Using Deterministic Networks for Industry Operations and Control

draft-km-detnet-for-ocn-04

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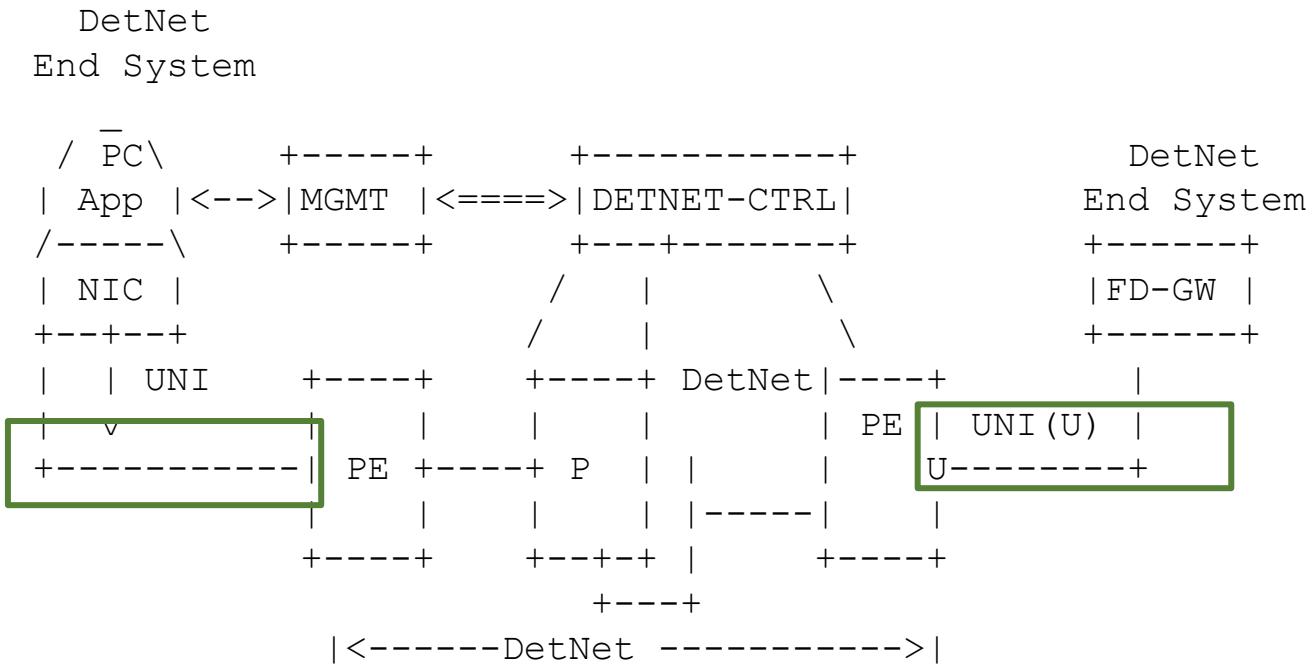
Recap: Industrial Automation (IA) system and DetNet



PC APP: Process Controller Application
FD-GW: Field device gateway
MGMT: Device mgmt. entity

Figure 4: A Realistic DetNet Based Industrial Application Network

- An application level set of APIs, interfaces, traffic behavior to communicate with the boundaries of DetNet.

- This was requested to explain how DetNet will have reserved resources per application.

Overview

- What this document is about?
  - Provide an interface/data valid for Industrial Automation operations.

- IETF-117 / draft-km-detnet-for-ocn-03
  - background and motivation provided
  - types of traffic patterns
  - ipv6 extension header based solution

- Feedback
  - concerns: extension header changes are a bigger ask.
  - alignment with TSN work.
  - suggestion: reorient to simplify and narrow the scope

Changes since 03

1. Removed extension header topic to appendix - no emphasis on specific type of data plane encoding/encapsulation.

2. Added traffic types aligned with "IEC/IEEE 60802 TSN Profile for Industrial Automation”
   a. The document does not reinvent anything
   b. Collects traffic type specification

Table of Traffic Types supported by TSN IA Profile

Traffic Type	TT-Code	Param	Param	Description
Isochronous	ISOC_TT	0x08	DL_TIME DL_UNIT	Deadline limit between Src and Dst Optional clock src info
Cyclic-Synchronous	CSYNC_TT	0x07	DL_TIME DL_UNIT	-same-
Cyclic-Asynchronous	CASYN_TT	0x06	DL_TIME DL_UNIT	-same- No clock source needed
Network Control	NWCTL_TT	0x05	-as above-	
Alarms and Event	ALEV_TT	0x04	DL_TIME RETRANS	Retransmission flag
Conf. Diag	CFDG_TT	0x03		
Best Effort High	BEHI_TT	0x02		
Best Effort Low	BELO_TT	0x01		

Async: Application controller can specify tolerance to packet loss rate

Network Control: for network operations such as time synchronization, loop prevention, and topology detection

Alarms: bounded latency and should follow bandwidth constraints.

Diagnostics: periodically transmit diagnostics packets and field device configurations

Traffic Types

4.2.1. Isochronous traffic-type

API format:

```
+-- tt_code = ISOC_TT
+-- dl_time = value
+-- dl_tmunite = ms |us
+-- app-flow-ref
+-- clock-src : ip address
```

4.2.2. Cyclic-synchronous

API format

```
+-- tt_code = CSYNC_TT
+-- dl_time = value
+-- dl_tmunit = ms |us
+-- app-flow-ref
+-- clock-src : ip address
```

4.2.3. Cyclic-Asynchronous

API Format

```
+-- tt_code = CSYNC_TT
+-- dl_time = value
+-- dl_tmunit = ms |sec
+-- app-flow-ref
+-- pkt-loss-tmunit
```

4.2.4. Alarms and Events traffic type

API format

```
+-- tt_code = ALEV_TT
+-- dl_time = value
+-- dl_tmunit = ms |sec
+-- restrans = yes |no
+-- burst-limit
```

4.2.5. Configuration and diagnostics

API format

```
+-- tt_code = CFDI_TT
+-- dl_time = value
+-- dl_tmunit = sec
+-- restrans = yes |no
```

4.2.6. Network Control

API format:

```
+-- tt_code = NWCTL_TT
+-- dl_time = value
+-- dl_tmunit = sec
+-- restrans = yes |no
```

Data plane agnostic approach

Once this data model/Interface is specified following implementations are possible

A. Apply out-of band
   - YANG model approach
   - Application controller will define its data-model and shares with DetNet management or orchestration entity

B. Apply in-band dataplane approaches
   - Suitable for programmability aspects.
   - Extension headers or additional service-sublayer extensions are potential approaches.
     - PoC being planned (leveraging on P4), yet under analysis

Feedback/Comments

Thank you!