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Traffic Type Characteristics

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Traffic Types

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- Traffic types: Application-derived characteristics of data streams

- Different applications have different requirements and different criticality levels
  - Real-time traffic, latency and deadline guaranties, critical
  - …
  - Best effort traffic, no bandwidth requirement, not critical

- Different applications have different properties
  - Periodic data transmission, fixed data size
  - Sporadic data transmission, variable data size

Traffic Types (II)

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- Continuation from Bangkok discussion – actually a step back
  - Lot of discussion, and no final agreement on the traffic type definition

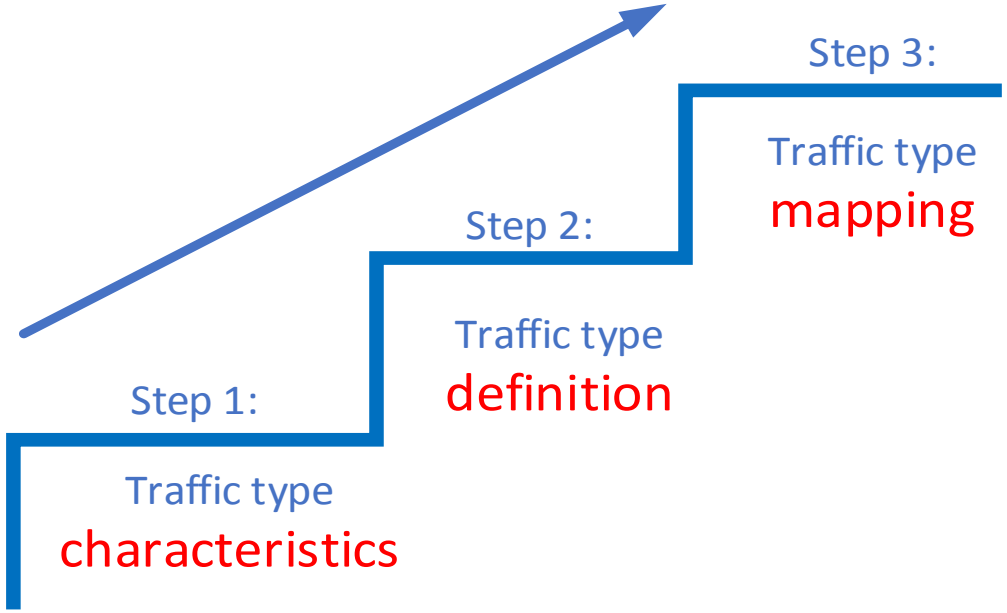
We need to bring the group at the same level of understanding

- Do not mixed up traffic types with traffic classes priority

Traffic Types (III)

The traffic types topics shall be 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)



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

- 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)

Content of this Contribution

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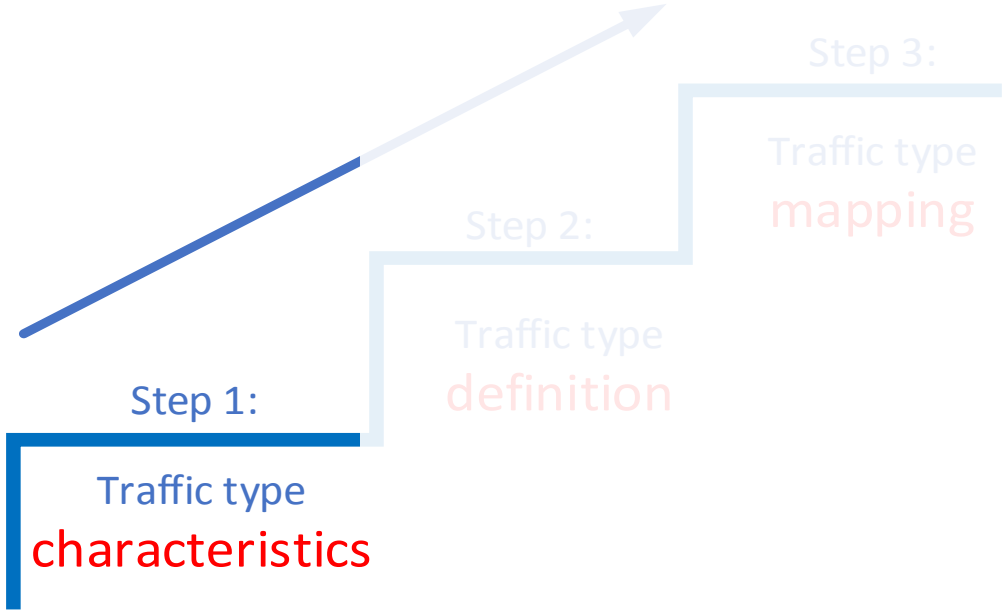
Step 1: Traffic types characteristics

The application-centric communication characteristics enable the identification of a small number of distinct traffic types that are shared among sets of industrial applications

This topic is treated ang agreed among the members of the IIC (Industrial Internet Consortium) – handled and reviewed with more than 10 contributors/reviewers

Goal is to use this as a solid starting point and to get the agreement within the IEEE/IEC 60802 WG for the traffic type definition



Traffic Type Characteristic (1)

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1. Data Transmission Periodicity

- *Cyclic/periodic* transmission
- *Acyclic/sporadic* - also periodic frames with large periods (1-2 seconds)

Traffic Type Characteristic (2)

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2. Period

- For traffic types that transmit cyclic/periodic data streams, period denotes the planned data transmission interval (often also called “cycle”) at the application layer.
  - The interval is provided as a typical range in orders of magnitude of time
  - i.e. 80% of the industrial applications in scope of the given traffic type are within the provided range.

- For the acyclic/sporadic traffic patterns, this characteristic does not apply

Traffic Type Characteristic (3)

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3. Application synchronized to network

- Denotes whether an application producing a traffic type is synchronized to the network time at the application layer.
- Applications that are synchronized to the network time can align their sending behavior to mechanisms provided by the network (e.g. scheduling) for reduced latency and jitter in the network communication.
- Available options are: **yes** or **no**.

Traffic Type Characteristic (4)

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4. Application data size

- Denotes the size of application data (payload) to be transmitted in the Ethernet frames.
- The size can be fixed (the data is always with the exact same size) or variable (data size varies from frame to frame, but not exceeding the given maximum size).
- The application data size provides a typical range in orders of magnitude of bytes, i.e. 80% of the industrial applications in scope of the given traffic type in the provided range.
- Where individual frame sizes widely fluctuate or cannot be determined at design or configuration time, data volume estimates (e.g. required bandwidth) is provided.

Traffic Type Characteristic (5)

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5. Data delivery guarantee

- **Deadline**: data delivery of each frame in a stream is guaranteed to occur at all registered receivers at or before a specified time (within a communication cycle)
- **Latency**: data delivery of each frame in a stream is guaranteed to occur at all registered receivers within a predictable timespan starting when the frame is transmitted by the sender and ending when the frame is received
- **Bandwidth**: data delivery of each frame in a stream is guaranteed to occur at all registered receivers if the bandwidth utilization is within the resources reserved by the sender

In the case that a frame cannot be delivered within the given latency or deadline requirement, that frame may be considered as lost or discarded by the application.

Traffic Type Characteristic (6)

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6. Tolerance to interference

- Denotes the application's tolerance to jitter for the traffic types with cyclic/periodic data transmission periodicity.
- In the case of a highly jitter-sensitive application, no jitter is expected and is to be indicated with the jitter value of zero, meaning that this jitter is negligible.
- If the application can cope with jitter, the response is yes and the amount of jitter is specified in a range.

Other sources of jitter in application processing besides network transmission jitter exist, e.g. stemming from local OS scheduling or time synchronization. These additional sources of jitter commonly have effects beyond individual traffic types and need to be considered separately.

- For traffic types with none or bandwidth data delivery guarantees the response is *yes* and jitter is not specified.

Traffic Type Characteristic (7)

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7. Tolerance to loss

- The applications may tolerate a certain amount of consecutive frame loss during frame delivery
- Number of tolerable lost frames can be indicated by the application
- Alternative, the option “yes” can be provided for applications that tolerate frame loss to the extent that basic redundancy protocols such as RSTP suffice to recover from potential network interruptions
- In case of a highly loss-sensitive application, where no single frame may be lost, “no (0 frames)” - is used

Traffic Type Characteristic (8)

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8. Criticality

- Describes the criticality of the data for the operation of the system.
- Application criticality is used as a criteria for bandwidth reservations in case of conflicting requirements.

The following categories of criticality are defined:

- **high**: for traffic types used either by application or the network services that are highly critical for the operation of the system. Data loss of this traffic type may cause critical system malfunction
- **medium**: for traffic types used either by application or the network services that are relevant but not continuously needed for the operation of the critical part of the system. Data loss of these traffic types may cause degraded operation but not a system malfunction. Data loss can be either tolerated or compensated by repeating/retransmitting the same data
- **low**: for traffic types used either by application or the network services that are not relevant for the operation of the critical part of the system.

Criticality of the data is not to be confused with the traffic class priority

Traffic Type Characteristics Overview

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1. Data Transmission Periodicity
2. Period
3. Application synchronized to network
4. Application data size
5. Data delivery guarantee
6. Tolerance to interference
7. Tolerance to loss
8. Criticality

Traffic Type Definition Example

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Types	Periodicity	Period	Synchronized to network	Data delivery guarantee	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

Future steps

Agree on Step 1: Traffic types characteristics Provide feedback on the content

Start working in Step 2 in March meeting