

P802.1CBdb Contribution



MPLS Label Match

Flow Identification and Mapping to/from TSN (DetNet – TSN Data Plane Interactions)

IEEE 802.1 TSN TG
TSN call, January 7, 2019

Topics



- Proposal
 - Extension of Stream Identification with MPLS label(s)
- Background
 - DetNet Data plane
 - MPLS based PSN
 - DetNet mapping to/from TSN

P802.1CBdb: mask & match proposal

Mapping MPLS label(s)



- P802.1CBdb: Simple flat mask & match stream identification
 - Another upper-layer protocol: MPLS
- Ethertype points to MPLS
 - There is a label stack
 - Variable size (32 bits per label)
 - S (Bottom-of-Stack) bit signifies that the current label is the last in the stack
 - Stream can be identified by
 - Whole label stack / Parts of the label stack
 - Match & mask
 - Label value, TC (Traffic Class)

MPLS Label

00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
Label																				TC: Traffic Class (QoS and ECN)			S: Bottom-of-Stack			TTL: Time-to-Live						

Mapping DetNet to/from TSN

DetNet MPLS data plane

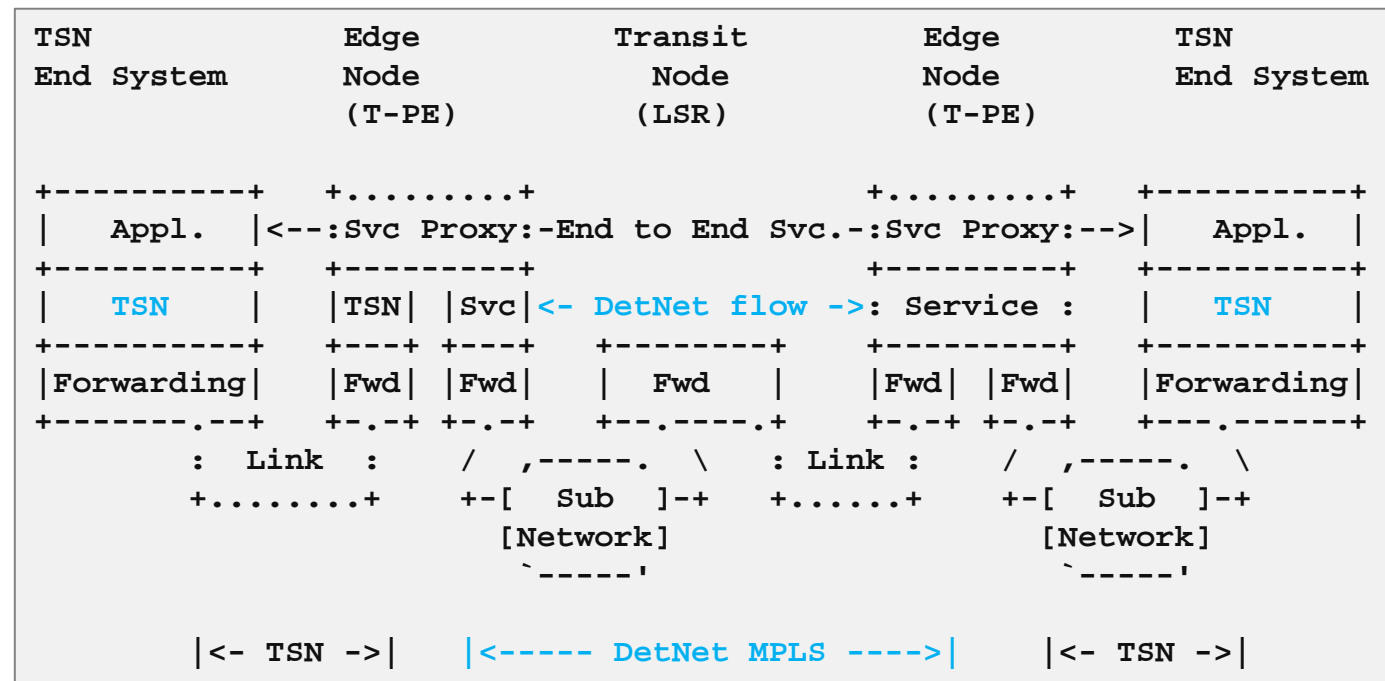




MPLS data plane – Scenarios

TSN over DetNet MPLS Enabled Network

- TSN end systems originate Ethernet encapsulated traffic
- DetNet Edge Nodes
 - sit at the boundary of a DetNet domain
 - are responsible for mapping non-DetNet aware traffic to DetNet services
 - support the imposition and disposition of the required DetNet encapsulation.
 - functionally similar to pseudowire (PW) Terminating Provider Edge (T-PE) nodes which use MPLS-TE LSPs.
- Transit nodes
 - are normal MPLS LSRs
 - are generally unaware of the special requirements of DetNet flows



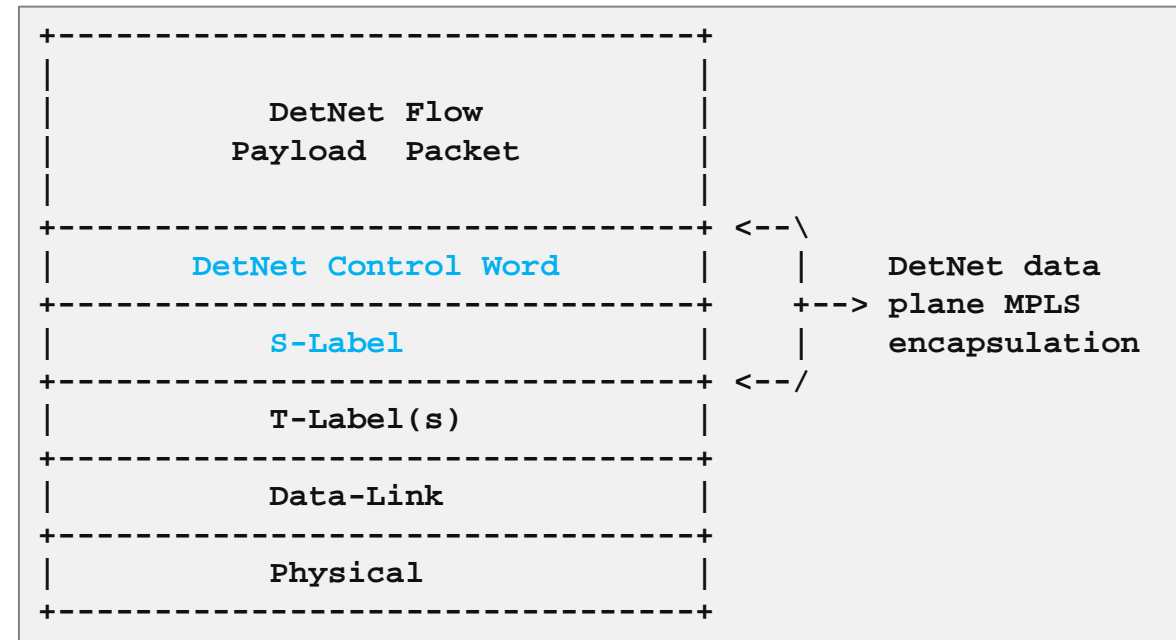
This conceptually parallels [L2VPN services](#)

MPLS data plane – Encapsulation

DetNet PW



- MPLS-based DetNet data plane encapsulation:
 - **DetNet control word (d-CW)** containing sequencing information for packet replication and duplicate elimination purposes, and the OAM indicator.
 - **DetNet service Label (S-label)** that identifies a DetNet flow to the peer node that is to process it.
 - Zero or more MPLS transport LSP label(s) (T-label) used to direct the packet along the label switched path (LSP) to the next peer node along the path.
 - The necessary data-link encapsulation is then applied prior to transmission over the physical media.



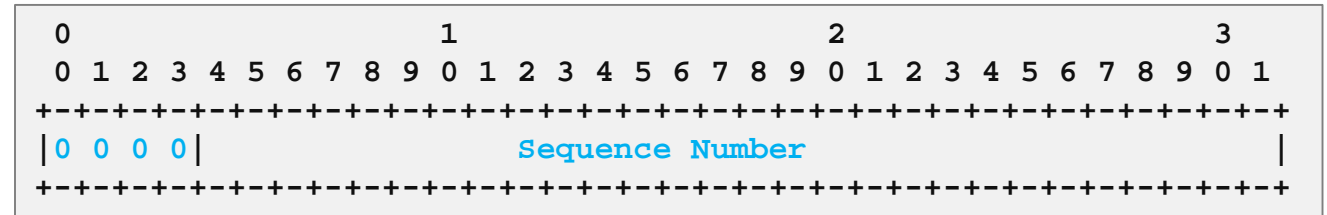
MPLS data plane – Encapsulation

DetNet control word



— d-CW:

- d-CW **MUST always be present** in a packet (even if it is not used)
- A DetNet control word (d-CW) conforms
 - to the Generic PW MPLS Control Word (PWMCW) defined in [RFC4385]
- Two sequence number sizes are supported:
 - **16** bits and **28** bits.
- The sequence number size
 - in use for the d-CW associated with a DetNet flow (S-Label) is configured either by a controller plane or manually for each DetNet flow.
- **Zero is an ordinary sequence number** with no special meaning

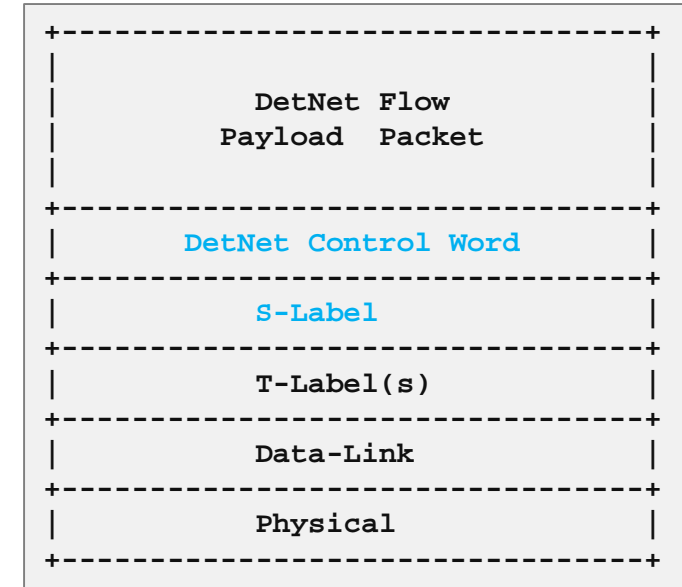


MPLS data plane – Encapsulation

Flow and payload type



- DetNet **Flow identification**
 - at a DetNet service sub-layer is realized by an **S-label**
 - S-label is allocated from the platform label space
 - S-label **MUST** be at the bottom label of the label stack and **MUST** precede the d-CW
- Indication of the DetNet **Payload Type**
 - only nodes that needs to know the payload type of a flow are the DetNet ingress node and the DetNet egress nodes
 - packet type is indicated to the egress edge node **through the value of the S-label**



Mapping DetNet to/from TSN

DetNet data plane drafts + IEEE 802.1CB

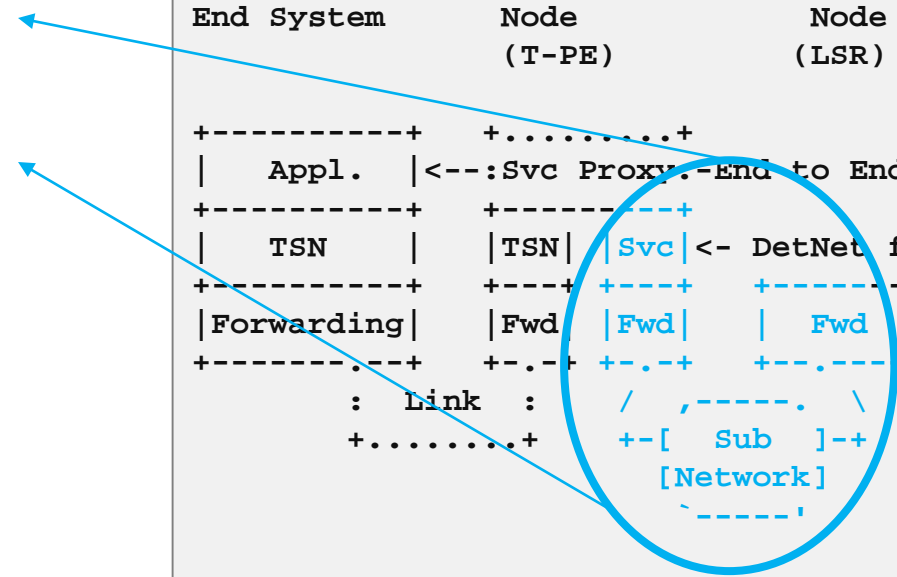
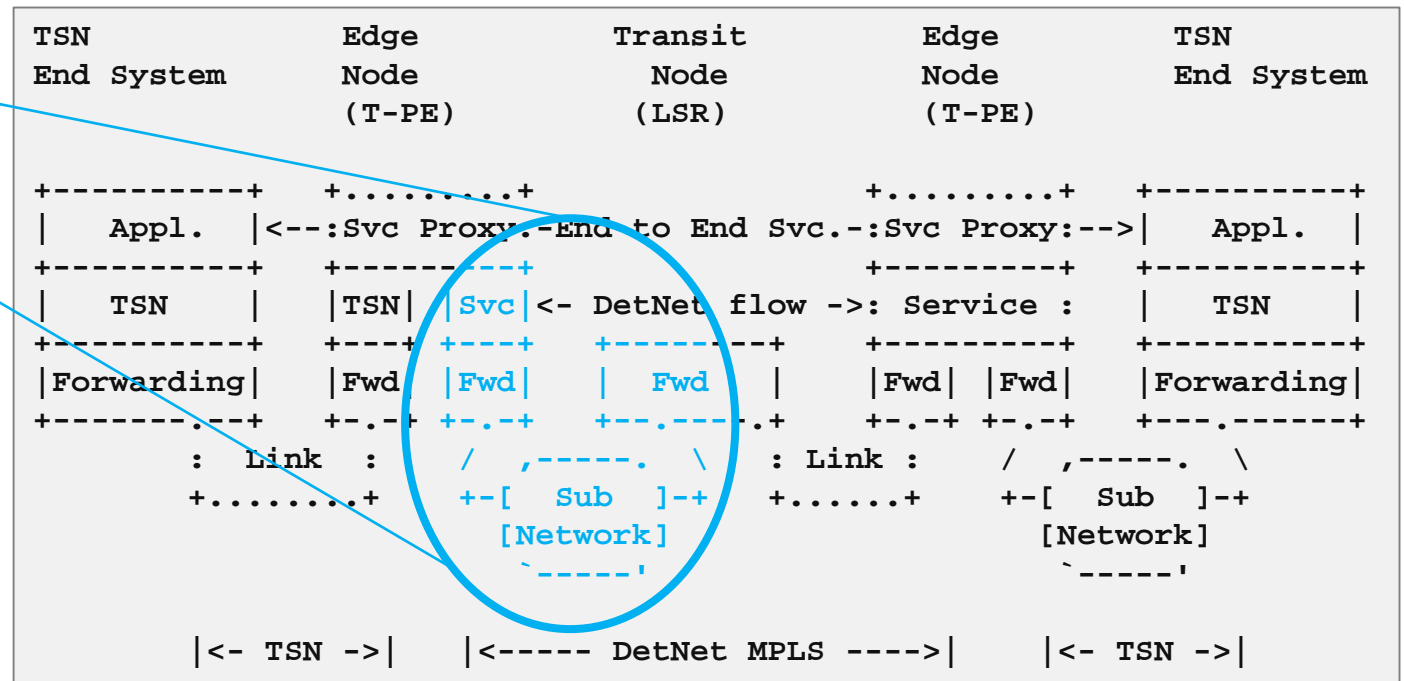


Scenario: DetNet Node connected to TSN Node



- Mapping DetNet flow(s) to/from TSN stream(s)
 - What packets require TSN treatment ... ?

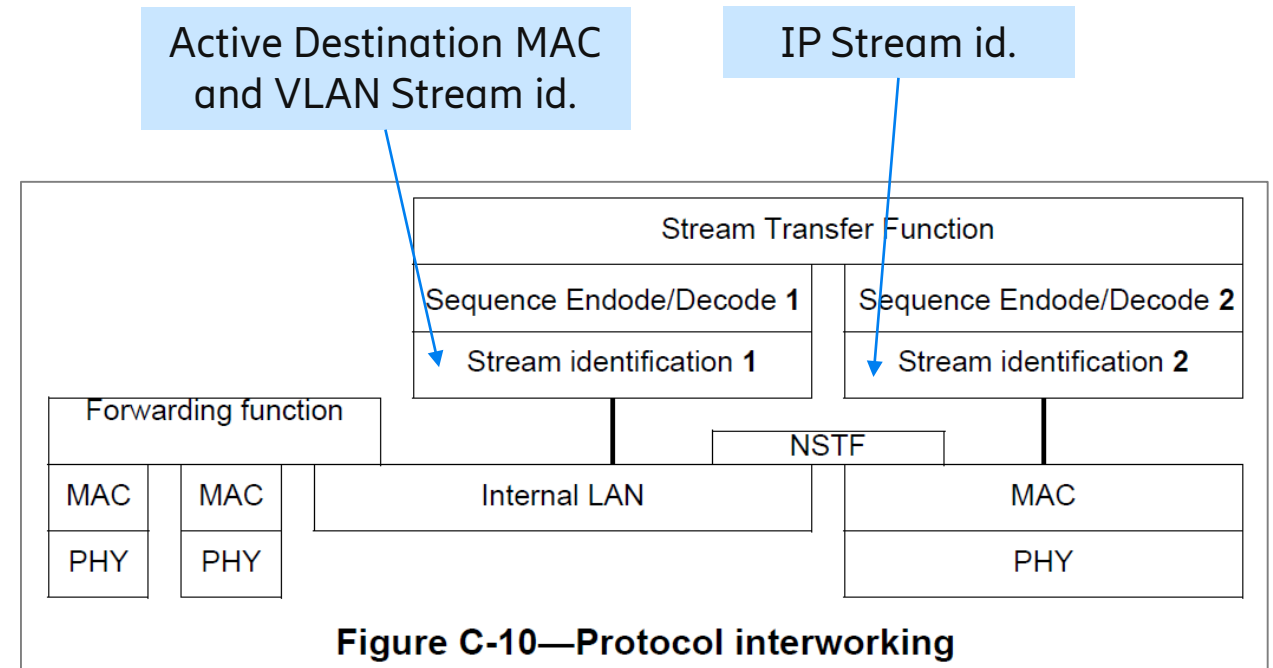
MPLS nodes are interconnected by a TSN domain



Mapping to TSN – IP/MPLS data plane Concept



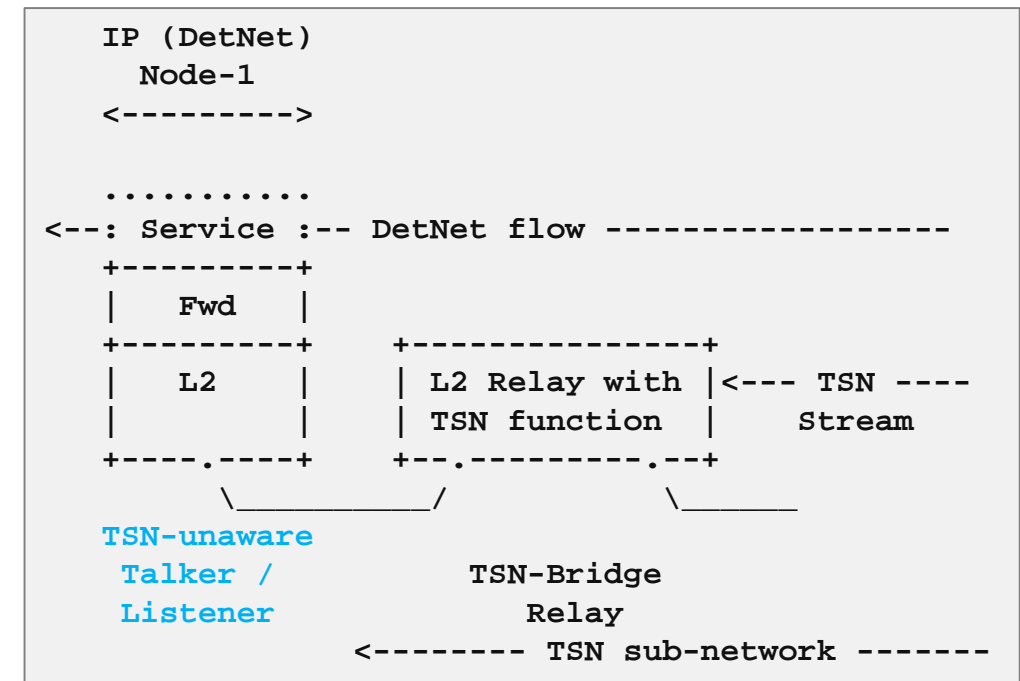
- Goal:
 - TSN functions have to identify flows those require TSN treatment (i.e., **VLAN/dst-MAC**)
- Concept:
 - DetNet Flow and TSN Stream mapping is based on the **active Stream Identification function**, that operates at the frame level.
 - E.g.,
 - Function 1 could be the Active Destination MAC and VLAN Stream identification
 - Function 2 could be the IP Stream identification
 - Protocol interworking required **at both** (ingress and egress) **end** of a TSN sub-network



Mapping to TSN – TSN-unaware DetNet nodes without any TSN functions



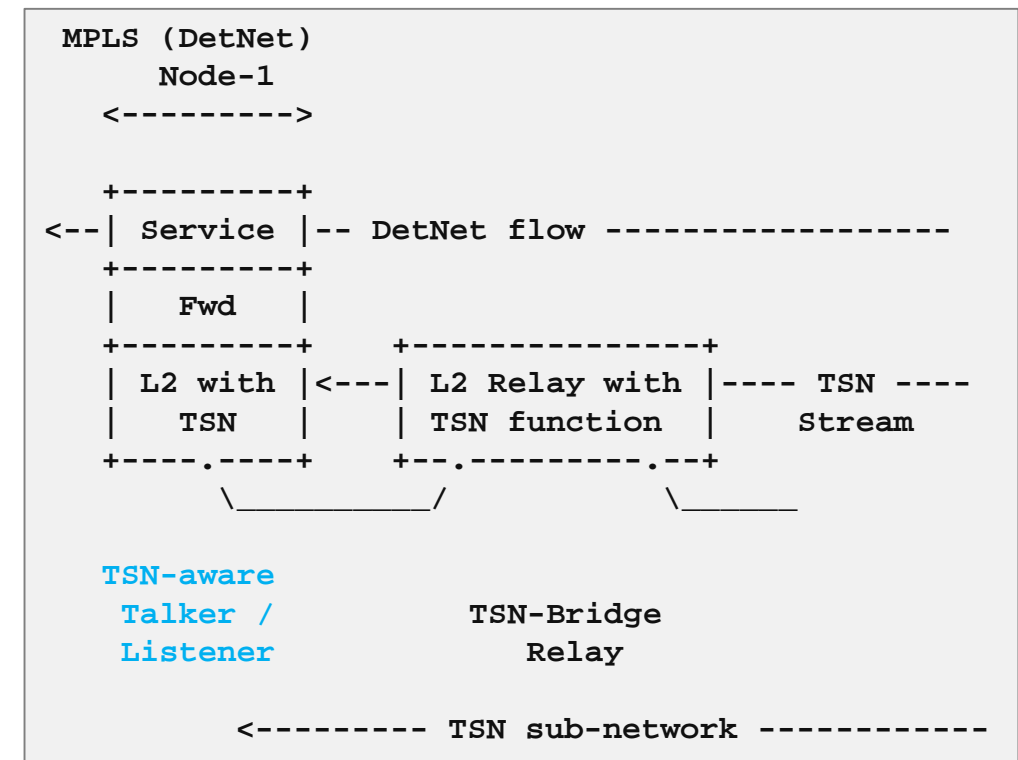
- **Limitation:**
 - Active stream identification defined only for IP header
 - MPLS labels are not recognized
- Mapping DetNet IP data plane:
 - IP DetNet nodes without any TSN functions can be treated as **TSN-unaware Talker or Listener**.
 - Relay nodes in the TSN sub-network MUST modify the Ethernet encapsulation of the IP DetNet flow (e.g., MAC translation, VLAN-ID setting, Adding Sequence number, etc.) to allow proper TSN specific handling of the flow inside the sub-network.



Mapping to TSN – TSN-aware DetNet nodes with TSN functions (MPLS example)



- Mapping:
 - **TSN capable** MPLS (DetNet) nodes are TSN end stations
 - Maps DetNet flows to/from TSN Streams
- TSN end station required capabilities includes the following TSN components:
 - For recognizing flows:
 - Stream Identification (MPLS-flow-aware)
 - For FRER used inside the TSN domain, additionally:
 - Sequencing function
 - Sequence encode/decode function
 - For FRER when the node is a replication or elimination point, additionally:
 - Stream splitting function
 - Individual recovery function





Questions ...