

# What Comes After Streaming DMX Over ACN?"



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# Panelists

Scott Blair - Video Equipment Rentals (VER)

Doug Fleenor - Doug Fleenor Design

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# PLASA Technical Standards Program

- ***The PLASA Technical Standards Program*** - responds to situations where the lack of standards, or the imposition of standards developed outside the entertainment industry, make difficult to conduct business safely & efficiently.
- ***The PLASA Technical Standards Program*** - is accredited by the American National Standards Institute. This accreditation ensures that all parties affected by a standard have had an “open-process” opportunity to participate in its development.
- ***The PLASA Technical Standards Program*** - is the largest and most effective volunteer driven program in the industry. Hundreds of volunteers are responsible for every aspect of the program.

# How Standards Are Written

The working groups write the standards.

- The standards must reflect the consensus of opinion in the industry. To ensure that they do, each standard is sent to a formal public review at least once, although most are publicly reviewed three or more times.
- Reviewers offer comments on the draft standard, and the working group then has to attempt to revise the standard to the satisfaction of the commenter. For any comment that is not accepted, the working group has to provide a written reason why.
- The process of sending a draft standard to public review, receiving comments, and revising the standard on the basis of those comments is a slow one, but it ensures that the standards drafted are fair and technically sound.

# Getting Involved in the PLASA Technical Standards Program

Join a Working Group! Membership in a working group is available to any party who has a legitimate interest in that group.

- Principals, Alternates and Individual Members are voting members who must attend 4 meetings per year.
- Observer members do not vote, and are not required to attend meetings, but are copied on all working group documents.

You need not be an PLASA member to participate!

You need not be a “subject matter expert” to participate. We need end users!

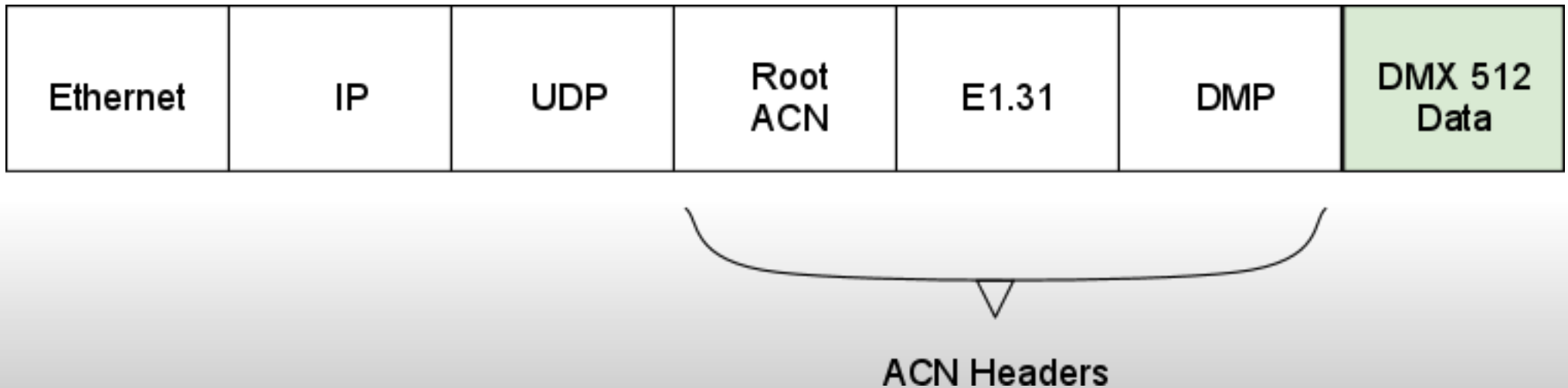
# Overview

- Brief overview of Streaming ACN (E1.31)
- Brief overview of RDM (E1.20)
- Tying it together: RDMnet (E1.33)
  - Discovery
  - Node Configuration
  - RDM Message Transport

# What is E1.31 Streaming ACN?

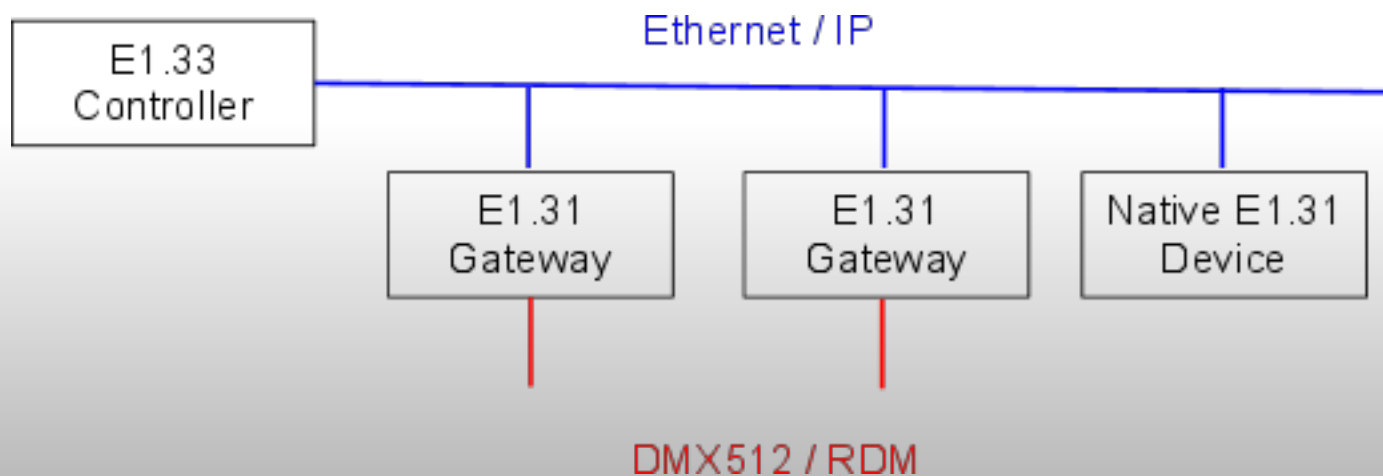
*A method of transporting DMX512 information over UDP/IP networks.*

Consists of a DMX512 frame wrapped in an ACN header



# Characteristics

- Supports up to 63999 universes
- Unidirectional, DMX512 data is sent from controllers to receivers.
- Allows multi-source prioritization & merging
- Simple, non-reliable data transfer, not to be used for hazardous equipment
- Supports a 'preview mode' to indicate the data isn't live
- Quickly becoming the preferred method of transporting DMX512 data over Ethernet



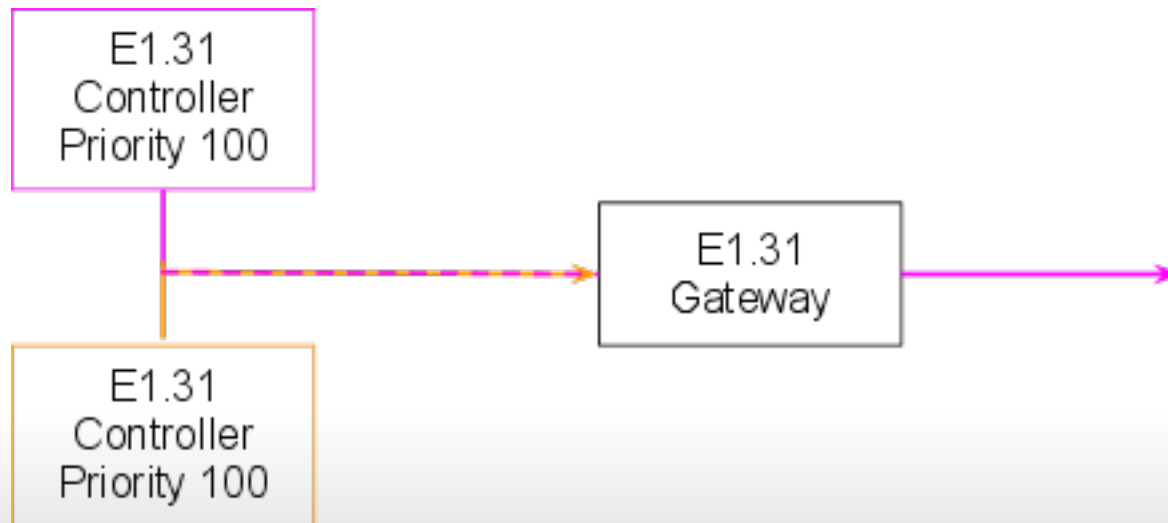


# Differences from ArtNet

- E1.31 uses multicast, so it scales much better than ArtNet, ArtNet 2 & ArtNet 3.
- Unlike ArtNet, E1.31 has no support for remote node discovery, node patching, RDM etc. All of this is coming in E1.33

# Prioritization & Merging

- Sources can be assigned a priority between 0 (least important) and 200 (most important).
- Controllers treat the highest priority source as definitive
- In the event of a tie, receivers can implement a merging algorithm.



# Common mistakes & problems

- Lack of network connectivity between nodes
  - Confirm with ping, but this requires you to know the IP addresses of the nodes
- Valid E1.31 universes range from 1 - 63999, universe 0 and 64000 - 65535 are reserved
- Switches with poor multicast support **or** high end switches and poorly implemented receivers
  - Receivers **must** join the appropriate multicast groups

# Packet Analysis - Wireshark

- A tool to capture & analyze network data
- Open source, available at <http://www.wireshark.org/>
- Runs on Windows, Mac OS X & Linux
- Wireshark dissectors allow us to investigate protocols such as E1.31

The screenshot displays the Wireshark 1.5.1 interface. The top menu bar includes File, Edit, View, Go, Capture, Analyze, Statistics, Telephony, Tools, Internals, and Help. Below the menu is a toolbar with various icons for file operations, capture, and analysis. A filter field is present with the text 'Expression... Clear Apply'. The main packet list table shows the following data:

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	75.210.81.128	239.255.0.3	ACN	670	CID a9fd7e...
2	1.013979	75.210.81.128	239.255.0.3	ACN	670	CID a9fd7e...
3	2.020729	75.210.81.128	239.255.0.3	ACN	670	CID a9fd7e...
4	3.031476	75.210.81.128	239.255.0.3	ACN	670	CID a9fd7e...
5	4.041276	75.210.81.128	239.255.0.3	ACN	670	CID a9fd7e...
6	5.051076	75.210.81.128	239.255.0.3	ACN	670	CID a9fd7e...

The packet details pane for the selected packet (Frame 1) shows the following structure:

- Frame 1: 670 bytes on wire (5360 bits), 670 bytes captured (5360 bits)
- Point-to-Point Protocol
- Internet Protocol, Src: 75.210.81.128 (75.210.81.128), Dst: 239.255.0.3 (239.255.0.3)
- User Datagram Protocol, Src Port: sdt (5568), Dst Port: sdt (5568)
- Architecture for Control Networks
  - Size of preamble: 16
  - Size of postamble: 0
  - Packet Identifier: ASC-E1.17
  - PDU: Root DMX, Src: a9fd7e32-a252-4d83-acb0-be626e30541a
    - Flags: 0x70
    - Length: 622
    - Protocol ID: Ratified DMX Protocol (4)
    - CID: a9fd7e32-a252-4d83-acb0-be626e30541a
    - PDU: Streaming DMX, Universe: 3, Priority: 100
      - Flags: 0x70
      - Length: 600

The packet bytes pane shows the raw data in hexadecimal and ASCII:

```
0000 ff 03 00 21 45 b8 02 9a fd a1 00 00 01 11 2b a5 ...!E... ..+..
0010 4b d2 51 80 ef ff 00 03 15 c0 15 c0 02 86 3b cc K.Q.....
0020 00 10 00 00 41 53 43 2d 45 31 2e 31 37 00 00 00 ...ASC- E1.17...
0030 72 6e 00 00 00 04 a9 fd 7e 32 a2 52 4d 83 ac b0 rn..... ~2.RM...
```

# ANSI E1.20 RDM (Remote Device Management)

- An enhancement to USITT DMX512 for configuration, status monitoring, and management of DMX512 based systems.
- An open standard developed by the PLASA Technical Standards Program that allows interoperability between many manufacturers.
- Compliant DMX512 and DMX512-A devices are completely functional when RDM is present.

# What is RDM?

- A protocol that sits on top of the normal DMX512 data standard which enables bi-directional communication.
- Responders can 'talk back' to the console
- Each responder has a unique identifier, known as a UID
  - UIDs are made up of a 2 byte manufacturer ID & a four byte device id

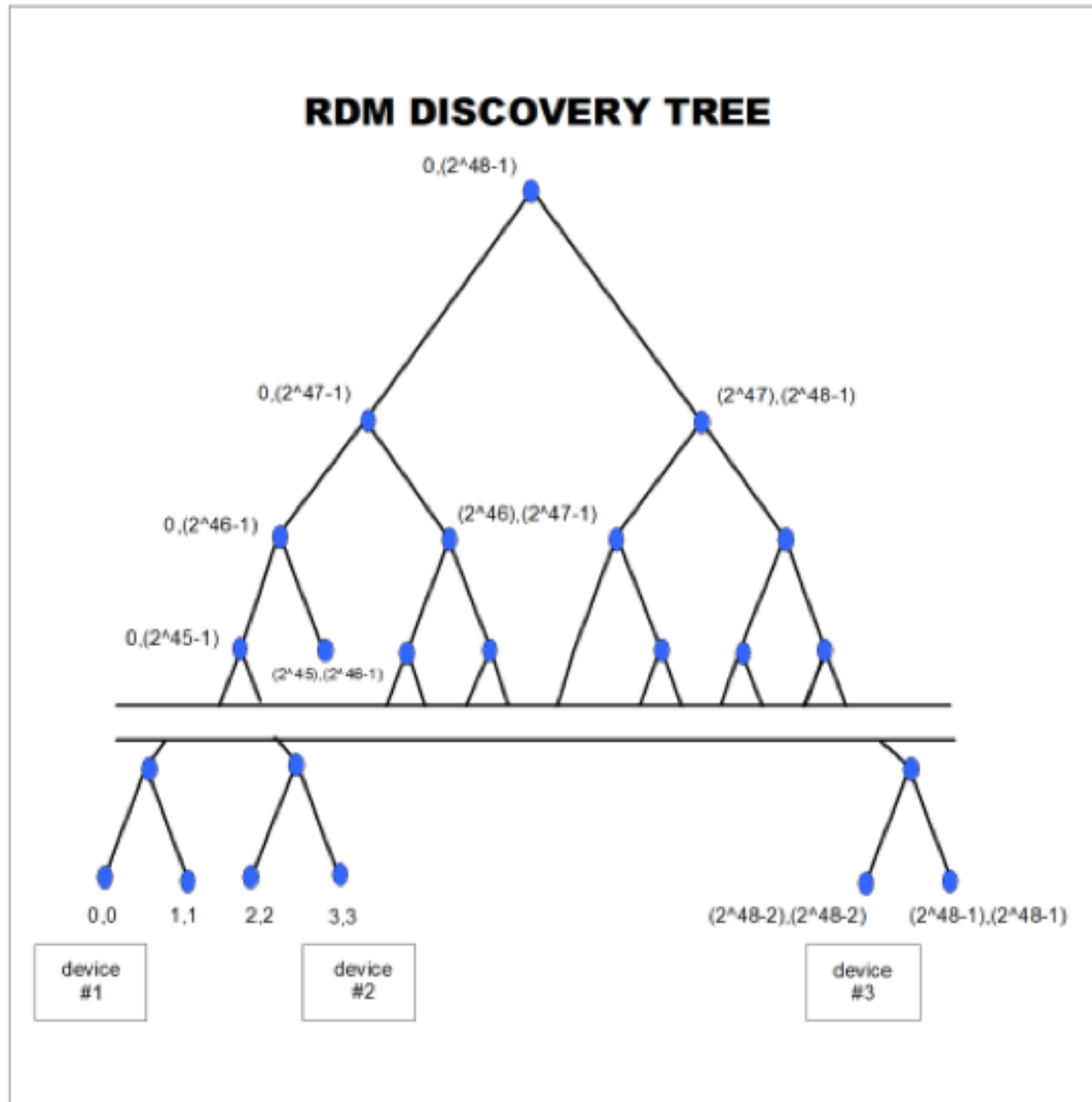
0808 : 0020abcd

↑                    ↑

Manufacturer ID    Device ID

- RDM messages use an alternate start code, so receivers don't confuse it with null start code data.

# RDM Discovery



# RDM Messaging & Parameters

- Once a controller has discovered devices, it can then send get or set messages to them.
- Each message contains a 2 byte Parameter ID (PID) which indicates the type of message.
- The RDM document defines many standard PIDs:
  - Get/Set DEVICE\_LABEL
  - Get/Set DMX\_START\_ADDRESS
  - Get/Set DMX\_PERSONALITY
  - Get LAMP\_HOURS



# Manufacturer Parameters.

- Manufacturers can also define their own Parameters for those things not defined in the E1.20 standard.
  - ETC\_LED\_CURVE - select which dimmer curve to use
  - AIR\_FILTER\_HOUR - read the number of hours for the air filter
  - PAN\_TILT\_LIMITATION\_AREA - restrict the motion of a moving head fixture
- This allows manufacturers to use RDM to transport their own specific information

# What Is E1.33?

- Brings the benefits of bi-directional communication to IP networks.
- E1.33 is to E1.31 as RDM is to DMX512
- Can be thought as as RDM for Ethernet
- Three parts:
  - Discovery
  - Node Configuration
  - RDM Message passing

Nodes connected to an E1.31 network are either:

- Controllers, typically consoles or monitoring devices
- Devices (can act as a DMX512/RDM gateway, native E1.31 device or both)

# E1.33 Discovery

- E1.33 discovery builds on a technology called SLP (Service Location Protocol)
  - Established protocol most commonly used for discovering printers on a network.

## SLP Terms:

- Service Agents (SA) are hosts that provide a service, e.g. a printer. In E1.33 SAs are the gateways or native devices.
- User Agents (UA) are hosts that use a service. In E1.33 UAs are the consoles or monitoring equipment
- Directory Agents (DAs) are specific network hosts that act as a rendezvous point in larger networks

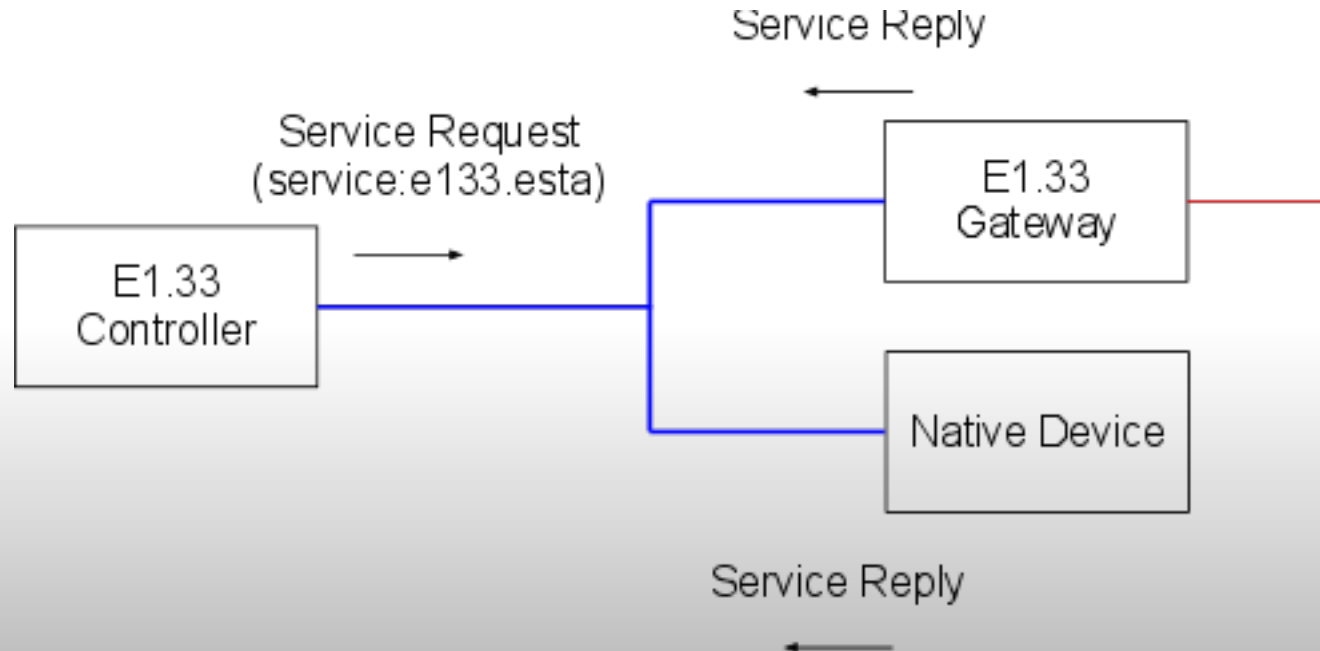
# E1.33 Discovery

- E1.33 networks can operate in one of two modes
  - No Directory Agents (DAs)
  - One or more Directory Agents
- DAs allow E1.33 to scale to very large networks.
- We generally expect consoles to implement the DA feature, this isn't required though.
- No configuration is required to switch modes, when a DA exists the hosts will use it, otherwise they'll fall back to non-DA mode.

# E1.33 Discovery without a DA

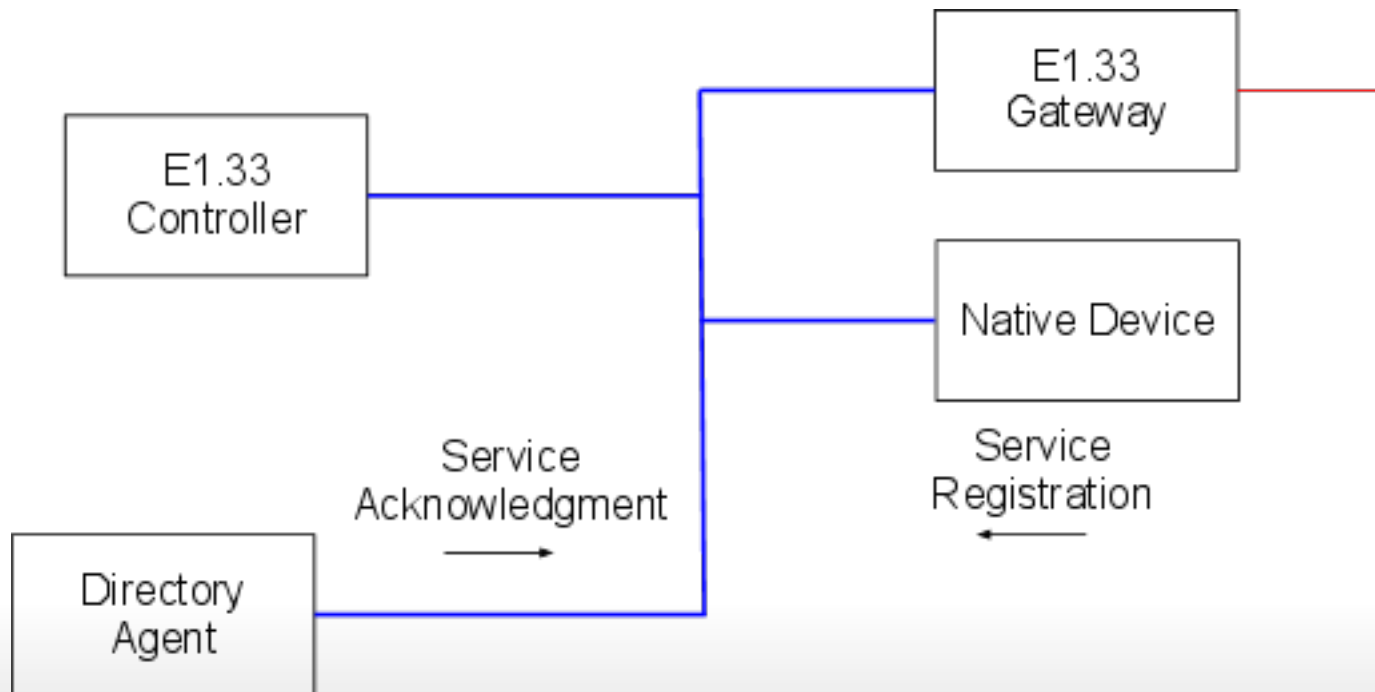
- The controller sends a Service Request (SrvRqst) for service:e133.esta
- All nodes respond with a url that contains the node's IP address, and E1.33 UID e.g.

service:e133.esta://192.168.0.1:5568/08080000200b



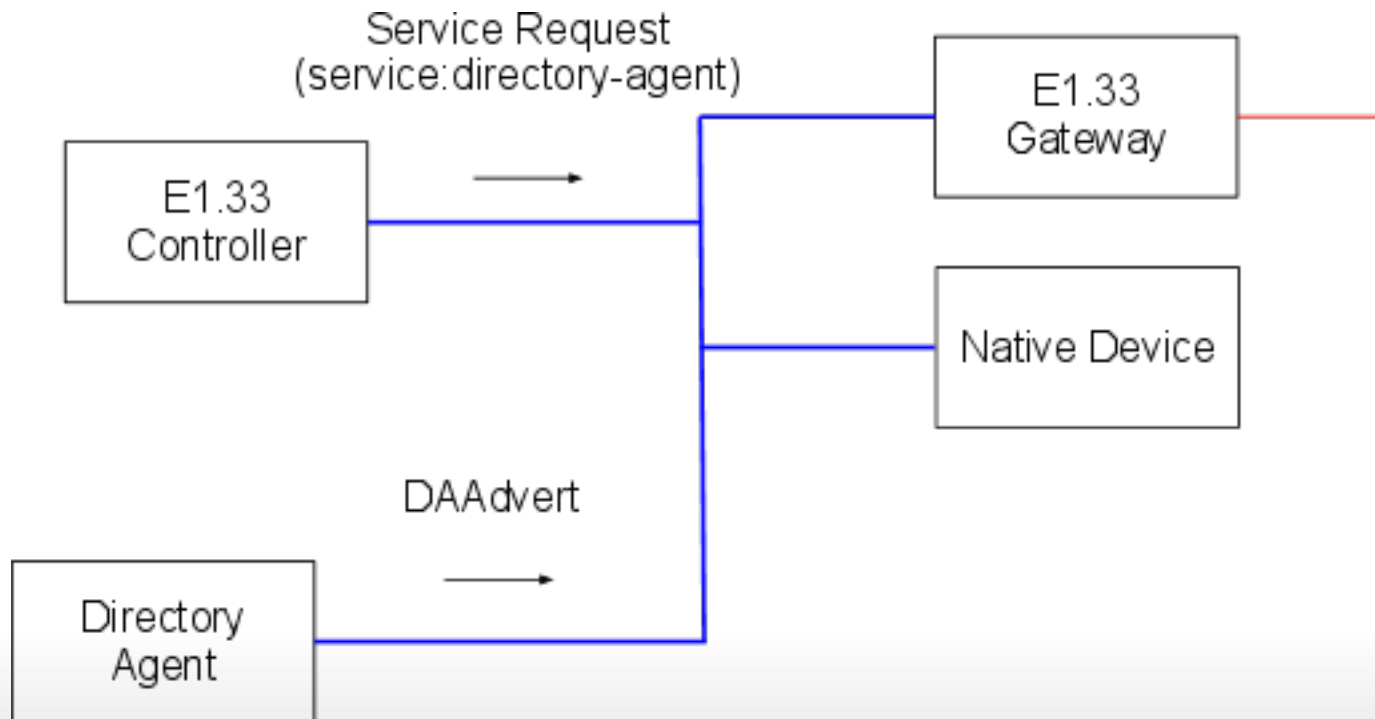
# E1.33 Discovery with DA Part 1

- Nodes register with the DA



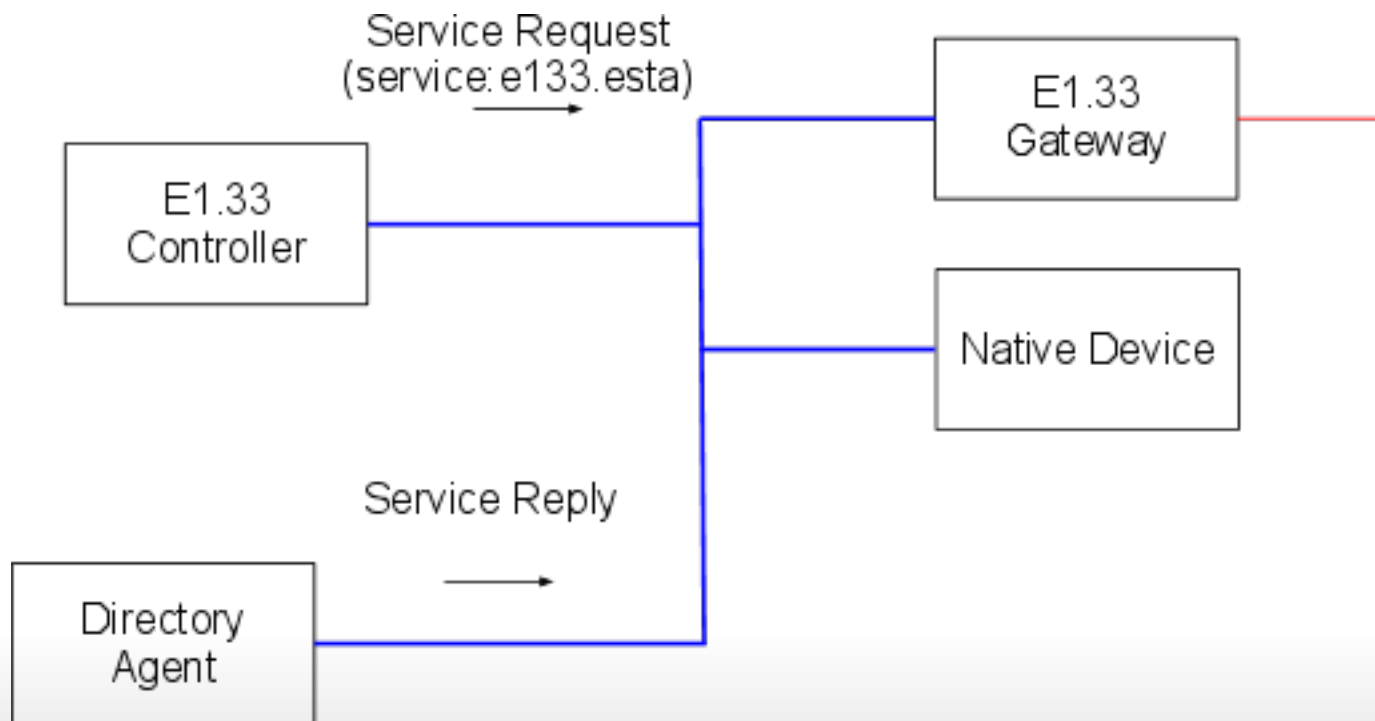
# E1.33 Discovery with DA Part 2

- Controllers locate the directory agent (DA)



# E1.33 Discovery with DA Part 3

- Controllers fetch the list of nodes from the DA



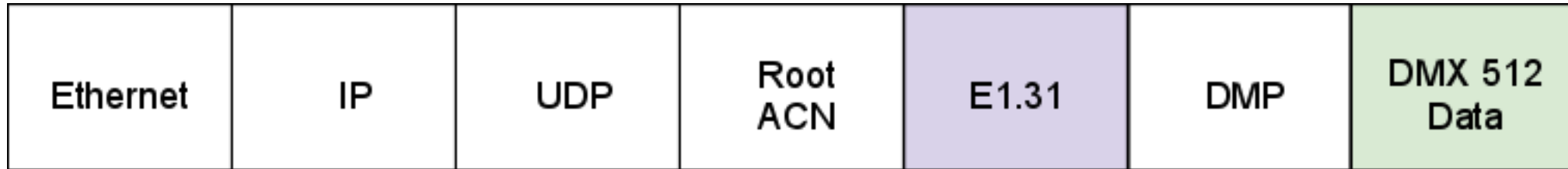


# E1.33 Discovery

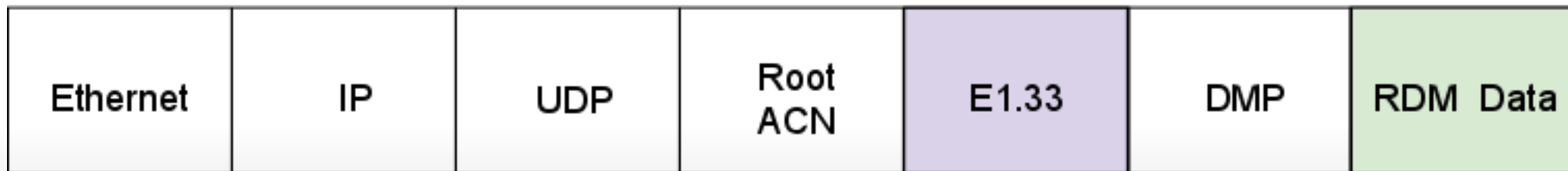
- Once a controller has discovered the IP address of all devices, it can then ask each device to enumerate the ports it contains using the `PORT_LIST` PID
- Controllers can then fetch a list of all UIDs connected to each port
- This completes the discovery phase, the controller now has a complete list of UIDs, and which ports & devices they are attached to.
- Controllers can then start communicating with the RDM devices.

# E1.33 Requests & Responses.

- RDM messages are wrapped in a similar packet structure as E1.31



E1.31 Packet



E1.33 Packet

# E1.33 Device Configuration

- Allows assigning gateway ports to E1.31 universes.
- Composite vs. Standard universes
  - Standard universes provide for complete mapping of an entire universe directly to a port without any other manipulation.
  - A Composite universe is a universe that is constructed by merging, re-patching, or manipulating the Null Startcode data from one or more E1.31 universes to create a new universe of DMX512 data.
    - Mapping is outside of E1.33.
    - Loses the ability to do DMX address auto-patching.
- Native Devices Support
  - Able to configure native E1.33 devices, such as media servers, that require multiple universes of data.

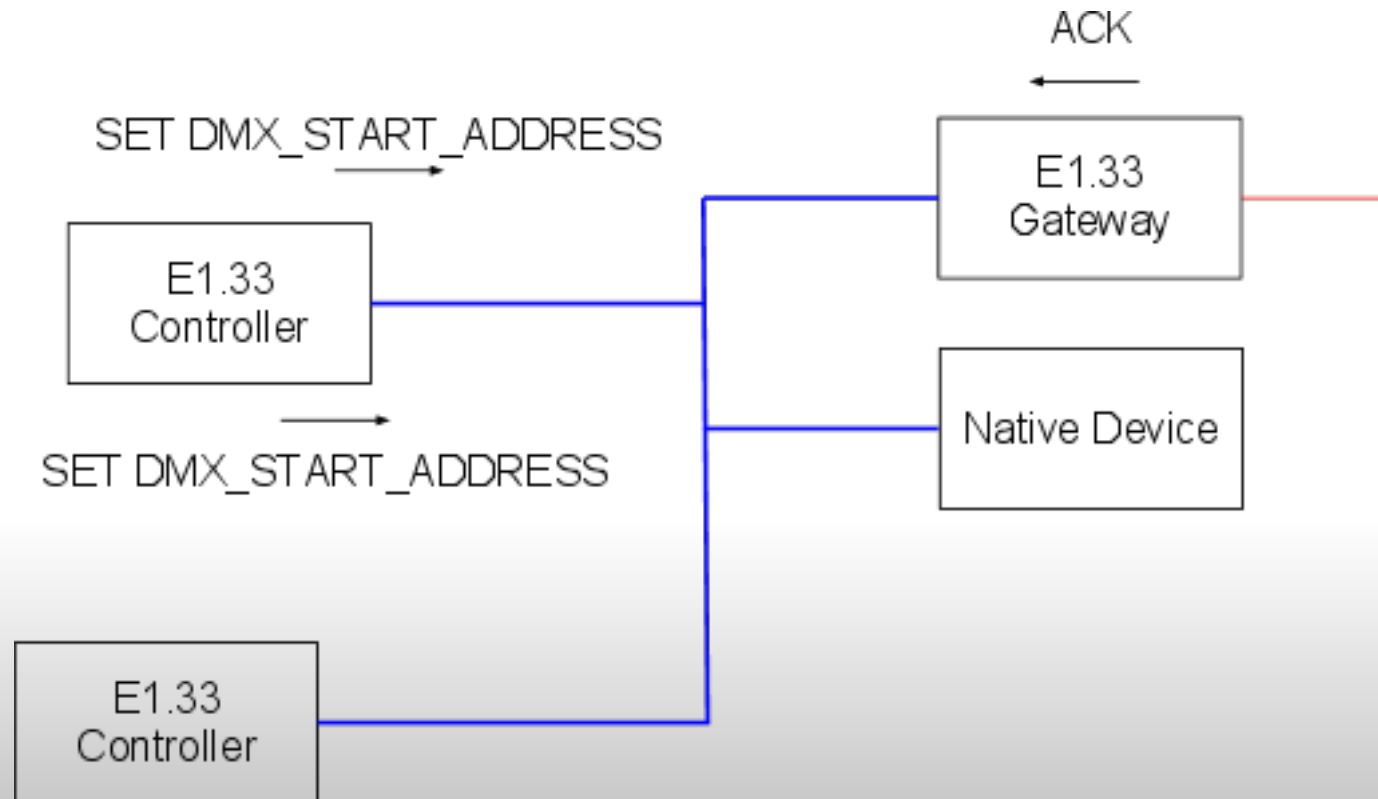
# E1.33 Device Configuration

New PID messages for E1.33:

- PORT\_LIST - Provides packed list of Port #'s on Gateway/Device.
- PORT\_IDENTIFY - Provides visual identification of the Gateway Port.
- PORT\_TO\_UNIVERSE - Assigns a given Port to a Universe. (Native devices also).
- RDM\_TRAFFIC\_ENABLE - Enables/Disables RDM traffic on an output port for non-compliant legacy devices.
- PORT\_FUNCTION - Assigns port as an Input or Output for DMX512.
- PORT\_LABEL - Sets human readable descriptive label.
- INITIATE\_DISCOVERY
- BACKGROUND\_DISCOVERY- Enables/Disables auto discovery.
- PORT\_TIMING - Configure port refresh/timing profile.
- PORT\_TIMING\_DESCRIPTION

# E1.33 Response Squawking

- In order to keep controllers in sync, commands that change the state of responders are reflected (squawked) to other controllers
- The same mechanism is used for queued messages.



# E1.33 Design Choices

- Unicast rather than Multicast for E1.33 messages.
  - Multicast works great in one direction but not both.
- Response Squawking
  - Allows multiple controllers to stay in sync with devices.
- Balancing Reliability vs. Simplicity
  - Queued/Status Message resending
  - Doesn't require TCP support in E1.33 Devices (only controllers)
  - Doesn't require the E1.33 Devices to track all controllers

# Where is E1.33?

- It's been in the works for a couple years already to get to this point.
- 1st Public Review completed last week. (major milestone)
  - 131 comments received.
- Goal will be to be ready for 2nd Public Review by Summer.
- 3 Public Reviews are expected in total.

Q & A



# More Information?

- PLASA Control Protocols Booth
  - Booth #1145 (Across from PLASA booth)
- [www.RDMProtocol.org](http://www.RDMProtocol.org)