

RAW DETNET multidomain extensions

draft-bernardos-detnet-raw-multidomain-03
+ experimentation highlights from the 6G-DATADRIVEN project

IETF 120 – DetNet WG

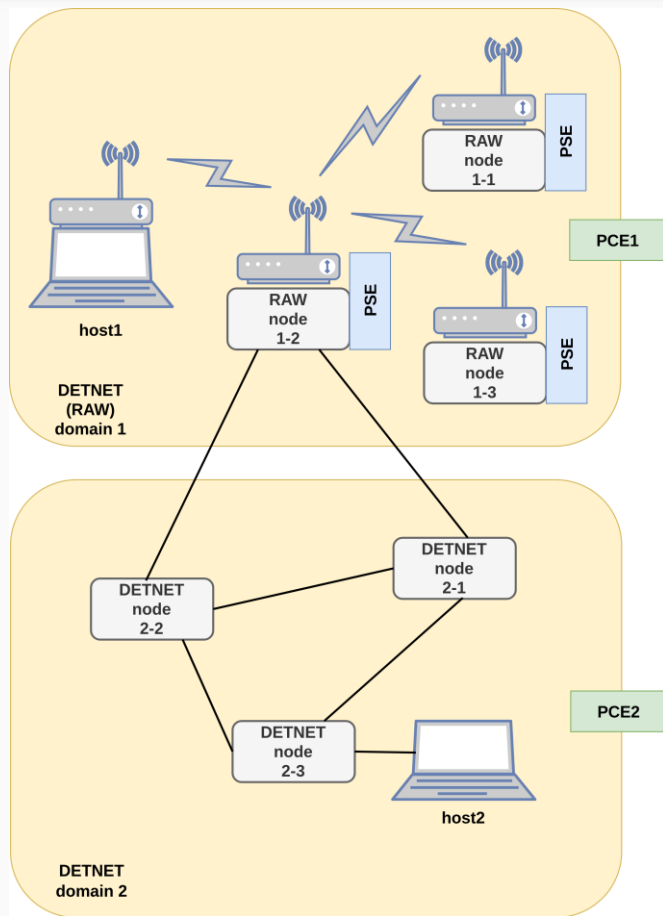
Carlos J. Bernardos (UC3M)
Alain Mourad (InterDigital)
Marc Molla (Ericsson)

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Aim and scope (draft-bernardos-detnet-raw-multidomain)

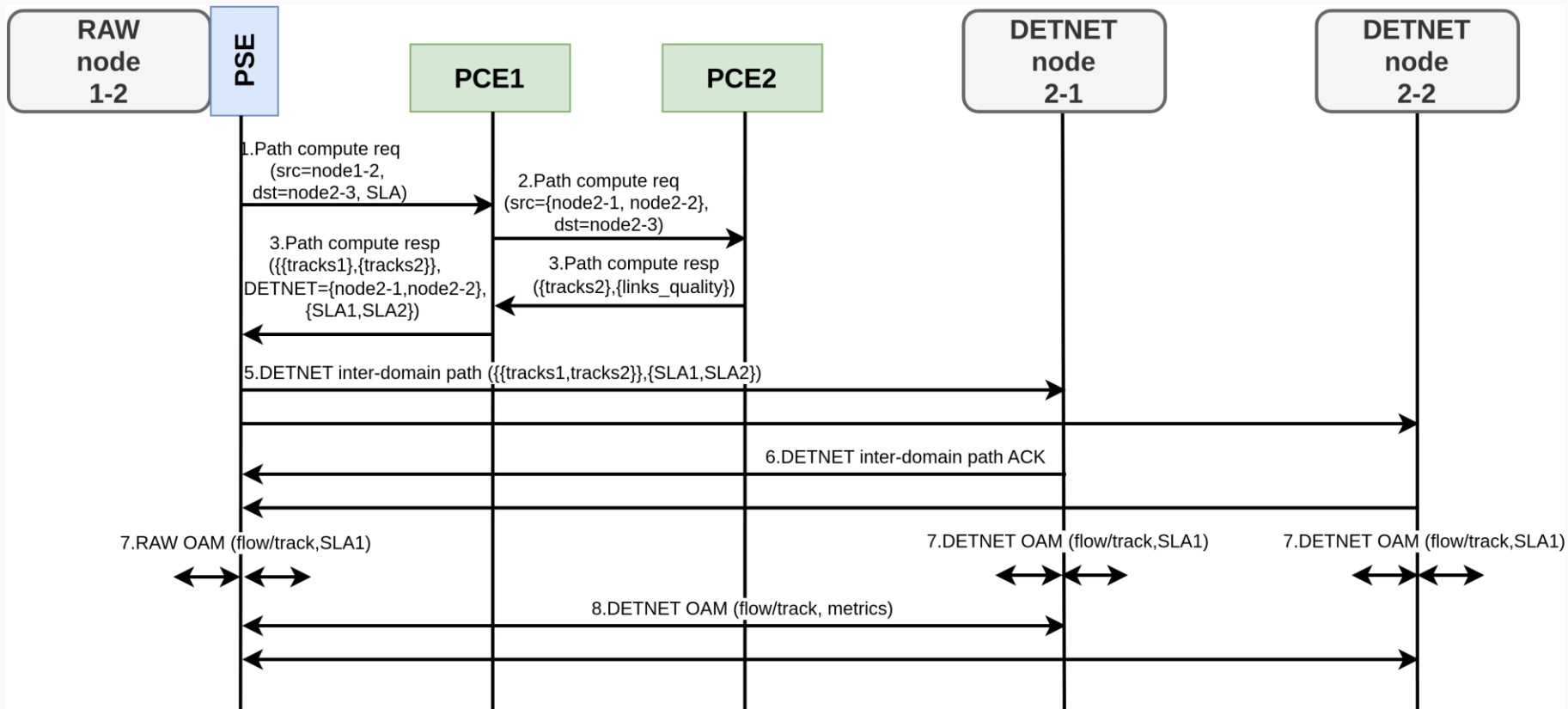
- Scope of the RAW WG was mostly focused on single-domain
- There are scenarios requiring multidomain RAW/DetNet
 - where hosts are connected to different ~~RAW~~ DETNET domains and they need to communicate to each other
 - E.g., in large factories where networks might be organized in domains (per production lines or building/sites)
- Goal is to explore ~~RAW~~ DETNET multi-domain gaps (arch, OAM, etc) and propose solutions
 - Gaps and requirements partially covered in [draft-ietf-detnet-controller-plane-framework](#)

Exemplary scenario (draft-bernardos-detnet-raw-multidomain)



- Two domains, each one with its own PCE
- Domains might be interconnected via multiple paths
- Domains might be wireless or wired
- Multiple gaps:
 - Domains need to set up the inter-domain connectivity (this might need discovery)
 - Multi-domain paths need to be discovered
 - There is inter-PCE work
 - Inter-domain coordination

Some proposed extensions (draft-bernardos-detnet-raw-multidomain)



Summary and next steps (draft-bernardos-detnet-raw-multidomain)

- Work presented in the RAW and DETNET WGs
 - Last time, during IETF 118
 - Request to include wired (not only wireless) domains addressed in the last revision
- Is there interest in working on this in the WG?
 - Potential new protocol work might be needed
- Please share your comments on the ML!

Experimentation highlights from the 6G-DATADRIVEN project

Making the Internet work better



6G-DATADRIVEN-04: summary as of today

objectives

Research solution for enhancing mobile networks (5G, 6G) with:

- 🕒 time-sensitiveness,
- 👉 reliability and
- ✅ availability

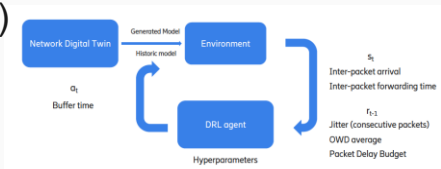
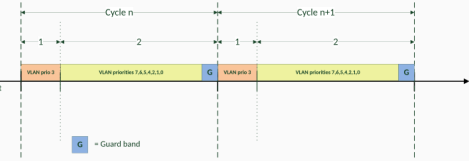
👉 reliability availability ✅

1. Frame Replication and Elimination for Reliability (FRER, IEEE 802.1QCB)
2. Time-based de-jittering
3. DetNet integration (multi-domain)



time-sensitiveness

1. Time-aware Schedulers:
 - Synchronous (IEEE 802.1Qbv)
 - Asynchronous (IEEE 802.1Qcr)
2. AI-based de-jittering



results



Smart Factory demo



Smart De-jittering using Network Digital Twin

Mani Mohan Suresh
Technology & Innovation
Director
Mani.Mohan@meditcom.com

Mansur Iqbal
Technology & Innovation
Director
Mansur.Iqbal@meditcom.com

Abstract—The evolution of mobile networks is converging with the pervasive digitalization of the industrial manufacturing sector, which is demanding highly reliable and deterministic wireless networking. The performance levels of wireless networks are greatly enhanced from our generation to the next, but the variability of performance, especially which regards latency, remains an issue to be addressed since most protocols and solutions are designed with the assumption that underlying elements and their generation time, which is very low variability, as it is the case, for example, of Ethernet networks. In this work, we address this critical time...

based on varying network delays for audio traffic: is proposed and in [1] first propose the use of historical information for adapting the network to the current network delay variation. In [2] the authors propose the algorithm de-jittering on each hop by using different parameters and spaces, all these works consider that the de-jittering mechanism is aware of either certain end-to-end parameters, or the periodic nature of the traffic (e.g. audio or video).

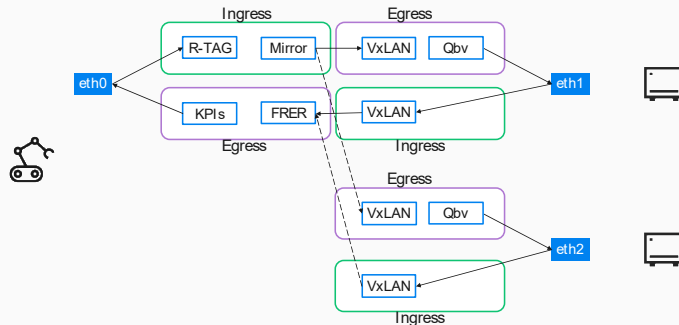
In this work we present a novel mechanism that relies on...

AI-Based de-jittering



6G-DATADRIVEN-04: goPSAv2

- goPSA version 2 is a software switch created for research and innovation
- Easy implementation of new features and capabilities
- Performance focus:
 - Throughput of **2,5 Gbps**: more than enough for current I4.0 requirements
 - Latency: less than **50 μ secs**
- Logic tailored to use cases



- Capabilities:
 - Traffic Classification:
 - Detnet S-Label, Shallow (5-tuple), DPI
 - Switch/Routing:
 - MAC learning
 - port mirroring
 - VLAN / VxLAN / NAT
 - IEEE 802.1Qbv: Support of time-aware shaping.
 - De-jittering: Based on Packet Delay Budget
- Ongoing:
 - Urgency-Based Scheduler
 - Asynchronous Traffic Shaping (IEEE 802.1Qcr)
 - Smart de-jittering

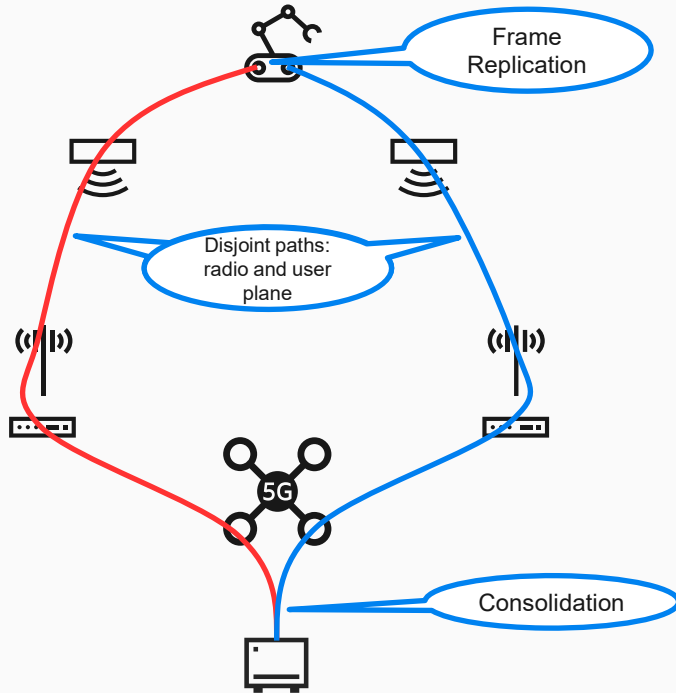
6G-DATADRIVEN-04: Time-aware schedulers: IEEE 802.1Qbv

- Time-based scheduler with traffic prioritization during pre-defined and synchronized time windows



- Introduces a new way of sharing resources (mainly radio resources) based on time
- Can complement other slicing techniques such as resource partitioning for enhancing the “virtualization” of radio resources
- Requires coordination between UEs and time synchronization between end-users and 5GS
- Results disseminated in a Smart Factory demo

6G-DATADRIVEN-04: Frame Replication and Elimination for Reliability



Extended R-Tag

- Standard (802.1CB)

0	1	2	3	4	5
Ether Type 0xF1 0XC1		Reserved		Sequence Number	

- Extended

0	1	2	3	4	5	6	7
Ether Type 0xF1 0XC1		Timestamp (32 bits)* * 4 seconds in ns precision				Sequence Number	

- Packet clone:
 - Using existing port mirroring to replicate the packet
- Elimination:
 - Strict order policy: out of order is a packet loss.
 - Drops duplicated and out-of-order packets

Acknowledgements

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Plan de Recuperación,
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