A Solution Approach for AS Relationships-aware Overlay Routing <draft-asai-cross-domain-overlay-01>

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Updates from IETF 78

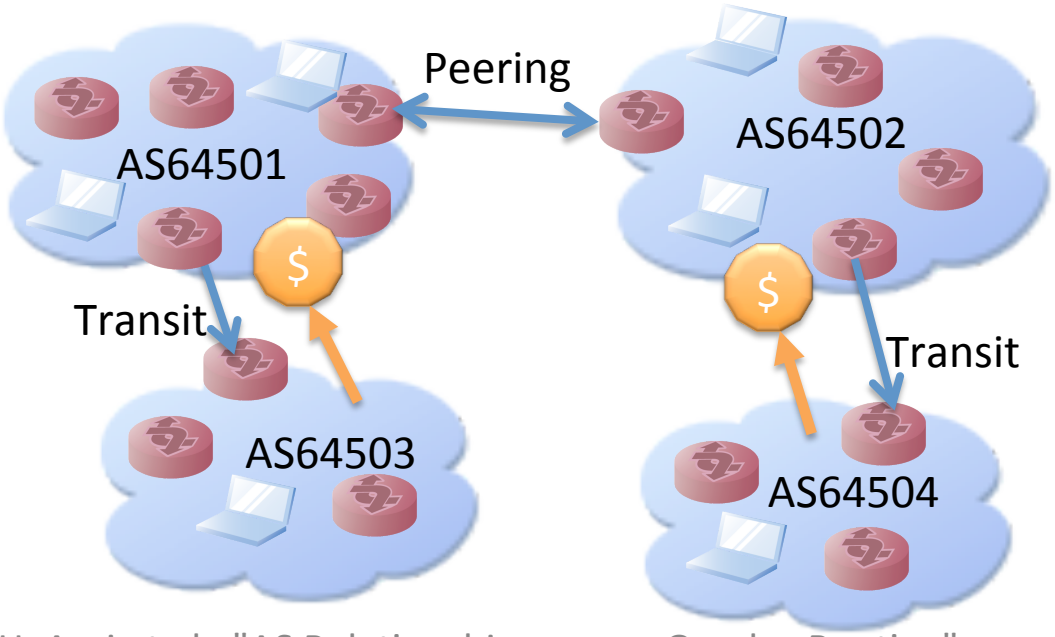
- Impact evaluation of cross-domain cooperation in CDN (w/ P2P)
  - Oracle-based peer selection (single-hop in app-layer)
    - Selfish
    - Gentle
    - Cooperative
  - Oracle-based content routing (multi-hop in app-layer)
    - To appear in next draft update
      - (Delayed due to the earthquake-related power shortage troubles…)
- Update our simulator
  - But not ready to be open to you yet…

Background

- P2P traffic (or overlay routing)
  - Against ISPs' traffic engineering
    - Override routing policy of BGP by application-layer routing
- ALTO
  - Intra-domain: probably works
  - Inter-domain: perhaps cause some problems

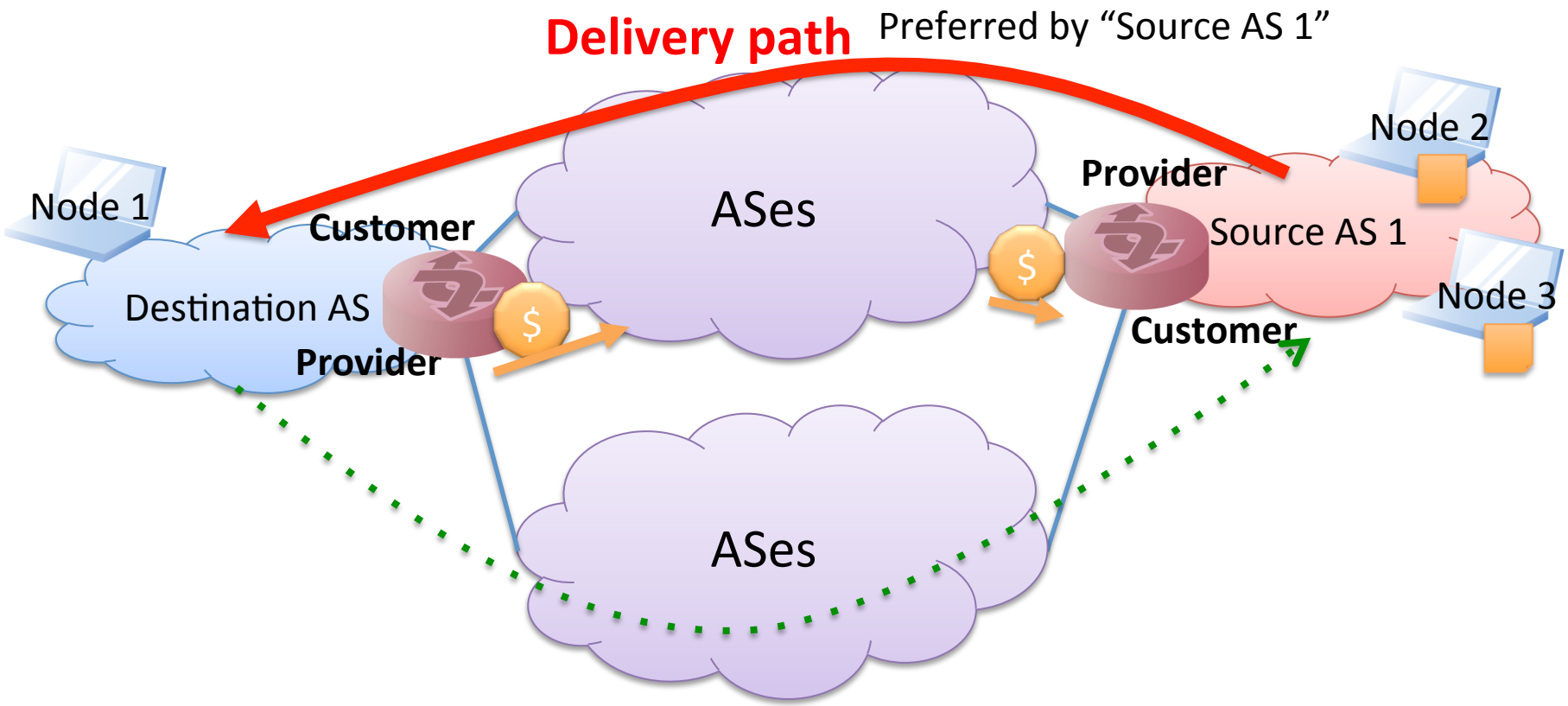
The Internet

- Autonomous systems (ASes)
  - e.g., ISPs, companies, and universities
- Inter-AS economics
  - Transit charge to traffic volume



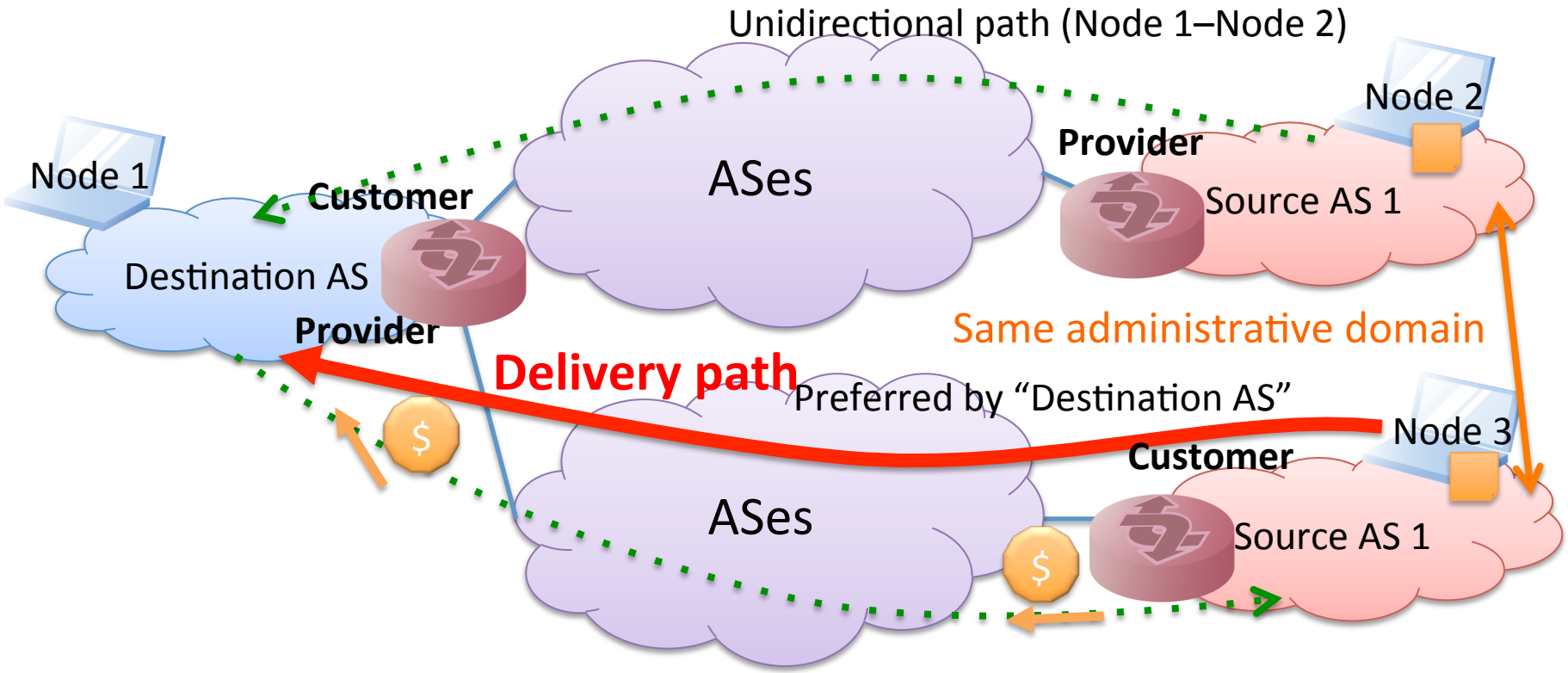
Conflicts: ISP vs. Applications

Typical ISP's policy (multihome)



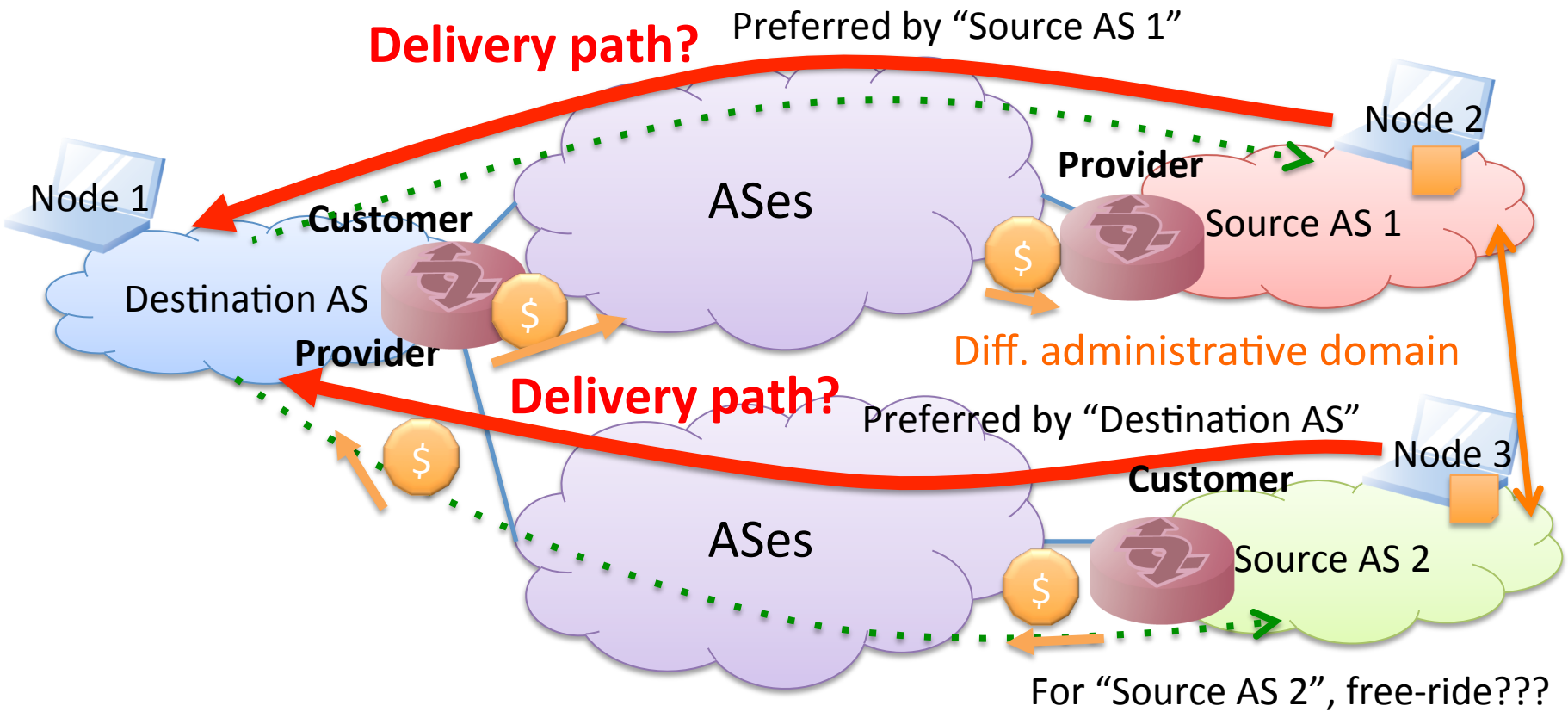
Conflicts: ISP vs. Applications

Typical ISP's policy (BGP anycast)

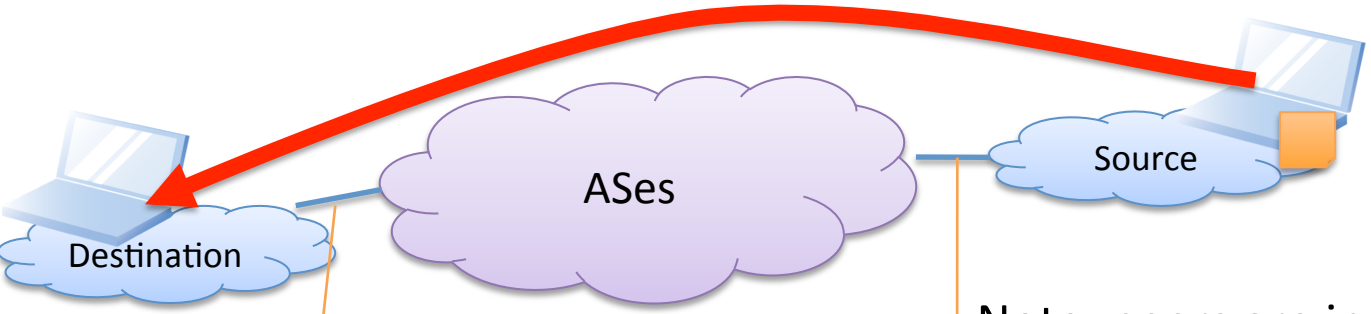


Conflicts: ISP vs. Applications

Application-layer routing (peer selection in P2P-CDN)



Focusing on transit fee of edge ASes



Note; peers are in edge ASes.

		Source edge: p2c	Source edge: p2p	Source edge: c2p
Destination edge	p2c	+,+	+,0	+,–
	p2p	0,+	0,0	0,–
	c2p	–,+	–,0	–,–

Higher preference

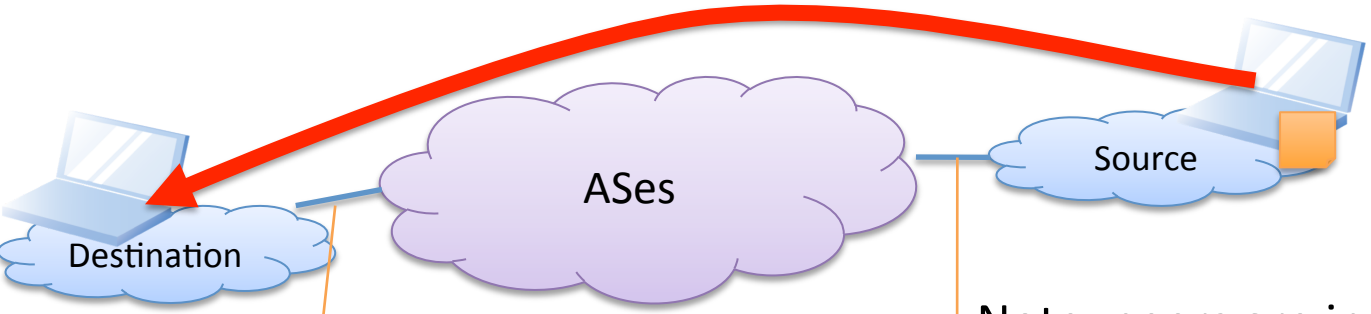
p2c: Provider to customer
c2p: Customer to provider
p2p: Peer to peer

Worst path: Both ASes pay transit fee.

AS relationships-aware peer selection

- Oracle-based approach
  - Selfish
    - Destination AS (downloader) view
      - Minimizing incoming transit traffic from providers (transit fee expense)
        - » w/ AS hop count
  - Gentle
    - Source AS (uploader) view
      - Maximizing outgoing transit traffic to customers (transit fee income)
        - » w/ AS hop count
  - Cooperative
    - Both destination and source AS view
- Estimation-based approach
  - Presented in IETF 78
  - Estimation errors affect performance in transit traffic reduction

Selfish



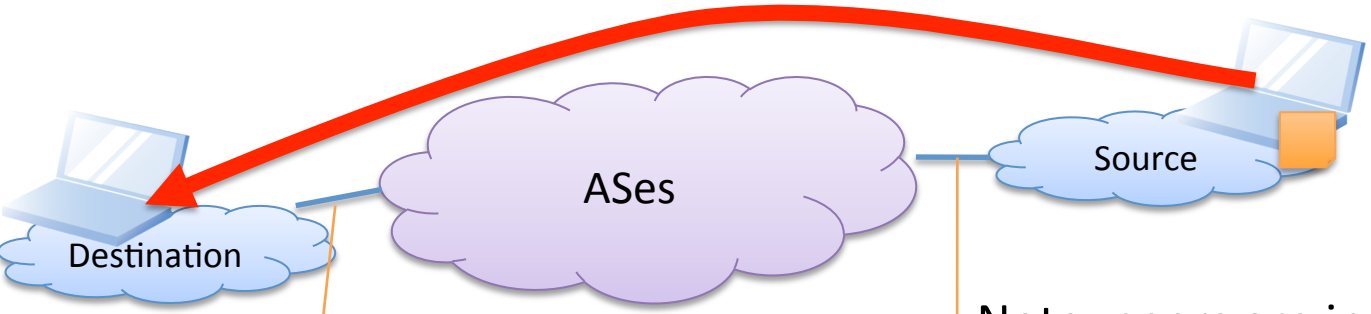
Note; peers are in edge ASes.

		Source edge: p2c	Source edge: p2p	Source edge: c2p
Destination edge: p2c		+,+	+,0	+,-
Destination edge: p2p		0,+	0,0	0,-
Destination edge: c2p		-,+	-,0	-,-

Higher preference

p2c: Provider to customer
c2p: Customer to provider
p2p: Peer to peer

Gentle



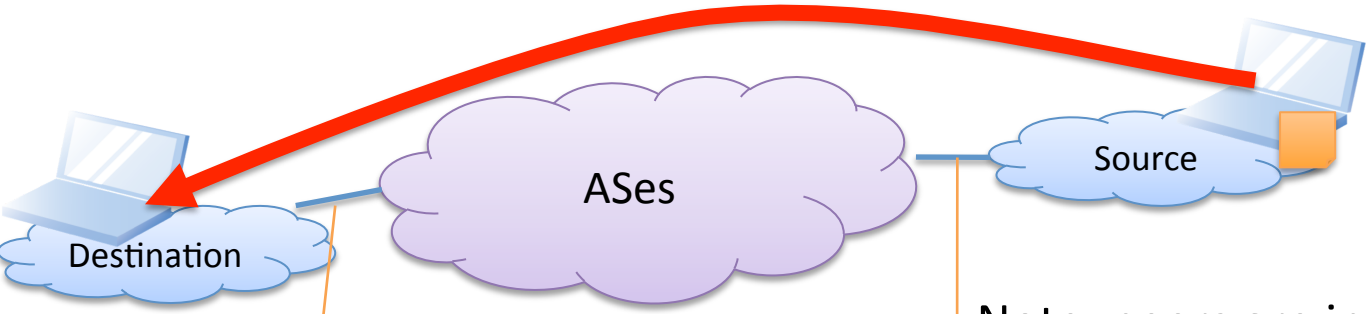
Note; peers are in edge ASes.

		Source edge		
		p2c	**p2p**	**c2p**
Destination edge	**p2c**	+,+	+,0	+,-
	p2p	0,+	0,0	0,-
	c2p	-,+	-,0	-,-

p2c: Provider to customer
c2p: Customer to provider
p2p: Peer to peer

Higher preference

Cooperative

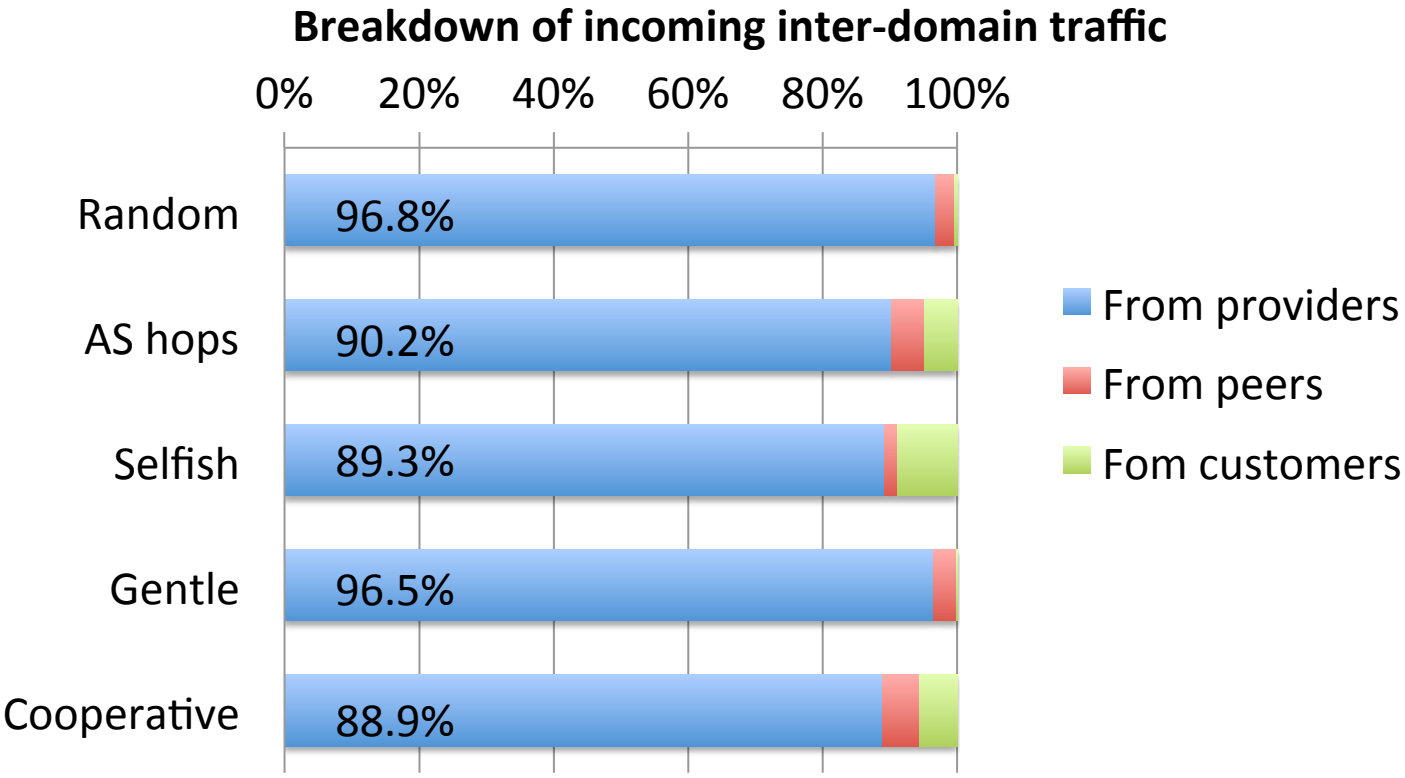


Note; peers are in edge ASes.

		Source edge		
	Higher preference	**p2c**	**p2p**	**c2p**
Destination edge	**p2c**	+,+	+,0	+,-
	p2p	0,+	0,0	0,-
	c2p	-,+	-,0	-,-

p2c: Provider to customer
c2p: Customer to provider
p2p: Peer to peer

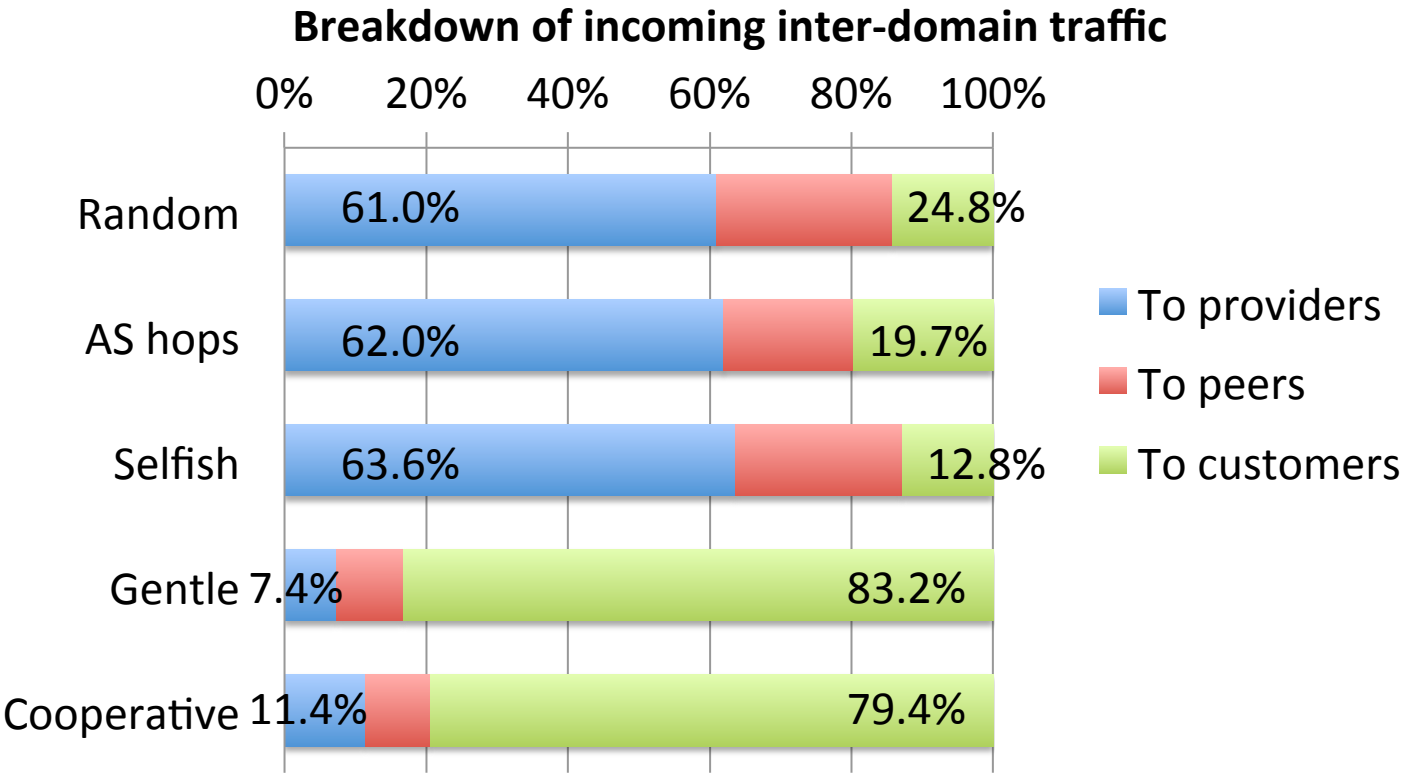
Impact of cross-domain cooperation (1) Download traffic



Not so much large impact upon transit traffic from providers

The dataset for this simulation is measured In a BitTorrent CDN network.

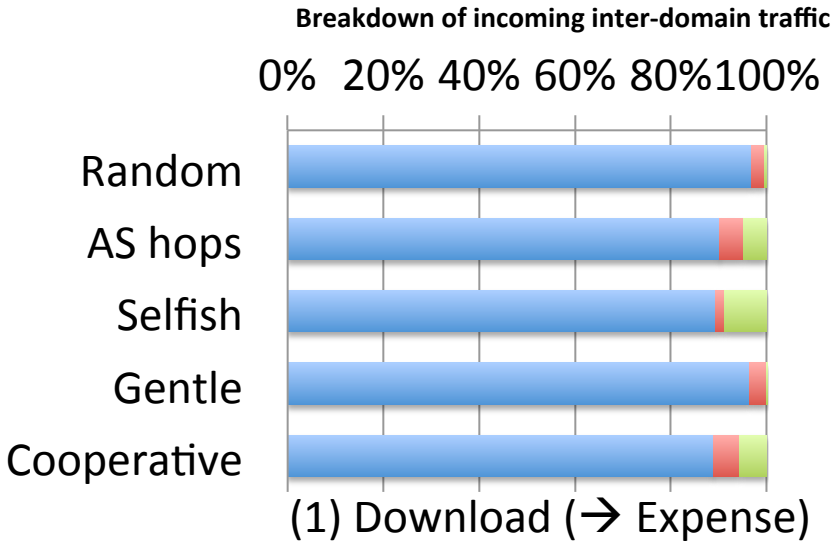
Impact of cross-domain cooperation (2) Upload traffic

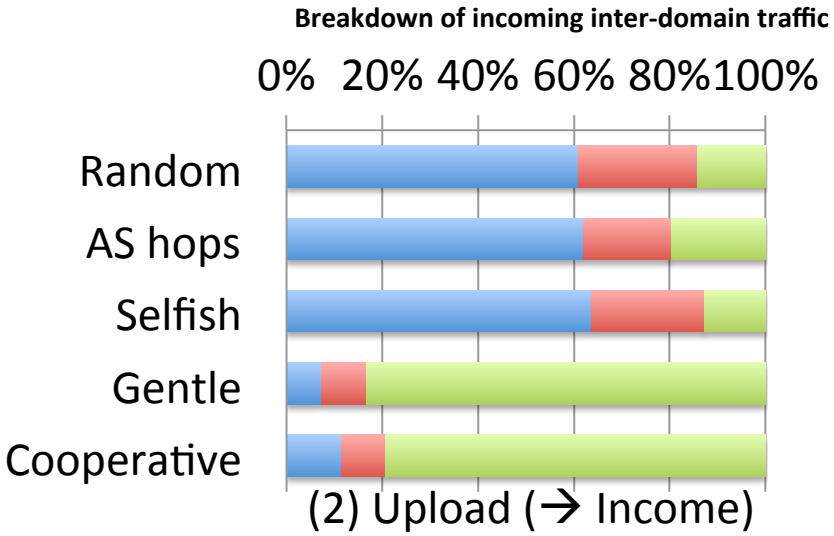


A large impact upon transit traffic to providers/customers

The dataset for this simulation is measured In a BitTorrent CDN network.

Impact of cross-domain cooperation –Summary–



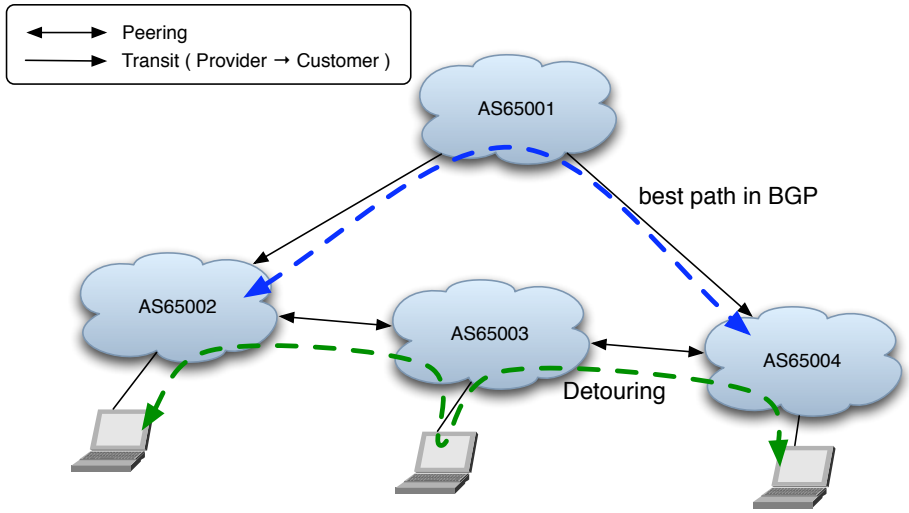


- Selfish: Selection through download-side preference
  - Bad for upload-side (i.e., free-ride)
- Gentle: Selection through upload-side preference
  - Very good for upload-side, but not so good for download-side
- Cooperative: Selection through cooperative preference
  - Very good for upload-side, and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

Deployment considerations

- AS relationships/cross-domain policy
  - Non-disclosure information

  →AS relationships estimation from measured AS graphs (presented in IETF 78)
- Multi-hop routing in app-layer
  - Requires more discussion and evaluation



Peering-peering paths become available when multi-hop routing in application-layer allowed.
→ Free-ride? A sort of alliance? Content peering?

Conclusion

- Impact evaluation of cross-domain cooperation (in peer selection)
  - Cooperation between ASes would
    - strongly increase income of upload-side ASes.
    - reduce expense of download-side ASes.
- Next step
  - “Routing” (not peer selection, multi-hop in app-layer)