P802.1Qee – “Traffic Engineering for Bridged Networks that include Wireless Technologies” Kick-off

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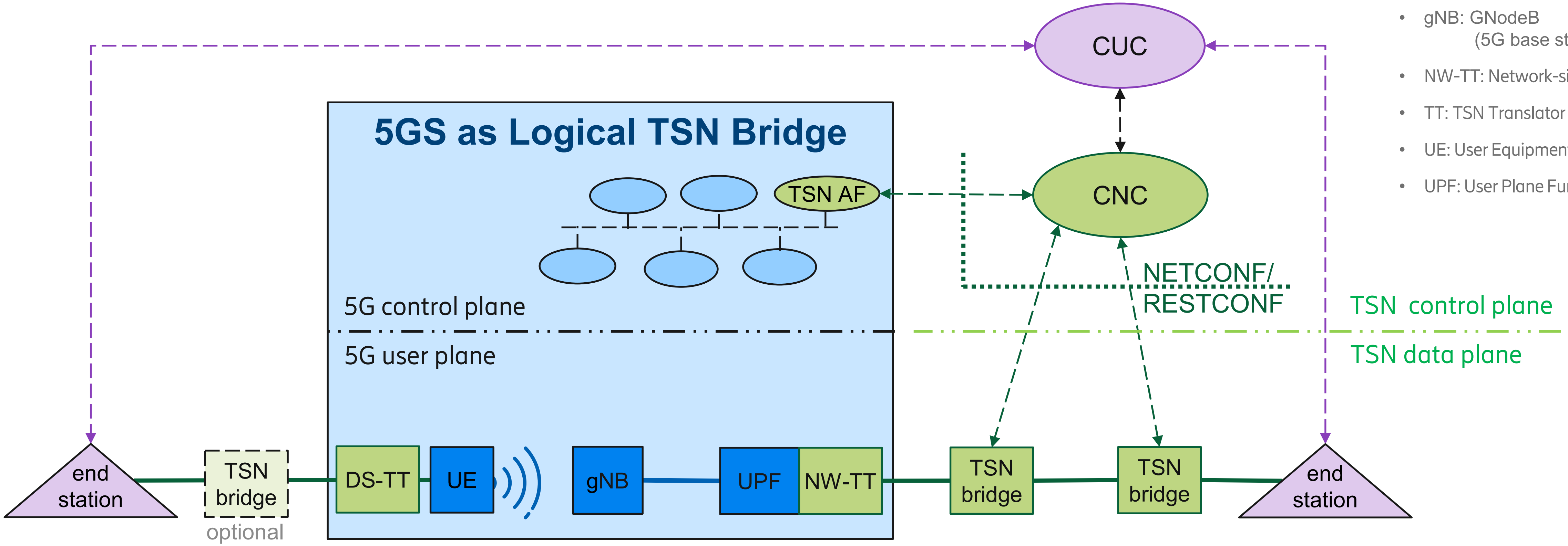
Recap: Scope

This amendment specifies procedures and YANG data models to extend bridge attributes for traffic engineering for bridged networks that include wireless technologies whose delay variance is beyond that of point-to-point wireline MAC technologies.

Recap: Wireless System as Logical TSN Bridge

- As per 3GPP standards, the 5G System (5GS) acts as a logical (virtual) TSN bridge

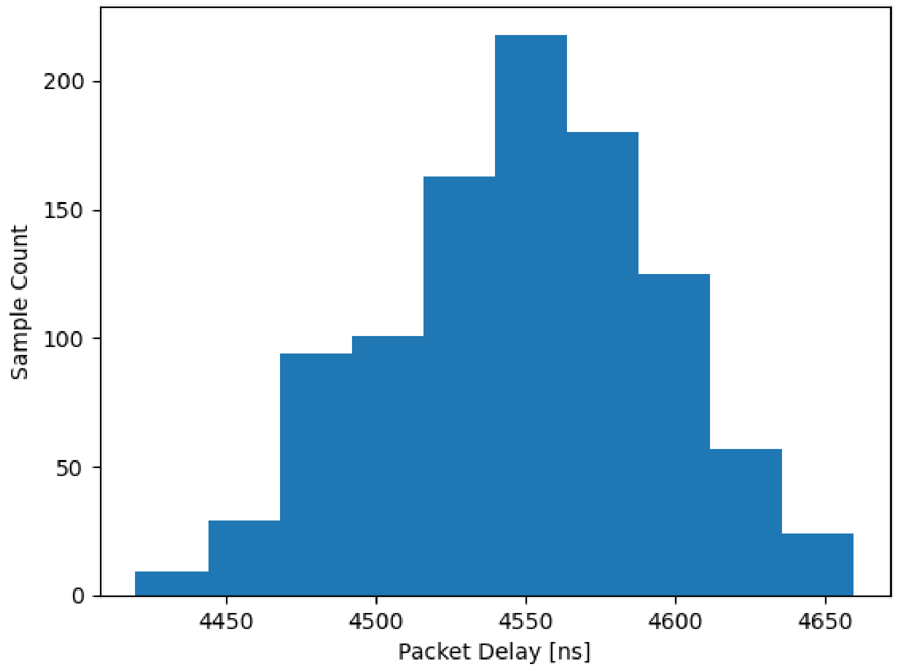


- AF: Application Function
- DS-TT: Device-Side TT
- gNB: GNodeB
  (5G base station)
- NW-TT: Network-side TT
- TT: TSN Translator
- UE: User Equipment
- UPF: User Plane Function

Recap: The Challenge

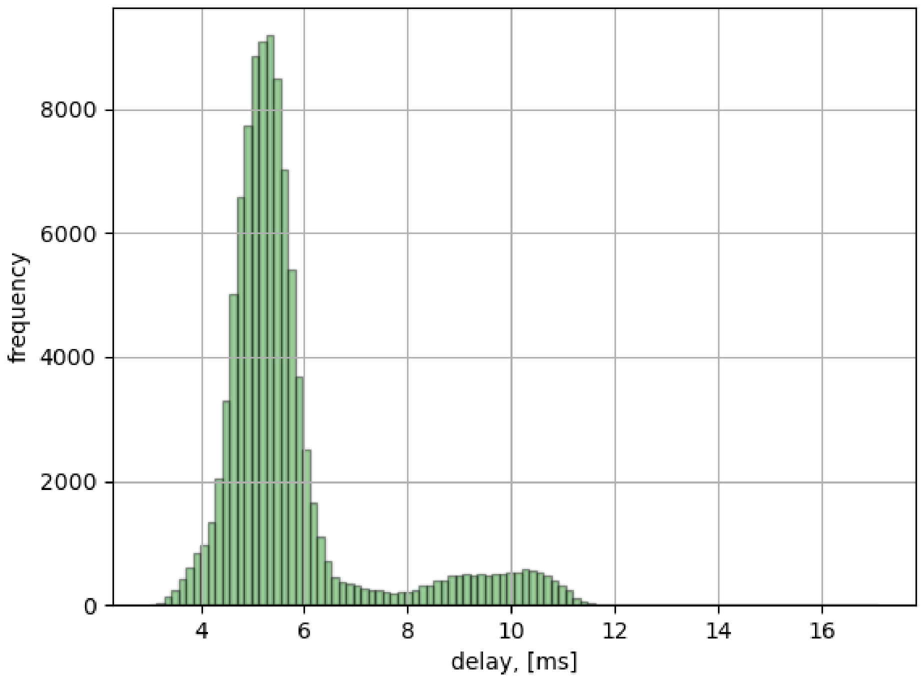
- wireline and wireless have very different characteristics

Wireline Bridge



vs

5GS Virtual Bridge



- delay data from measurements: https://github.com/DETERMINISTIC6G/deterministic6g_data

Recap: Bridge Delay

- Bridge Delay [12.32.1 in IEEE Std 802.1Q-2022]

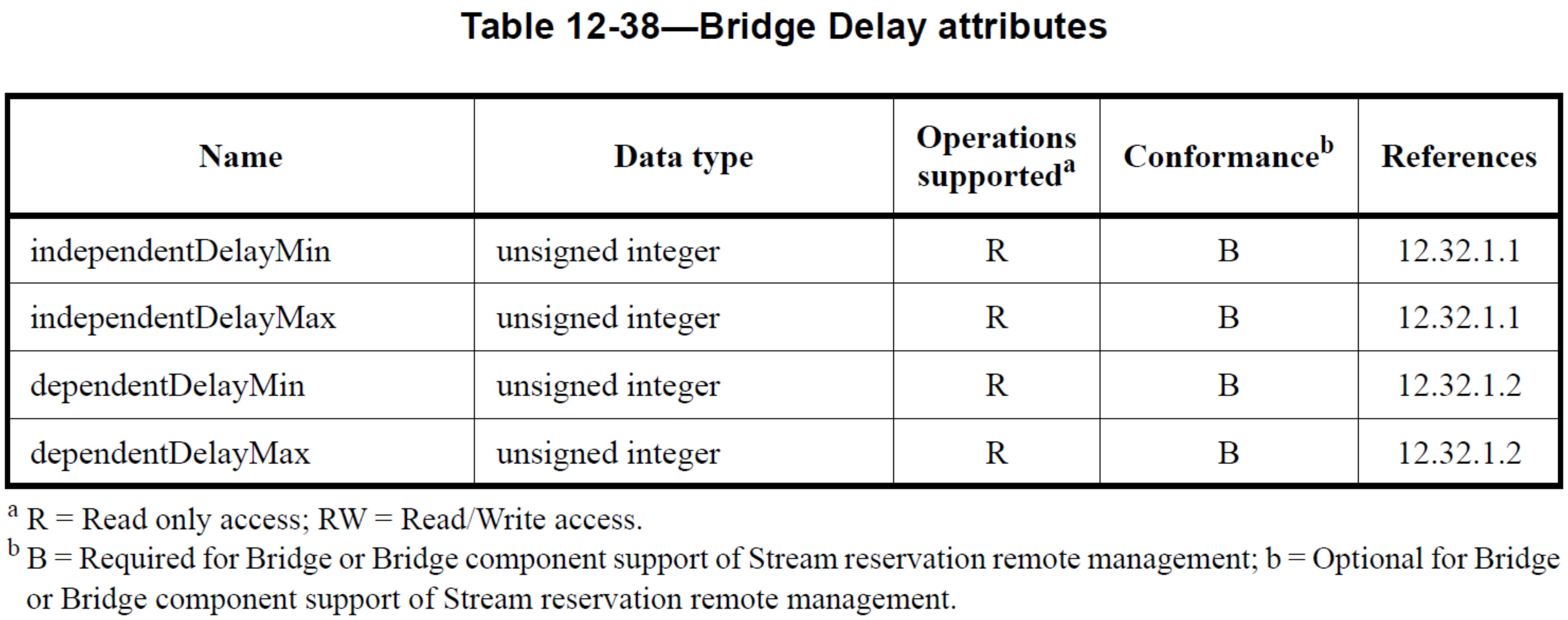


Table 12-38—Bridge Delay attributes

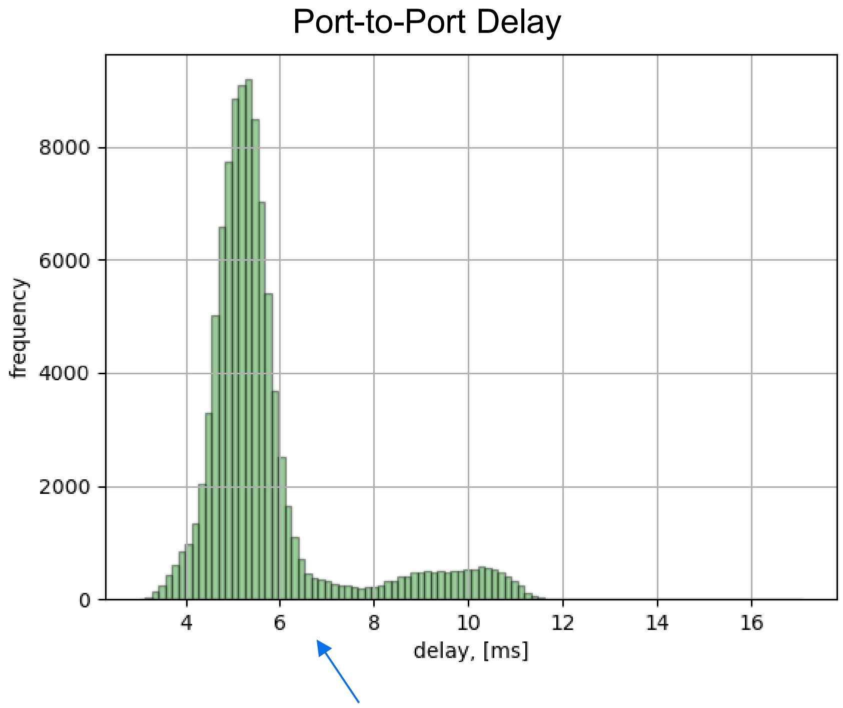
Name	Data type	Operations supported[a]	Conformance[b]	References
independentDelayMin	unsigned integer	R	B	12.32.1.1
independentDelayMax	unsigned integer	R	B	12.32.1.1
dependentDelayMin	unsigned integer	R	B	12.32.1.2
dependentDelayMax	unsigned integer	R	B	12.32.1.2

[a] R = Read only access; RW = Read/Write access.

[b] B = Required for Bridge or Bridge component support of Stream reservation remote management; b = Optional for Bridge or Bridge component support of Stream reservation remote management.

A Solution: Extend Bridge Delay to Histogram

```
grouping delay-histogram {
    description "Delay histogram";
    leaf start {
        type uint64;
        description
            "The start value of the first bin in nano-seconds.
            If not specified, the first bin starts at 0.";
    }
    leaf bin-count {
        type uint32;
        mandatory true;
        description "Number of bins.";
    }
    list bin {
        description "Bins of histogram.";
        key index;
        leaf index {
            type uint32;
            mandatory true;
            description "The index of this bin.";
        }
        leaf width {
            type uint64;
            mandatory true;
            description "The width of this bin in nano-seconds.";
        }
        leaf count {
            type uint32;
            mandatory true;
            description "Count of values in this bin.";
        }
    }
```



bins

Recap: Bridge Delay in 802.1Q-2022

- Managed object
  - 12.32 Stream reservation remote management

    This subclause specifies managed objects within the Bridge that can be used by the TSN CNC station or any other management component.

    - 12.32.1 Bridge Delay
- MIB
  - IEEE8021-TSN-REMOTE-MANAGEMENT-MIB
    - ieee8021TsnRemoteMgmtBridgeDelayTable
- YANG
  - No YANG in 802.1Q for Bridge Delay
  - However, there is YANG in IEC/IEEE 60802 for the Bridge Delay attributes

Recap: Bridge Delay Attributes in IEC/IEEE 60802 D3.4

6.4.10.3.6 IEC/IEEE 60802 managed objects per bridge component

6.4.10.3.6.2 delayTimes

- per supported MAU Type pair and traffic class, if delayVariance is singleValue, or
- per port pair with supported MAU Types and traffic class, if delayVariance is multipleValues

a) independentDelayMin

The value is the minimum delay portion that is independent of frame length according to IEEE Std 802.1Q-2022, 12.32.1.1.

b) independentDelayMax

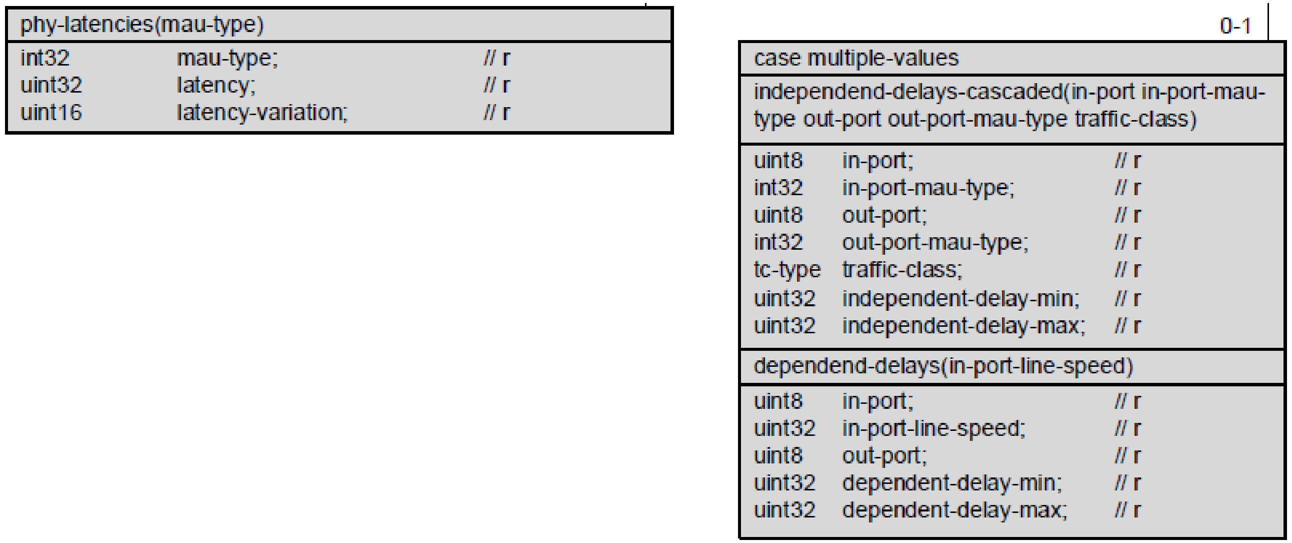
The value is the maximum delay portion that is independent of frame length according to IEEE Std 802.1Q-2022, 12.32.1.1.

c) dependentDelayMin

The value is the minimum delay portion that is dependent on frame length according to IEEE Std 802.1Q-2022, 12.32.1.2.

d) dependentDelayMax

The value is the maximum delay portion that is dependent on frame length according to IEEE Std 802.1Q-2022, 12.32.1.2.



phy-latencies(mau-type)		
int32	mau-type;	// r
uint32	latency;	// r
uint16	latency-variation;	// r

0-1

case multiple-values		
independend-delays-cascaded(in-port in-port-mau-type out-port out-port-mau-type traffic-class)		
uint8	in-port;	// r
int32	in-port-mau-type;	// r
uint8	out-port;	// r
int32	out-port-mau-type;	// r
tc-type	traffic-class;	// r
uint32	independent-delay-min;	// r
uint32	independent-delay-max;	// r
dependend-delays(in-port-line-speed)		
uint8	in-port;	// r
uint32	in-port-line-speed;	// r
uint8	out-port;	// r
uint32	dependent-delay-min;	// r
uint32	dependent-delay-max;	// r

Figure 30 – Module iecieee60802-bridge

(imports ieee802-dot1q-bridge)

What to do in P802.1Qee?

- Solution proposal
  - Extend Bridge Delay Min – Max values to a Histogram

- Managed object
  - Extend 12.32.1 Bridge Delay

- YANG
  - Augment ieee802-dot1q-bridge in a fashion similar to IEC/IEEE 60802?

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