ALTO Extension: Path Vector

draft-yang-alto-path-vector-04

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IETF 98
March 31, 2017
Overview

• Draft goal: address the network graph milestone

• Status at the last IETF
  • Three key remaining issues and potential design choices for each, but no choices were made

• Progress made after last IETF
  • Investigated the design choices, and made design choice for each
Recall: Three Key Remaining Issues at IETF 96

- **Issue 1**: How to encode path vector (PV) in cost maps?
- **Issue 2**: What is the query format?
- **Issue 3**: How to provide PV network element properties (nep)?

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Design Choice Made

- **Issue 1**: How to encode path vector (PV) in cost maps?
- **Issue 2**: What is the query format?
- **Issue 3**: How to provide PV network element properties (nep)?

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Detail: Design Choice for Issue 1 (Encode Path Vector)

- **Introduce new cost type:**
  "cost-mode": "path-vector"
  "cost-metric": "ane"

- **Introduce new cost-metric "ane":** an abstract network element, which can be a device, an aggregation of network links...

- **Make cost into an array (i.e., path vector):** each cost value (in Cost Maps and Endpoint Cost Maps) is a JSONArray of abstract network elements, e.g.,

```java
object {
    CostMapData cost-map;
} InfoResourceCostMap : ResponseEntityBase;
object-map {
    PIDName -> DstCosts;
} CostMapData;
object-map {
    PIDName -> JSONValue; // allowed to be an array of ane names
} DstCosts;
```

**Example:** ["ane:L001", "ane:L002", "ane:L003", ...]
Detail: Design Choice for Issue 2 (Query Format)

- Still support legacy FCM/ECS query format

```json
object {
  CostType cost-type;
  [JSONString constraints<0..*>;]
  [PIDFilter pids;]
} ReqFilteredCostMap;

object {
  PIDName srcs<0..*>;
  PIDName dsts<0..*>;
} PIDFilter;
```

- Comment: cross-product query is limited
Detail: Design Choice for Issue 2 (Query Format)

- Introduce a new field for flows (no new media type), e.g.,

```plaintext
object {
    CostType cost-type;
    [JSONString constraints<0..*>;]
    [PIDFilter pids;]
    [PIDFlowFilter pid-flows<1..*>;]
} ReqFilteredCostMap;
```

```plaintext
object {
    PIDName srcs<0..*>;
    PIDName dsts<0..*>;
} PIDFilter;
```

- Comment: acceptable backward compatibility.
Detail: Issue 3 (Provide PV Element Properties)

Decided to not use inline mode:
Inline mode: embedded in the same cost map/endpoint cost map

// Example of filtered cost map resource entry
"filtered-cost-map": {
  "capabilities": {
    "cost-type-names": ["pv-ane"],
    "prop-types": ["delay"]
  }
}

// Example of filtered cost map response
{
  "cost-map":{
    "PID1": {"PID2": ["ane:L001", "ane:L002"], ……} ……
  }
  "nep-map": {
    "ane:L001": {"delay": "10"},
    "ane:L002": {"delay": "30"} ……
  }
}

Limitations:
• Capabilities field depends on value of cost-type
• Need a new FCM/ECS response format
Detail: Design Choice for Issue 3 (Provide PV Element Properties)

Reference Mode:

// Resource 1: Resource providing path vector
"pv-map1" : {
    "media-type" : "application/alto-costmap+json",
    "accepts" : "application/alto-costmapfilter+json",
    "capabilities" : {
        "cost-type-names": ["pv-cost-type"]
    },
    "uses": [ "my-default-network-map"],
}

// Resource 2: Resource providing network element property
"nep-map1": {
    "media-type": "application/alto-propmap+json",
    "capabilities": {
        "domain-types": ["ane"],
        "prop-types": ["delay"]
    }
    ...
}

// Resource 3: Resource providing network element property
"nep-map2": {
    "media-type": "application/alto-propmap+json",
    "capabilities": {
        "domain-types": ["ane"],
        "prop-types": ["bandwidth"]
    }
    ...
}

Requirements:
1. Client needs to know which nep-map to get the ane properties of a response
2. Since response can depend on query, the set of ane’s can be dynamically generated. Hence need to handle query specific ane’s.
Detail: Design Choice for Issue 3 (Provide PV Element Properties)

Reference Mode:

// Resource 1: Resource providing path vector
"pv-map1" : {
    "media-type" : "application/alto-costmap+json",
    "accepts" : "application/alto-costmapfilter+json",
    "capabilities" : {
        "cost-type-names": ["pv-cost-type"]
    },
    "uses": [ "my-default-network-map" ],
    "propertymap": "nep-map1"
}

// Resource 2: Resource providing network element property
"nep-map1": {
    "media-type": "application/alto-propmap+json",
    "capabilities": {
        "domain-types": ["ane"],
        "prop-types": ["delay"]
    }
    ...
}

// Resource 3: Resource providing network element property
"nep-map2": {
    "media-type": "application/alto-propmap+json",
    "capabilities": {
        "domain-types": ["ane"],
        "prop-types": ["delay", "bandwidth"]
    }
    ...
}

Requirements:
1. Client needs to know which nep-map to get the ane properties of a response
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Detail: Design Choice for Issue 3 (Provide PV Element Properties)

- PV-map1 query & response

```
// pv-map1 request:
{  
  "cost-type": {  
    "cost-mode": "path-vector",  
    "cost-metric": "ane"  
  },  
  "pids": {  
    "srcs": ["PID1", "PID3"],  
    "dsts": ["PID2", "PID4"]  
  }  
}
// pv-map1 response:
{  
  "meta": {  
    "vtag": [{  
      "resource-id": "pv-map1",  
      "tag": "<sha256>",  
      "query-id": "query_0"  
    }],  
    "dependent-vtags": [{  
      "resource-id": "default-network-map",  
      "tag": "<sha256>"  
    }],  
    "cost-type": {  
      "cost-mode": "path-vector",  
      "cost-metric": "ane"  
    }  
  },  
  "cost-map": {  
    "PID1": {"PID2": ["ane:L01", "ane:L02"],  
              "PID4": ["ane:L01", "ane:L03"]},  
    "PID3": {"PID2": ["ane:L04", "ane:L02"],  
              "PID4": ["ane:L05", "ane:L03"]}
  }
}
```

- nep-map1 query & response

```
// nep-map1 request:
{  
  "query-id": "query_0",  
  "entities": ["ane:L01", "ane:L02", "ane:L03", "ane:L04",  
               "ane:L05"],  
  "properties": ["availbw"]
}
// nep-map1 response:
{  
  "property-map": {  
    "ane:L01": {"availbw": "30"},  
    "ane:L02": {"availbw": "40"},  
    "ane:L03": {"availbw": "50"},  
    "ane:L04": {"availbw": "40"},  
    "ane:L05": {"availbw": "70"}
  }
```

Introduce query ID
Other Considerations

• Compatibility with multi-cost
  – Path Vector is not a testable cost type: path vector MUST NOT be included in testable-cost-type-names or testable-cost-types.
  – Fields "constraints" and "or-constraints" on path vector SHOULD be regarded as error.

• Time-to-live (TTL)
  – Query specific ane’s can consume resources when cached. Need a TTL to remove outdated entries.
Discussion

- Cost calendar for PV:
  - Calendar for FCM/ECS
  - Calendar for property map

- Snapshot and real-time update: query specific ane properties are likely to be snapshot, and hence no longer updates in realtime.

```json
query of FCM/ECS

return FCM/ECS response & generate nep-map with query-id info

query of nep-map with query-id

return nep-map response with query-id

Time1: "ane:L001": {"delay": "10"}

Time2: "ane:L001": {"delay": "30"}
```
Summary

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• Status at the last IETF
  • Three key remaining issues and potential design choices for each, but no choices were made

• Good progress made after last IETF
  • Investigated the design choices, and made design choice for each
Q & A

Thanks