

# HARMAN

## Media Clock Negotiation (MCN)

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## ▪ Requirements

- Automatic election of a media clock
- Support for multiple clock frequencies
- Support for multiple clock domains
- Support for AVB cloud boundaries
- Quick failover in case of network break
- Mechanism to avoid thrashing at startup
- Base clock identifier

## ▪ Options

- Human readable clock identifier

# MCN Election

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- **Primary and Secondary streams are elected**
- **Match criteria**
  - gm\_id
  - Domain\_id
  - Frequency
- **Election criteria**
  - priority1 (lowest value wins)
  - gptp\_clock\_period
  - media\_clock\_variance
  - priority2 (lowest value wins)
  - Source Mac Address (same comparison algorithm as MAAP)

- **Single Packet Type**

- Advertise Packet

- **Election losers go silent**

- Only the Primary and Secondary continue to send Advertise Packets

- **Primary and Secondary media streams must be active**

- Streams will not actually flow until an SRP reservation is made

- **User can specify whether or not `base_stream_id` is required**

- This decision needs to be made on a network wide basis
- If `base_stream_id` is required then each `base_stream_id` becomes a separate domain
- If `base_stream_id` is not required then `base_stream_id` is informational only and not used in the match phase

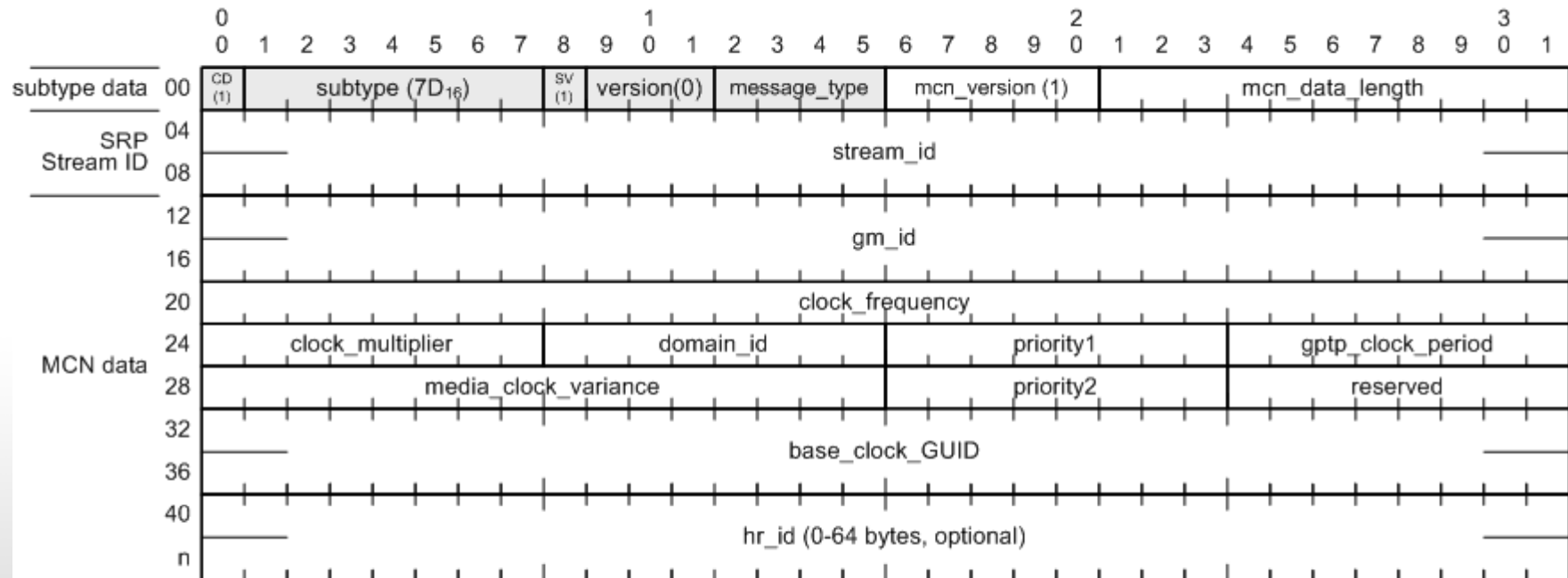
# Media clock characteristics

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- **Media clocks may or may not include valid data**
    - Since media clock streams look just like data streams, they must contain data however it may not be valid. (since any properly formatted stream contains data, this is really irrelevant)
  - **Secondary streams may be frequency locked to the primary**
    - It is possible for a device that cannot receive a media stream to advertise itself as a media clock stream.

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- **Everyone keeps two winners, primary and secondary**
  - **All listeners immediately switch to the secondary on primary timeout or loss of primary stream media stream**
  - **New election for secondary takes place on fail over. Previous secondary becomes primary**
  - **Talker is enabled and reservation is registered for primary and secondary**
  - **If a node is unable to get a reservation to the media stream then it should accept the election results and not start a new election even though the primary stream is in a failed state.**

# MCN Packet Fields

- mcn\_version
- mcn\_data\_length
- stream\_id
- gm\_id
- clock frequency
- clock\_multiplier
- domain\_id
- priority1
- gptp\_clock\_period
- media\_clock\_variance
- priority2
- base\_clock\_GUID
- hr\_id



# Packet Contents

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- **Single packet type – MCN Advertise**
  - **MCN subtype assigned from 1722 subtypes**
  - **MCN multicast address assigned from 1722 reserved addresses**



# Packet Fields

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- **mcn\_version**

- Current MCN version (1)

- **mcn\_data\_length**

- Length in bytes of the mcn data

- **stream\_id**

- Stream id of the media stream being advertised

- **gm\_id**

- Current gPTP grandmaster ID

- **clock\_frequency**

- clock frequency in hertz of the advertised media clock stream, prior to any adjustments from the clock\_multiplier

# Packet Fields

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- **clock\_multiplier**

- Media clock frequency equals  $\text{clock\_frequency} * \text{value from clock\_multiplier table}$

- **domain\_id**

- User configured domain ID (default = 0)

- **priority1**

- User configured Priority (default = 248)

- **gptp\_clock\_period**

- Base clock period of the 802.1AS clock in nanoseconds

- **media\_clock\_variance**

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- **priority2**

- Internal priority
- Beginning value = 248
- Decrements by 10 when first device subscribes to the advertised media stream

- **base\_clock\_GUID**

- 48 bit MAC address + 16 bits of unique clock ID
- Uniquely identifies a base clock that multiple media clock may be derived from
- Media clock may be an integer multiple of the base clock

## ▪ **hr\_id (optional)**

- Human readable clock identifier (0-64 utf-8 bytes)
  - Should this be utf16
- If the hr\_id is included in an MCN packet then a base\_stream\_id must also be included
- The actual text should be designed to be useful to the user to easily identify the source. Text should include make, model and unique id.
- Example
  - “dbx SC 00:01:23:45:67:89”
  - “dbx SC HiQnet node 34”

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- **Advertise packet 1 per advertise interval**
  - **Advertise timeout is 3x advertise interval**
  - **All Advertise packets that do not match gm\_id, domain\_id and frequency and optionally base\_stream\_id are ignored**
  - **Once a higher priority packet is received, Advertises are no longer sent**
  - **Devices without a user configured domain\_id use the default domain\_id**

# Thrash Avoidance

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- **priority\_2 modifications to avoid thrash**

- Initial value on startup is 248
- Value is decremented by 10 upon being elected primary and an active SRP reservation is acquired
- On loss of an election the priority2 value reverts to 248
- On loss of a all valid SRP reservations value reverts to 248

# Clock Multiplier

- Values from 1722.1

Value	Description
0	Multiply frequency by 1.0
1	Multiply frequency by $1/1.001$
2	Multiply frequency by 1.001
3	Multiply frequency by $24/25$
4	Multiply frequency by $25/24$
5..255	

# Clock Quality

## ▪ gPTP Clock Period

- This is the base clock period of the 802.1AS clock in nanoseconds
- Typical values are 8ns or 40ns
- This is the largest contributor to jitter in the 1722 stream

## ▪ Clock Variance

- Report the stability of the base media clock
- 1722.1 uses ppm drift
- AS uses PTPDEV which is derived from the Allan Deviation
- <http://www.ieee802.org/1/files/public/docs2011/as-garner-corrected-offsetScaledLogVariance-calculation-0711-v2.pdf>

### ▪ PTPDEV

$$\sigma_{PTP}(\tau) = \frac{\tau}{\sqrt{3}} \sigma_y(\tau) = \sqrt{\frac{1}{6(N-2n)} \sum_{i=1}^{N-2n} (x_{i+2n} - 2x_{i+n} + x_i)^2}, \quad n = 1, 2, \dots, \left\lfloor \frac{N-1}{2} \right\rfloor$$



# HARMAN

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