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Contact Plan Yang Model for Time-Variant Routing of the Bundle Protocol

Abstract

Some networks, such as in space, have links that are up and down based on a known schedule. The links characteristics, such as latency and bandwidth, are often also known in advance and are important information for routing decisions. This document describes a Yang data model, also known as contact plan. This specification applies to the Bundle Protocol.

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1. Introduction

Some networks, such as in space, have links that are up and down based on a known schedule. The links characteristics, such as latency and bandwidth, are also known in advance and are important information for routing decisions. This document describes a Yang data model, also known as contact plan. This specification applies to the Bundle Protocol.

For delay-tolerant networks using the Bundle Protocol(BP) [[RFC9171](#)], implementations have defined different formats and data models ([\[iondtncp\]](#), [\[ionipncp\]](#), [\[ud3tncgf\]](#), [\[hdtncp\]](#)) for such data. This specification aims to specify a common interoperable data model.

While this work is related to space communications, it could be applied to any use case that is using a contact plan.

1.1. Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14 [[RFC2119](#)] [[RFC8174](#)] when, and only when, they appear in all capitals, as shown here.

2. Data Model

The Yang data model augments the Bundle Protocol Yang data model [[draft-blanchet-dtn-bp-yang-model](#)] by adding the TVR schedule Yang data model [[draft-qu-tvr-schedule-yang](#)] to the neighbors of a Bundle protocol node.

In the case of DTN networks using Bundle Protocol, additional attributes are used on the contact, such as the bandwidth of the

convergence layer adapter link at the time of the contact. It is added to the augmentation.

```
<CODE BEGINS> file "ietf-tvr-bundle-schedule@2023-07-05.yang"
module ietf-tvr-bundle-schedule {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-tvr-bundle-schedule";
  prefix bundle-schedule;

  import ietf-bundle-protocol {
    prefix bundle;
  }
  import ietf-tvr-schedule {
    prefix tvr-schedule;
  }

  organization
    "IETF TVR - Time Variant Routing Working Group";
  contact
    "WG Web: <http://datatracker.ietf.org/wg/tvr>
    WG List: <mailto:tvr@ietf.org>

    Author: Marc Blanchet
            <mailto:marc.blanchet@viagenie.ca>
    Author: Yingzhen Qu
            <mailto:yingzhen.ietf@gmail.com>
    Author: Leigh Jordan Torgerson
            <mailto:jordan.l.torgerson@jpl.nasa.gov>";

  description
    "The YANG module defines an augmentation to the Bundle
    protocol YANG mode.

    This YANG model conforms to the Network Management
    Datastore Architecture (NMDA) as described in RFC 8342.

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    forth in Section 4.c of the IETF Trust's Legal Provisions
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    (https://trustee.ietf.org/license-info).

    This version of this YANG module is part of RFC XXXX
    (https://www.rfc-editor.org/info/rfcXXXX); see the RFC itself
    for full legal notices.

    The key words 'MUST', 'MUST NOT', 'REQUIRED', 'SHALL', 'SHALL
    NOT', 'SHOULD', 'SHOULD NOT', 'RECOMMENDED', 'NOT RECOMMENDED',
    'MAY', and 'OPTIONAL' in this document are to be interpreted as
```

```

        described in BCP 14 (RFC 2119) (RFC 8174) when, and only when,
        they appear in all capitals, as shown here.";
reference
    "RFC XXXX: Contact Plan Yang Model for Time-Variant Routing of the

revision 2023-07-05 {
    description
        "Initial Version";
    reference
        "RFC XXXX: Contact Plan Yang Model for Time-Variant Routing of t
}

augment "/bundle:node/bundle:neighbors/bundle:neighbor" {
    container contact-schedule {
        description
            "Augment Bundle node neighbor with a contact schedule.";
        uses tvr-schedule:schedule;
        leaf bandwidth {
            type yang:gauge64;
            units "bits/second";
            description
                "An estimate of the convergence layer current bandwidth in b
                per second";
        }
    }
}
description
    "Augment the neighbor with a contact schedule.";
}
}
<CODE ENDS>

```

3. Security Considerations

The YANG modules specified in this document define a schema for data that is designed to be accessed via network management protocols such as NETCONF [[RFC6241](#)] or RESTCONF [[RFC8040](#)]. The lowest NETCONF layer is the secure transport layer, and the mandatory-to-implement secure transport is Secure Shell (SSH) [[RFC6242](#)]. The lowest RESTCONF layer is HTTPS, and the mandatory-to-implement secure transport is TLS [[RFC8446](#)].

The NETCONF access control model [[RFC8341](#)] provides the means to restrict access for particular NETCONF or RESTCONF users to a pre-configured subset of all available NETCONF or RESTCONF protocol operations and content.

Augmenting neighbors with a contact plan could be used by an adversary to influence the routing and the base function of the networking config of the node, the end-result may be a denial of service.

4. IANA Considerations

This document registers an URI in the IETF XML registry [[RFC3688](#)]. Following the format in [[RFC3688](#)], the following registration is requested to be made:

URI: urn:ietf:params:xml:ns:yang:ietf-tvr-bundle-schedule
Registrant Contact: The IESG.
XML: N/A, the requested URI is an XML namespace.

This document registers a YANG module in the YANG Module Names registry [[RFC6020](#)].

name: ietf-tvr-bundle-schedule
namespace: urn:ietf:params:xml:ns:yang:ietf-tvr-bundle-schedule
prefix: bundle-schedule
reference: RFC XXXX

5. References

5.1. Normative References

- [[RFC2119](#)] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, DOI 10.17487/RFC2119, March 1997, <<https://www.rfc-editor.org/info/rfc2119>>.
- [[RFC3688](#)] Mealling, M., "The IETF XML Registry", BCP 81, RFC 3688, DOI 10.17487/RFC3688, January 2004, <<https://www.rfc-editor.org/info/rfc3688>>.

[RFC6020]

Bjorklund, M., Ed., "YANG - A Data Modeling Language for the Network Configuration Protocol (NETCONF)", RFC 6020, DOI 10.17487/RFC6020, October 2010, <<https://www.rfc-editor.org/info/rfc6020>>.

[RFC6241]

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

[RFC6242]

Wasserman, M., "Using the NETCONF Protocol over Secure Shell (SSH)", RFC 6242, DOI 10.17487/RFC6242, June 2011, <<https://www.rfc-editor.org/info/rfc6242>>.

[RFC8040]

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

[RFC8174]

Leiba, B., "Ambiguity of Uppercase vs Lowercase in RFC 2119 Key Words", BCP 14, RFC 8174, DOI 10.17487/RFC8174, May 2017, <<https://www.rfc-editor.org/info/rfc8174>>.

[RFC8341]

Bierman, A. and M. Bjorklund, "Network Configuration Access Control Model", STD 91, RFC 8341, DOI 10.17487/RFC8341, March 2018, <<https://www.rfc-editor.org/info/rfc8341>>.

[RFC8446]

Rescorla, E., "The Transport Layer Security (TLS) Protocol Version 1.3", RFC 8446, DOI 10.17487/RFC8446, August 2018, <<https://www.rfc-editor.org/info/rfc8446>>.

[RFC9171]

Burleigh, S., Fall, K., and E. Birrane, III, "Bundle Protocol Version 7", RFC 9171, DOI 10.17487/RFC9171, January 2022, <<https://www.rfc-editor.org/info/rfc9171>>.

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Qu, Y., Lindem, A., and M. Blanchet, "YANG Model for Scheduled Attributes", Work in Progress, Internet-Draft, draft-qu-tvr-schedule-yang-00, July 2023, <[draft-qu-tvr-schedule-yang](#)>.

[draft-blanchet-dtn-bp-yang-model]

Blanchet, M. and Y. Qu, "Bundle Protocol Yang Model", Work in Progress, Internet-Draft, draft-blanchet-dtn-bp-yang-model-00, July 2023, <[draft-blanchet-dtn-bp-yang-model](#)>.

5.2. Informative References

[ud3tncgf] "µD3TN Contacts Data Format", <https://gitlab.com/d3tn/ud3tn/-/blob/master/doc/contacts_data_format.md>.

[hdtncp]

"High-rate Delay Tolerant Network Contact Plan Example",
<<https://github.com/nasa/HDTN/blob/master/module/scheduler/src/contactPlan.json>>.

[iondtncp] "ION "dtn" scheme configuration commands file", <<https://sourceforge.net/p/ion-dtn/code/ci/current/tree/bpv7/doc/pod5/dtn2rc.pod>>.

[ionipncp] "ION "ipn" scheme configuration commands file", <<https://sourceforge.net/p/ion-dtn/code/ci/current/tree/bpv7/doc/pod5/ipnrc.pod>>.

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