Resource Attributes for ALTO Protocol
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Abstract

   This document extends the Application-Layer Traffic Optimization
   (ALTO) Protocol [RFC7285] by defining additional descriptive
   attributes for the resources offered by an ALTO Server.

Status of this Memo

   This Internet-Draft is submitted in full conformance with the
   provisions of BCP 78 and BCP 79.

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   This Internet-Draft will expire on April 11, 2015.

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1. Introduction

   In the ALTO Protocol [RFC7285], the Information Resource Directory
   (IRD) defines the resources, or services, offered by an ALTO server.
   An IRD contains one entry for each resource. Each entry provides the
   information a client needs to use that resource: the URI for the
   resource, the type of data the server returns, the type of data the
   client sends (if any), the identifiers of any resources on which this
   resource depends, and optional capabilities for the resource.

   However, resources have many additional attributes. For example, a
   Network Map resource maps PID (Provider-defined Identifier) names to
   network address prefixes. A small Network Map resource might define
   20 PIDs and a total of 100 prefixes, while a large Network Map might
   have 5,000 PIDs and 500,000 prefixes. A client might like to know
   the size of the Network Map before retrieving it, but the IRD gives
   no hint.

   Also, an ALTO server provided by an Internet Service Provider (ISP)
   might have detailed information for network addresses managed by that
   ISP, but only coarse information (or no information at all) for other
   network addresses. If an ALTO Client needs cost information for a
   particular network address, and the client knows about several
   different ALTO Servers, the client would prefer to use the ALTO
   Server with the best data for that address. But the IRD entries give
   no hint as to the best server; the client would have to try each
   server and guess as to which was the most accurate.

   This document defines a framework for declaring such attributes in
   IRD entries, and defines an initial set of attributes.

1.1. Attributes Versus Capabilities

   The ALTO Protocol already defines a "capabilities" section for IRD
   entries, so one alternative is simply to define additional
   capabilities. We prefer not to do that for several reasons:

   o Capabilities are always defined; the ALTO protocol either requires
      the IRD entry to specify a value, or else defines a default.
      Attributes are optional, and do not have defaults.

   o Capability names are defined by the ALTO protocol; adding a new
      capability requires a new RFC. Attribute names are managed by
      IANA, so new attributes can be added without extending the
      protocol.

   o A client can deduce attributes by using the resource.
      Capabilities cannot be deduced.

o Attribute values are approximate, and/or may change frequently.
   Capabilities are accurate, and should not change unless the
   resource is redefined. For example, if a Cost Map attribute says
   the map has 500 cost points, that means that was the size when the
   client retrieved the IRD. If the client retrieves the map a few
   minutes later, the size might be different. However, if a
   capability says a Cost Maps returns a "routingcost" cost metric,
   it is an error if the resource returns a "hopcount" instead.

2. Changes To ALTO Protocol

2.1. IRD Entries

   Resources attributes are defined by a new field, named "attributes",
   at the same level as the existing "uri" and "media-type" fields in
   IRD entries. That is, in [RFC7285] Sec. 9.2.2, IRDResourceEntry is
   revised as:

```
        object {
          JSONString       uri;
          JSONString       media-type;
          [JSONString      accepts;]
          [Capabilities    capabilities;]
          [ResourceID      uses<0..*>;]
          [Attributes      attributes;]      // Added
        } IRDResourceEntry;

        object {
          ...
        } Attributes;     // Added
```

   Here is an example of an IRD with attributes:

```
       ...
     "resources" : {
        "my-default-network-map" : {
           "uri" : "http://alto.example.com/networkmap",
           "media-type" : "application/alto-networkmap+json",
           "attributes" : {
              "pid-count-current" : 50,
              "prefix-count-current" : 150,
              "authoritative-prefixes" : {
                 "ipv4": [ "1.2.0.0/16", "3.4.0.0/16" ]
              },
              "authoritative-exclusions" : {
                 "ipv4": [ "1.2.1.0/25" ]
              }
           }
        },
        "numerical-routing-cost-map" : {
           "uri" : "http://alto.example.com/costmap/num/routingcost",
           "media-type" : "application/alto-costmap+json",
           "capabilities" : {
              "cost-type-names" : [ "num-routing" ]
           },
           "uses" : [ "my-default-network-map" ],
           "attributes" : {
              "cost-count-current" : 500,
              "cost-count-range" : [ 250, 750 ]
           }
        },
        ...
```

3. Resource Attributes

3.1. Attribute Names

An attribute name is encoded as a string. The string MUST be no more
than 32 characters, and it MUST NOT contain characters other than US-
ASCII alphanumeric characters (U+0030-U+0039, U+0041-U+005A, and
U+0061-U+007A), the hyphen ('-', U+002D), the colon (':', U+003A),
the low line ('_', U+005F), or the '.' separator (U+002E). The '.'
separator is reserved for future use and MUST NOT be used unless
specifically indicated by a companion or extension document.

Identifiers prefixed with "priv:" are reserved for Private Use
[RFC5226] without a need to register with IANA. All other
identifiers MUST be registered in the "ALTO Resource Attribute
Registry" (see Section 7). For an identifier with the "priv:"

prefix, an additional string (e.g., company identifier or random string) MUST follow (i.e., "priv:" only is not a valid identifier) to reduce potential collisions.

Section 3.3 defines an initial set of Resource Attributes.

3.2. Attribute Values

The type of an attribute value depends on the attribute. When registering an attribute with IANA, the JSON value type MUST be specfied.

3.3. Proposed Resource Attributes

We propose the following Resource Attributes:

pid-count-current:
     Resource type: Network Map
     Value type: JSON Number
     Semantics: The number of PIDs in the current Network Map.

prefix-count-current:
     Resource type: Network Map
     Value type: JSON Number
     Semantics: The total number of prefixes in the current Network Map.

pid-count-range:
     Resource type: Network Map
     Value type: JSON Array with two JSON Numbers
     Semantics: Low and high values for the number of PIDs in the Network Map. This range SHOULD cover the expected size of the map for the foreseeable future.

prefix-count-range:
     Resource type: Network Map
     Value type: JSON Array with two JSON Numbers
     Semantics: Low and high values for the total number of prefixes in the Network Map. This range SHOULD cover the expected size of the map for the foreseeable future.

authoritative-prefixes:
     Resource types: Network Map and Endpoint Cost Map
     Value type: A JSON Object of type NetworkMapData (Section 11.2.1.6 of [RFC7285])
     This resource is authoritative (see Section 3.4) for all endpoints which are covered by a prefix in this set, and which are not covered by a prefix in the "authoritative-exclusions"

        set.

    authoritative-exclusions:
        Resource types: Network Map and Endpoint Cost Map
        Value type: A JSON Object of type NetworkMapData (Section
        11.2.1.6 of [RFC7285])
        See the "authoritative-prefixes" resource, above.

    cost-count-current:
        Resource type: Cost Map
        Value type: JSON Number
        Semantics: The number of cost points in the current Cost Map.
        Note that although a Cost Map is an NxN matrix, where N is the
        number of PIDs, a Cost Map is not required to define a cost for
        every {source,destination} pair.

    cost-count-range
        Resource type: Cost Map
        Value type: JSON Array with two JSON Numbers
        Semantics: Low and high values for the total number of cost
        points in the Cost Map. This range SHOULD cover the expected
        size of the map for the foreseeable future.

3.4. Authoritative Endpoint Sets

   The set of endpoints defined by the "authoritative-prefixes" and
   "authoritative-exclusions" attributes are the endpoints for which a
   resource provides authoritative data. For an ALTO Server provided by
   an ISP, this will usually be the endpoints of the ISP's customers.

   While we do not rigorously define "authoritative", in general if a
   resource is authoritative for a set of endpoints, then:

   o No other ALTO Server has more accurate data for those endpoints.

   o The ALTO Server SHOULD fully specify the costs for those
      endpoints. That is, for every endpoint EA in the authoritative
      set and every other endpoint EX, the associated cost map
      service(s) SHOULD define the costs from EA to EX and from EX to
      EA.

   o PIDs covering endpoints in the authoritative set SHOULD be more
      detailed (smaller, finer-grained, etc.) than PIDs for other
      endpoints.

   We define the authoritative set with two sets of prefixes, one
   inclusive, the other exclusive, for the following reason. The most
   likely case is that an authoritative set represents the addresses of

an ISP's customers. In this case, the inclusive set would be the
prefixes that have been allocated to the ISP by the appropriate
authority. If customers have migrated to other ISPs and taken their
addresses, those prefixes form the exclusionary set. While the
exclusionary set is not necessary, it provides an efficient way to
represent a large block of addresses with a few exceptions. This
two-level model seems to be a good balance between efficiency and
simplicity.

4. Use Cases

   Here are brief descriptions of several ways in which clients can take
   advantage of Resource Attributes:

   o Advance knowledge of the size of a network or cost map allows an
      ALTO client to allocate sufficient space to hold the map, or to
      select the appropriate way to store it. For example, a Cost Map
      is an NxN matrix, where N is the number of PIDs. But it may be
      sparse. If the number of costs in the Cost Map is considerably
      less than the square of the number of PIDs in the associated
      Network Map, then the client knows in advance that the Cost Map is
      likely to be sparse, and can use a sparse matrix object. On the
      other hand, if the number of costs is close to the square of the
      number of PIDs, the client knows that there is no advantage in
      using sparse matrix techniques.

   o A client such as a P2P tracker can use the authoritative sets to
      select the appropriate ALTO Server. For example, suppose the
      tracker has obtained the IRDs for a number of ISP-maintained ALTO
      Servers. When a peer at address E asks the tracker for a set of
      peers, the tracker would locate the Network Map (or Endpoint Cost
      Service) whose authoritative set includes E. This will mostly be
      the ALTO Server for the requesting peer's ISP. The tracker uses
      that ALTO resource to evaluate costs between E and the other
      peers, and returns the peers with the lowest costs.

   o If an ALTO Server offers several different Network Maps, a client
      can use the network map size and/or authoritative sets to select
      the appropriate Network Map.

5. Alternatives And Discussion (Delete if draft is published)

   Here a few points for which I welcome discussion:

   o Can anyone suggest a better name than "attributes"? I considered
      "properties", but that conflicts with Endpoint Properties.

Another possibility is "meta", but we have overloaded that name.

o I don't like the term "authoritive" to describe the endpoints on
   which a Network Map is centered. However, I can't think of
   anything better, and it does seem to accurately reflect the
   intent. Can anyone suggest an alternative?

6. Security Considerations

   Because attributes should not provide any information which cannot be
   deduced from the data already provided by an ALTO Server, this
   extension does not introduce any security considerations not already
   present in the ALTO Protocol.

7. IANA Considerations

   This document defines a registry for ALTO Resource Attributes. When
   a new ALTO Resource Attribute is defined and accepted by the ALTO
   working group, requests for IANA registration MUST include the
   identifier, applicable resource type(s), JSON type and intended
   semantics.

   Section 3.3 defines the initial set of Resource Attributes.

8. References

   [RFC5226] Narten, T. and H. Alvestrand, "Guidelines for Writing an
              IANA Considerations Section in RFCs", RFC 5226, BCP 26,
              May 2008.

   [RFC7285] Almi, R., Penno, R., Yang, Y., Kiesel, S., Previdi, S.,
              Roome, W., Shalunov, S., and R. Woundy, "Application-Layer
              Traffic Optimization (ALTO) Protocol", RFC 7285,
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