Global Cost Mapping for AS-Level Application-Layer Traffic Optimization <draft-asai-cross-domain-overlay-02>

Hirochika Asai, U. Tokyo
Hiroshi Esaki, U. Tokyo
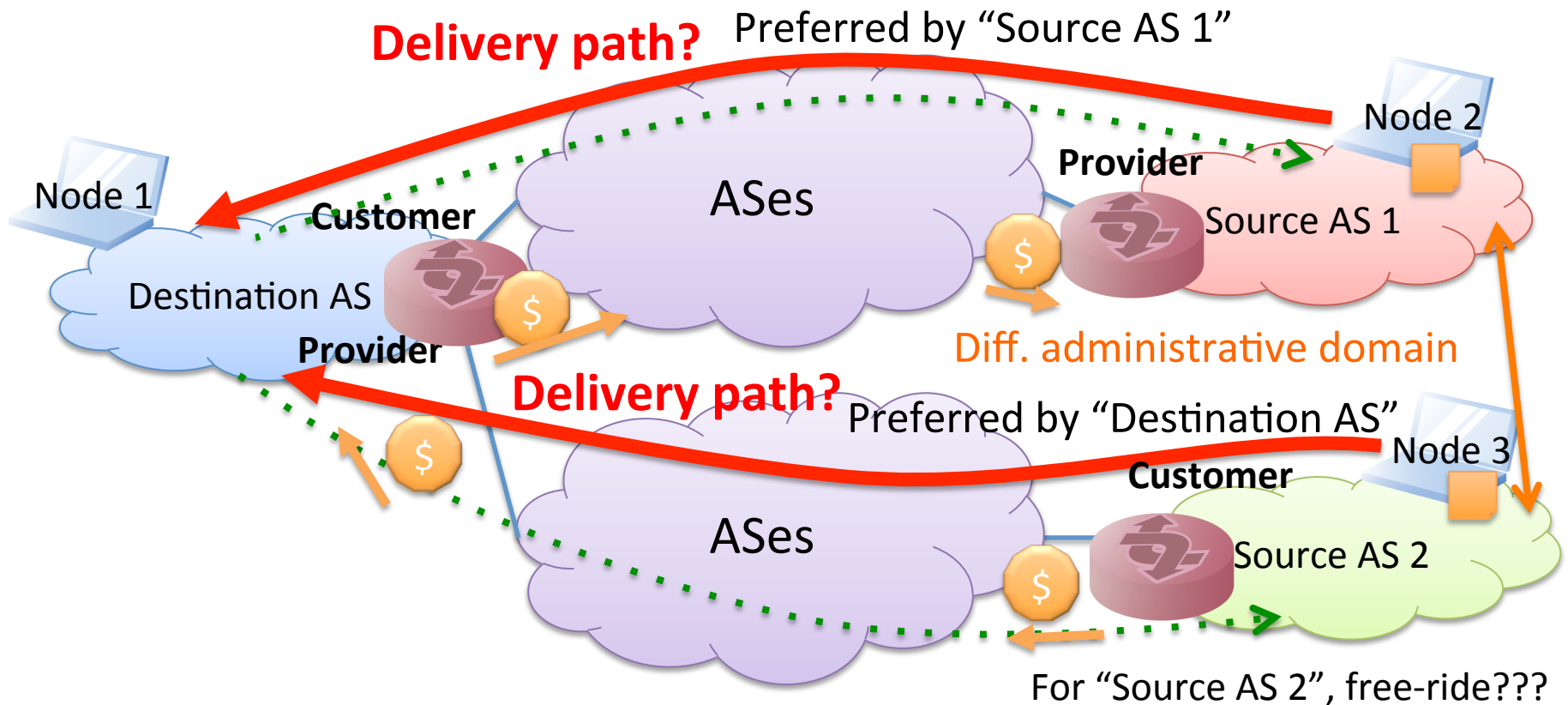Tsuyoshi Momose, Cisco Systems
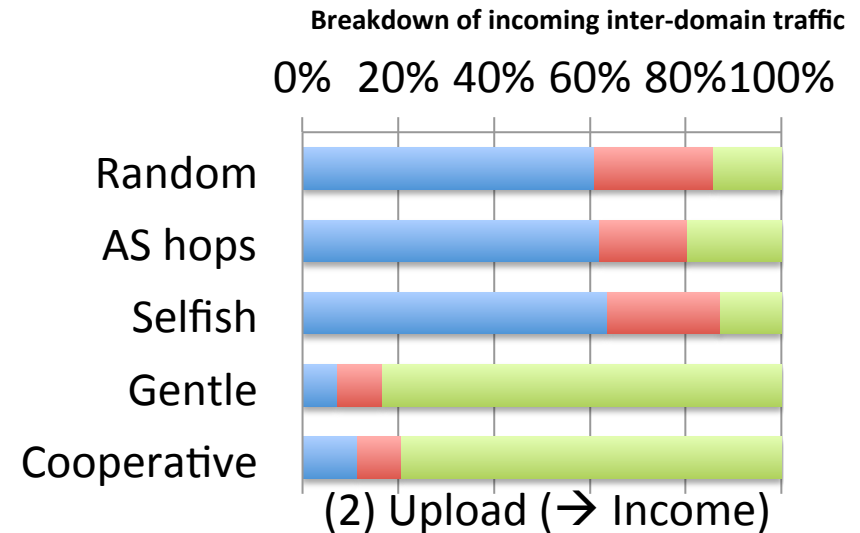July 26th, 2011, P2P RG, IETF 81 @ Quebec
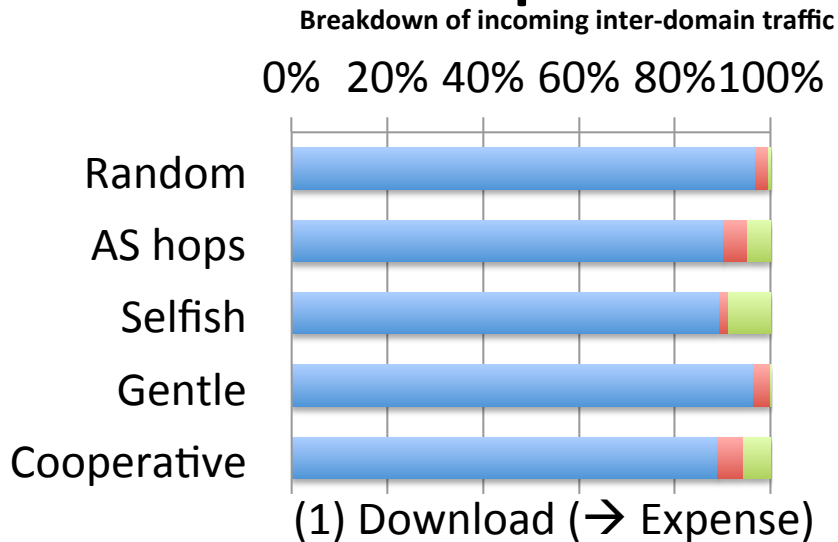
Update from IETF 80

- Quick review of -01
  - Point out economic problems with policy conflicts between distinct ISPs
    - _Multi-domain_ application-layer routing
    - Provider vs. Customer (on transit links)

- Main update
  - Propose the hierarchical ALTO extension
    - Global cost map
      - To regulate policy conflicts between distinct ISPs

Brief problem statement:
Policy conflicts between ISPs

Application-layer routing (e.g., peer selection in P2P-CDN)

Delivery path? Preferred by "Source AS 1"

Node 2

Provider

Node 1

Customer

ASes

Source AS 1

Destination AS

Provider

Diff. administrative domain

Delivery path? Preferred by "Destination AS"

Node 3

Customer

ASes

Source AS 2

For "Source AS 2", free-ride???

Cross-domain cooperation is needed as presented in IETF 80

Breakdown of incoming inter-domain traffic

0% 20% 40% 60% 80% 100%

Random
AS hops
Selfish
Gentle
Cooperative

(1) Download (→ Expense)

Breakdown of incoming inter-domain traffic

0% 20% 40% 60% 80% 100%

Random
AS hops
Selfish
Gentle
Cooperative

(2) Upload (→ Income)

- Selfish: Selection through download-side preference
  - Bad for upload-side (i.e., free-ride)
- Gentle: Selection through upload-side preference
  - Very good for upload-side, but not so good for download-side
- Cooperative: Selection through cooperative preference
  - Very good for upload-side, and not bad for download-side too
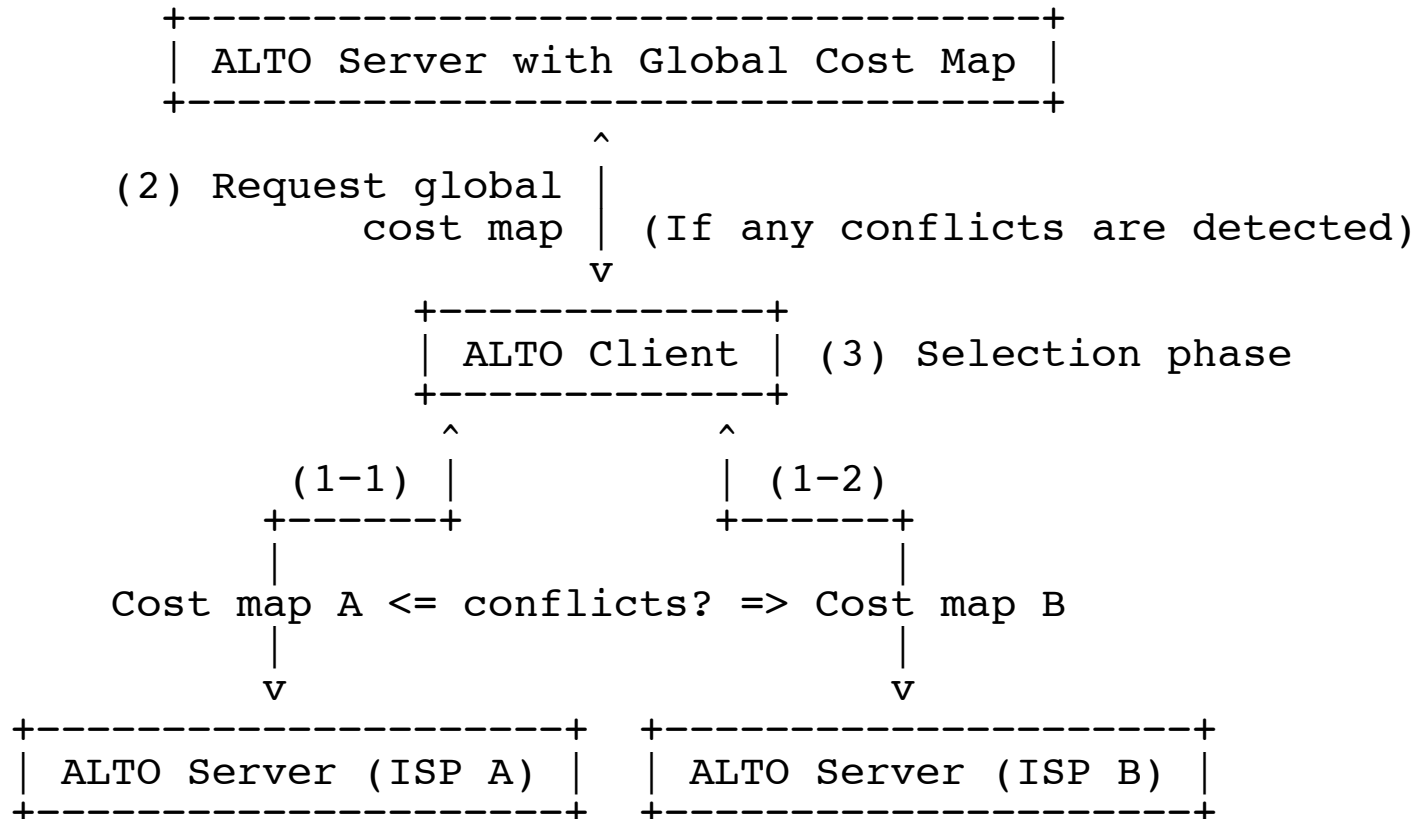
Policy conflicts and regulation

ALTO server w/ global cost map

Cost(AS 1, AS 3) = 2
Cost(AS 2, AS 3) = 3

fallback to regulate the conflict

Candidate A

A

ALTO server

Cost(X, A) = 5
Cost(X, C) = 6
Cost(default) = 100

AS 1

C

Candidate C

Cost = 3 for AS 3
Cost = 5 for AS 1

ALTO server

Cost(X, A) = 3
Cost(X, B) = 4
Cost(X, C) = 3

Conflict

Cost = 3 for AS 3
Cost = 6 for AS 1

ALTO server

Cost(X, B) = 2
Cost(default) = 100

AS 2

AS 3

X

ALTO client

Cost = 4 for AS 3
Cost = 2 for AS 2

B

Candidate B

5

Hierarchical ALTO architecture

```
        +----------------------------------+
        │ ALTO Server with Global Cost Map │
        +----------------------------------+
                            ^
   (2) Request global       │
            cost map        │  (If any conflicts are detected)
                            v
                +--------------+
                │ ALTO Client  │ (3) Selection phase
                +--------------+
                   ^            ^
      (1-1) │            │ (1-2)
        +------+        +------+
        │               │
   Cost map A <= conflicts? => Cost map B
        │               │
        v               v
+--------------------+  +--------------------+
│ ALTO Server (ISP A) │  │ ALTO Server (ISP B) │
+--------------------+  +--------------------+
```

Figure 7: Hierarchical ALTO Architecture

Conflicts? Need discussion

ALTO server w/ global cost map

Cost(AS 1, AS 3) = 2
Cost(AS 2, AS 3) = 3

fallback to regulate the conflict

Candidate A
A

ALTO server

Cost(X, A) = 5
Cost(X, C) = 6
Cost(default) = 100

AS 1

C

Candidate C

Cost = 3 for AS 3
Cost = 5 for AS 1

ALTO server

Cost(X, A) = 3
Cost(X, B) = 4
Cost(X, C) = 3

Conflict

Cost = 3 for AS 3
Cost = 6 for AS 1

ALTO server

Cost(X, B) = 2
Cost(default) = 100

AS 2

AS 3

X

ALTO client

Cost = 4 for AS 3
Cost = 2 for AS 2

B

Candidate B

Conflicts? Need discussion

Next step

- Summarize "**problem statement**", i.e., policy conflicts, with traffic optimization in multi-domain overlay systems
  - We want to work with volunteers of P2P RG folks.
  - Explicit definition of "policy conflicts"
  - RG item for an informational RFC (intended)
- Validate and evaluate the proposed "hierarchical ALTO architecture"
  - Applicable model?
    - Architecture (extendability etc)
    - Policy conflict regulation method
  - Performance in traffic optimization?
    - Partly evaluated in <draft-kamei-p2p-experiments-japan-05>?
- Define specific "schemes" and "protocols"
  - Thinking that these should be brought to ALTO WG