Extensions on the TSN UNI traffic specification

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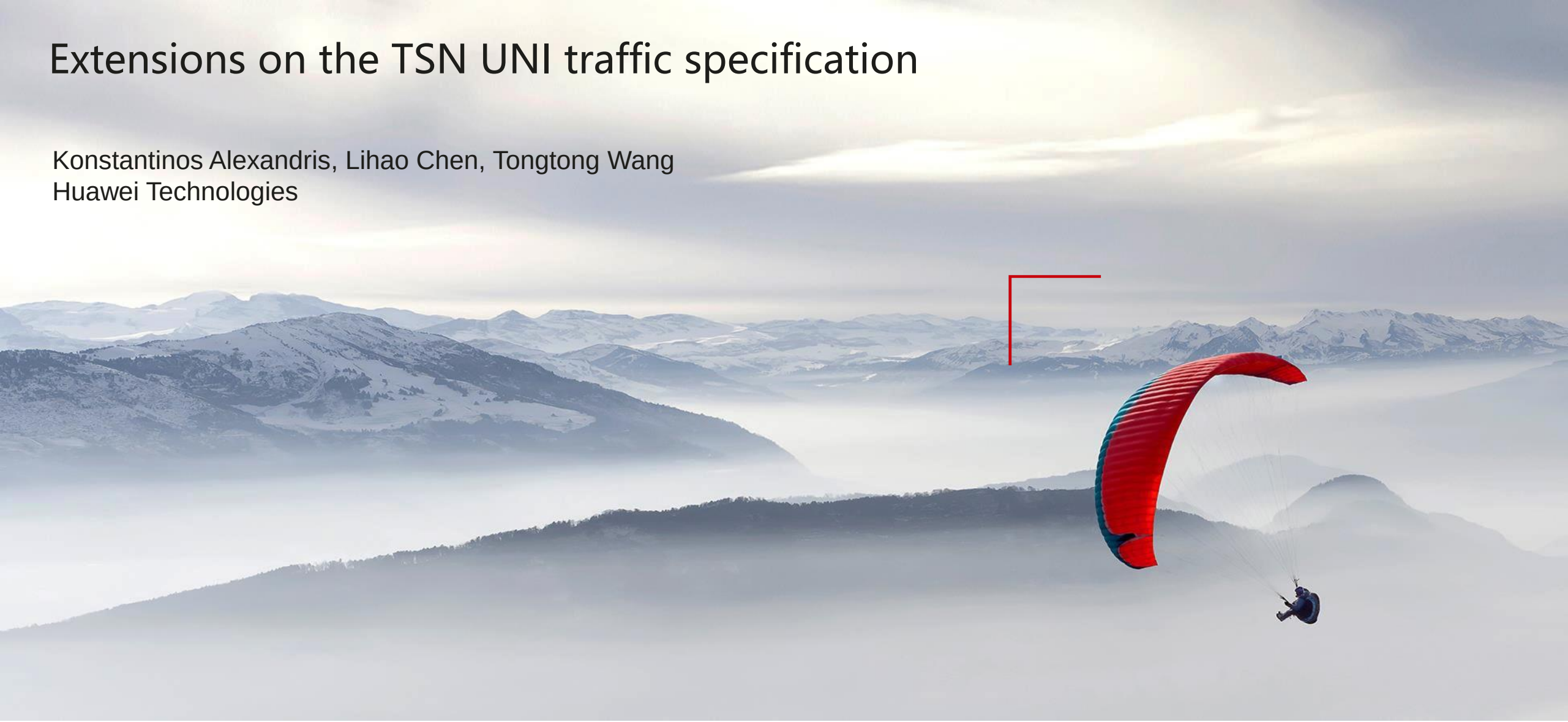

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Introduction

- **Resource allocation** mechanisms need to be revised to cover network traffic variability and interoperability.
- **Deviation** in traffic characteristics sourced by various types of applications has not be thoroughly investigated in **TSpec** TLVs.
- **Trials** to extend Tspec [1-4] in specific amendments. The approach was to cover the generic use case.
- Our proposal is **beyond the scope of** the existing projects and published standards.
- The direction is not bound Tspec TLVs to distinct **protocols** or/and certain **configuration models**.
- Define a unified **TSN Tspec** (generic traffic models) is emerged towards flexible traffic engineering and IT/OT network convergence.

[1] https://www.ieee802.org/1/files/public/docs2022/dj-alexandris-extension-TSN-UNI-traffic-specification-0522-v01.pdf.
[2] https://www.ieee802.org/1/files/public/docs2022/new-alexandris-extension-traffic-specification-TSN-UNI-0722-v01.pdf.
[3] https://www.ieee802.org/1/files/public/docs2022/dd-alexandris-reworking-extensions-TSN-UNI-RAP-1122.pdf.
[4] https://www.ieee802.org/1/files/public/docs2023/new-alexandris-extensions-TSN-UNI-0123-v02.pdf.

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Background in IEEE Std 802.1Q-2022

IEEE Std 802.1Q-2022

46.2.3.5 TrafficSpecification

The TrafficSpecification group specifies how the Talker transmits frames for the Stream. This is effectively the Talker's promise to the network. The network uses this traffic specification to allocate resources and adjust queue parameters in Bridges.

The TrafficSpecification group consists of the following:

a) Its required elements, listed in Table 46-8.

Table 46-8—TrafficSpecification elements

Name	Data type	Reference
Interval	rational	46.2.3.5.1
MaxFramesPerInterval	uint16	46.2.3.5.2
MaxFrameSize	uint16	46.2.3.5.3
TransmissionSelection	uint8	46.2.3.5.4

b) An optional TSpecTimeAware group, whose elements are listed in Table 46-9.

Table 46-9—TSpecTimeAware elements

Name	Data type	Reference
EarliestTransmitOffset	uint32	46.2.3.5.5
LatestTransmitOffset	uint32	46.2.3.5.6
Jitter	uint32	46.2.3.5.7

	Octet	Length
MaxTransmittedFrameLength	1	2
MinTransmittedFrameLength	3	2
CommittedInformationRate	5	8
CommittedBurstSize	13	4

IEEE Std 802.1Q-2022
IEEE Standard for Local and metropolitan area networks—Bridges and Bridged Networks

46.2 User/network configuration information

This subclause specifies the user/network configuration information that is used for the three TSN configuration models (46.1.3). The semantics for the TSN user/network configuration information is specified independent of schema, encoding, or protocol.

- We focus on the generic TSN UNI Tspec as defined in **Section 46.2.3.5 (IEEE Std 802.1Q-2022)**.
- **What about burst traffic ?** The supported parameters do not suffice in configuring relevant TSN shaping features.
- **Key elements:** Committed Information Rate (CIR), Committed Burst Size (CBS) & Max/Min Frame Length (see Token Bucket model in **Qcr [5]/Qdd [6]**).
- Upper bounds on burst traffic characteristics (i.e., arrival curves) and latency usually described in terms of those elements.
- **Gap:** No matter the **use case** and no matter the **configuration** model; the **burst traffic** model is not part of the current TSN UNI Tspec.

[5] https://www.ieee802.org/1/files/public/docs2021/new-specht-onats-0921-v01.pdf.
[6] https://1.ieee802.org/tsn/802-1qdd/.

Traffic model – History & Various Amendments

A TSpec does not have to be supported by any reservation protocol.

No dependencies

Reservation protocol specific

Added parameters from Qat, revised and expanded by Qcc.

Octet # 17	19	20
MaxFrameSize	MaxIntervalFrames	

IEEE Std 802.1Qat: SRP/MSRP

Proposal 1: Add parameters from Qdd.

	Octet	Length
MaxTransmittedFrameLength	1	2
MinTransmittedFrameLength	3	2
CommittedInformationRate	5	8
CommittedBurstSize	13	4

Figure 99-14—Value of Token Bucket TSpec sub-TLV

IEEE Std P802.1Qdd: RAP

Proposal 2: More traffic models to be studied and added to generic Tspec [1].

IEEE Std 802.1Q-2022: Generic TSpec (Traffic model)

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+

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Shaper parameters

A generic traffic model can be mapped to various shaper parameter configurations.

TimeAwareOffset placed for TAS configuration.

IEEE Std 802.1Qbv: TAS

CIR/CBS & Max/Min Frame Length fit well with ATS.

IEEE Std 802.1Qcr: ATS

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TSN UNI Tspec: Other Subclauses

Existing

Non-Existing

				Our proposal (unified approach)
	Fully distributed model	Fully centralized or Centralized network/distributed user model	Fully distributed model	Generic configuration (all 3 models)
Tspec (TLV)	**MSRP (original) [a]**	**MSRP (enhanced) [b]**	**RAP [c]**	**MSRP, RAP or others [d, e]**
TrafficSpecification elements	[√]	[√]	[√]	[√]
TspecTimeAware elements	[X]	[√]	[X]	[√]
TspecTokenBucket elements	[X]	[X]	[√]	[X] → [√]

Models

Protocols

[a] 802.1Q-2022: Subclause 35.2.2.8.4 (Tspec).

[b] 802.1Q-2022: Subclause 35.2.2.10.6 (TrafficSpecification and TSpecTimeAware), 35.2.3.1.1 (REGISTER_STREAM.request).

[c] P802.1Qdd: Subclause 99.5.3 (Talker Announce attribute and TLV encoding), 99.5.3.6 (Token Bucket Tspec sub-TLV), 99.5.3.7 (MSRP Tspec sub-TLV).

[d] 802.1Q-2022: Subclause 46.2.3.5 (TrafficSpecification), **P802.1Qdj:** Subclause 46.2.3 (Talker – TrafficSpecification).

[e] 802.1Q-2022: Subclause 47.1.1 (ATS traffic class model in Talkers), 48.2.7 (ATS YANG model – Only for Bridges).

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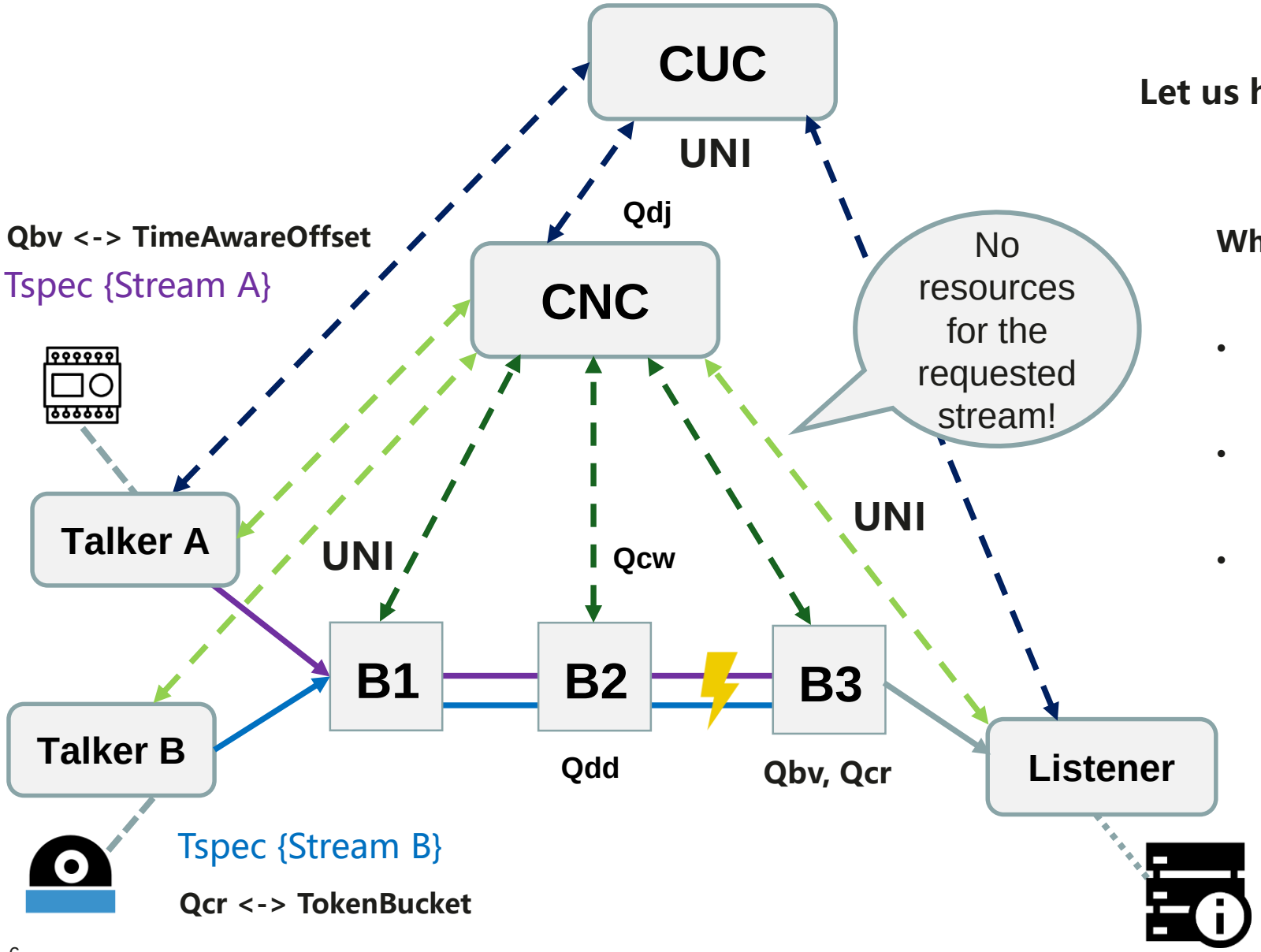
TSN UNI Tspec – Configuration models



Let us have a look at the big picture !

What about the following combinations ?

- **Example: I want to use ATS with centralized model, i.e., CNC assistance support.**
- **End-station/CUC needs to send the TokenBucket Tspec via UNI.**
- **Is there any YANG model supported ?**

Summary – Open discussion

- The parameters needed to characterize burst traffic requirements are missing in the generic TSN UNI Tspec (**Section 46.2.3.5, IEEE Std 802.1Q-2022**), i.e., irrespectively of the applied configuration model.
- **Main ingredients:** Committed Information Rate (CIR), Committed Burst Size (CBS) & Max/Min Frame Length (see Token Bucket model in **Qcr/Qdd**).
- **Proposal:** Specify a **new unified Tspec** (generic traffic models) on top of the **existing TSN UNI TSpec**.
- New project proposal in IEEE TSN TG ? How to proceed further after drawing conclusions?

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Thank you.