Enhanced DetNet Data Plane

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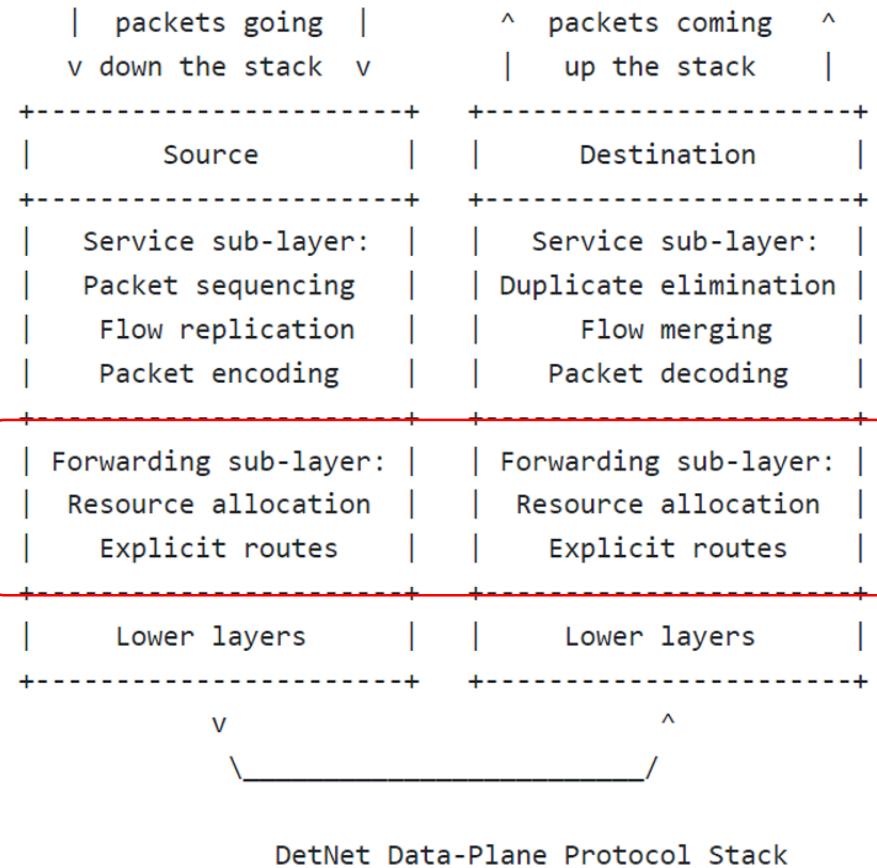
IETF 116 @ Yokohama

Scope of DetNet Enhancement

Provide a rough understanding of DetNet Enhancement...

DetNet:

- Reuse the exiting IETF and IEEE mechanism
- RFC 9320 (Deterministic Networking (DetNet) Bounded Latency) gives a timing model to compute end-to-end latency and backlog bounds for various queuing mechanisms
- The queuing mechanism includes: Frame Preemption, Time-Aware Shaper, Credit-Based Shaper, Cyclic Queuing and Forwarding, etc.

```
   |  packets going  |          ^  packets coming  ^
   v down the stack  v          |   up the stack   |
   +-------------------+        +-------------------+
   |      Source       |        |    Destination    |
   +-------------------+        +-------------------+
   | Service sub-layer:|        | Service sub-layer:|
   | Packet sequencing |        | Duplicate elimination |
   | Flow replication  |        |   Flow merging    |
   | Packet encoding   |        |  Packet decoding  |
   +-------------------+        +-------------------+
   | Forwarding sub-layer: |    | Forwarding sub-layer: |
   | Resource allocation  |     | Resource allocation  |
   |   Explicit routes    |     |   Explicit routes    |
   +-------------------+        +-------------------+
   |   Lower layers    |        |   Lower layers    |
   +-------------------+        +-------------------+
             v                            ^
             _____/

        DetNet Data-Plane Protocol Stack
```
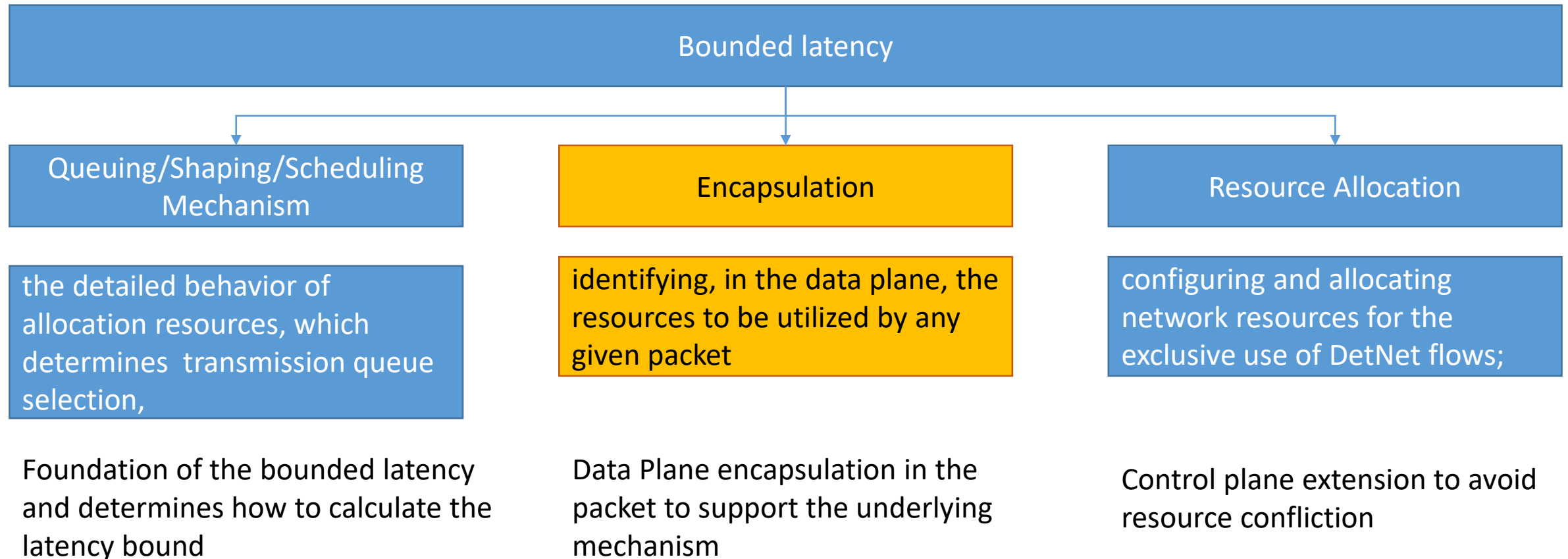
Enhanced DetNet:

- Define new Layer 3 mechanism for resource allocation for bounded latency and zero congestion loss to satisfy new requirements, for example large scale deterministic networking as discussed in **draft-liu-detnet-large-scale-requirements**
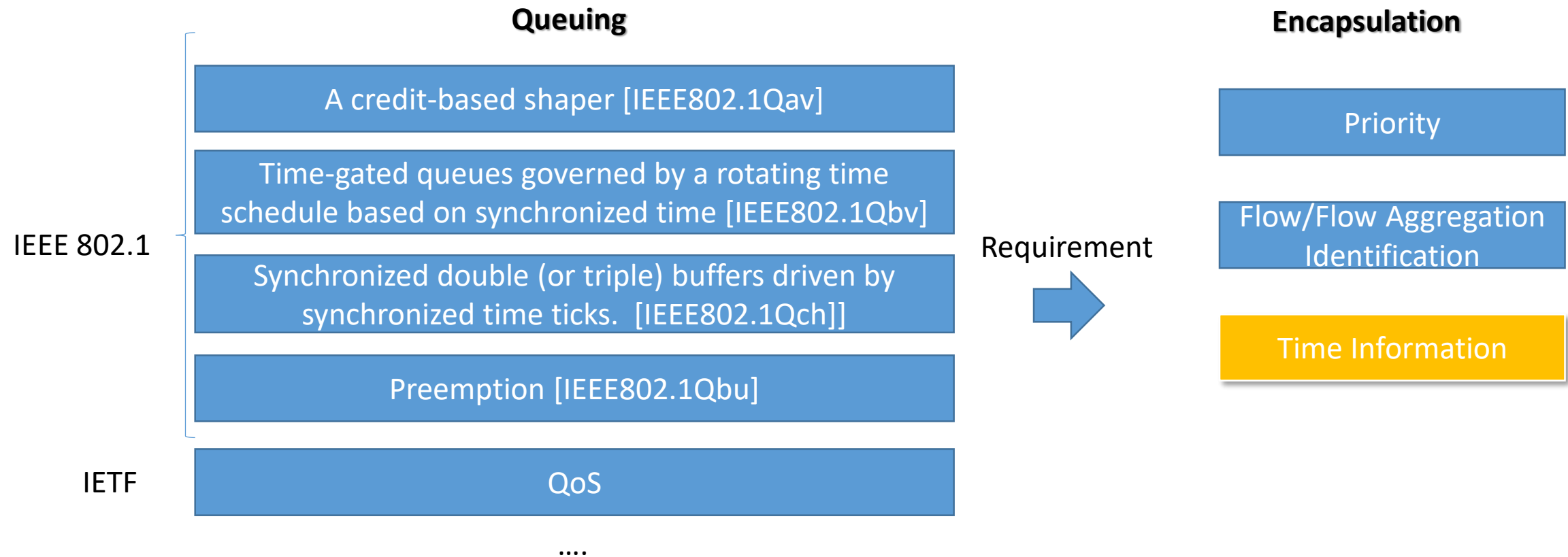
DetNet Enhancement Data Plane Encapsulation

As defined in RFC 9320, Enhanced DetNet services of bounded latency and zero congestion loss depends upon the following 3 parts of mechanism:

Bounded latency

Queuing/Shaping/Scheduling Mechanism	Encapsulation	Resource Allocation
the detailed behavior of allocation resources, which determines transmission queue selection,	identifying, in the data plane, the resources to be utilized by any given packet	configuring and allocating network resources for the exclusive use of DetNet flows;
Foundation of the bounded latency and determines how to calculate the latency bound	Data Plane encapsulation in the packet to support the underlying mechanism	Control plane extension to avoid resource confliction

DetNet Enhancement Data Plane Encapsulation Gap Analysis

DetNet Enhancement Data Plane Encapsulation is used to support the queuing mechanism, so the gap anaylsis should base on the queuing requirement

Queuing

Encapsulation

IEEE 802.1

| A credit-based shaper [IEEE802.1Qav] |
| Time-gated queues governed by a rotating time schedule based on synchronized time [IEEE802.1Qbv] |
| Synchronized double (or triple) buffers driven by synchronized time ticks. [IEEE802.1Qch]] |
| Preemption [IEEE802.1Qbu] |

IETF

| QoS |

....

Requirement →

| Priority |
| Flow/Flow Aggregation Identification |
| Time Information |

Conclusion: "Time Information" may be the missing part for DetNet Enhancement Data Plane Encapsulation

DetNet Enhancement Data Plane Encapsulation Solutions

- If "Time Information" is the missing part for DetNet Enhancement Data Plane Encapsulation

- There could be solution proposal for different types of DetNet data plane, including:

  - **IPv4/IPv6 Header**: New DSCP value or new DSCP meaning could be defined for presenting time information

  - **MPLS**: New EXP value of MPLS Lable could be introduced to convey time information.

  - **IPv6 Extension Header**: new options (DoH or HbH) could be defined to carry time information

  - **SR MPLS/ SRv6**: ime Aware SID could be introduced to convey time information

Comments are welcome!

Thanks