

# Data plane Enhancement Taxonomy

draft-joung-detnet-taxonomy-dataplane-01

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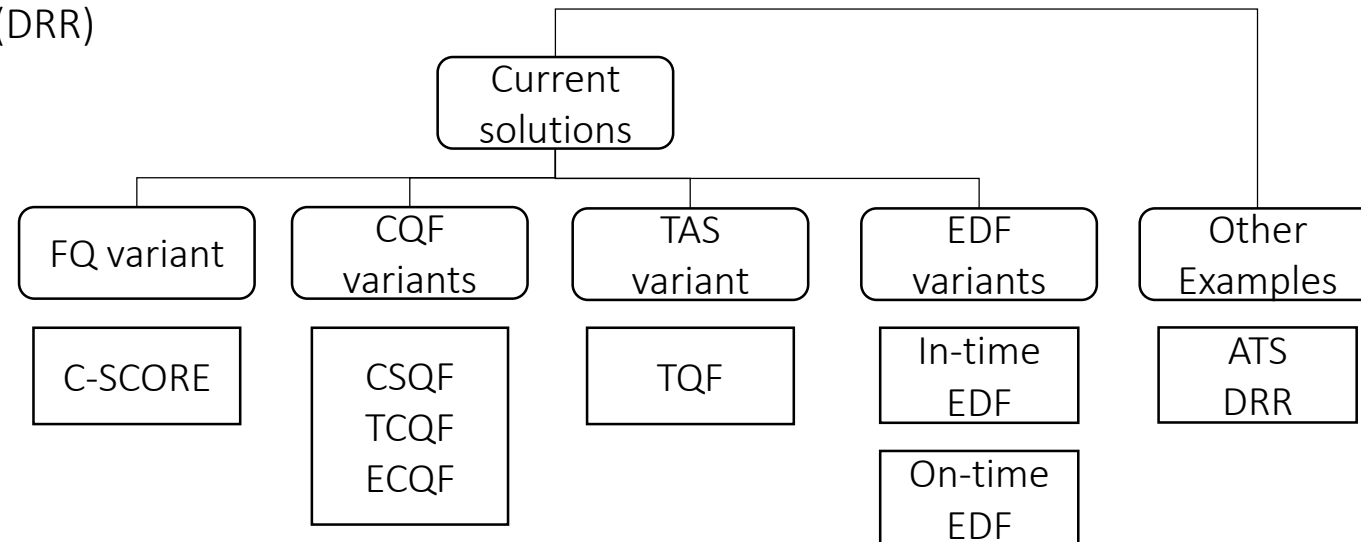
DetNet 119, Mar. 2024

# Overview of the draft

- Purpose
  - To facilitate the understanding of the data plane enhancement solutions, which are suggested currently or can be suggested in the future, for deterministic networking
- Scope: to provide
  - criteria for classifying data plane solutions
  - examples of each category, along with reasons where necessary
  - strengths and limitations of the categories
  - suitability of the solutions for various services of deterministic networking
- Out of scope
  - The candidate solutions currently being proposed in DetNet WG are simply listed without any descriptions. The details of the solutions are intentionally omitted.
- Definitions:
  - An enhancement solution can be a combination of multiple data plane functional entities, such as regulators, queues, and schedulers.
  - A solution can also include functional entities across network nodes, e.g. traffic enforcement or regulation functions at the edge.

# Current solutions of DetNet & Other examples

- Current solutions of DetNet, mentioned in the draft:
  - CQF variants: Cycle Specified Queuing and Forwarding (CSQF), Tagged Cyclic Queuing and Forwarding (TCQF), IEEE 802.1Qdv Enhanced CQF (ECQF)
  - Fair Queuing (FQ) variant: Work Conserving Stateless Core Fair Queuing (C-SCORE)
  - Time Aware Shaper (TAS) variant: Timeslot Queuing and Forwarding (TQF)
  - Earliest Deadline First (EDF) variant: EDF, proposed to DetNet WG, which happens to have the same name.
- Examples mentioned
  - ATS, Deficit Round Robin (DRR)



# DetNet service category

- “Requirements for Reliable Wireless Industrial Services” [I-D.ietf-detnet-raw-industrial-req] characterizes the services by the latency bound, the burst size, the burst transmission period, the number of nodes, etc.
- This document adopts this characterization rule, and classifies the services into one of **tight/loose latency, large/small burst, periodic/non-periodic, and large/small scale** services.
- For example, the display information service defined in Section 4.4. of [I-D.ietf-detnet-raw-industrial-req] is a loose latency, large burst, non-periodic, and small scale service.

\*Display information

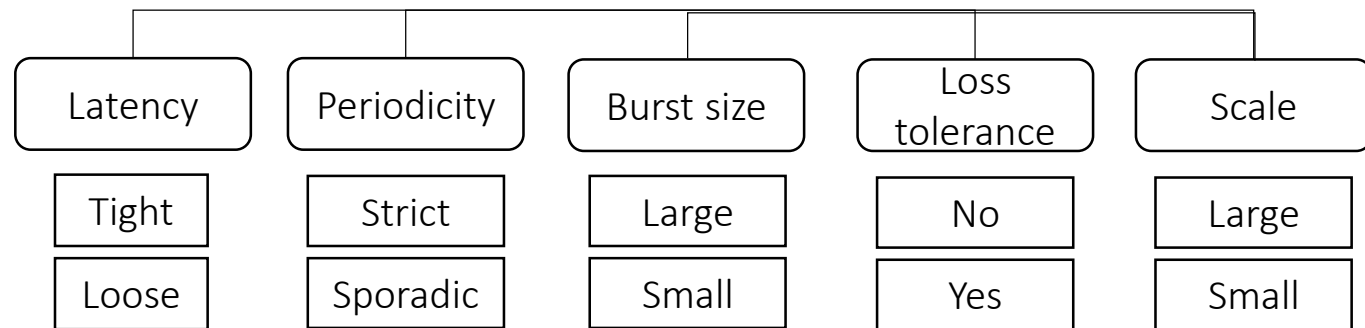
-Bounded latency: 10s.

-Sporadic, once per hour.

-Transmit data size (bytes): 10-6K.

-Tolerance to packet loss: yes.

-Node density: 1-30.

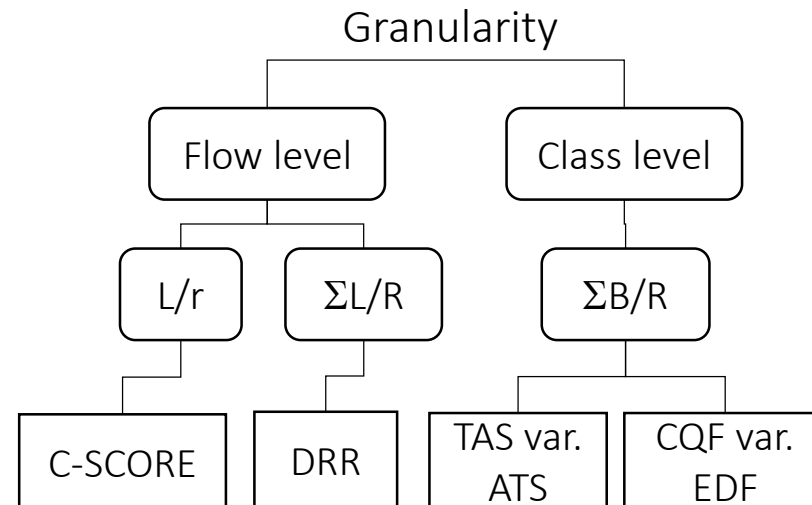


# Taxonomy of solutions

Taxonomy	Categories		
Per Hop Dominant Factor for E2E Latency Bound	Max Packet Length / Service Rate	Sum of Max Packet Lengths / Link Capacity	Sum of Max Burst Sizes / Link Capacity
Periodicity	Periodic	-	Non-periodic
Network Synchronization	Phase synchronous	Frequency synchronous	Asynchronous
Traffic Granularity	Flow level	Flow aggregate level	Class level
Work Conserving	Work conserving	-	Non-work conserving
Target Transmission Time	On-time	-	In-time
Service Order	Rate-based	Time-based	Arrival-based Priority-based

# Grouping of the taxonomies (1/3)

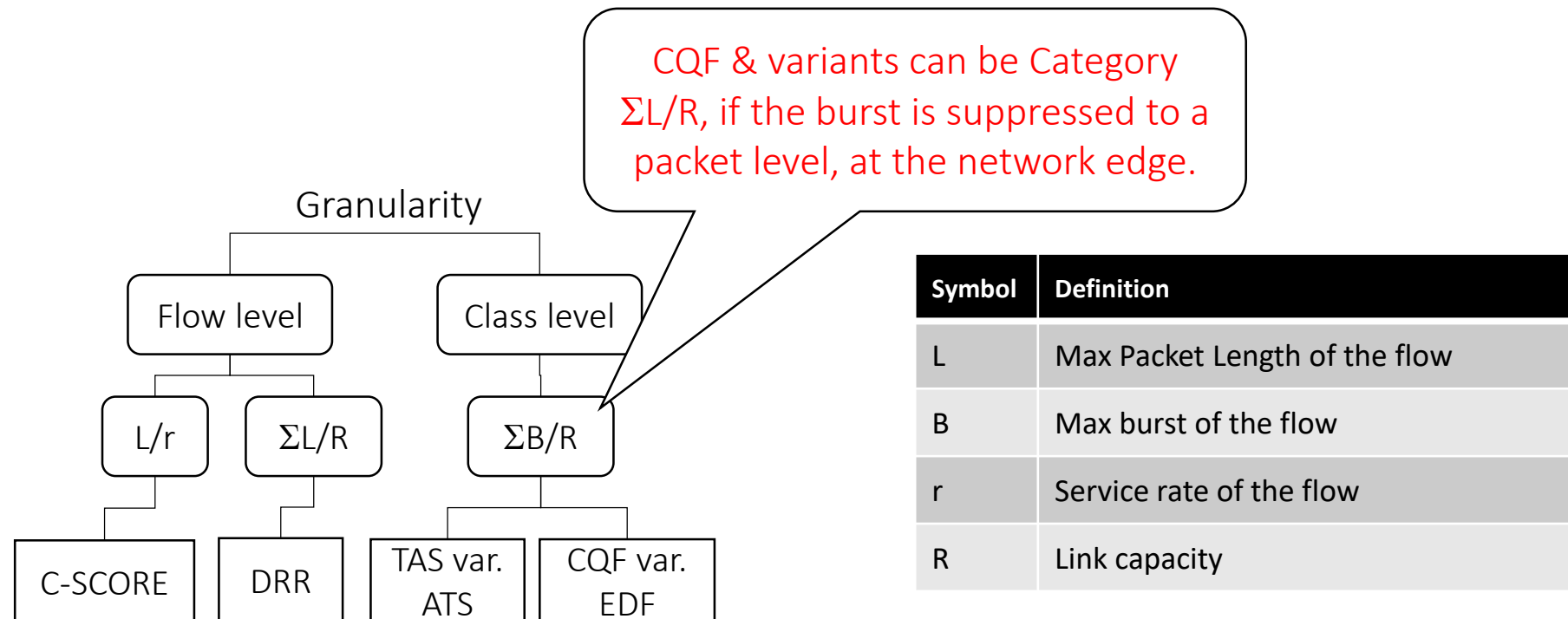
- Seven taxonomies can be grouped by rough dependency
  - Traffic granularity & Per-hop Dominant factor for E2E latency bound



Symbol	Definition
L	Max Packet Length of the flow
B	Max burst of the flow
r	Service rate of the flow
R	Link capacity

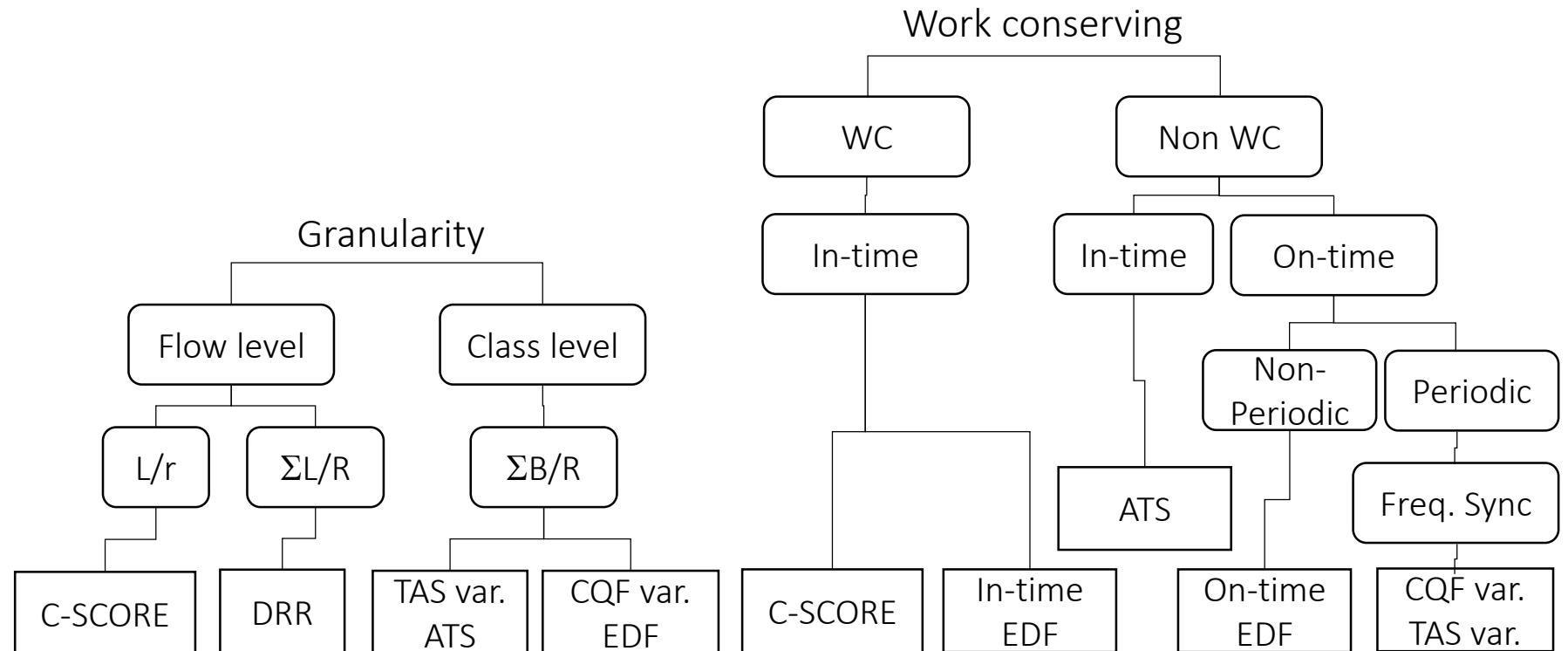
# Grouping of the taxonomies (1/3)

- Seven taxonomies can be grouped by rough dependency
  - Traffic granularity & Per-hop Dominant factor for E2E latency



# Grouping of the taxonomies (2/3)

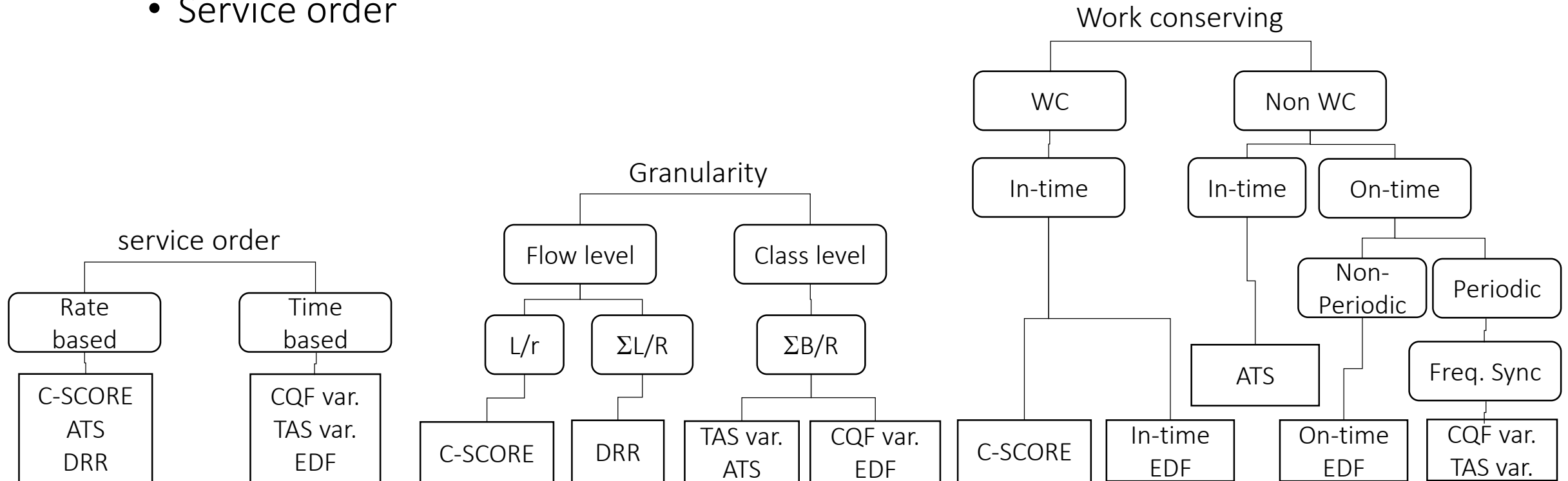
- Seven taxonomies can be grouped by rough dependency
  - Traffic granularity & Per-hop Dominant factor for E2E latency
  - Work conserving & In/On time; Periodicity & Network synchronization



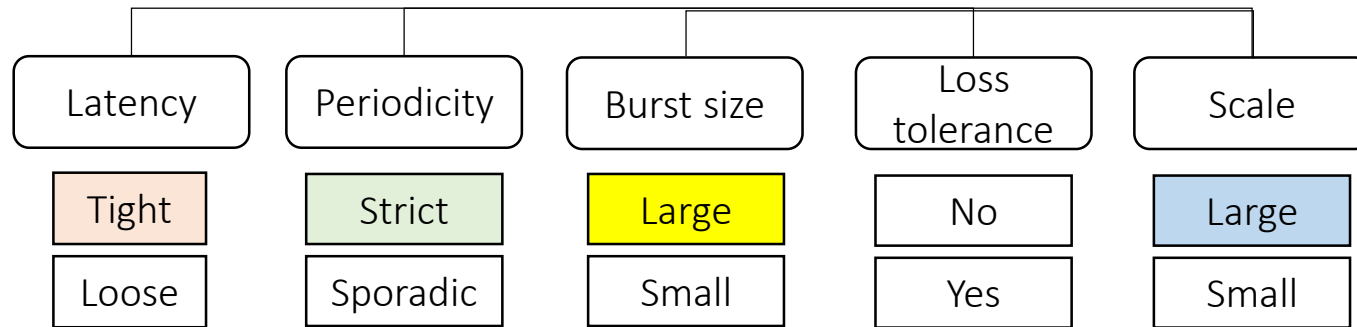


# Grouping of the c taxonomies (3/3)

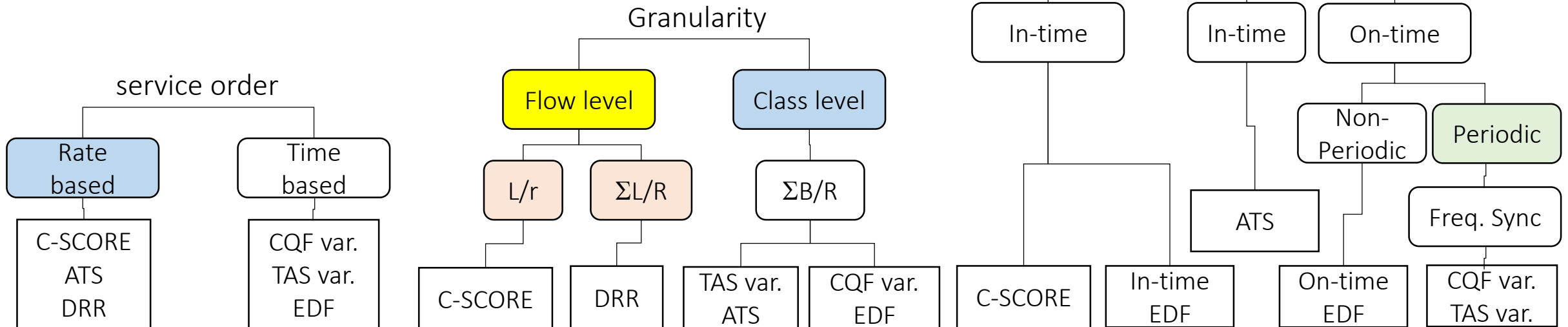
- Seven taxonomies can be grouped by rough dependency
  - Traffic granularity & Per-hop Dominant factor for E2E latency
  - Work conserving & In/On time; Periodicity & Network synchronization
  - Service order



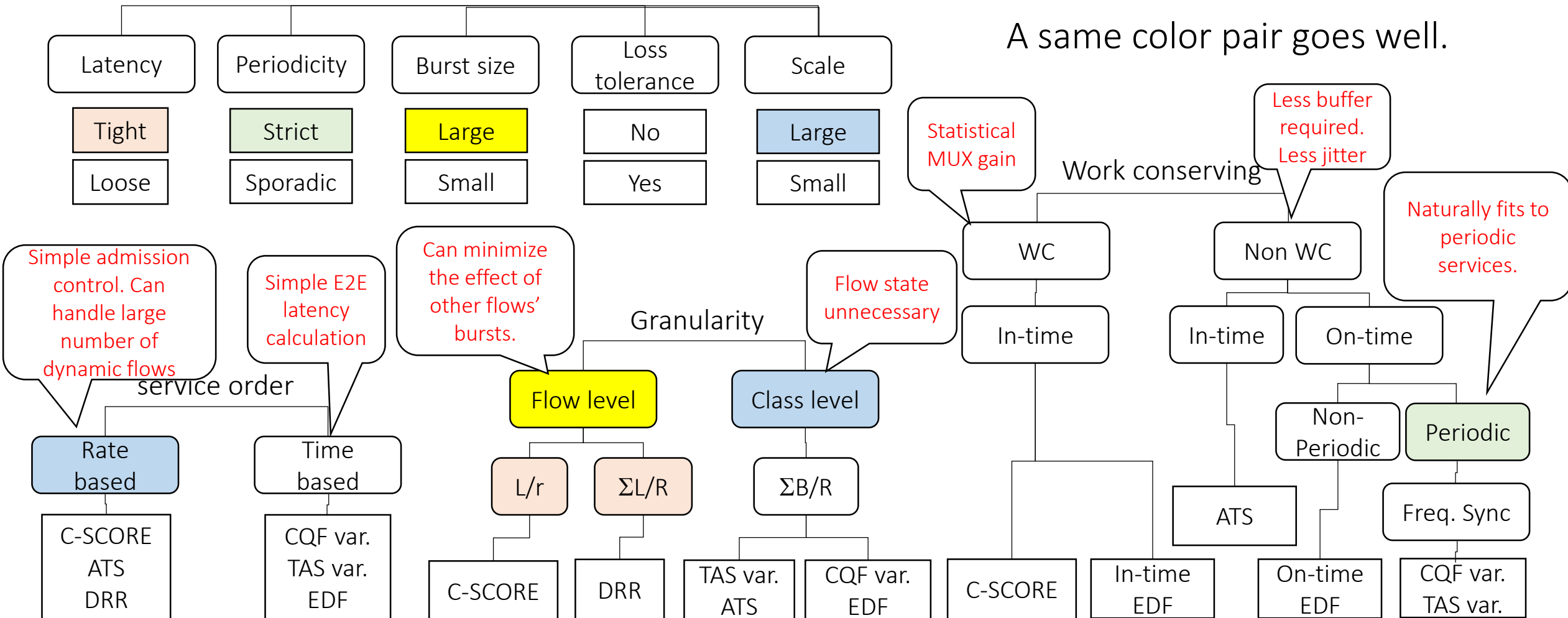
# Suitability of the current solutions for DetNet services



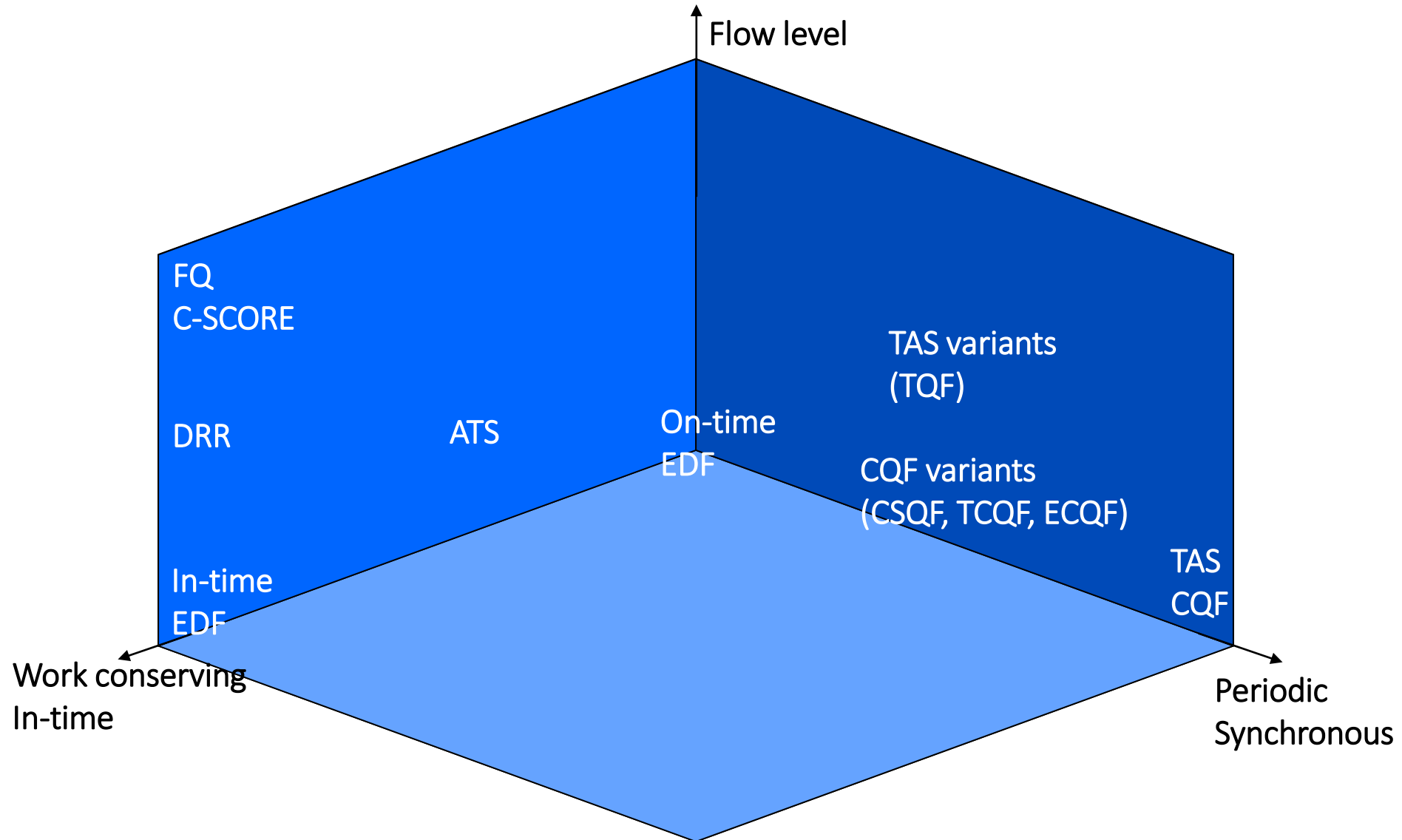
A same color pair goes well.



# Suitability of the current solutions for DetNet services



# Visualization of taxonomy



# Thank you

- Please take a look at

<https://datatracker.ietf.org/doc/draft-joung-detnet-taxonomy-dataplane/>

- Please share your comments and questions.

- References:

- Norman Finn, IEEE P802.1DC and IEEE P802.1Qdv Time Sensitive Networking Developments, finn-tutorial-802-1DC-1Qdv-2023-12-v02.pdf, DetNet WG Interim meeting, Dec. 2023.
- [I-D.chen-detnet-sr-based-bounded-latency]
- [I-D.eckert-detnet-tcqf]
- [I-D.ietf-detnet-raw-industrial-req]
- [I-D.joung-detnet-stateless-fair-queuing]
- [I-D.peng-detnet-deadline-based-forwarding]
- [I-D.peng-detnet-packet-timeslot-mechanism]
- [IEEE\_802.1Qcr]