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Traffic Type Introduction

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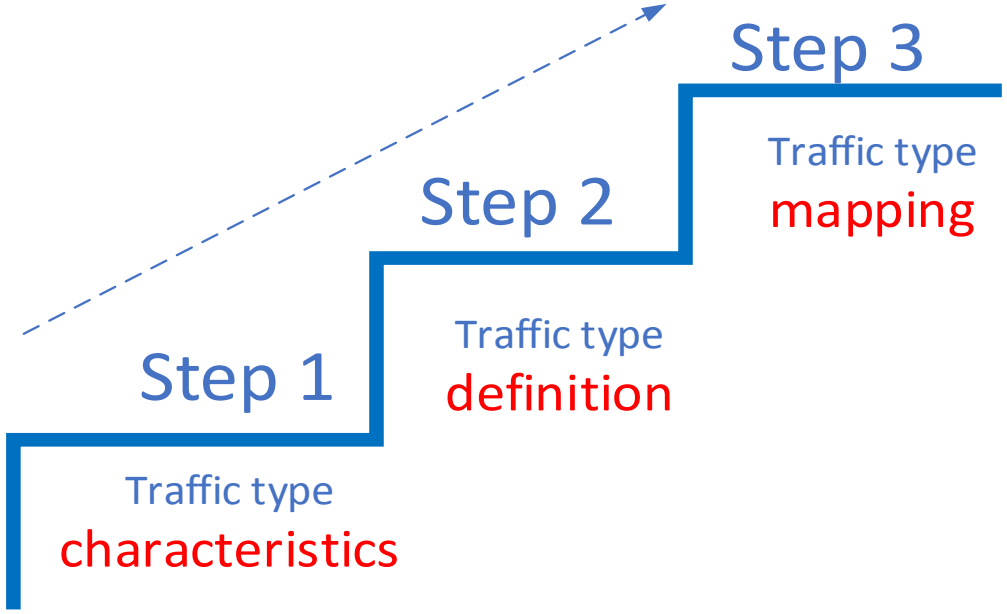
Traffic Types

The traffic types topics is spitted in three parts

1. Traffic types characteristics
2. Traffic type definition (based on the agreed traffic types characteristics)
3. Traffic type mapping (mapping of agreed traffic types to QoS/TSN mechanisms) – not restricted to priorities



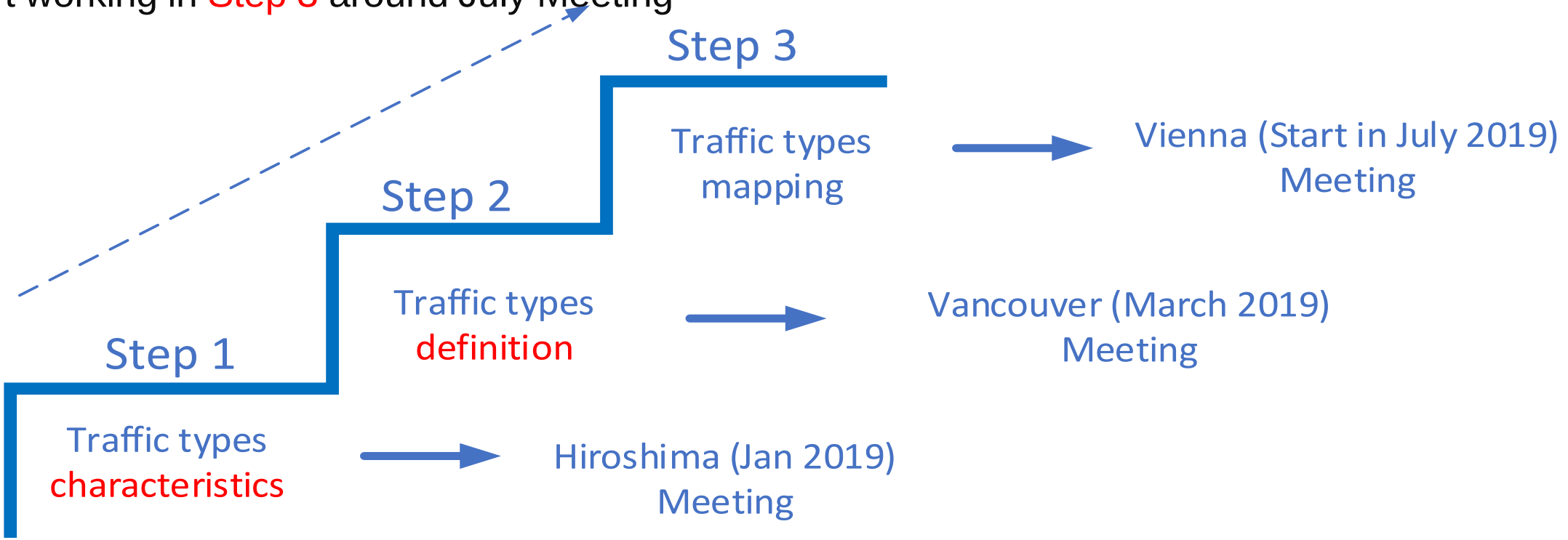
Each part need to be precisely defined (and agreed) before going to the definition of the second part

Traffic Types

Agree on Step 1 and 2: Traffic types characteristics and definition – topic of this presentation

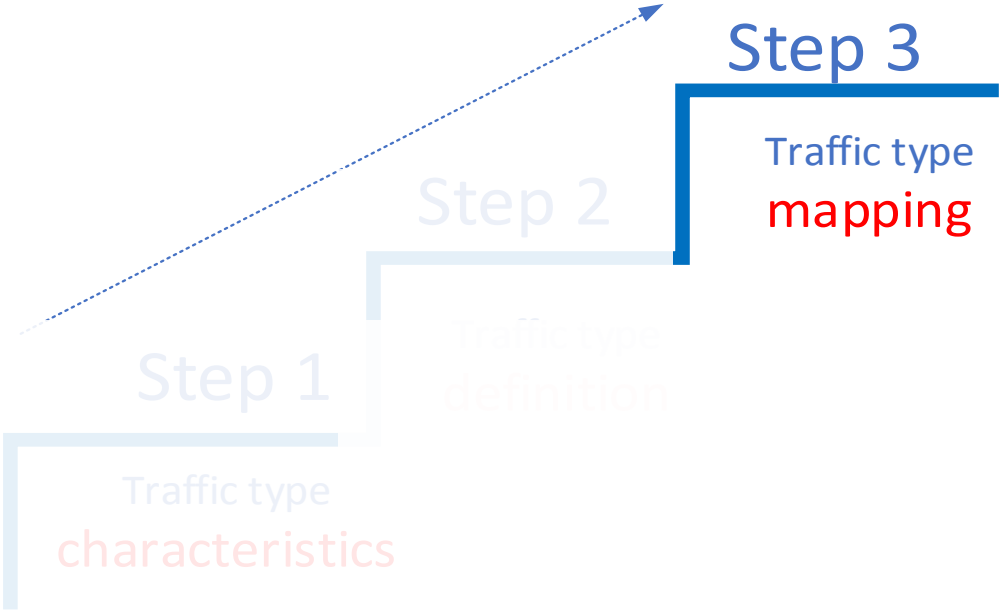
Contribution text provided, after integrated in the draft spec, expect feedback through the balloting

Start working in Step 3 around July Meeting



Traffic Types Mapping (not in scope of this presentation)

- Traffic type mapping
- Not to mixed up traffic types with traffic classes priority (not an exclusive 1:1 relation)
  - One traffic type may be mapped to different traffic classes (1:1 or 1:n relation)
  - Multiple traffic types can be mapped to one traffic class (n:1 or 1:1 relation)



- **Mapping is not ONLY selecting the traffic class priority**
- **It mainly about selection of QoS/TSN mechanisms (1AS, Qbv, Qbu, 1CB, ….)**

Step 1: Traffic types characteristics

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1. Data Transmission Periodicity
2. Period
3. Application synchronized to network -> Feedback from the Hiroshima meeting: rename to "***Data transmission time is synchronized to network cycle***"
4. Application data size
5. Data delivery guarantee / requirements
   - Bandwidth
   - Latency
   - **Deadline – *several comments, unclear why it is not expressed in terms of latency***
6. Tolerance to interference
7. Tolerance to loss
8. Criticality

Contribution text:
60802-ademaj-contribution-traffic-type-characteristics-0319-v03.pdf

Traffic Type Characteristic (5)

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Data delivery guarantee / requirements

Latency: data delivery of each packet in a stream is guaranteed to occur at all registered receivers within a predictable timespan starting when the packet is transmitted by the sender and ending when the packet is received. Please note that the requested data delivery guarantee takes as a reference, the point in time of frame transmission at the talker

Deadline: data delivery of each packet in a stream is guaranteed to occur at all registered receivers at or before a predictable time. Please note that the requested data delivery guarantee takes as a reference, the point in time of the start of a communication cycle. From the network point of view the deadline requirement can be expressed as latency (if talker sending point in time is known), but from an application point of view it is the point in time when frames are received at the listener

Step 2: Traffic types definitions

Contribution text:
60802-ademaj-contribution-traffic-type-definitions-0319-v03.pdf

Step 2: Traffic Type Definitions

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Types	Periodicity	Period	Synchronized to network	Data delivery requirements	Tolerance to interference	Tolerance to loss	Application data size	Criticality
Isochronous	Periodic	< 2ms	Yes	Deadline	0	None	Fixed: 30 - 100 Bytes	High
Cyclic	Periodic	2 - 20ms	No	Latency	<= latency	1 - 4 Frames	Fixed: 50 - 1000 Bytes	High
Events	Sporadic	n.a.	No	Latency	n.a.	Yes	Variable: 100 - 1500 Bytes	High
Network Control	Periodic	50ms - 1s	No	Bandwidth	Yes	Yes	Variable: 50 - 500 Bytes	High
Config & Diagnostics	Sporadic	n.a.	No	Bandwidth	n.a.	Yes	Variable: 500 - 1500 bytes	Medium
Best Effort	Sporadic	n.a.	No	None	n.a.	Yes	Variable: 30 - 1500 Bytes	Low
Video	Periodic	Frame Rate	No	Latency	n.a.	Yes	Variable: 1000 - 1500 Bytes	Low
Audio/Voice	Periodic	Sampling Rate	No	Latency	n.a.	Yes	Variable: 1000 - 1500 Bytes	Low

Traffic Type: Isochronous

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Example: Printing machine with synchronized drives

- Devices synchronously sample inputs and apply outputs by exchanging data at a defined periodic rate
- Applications in each device are synchronized to a common (network) time
- For tight control loops, transmission jitter must be minimal with no loss and interference from other traffic

Isochronous		
Characteristics		**Notes**
Periodicity	Cyclic/periodic	
Period	< 2ms	
Synchronized to network	Yes	
Data delivery requirements	Deadline	Usually within one data transmission period
Tolerance to interference	0	Least possible jitter is required
Tolerance to loss	None	Seamless redundancy is required
Application Data size	Fixed (30 - 100 bytes)	
Criticality	High	

Traffic Type: Cyclic

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Example: Pick & Place, Sorting

- Devices sample inputs and apply outputs cyclically (cycle may differ from data transmission period)
- Applications in each device may not be synchronized to a common (network) time
- Time between sending and receiving application data should be minimized, with predictable interruptions

Cyclic		
Characteristics		**Notes**
Periodicity	Cyclic/periodic	
Period	2 - 20ms	
Synchronized to network	No	
Data delivery requirements	Latency	Typically less than 50% of the period; lower network latency improves control
Tolerance to interference	<= latency	The jitter is constrained by the latency requirement
Tolerance to loss	1 - 4 frames	Applications may tolerate frame loss for 1 - 4 periods
Application Data size	Fixed (50 - 1000 bytes)	
Criticality	High	

Traffic Type: Events

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Examples: a) Event-based control, b) alarms/warnings and operator commands

- Devices generate messages when an input or output variable change occurs that requires attention
- May lead to single message or a flurry of messages (domino effect) depending on the type of change
- Network must be able to handle messages burst without loss (up to a certain no. of messages or bandwidth)

Events		
Characteristics		**Notes**
Periodicity	Acyclic/sporadic	
Period	n.a.	
Synchronized to network	No	
Data delivery requirements	Latency (10ms - 2s)	• *Alarms* and *operator commands* have relaxed latency • *Control events* have much shorter latency requirements
Tolerance to interference	n.a.	
Tolerance to loss	No	Unless application exceeds configured bandwidth limits
Application Data size	Variable (100 - 1500 bytes)	
Criticality	High	

Traffic Type: Configuration & Diagnostics

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Examples: Network and System management and configuration (e.g. SNMP, RESTCONF/NETCONF, firmware updates)

- This traffic type may occasionally create peaks of bandwidth utilization and has a latency of up till 1 second
- Diagnostic activities to monitor equipment health typically creates acyclic traffic type

Events		
Characteristics		**Notes**
Periodicity	Acyclic/sporadic	
Period	n.a.	
Synchronized to network	No	
Data delivery requirements	Bandwidth	
Tolerance to interference	Yes	Additionally, the latency is in the range of 100ms
Tolerance to loss	Yes	No seamless redundancy required
Application Data size	Variable (500 - 1500 bytes)	
Criticality	Medium	

Traffic Type: Network Control

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Examples: Clock synchronization (e.g. PTP), Network redundancy (e.g. RSTP), Topology detection (e.g. LLDP)

- The network control traffic type contains network control messages. These messages are low in volume but have critical delivery requirements. Many of the messages are cyclic, but not relative to any TSN network cycle times.

Events		
Characteristics		**Notes**
Periodicity	Cyclic/periodic	
Period	50ms ~ 1s	
Synchronized to network	No	
Data delivery requirements	Bandwidth	Typically 1 ~ 2 Mbits
Tolerance to interference	Yes	Transmission jitter should not exceed the period.
Tolerance to loss	Yes	Excessive loss of network control frames can lead to loss of network functions (e.g. link-down state or grand master fail-over).
Application Data size	Variable (50 ~ 500 bytes)	
Criticality	High	

Traffic Type: Best Effort

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Best effort traffic can follow two rules:

- Either it suffers from data loss when higher priority traffic uses all the bandwidth allocated (default)
- Or it can utilize a guaranteed bandwidth allocation

Best effort provides no delivery guarantees in the former case, and bandwidth guarantees in the latter

Events		
Characteristics		**Notes**
Periodicity	Acyclic/Sporadic	
Period	n.a	
Synchronized to network	No	
Data delivery requirements	None	Typically networks are configured to provide some bandwidth to Best Effort
Tolerance to interference	Yes	
Tolerance to loss	Yes	
Application Data size	Variable (30 ~ 1500 bytes)	
Criticality	Low	

Traffic Type: Video

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Examples: Video Surveillance traffic used to visually monitor production conditions but are not part of any control process

- Video for human consumption – no vision based control application traffic

Events		
Characteristics		**Notes**
Periodicity	Frame Rate	
Period	n.a	
Synchronized to network	No	
Data delivery requirements	Bandwidth	Latency greater than 10ms may impact application performance
Tolerance to interference	n.A	
Tolerance to loss	Yes	Loss of packets may lead to decreased quality, but not necessarily application failure
Application Data size	Variable (1000 ~ 1500 bytes)	
Criticality	Low	

Traffic Type: Audio

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- Audio traffic is the streaming of audio or voice traffic between end-points.
- Audio streaming for human consumption tends to have lower performance requirements and is reflected in the IEEE 802.1Q where audio traffic is “characterized by less than 100 ms delay, or other applications with low latency as the primary QoS requirement”.

Events		
Characteristics		**Notes**
Periodicity	Sampling Rate	
Period	n.a	
Synchronized to network	No	
Data delivery requirements	Bandwidth	Latency greater than 10ms may impact application performance
Tolerance to interference	n.A	
Tolerance to loss	Yes	Loss of packets may lead to decreased quality, but not necessarily application failure
Application Data size	Variable (1000 ~ 1500 bytes)	
Criticality	Low	