Yang Data Model for OAM and Management of ALTO protocol

draft-zhang-alto-oam-yang

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Main Goal

Define a YANG data model for Operations, Administration, and Maintenance (OAM) & Management of ALTO Protocol.

Latest version: https://datatracker.ietf.org/doc/html/draft-zhang-alto-oam-yang-02

Editor’s copy on GitHub:
https://openalto.github.io/draft-alto-oam-yang/draft-zhang-alto-oam-yang.html

YANG modules: https://github.com/openalto/draft-alto-oam-yang/tree/main/yang

Major Changes since -01

- Change document title: OAM -> O&M (OAM and Management)
  - Follow the guidelines of RFC6291
  - This document targets not only OAM but also Management
  - Thank comments from Adrian Farrel
- Revised scope and requirements to be exactly aligned with RFC7285 and RFC7971
- Make the initial YANG module code ready
  - Ready to be reviewed: https://github.com/openalto/draft-alto-oam-yang/tree/main/yang
  - Thank Qiufang Ma's contribution to the initial version

Basic Requirements

Requirement		Reference
R1: The data model should support configuration for ALTO server setup.		Sec 16.1 of RFC7285
R2: The data model should provide logging management.		Sec 16.2.1 of RFC7285
R3: The data model should provide ALTO-related management information.		Sec 16.2.2 of RFC7285
R4: The data model should provide metrics for server failures.		Sec 16.2.3 of RFC7285, Sec 3.3 of RFC7971
R5	R5-1: The data model should support configuration for different data sources.	Sec 16.2.4 of RFC7285, Sec 3.2 of RFC7971
	R5-2: The data model should support configuration for information resource generation algorithms.	Sec 16.2.4 of RFC7285
	R5-3: The data model should support configuration for access control at information resource level.	Sec 16.2.4 of RFC7285
R6: The data model should provide performance monitoring for ALTO-specific metrics.		Sec 16.2.5 of RFC7285, Sec 3.4 of RFC7971
R7: The data model should support configuration for security policy management.		Sec 16.2.6 of RFC7285

Additional Requirements

R8: As the ALTO protocol is extensible, the data model for ALTO O&M should allow for augmentation to support potential future extensions.

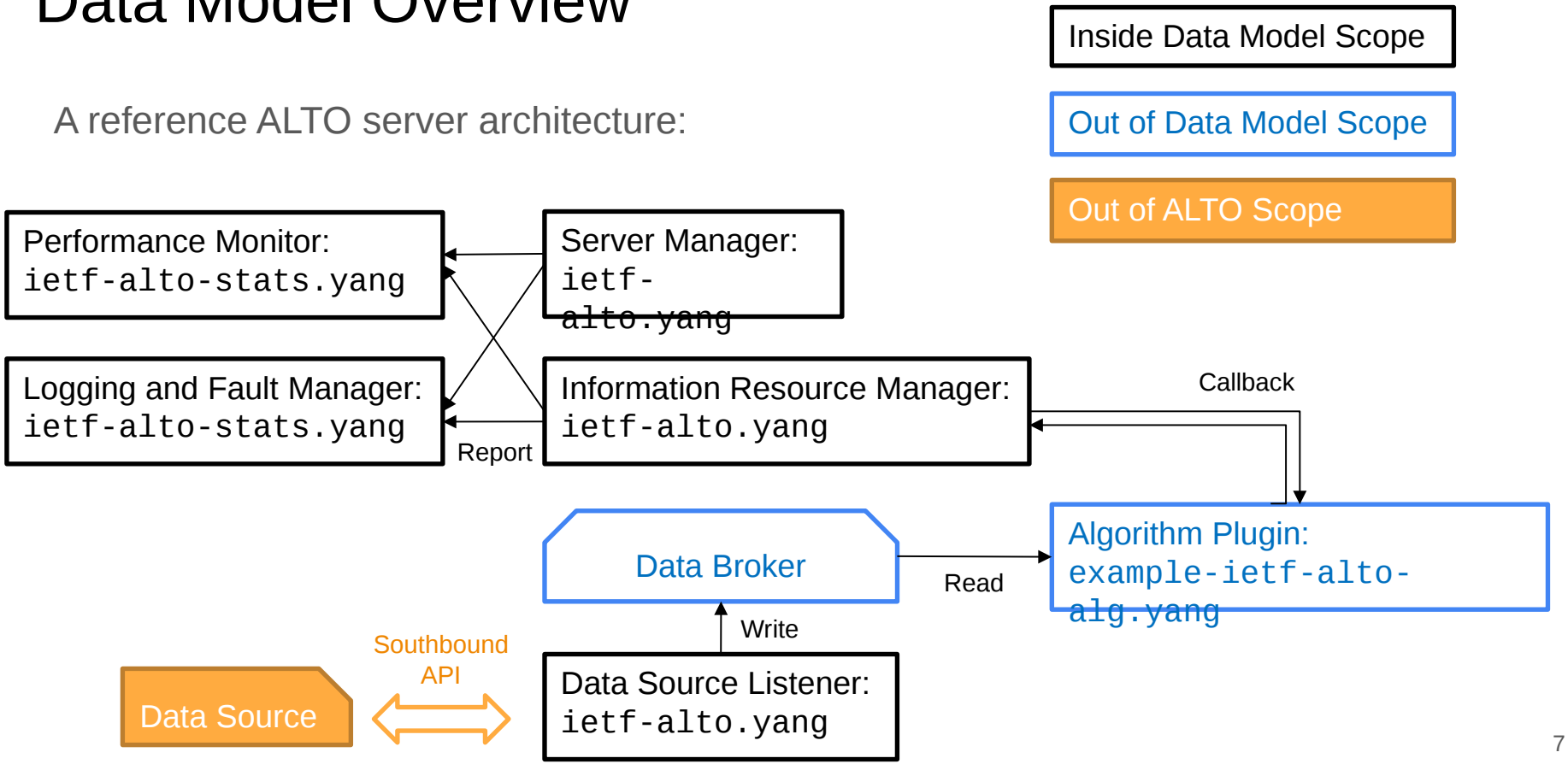
Current Status

Initial Proposal | Working in Progress | TODO

Requirement		Reference
R1: The data model should support configuration for ALTO server setup.		Sec 16.1 of RFC7285
R2: The data model should provide logging management.		Sec 16.2.1 of RFC7285
R3: The data model should provide ALTO-related management information.		Sec 16.2.2 of RFC7285
R4: The data model should provide metrics for server failures.		Sec 16.2.3 of RFC7285, Sec 3.3 of RFC7971
R5	R5-1: The data model should support configuration for different data sources.	Sec 16.2.4 of RFC7285, Sec 3.2 of RFC7971
	R5-2: The data model should support configuration for information resource generation algorithms.	Sec 16.2.4 of RFC7285
	R5-3: The data model should support configuration for access control at information resource level.	Sec 16.2.4 of RFC7285
R6: The data model should provide performance monitoring for ALTO-specific metrics.		Sec 16.2.5 of RFC7285, Sec 3.4 of RFC7971
R7: The data model should support configuration for security policy management.		Sec 16.2.6 of RFC7285
R8: The data model should allow for augmentation to support future extensions.		N/A

Data Model Overview

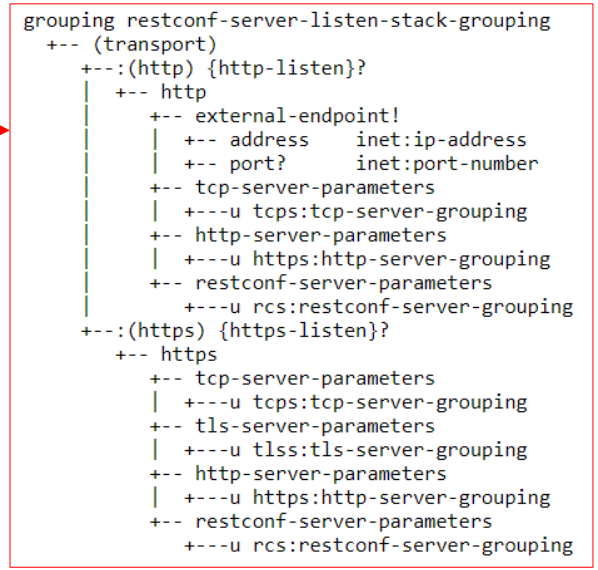
A reference ALTO server architecture:



Data Model for Server Setup [R1]

- Meta Information for Server-level O&M

```
module: ietf-alto
  +--rw alto-server
     +--rw hostname?       inet:host
     +--rw cost-type* [cost-type-name]
     |  +--rw cost-type-name     string
     |  +--rw cost-mode          cost-mode
     |  +--rw cost-metric        cost-metric
     +--rw meta* [meta-key]
     |  +--rw meta-key       string
     |  +--rw meta-value     string
     ...
```



TODOs:

- HTTP server listen configuration
- DNS configuration (for server discovery [RFC7286] [RFC8686])

Data Model for Information Resource Management [R5]

```
module: ietf-alto
  +--rw alto-server
     ...
     +--rw resource* [resource-id]
     |    +--rw resource-id     resource-id
     |    +--rw resource-type   identityref
     |    +--rw description?    string
     |    +--rw accepted-group* [user-group]
     |    +--rw dependency*     resource-id
     |    +--rw auth
     |    |  +--rw (auth-type-selection)
     |    |     +--:(auth-key-chain)
     |    |     +--:(auth-key)
     |    |     +--:(auth-tls)
     |    |  ...
     |    +--rw (resource-params)
     |       +--:(ird)
     |       |  +--rw alto-ird-params
     |       |     +--rw delegation          inet:uri
     |       +--:(networkmap)
     |       |  +--rw alto-networkmap-params
     |       |     +--rw is-default?         boolean
     |       |     +--rw filtered?           boolean
     |       |     +--rw (algorithm)
```

Common Parameter

Resource-Specific Parameter

Creation Algorithm

```
augment /alto:alto-server/alto:resource/alto:resource-params
          /alto:networkmap/alto:alto-networkmap-params
          /alto:algorithm:
  +--rw l3-unicast-cluster-algorithm
     +--rw l3-unicast-topo
     |       -> /alto:alto-server/data-source/source-id
     +--rw depth?    uint32
```

```
module: ietf-alto
  +--rw alto-server
     ...
     +--rw data-source* [source-id]
        +--rw source-id   string
        +--rw source-type identityref
        +--rw (update-policy)
        |  +--:(reactive)
        |  |  +--rw reactive          boolean
        |  +--:(proactive)
        |     +--rw poll-interval     uint32
        +--rw (source-params)
           +--:(yang-datastore)
           |  +--rw yang-datastore-source-params
           |     +--rw source-path    yang:xpath1.0
           +--:(prometheus)
              +--rw prometheus-source-params
                 +--rw source-uri     inet:uri
                 +--rw query-data?    string
```

Data Source

Data Model for Server Monitoring [R6]

Measurement information suggested by RFC7971:

- Measurement of impact
  - Total amount and distribution of traffic
  - Application performance
- System and service performance
  - Requests and responses for each information resource
  - CPU and memory utilization
  - ALTO map updates
  - Number of PIDs
  - ALTO map sizes

Other useful measurement information for ALTO extensions:

- Number of other ALTO entities
- Statistics for update sessions and events
- Statistics for calendars

```
module: ietf-alto-stats

  augment /alto:alto-server/alto:resource:
    +--ro num-res-upd?    yang:counter32
    +--ro res-mem-size?   yang:counter32
    +--ro res-enc-size?   yang:counter32

  augment /alto:alto-server/alto:resource/alto:resource-params
            /alto:networkmap/alto:alto-networkmap-params:
    +--ro num-map-pid?    yang:counter32

  augment /alto:alto-server/alto:resource/alto:resource-params
            /alto:propmap/alto:alto-propmap-params:
    +--ro num-map-entry?  yang:counter32

  augment /alto:alto-server/alto:resource/alto:resource-params
            /alto:cdni/alto:alto-cdni-params:
    +--ro num-base-obj?   yang:counter32

  augment /alto:alto-server/alto:resource/alto:resource-params
            /alto:update/alto:alto-update-params:
    +--ro num-upd-sess    yang:counter32
    +--ro num-event-total yang:counter32
    +--ro num-event-max?  yang:counter32
    +--ro num-event-min?  yang:counter32
    +--ro num-event-avg?  yang:counter32
```

Extension of ALTO O&M Data Model [R8]

The following example shows how the developer augments the `algorithm` choice of `alto-networkmap-params` with a creation algorithm for the network map resource:

```
module: example-ietf-alto-alg

  augment /alto:alto-server/alto:resource/alto:resource-params
            /alto:networkmap/alto:alto-networkmap-params
            /alto:algorithm:
    +--:(l3-unicast-cluster)
       +--rw l3-unicast-cluster-algorithm
          +--rw l3-unicast-topo
          |       -> /alto:alto-server/data-source/source-id
          +--rw depth?             uint32
```

A referenced algorithm implementation: https://datatracker.ietf.org/doc/html/draft-hzx-alto-network-topo-00

YANG data node in /nw:networks/nw:network/	ALTO data object
l3t:l3-topology-attributes/l3t:name	network-map/resource-id
nw:node/l3t:l3-node-attributes /l3t:name	network-map/PIDName
/nw:node/l3t:l3-node-attributes /l3t:flag	network-map/PIDName.flag
/nw:node/l3t:l3-node-attributes /l3t:router-id	network-map/PIDName /EndpointAddrGroup
/nw:node/l3t:l3-node-attributes /l3t:prefix/l3t:prefix	network-map/PIDName /EndpointAddrGroup
/nw:node/l3t:l3-node-attributes /l3t:prefix/l3t:metric	network-map/PIDName /EndpointAddrGroup.metric
/nw:node/l3t:l3-node-attributes /l3t:prefix/l3t:flag	network-map/PIDName /EndpointAddrGroup.flag
/nw:link/l3t:l3-link-attributes /l3t:name	network-map/PIDName /PIDName
/nw:link/l3t:l3-link-attributes /l3t:metric1	network-map/PIDName /PIDName/DstCost
/nw:link/l3t:l3-link-attributes /l3t:metric2	network-map/PIDName /PIDName/DstCost
/nw:link/l3t:l3-link-attributes /l3t:flag	network-map/PIDName /PIDName.flag

Discussions

Q1: This model references several identities and enumeration typedefs (e.g., `cost-metric`) which are managed by IANA registries. To make the model extensible, should we move them into a separated `iana-alto-types.yang`?

Current status: Asking yang-doctors about the best practice
https://mailarchive.ietf.org/arch/msg/yang-doctors/rVflF_sVEv3fR4reZ6y93ikD2yE/

Argument: Making this change will also make the future updates like draft-ietf-alto-performance-metrics and draft-bw-alto-cost-mode easy to be supported without updating the basic YANG module.

Discussions

Q2: Lots of parameters can be configured for specific ALTO information resources. Which ones should be defined in the standard basic module? Which ones should be delegated to algorithm extensions?

- Default two PIDs of cost map
- Granularity of network map and cost map
- Client-specific configuration

Discussions

Q3: So far, all the requirements are for ALTO server. What will be requirements for ALTO client?

For our experience, ALTO clients do need O&M (e.g., caching mgmt, server discovery, multi-server mgmt). But how useful the YANG model will be for the client O&M?

Update to Milestones

- Ready to be adopted as a WG item?
- Make the main structure of YANG modules stable by IETF 114
  - If possible, do some simple demo in IETF 114 Hackathon
- Make the document ready for IESG review by IETF 115

Further Feedback

Email to ALTO WG mailing list: alto@ietf.org
Or cc Authors: draft-zhang-alto-oam-yang@ietf.org

Open an issue in GitHub:
https://github.com/openalto/draft-alto-oam-yang/issues/new/choose

We are looking forward to receiving your feedback!