ALTO New Transport Extension

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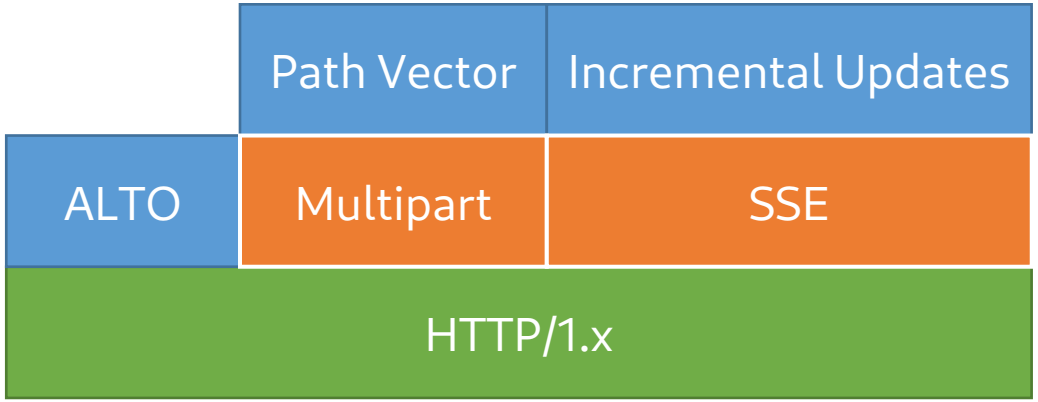
Motivation

- HTTP/2 (RFC 7540) and HTTP/3 (RFC-to-be) improve the performance of HTTP
  - Avoid slow-start of multiple connections
  - Avoid head-of-line blocking of request piplining (in HTTP/1.1)
  - Allow concurrent transmission (HTTP/3)
  - Native support for server push and stream multiplexing

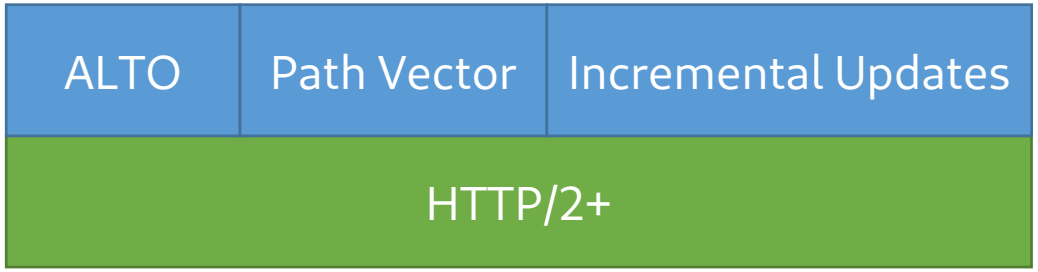
- ALTO extensions have workarounds that are unnecessary and inefficient when using HTTP/2 and above
  - Path vector
    - use multipart to encode two resources in the same response
  - Incremental update
    - allow one server to provide updates of many resources (to avoid creating too many connections)
    - use SSE to multiplex the updates

Current issues

- Transport mechanisms in the current ALTO framework



- Proposed alternative transport mechanism on top of HTTP/2 and above

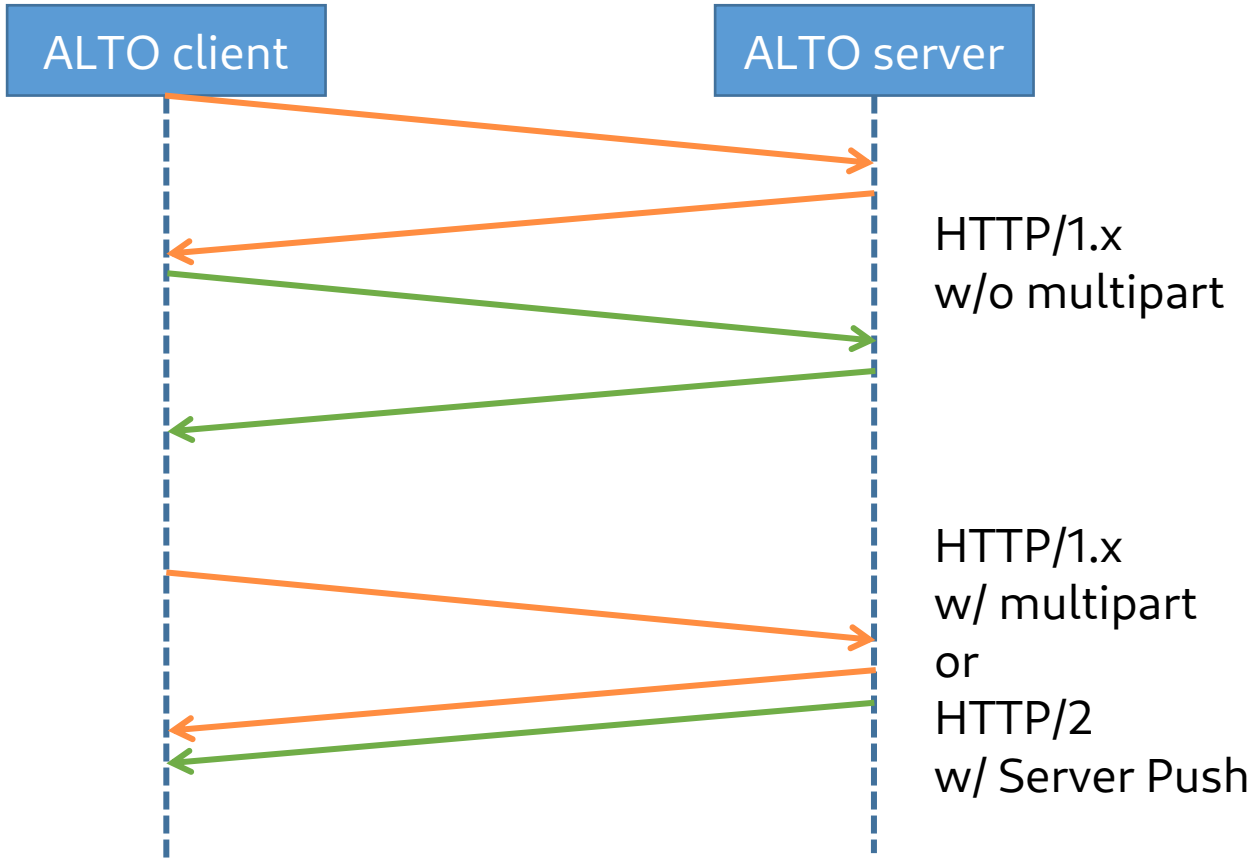


ALTO Transport over HTTP/2 and HTTP/3: Feasibility

- Workarounds can be replaced by standard features of HTTP/2 and above
  - Server push
    - Push (temporary) dependent data (e.g., path vector) as different streams
    - Push incremental updates of each resource as a single stream
  - Stream multiplexing
    - Native and more efficient support for event multiplexing
  - Rest stream
    - Subscription of incremental updates can be cancelled by the client using the rest stream frame
- Already supported by many mainstream programming languages (C/C++, Java, Python, Go, etc.) and network development frameworks (nginx, Apache, etc.)

Case study: Path vector

- One consideration of using multipart message is to avoid security risks when it takes a long time for the client to query the property map part
- With HTTP/2+, an ALTO server can actively push the property part to the client, eliminating the need of a multipart message



Multipart v.s. Server Push

```
HTTP/1.1 200 OK
Content-Length: [TBD]
Content-Type: multipart/related; boundary=example-1;
              type=application/alto-costmap+json

--example-1
Resource-Id: costmap
Content-Type: application/alto-costmap+json

{
  "meta": { “vtag": {
      "resource-id": "filtered-cost-map-pv.costmap",
      "tag": "d827f484cb66ce6df6b5077cb8562b0a"
    },
    "dependent-vtags": [{
        "resource-id": "my-default-networkmap",
        "tag": "75ed013b3cb58f896e839582504f6228"
    }],
    "cost-type": { "cost-mode": "array", "cost-metric": "ane-path" }
  },
  "cost-map": {
    "PID1": { "PID2": ["ANE1"] }
  }
}
--example-1
Resource-Id: propmap
Content-Type: application/alto-propmap+json

{
  "meta": {
    "dependent-vtags": [{
        "resource-id": "filtered-cost-map-pv.costmap",
        "tag": "d827f484cb66ce6df6b5077cb8562b0a"
    }]
  },
  "property-map": {
    ".ane:ANE1": { "max-reservable-bandwidth": 100000000 }
  }
}
```

```
// SETTINGS frame
...
// PUSH_PROMISE frame
:method: GET
:path: filtered-cost-map-pv.propmap
// promised_stream_id=2

// HEADER frame
:status: 200
content-type: application/alto-costmap+json
content-length: 46

// DATA frame
{
     "meta": { “vtag": {
         "resource-id": "filtered-cost-map-pv.costmap",
         "tag": "d827f484cb66ce6df6b5077cb8562b0a"
       },
       "dependent-vtags": [{
           "resource-id": "my-default-networkmap",
           "tag": "75ed013b3cb58f896e839582504f6228"
       }],
       "cost-type": { "cost-mode": "array", "cost-metric": "ane-path" }
     },
     "cost-map": {
       "PID1": { "PID2": ["ANE1"] }
     }
   }

// HEADER frame
:status: 200
content-type: application/alto-propmap+json
expires: Thu, 19 Nov 2020 06:39:22 GMT

// DATA frame
{
     "meta": {
       "dependent-vtags": [{
           "resource-id": "filtered-cost-map-pv.costmap",
           "tag": "d827f484cb66ce6df6b5077cb8562b0a"
       }]
     },
     "property-map": {
       ".ane:ANE1": { "max-reservable-bandwidth": 100000000 }
     }
   }
```

Specific problems to be addressed

- Define a unified transport mechanism for ALTO objects over HTTP/2 and HTTP/3
  - Specify unified naming and dependency indication of potentially dynamic resources
  - The current design is to reuse the idea of stream-id as in the incremental update extension

- Backward compatability
  - Specify an extension to allow clients and servers to negotiate the transport mechanism
  - The current design is to add a new cabability to the IRD, and clients must explicitly specify the new transport mechanism

Remaining issues

- Security and privacy concerns introduced by HTTP/2 and above need to be investigated
- Potential future capabilities
  - Transaction capability: The values/updates of dependent resources always belong to the same consistent snapshot.

Q & A

- Who will work on this extension
  - Kai
  - Other people are more than welcome to contribute!
- Milestones
  - A new IETF RFC
  - An initial version before IETF 110