot of user stories.

- Developing a "full stack" needs to be more specific to a type of use

- For the purposes of this talk, our Domain of Use is:
  - Engineered Facilities (Fixed or Mobile) with Engineered IP networks
  - Producing, Packaging, or Delivering television or radio content
  - Built around SMPTE ST 2110 and AMWA IS-04/05 technologies

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Devices, Environments, and Workflow

- Devices
  - Endpoint Devices which create or consume ST 2110 streams

- Environment
  - The management and data *networks* that interconnect the endpoints
  - The management *services* that are supplied through the networks

- Straightforward Workflow
  - "Human in the Loop" workflow for new devices, in order to authenticate devices, assign names / identities / groupings to signals
  - Should not require too much engineering knowledge to add a device

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Standards and Behaviors

- Standards
  - SMPTE ST 2110-10, -20, -21, -30, -31, and -40
  - SMPTE ST 2059-1 and 2059-2
  - AMWA IS-04 and IS-05
  - IEEE 802.1AB Station and Media Access Control Connectivity Discovery (LLDP)
  - Detailed additional constraints on the use of these standards

- Behaviors (How does a device …)
  - Know its network host addresses, Gateway(s), and CIDR mask details ?
  - Know if it is waking up in a system that they are part of, or a new (to them) system, so they can know whether to trust their transmit settings?
  - Know the prevailing PTP domain and Announce and Timeout intervals
  - Find the IS-04 registry and what timeout value prevails?
  - Know what multicast transmit addresses to use?

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Things that Need Work / Definition / Finishing

- Standards are basically done, and the constraints of how to use them in a specific domain can be documented

- Domain, Devices, Environment, and Workflow are pretty clear

- But What about those "Behaviors" ?
  - These are the core of the "full stack" definition for 2110 Media Systems

- Let's attack these in order and see which ones need work…

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Behavior 1: How to Find your Network Details

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- Endpoint Devices Need to know about their place in the network
  - For Each Interface on Management and Media/Data Networks
    - Host Address and CIDR "mask"
  - Default Route (Gateway)
  - DNS Server Information if needed

- DHCP (Dynamic Host Configuration Protocol) is typical for this purpose
  - It is well-known and works at scale
  - It is well-supported in routers and network equipment and servers
  - It is not inherently secure, but can be made fairly robust with some careful network design (ACLs to block other devices from acting like DHCP servers)

- There is widespread agreement that DHCP is a reasonable choice

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Behavior 2: Fresh-Start –vs- Re-Start

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- Common practice in "broadcast equipment" is to power up and resume operation with the last stored settings
  - In recovery from system power loss, this is the fastest path to restarting
  - Most Customers expect/demand this behavior
- This behavior is problematic for "new" equipment or rental gear
  - The stored settings are probably not useful and might be harmful
- It would be very helpful if devices could reliably know that they are waking up in the same system that they were last used in (or not)
  - If "same system" then use stored settings
  - If "new system" then mute any multicast senders and wait for configuration

- A "System GUID" (globally unique identifier) could be compared against the previous known value – but need a universal way to provide the system GUID

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Behavior 3: Finding the Prevailing PTP Parameters

- Endpoint Devices need to know the local PTP Domain number

- Endpoint Devices with more than one Media Network port need to also know the PTP Announce Interval and Announce Timeout in order to do BMCA across the two interfaces

- ST 2059 (or in general PTP) has no mechanism to distribute this info

- Need a way to distribute this information, or to rely on default values

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Behavior 4: Finding the IS-04 Registry & Timeout

- IS-04 specifies MDNS or DNS-SD for finding the registry
  - MDNS is local-subnet specific (does not route) and impractical for some network architectures
  - DNS-SD via unicast DNS can work, but
    - Adds (redundant) DNS servers as critical infrastructure
    - Makes every system requires local DNS servers in addition to any enterprise ones

- Is there a simpler alternative way to distribute the list of registry service pointers?

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One Possibility – DHCP Vendor Information

- Wireless Access Points in enterprise networks had a similar need to distribute extended configuration information to each WAP
- DOCSIS had a similar problem for distributing extended configuration parameters to thousands of cable modems

- RFC 3925 (Vendor-Identifying Vendor Options for DHCP) is used
  - Allows a Device to ask for multiple "vendor" options when doing DHCP
  - Works around the only-one-vendor-code problem of option 43

- We could register an IANA enterprise ID for this purpose, and use the options to distribute PTP info, System GUID, and registry list.

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Behavior 5: Multicast Address Allocation

- Current practice is to manually allocate multicast addresses, preferably in some pattern related to the types of signals and identity of the sender
- MADCAP (RFC 2730) could possibly be used, but has some limitations

- IS-05 provides a mechanism for a controller to specify the transport parameters (multicast address) to senders, if the sender supports it

- We could
  - Document that senders must support IS-05 setting the transport parameters
  - Use the "behavior 2" from previous slides to handle re-start / persistence
  - Leave allocation of addresses to the controller

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How to Move Forward with Full Stack

- The "Full Stack" proposal needs to be drafted and promulgated by one or more of the involved organizations
  - I am happy to draft/edit this document

- As an industry we have established the need for this work

- There are plenty of proponents

- Interop Events will likely be needed

- The time has come

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Thank You

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