ALTO Protocol

draft-penno-alto-protocol-03

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Grateful to the contributions of a large number of collaborators;
Complete list please see draft.
Outline

- Design history
- Basic concepts
- Protocol framework
- Use cases
- Next step
Design history

- IETF-74
  - Merged P4P and InfoExport

- Between IETF-74 and IETF-75
  - Merged ATTP
  - Merged Query-Response
  - Merged DNS based NetLocation Service
  - Merged Proxidor

- IETF-75
  - Today...
Contributing Proposal: P4P

- [draft-p4p-framework-00, draft-wang-alto-p4p-specification-00]
  - R. Alimi, D. Pasko, L. Popkin, Y. Wang, Y. Wang, Y. R. Yang

- Key Features
  - Theoretical foundation based on primal-dual decomposition
  - Network Map and Cost Map
  - PIDS and Grouping
  - Tracker-based selection
  - RESTful URLs and Text encoding
  - Leverage P2P caching (extension)
Contributing Proposal: InfoExport

- [draft-shalunov-alto-infoexport-00]
  - S. Shalunov, R. Penno, R. Woundy

Key Features
- Cost Map
- PID and Grouping
- Client-based selection
- HTTP Transport and Text encoding
- Leverage P2P caching (extension)
- IP/ASN mapping (extension)
Contributing Proposals: Proxidor

- [draft-akonjang-alto-proxidor-00]
  - Drawn from merged proposals
    - DT Oracle, Cisco Proximity Engine, UCL-Belgium IDIPS

- **Key Features**
  - Cost types
  - Path ranking
    - Addresses and groupings
  - Include P2P caches in ranked lists (extension)
  - ALTO Info derived from routing protocols/policies
Contributing Proposal: Query/Response

- [draft-saumitra-alto-queryresponse-00, draft-saumitra-alto-multi-ps-00]
  - S. Das, V. Narayanan, L. Dondeti

- Query/Response
  - XML/Text encoding
  - Cost constraints
  - Service Configuration (now Server Capability)
  - Overlay ID (now type of Endpoint)
  - Multi-homed clients (extension)
  - Client Feedback (extension)
Contributing Proposal: ATTP

- [draft-zhang-alto-attp-02]
  - Y. Zhang, H. Liao, N. Zhou

- Key Features
  - Discovery of tracker (done by Server Capability query)
  - Leverage P2P caching (extension)
  - Client feedback (extension)
Contributing Proposal: DNS based NetLocation Service

• Presentation at IETF74
  - Syon Ding

• Key features
  – Location
  – Potential extension to support info through hierarchy aggregation
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Concept: my-Internet View

- Defined by ALTO Server
- Defines set of Network Locations
  - Intradomain
  - External
- Defines generic costs amongst network locations
Concept: Hosting ALTO Server

- Resource Consumer's *Hosting ALTO Server* determined by Service Discovery
- my-Internet View from Hosting ALTO Server applied for guidance of Resource Consumer
Concept: ALTO Cost Type

- ALTO Server may define multiple costs between pair of network locations
- Each cost distinguished by Type

ALTO/IETF 75
Concept: Location Grouping

- Network Locations may indicate set of locations
  - Coarse-grained proximity
  - Scalability and Privacy
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ALTO Protocol Scope

- ALTO Protocol defines communication between ALTO Client and ALTO Server

ALTO Client

ALTO Protocol

ALTO Server

Routing Protocols

Provisioning Policy

Dynamic Network Info

...
ALTO Service Model

ALTO Server provides ALTO Information to ALTO Clients
- Indicates preferences amongst Resource Consumers and Resource Providers

ALTO Client (P2P Client)  ALTO Server  ALTO Client (P2P Tracker)  Resource Consumers and Providers
ALTO Query Types

- Generic and extensible query framework
- Four types of queries
  - ALTO capability query
  - Endpoint property lookup service
    - [IP, property] -> value
    - Property can be, e.g., Location definition, Connectivity type (e.g., ADSL, 512Kup/2Mdown), Usage (e.g., client usage cap; current usage), Devices (e.g., caches/Gateway)
  - Network property reverse mapping service
    - E.g., Location -> list of IP prefixes in a location
  - Path property service
    - E.g., inter-location path cost/distance
ALTO Protocol Design

- Focus on
  - Network Map: an endpoint property
- Path Rating: a path property to indicate preference of communication patterns
Network Map

- Grouping indicated by an endpoint property
  - Set of groupings is called *Network Map*

- PID: identifier for a group
  - Network-agnostic
    - Subnet, set of subnets, metro area, PoP, AS, etc
  - Indicates coarse-grained proximity
  - Scalability and privacy
Network Map Queries

**Endpoint PID Query:** Lookup PIDs for set of endpoints

- **Input:** Set of endpoints
- **Output:** PID for each endpoint

**Reverse Network Map Query:** Find set of Endpoints within PIDs

- **Input:** Set of PIDs
- **Output:** Set of Endpoints within each PID
Path Rating

- Property indicating rating of path between network locations (endpoints or PIDs)

- Rating is conveyed by Path Costs
  - Type: What the cost represents
    - Air miles, hop count, routing cost, etc
  - Mode: Interpretation of the cost
    - Numerical or ordinal (ranking)
Path Rating Query

**Input**
- Cost type and mode
- List of source network locations
- List of destination network locations
- Constraints (optional)

**Output**
- Cost Map containing costs among each source/destination pair
Protocol Message Encoding

- **Employ HTTP**
  - Wide infrastructure support, implementations
  - Authentication/encryption in HTTP and SSL

- **REST-ful API**
  - Simple HTTP caching

- **Currently use XML encoding**
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  - Use cases
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Use Case 1: ALTO Client Embedded in App. Tracker
<?xml version="1.0" encoding="UTF-8"?>
<alto xmlns="urn:ietf:params:xml:ns:p2p:alto">
  <configuration instance-name="alto.isp.net">
    <cost type="latency" units="ms"/>
    <cost type="pDistance" units="scalar"/>
    <constraint-support value="false"/>
  </configuration>
</alto>
<?xml version="1.0" encoding="UTF-8"?>
<alto xmlns="urn:ietf:params:xml:ns:p2p:alto">
<pids size="3">
  <pid name="PID1" size="3">
    <cidr4 name="128.36.1.0/24"/>
    <cidr4 name="132.130.1.0/24"/>
    <cidr4 name="132.130.2.0/24"/>
  </pid>
  <pid name="PID2" size="1">
    <cidr4 name="130.132.3.0/24"/>
  </pid>
  <pid name="PID3" size="1">
    <cidr4 name="0.0.0.0/0"/>
  </pid>
</pids>
</alto>
Retrieve Cost Map
GET /cost/map

<?xml version="1.0" encoding="UTF-8"?>
<alto xmlns="urn:ietf:params:xml:ns:p2p:alto">
    <costmap type="routingcost" mode="numerical">
        <row srcpid="PID1" size="2">
            <pid name="PID2" cost="5"/>
            <pid name="PID3" cost="10"/>
        </row>
        <row srcpid="PID2" size="2">
            <pid name="PID1" cost="5"/>
            <pid name="PID3" cost="15"/>
        </row>
        <row srcpid="PID3" size="2">
            <pid name="PID1" cost="20"/>
            <pid name="PID2" cost="15"/>
        </row>
    </costmap>
</alto>
ALTO Server (alto.isp.net:80)

ALTO Client @appTracker

get peers

selected peer list

Peer 1

Peer 2

Peer 40
Use Case 2: ALTO Client Embedded in a P2P Client
ALTO Server
(alto.isp.net:80)

P2P Client
(in PID1)

Retrieve Server Capability
GET /capability

<?xml version="1.0" encoding="UTF-8"?>
<alto xmlns="urn:ietf:params:xml:ns:p2p:alto">
  <configuration instance-name="alto.isp.net">
    <cost type="latency" units="ms"/>
    <cost type="pDistance" units="scalar"/>
    <constraint-support value="false"/>
  </configuration>
</alto>
<?xml version="1.0" encoding="UTF-8"?>
<alto xmlns="urn:ietf:params:xml:ns:p2p:alto">
  <pids size="3">
    <pid name="PID1" size="3">
      <cidr4 name="128.36.1.0/24"/>
      <cidr4 name="132.130.1.0/24"/>
      <cidr4 name="132.130.2.0/24"/>
    </pid>
    <pid name="PID2" size="1">
      <cidr4 name="130.132.3.0/24"/>
    </pid>
    <pid name="PID3" size="1">
      <cidr4 name="0.0.0.0/0"/>
    </pid>
  </pids>
</alto>
Retrieve Cost Map
GET /cost/row?srcpid=PID1

```xml
<?xml version="1.0" encoding="UTF-8"?>
<alto xmlns="urn:ietf:params:xml:ns:p2p:alto">
  <costmap type="routingcost" mode="numerical">
    <row srcpid="PID1" size="2">
      <pid name="PID2" cost="5"/>
      <pid name="PID3" cost="10"/>
    </row>
  </costmap>
</alto>
```
ALTO Server (alto.isp.net:80)

ALTO Info

P2P Client (in PID1)

P2P Client

Peer Exchange

new peers

DHT

Tracker

new peers
Use Case 3: ALTO Client Embedded at a P2P Client using Ranking
ALTO Server
(alto.isp.net:80)

Retrieval Server Capability
GET /capability

<?xml version="1.0" encoding="UTF-8"?>
<alto xmlns="urn:ietf:params:xml:ns:p2p:alto">
  <configuration instance-name="alto.isp.net">
    <cost type="latency" units="ms"/>
    <cost type="pDistance" units="scalar"/>
    <constraint-support value="false"/>
  </configuration>
</alto>

P2P Client
(in PID1)
ALTO Server
(alto isp.net:80)

Request Ranking
POST /cost/m?mode=ordinal HTTP/1.1
...(contains src & dest addresses)

P2P Client
(in PID1)

<?xml version="1.0" encoding="UTF-8"?>
<alto xmlns="urn:ietf:params:xml:ns:p2p:alto">
  <costmap type="routingcost" mode="ordinal">
    <row srcendp="ipv4:128.36.22.1" size="3">
      <endpoint name="ipv4:130.132.33.4" cost="1"/>
      <endpoint name="ipv4:128.30.24.89" cost="2"/>
      <endpoint name="ipv4:12.32.67.3" cost="3"/>
    </row>
  </costmap>
</alto>
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Next Steps

- Adoption as WG document
- Discussions on possible extensions
Extensions

- ALTO Info Caching / Redistribution
  - Mechanisms
    - ALTO Info served by existing HTTP caches
    - ALTO Clients redistribute amongst themselves
  - Improves scalability
    - Example: millions of viewers beginning to watch the same live streaming event
- Hierarchical Groupings (PID) {IDs}
  - Allow hierarchy of PID (Group IDs) for finer accuracy when desired
Extensions

LTO Client feedback
- Allow clients to feed back information to ALTO Service
- Improve ALTO info
- Examples: ATTP, Query/Response
Thank you!