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Structure Identifier (SID)
draft-somaraju-core-sid-00

Abstract

   Structured IDentifiers (SID) are used to identify different YANG
   items when encoded in CBOR. This document defines the registration
   and assignment processes of SIDs. To enable the implementation of
   these processes, this document also defines a file format used to
   persist and publish assigned SIDs.

Status of This Memo

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1. Introduction

   This document describes the registries required to manage SIDs and a
   file format used to persist and publish the assigned SIDs.

2. Terminology and Notation

   The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT",
   "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this
   document are to be interpreted as described in [RFC2119].

   The following terms are defined in [I-D.ietf-netmod-rfc6020bis]:

   o action

   o module

   o notification

   o RPC

   o schema node

o schema tree

o submodule

This specification also makes use of the following terminology:

o identifier: An identifier embodies the information required to
   distinguish what is being identified from all other things within
   its scope of identification.

o delta : Difference between the SID assigned to the current schema
   node and the SID assigned to the parent.

o item: A schema node or identity which has been allocated a SID.

o path: A path is a string that identifies a schema node within the
   schema tree. A path consists of the list of schema node
   identifier(s) separated by slashes ("/"). Schema node
   identifier(s) are always listed from the top-level schema node up
   to the targeted schema node. (e.g. "/system-state/clock/current-
   datetime")

3. Structured IDentifiers (SID)

Some of the items defined in YANG [I-D.ietf-netmod-rfc6020bis]
require the use of a unique identifier. In both NETCONF and
RESTCONF, these identifiers are implemented using names. To allow
the implementation of data models defined in YANG in constrained
devices and constrained networks, a more compact method to identify
YANG items is required.

This compact identifier, called SID, is encoded using an unsigned
integer. To minimize its size, SIDs are often implemented using a
delta from a reference SID and the current SID. To guaranty the
uniqueness of each assigned SID, SID ranges MUST be registered.
Section 7.1 provide more details about the registration process of
SID range(s).

To avoid duplicate assignment of SIDs, the registration of the SIDs
assigned to YANG module(s) is recommended. Section 7.2 provide more
details about the registration process of YANG modules.

The following items are identified using SIDs:

o identities

o data nodes

o RPCs and associated input(s) and output(s)

o actions and associated input(s) and output(s)

o notifications and associated information

Assignment of SIDs can be automated, the recommended process to
assign SIDs is as follows:

o A tool extracts the different items defined for a specific YANG
   module.

o The list of items is ordered by type and label.

o SIDs are assigned sequentially for the entry point up to the size
   of the registered SID range. It is important to note that
   sequentially assigning SIDs optimizes the CBOR serialization due
   to the use of delta encoding.

o If the number of items exceeds the SID range(s) allocated to a
   YANG module, an extra range is added for subsequent assignments.

o SIDs are assigned permanently, items introduced by a new revision
   of a YANG module are added to the list of SIDs already assigned.
   Section 5 defines a standard file format used to store and publish
   SIDs.

4. ".sid" file lifecycle

The following activity diagram summarize the life cycle of ".sid"
files.

```
             +--------------+
    O        | Creation of a|
  -|- ->| YANG module  |
   / \       +--------------+
                    |
                    V
            /-------------\
           / Standardized  \ yes
           \ YANG module ? /------------+
            \-------------/             |
                  | no                  |
                  V                     V
            /-------------\      +--------------+
           / Constrained   \ yes | SID range    |
    +-->\ application ? /---->| registration |
    |     \-------------/      +--------------+
    |           | no                   |
    |           V                      V
    |     +--------------+      +--------------+
    +---| YANG module  |      | .sid file    |
        | update       |      | generation   |
        +--------------+      +--------------+
                                     |
                                     V
                           /-------------\      +--------------+
                          /  Publicly     \ yes | YANG module  |
            +------------>\  available ? /---->| registration |
            |             \-------------/      +--------------+
            |                   | no                  |
            |             +-------------------+       |
            |                   V                     
    +--------------+     +--------------+
    | .sid file    |     | Update of the|
    | update based |     | YANG module  |
    | on previous  |     | or include(s)|
    | .sid file    |     | or import(s) |
    +--------------+     +--------------+
            ^                    |
            |                    V
            |             /-------------\      +--------------+
            |            /  More SIDs    \ yes | Extra range  |
            |            \  required ?  /---->| assignment   |
            |             \-------------/      +--------------+
            |                   | no                  |
            +-------------------+-------------------+
```
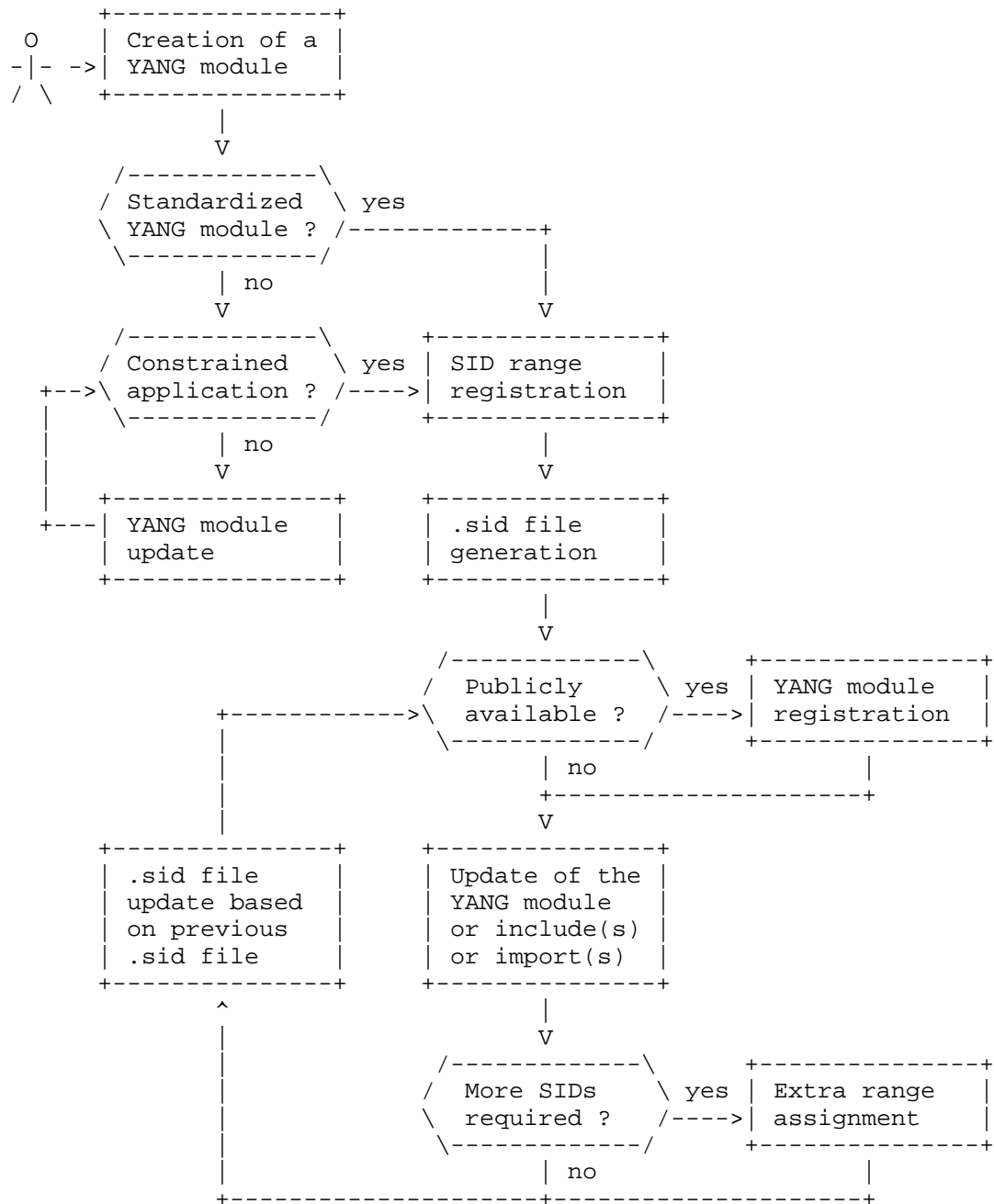
YANG modules are not necessary created in the context of constrained applications. YANG modules can be implemented using NETCONF or RESTCONF without the need to assign SIDs.

As needed, authors of YANG modules can assign SIDs to their modules. This process starts by the registration of a SID range. Once a SID range is registered, the owner of this range assigns sub-ranges to each YANG module in order to generate the associated ".sid" files. Generation of ".sid" files SHOULD be performed using an automated tool.

Registration of the .sid file associated to a YANG module is optional but recommended to promote interoperability between devices and to avoid duplicate allocation of SIDs to a single YANG module.

Each time a YANG module or one of its imported module(s) or included sub-module(s) is updated, the ".sid" file MAY need to be updated. This update SHOULD also be performed using an automated tool.

If a new revision requires more SIDs than initially allocated, a new SID range MUST be added to the assignment ranges as defined in the ".sid" file header. These extra SIDs are used for subsequent assignments.

5. ".sid" file format

".sid" files are used to persist and publish SIDs assigned to the different YANG items of a specific YANG module. The following YANG module defined the structure of this file, encoding is performed using the rules defined in [I-D.ietf-netmod-yang-json].

```
module sid-file {
  namespace "urn:ietf:ns:cool:sid-file";
  prefix sid;

  organization
    "IETF Core Working Group";

  contact
    "Ana Minaburo
     <ana@ackl.io>

     Alexander Pelov
     <mailto:a@ackl.io>

     Abhinav Somaraju
     <mailto:abhinav.somaraju@tridonic.com>
```

```
        Laurent Toutain
        <Laurent.Toutain@telecom-bretagne.eu>

        Randy Turner
        <mailto:Randy.Turner@landisgyr.com>

        Michel Veillette
        <mailto:michel.veillette@trilliantinc.com>";

  description
    "This module define the structure of the .sid files.
     .sid files contains the identifiers (SIDs) assigned
     to the different items defined in a YANG module.
     SIDs are used to encode a data model defined in YANG
     using CBOR.";

  revision 2015-12-16 {
    description
      "Initial revision.";
    reference
      "draft-veillette-core-yang-cbor-mapping";
  }

  typedef yang-identifier {
    type string {
      length "1..max";
      pattern '[a-zA-Z_][a-zA-Z0-9\-_.]*';
      pattern '.|..|[^xX].*|.[^mM].*|..[^lL].*';
    }
    description
      "A YANG identifier string as defined by the 'identifier'
       rule in Section 12 of RFC 6020.";
  }

  typedef revision-identifier {
    type string {
      pattern '\d{4}-\d{2}-\d{2}';
    }
    description
      "Represents a date in YYYY-MM-DD format.";
  }


  typedef date-and-time {
    type string {
      pattern '\d{4}-\d{2}-\d{2}T\d{2}:\d{2}:\d{2}(\.\d+)?' +
              '(Z|[\+\-]\d{2}:\d{2})';
    }
```

```
      description
        "The date-and-time type is a profile of the ISO 8601
         standard for representation of dates and times using the
         Gregorian calendar.  The profile is defined by the
         date-time production in section 5.6 of RFC 3339.";
    }

    leaf module-name {
      type yang-identifier;
      description
        "Name of the module associated with this .sid file.";
    }

    leaf module-revision {
      type revision-identifier;
      description
        "Revision of the module associated with this .sid file.
         This leaf is not present if no revision statement is
         defined in the YANG module.";
    }

    list assigment-ranges {
      key "entry-point";
      description
        "Range(s) of SIDs available for assignment to the
         different items defined by the associated module.";

      leaf entry-point {
        mandatory true;
        type uint32;
        description
          "Lowest SID available for assignment.";
      }

      leaf size {
        mandatory true;
        type uint16;
        description
          "Number of SIDs available for assignment.";
      }
    }

    list items {
      key "type assigned label";
      description
        "List of items defined by the associated YANG module.";

      leaf type {
```

```
        description
          "Item type assigned, this field can be set to:
            - 'identity'
            - 'node'
            - 'notification'
            - 'rpc'
            - 'action'";
        mandatory true;
        type string {
          pattern 'identity$|node$|notification$|rpc$|action$';
        }
      }

      leaf assigned {
        mandatory true;
        type date-and-time;
        description
          "Date and time when this entry has been created.";
      }

      leaf label {
        mandatory true;
        type string;
        description
          "Label associated to this item, can be set to:
            - an identity encoded as: '<module name>:<entity name>'
            - a schema node path";
      }

      leaf sid {
        mandatory true;
        type uint32;
        description "Identifier assigned to this YANG item.";
      }
    }
  }
}
```

6. Security Considerations

   The security considerations of [RFC7049] and
   [I-D.ietf-netmod-rfc6020bis] apply.

   This document defines an new type of identifier used to encode data
   models defined in YANG [I-D.ietf-netmod-rfc6020bis]. As such, this
   identifier does not contribute to any new security issues in addition
   of those identified for the specific protocols or contexts for which
   it is used.

7. IANA Considerations

7.1. "SID" range registry

   IANA is requested to create a registry for Structure Identifier (SID)
   ranges. This registry needs to guarantee that the ranges registered
   do not overlap. The registry SHALL record for each entry:

   o The entry point (first entry) of the registered SID range.

   o The size of the registered SID range.

   o The contact information of the owner of the range such as name,
      email address, and phone number.

   The IANA policy for this registry is split into four tiers as
   follows:

   o The range of 0 to 9999 and 0x40000000 to 0xFFFFFFFFFFFFFFFF are
      reserved for future extensions of this protocol. Allocation
      within these ranges require IETF review or IESG approval.

   o The range of 1000 to 59999 is reserved for standardized YANG
      modules. Allocation within this range requires publishing of the
      associated ".yang" and ".sid" files. (Specification required.)

   o The range of 60000 to 99999 is reserved for experimental YANG
      modules. Use of this range MUST NOT be used in operational
      deployments since these SIDs are not globally unique which limit
      their interoperability.

   o The range of 100000 to 0x3FFFFFFF is available on a first come
      first served basis. The only information required from the
      registrant is a valid contact information. The recommended size
      of the SID ranges allocated is 1,000 for private use and 10,000
      for standard development organizations (SDOs). Registrants MAY
      request fewer or more SIDs based on their expected, sat needs.
      Allocation of a significantly larger SID range MAY required IETF
      review or IESG approval. IANA MAY delegate this registration
      process to one or multiple sub-registries. The recommended size
      of the SID range allocation for a sub-registry is 1,000,000.

```
+-----------+----------------+----------------------------------+
| Entry     | Size           | Registration Procedures          |
| Point     |                |                                  |
+-----------+----------------+----------------------------------+
| 0         | 1,000          | IETF review or IESG approval     |
| 1,000     | 59,000         | Specification and associated     |
|           |                | ".yang" and ".sid" files required|
| 60,000    | 40,000         | Experimental use                 |
| 100,000   | 0x3ffe7960     | Contact information is required. |
|           |                | Registration of the module name(s)|
|           |                | and associated ".yang" and ".sid"|
|           |                | files are optional.              |
| 0x40000000| 2^64-0x40000000| Specification required, expert   |
|           |                | review                           |
+-----------+----------------+----------------------------------+
```

7.2. YANG module registry

   Each registered SID range can be used to assign SIDs to one or more
   YANG modules. To track which YANG modules have been assigned and to
   avoid duplicate allocation, IANA is requested to provide a method to
   register and query the following information:

   o The YANG module name

   o The contact information of the author

   o The specification reference

   o The associated ".yang" file(s) (Optional)

   o The associated ".sid" file (Optional)

   Registration of YANG modules is optional. When a YANG module is
   registered, the registrant MUST provide the module name and contact
   information and/or a specification reference.

   The registration of the associated ".yang" and ".sid" files is
   optional. When provided, the validity of the files MUST be verified.
   This can be accomplished by a YANG validation tool specially modified
   to support ".sid" file verification. The SID range specified within
   the ".sid" file SHOULD also be checked against the "SID" range
   registry (Section 7.1) and against the other YANG modules registered
   to detect any duplicate use of SIDs.

   Initial entries in this registry are as follows:

```
+-------------+------+----------------+--------------------------+
| Entry Point | Size | Module name    | Reference                |
+-------------+------+----------------+--------------------------+
| 1000        | 100  | ietf-cool      | [I-D.veillette-core-cool]|
| 1100        | 400  | iana-if-type   | [RFC7224]                |
| 1500        | 100  | ietf-interfaces| [RFC7223]                |
| 1600        | 100  | ietf-ip        | [RFC7277]                |
| 1700        | 100  | ietf-system    | [RFC7317]                |
+-------------+------+----------------+--------------------------+
```

8. Acknowledgments

   The authors would like to thank Carsten Bormann for his help during
   the development of this document and his useful comments during the
   review process.

9. References

9.1. Normative References

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              System Management", RFC 7317, DOI 10.17487/RFC7317, August
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Appendix A. ".sid" file example

   The following .sid file (ietf-system@2014-08-06.sid) have been
   generated using the following yang modules:

   o ietf-system@2014-08-06.yang

   o ietf-yang-types@2013-07-15.yang

   o ietf-inet-types@2013-07-15.yang

   o ietf-netconf-acm@2012-02-22.yang

   o iana-crypt-hash@2014-04-04.yang

```
 {
   "assignment-ranges": [
     {
       "entry-point": 1700,
       "size": 100
     }
   ],
   "module-name": "ietf-system",
   "module-revision": "2014-08-06",
   "items": [
     {
       "type": "identity",
       "assigned": "2016-01-13T21:00:19Z",
       "label": "ietf-system:authentication-method",
       "sid": 1700
     },
     {
```

```
        "type": "identity",
        "assigned": "2016-01-13T21:00:19Z",
        "label": "ietf-system:local-users",
        "sid": 1701
      },
      {
        "type": "identity",
        "assigned": "2016-01-13T21:00:19Z",
        "label": "ietf-system:radius",
        "sid": 1702
      },
      {
        "type": "identity",
        "assigned": "2016-01-13T21:00:19Z",
        "label": "ietf-system:radius-authentication-type",
        "sid": 1703
      },
      {
        "type": "identity",
        "assigned": "2016-01-13T21:00:19Z",
        "label": "ietf-system:radius-chap",
        "sid": 1704
      },
      {
        "type": "identity",
        "assigned": "2016-01-13T21:00:19Z",
        "label": "ietf-system:radius-pap",
        "sid": 1705
      },
      {
        "type": "node",
        "assigned": "2016-01-13T21:00:19Z",
        "label": "/system",
        "sid": 1706
      },
      {
        "type": "node",
        "assigned": "2016-01-13T21:00:19Z",
        "label": "/system-state",
        "sid": 1707
      },
      {
        "type": "node",
        "assigned": "2016-01-13T21:00:19Z",
        "label": "/system-state/clock",
        "sid": 1708
      },
      {
```

```
      "type": "node",
      "assigned": "2016-01-13T21:00:19Z",
      "label": "/system-state/clock/boot-datetime",
      "sid": 1709
    },
    {
      "type": "node",
      "assigned": "2016-01-13T21:00:19Z",
      "label": "/system-state/clock/current-datetime",
      "sid": 1710
    },
    {
      "type": "node",
      "assigned": "2016-01-13T21:00:19Z",
      "label": "/system-state/platform",
      "sid": 1711
    },
    {
      "type": "node",
      "assigned": "2016-01-13T21:00:19Z",
      "label": "/system-state/platform/machine",
      "sid": 1712
    },
    {
      "type": "node",
      "assigned": "2016-01-13T21:00:19Z",
      "label": "/system-state/platform/os-name",
      "sid": 1713
    },
    {
      "type": "node",
      "assigned": "2016-01-13T21:00:19Z",
      "label": "/system-state/platform/os-release",
      "sid": 1714
    },
    {
      "type": "node",
      "assigned": "2016-01-13T21:00:19Z",
      "label": "/system-state/platform/os-version",
      "sid": 1715
    },
    {
      "type": "node",
      "assigned": "2016-01-13T21:00:19Z",
      "label": "/system/authentication",
      "sid": 1716
    },
    {
```

```
            "type": "node",
            "assigned": "2016-01-13T21:00:19Z",
            "label": "/system/authentication/user",
            "sid": 1717
          },
          {
            "type": "node",
            "assigned": "2016-01-13T21:00:19Z",
            "label": "/system/authentication/user-authentication-order",
            "sid": 1718
          },
          {
            "type": "node",
            "assigned": "2016-01-13T21:00:19Z",
            "label": "/system/authentication/user/authorized-key",
            "sid": 1719
          },
          {
            "type": "node",
            "assigned": "2016-01-13T21:00:19Z",
            "label": "/system/authentication/user/authorized-key/algorithm",
            "sid": 1720
          },
          {
            "type": "node",
            "assigned": "2016-01-13T21:00:19Z",
            "label": "/system/authentication/user/authorized-key/key-data",
            "sid": 1721
          },
          {
            "type": "node",
            "assigned": "2016-01-13T21:00:19Z",
            "label": "/system/authentication/user/authorized-key/name",
            "sid": 1722
          },
          {
            "type": "node",
            "assigned": "2016-01-13T21:00:19Z",
            "label": "/system/authentication/user/name",
            "sid": 1723
          },
          {
            "type": "node",
            "assigned": "2016-01-13T21:00:19Z",
            "label": "/system/authentication/user/password",
            "sid": 1724
          },
          {
```

```
        "type": "node",
        "assigned": "2016-01-13T21:00:19Z",
        "label": "/system/clock",
        "sid": 1725
      },
      {
        "type": "node",
        "assigned": "2016-01-13T21:00:19Z",
        "label": "/system/clock/timezone/timezone-name/timezone-name",
        "sid": 1726
      },
      {
        "type": "node",
        "assigned": "2016-01-13T21:00:19Z",
        "label": "/system/clock/timezone/timezone-utc-offset/
        timezone-utc-offset",
        "sid": 1727
      },
      {
        "type": "node",
        "assigned": "2016-01-13T21:00:19Z",
        "label": "/system/contact",
        "sid": 1728
      },
      {
        "type": "node",
        "assigned": "2016-01-13T21:00:19Z",
        "label": "/system/dns-resolver",
        "sid": 1729
      },
      {
        "type": "node",
        "assigned": "2016-01-13T21:00:19Z",
        "label": "/system/dns-resolver/options",
        "sid": 1730
      },
      {
        "type": "node",
        "assigned": "2016-01-13T21:00:19Z",
        "label": "/system/dns-resolver/options/attempts",
        "sid": 1731
      },
      {
        "type": "node",
        "assigned": "2016-01-13T21:00:19Z",
        "label": "/system/dns-resolver/options/timeout",
        "sid": 1732
      },
```

```
      {
        "type": "node",
        "assigned": "2016-01-13T21:00:19Z",
        "label": "/system/dns-resolver/search",
        "sid": 1733
      },
      {
        "type": "node",
        "assigned": "2016-01-13T21:00:19Z",
        "label": "/system/dns-resolver/server",
        "sid": 1734
      },
      {
        "type": "node",
        "assigned": "2016-01-13T21:00:19Z",
        "label": "/system/dns-resolver/server/name",
        "sid": 1735
      },
      {
        "type": "node",
        "assigned": "2016-01-13T21:00:19Z",
        "label": "/system/dns-resolver/server/transport/udp-and-tcp/
        udp-and-tcp",
        "sid": 1736
      },
      {
        "type": "node",
        "assigned": "2016-01-13T21:00:19Z",
        "label": "/system/dns-resolver/server/transport/udp-and-tcp/
        udp-and-tcp/address",
        "sid": 1737
      },
      {
        "type": "node",
        "assigned": "2016-01-13T21:00:19Z",
        "label": "/system/dns-resolver/server/transport/udp-and-tcp/
        udp-and-tcp/port",
        "sid": 1738
      },
      {
        "type": "node",
        "assigned": "2016-01-13T21:00:19Z",
        "label": "/system/hostname",
        "sid": 1739
      },
      {
        "type": "node",
        "assigned": "2016-01-13T21:00:19Z",
```

```
        "label": "/system/location",
        "sid": 1740
      },
      {
        "type": "node",
        "assigned": "2016-01-13T21:00:19Z",
        "label": "/system/ntp",
        "sid": 1741
      },
      {
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      },
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      "label": "/system-shutdown",
      "sid": 1765
    }
  ]
}
```

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