DetNet Configuration YANG Model Update

draft-ietf-detnet-yang-09

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Status

• Ready for WG Last Call
• Will present a summary today
• We have cleaned up items from reviews
• Please Review and Comment
History

• Version 00: accepted as a WG document after IETF 102

• Version 01: `ietf-detnet-topology-yang` is defined independently

• Version 02: updated following the feedback from IETF103
  - Add ‘Sequence Number Generation’
  - OAM considerations
  - Add ‘DetNet Service Decapsulation’
  - Add ‘DetNet Transport Tunnel Decapsulation’

• Version 03: DetNet Configuration Structure
  Update in IETF104 and IETF105

• Version 04: Modify the scope of DetNet YANG Model

• Version 05/06:
  - Two YANG Models Discussion -> Comparison

• Version 07
  - Merging Models. Some terminology alignment.

• Version 08
  - Aggregation and Instance Models

• Version 09
  - Terminology and name changing

• Versions 10-11
  - Finalization for last call

WG Call Meeting Every Week

03/05/2021
Detnet Architecture

Architectural Model

Control Planes (Future)

Flow Model

Data Plane Drafts

TSN End System  Edge Node  Transit Node  Relay Node  DetNet End System

Application  Svc Proxy  Forwarding  DetNet Flow  Application

TSN  TSN  SVC  Forwarding  Service  Forwarding

FWD  FWD  FWD  FWD  FWD

End-to-End Service

Sub-Network

Sub-Network

TSN  YANG Model  YANG Model  YANG Model  YANG Model  YANG Model

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Flow Model Attributes Supported by YANG

App-flow, DetNet flow and DetNet service

**App-flow**
Characteristics
- FlowID: unique (manag.) ID
- FlowType: Eth, MPLS, IP
- DataFlowSpecification: src/dst-addr, label, VLAN, etc.
- TrafficSpecification:
  - interval, Packets per interval
  - max/min payload-size, Min packets per interval
- FlowEndpoints: Src, Dst(s)
- FlowRank
- FlowStatus

Requirements
- FlowRequirements: MinBW, Max Latency, ML Variation, Loss tolerance, etc.
- FlowBiDir

**DetNet flow**
Characteristics
- DnFlowID: unique (manag.) ID
- DnPayloadType: Eth, MPLS, IP
- DnFlowFormat: MPLS, IP
- DnFlowSpecification:
  - Label, 6-tuple
- DnTrafficSpecification:
  - interval, Packets per interval
  - max/min payload-size, Min packets per interval
- DnFlowEndpoints: Ingress, Egress(s)
- DnFlowRank
- DnFlowStatus

Requirements
- DnFlowRequirements: MinBW, Max Latency, ML Variation, Loss tolerance, etc.
- DnFlowBiDir

**DN Service**
- DnServiceID: unique (manag.) ID
- DnServiceDeliveryType: Eth, MPLS, IP
- DnServiceConnectivity: p2p, p2mp
- DnServiceRank
- DnServiceDeliveryProfile:
  - MinBW, Max Latency, ML Variation, Loss tolerance, etc.
- DnServiceBiDir
- DnServiceStatus

A DetNet flow contains one or more App-flows (N:1 mapping).
A DetNet service supports one or more DetNet-flows (M:1 mapping).

UserToNetworkRequirements

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Observations

DetNet Data plane YANG Model

• Hierarchical aggregation
• Location dependent
  • Endpoint,
  • Transit
  • Relay
• Flow aggregates are flows
• Captures Flow attribute and status
• Built on reusable pieces – IP/MPLS
• Configuration centric
• Includes Operational attributes

DetNet Flow Model

• Functional
• Concerned with the attributes and characteristics of flow.
• Covers Configuration and operational aspects
Methodology

YANG Model

- Large model ~ 1300 lines
- Many permutations
- Hard to validate by simple inspection.
- Needed to enumerate the various cases

What we found worked:

- Consider Configuration Cases with model validation
- Use Yanglint to test and document the cases
- Provide diagrams for the cases
  - Basic single DetNet flow Endpoint Unidirectional/Bidirectional
  - Basic single DetNet flow Transit Node
  - Simple aggregation
  - Aggregation at several places.
Scenarios Covered by DetNet YANG Model
(w/o Aggregation)

Needs updating

Not shown Ethernet or other Tunnels as be underlay

Corresponding Data Plane drafts:
RFC8939 (Deterministic Networking (DetNet) Data Plane: IP)
RFC8964 (Deterministic Networking (DetNet) Data Plane: MPLS)
draft-ietf-detnet-ip-over-mpls-09
draft-ietf-detnet-mpls-over-udp-ip-08 (Out-of-scope)
draft-ietf-detnet-tsn-vpn-over-mpls-07 (Out-of-scope)
draft-ietf-detnet-mpls-over-tsn-07(Out-of-scope)
draft-ietf-detnet-ip-over-tsn-07(Out-of-scope)
DetNet YANG Model Structure

```
App Flows
  Refer to Traffic Profile

Service Sub-layer
  Refer to Traffic Profile

Forwarding Sub-layer
  Refer to Traffic Profile

Traffic Profile
```

Refer to Traffic Profile
Case A-1: Ingress node 1 aggregates **App flows 0 and 1** into a service sub-layer of DetNet flow 1.
Case a-1 aggregation & disaggregation

Case A-1 (Ingress 1)
- Incoming app-flow
- Service-sub-layer
- Forwarding-sub-layer
- Interface
- Outgoing service

Case A-1 (Egress 1)
- Incoming service
- Service-identification
- Forwarding-identification
- App-flow
- Outgoing service

App to Svc

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Case B-1: The service sub-layers of DetNet flows 1 and 2 are aggregated into a forwarding sub-layer.
Yanglint Validation Case B-1 (Cont.)

"traffic-profile": [
  {
    "profile-name": "1",
    "traffic-requirements": {
      "min-bandwidth": "100000000",
      "max-latency": 100000000,
      "max-latency-variation": 200000000,
      "max-loss": 2,
      "max-consecutive-loss-tolerance": 5,
      "max-misordering": 0
    },
    "member-apps": [
      "app-1",
      "app-2"
    ]
  },
  {
    "profile-name": "2",
    "traffic-requirements": {
      "min-bandwidth": "100000000",
      "max-latency": 100000000,
      "max-latency-variation": 200000000,
      "max-loss": 2,
      "max-consecutive-loss-tolerance": 5,
      "max-misordering": 0
    },
    "member-services": [
      "ssl-1",
      "ssl-2"
    ]
  },
  {
    "profile-name": "3",
    "flow-spec": {
      "interval": 5,
      "max-pkts-per-interval": 10,
      "max-payload-size": 1500
    },
    "member-fwd-sublayers": [
      "afl-1"
    ]
  }
],

"service-sub-layer": {
  "service-sub-layer-list": [
    {
      "name": "ssl-1",
      "service-rank": 10,
      "traffic-profile": "2",
      "service-operation-type": "service-initiation",
      "service-protection": {
        "service-protection-type": "none",
        "sequence-number-length": "long-sh"
      },
      "incoming-type": {
        "app-flow": {
          "app-flow-list": [
            "app-1"
          ]
        }
      },
      "outgoing-type": {
        "forwarding-sub-layer": {
          "service-outgoing-list": [
            "mpls-label-stack": {
              "entry": [
                {
                  "id": 0,
                  "label": 100
                }
              ]
            }
          ]
        }
      }
    }
  ]
}
}
Yanglint Validation Case B-1

```json
{
  "ietf-interfaces:interfaces": {
    "interface": [
      {
        "name": "eth0",
        "type": "iana-if-type:ethernetCsmacd",
        "oper-status": "up",
        "statistics": {
          "discontinuity-time": "2020-12-18T23:59:00Z"
        }
      },
      {
        "name": "eth1",
        "type": "iana-if-type:ethernetCsmacd",
        "oper-status": "up",
        "statistics": {
          "discontinuity-time": "2020-12-18T23:59:00Z"
        }
      },
      {
        "name": "eth2",
        "type": "iana-if-type:ethernetCsmacd",
        "oper-status": "up",
        "statistics": {
          "discontinuity-time": "2020-12-18T23:59:00Z"
        }
      },
      {
        "name": "eth3",
        "type": "iana-if-type:ethernetCsmacd",
        "oper-status": "up",
        "statistics": {
          "discontinuity-time": "2020-12-18T23:59:00Z"
        }
      },
      {
        "name": "eth4",
        "type": "iana-if-type:ethernetCsmacd",
        "oper-status": "up",
        "statistics": {
          "discontinuity-time": "2020-12-18T23:59:00Z"
        }
      }
    ],
    "ietf-detnet:detnet": {
      "app-flows": {
        "app-flow": [
          {
            "name": "app-1",
            "app-flow-bidir-congruent": false,
            "outgoing-service": "ssl-1",
            "traffic-profile": "1",
            "ingress": {
              "app-flow-status": "ready",
              "interface": "eth0",
              "ip-app-flow": {
                "src-ip-prefix": "1.1.1.1/32",
                "dest-ip-prefix": "8.8.8.8/32",
                "dscp": 6
              }
            }
          },
          {
            "name": "app-2",
            "app-flow-bidir-congruent": false,
            "outgoing-service": "ssl-2",
            "traffic-profile": "1",
            "ingress": {
              "app-flow-status": "ready",
              "interface": "eth1",
              "ip-app-flow": {
                "src-ip-prefix": "1.1.1.2/32",
                "dest-ip-prefix": "8.8.8.9/32",
                "dscp": 7
              }
            }
          }
        ]
      }
    }
  }
}
```
Yanglint Validation Case B-1 (Cont.)

```
{  
  "name": "ssl-2",  
  "service-rank": 10,  
  "traffic-profile": "2",  
  "service-operation-type": "service-initiation",  
  "service-protection": {  
    "service-protection-type": "none",  
    "sequence-number-length": "long-sh"  
  },  
  "incoming-type": {  
    "app-flow": {  
      "app-flow-list": [  
        "app-2"  
      ]  
    }  
  },  
  "outgoing-type": {  
    "forwarding-sub-layer": {  
      "service-outgoing-list": [  
        {  
          "service-outgoing-index": 0,  
          "mpls-label-stack": {  
            "entry": [  
              {  
                "id": 0,  
                "label": 103  
              }  
            ]  
          },  
          "forwarding-sub-layer": [  
            "afl-1"  
          ]  
        }  
      ]  
    }  
  }  
}  

"forwarding-sub-layer": {  
  "forwarding-sub-layer-list": [  
    {  
      "name": "afl-1",  
      "traffic-profile": "3",  
      "forwarding-operation-type": "impose-and-forward",  
      "incoming-type": {  
        "service-sub-layer": {  
          "ssl-1": "ssl-2"  
        }  
      },  
      "outgoing-type": {  
        "interface": {  
          "outgoing-interface": "eth2",  
          "mpls-label-stack": {  
            "entry": [  
              {  
                "id": 0,  
                "label": 10000  
              }  
            ]  
          }  
        }  
      }  
    }  
  ]  
}  
```

Service Sub-Layer

Forward Sub-Layer
Case b-1 aggregation & disaggregation

Case B-1 (Ingress 1)

Case B-1 (Egress 1)
Case B-2: The **service sub-layers** of DetNet flows 1 and 2 are aggregated into a service sub-layer of Aggregated DetNet flow 1

Notes:
- S and A labels in this diagram include d-CWs of their own.

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Case b-2 aggregation & disaggregation

Case B-2 (Ingress 1)

Case B-2 (Egress 1)
Case C-1: Relay node 1 aggregates the forwarding sub-layers of DetNet flows 1 and 2 into a forwarding sub-layer

Note: S-label in this diagram includes d-CW.
Case c-1 aggregation

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Case c-1 disaggregation

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Case C-1 (Relay 2)
Case C-2: Relay node 1 aggregates the service sub-layers of DetNet flows 1 and 2 into a forwarding sub-layer.

Note: S-label in this diagram includes d-CW.
Case c-2 aggregation
Case c-2 disaggregation
Case C-3: Relay node 1 aggregates the service sub-layers of DetNet flows 1 and 2 into a service sub-layer of Aggregated DetNet flow 1.

Note: S and A labels in this diagram include d-CWs of their own.
Case c-3 aggregation

Svc toSvc

incoming service-identification

outgoing service-sub-layer

SVC

SVC

outgoing service-sub-layer

fwd

fwd

incoming forwarding-identification

outgoing service-sub-layer

incoming service-sub-layer

interface

interface

Case C-3 (Relay 1)
Case c-3 disaggregation

Svc to Svc

incoming service-identification

outgoing service-disaggregation

Svc

incoming service-identification

outgoing service-disaggregation

fwd

incoming forwarding-identification

outgoing forwarding-sub-layer

fwd

incoming forwarding-identification

outgoing forwarding-sub-layer

fwd

incoming forwarding-identification

outgoing forwarding-sub-layer

fwd

incoming forwarding-identification

outgoing forwarding-sub-layer

incoming service-sub-layer

outgoing interface

incoming service-sub-layer

outgoing interface

inbound Svc to Svc

outbound Svc to Svc

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Case C-4: Relay node 1 aggregates the **forwarding sub-layers** of DetNet flow 1 and 2 into a **service sub-layer** of Aggregated DetNet flow 1.

**Note:** S and A labels in this diagram include d-CWs of their own.
Case c-4 aggregation

Case C-4 (Relay 1)
Case D-1: Transit node 1 aggregates the forwarding sub-layers of DetNet flow 1 and 2 into a forwarding sub-layer.
Case d-1 aggregation

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Case D-1 (Transit 1)
Case d-1 disaggregation
Thank You