Workgroup: CCAMP Working Group
Internet-Draft:
draft-zheng-ccamp-client-pm-yang-07
Published: 11 January 2023
Intended Status: Standards Track
Expires: 15 July 2023
A   H. Zheng   I. Busi
uHuawei Technologies   Huawei Technologies
t
h
o
r
s
:
Y. Zheng   V. Lopez   O. Gonzalez de Dios
China Unicom   Nokia   Telefonica

A YANG Data Model for Client Signal Performance Monitoring

Abstract

A transport network is a server-layer network to provide connectivity services to its client. Given the client signal is configured, the followup function for performance monitoring, such as latency and bit error rate, would be needed for network operation.

This document describes the data model to support the performance monitoring functionalities.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF). Note that other groups may also distribute working documents as Internet-Drafts. The list of current Internet-Drafts is at https://datatracker.ietf.org/drafts/current/.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

This Internet-Draft will expire on 15 July 2023.

respect to this document. Code Components extracted from this document must include Revised BSD License text as described in Section 4.e of the Trust Legal Provisions and are provided without warranty as described in the Revised BSD License.

Table of Contents

1. Introduction

Client-layer network and server-layer network have been respectively modeled to allow the tunnels carrying the client traffic. Server-layers are modeled as tunnels with various switching technologies, such as OTN in [I-D.ietf-ccamp-otn-tunnel-model] and WSON in [I-D.ietf-ccamp-wson-tunnel-model]. Client-layers are modeled as client signals according to the client-signal identities specified in [I-D.ietf-ccamp-layer1-types]. These client signals can be configured to existing tunnels via the client signal configuration model specified in [I-D.ietf-ccamp-client-signal-yang].

In the network operation, the operator is interested in monitoring their instantiated client signal over tunnels. The objective of such monitoring is to complete timely adjustment once there is abnormal statistic which may result in failure of the client signal. The parameters specified in the performance monitoring model can be collected for the operation need. The OAM mechanism, can be configured together with the performance monitoring model.

2. Terminology and Notations

A simplified graphical representation of the data model is used in this document. The meaning of the symbols in the YANG data tree presented later in this document is defined in [RFC8340]. They are provided below for reference.

*Brackets "[" and "]" enclose list keys.

*Abbreviations before data node names: "rw" means configuration (read-write) and "ro" state data (read-only).

Symbols after data node names: "?" means an optional node, "!" means a presence container, and "" denotes a list and leaf-list.

*Parentheses enclose choice and case nodes, and case nodes are also marked with a colon (":").

*Ellipsis ("...") stands for contents of subtrees that are not shown.

3. Model Relationship

[I-D.ietf-ccamp-client-signal-yang] has specified the two models for the client signal configuration, module ietf-trans-client-service for transparent client service and module ietf-eth-tran-service for Ethernet service. Basically the client signal types in this document is consistent with ietf-eth-tran-types, and focus on different functionality. On the perspective of operator, the modules in [I-D.ietf-ccamp-client-signal-yang] can be used to configure the service given any underlay tunnels, while the operation about monitoring the performance on given service can be achieved by using the model in this document.

Consideration on Key Performance Information (KPI) monitoring for Virtual Network (VN) and tunnels has been specified in [I-D.ietf-teas-actn-pm-telemetry-autonomics]. Usually the monitoring on the tunnels are the VNs should be separately deployed for the network operation, but it is possible to have common parameters that are both needed for the VN/TE and the configured services. Common types are imported in both modules.

VPN-level parameters and their monitoring have been defined in [I-D.www-bess-yang-vpn-service-pm]. This module focus on the performance on the topology at different layer or the overlay topology between VPN sites. On the other hand, this document is focusing on the performance of the service configured between Customer Ends (CE).

4. Consideration on Monitoring Parameters

There can be multiple groups of parameters for monitoring, such as latency, bit error rate (BER). Some of these parameters are layer-dependent, for example, packet loss is only applicable in packet networks are won't be neede for layer 1 OTN and layer 0 WSON.

This document starts with the specification of the latency measurement for both Ethernet service and client signal service. In the future version additional parameters would be added into the data model in the same approach as the latency in the current version. A candidate list of parameters to be monitored include: Latency, Packet Loss, Bit Error Rate (BER), Jitter, Bandwidth, Byte/Packet number and so on.

5. OAM Configuration

The operation, administration and maintenance protocols and data models have been specified in [RFC8531] for the connection-oriented network. The model is referenced in this work to develop an

Ethernet-specific OAM models, which is augmenting the service performance monitoring data model.

The definitions of OAM terminologies, such as maintainence Maintenance Domain (MD), Maintenance Association (MA), and Maintenance End Points (MEP), can be found in [RFC8531] as well.

6. YANG Model for Performance Monitoring

6.1. YANG Tree for Performance Monitoring

```
module: ietf-service-pm
  +--rw performance-monitoring
     +--rw service-pm* [service-name]
        +--rw service-name                union
        +--rw task-pm-enable?             boolean
        +--rw granularity?                identityref
        +--rw performance-data-config* [parameter-name]
        |  +--rw parameter-name    identityref
        |  +--rw measure-method?   identityref
        +--ro service-pm-state
           +--ro oam-state
           |  +--ro cc-state    enumeration
           |  +--ro lm-state?   enumeration
           |  +--ro dm-state?   enumeration
           +--ro performance-data* [parameter-name]
           |  +--ro parameter-name     identityref
           |  +--ro parameter-value* [index]
           |     +--ro index              uint64
           |     +--ro value              performance-parameter-value
           |     +--ro value-unit         string
           |     +--ro value-description? string
           |     +--ro start-time?        yang:date-and-time
           |     +--ro end-time?          yang:date-and-time
           +--ro monitor-state       identityref
           +--ro error-info
           |  +--ro error-code?      uint32
           |  +--ro error-message?   string
           +--ro alarm
              +--ro status?   identityref
```

6.2. YANG Tree for OAM Configuration

```
module: ietf-eth-service-oam
  augment /svc-pm:performance-monitoring/svc-pm:service-pm:
    +--rw oam-config
       +--rw source
       |  +--rw md-name?         string
       |  +--rw ma-name?         string
       |  +--rw ma-level?        string
       |  +--rw meg-id?          string
       |  +--rw meg-level?       string
       |  +--rw mep-id?          uint8
       |  +--rw remote-mep-id?   uint8
       +--rw destination
       |  +--rw md-name?         string
       |  +--rw ma-name?         string
       |  +--rw ma-level?        string
       |  +--rw meg-id?          string
       |  +--rw meg-level?       string
       |  +--rw mep-id?          uint8
       |  +--rw remote-mep-id?   uint8
       +--rw cc-interval?   identityref
       +--rw lm-interval?   identityref
       +--rw dm-interval?   identityref
```

7. YANG Code for Performance Monitoring

7.1. The Performance Monitoring YANG Code

```
<CODE BEGINS> file "ietf-service-pm@2021-07-07.yang"

module ietf-service-pm {
  yang-version 1.1;

  namespace "urn:ietf:params:xml:ns:yang:ietf-service-pm";
  prefix "svc-pm";

  import ietf-eth-tran-service {
    prefix "ethtsvc";
  }

  import ietf-yang-types {
    prefix "yang";
  }

  import ietf-trans-client-service {
    prefix "clntsvc";
  }

  organization
    "Internet Engineering Task Force (IETF) CCAMP WG";
  contact
    "
      WG List: <mailto:ccamp@ietf.org>
      ID-draft editor:
        Haomian Zheng (zhenghaomian@huawei.com);
        Italo Busi (italo.busi@huawei.com);
        Yanlei Zheng (zhengyanlei@chinaunicom.cn);
        Victor Lopez (victor.lopez@nokia.com);
        Oscar Gonzalez de Dios(oscar.gonzalezdedios@telefonica.com);
    ";

  description
    "This module defines the performance monitoring for Ethernet
     services. The model fully conforms to the Network Management
     Datastore Architecture (NMDA).

     Copyright (c) 2021 IETF Trust and the persons
     identified as authors of the code.  All rights reserved.
     Redistribution and use in source and binary forms, with or
     without modification, is permitted pursuant to, and subject
     to the license terms contained in, the Simplified BSD License
     set forth in Section 4.c of the IETF Trust's Legal Provisions
     Relating to IETF Documents
     (https://trustee.ietf.org/license-info).
     This version of this YANG module is part of RFC XXXX; see
     the RFC itself for full legal notices.";

  revision 2021-07-07 {
    description
      "Initial version";
    reference
      "ADD REFERENCE HERE";
  }

  typedef performance-parameter-value {
    type union {
```

```
    type uint32;
    type uint64;
    type decimal64 {
      fraction-digits 6;
    }
    type string;
  }
  description
    "A performance parameter value.";
}

grouping service-performance-monitor-set{
  description "the set of parameter name, value and description.";
  leaf parameter-name{
    type identityref {
      base performance-parameter-type;
    }
    description
      "The name of parameters to be monitored.
       For example, latency, Bit Error Rate, Bandwidth and so on.";
  }
  list parameter-value {
    key index;
    description
      "The table of values of the performance and
      their descriptions.";
    leaf index {
      type uint64;
      description
        "Used for list index";
    }
    leaf value {
      type performance-parameter-value;
      mandatory true;
      description
        "The value of the parameter. ";
    }
    leaf value-unit {
      type string;
      mandatory true;
      description
        "The value unit of the parameter.
         For example, second, minute and so on.";
    }
    leaf value-description{
      type string;
      description
        "The description of previous value. ";
    }
    leaf start-time {
      type yang:date-and-time;
      description
        "The time stamp when the parameter is started.";
    }
    leaf end-time {
      type yang:date-and-time;
      description
        "The time stamp when the parameter is ended.";
```

```
    }
  }
}

identity performance-parameter-type {
  description
    "Base type of the performance parameter being monitored.";
}

identity near-frame-loss {
  base performance-parameter-type;
  description
    "Near frame loss, using one-way eth loss measure,
     the sampling point is the MEP.";
}

identity far-frame-loss {
  base performance-parameter-type;
  description
    "Far frame loss, using one-way eth loss measure,
     the sampling point is the MEP.";
}

identity one-way-delay {
  base performance-parameter-type;
  description
    "One way delay.";
}

identity two-way-delay {
  base performance-parameter-type;
  description
    "Two way delay.";
}

identity receive-packets {
  base performance-parameter-type;
  description
    "Total number of received packets.";
}

identity transmit-packets {
  base performance-parameter-type;
  description
    "Total number of transmitted packets.";
}

identity ingress-bandwidth {
  base performance-parameter-type;
  description
    "Current bandwidth usage of the ingress traffic.";
}

identity egress-bandwidth {
  base performance-parameter-type;
  description
    "Current bandwidth usage of the egress traffic.";
}
```

```
identity alarm-status {
  description "indicates whether there is alarm or not";
}
identity alarm {
  base alarm-status;
  description "There is one or multiple alarms from the monitor. ";
}

identity no-alarm {
  base alarm-status;
  description "There is no alarms from the monitor. ";
}

identity monitoring-state {
  description
    "The state of performance monitoring. ";
}

identity monitoring {
  base monitoring-state;
  description "The Ethernet client signal is under monitoring. ";
}

identity monitor-finished {
  base monitoring-state;
  description
    "The monitoring of Ethernet client signal is finished. ";
}

identity monitor-failed {
  base monitoring-state;
  description
    "The monitoring of Ethernet client signal is failed. ";
}

identity granularity-type {
  description
    "Monitoring granularity";
}

identity granularity-1min {
  base granularity-type;
  description
    "1 minute";
}

identity granularity-15min {
  base granularity-type;
  description
    "15 minutes";
}
identity granularity-24h {
  base granularity-type;
  description
    "24 hours";
}
```

```
identity measure-method {
  description "Measure method.";
}

identity measure-by-loopback {
  base measure-method;
  description "Loopback measure method.";
}

identity measure-at-ingress {
  base measure-method;
  description "Ingress measure method.";
}

container performance-monitoring {
  description
    "This part is for performance monitoring. ";
  list service-pm {
    key "service-name";
    description
      "The list of service to be monitored.";
    leaf service-name {
      type union {
        type leafref {
          path "/ethtsvc:etht-svc/ethtsvc:etht-svc-instances"
             + "/ethtsvc:etht-svc-name";
        }
        type leafref {
          path "/clntsvc:client-svc/clntsvc:client-svc-instances"
             + "/clntsvc:client-svc-name";
        }
      }
      mandatory true;
      description "The name of service.";
    }

    leaf task-pm-enable {
      type boolean;
      description
        "Indicate whether the performance monitoring
        is enable or not.";
    }

    leaf granularity {
      type identityref {
        base granularity-type;
      }
      description
        "Monitoring granularity";
    }

    list performance-data-config {
      key parameter-name;
      description
        "Specify the performance parameters to be queried";

      leaf parameter-name {
        type identityref {
```

```
      base performance-parameter-type;
    }
    description
      "The name of parameters to be monitored.
       For example, latency, BER, Bandwidth and so on.";
  }
  leaf measure-method {
    type identityref {
      base measure-method;
    }
    description "Measure Methods.";
  }
}

container service-pm-state {
  config false;
  description
    "The state of service performance monitoring.";

  container oam-state {
    description "the state of OAM. ";
    leaf cc-state {
      type enumeration {
        enum up {
          description "up";
        }
        enum down {
          description "down";
        }
      }
      mandatory true;
      description
        "The state of continuity check.";
    }
    leaf lm-state {
      type enumeration {
        enum up {
          description "up";
        }
        enum down {
          description "down";
        }
      }
      description
        "The state of loss measurement.";
    }
    leaf dm-state {
      type enumeration {
        enum up {
          description "up";
        }
        enum down{
          description "down";
        }
      }
      description
        "The state of delay measurement.";
    }
```

```
        }

        list performance-data{
          key parameter-name;
          description "The list of performance under monitor.";
          uses service-performance-monitor-set;
        }

        leaf monitor-state {
          type identityref {
            base monitoring-state;
          }
          mandatory true;
          description "The status of performance monitoring. ";
        }

        container error-info {
          description
            "Describe the error message.";
          leaf error-code {
            type uint32;
            description
              "The code of error.";
          }
          leaf error-message {
            type string;
            description
              "The message of error.";
          }
        }

        container alarm {
          description
            "To retrieve the Alarm during performance Monitoring.";
          leaf status {
            type identityref {
              base alarm-status;
            }
            description "The status of the alarm. ";
          }
        }
      }
    }
  }

}
```

<CODE ENDS>

7.2. The OAM Configuration YANG Code

```
<CODE BEGINS> file "ietf-eth-service-oam@2021-07-10.yang"

module ietf-eth-service-oam {
  yang-version 1.1;

  namespace "urn:ietf:params:xml:ns:yang:ietf-eth-service-oam";
  prefix "eth-oam";

  import ietf-eth-tran-service {
    prefix "ethtsvc";
  }

  import ietf-service-pm {
    prefix "svc-pm";
  }

  import ietf-trans-client-service {
    prefix "clntsvc";
  }

  import ietf-network {
    prefix nw;
  }

  organization
    "Internet Engineering Task Force (IETF) CCAMP WG";
  contact
    "
      WG List: <mailto:ccamp@ietf.org>
      ID-draft editor:
        Haomian Zheng (zhenghaomian@huawei.com);
        Italo Busi (italo.busi@huawei.com);
        Yanlei Zheng (zhengyanlei@chinaunicom.cn);
        Victor Lopez (victor.lopez@nokia.com);
        Oscar Gonzalez de Dios(oscar.gonzalezdedios@telefonica.com);
    ";

  description
    "This module defines the performance monitoring for Ethernet
     services OAM. The model fully conforms to the Network Management
     Datastore Architecture (NMDA).

     Copyright (c) 2021 IETF Trust and the persons
     identified as authors of the code.  All rights reserved.
     Redistribution and use in source and binary forms, with or
     without modification, is permitted pursuant to, and subject
     to the license terms contained in, the Simplified BSD License
     set forth in Section 4.c of the IETF Trust's Legal Provisions
     Relating to IETF Documents
     (https://trustee.ietf.org/license-info).
     This version of this YANG module is part of RFC XXXX; see
     the RFC itself for full legal notices.";

  revision 2021-07-10 {
    description
      "Initial version";
    reference
      "ADD REFERENCE HERE";
```

```
}

identity interval-type {
  description "Time interval";
}

identity interval-3p33ms {
  base interval-type;
  description "3.33 milliseconds";
}

identity interval-10ms {
  base interval-type;
  description "10 milliseconds";
}

identity interval-100ms {
  base interval-type;
  description "100 milliseconds";
}

identity interval-1s {
  base interval-type;
  description "1 second";
}

identity interval-10s {
  base interval-type;
  description "10 seconds";
}

identity interval-1m {
  base interval-type;
  description "1 minute";
}

identity interval-10m {
  base interval-type;
  description "10 minutes";
}

grouping eth-service-oam-config {
  container source {
    uses mep-config;
    description "OAM MEP configuration on source node.";
    }
  container destination {
    uses mep-config;
    description "OAM MEP configuration on destination node.";
    }
  uses interval-config;
  description "OAM configuration on Eth services.";
}

grouping interval-config {
  description "OAM Interval Configuration.";
  leaf cc-interval {
    type identityref {
```

```
      base interval-type;
    }
    description "Continuity check interval.";
  }

  leaf lm-interval {
    type identityref {
      base interval-type;
    }
    description "Loss measurement interval.";
  }

  leaf dm-interval {
    type identityref {
      base interval-type;
    }
    description "Delay measurement interval.";
  }
}

grouping mep-config {
  description "OAM MEP Configuration.";
  leaf md-name {
   type string;
   description
     "Name of Maintenance Domain.";
  }
  leaf ma-name {
   type string;
   description
     "Name of Maintenance Domain.
      An maintenance association(MA) is a part of an MD.
      An MD can be divided into one or more MAs. ";
  }

  leaf ma-level {
    type string;
    description
      "Maintenance Association Level.";
  }

  leaf meg-id {
    type string;
    description
      "Comply with Y.1731 term, mapping with 802.lag MA name.";
  }
  leaf meg-level {
    type string;
    description "Mapping with 802.lag MA level.";
  }

  leaf mep-id {
    type uint8;
    description "0 if Abnormal";
  }

  leaf remote-mep-id {
    type uint8;
```

```
    description "The remote MEP ID must be specified.";
  }
}


augment "/svc-pm:performance-monitoring/svc-pm:service-pm" {
  description
    "Augment with additional parameters required for Ethernet OAM";

  container oam-config {
    description "OAM configuration container.";
    uses eth-service-oam-config;
  }
}

grouping errors {
  description "The grouping of error information.";
  leaf error-code {
    type uint32;
    description "The error code.";
  }

  leaf error-message {
    type string;
    description "The error message.";
  }
}

/*
  * Operations
  */
rpc configure-oam {
  description "Deliver OAM configurations. ";

  input {
    list oam-config-list {
      key "service-name";
      description
        "The request list of service oam to be configured.";
      leaf service-name {
        type union {
          type leafref {
            path "/ethtsvc:etht-svc/ethtsvc:etht-svc-instances"
               + "/ethtsvc:etht-svc-name";
          }
          type leafref {
            path "/clntsvc:client-svc/clntsvc:client-svc-instances"
               + "/clntsvc:client-svc-name";
          }

        }
        mandatory true;
        description "The name of service.";
      }
      uses eth-service-oam-config;
    }
  }
```

```
output {
  list oam-config-list {
    key "service-name";
    description "The OAM configuration list. ";
    leaf service-name {
      type union {
        type leafref {
          path "/ethtsvc:etht-svc/ethtsvc:etht-svc-instances"
             + "/ethtsvc:etht-svc-name";
        }
        type leafref {
          path "/clntsvc:client-svc/clntsvc:client-svc-instances"
                   + "/clntsvc:client-svc-name";
        }
      }
      mandatory true;
      description "The name of service.";
    }
  }
    leaf result {
      type enumeration {
        enum success {
          description "success";
        }
        enum failure {
          description "failure";
        }
      }
      description "Result of OAM configuration.";
    }
    uses errors;

  }
}

rpc delete-oam-configurations {
  description "Delete OAM configurations. ";
    input {
      list service-list {
        key "service-name";
        leaf service-name {
          type union {
            type leafref {
              path "/ethtsvc:etht-svc/ethtsvc:etht-svc-instances"
                 + "/ethtsvc:etht-svc-name";
            }
            type leafref {
              path "/clntsvc:client-svc/clntsvc:client-svc-instances
                 + "/clntsvc:client-svc-name";
            }
          }
          mandatory true;
          description "The name of service.";
        }
        description "The list of service.";
      }
    }
```

```
    output {
      list oam-config-list {
        key "service-name";
        leaf service-name {
          type union {
            type leafref {
              path "/ethtsvc:etht-svc/ethtsvc:etht-svc-instances"
                 + "/ethtsvc:etht-svc-name";
            }
            type leafref {
              path "/clntsvc:client-svc/clntsvc:client-svc-instances
                 + "/clntsvc:client-svc-name";
            }
          }
          mandatory true;
          description "The name of service.";
        }

        leaf result {
          type enumeration {
            enum success {
              description "success";
            }
            enum failure {
              description "failure";
            }
          }
          description "The result of OAM deletion.";
        }

        uses errors;
        description "The list of service.";
      }
    }
}

rpc get-node-eth-oam-configurations {
  description "Get the Eth node OAM configuration info.";
  input {
    leaf-list te-node-list {
       type leafref {
         path "/nw:networks/nw:network/nw:node/nw:node-id";
       }
      description
        "Node identifier.  Must be same in the topology.";
    }
  }

  output {
    list oam-list {
      leaf node-id {
        type leafref {
         path "/nw:networks/nw:network/nw:node/nw:node-id";
        }
        description "The node identifier.";
      }
      list mep-config-list {
        key "md-name ma-name meg-id mep-id";
```

```
            uses mep-config;
            description "The list of MEP configuration.";
          }
          description "The list of OAM.";
        }
      }
    }
}



<CODE ENDS>
```

8. IANA Considerations

It is proposed that IANA should assign new URIs from the "IETF XML Registry" [RFC3688] as follows:

```
URI: urn:ietf:params:xml:ns:yang:ietf-service-pm
Registrant Contact: The IESG
XML: N/A; the requested URI is an XML namespace.
```

```
URI: urn:ietf:params:xml:ns:yang:ietf-eth-service-oam
Registrant Contact: The IESG
XML: N/A; the requested URI is an XML namespace.
```

This document registers following YANG modules in the YANG Module Names registry [RFC7950].

```
name:         ietf-service-pm
namespace:    urn:ietf:params:xml:ns:yang:ietf-service-pm
prefix:       svc-pm
reference:    RFC XXXX (This document)
```

```
name:         ietf-eth-service-oam
namespace:    urn:ietf:params:xml:ns:yang:ietf-eth-service-oam
prefix:       eth-oam
reference:    RFC XXXX (This document)
```

9. Manageability Considerations

TBD.

10. Security Considerations

The data following the model defined in this document is exchanged via, for example, the interface between an orchestrator and a transport network controller. The security concerns mentioned in [I-D.ietf-ccamp-client-signal-yang] also applies to this document.

The YANG module defined in this document can be accessed via the RESTCONF protocol defined in [RFC8040], or maybe via the NETCONF protocol [RFC6241].

11. Contributors

Chaode YU Huawei Technologies, Email: yuchaode@huawei.com

12. References

12.1. Normative References

[I-D.ietf-ccamp-client-signal-yang]

Zheng, H., Guo, A., Busi, I., Snitser, A., and F. Lazzeri, "A YANG Data Model for Transport Network Client Signals", Work in Progress, Internet-Draft, draft-ietf-ccamp-client-signal-yang-07, 10 July 2022, <https://www.ietf.org/archive/id/draft-ietf-ccamp-client-signal-yang-07.txt>.

[I-D.ietf-ccamp-layer1-types] Zheng, H. and I. Busi, "A YANG Data Model for Layer 1 Types", Work in Progress, Internet-Draft, draft-ietf-ccamp-layer1-types-15, 23 November 2022, <https://www.ietf.org/archive/id/draft-ietf-ccamp-layer1-types-15.txt>.

[I-D.ietf-teas-actn-pm-telemetry-autonomics] Lee, Y., Dhody, D., Vilalta, R., King, D., and D. Ceccarelli, "YANG models for Virtual Network (VN)/TE Performance Monitoring Telemetry and Scaling Intent Autonomics", Work in Progress, Internet-Draft, draft-ietf-teas-actn-pm-telemetry-autonomics-09, 11 July 2022, <https://www.ietf.org/archive/id/draft-ietf-teas-actn-pm-telemetry-autonomics-09.txt>.

[I-D.www-bess-yang-vpn-service-pm] Wu, Q., Boucadair, M., de Dios, O. G., Wen, B., Liu, C., and H. Xu, "A YANG Model for Network and VPN Service Performance Monitoring", Work in Progress, Internet-Draft, draft-www-bess-yang-vpn-service-pm-06, 22 April 2020, <https://www.ietf.org/archive/id/draft-www-bess-yang-vpn-service-pm-06.txt>.

[RFC3688] Mealling, M. and RFC Publisher, "The IETF XML Registry", BCP 81, RFC 3688, DOI 10.17487/RFC3688, January 2004, <https://www.rfc-editor.org/info/rfc3688>.

[RFC6241] Enns, R., Ed., Bjorklund, M., Ed., Schoenwaelder, J., Ed., Bierman, A., Ed., and RFC Publisher, "Network Configuration Protocol (NETCONF)", RFC 6241, DOI 10.17487/RFC6241, June 2011, <https://www.rfc-editor.org/info/rfc6241>.

[RFC7950] Bjorklund, M., Ed. and RFC Publisher, "The YANG 1.1 Data Modeling Language", RFC 7950, DOI 10.17487/RFC7950, August 2016, <https://www.rfc-editor.org/info/rfc7950>.

[RFC8040] Bierman, A., Bjorklund, M., Watsen, K., and RFC Publisher, "RESTCONF Protocol", RFC 8040, DOI 10.17487/RFC8040, January 2017, <https://www.rfc-editor.org/info/rfc8040>.

[RFC8531] Kumar, D., Wu, Q., and Z. Wang, "Generic YANG Data Model for Connection-Oriented Operations, Administration, and Maintenance (OAM) Protocols", RFC 8531, DOI 10.17487/RFC8531, April 2019, <https://www.rfc-editor.org/info/rfc8531>.

12.2. Informative References

[I-D.ietf-ccamp-otn-tunnel-model] Zheng, H., Busi, I., Belotti, S., Lopez, V., and Y. Xu, "OTN Tunnel YANG Model", Work in

Progress, Internet-Draft, draft-ietf-ccamp-otn-tunnel-model-17, 9 October 2022, <https://www.ietf.org/archive/id/draft-ietf-ccamp-otn-tunnel-model-17.txt>.

[I-D.ietf-ccamp-wson-tunnel-model]
Lee, Y., Zheng, H., Guo, A., Lopez, V., King, D., Yoon, B., and R. Vilalta, "A Yang Data Model for WSON Tunnel", Work in Progress, Internet-Draft, draft-ietf-ccamp-wson-tunnel-model-08, 8 January 2023, <https://www.ietf.org/archive/id/draft-ietf-ccamp-wson-tunnel-model-08.txt>.

[RFC8340] Bjorklund, M., Berger, L., Ed., and RFC Publisher, "YANG Tree Diagrams", BCP 215, RFC 8340, DOI 10.17487/RFC8340, March 2018, <https://www.rfc-editor.org/info/rfc8340>.

Authors' Addresses

Haomian Zheng
Huawei Technologies
H1, Xiliu Beipo Village, Songshan Lake,
Dongguan
Guangdong, 523808
China

Email: zhenghaomian@huawei.com

Italo Busi
Huawei Technologies
Italy

Email: Italo.Busi@huawei.com

Yanlei Zheng
China Unicom
China

Email: zhengyanlei@chinaunicom.cn

Victor Lopez
Nokia
Spain

Email: victor.lopez@nokia.com

Oscar Gonzalez de Dios
Telefonica
Spain

Email: oscar.gonzalezdedios@telefonica.com