

# Generic TSN end-to-end guideline

## How to use TSN

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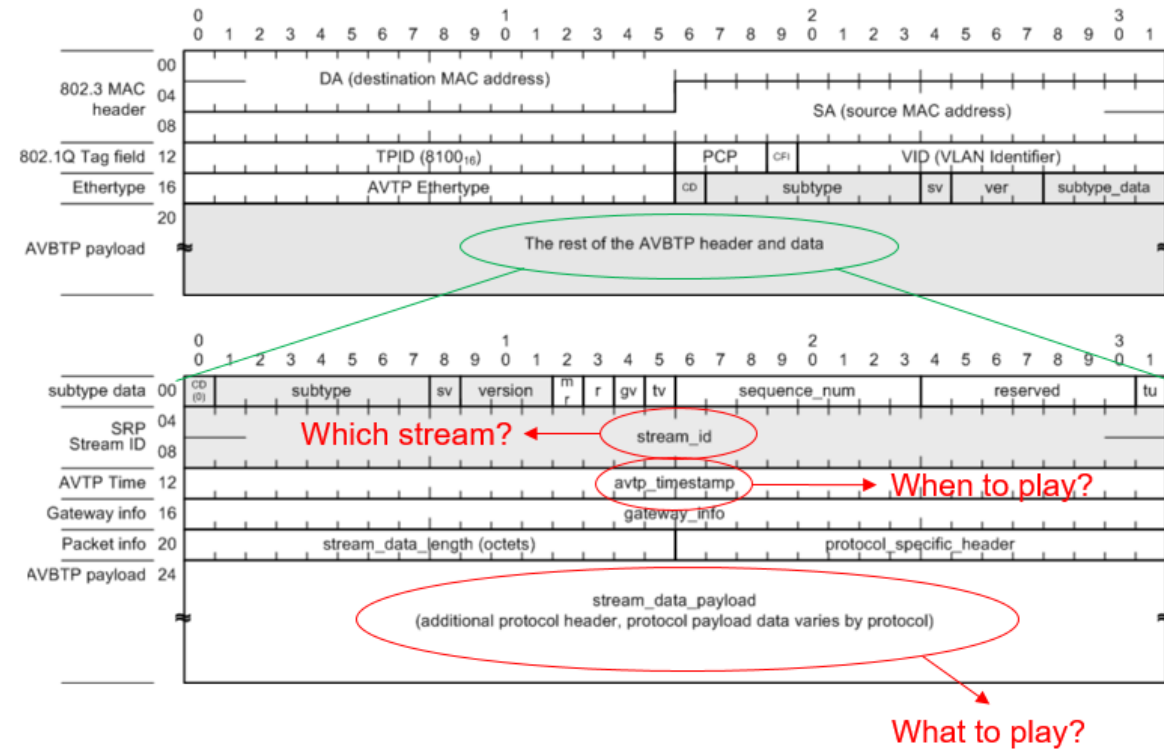
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# A quick look back on AVB

- IEEE 802.1BA AVB Systems
  - > 802.1Qat Stream Reservation Protocol for resource reservation.
  - > 802.1Qav Credit-Based Shaping for transmission selection.
  - > 802.1AS Timing and Synchronization for upper layer usage.
- Not only 802.1
  - > IEEE 1722 AVTP, IEEE 1722.1 AVDECC, ...
- These designs are interrelated, and they combine together to form an **end-to-end solution**.
  - > End-to-End: from the sender's application to the receiver's application.



- The author is not saying that we need to define new upper-layer protocols for TSN.

# Why a generic TSN end-to-end guideline is needed?

- How to use TSN(AVB) for time-sensitive audio and/or video applications?
  - > Buy 802.1BA conformance bridges and end-stations.
  - > Develop apps based on AVBTP. The AVBTP uses Ethernet AVB which provides StreamID and timestamps.
- How to use TSN for industrial automation applications?
  - > Buy IEC/IEEE 60802 conformance bridges and end-stations.
  - > Develop apps based on the X protocols (PROFINET, OPA UA, etc.), which is Ethernet TSN based.
- How to use TSN for automotive In-Vehicle applications, aerospace onboard applications, ...?
- **How to use TSN for any other time-sensitive applications?**
  - > **The author believes that a TSN guideline for generic time-sensitive scenarios would be very helpful.**

# Why a generic TSN end-to-end guideline is needed? Cont.

Some voices from the users:

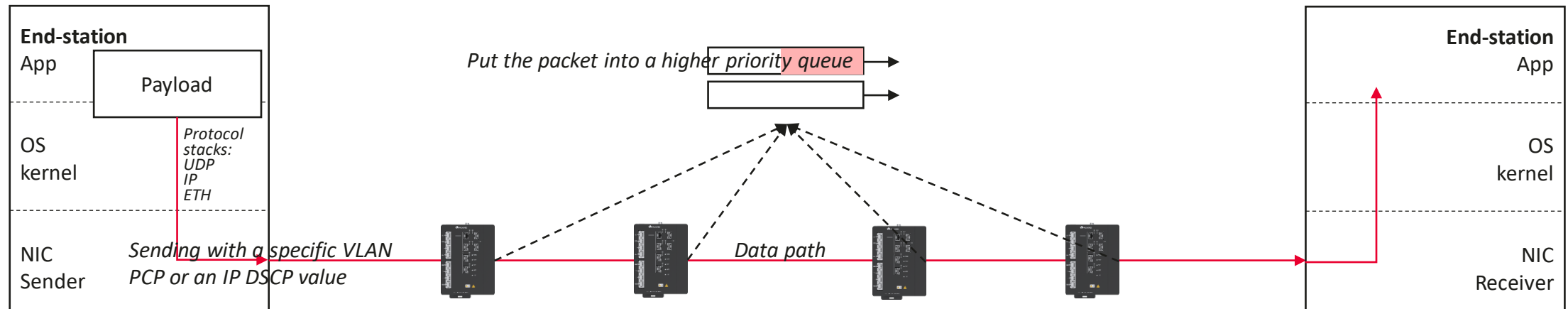
- I know TSN and I agree it's useful, but I don't see many mature end-to-end TSN based solutions.
- Can I try it? Maybe. It would be great if you give me some references. And I also have concerns...
  - > The implementation of TSN is complex, and the scheduling algorithm is very difficult.
  - > While there are many TSN switches available, there are few market-level TSN end-station devices.

Some voices from the vendors:

- I don't see users asking for TSN end-station devices.
- Can I produce it? Maybe. It would be great if you give me some references. And I also have concerns...
  - > TSN end-stations rely on TSN specific hardware. It adds costs and complexity.
  - > There are thousands of pages of standard (and mostly about bridges). It's hard to know what to do.
- These thoughts have also slowed down the progress of TSN application implementation.
- **The Generic TSN end-to-end guideline can inform stakeholders of **baseline examples for deploying a TSN system, which minimizes the need for 'TSN-dedicated' hardware and software, especially on the end-station side.****
  - > E.g., the scheduling/gating/TAS/Qbv..., preemption, PSFP, FRER, and so on are added-on options, but not a must.

# Proposal

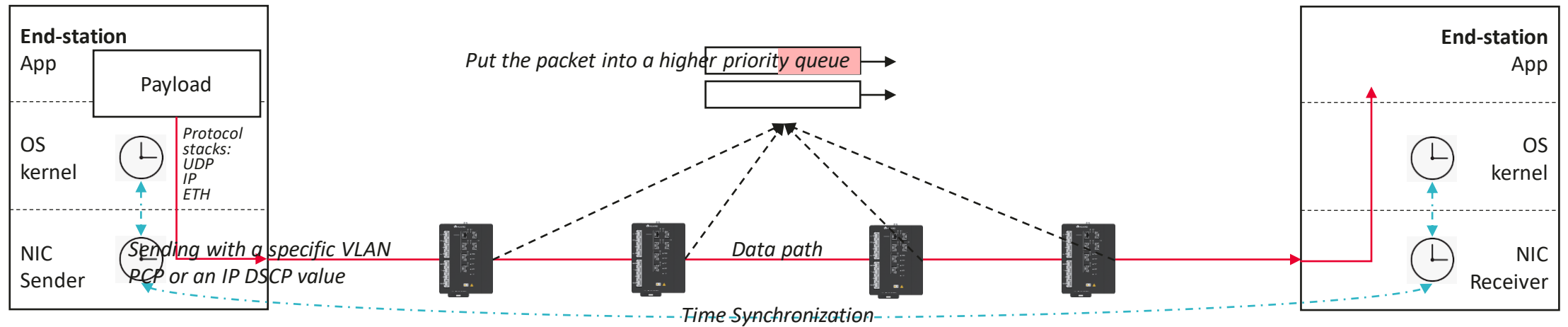
- A Generic TSN end-to-end guideline, showing examples, but not dictate you must do this or that.
  - > A new standalone draft / Annex to .1DC (may not perfectly fit) / Annex to .1Q.
- Content: List the fundamental factors that need to be considered.
  - > The usage of transmission selection schemes.
  - > The collaboration between end-stations and bridges.



*A basic option is to use Strict Priority (802.1Q 8.6.8.1)*

# Proposal

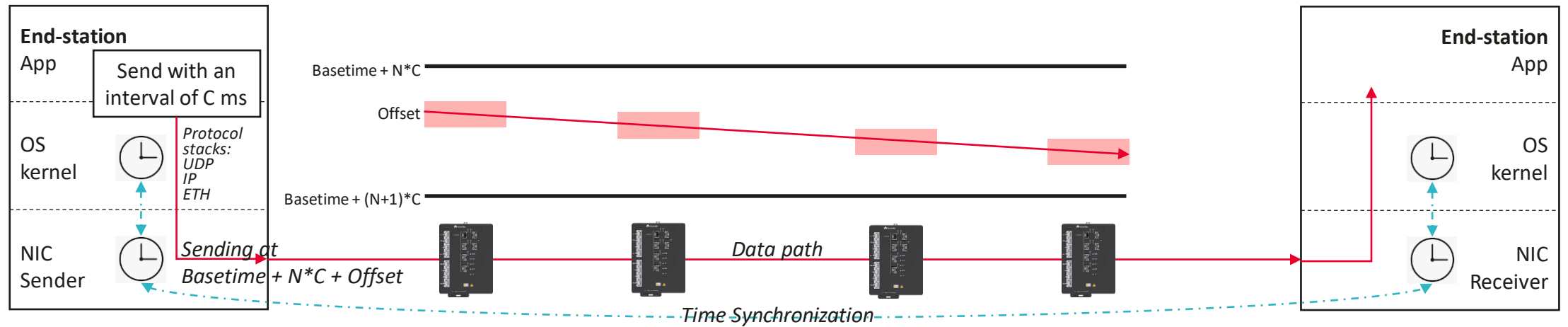
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*Strict Priority (802.1Q 8.6.8.1) and time synchronization*

# Proposal

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*Another example using Enhancements for scheduled traffic (802.1Q 8.6.8.4) with time synchronization.*

# Backup information 1 - potential additional contents

Provides

Guidelines

&

Demonstrations

showing what kind of time-sensitive performance can be achieved

End-to-end time synchronization accuracy

End-station packet sending accuracy (jitter)

End-to-end latency bound

with different influencing factors

Computing power and architecture

OS and software/hardware real-time

NIC

protocol stack



# Backup information 2

- P802.1DC specifies procedures and managed objects for QoS features specified in IEEE Std 802.1Q in a network system which is not a bridge (An end system or a forwarding system).
- The generic TSN end-to-end guideline includes more other than .1Q on the end system part.

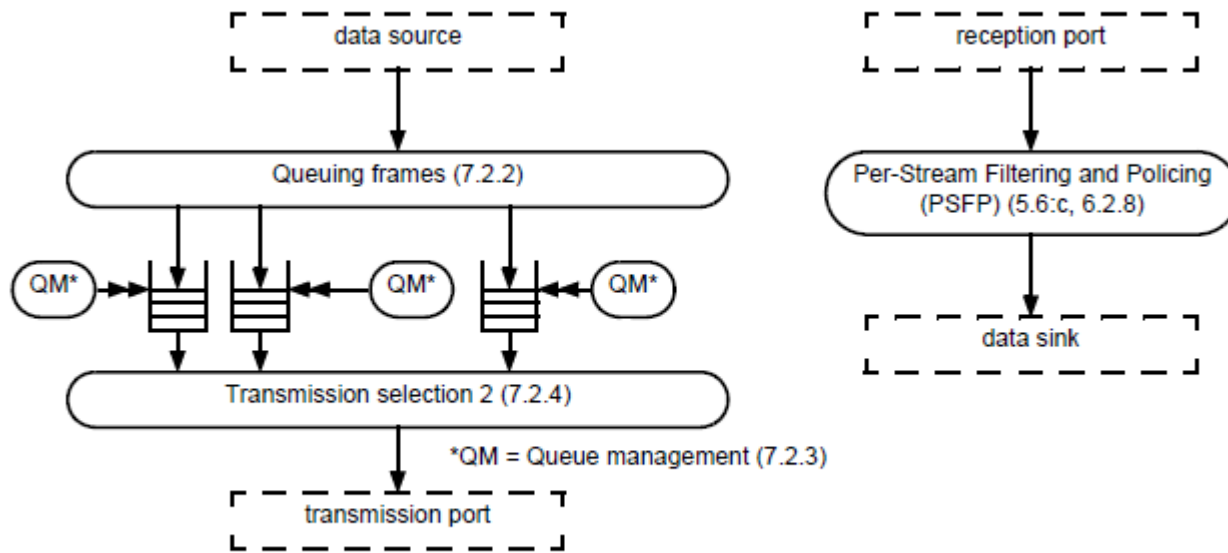
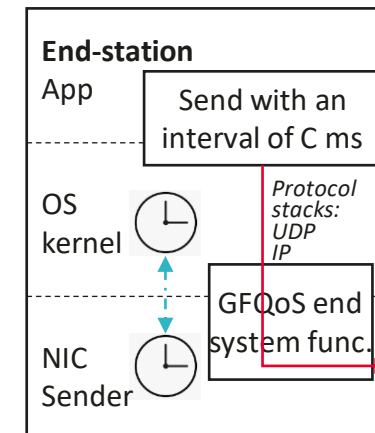


Figure 7-2—GFQoS end system functions

[802.1DC, D3.2](#)



End system functions  
for the generic TSN end-to-end guideline