Protocol extension proposal
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Use case 1

(1) Get ALTO PID Costs Calendar on cells

Local ALTO SERVER

(1.5) Get ALTO info on endpoints

Delay-tolerant application server

WAN ALTO SERVER

ALTO Client

UE

App

AEP2

AEP3

Cell 1

Cell 2

AEP1

« Simple » ALTO Cost Calendar

5 1 3 2 5

Other network information eg LTE release 13 may instantly indicate whether unattended data transmission is allowed or not.

➔ UE may do finer grained transmission/connection decisions

UDI= Unattended Data Indicator

UE wants to know when to connect wrt cellular load sensitive « RF costs »
Example: context_param = [uda, udna]

UDI aware ALTO Calendar

Example: context_param = [uda, udna]

- UDA = Unattended Data Allowed
  - Indicates good connection
- UDNA = Unattended Data Not Allowed
  - Indicates poor connection

ALTO Calendar attributes
- Nb time intervals: 5
- Time interval length: 1-5 minutes

ALTO Calendar values = NON REAL TIME
UDI = REAL TIME provided by network

Example
- UDI sent every 1 msec:
  = UDA when RFCost >= 3
  = UDNA otherwise

- ALTO Calendar attributes
  - Nb time intervals: 5
  - Time interval length: 1-5 minutes

Problem
- Cumbersome to define a metric associated to context C1, C2, ... CN
- Request input may be too heavy
- Not affordable to get N cost maps
Use case 2

ALTO Client wants Cost Maps with values depending on different policies
- Discussion launched in 2012 for CDN applications
- Cost Maps for CDN can be voluminous

Use case 3

ALTO Client wants Cost Maps with values depending on different policies
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PROBLEM for cases 2 and 3
- Cumbersome to define a metric associated to context C1, C2, ... CN
- Request input may be too heavy
- Not affordable to get N cost maps
Proposal

• **Extend cost information specified in [RFC7285] by**
  • providing, *for a same cost metric, several possible cost values*
  • where each value depends on *qualitative* criteria as opposed to quantitative criteria such as time.

• **Approach:** introduce member “cost-context"
  • in IRD resource capabilities + “meta” of ALTO queries and responses
  • “cost-context“ has members
    • “cost-type-names” in IRD
    • “context-params” = [[P1, P2, ... ] AND [CA, CB, ...]]., list of possible parameter combinations

• **Thus allowing for example**
  • **Ex 1:** get an ALTO calendar of cellular connection costs
    • In the uplink and downlink directions AND
    • Depending on whether unattended data is allowed or not.
  • **Ex 2:** getting "routingcost" values
    • In the case of cellular and wifi access type AND
    • In case of “SLA3”
  • **Ex 3:** get Cost Maps with values for policy, Pa, Ph, Pw, ...

Applicable ALTO Services:
• Filtered Cost Map
• Endpoint Cost Service
Example IRD

```
"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" ],
        "calendar-attributes" : [ {
            "cost-type-names" : "num-routingcost",
            "time-interval-size" : "1 hour",
            "number-of-intervals" : 24,
        }, {
            "cost-type-names" : "num-RFcost",
            "time-interval-size" : "5 minute",
            "number-of-intervals" : 12
        } ],
        "cost-context" : [ { "cost-type-names" : "num-RFcost",
            "context-params" : [{ "uda", "udna" }, { "uplink", "downlink" }] } // multiple occurrences ignored
    }
}
```

ALTO Client may pick e.g.
(uda AND uplink) OR (udna AND downlink)

AND-combination

OR-combination
Example use case 1: request and response

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"]],
  "pids" : [
    {"srcs" : [ "Cell1"], "dsts" : [ "Cell1", "Cell2"],
     {"srcs" : [ "Cell2"], "dsts" : [ "Cell1", "Cell2"]}
  ]
}

All context-param combinations selected

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" : [["upa", "uplink"], // ++NEW
      ["udn", "downlink"],
      ["udn", "uplink"],
      ["upa", "downlink"]]
  } // end meta

"cost-map" : {
  "Cell1": { "Cell1" : [[70, 20, 90, 20], ...,[50, 20, 70, 20]],
   "Cell2": { "Cell2" : [[20, 70, 20, 90], ...,[20, 50, 20, 70]]
  }
}

Example use case 2: IRD and response

```
"resources" : {
    "filtered-cost-calendar-map" : { 
        "uri" : "http://###/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"] ]
              } ]
    } // end ECM capab
} // end resources

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"] ]
    }
} "endpoint-cost-map" : { 
    "ipv4:192.0.2.2" : { 
        "ipv4:192.0.2.89" : [10, 4],
    }
} } // end ECM capab
... other resources ...
// end resources

Array of 2 context-based values:
[ cell AND sla, wifi AND sla ]

If Client requests 2 combos:
- « cell » AND « SLA-3 »,
- « wifi » AND « SLA-3 »
Required ALTO extensions for use cases in draft

• Cost value context parameters: a capability to allow exposing several possible context-dependent values for one metric,
  • Focus of this draft

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

• Cost metrics for cellular and wireless networks: these features would extend current proposals in the WG,
  • could be added to [draft-ietf-alto-performance-metrics]

• For cellular and wireless networks: entities with associated address space and properties
  • could be added to [draft-roome-alto-unified-props]
Design principles & choices

• Keep backwards compatibility wrt RFC7285
• No new media type
• Logically combines several sets of context parameters, moderating thus the set of conveyed parameters combinations and metrics
• Design option for cellular networks is to map a cell to a PID
  • Connection costs within a cell C1 mapped to say PID1 are conveyed as a PID1 to PID1 cost
Next steps

- Correct IRD example
- Rules to arrange logical combinations of context params
- Examples for the EP property service
- Collect WG feedback on this proposal
  - Adopt extension supporting Cost/Property Context Parameters ?
  - Opinion on the design ?
  - Suggestions ?
Thank you

Back-up follows
ALTO Cost Context overview

• Resumes previous discussions and proposals
  • Discussion in 2012 on how to get Cost Map K associated to policy Y

• Applicable to many network types

• Use cases in this draft: in cellular and wireless networks.
  • assumes the availability of cellular cost metrics and associated namespace.

• Allows finer grained decisions

• To avoid defining as many metrics as context parameters
  • Instead of: cost_policyA, ... cost_policyT, CCost uda, Ccost_udna, ...
  • ➔ cost_policy[pA, ... pT], Ccost[uda, udna]

• Avoid heavy request input, e.g.

• Applicable ALTO services
  • Filtered Cost Map service, Endpoint Property Service