Multiple ALTO Resources Query

draft-zhang-alto-multipart-00

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Motivation

- A lot of use cases require to query multiple ALTO information resources in a single request for some reasons:
  - Efficiency
  - Consistency
  - Relational Query
- This document lists three potential use cases:
  - Simple Batch Query
  - Properties Constrained Query
  - Path Vector Query (from draft-ietf-alto-path-vector)

Additional Requirements

- The base ALTO protocol cannot work in these cases. To make them work, there are some additional requirements raised:
  - Req 1: New response schema: multiple resources in a single response entry.
  - Req 2: General query schema to filter arbitrary ALTO information resource.
  - Req 3: Relational query amongst multiple ALTO information resources.

Roadmap

- This document propose a new ALTO service called ALTO "Multipart Query" service to fit these requirements.
- The overview of the techniques adopted to address each requirement:
  - Req 1 -> HTTP "multipart/related" message
  - Req 2 -> Unified request format
  - Req 3 -> General-purpose query languages, e.g., XQuery, JSONiq, etc.

HTTP "multipart/related" Message

- The response of a Multipart Query service is an HTTP message with the "multipart/related" content-type.
- Example:

```
Content-Type: multipart/related; boundary=query-boundary

--query-boundary
Content-Type: <content-type of resource 1>

<response data entry of resource 1>

... response for resource 2 – n-1 ...

--query-boundary
Content-Type: <content-type of resource n>

<response data entry of resource n>
```

Unified Request Format

- The request format of a Multipart Query service is independent from any ALTO information resource
- Request Format:

```
object {
  ResourceQuery    resources<1..*>;
  [JsonString      query-lang;]
} ReqMultipartQuery;

object {
  JsonString       resource-id;
  [JsonValue       input;] // POST-mode required
} ResourceQuery;
```

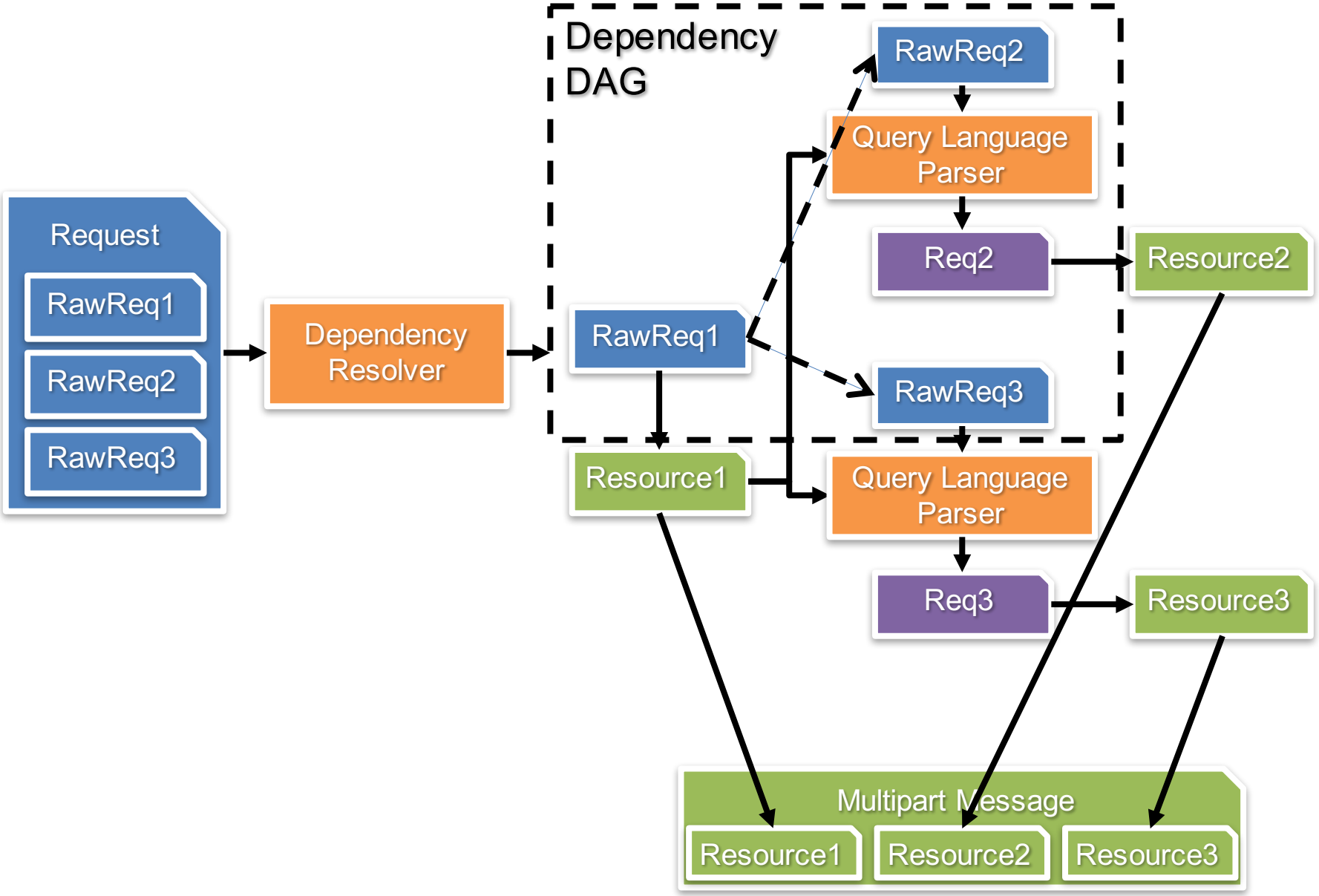
- The "input" field is extended and can support the input parameters of any ALTO information resource.

General-purpose query languages

- The request of a Multipart Query service can support program written in general-purpose query languages.
  - The value of "input" field can be a query program.
  - The result of the query program is the input parameters for a requested ALTO information resource.
  - The query program can use the response data of another requested ALTO information resource.
- Example:

```
{ "query-lang": "jsoniq",
  "resources": [
    { "resource-id": "propmap-location" }, // GET-mode for resource_0
    { "resource-id": "my-default-costmap", // POST-mode for resource_1
      "input": `let $propmap := collection("propmap-location")
.("property-map") // Read response of resource_0 into a variable
        return { ... Construct Input Parameters ... }` } ] }
```

Logical Workflow inside the Server



A Comprehensive Example

```
POST /multipart HTTP/1.1
Host: alto.example.com
Accept: multipart/related, application/alto-error+json
Content-Lenght: ###
Content-Type: application/alto-multipartquery+json

{
  "query-lang": "jsoniq",
  "resources": [
    {
      "resource-id": "endpoint-path-vector",
      "input": {
        "cost-type": {
          "cost-mode": "array",
          "cost-metric": "ane-path"
        },
        "endpoints": {
          "srcs": [ "ipv4:192.0.2.2" ],
          "dsts": [ "ipv4:192.0.2.89",
                    "ipv4:203.0.113.45" ]
        }
      }
    },
    {
      "resource-id": "propmap-availbw",
      "input": `
        let $propmap :=
            collection("endpiont-path-vector")
                      .("endpoint-cost-map")
        return {
          "entities": [
            distinct-values(flatten(
              for $src in keys($propmap)
              let $dsts := $propmap.$src
              return flatten(
                for $dst in keys($dsts)
                return $dsts.$dst
              )
            ))
          ],
          "properties": [ "availbw" ]
        }
      `
    }
  ]
}
```

A Comprehensive Example

```
HTTP/1.1 200 OK
Content-Length: ###
Content-Type: multipart/related; boundary=path-
vector-query

--path-vector-query
Content-Type: application/alto-endpointcost+json

{
  "meta": {
    "cost-type": {
      "cost-mode": "array",
      "cost-metric": "ane-path"
    }
  },
  "endpoint-cost-map": {
    "ipv4:192.0.2.2": {
      "ipv4:192.0.2.89":   [ "ane:L001",
"ane:L003", "ane:L004" ],
      "ipv4:203.0.113.45": [ "ane:L001",
"ane:L004", "ane:L005" ],
      "ipv6:2001:db8::10": [ "ane:L001",
"ane:L005", "ane:L007" ]
    }
  }
}

--path-vector-query
Content-Type: application/alto-propmap+json

{
  "property-map": {
    "ane:L001": { "availbw": 50 },
    "ane:L003": { "availbw": 48 },
    "ane:L004": { "availbw": 55 },
    "ane:L005": { "availbw": 60 },
    "ane:L007": { "availbw": 35 }
  }
}
```

Remaining Issues

- Is it general enough for potential use cases?
  - Current relational query is a Pipeline/DAG
  - Can we achieve general relational query, e.g., "join" operator for relational database. Do we need this?
- Implementation complexity to support query languages.
- Security considerations to support query languages.
- Error handling:
  - How about the query program execution failed?
  - How about the query program result has pre-defined ALTO errors, e.g., E_SYNTAX, E_MISSING_FIELD, E_INVALID_FIELD_TYPE and E_INVALID_FIELD_VALUE?

Next Steps

- Implement it and show some experimental result by next meeting.
- WG item?

- See https://github.com/openalto/alto-multipart for details.

Backup Slides