4.6.1 Introduction

Industrial automation applications make use of different traffic schemes/patterns for different functionalities (e.g. parameterization, control, alarming). The various traffic patterns have different characteristics and thus, impose different requirements on a TSN network. To specify these traffic types, a two-step approach is used:

1.) First define characteristics of generic traffic type (traffic-type-categories) and
2.) Second define instances of the generic types, i.e. the traffic types.

This two-step approach allows a clear differentiation between characteristics as seen from the "Ethernet interface" point of view and "application" point of view. Traffic-type-categories allow different IEEE 802 feature selections to achieve the specified goals. Four traffic-types-categories are identified in Industrial Automation (IA) systems:

1. IA time-aware stream
2. IA stream
3. IA traffic engineered non-stream
4. IA non-stream

IA time-aware stream

IA time-aware streams *are used for periodic* traffic with either deadline or latency requirements.

Characteristics		**Note**
Cyclic	Yes	
Data delivery requirement	Deadline or latency	Each stream may have its individual deadline or latency value, but also multiple streams with the same period may share the same deadline or latency value
Time-triggered transmit	Yes	

IA stream

IA stream traffic are used for periodic traffic with latency requirements.

Characteristics		**Note**
Cyclic	Yes	
Data delivery requirement	Latency	Each stream may have its individual deadline or latency value, but also multiple streams with the same period may share the same deadline or latency value
Time-triggered transmit	Optional	

IA traffic engineered non-stream

This traffic is used to send sporadic traffic with bounded latency and requiring a certain bandwidth along the path of the traffic.

Characteristics		**Note**
Cyclic	No	
Data delivery requirement	Latency	Expected bandwidth usage is engineered offline, and Ethernet interfaces are configured accordingly.
Time-triggered transmit	No	

IA non-stream

IA non-stream is used for the bulk traffic with no specific data delivery requirements.

Characteristics		**Note**
Cyclic	No	
Data delivery requirement	None	Bulk traffic, best-effort.
Time-triggered transmit	No	

Table 3 summarizes relevant industrial automation traffic types and their associated characteristics.

Table 1 – Industrial automation traffic types summary

Traffic type name	**Cyclic**	**Data delivery requirements**	**Time-triggered transmit**	**Traffic-type-category**
Isochronous	Yes	Deadline	Yes	IA time-aware-stream
Cyclic-Synchronous	Yes	Latency	Yes	IA time-aware-stream
Cyclic-Asynchronous	Yes	Latency	No	IA stream
Alarms and Events	No	Latency	No	IA traffic engineered non-stream
Configuration & Diagnostics	No	Latency	No	IA traffic engineered non-stream
Network Control	Yes	Latency	No	IA traffic engineered non-stream
Best Effort	No	None	No	IA non-stream
Video	No	Latency	No	IA stream
Audio/Voice	No	Latency	No	IA stream

Traffic classes to traffic-type-classes assignment

The following Table defines the usage of the following traffic classes based on the traffic type-classes:

Traffic class	**Traffic type class**	Traffic Type
7	**IA time-aware-stream**	Periodic, traffic engineered path, time-sensitive stream, zero congestion loss, defined receive deadline (engineered max latency)
6		Periodic, traffic engineered path, time-sensitive stream, zero congestion loss, engineered max latency
5	**IA stream**	Periodic, learned path, time-sensitive stream, defined bandwidth, engineered max latency
4	**IA traffic engineered non-stream**	Event-driven, learned path, defined bandwidth, network management
3		Event-driven, learned path, defined bandwidth
2		Event-driven, learned path, defined bandwidth
1	**IA non-stream**	Event-driven, learned path, limited bandwidth (per class)
0		Event-driven, learned path, limited bandwidth

Traffic-Type-Classes definition would allow different IEEE 802 feature selections to achieve the specified goals. Moreover it helps in identification of the traffic protection mechansims.