Peer-to-Peer Work in the IETF: ALTO

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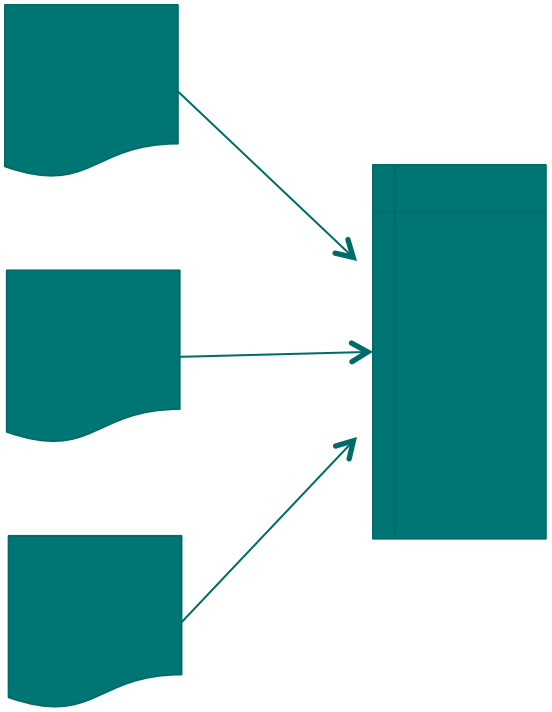
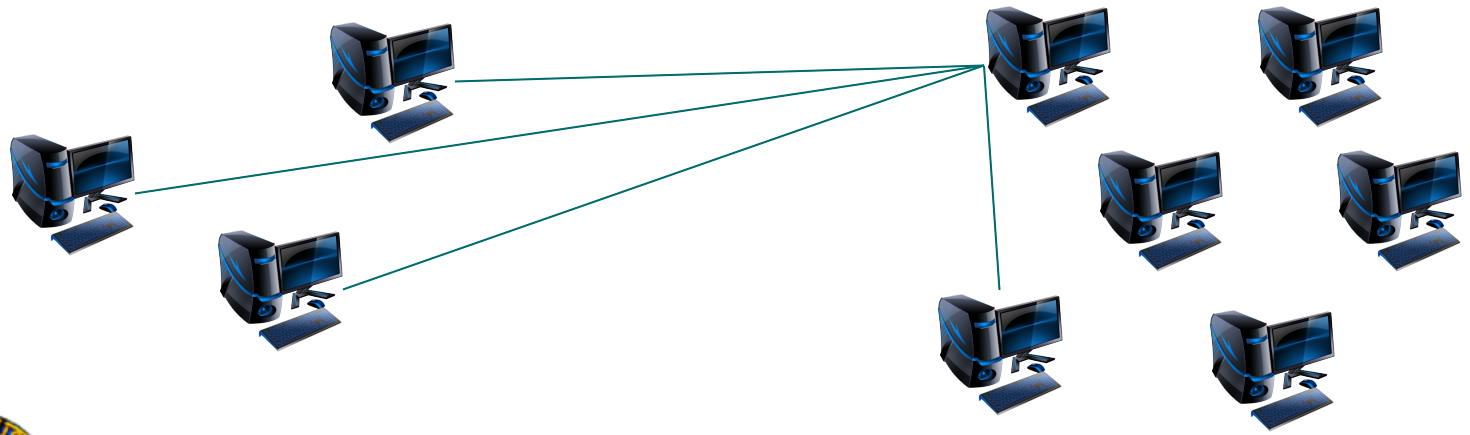
How Do Peer-to-Peer Networks Work?

- Distributed Resources
  - Files, partial files, caches, etc.
  - Processing resources
    - Streaming servers
    - Relay resources
- Multiple resources in network
- Clients need to select which nodes to fetch resources from



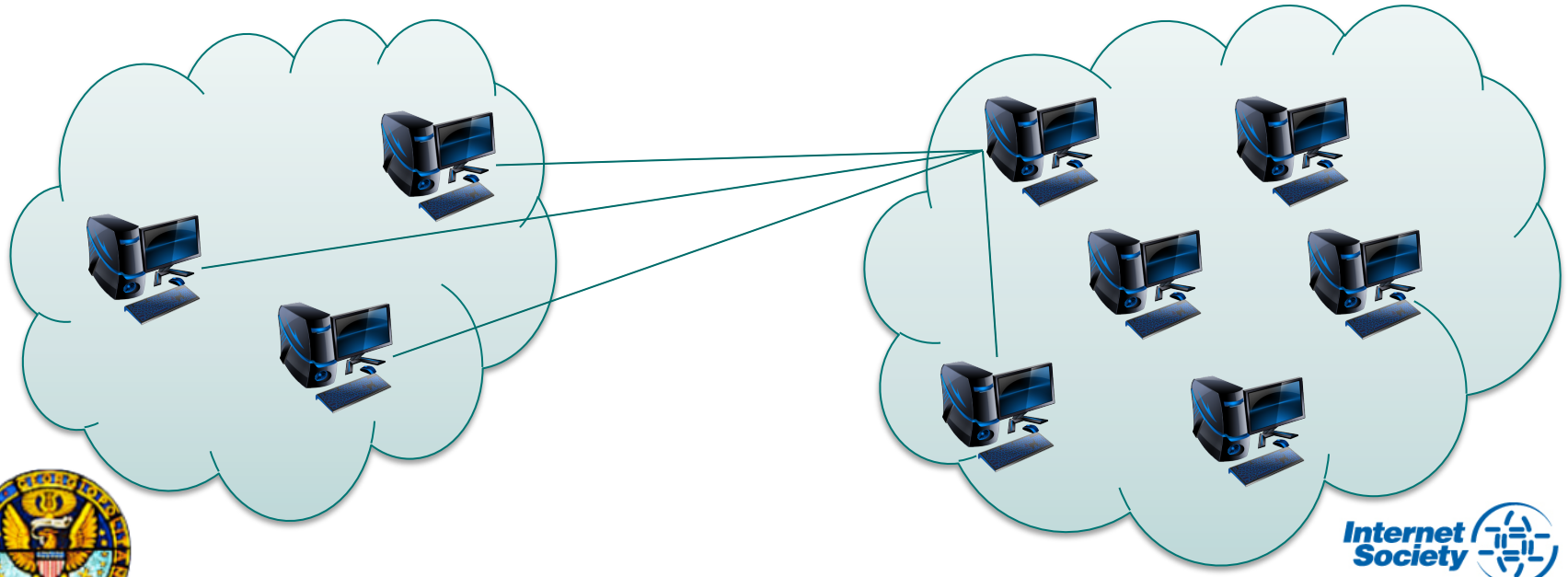
Peer Selection

- Some idea of fast
  - Round-trip time, usually
  - Some fairness, don't hit same server all the time



Peer Selection

- Issues with selection algorithms
  - What looks close or fast might not be
  - Crossing network boundaries often costs money

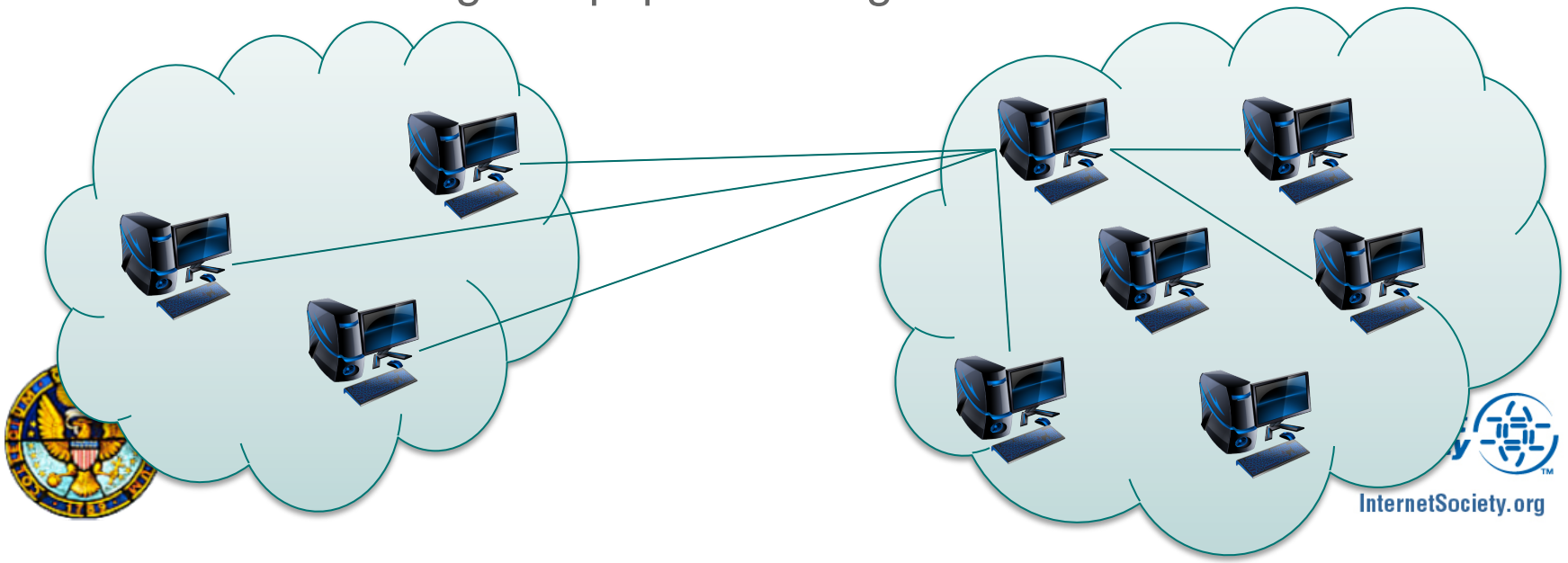


P2P Networks Are Overlay Networks

- Do not have topology
- Have to estimate what is a good peer
- Stand-in metrics for topology
  - Experience with prior transfers from a given node
  - Measured round-trip time (ping)
- Problems with stand-in metrics
  - By design do not want to hit same nodes repetitively
  - Data will most likely be old
  - Round-trip time does not measure throughput

What Could Make Things Better?

- Let Peer-to-Peer have clues to the actual topology
- Clients could make better node selection
- ISPs could save on peering costs
- Users get faster downloads and more responsive streaming and p2p streaming sessions



Why Improve Peer-to-Peer Networking?

- User
  - Faster downloads
- ISP
  - Happier users with faster downloads
  - Reduced peering costs by keeping traffic on-net
  - Competitive advantage with happy users and lower costs
- Peer-to-Peer developers
  - Happier users with faster downloads
  - Cooperative relationships with supportive ISPs

What Needs to be Done?

- How can the ISP securely advertise the peer network topology?
- How can the P2P network trust the ISP?
- How can the user be protected from uninvited tracking?

Why Have We Not Done This Before?

- Historically, many ISPs and peer-to-peer vendors had adversarial relationships
- ISPs blocked or impaired p2p applications in the past
- ISPs hesitant to divulge internal network topology to organizations with names like “The Pirate Bay”
- Peer-to-peer users [should be] concerned with ISPs tracking their peer-to-peer activities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ALTO
Application Layer Transport Optimization
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ALTO Goals

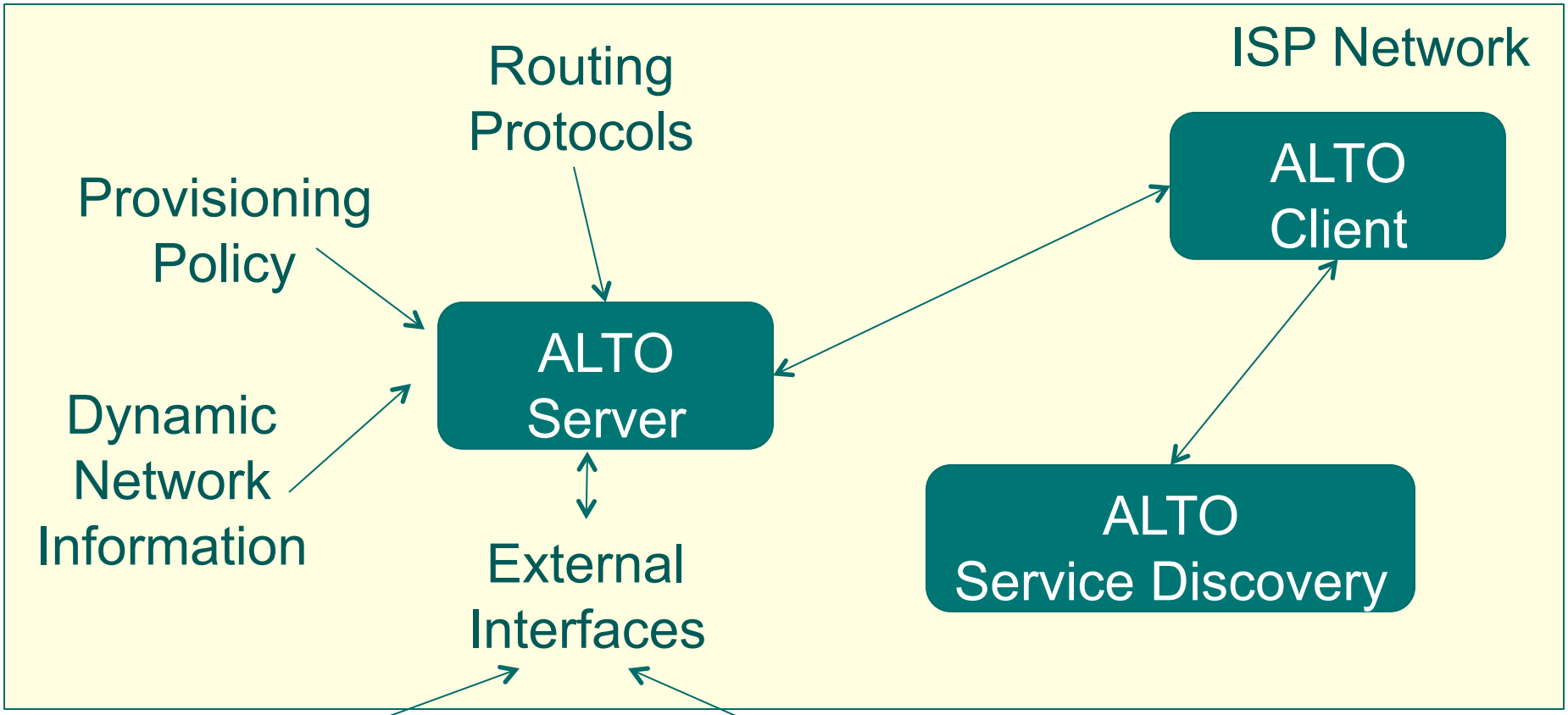
- Deliver better than random performance to peer-to-peer applications

- Deliver better than random network utilization to ISPs

What is ALTO?

- Secure publication of topology information by ISP
- Secure consumption of topology information by peer-to-peer clients
- Mechanisms for
  - Topology hiding (for the ISP)
  - Activity hiding (for the user by the P2P client)
  - Optimizing on user experience and ISP metrics

ALTO Architecture



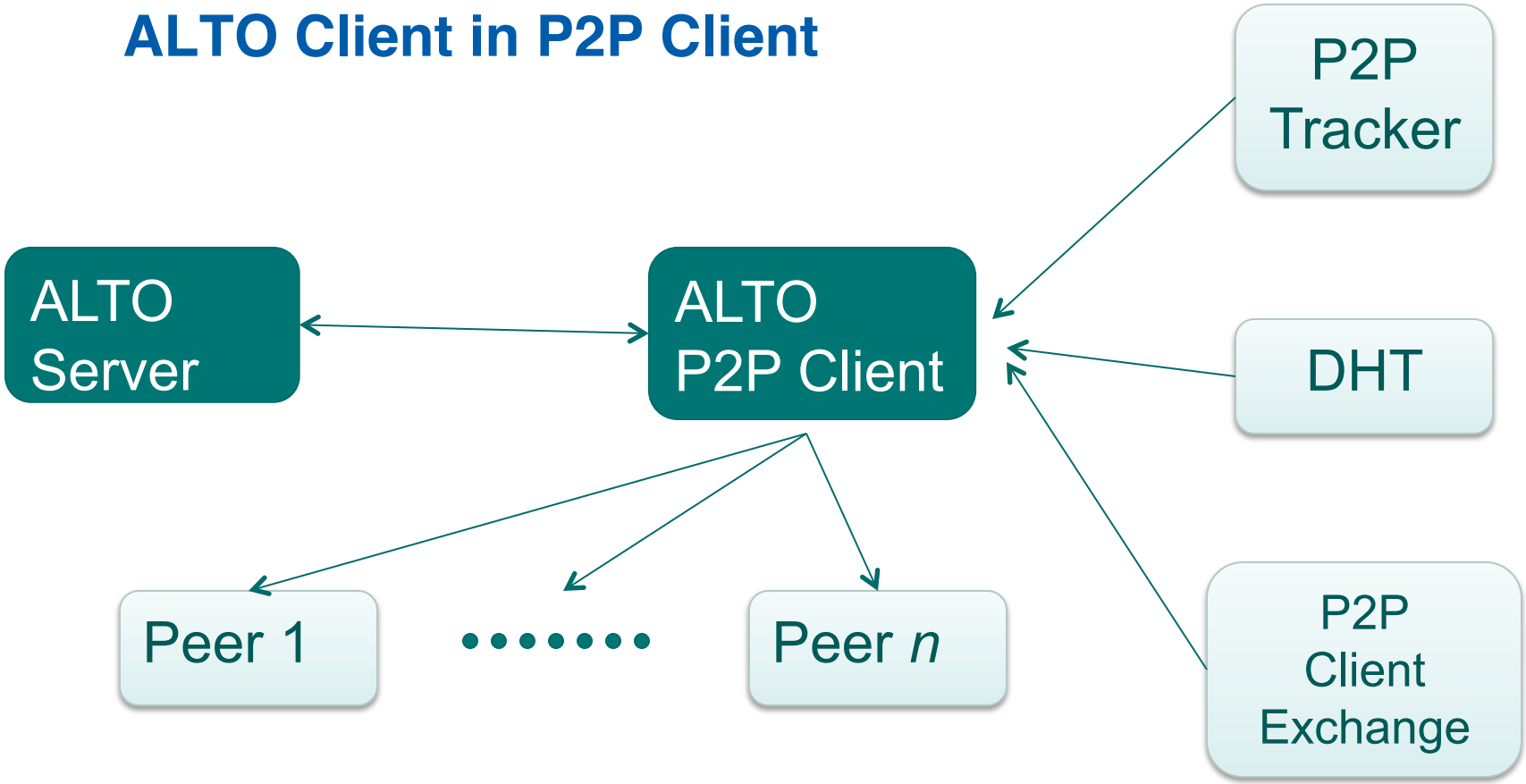
ALTO Architecture

- Discovery protocol
  - How clients learn where the ALTO servers are
- Client protocol
  - How clients make requests and get responses from ALTO servers
- Support protocols
  - Inter ALTO server / Inter ISP information exchange
  - Content provider input

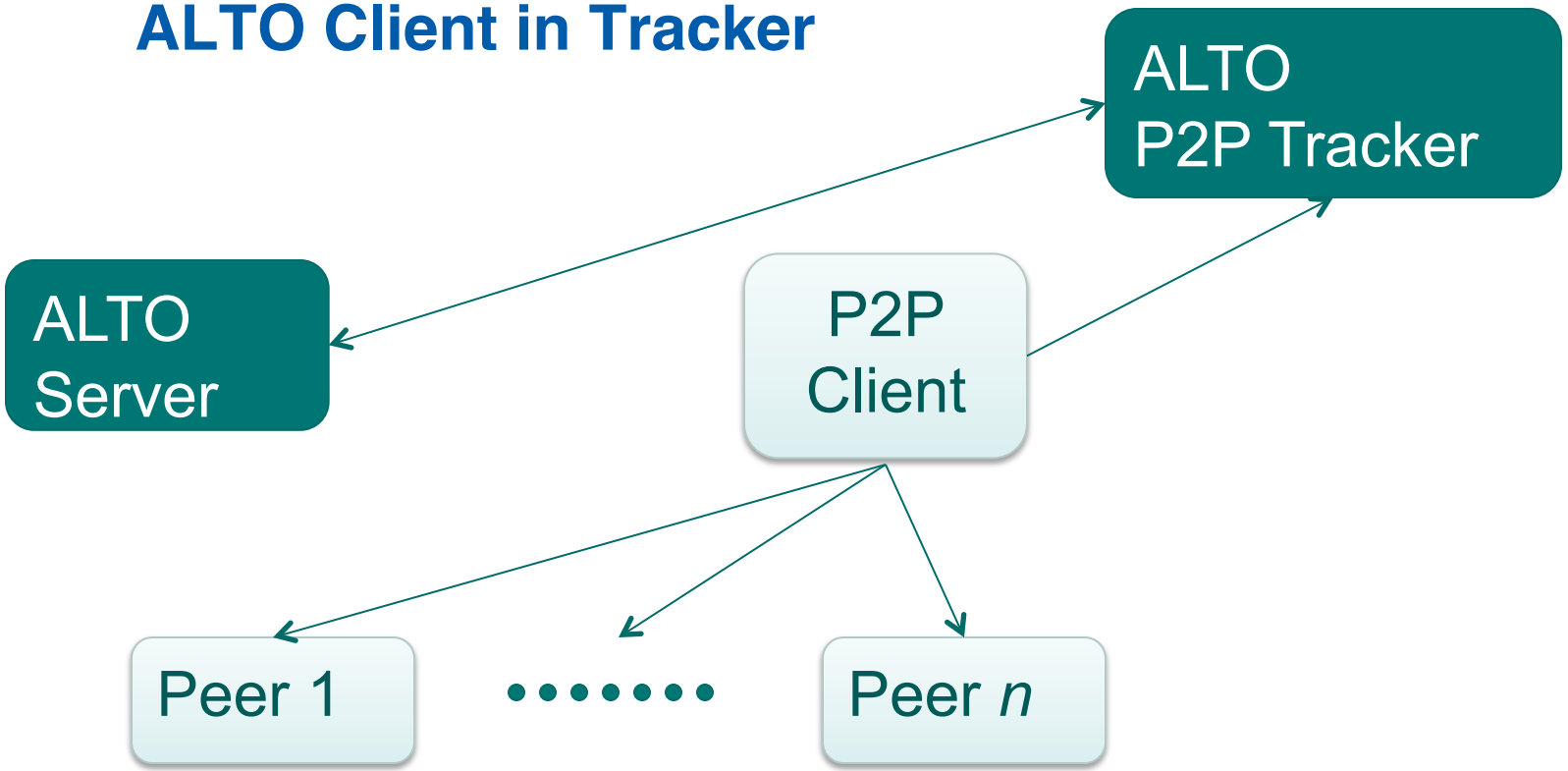
Criteria descriptors

- Topology: How far away is the node
  - Logically
  - Topologically
  - Physically
- Charging
  - Data transfer caps at the target node
  - What those caps are (potentially)
- Performance
  - Minimum throughput
  - Theoretical maximum throughput
  - Maximum RTT
  - Theoretical minimum RTT

ALTO Client in P2P Client



ALTO Client in Tracker



Connectivity to ALTO Servers

- Depends on scale of peer-to-peer network
- Small networks: clients connect directly to ALTO server
- Large networks
  - Clients already connect to supernodes / trackers
  - Trackers are ALTO clients
  - Apply ALTO intelligence on behalf of peer-to-peer clients

What Does It Look Like? Map Request

```
GET /map/core/pid/net HTTP/1.1
Host: alto.example.com:6671
```

```
HTTP/1.1 200 OK
Content-Length: [TODO]
Content-Type: application/alto

{
    "meta" : {
        "version" : 1,
        "status" : {
            "code" : 1
        }
    },
    "type" : "network-map",
    "data" : {
        "map-vtag" : "1266506139",
        "map" : {
            "PID1" : [
                "192.0.2.0/24",
                "198.51.100.0/25"
            ],
            "PID2" : [
                "198.51.100.128/25"
            ]
            "PID3" : [
                "0.0.0.0/0"
            ]
}   }   }
```

What Does It Look Like? Cost Request

```
GET /map/core/pid/cost HTTP/1.1
Host: alto.example.com:6671
```

```
HTTP/1.1 200 OK
Content-Length: [TODO]
Content-Type: application/alto

{
    "meta" : {
        "version" : 1,
        "status" : {
            "code" : 1
        }
    },
    "type" : "cost-map",
    "data" : {
        "map-vtag"  : "1266506139",
        "cost-type" : "routingcost",
        "cost-mode" : "numerical",
        "map" : {
            "PID1": { "PID1": 1,  "PID2": 5,  "PID3": 10 },
            "PID2": { "PID1": 5,  "PID2": 1,  "PID3": 15 },
            "PID3": { "PID1": 20, "PID2": 15, "PID3": 1  }
}   }   }
```

Why ALTO? Why Not OSPF?

- Time scale
  - Routing protocols deal with congestion NOW
  - Routing protocols deal with fibre cuts NOW
  - ALTO operates on much longer timescales
- Accuracy
  - Non-converged routing = cannot get there from here
  - Out of date ALTO = slower download, but download happens
- Important parameters
  - Routing: link “cost”
  - ALTO: end-to-end “cost”

Work Status

- Problem statement published (RFC 5693)
- Requirements done, but kept alive
- ALTO protocol progressing nicely (-06)
- Experiential reports documented
- Chartered work underway
  - Deployment considerations
  - Discovery mechanisms
- Other work underway
  - Inter-ISP ALTO sharing
  - ALTO and CDN networks
  - ALTO and mobile networks

ALTO WG Goals and Milestones

Done	Working Group Last Call for problem statement
Done	Submit problem statement to IESG as Informational
Jan 2011	Working Group Last Call for requirements document
Jan 2011	Working Group Last Call for request/response protocol
Mar 2011	Submit request/response protocol to IESG as Proposed Standard
Mar 2011	Submit requirements document to IESG as Informational
May 2011	Working Group Last Call of deployment considerations document
Aug 2011	Submit deployment considerations document to IESG as Informational
Nov 2011	Working Group Last Call of discovery mechanism
Feb 2012	Submit discovery mechanism to IESG as Proposed Standard
Mar 2012	Dissolve or re-charter

What Can YOU Do?

The Internet is **by** everyone

- Review the documents:
  - http://datatracker.ietf.org/wg/alto/
- Participate in the discussion:
  - https://www.ietf.org/mailman/listinfo/alto
- Participate at IETF face-to-face meetings
  - http://www.ietf.org
- Build P2P, CDN, ALTO services and share your results!

Who Has Been Involved - Academia

- Athens University of Economics and Business
- Beijing University of Posts and Telecommunication
- ETRI
- Georgetown
- TU Berlin
- Universite Catholique de Louvain
- University of California Berkeley
- University of Stuttgart
- University of Washington
- University of Würzburg
- University of Zurich
- Yale

Not a complete list – apologies if I missed you!

Who Has Been Involved – Service Providers

- AT&T
- Bell Canada
- China Mobile
- China Telecom
- Comcast
- Deutche Telecom
- Intracom Telecom
- NTT DOCOMO
- Telecom Italia
- Telefonica
- Verizon

Not a complete list – apologies if I missed you!

Who Has Been Involved – Vendors

- Alcatel-Lucent
- BitTorrent
- Cisco
- Ericsson
- Huawei
- IBM
- Juniper
- Microsoft
- NEC
- Neustar
- Pando Networks
- PPLive
- Qualcomm
- Technicolor
- Tekelec
- ZTE

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Thank You

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