Augmented-by Addition into the ietf-yang-library

draft-lincla-netconf-yang-library-augmentation-01

IETF 119 Hackathon
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Background

The YANG library [RFC8525] specifies a YANG module that provides the information about the YANG models and datastores to facilitate a client **application to fully utilize and understand the YANG** data modelling language.

With the requirement of automated network management arises, more and more scenarios appears where the **real-time knowledge of YANG dependencies** are needed.

While the deviation is used to understand the API contract of server and client, the augmentation is required to directly understand YANG dependency from ietf-yang-library [RFC8525], and obviously it is missing for the moment.

```
module: ietf-yang-library
  +--ro yang-library
  |  +--ro module-set* [name]
  |  |  +--ro name                   string
  |  |  +--ro module* [name]
  |  |  |  +--ro name         yang:yang-identifier
  |  |  |  +--ro revision?    revision-identifier
  |  |  |  +--ro namespace    inet:uri
  |  |  |  +--ro location*    inet:uri
  |  |  |  +--ro submodule* [name]
  |  |  |  |  +--ro name        yang:yang-identifier
  |  |  |  |  +--ro revision?   revision-identifier
  |  |  |  |  +--ro location*   inet:uri
  |  |  |  +--ro feature*     yang:yang-identifier
  |  |  |  +--ro deviation*   -> ../../module/name
  |  |  +--ro import-only-module* [name revision]
  |  |     +--ro name         yang:yang-identifier
  |  |     +--ro revision     union
  |  |     +--ro namespace    inet:uri
  |  |     +--ro location*    inet:uri
  |  |     +--ro submodule* [name]
  |  |        +--ro name        yang:yang-identifier
  |  |        +--ro revision?   revision-identifier
  |  |        +--ro location*   inet:uri
  |  +--ro schema* [name]
  |  |  +--ro name          string
  |  |  +--ro module-set*   -> ../../module-set/name
  |  +--ro datastore* [name]
  |  |  +--ro name      ds:datastore-ref
  |  |  +--ro schema    -> ../../schema/name
  |  +--ro content-id    string
```

Import: Parse from module source code

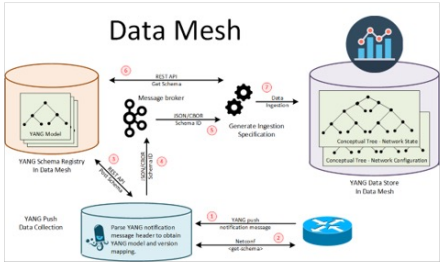
Include: Parse from module source code/<get> request to ietf-yang-library

Deviation: <get> request to ietf-yang-library

Augmentation: **missing**

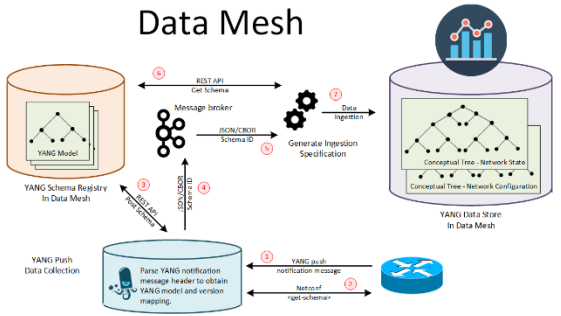
YANG & Kafka Data Mesh Architecture

With the **schema registry** introduce in this architecture to maintain YANG semantics in the whole pipeline, there is a need for it to know the **dependencies of each modules**, in order to provide the **correct and complete** module set.



draft-netana-nmop-yang-kafka-integration

Current solution & Limitation



Get-all-schemas

What it is: Fetch all YANG models and parse them to fully understand their relationship

Limitation: **Time-consuming**. Hard to reflect module changes. Require extra procession of all modules.

Performance:

Device 1	Device 2
Around 5 min	Around 3 min

Evaluation: Not ideal in the data real-time ingestion background

Real-time parse message

What it is: Parse prefix in the message to know the augmentation.

```
"datastore-contents": {
    "ietf-interfaces:interfaces": [
     {
      "interface": {
       "name": "eth0",
       "type": "iana-if-type:ethernetCsmacd",
       "oper-status": "up",
       "speed": "1000000"
       "ietf-ip:ipv4": {
        "enabled": true,
        "forwarding": true
       }
      }
     }
    ]
}
```

Principle: In the received YANG-push message, fields name with prefix(Or element with namespace) are from the augment module.

Evaluation: Dependency missing are highly possible, since not all augments will appear in the first message but it may do in the following.

libyangpush: https://github.com/network-analytics/libyangpush

Hackathon Plan

<Motivation>

- **Augment the ietf-yang-library defined in RFC8525 to provide an augmented-by list.**
- **Prove how it facilitates obtaining the entire dependencies of a YANG model.**

<Draft>

- **Augmented-by Addition into the ietf-yang-library**

<How we planned to solve it?>

- **Implement the feature to libyang/sysrepo and demonstrate it on netopeer2**

YANG tree of *ietf-yang-library* Plus the augmentation

ietf-yang-library **in RFC8525**

```
module: ietf-yang-library
  +--ro yang-library
  |  +--ro module-set* [name]
  |  |  +--ro name              string
  |  |  +--ro module* [name]
  |  |  |  +--ro name                  yang:yang-identifier
  |  |  |  +--ro revision?             revision-identifier
  |  |  |  +--ro namespace               inet:uri
  |  |  |  +--ro location*             inet:uri
  |  |  |  +--ro submodule* [name]
  |  |  |  |  +--ro name       yang:yang-identifier
  |  |  |  |  +--ro revision?   revision-identifier
  |  |  |  |  +--ro location*   inet:uri
  |  |  |  +--ro feature*              yang:yang-identifier
  |  |  |  +--ro deviation*             -> ../../module/name
  |  |  |  +--ro yanglib-aug:augmented-by*   ->
                                          ../../yanglib:module/name
```

ietf-yang-library **in RFC7895**

```
module: ietf-yang-library
  +--ro modules-state
    +--ro module-set-id    string
    +--ro module* [name revision]
      +--ro name                  yang:yang-identifier
      +--ro revision              union
      +--ro schema?                 inet:uri
      +--ro namespace               inet:uri
      +--ro feature*              yang:yang-identifier
      +--ro deviation* [name revision]
      |  +--ro name       yang:yang-identifier
      |  +--ro revision   union
      +--ro conformance-type         enumeration
      +--ro submodule* [name revision]
      |  +--ro name       yang:yang-identifier
      |  +--ro revision   union
      |  +--ro schema?    inet:uri
      x--ro yanglib-aug:augmented-by* [name revision]
        +--ro yanglib-aug:name       -> /yanglib:modules-state/module/name
        +--ro yanglib-aug:revision   -> /yanglib:modules-state/module/revision
```

Hackathon Demo

Based on libyang&sysrepo
Run on netopeer2

```
> get --filter-xpath /ietf-yang-library:yang-library/module-set/module/augmented-by
DATA
<data xmlns="urn:ietf:params:xml:ns:netconf:base:1.0">
  <yang-library xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-library">
    <module-set>
      <name>complete</name>
      <module>
        <name>ietf-factory-default</name>
        <augmented-by xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-library-augmentedby">sysrepo-factory-default</augmented-by>
      </module>
      <module>
        <name>ietf-yang-library</name>
        <augmented-by xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-library-augmentedby">ietf-yang-library-augmentedby</augmented-by>
      </module>
      <module>
        <name>ietf-netconf</name>
        <augmented-by xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-library-augmentedby">ietf-netconf-with-defaults</augmented-by>
        <augmented-by xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-library-augmentedby">ietf-netconf-nmda</augmented-by>
      </module>
      <module>
        <name>ietf-interfaces</name>
        <augmented-by xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-library-augmentedby">ietf-ip</augmented-by>
        <augmented-by xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-library-augmentedby">ietf-network-instance</augmented-by>
      </module>
      <module>
        <name>ietf-subscribed-notifications</name>
        <augmented-by xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-library-augmentedby">ietf-yang-push</augmented-by>
      </module>
    </module-set>
  </yang-library>
</data>
```

Hackathon Demo

Based on libyang&sysrepo
Run on netopeer2

```
> get --filter-xpath /ietf-yang-library:modules-state/module/augmented-by
DATA
<data xmlns="urn:ietf:params:xml:ns:netconf:base:1.0">
  <modules-state xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-library">
    <module>
      <name>ietf-factory-default</name>
      <revision>2020-08-31</revision>
      <augmented-by xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-library-augmentedby">
        <name>sysrepo-factory-default</name>
        <revision>2023-02-23</revision>
      </augmented-by>
    </module>
    <module>
      <name>ietf-yang-library</name>
      <revision>2019-01-04</revision>
      <augmented-by xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-library-augmentedby">
        <name>ietf-yang-library-augmentedby</name>
        <revision>2023-10-27</revision>
      </augmented-by>
    </module>
    <module>
      <name>ietf-netconf</name>
      <revision>2013-09-29</revision>
      <augmented-by xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-library-augmentedby">
        <name>ietf-netconf-with-defaults</name>
        <revision>2011-06-01</revision>
      </augmented-by>
      <augmented-by xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-library-augmentedby">
        <name>ietf-netconf-nmda</name>
        <revision>2019-01-07</revision>
      </augmented-by>
    </module>
    <module>
      <name>ietf-interfaces</name>
      <revision>2018-02-20</revision>
      <augmented-by xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-library-augmentedby">
        <name>ietf-ip</name>
        <revision>2018-02-22</revision>
      </augmented-by>
      <augmented-by xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-library-augmentedby">
        <name>ietf-network-instance</name>
        <revision>2019-01-21</revision>
      </augmented-by>
    </module>
    <module>
      <name>ietf-subscribed-notifications</name>
      <revision>2019-09-09</revision>
      <augmented-by xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-library-augmentedby">
        <name>ietf-yang-push</name>
        <revision>2019-09-09</revision>
      </augmented-by>
    </module>
  </modules-state>
</data>
```

Hackathon Demo

Based on libyang&sysrepo
Run on netopeer2

```
YANG_LIBRARY_SUBTREE = """
<yang-library xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-library">
    <module-set>
        <module/>
    </module-set>
</yang-library>
"""
```

```
        <location>file:///opt/dev/sysrepo/build/repository/yang/ietf-network-instance@2019-01-21.yang</location>
      </module>
      <module>
        <name>ietf-subscribed-notifications</name>
        <revision>2019-09-09</revision>
        <namespace>urn:ietf:params:xml:ns:yang:ietf-subscribed-notifications</namespace>
        <location>file:///opt/dev/sysrepo/build/repository/yang/ietf-subscribed-notifications@2019-09-09.yang</location>
        <feature>encode-xml</feature>
        <feature>replay</feature>
        <feature>subtree</feature>
        <feature>xpath</feature>
        <augmented-by xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-library-augmentedby">ietf-yang-push</augmented-by>
      </module>
      <module>
        <name>ietf-yang-push</name>
        <revision>2019-09-09</revision>
        <namespace>urn:ietf:params:xml:ns:yang:ietf-yang-push</namespace>
        <location>file:///opt/dev/sysrepo/build/repository/yang/ietf-yang-push@2019-09-09.yang</location>
        <feature>on-change</feature>
      </module>
    </module-set>
  </yang-library>
</data>

Execution Time: 0:00:00.457945
```

Device 1	Device 2	One <get>
Around 5 min	Around 3 min	0.46s

Wrap Up

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Repository links:

Libyang with augmented-by:
https://github.com/Zephyre777/libyang.git
Sysrepo with augmented-by:
https://github.com/Zephyre777/sysrepo.git
Draft repo:
https://github.com/Zephyre777/draft-lincla-netconf-yang-library-augmentation.git