ALTO Framework and Remaining Issues

Presenter: Y. Richard Yang

As a result of discussions with Sabine R., Lyle B., Danny L., Christian R., Dawn C., Jensen Z., Qiao X., Shawn L.

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Existing RFCs/WG Docs/Drafts

- **Multicost** (RFC8189)
- **Deployment** (RFC7971)
- **Server Discovery** (RFC7286)
- **Base Protocol** (RFC7285)
- **Requirements** (RFC6708)
- **Problem Statement** (RFC5693)

- **CDNi**
- **Path Vector**
- **Unified Properties**
- **XDOM**
- **SSE/Incr Update**
- **Cost Calendar**
- **Cost Metrics**

- **Multi-domain Orchestration**
- **Compressing PV**
- **Implementation & Use Cases**
- **Cellular Address**
- **Unified Resource Representation**
- **Flow-based Cost Query**
- **Multipart Messages**
- **Multi-domain (Broker Assisted)**
Existing RFCs/WG Docs

- CDNi FCI
- Cost Metrics
- Path Vector
- XDOM
- Deployment (RFC7971)
- Multicost (RFC8189)
- Cost Calendar
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- Problem Statement (RFC5693)
ALTO Protocol Framework

- Network information **divided** into (network) information resources
  - Explicit division allows modularity (**media types**), flexibility, scalability
  - Dependency (**consistency**) among information resources can be specified
  - List of available information resources provided by **Information Resource Directory (IRD)**
    - Bootstrap server provided by **server discovery**
- Each individual information resource is provided as a **RESTful service**
  - Has a simple, but so far working well **grammar**
- Information resource can be **filtered**
- A generic, SSE-based framework to **stream-control, push, incrementally update** information resources
- A generic framework supporting **entity properties**, supporting **inheritance, entity decomposition**
ALTO Protocol Framework

Modular Media Types

Information Resource Directory

Information Resource (Resource)

Resource Dependency

Simple JSON Grammar Spec

Server Discovery

Stream Control

Server Push

Incremental Update

ALTO Error

Filtered Concept
ALTO Network Abstractions to Applications

• A network consists of nodes and paths

• Nodes can be
  – endpoints
  – aggregations of endpoints (PID)
  – abstract network elements

• A path has path properties:
  – cost metrics, calendars
  – vector of abstract network elements

• Endpoints, partitions, abstract network elements are called entities

• Entities have properties that can be inherited, decomposed
ALTO Network Abstractions to Applications

- Endpoint Property Service
  - Network Map
  - Property Map
  - Entity Domain
  - Property
  - Entity
  - ANE

- Cost Map
- Endpoint Cost Service
- Cost Metrics
- Path Vector
- Filtered Network Info
- Calendar Concept
Remaining Issues – Protocol Framework

- Generic, flexible dependency specification, transport?
- Simple grammar vs YANG model?
- Leveraging more flexible transport for push/incremental updates?
- Generic filtering (xpath...)?

Diagram:
- Modular Media Types
- Information Resource Directory
- Information Resource (Resource)
- Resource Dependency
- Simple JSON Grammar Spec
- Server Discovery
- Stream Control
- Server Push
- Incremental Update
- ALTO Error
- Filtered Concept
Remaining Issues: ALTO Network Abstractions to Applications

- Key entity domains beyond (ipv4/ipv6 endpoints, pid for network regions))?

- Unified, generic path (cost): e.g., endpoint/pid pair -> flow/multicast/multipath/?

- FCI to general network capability exposure?

- General, network information filtering/extraction (unified resource discovery)?

- Generic calendar mechanism?
Remaining Issues – Bigger Picture
(Most Important)

• App use cases/requirements
  – Systematic study of how ALTO info be integrated/utilize in *orchestration*
    • One aspect ALTO + PCE, ABNO, Path based, ...
  – Extension to important settings such as multi-domains, NFV, edge clouds, IoT

• Backend/infrastructure, e.g.,
  – Smart/on-demand measurements (query miss trigger, start and collect measurements, formalize the protocol, connect to IPPM, accuracy/freshness, what kind of info to be provided)
  – Proxy architecture, for scale, interdomain, for fault tolerance, for security/privacy
Comments?