Yang Data Model for OAM and Management of ALTO protocol

draft-ietf-alto-oam-yang

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ALTO WG @ IETF 115
Current Status

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


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

Current Status (Cont.)

Open discussions and progress since IETF 114:
- **T1**: How to handle data types defined by IANA registries (e.g., ALTO cost modes and metrics)
  - [https://mailarchive.ietf.org/arch/msg/alto/S10Ua4tvVhPGu6FFJhbhDGBbPXs/](https://mailarchive.ietf.org/arch/msg/alto/S10Ua4tvVhPGu6FFJhbhDGBbPXs/)
- **T2**: Whether and how to supply server-to-server communication for multi-domain settings
  - [https://mailarchive.ietf.org/arch/msg/alto/MvVDgeZnmi-_0sY8al0hGuWbWU8/](https://mailarchive.ietf.org/arch/msg/alto/MvVDgeZnmi-_0sY8al0hGuWbWU8/)
- **T3**: How to build connection between data sources and algorithm data model

Achieved Milestones:
- **IETF 115 Hackathon**
  - Partial implemented ALTO O&M data model in OpenALTO implementation: [https://github.com/openalto/alto](https://github.com/openalto/alto)
Overall Update: Reorganize the Contents

1. Introduction .......................................................... 3
2. Requirements Language ................................................. 3
3. Terminology .......................................................... 3
  3.1. Tree Diagrams ...................................................... 3
3.2. Prefixes in Data Node Names ........................................ 4
4. Design Scope and Requirements ....................................... 4
  4.1. Scope of Data Model for ALTO O&M ....................... 4
  4.2. Basic Requirements ................................................ 6
  4.3. Additional Requirements for Extensibility .................. 6
  4.4. Overview of ALTO O&M Data Model for Reference ALTO  6
      Architecture ....................................................... 6
  5. Design of ALTO O&M Data Model .................................. 6
  5.1. Overview of ALTO O&M Data Model ......................... 7
  5.2. Meta Information of ALTO Server ......................... 8
  5.3. ALTO Information Resources Configuration Management  10
  5.4. Data Sources ................................................... 12
  5.4.1. Yang DataStore Data Source ............................ 13
  5.4.2. Data Source for Security Data Source ............... 14
  5.5. Model for ALTO Server-to-server Communication ........ 14
  6. Design of ALTO O&M Statistics Data Model .................. 15
  6.1. Model for ALTO Logging and Fault Management .......... 14
  6.2. Model for ALTO-specific Performance Monitoring ....... 14
  7. Extension of ALTO O&M Data Model ............................. 16
  8. ALTO O&M YANG Module ......................................... 17
    8.1. The ietf-altomodule ........................................ 17
    8.2. The ietf-altostats Module ................................ 34
  9. Security Considerations ......................................... 39
  10. References ................................................................ 39
  11.1. Normative References ........................................ 40
  11.2. Informative References ....................................... 41
Appendix A. Example Module for Information Resource Creation
  A.1. Example Module for Information Resource Creation Algorithm 42
  Acknowledgements ................................................... 43
  Authors’ Addresses .................................................. 43

Exactly align with all the 7 basic requirements in order.

Put implementation-specific data model as an example in appendix.
The decision is to use identity to define data types.

- This allows the data types to be managed in a more modular way, and to guarantee backward compatibility.
- Future documents can define new data types by adding new identities in extension modules. Once a document becomes a standard, the new extension module will also be added to the standard IETF YANG module base.
WG has different opinions about whether to use an IANA-maintained module (e.g., iana-alto-types.yang):

- Support: IANA-maintained module can guarantee compatibility
- Not support: If not expect to have frequent changes, IANA-maintained module is overdesign
T1: Data Types in ALTO Related IANA Registries (Cont.)

- WG has different opinions about whether use an IANA-maintained module (e.g., iana-alto-types.yang):
  - Support: IANA-maintained module can guarantee compatibility
  - Not support: If not expect to have frequent changes, IANA-maintained module is overdesign

```
module1 (iana-alto-types@2022-10-24.yang)  Update to IANA registry
module0 (ietf-alto@2022-07-11.yang)       module2 (priv-alto-perf-metric.yang)

ALTO Server 1

ALTO Server 2
```

No need to update

Update to IANA registry
T2: Server-to-Server Communication

O&M data model to configure server-to-server communication requires the following functionalities:

- **T2.1: Configure how the server to be discovered by another server/client**
  - Status: ready

- **T2.2: Configure how the server to discover another server**
  - Status: in progress

- **T2.3: Configure how the server to communicate to a discovered server**
  - Status: not determined whether should be in the scope

For T2.1, the current data model provide predefined cases for server discovery learned from practical deployment but can be extended through augmentation:

- Reverse DNS: RFC8686
- IRR: RFC2622
- PeeringDB: [https://www.peeringdb.com/](https://www.peeringdb.com/)
T2: Server-to-Server Communication

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The model can also be extended by augmentation.

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Similar to T2.1, T2.2 provides common model for how to access an existing server discovery system.

Predefined server discovery systems are aligned with mechanism defined in `alto-server-discovery-grouping`.

The model can also be extended by augmentation.
T2: Server-to-Server Communication

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There are multiple potential solutions:

- C/S mode using ALTO
- C/S mode using other underlay protocols
- Peering mode using other underlay protocols

None of them has become the standard yet.

Implementation & Deployment updates will discuss more details.
T3: Connection between Data Sources and Algorithms

As suggested by RFC7285 (Sec 16.2.4), data sources and algorithms are two major components to be configured.

\[
\text{ALTO Information Resource} = \text{Algorithm}(\text{Data Source 1, Data Source 2, …})
\]

Configure how to use data

Configure how to get data

O&M: Provide basic, unified model to cover common configuration cases and configuration parameters
T3: Connection between Data Sources and Algorithms (cont.)

From implementation & deployment perspective:
- How to handle heterogeneous formats of data sources
- How to process data collected from data sources

From O&M perspective:
- How to handle heterogeneous mechanisms to access data sources
- How to correctly configure calling flows for information resource creation

<table>
<thead>
<tr>
<th>ALTO Protocol as Frontend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-network Information</td>
</tr>
<tr>
<td>Network Model Abstraction Layer</td>
</tr>
<tr>
<td>Control Plane</td>
</tr>
<tr>
<td>Data Plane: FIB</td>
</tr>
<tr>
<td>Data Plane: Sampling</td>
</tr>
</tbody>
</table>

A real deployment in https://alto.nrp-nautilus.io/directory/default (IRD):

```
λ kubectl get deployments | grep openalto
openalto-agent    1/1  1  1  2d23h
openalto-db       1/1  1  1  2d23h
openalto-frontend 1/1  1  1  2d23h
```
T3: Connection between Data Sources and Algorithms (cont.)

Mapping from O&M perspective to data model:

- **ALTO Protocol Frontend: Message Layer**
- **ALTO Protocol Backend: Algorithm Layer**
- **Aggregated Data Source: Backend Database with Conflict Resolution**
- **On-demand Data Source**
- **Polling Data Source**
- **Pub-sub Data Source**

O&M: Common information resource configuration (resource-id, resource-type, capabilities, used algorithm …)

O&M: Implementation-specific configuration parameters (used data sources, PID granularity, cost precision, …)

O&M: Configuration parameters for algorithms to access data sources (southbound protocol, update mechanism, conflict resolution, …)
T3: Connection between Data Sources and Algorithms (cont.)

A main lesson learned from real implementation & deployment: Different data sources may have conflicts.

- Special data source type: aggregated data source
  - An aggregated data source provides a unified data lookup API to other data sources
  - Conflict resolution policy can be configured to automatically resolve data source conflicts
  - An algorithm can decide whether to use an aggregated data source to resolve conflicts, or handle conflicts by itself.
A main lesson learned from real implementation & deployment:
Different data sources may have conflicts.

```
augment /alto:alto-server/alto:data-source
    /alto:source-params
  +--:(redis-db)
    +--rw redis-params
      +--rw host inet:host
      +--rw port inet:port-number
      +--rw db uint16
    +--rw inputs
      |   -> /alto:alto-server/data-source
      |     /source-id
    +--u conflict-resolver-grouping

  grouping conflict-resolver-grouping
    +-- (conflict-resolver)
      +--:(global-conflict-resolver)
        +-- global-priority* [source-id]
          +-- source-id
            |   -> /alto:alto-server/data-source
            |     /source-id
          +-- priority uint16
```
Next Step

- **Standard track**
  - Quickly fix YANG errors and submit a new version.
  - Finish T2.2 and T2.3 soon.
  - YANG doctor review and IESG review?

- **Deployment**
  - Fully implement O&M in OpenALTO by next IETF.
Backup
Implement ALTO O&M YANG modules in OpenALTO