ALTO Contextual Cost Values
draft-randriamasy-alto-cost-context-00

Abstract

   The Application-Layer Traffic Optimization (ALTO) Service has defined
   network and cost maps to provide basic network information, where the
   cost maps allow only one JSON value for a requested metric.

   This document introduces several protocol extensions to allow ALTO
   clients to support use cases such as context based connection
   selection in cellular networks and calendaring for unattended data.
   This document refers to other extension proposals posted in the ALTO
   WG that can support the present use cases as well. Likewise, some of
   the proposed extensions may serve other ALTO use cases.

Requirements Language

   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 RFC 2119 [RFC2119].

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1. Introduction

   The IETF ALTO protocol specified in [RFC7285] provides guidance to
   over the top applications which have to select one or several hosts
   or endpoints from a set of candidates that are able to provide a
   desired data resource, or which need some provider-centric insight on
   the cost of application paths to these endhosts. The ALTO Service
   has defined network and cost maps to provide basic network
   information, where the cost maps allow only one JSON value for a
   requested metric.

   This draft brings a use case where providing different values for a
   same cost metric can help in optimizing the application path
   selection. Typically, when an end host can connect to the network
   via multiple technologies or access points, the path performance for
   a metric may be accordingly impacted.

   The present draft proposes to extend the cost information specified
   in [RFC7285] by providing, for a same cost metric, several possible
   cost values. Which value to provide depends on qualitative criteria
   as opposed to quantitative criteria such as time. The purpose is to
   allow a finer grained decision on which application endpoint or sub
   network to access.

   Previous ALTO WG discussions have suggested to introduce "the ability
   to "name" cost maps so that a single Information Resource Directory
   can link multiple cost maps with the same cost type to a single
   network map." The goal was to provide, for a given cost metric,
   multiple cost values depending on qualitative conditions named
   "circumstance", where a circumstance reflects a given policy.

   For applications such as video download or streaming, a user
   equipment (UE) may use [RFC7285] to choose the best possible
   application resource location.

   Currently, the insight of ALTO information on the path between a UE
   and a connection node (or say Endpoint) does not provide details
   below IP hops. However the major QoE challenges of wireless network
   users arise in the access network, that is, in the first hop between
   the UE and its one or more serving packet data network gateway (PGW).
   The path of a UE to its serving PGW(s) impacts the path to the
   content and thus the related QoE. Therefore, it is necessary to
   inform the UE, which could take the appropriate decisions w.r.t. the

utilized access path. The access technology in current ALTO
documents is accounted at the content location (last hop) side by
distinguishing whether the requested content is located in a fixed or
a wireless access network, as described in
[draft-ietf-alto-deployment]

This document introduces several protocol extensions to allow ALTO
clients to support use cases such as context-based connection
selection in cellular networks and calendaring for unattended data.
This document refers to other extension proposals posted in the ALTO
WG that can support the present use cases as well. Likewise, some of
the proposed extensions may serve other ALTO use cases.

2. Use cases

This section presents motivating use cases for contextual ALTO Costs
with a focus on conditional RF costs in cellular networks. In these
2 use cases, a terminal UE is located in a LTE network and associated
to a "local" ALTO Server(LAOS) that covers this access network, say
up to the Packet Data Network (PDN) Gateway PGW and can itself
connect to another ALTO Server having a more global view covering up
to the whole ISP network. Such a deployment is proposed in section
Section 5 of this draft.

2.1. Use Case 1: conditional RF costs in cellular networks

Let's assume a terminal UE located in a cellular network. An ALTO
Client (LAOC) associated to the UE queries the local ALTO Server in
order to know via which cell it should connect to the network. So in
a first place, LAOC will query the connection cost associated to
cells C1,.. CK. This example assumes that this cost is a unitless
value abstracting a (RF) cost to a cell. Our example however
includes 2 additional considerations:

- the RF cost to a cell may be impacted by its load,

- a UE usually transmits a fair amount of "unattended data" (UD).

UD is considered in one of the key features for LTE enhancements in
Release 13 and defined in 3GPP TS22.101 as follows: "Unattended Data
Traffic : Data traffic of which the user is unaware he/she initiated,
e.g. based on the screen/keypad lock being activated, length of time
since the UE last received any input from the user, known type of app
(e.g. an application monitoring a user's health "mHealth" may need
its data never treated as Unattended Data Traffic.)". UD traffic is
often delay tolerant and it would be beneficial for the network if
the UE can schedule its transmission. To this end, the UE can use an
instant UD Indicator (UDI) sent by the LTE network. The UDI,

accepted for LTE Release 13 is a single bit sent to the UE indicating
whether UD in a cell is allowed (UDA) or not (UDNA). The status
change of a UDI from UDA to UDNA is presumably triggered when the
cell load exceeds a given threshold T(udna). The value of T(udna)
may change across cells and in time but is not provided to UEs. If
the UE had an ALTO calendar for either T(udna) or for the abstracted
cell load values, it could appropriately schedule the transmission of
its UD, that will have to occur anyway. The UE could combine this
calendar with the UDI it receives from the cellular network. The UDI
state may change within sub-seconds and impact the data exchange.
What is missing in the provided LTE information is:

- knowing whether the UDI threshold relates to downlink or uplink
congestion.

- knowing the level of congestion that triggers a change in UDI and
how it may evolve in time.

The UE thus can advatageously combine the non-real time ALTO
information with the real-time UDI provided by the LTE network. The
present draft illustrates how ALTO can fill these gaps with the
support of:

- ALTO Cost Calendars,

- the proposed protocol extension providing context-dependent ALTO
Cost values.

In this use case: ALTO calendars need to be requested via for the
ALTO Filtered Cost Map (FCM) Service, the context parameters
impacting the cost values are: "uda" (Unattended Data Allowed),
"udna" (Unattended Data Not Allowed), "uplink", "downlink".

2.2. Use case 2: access-aware endpoint selection

In a second use case, an end-system called UEP is located in a LTE
network and may connect via several access technologies, e.g.
Cellular or WiFi. UEP may also benefit from a given Service Level
Agreement SLA-m. Other parameters may characterize the UEP generated
traffic.

Currently the insight of ALTO information in the path between a UE
and a connection node (or say Endpoint) does not provide details
below IP hops. However the major QoE challenges of wireless network
users arise in the access network, that is, in the first hop between
the UE and its one or more serving packet data network gateway (PGW).
The path of a UE to its serving PGW(s) impacts the path to the
content and thus the related QoE. Therefore, it is necessary to

inform the UE, which could take the appropriate decisions w.r.t. the utilized access path. The access technology in current ALTO proposals is accounted at the content location (last hop) side by distinguishing whether the requested content is located in a fixed or a wireless access network, as described in [draft-ietf-alto-deployments] that states: "For ISPs with mobile network and fixed network, the traffic optimizing problems they focus will be optimizing the mobile traffic, except problems on last hop section."

For Mobile Network Operators (MNO) and their users, being connected via e.g. cellular or trusted Wifi can hugely impact the QoE and routing cost. Sometimes a 4G connection is preferable for users than a poor WiFi connection although potentially more expensive. Sometimes, MNOs have spare data resources or offer them for given SLAs. For both parties, access-aware Endpoint selection for Users is thus beneficial. One way to achieve this is that ALTO provides cost values depending on qualitative contextual parameters such as access technology and the access technology and SLA.

3. Required ALTO extensions

The aforementionned use cases can be supported with a few simple extensions to the ALTO protocol. A number of them have already been discussed in other WG drafts and use cases. The proposed extensions include:

- Cost value context: a capability to allow exposing several possible context-dependent values for one metric.

- Cost metrics, Network Maps and Cost Maps, PID properties for cellular and wireless networks: these topics would extend current proposals in the WG,

- Availability of Filtered Cost Map Service for ALTO Cost Calendars: the FCM Service for ALTO Cost Calendars will have to be specified in next versions of [draft-ietf-alto-cost-calendar] that is in progress.

- Extended input for the Filtered Cost Map Service: to allow the input to comprise several(source-array, destination-array) pairs, as it has been proposed in [draft-yang-alto-path-vector].

- Extensions to section 11.2.2 of [RFC7285] on mapping IP addresses to PIDs : one cellular network map design proposed in this draft requires the possibility to associate a UE to two PIDs .

4. Design options and examples

Similarly to Multi-Cost and Cost Calendar (
[draft-ietf-alto-cost-calendar]), this proposal does not introduce
new cost modes or new media-types. It ensures backwards
compatibility with legacy ALTO Clients, that is: "A legacy ALTO
Client must be able to send legacy requests to a Cost Context aware
ALTO Server and get legacy responses as specified in RFC7285".

"A Cost Context aware ALTO Server must be able to receive and process
requests sent by legacy ALTO Clients, as specified in RFC 7285".

Besides, the proposed extension is designed to be compatible with
Multi-Cost ALTO and ALTO Cost Calendars
([draft-ietf-alto-cost-calendar]).

In the present draft version, the IRD indicates the supported context
parameters as values encoded in JSON strings. The idea is that this
design simplifies the transactions, as it applies to context
attributes that take a limited number of values, say 1 to 5. Context
attributes taking numerous or unpredictible values should be handled
as values properties or metrics expressed in constraints.

4.1. Overview of cost context features

Cost context attributes are strings with values such as "wifi",
"cellular", "uda".

Cost context attributes are indicated in the IRD as capabilities of
an information resource. They are associated to cost type names.

4.1.1. Applicable ALTO services

Draft [draft-bertz-alto-mobilitynets] proposes to identify network
points of attachment (PoA) such as cells to PIDs, as PoAs are
endpoint types not currently supported in ALTO. The current proposal
is to represent cellular PIDs in an ALTO Network Map with no routes.
PID propeties as specified in [draft-roome-alto-unified-props-01]
could be used to indicate the Endpoint type of the PoA, together with
other properties.

Such an approach is suitable for properties with constant-like values
such as access type. However when ALTO is used to indicate
connection properties with changing values such as RF Cost
congestion, using Filtered Cost Maps is preferable.

4.2. Example IRD

   The purpose of ALTO is to guide the behavior of the end systems or
   applications without the need for networks to explicitely expose
   their performance values. In this example, the IRD does not expose
   the real load percentage of a cell to UE. Instead, it abstracts the
   cell congestion by a metric called 'RFcost' represented by a number
   between 0 and 100. The values of 'RFcost' are provided as a an ALTO
   Calendar as specified in [draft-ietf-alto-cost-calendar-00] in
   shorter time intervals. In addition they differ, depending on the
   the context values "uda" and "udna".

   Besides, the IRD provides metric 'routingcost' as a MUST specfied in
   [RFC7285], that may represent a more administrative or monetary
   access cost.

   The IRD could publish the capability of a resource to provide context
   dependent 'routingcost' values as expressed for resource "filtered-
   cost-calendar-map".

```
HTTP/1.1 200 OK
Content-Length: [TODO]
Content-Type: application/alto-directory+json

{
  "meta" : {
     "cost-types": {
        "num-routingcost": {
           "cost-mode"   : "numerical",
           "cost-metric" : "routingcost"
        },
        "num-RFcost": {
           "cost-mode"  : "numerical",
           "cost-metric": "RFcost",
        }
      }
      ... other meta ...
  },
  "resources" : {
        "filtered-cost-calendar-map" : {
        "uri" : "http://alto.local.example.com/costmap/filtered/calendar/
context",
        "media-types" : [ "application/alto-endpointcost+json" ],
        "accepts" : [ "application/alto-endpointcostparams+json" ],
             "capabilities" : {
           "cost-constraints" : true,
           "cost-type-names" : [ "num-routingcost",
                                 "num-RFcost"],// ++NEW
           "calendar-attributes" : [
              {"cost-type-names" : "num-routingcost",
               "time-interval-size" : "1 hour",
               "number-of-intervals" : 24}, // MAY ALSO BE SINGLE VALUE
               {"cost-type-names" : "num-RFcost", // ++NEW
               "time-interval-size" : "5 minute",
               "number-of-intervals" : 12}
           ],
           "cost-context" : [ // ++NEW
              {"cost-type-names" : "num-RFcost",
               "context-params" : ["uda", "udna", "uplink", "downlink"]
               }
             ] // ++NEW
           "uses": [ "my-default-network-map" ]
                 } // end ECM capab
     ... other resources ...
  } // end resources
} // end IRD
```

4.3. Use case 1: Example scenario for the FCM Service

We assume an example scenario where a UE has the choice to connect to
2 cells C1 and C2.

As suggested in [draft-bertz-alto-mobilitynets], we may represent the
cellular topology with an ALTO Network Map comprising PIDs
representing the cells and named "Cell1", "Cell2", ... "Celln". A
format for a cell identifier has been proposed in
[draft-rauschenbach-alto-wireless-access] and is not being discussed
here.

As a Network Map may cover a large number of cells, the Filtered Cost
Map Service can be used to reduce data exchange and get information
on a restricted number of cells, say PID1 and PID2.

We assume that the ALTO Client in the UE wants to get calendared
values for ALTO metric "RFcost" in order to appropriately schedule
its unattended data transmission. The ALTO information resource
'ALTO Calendar' provides an array of time-dependent cost values and
is being specified in [draft-ietf-alto-cost-calendar]. In addition,
the ALTO Client wants these values for both the "uda" and "udna"
context. Last, we assume that the UE needs the Cost values for both
the uplink (UE to Cell-k) and downlink (Cell-k to UE) directions. We
assume that the UE is located in the PID called "Cell1".

In this scenario, C1 is limited by its uplink capacity, C2 is limited
by its downlink capacity. ALTO can be used to convey the following
information:

At time interval T1 of the next Calendar:

- if C1 indicates "unattended data allowed" the downlink RF cost is
20, and the uplink RF cost is 70

- if C1 indicates "unattended data NOT allowed", the downlink RF cost
is 20, and the uplink RF cost is 90

- if C2 indicates "unattended data allowed" the downlink RF cost is
70, and the uplink RF cost is 20

- if C2 indicates "unattended data NOT allowed", the downlink RF cost
is 90, in the uplink RF cost is 20.

The ALTO Calendar provides values for the other 11 time intervals Ti.

4.4. Design option1: uniform Network Map with cells as PIDs

In this design, the cellular topology is represented with an ALTO
Network Map comprising PIDs named "Cell1", "Cell2", ... "Celln". The
UE is located in one of these PIDs. A Cost Map is associated to this
Network Map and conveys metrics indicated in the IRD. The Cost Map
is requested to convey connection costs between firstly the UE to its
serving cell (that is the PID to itself) and secondly the UE and
neighboring cells (that is the PID to another one) and last, for both
uplink and downlink directions.

The ALTO Server can regularly update the Cost Map and send filtered
information to the ALTO Client. The proposed IRD design announces
additional context attributes "uplink", "downlink". In this case and
other potential cases, the context parameters need to be arranged
w.r.t. their possible combinations (to be further specified in the
IRD). For example, the IRD may announce that costs are provided for
contexts "uda" and "udna" and this in both contexts "uplink" and
"downlink". Or that costs are provided for contexts "uplink" and
"downlink" and this in both contexts "udna" and "uda". In such a
case, the IRD capability member may list the possible combinations in
the capabilities as follows:

```
"cost-context" : [ // ++NEW
   { "cost-type-names" : "num-RFcost",
     "context-params"[["uda", "uplink"],
                      ["uda", "downlink"],
                      ["udna", "uplink"],
                      ["udna", "downlink"]] // ++NEW
   }
  ]
```

This arrangement indicates that for the metric named "num-RFcost",
the ALTO Server can provide 4 different values: v1 for ["uda" AND
"uplink"], ... v4 for ["udna" AND "downlink"].

4.4.1. Uniform Network Map: FCM Request for contextual 'RFcost'

The ALTO Client can specify the desired cost value context parameters
in the request input. In particular, it can select one or more
combinations indicated in the IRD. Its input parameter "cost-
context-params" is an array of all the desired combinations. In this
example, the ALTO Client wants 4 values corresponding to the
combinations.

```
POST /costmap/filtered/calendar/context HTTP/1.1
Host: alto.example.com
Accept: application/alto-costmap+json,application/alto-error+json
Content-Type: application/alto-costmapfilter+json
Content-Length: ###

{
  "cost-type" : { "cost-mode": "numerical", "cost-metric": "RFcost"},
  "calendared" : true,
  "context-params" : [["uda", "uplink"],
                      ["uda", "downlink"],
                      ["udna", "uplink"],
                      ["udna", "downlink"]], // ++NEW
  "pids" : [
    {"srcs" : [ "Cell1"], "dsts" : [ "Cell1", "Cell2"]},
    {"srcs" : [ "Cell2"], "dsts" : [ "Cell1", "Cell2"]}
  ]
}
```

4.4.2. Uniform Network Map: FCM Response for contextual RFcost

The ALTO response provides, for each requested ("src", "dest") pair,
a calendar of 12 JSON values, where each value corresponds to an
arrangement specified in the "meta" of the ALTO response.

```
HTTP/1.1 200 OK
Content-Type: application/alto-costmap+json
Content-Length: ###

{
  "meta" : {
    "dependent-vtags" : [
      {"resource-id": "my-default-network-map",
       "tag": "3ee2cb7e8d63d9fab71b9b34cbf764436315542e"
      }
    ],
    "cost-type" : {"cost-mode": "numerical", "cost-metric": "RFcost"},
    "calendar-response-attributes" :
       { "calendar-start-time" : Tue, 1 Sept 2016 13:00:00 GMT,
         "time-interval-size" : "5 minute",
         "numb-intervals" : 12},
         "context-params" : [["uda", "uplink"],
                              ["uda", "downlink"],
                              ["udna", "uplink"],
                              ["udna", "downlink"]] // ++NEW
  } // end meta
  "cost-map" : {
    "Cell1": { "Cell1": [[70, 20, 90, 20], ... ,[50, 20, 70, 20]],     // ++NEW
    "Cell2": { "Cell2": [[20, 70, 20, 90], ... ,[20, 50, 20, 70]]      // ++NEW
  }
}
```

4.5. Design option2 Mixed Network Map: with cells as PIDs and UE as a dummy PID

   In this design, PIDs represents cells hosting several UEs and one of
   them is a dummy PID hosting a single UE, namely the one on behalf of
   which the ALTO Client requests a Calendar. Let's assume this PID is
   named "UE".

   The advantage of this design is that PID UE enables distiguishing
   costs in the uplink and downlink directions and thus spares the usage
   of the "uplink" and "downlink" context attributes. Indeed, ALTO
   provides directed path costs, so the values are implicitly provided
   for both the uplink (UE to Cell-k) and downlink (Cell-k to UE)
   directions. This design requires to extend section {11.2.2} of
   [RFC7285] with the possibility single addresses or other Endpoint
   identifiers to be mapped to several PIDs (2 in our case).

4.5.1. Mixed Network Map: FCM Request for contextual 'RFcost'

   It is no more necessary for the ALTO Client to list ALTO cost context
   parameter "uplink" and "downlink" in the request input. Its input
   parameter "cost-context-params" is an array of all the desired
   combinations, where a combination can be a single parameter. In this
   example, the ALTO Client wants 2 values corresponding to the context
   parameters "uda" and "udna".

```
POST /costmap/filtered/calendar/context HTTP/1.1
Host: alto.example.com
Accept: application/alto-costmap+json,application/alto-error+json
Content-Type: application/alto-costmapfilter+json
Content-Length: ###

{
  "cost-type" : { "cost-mode": "numerical", "cost-metric": "RFcost"},
  "calendared" : true,
  "context-params" : ["uda", "udna"], // ++NEW
  "pids" : [
    {"srcs" : [ "UE"], "dsts" : [ "Cell1", "Cell2"]},
    {"srcs" : [ "Cell1"], "dsts" : [ "UE"]},
    {"srcs" : [ "Cell2"], "dsts" : [ "UE"]}
  ]
}
```

4.5.2. FCM Response for contextual RFcost

   The ALTO response provides for each requested ("src", "dest") pair a
   calendar or 12 pairs of values, where each value of the pair
   corresponds to respectively "uda" and "udna".

```
  HTTP/1.1 200 OK
  Content-Type: application/alto-costmap+json
  Content-Length: ###

  {
    "meta" : {
      "dependent-vtags" : [
        {"resource-id": "my-default-network-map",
         "tag": "3ee2cb7e8d63d9fab71b9b34cbf764436315542e"
        }
      ],
      "cost-type" : {"cost-mode": "numerical", "cost-metric": "RFcost"},
      "calendar-response-attributes" :
         { "calendar-start-time" : Tue, 1 Sept 2016 13:00:00 GMT,
           "time-interval-size" : "5 minute",
           "numb-intervals" : 12},
      "context-params" : ["uda", "udna"] // ++NEW
    }
    "cost-map" : {
      "UE": { "Cell1": [[70, 90], ... ,[50, 70]],      // ++NEW
              "Cell2": [[20, 20], ... ,[40, 60]] },    // ++NEW
      "Cell1": { "UE": [[20, 20], ... ,[20, 20]] },    // ++NEW
      "Cell2": { "UE": [[70, 90], ... ,[40, 60]] }     // ++NEW
    }
  }
```

4.6. Use case 2: example ALTO transactions for the ECS

   In this use case, the UE requests the ECS to a local ALTO server for
   the routingcost to the PGW and wants the metric values varying w.r.t.
   the "access-type" and "SLA-id". Note that the "context" related
   design feature can be easily transposed for the Cost Map Service.

4.6.1. Use case 2: Example IRD

   In this example the ALTO Server indicates in its IRD to provide
   endpoint cost maps for metrics "routingcost" and "bandwidthscore".
   Values for metric "routingcost" are provides w.r.t. contextual
   attributes. The ALTO Client may query values for metric
   "routingcost" for either of these parameters or both. In this
   example, the context dependent values are provided for metrics
   otherwise provided as single values as specified in [RFC7285]

```
      "resources" : {
         "filtered-cost-calendar-map" : {
         "uri" : "http://alto.local.example.com/endpointcostmap/lookup/
context",
         "media-types" : [ "application/alto-endpointcost+json" ],
         "accepts" : [ "application/alto-endpointcostparams+json" ],
               "capabilities" : {
            "cost-constraints" : true,
            "cost-type-names" : [ "num-routingcost",
                                  "num-bandwidthscore"],
            "cost-context" : [// ++NEW
              {"cost-type-names" : "num-routingcost",
               "context-params" : ["cell", "wifi", "lan",
                                   "SLA-1", "SLA-2", "SLA-3"]
               } // ++NEW
              ]
                  } // end ECM capab
      ... other resources ...
   } // end resources
```

4.6.2. Use case 2: example ECS request

Example ECS request between 2 endpoints

```
      POST /endpointcost/lookup/context HTTP/1.1
      Host: alto.local.example.com
      Content-Length: [TODO]
      Content-Type: application/alto-endpointcostparams+json
      Accept: application/alto-endpointcost+json,application/alto-error+json

  {
    "cost-type" : {"cost-mode" : "numerical", "cost-metric" : "routingcost"},
    "context-params" : ["cell", "wifi", "SLA-3"],
    "endpoints" : {
      "srcs": [ "ipv4:192.0.2.2" ],
      "dsts": [
        "ipv4:192.0.2.89",
        "ipv6:2000::1:2345:6789:abcd"
      ]
    }
  }
```

4.6.3. Use case 2: example ECS response

```
        HTTP/1.1 200 OK
 Content-Length: [TODO]
 Content-Type: application/alto-endpointcost+json

 {
   "meta" : {
     "cost-type" : {"cost-mode" : "numerical", "cost-metric" : "routingcost"},
     "context-params" : ["cell", "wifi", "SLA-3"]
     } // end meta

     "endpoint-cost-map" : {
       "ipv4:192.0.2.2": {
         "ipv4:192.0.2.89"    : [10, 4, "SLA-3"],
         "ipv6:2000::1:2345:6789:abcd" : [4, 6, "SLA-3"]
       }
     }
 }
```

5. Deployment case: local ALTO Server cascaded with global ALTO Server

To maintain scalability, the initial assumption was that the ALTO
coverage network zone is decomposed in one local ALTO Server part
covering a restricted local network zone, for instance within the
first IP hop range and the other part covering the rest of the ISP
network, similarly to what is proposed in [draft-ietf-alto-
deployments]. The local ALTO server may thus include the guidance
given by the ISP ALTO server and compose both views in its replies to
its ALTO clients. Recent ALTO WG discussions open the possibility
for one IRD to indicate multiple network maps having different levels
of detail.

5.1. Cascaded ALTO Servers with one network map each

In the "cascaded" use case, the ALTO Service is preferably
distributed among two ALTO Servers as follows:

The ALTO Client serving the UE is referred to as the LAOC and can be
located either in the UE or in the network.

1. A Local ALTO Server (LAOS)

    * Hosts the information on the local EPS network, covering the
       paths between e.g. the UEs and the cells or the PGWs,

    * Hosts an ALTO Client that sends an ALTO request to a "global"
       ALTO Server, covering the zone beyond the PGW. It can

possibly get the global Server updates using the extensions
specified in [draft-ietf-alto-incr-update-sse].

* receives the ALTO request issued by the ALTO Client associated
to the UE.

2. a "core" ALTO Server covers the whole ISP network view, as it
would if the "local ALTO Service" is not available or
deactivated.

6. IANA Considerations

This document makes no request of IANA.

Note to RFC Editor: this section may be removed on publication as an
RFC.

7. Security Considerations

8. Acknowledgements

9. References

9.1. Normative References

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Appendix A. An Appendix

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