

ETM – Economic Traffic Management Approaches

UZH, DOCOMO, TUD, AUEB, PrimeTel, AGH, ICOM, UniWue, TID

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Triple Win

- Management of **overlay networks** based on a collaboration between the overlay provider and the network (underlay) provider in support of the user
 - Cost and investment recovery for operators
- Incentives for **operators**
 - Monetary: reduce overlay traffic and inter-domain traffic
 - Traffic management: less congested links, better performance
 - Reputation: keep customers, distinguish from other operators
- Incentives for **overlay providers**
 - Performance: Active role in traffic mgmt increases service quality
 - Reputation: increased user base due to better performing services
- Incentives for **user**
 - Performance: Increased service quality, e.g., reliability, RTT, BW
 - Monetary: lower price for network access



Outline

- IoP Results
 - For existing scenario
- Tussles Analysis
 - Work in progress



ISP-owned Peers (IoP) (1)

- *Motivation*: Sole locality may not improve peers' performance. We can exploit overlay functioning to localize traffic and achieve **Win-Win**
- *Approach*: Insert an ISP-owned peer (overlay entity) provisioned with higher access capacity
- *Impact*: Improvement of peers' performance and reduction of inbound traffic
- *Innovation*: Transparency, no interception required. Variety of policies

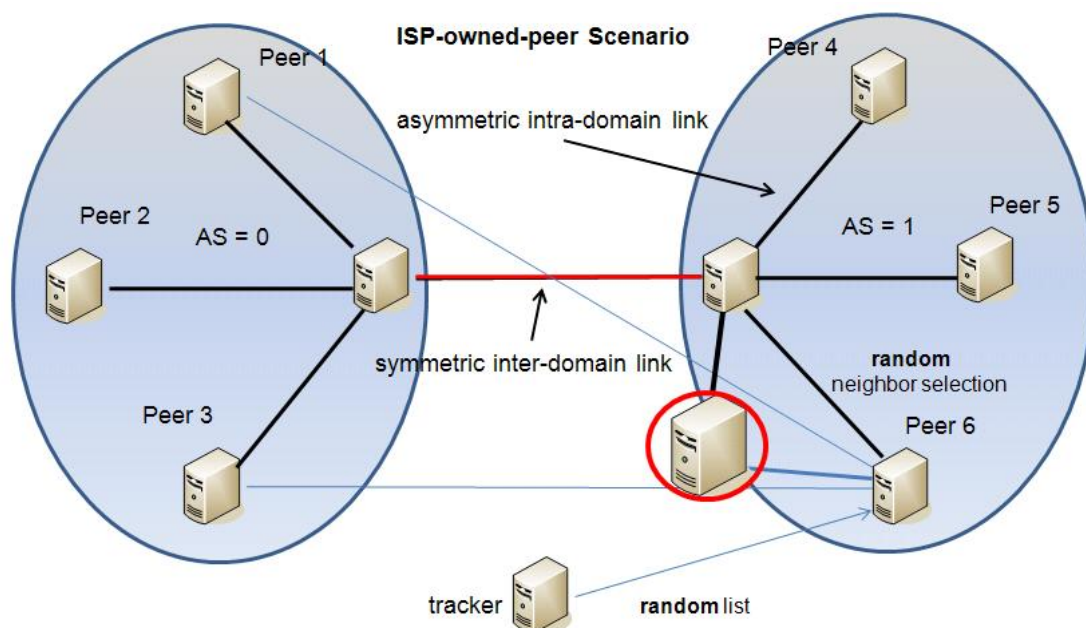


ISP-owned Peers (2)

- Resourceful **entity** that acts as an overlay peer:
 - Belongs to and is controlled by the ISP
 - Participates actively in the overlay
 - Exploits self-organizing mechanism of “tit-for-tat” (t4t)
 - Not an interceptive cache
 - Not a gateway peer
 - *Transparent*
- loP: *no* content initially → acquires the content gradually
- ISP-owned Seed (loS): possesses the *entire* content file from the beginning
 - loS is expected to achieve better performance than loP



Simulation Topology



- bittorrent.patch* for *ns-2*
- *Topology based on PrimeTel's requirements (Cyprus)*



Simulation Scenarios

1. Original BitTorrent
 2. BitTorrent and locality awareness
(biased neighbor selection by Bindal et al.)
 3. Insertion of IoP in original BitTorrent
 4. Insertion of IoP in BitTorrent with Locality Awareness (LA)
- Symmetric or Asymmetric
 - Symmetric: same number of peers in 2 ASes, e.g., 2 Tier-3 ISPs
 - Asymmetric: one AS larger than the other, e.g., Tier-2 and Tier-3
 - All-together or Split
 - All-together: Joining time of all peers $\sim U(0,10)$
 - Split: Joining time of 5 peers in each AS $\sim U(150,300)$, joining time of the rest of the peers and the ISP-owned peer $\sim U(0,10)$



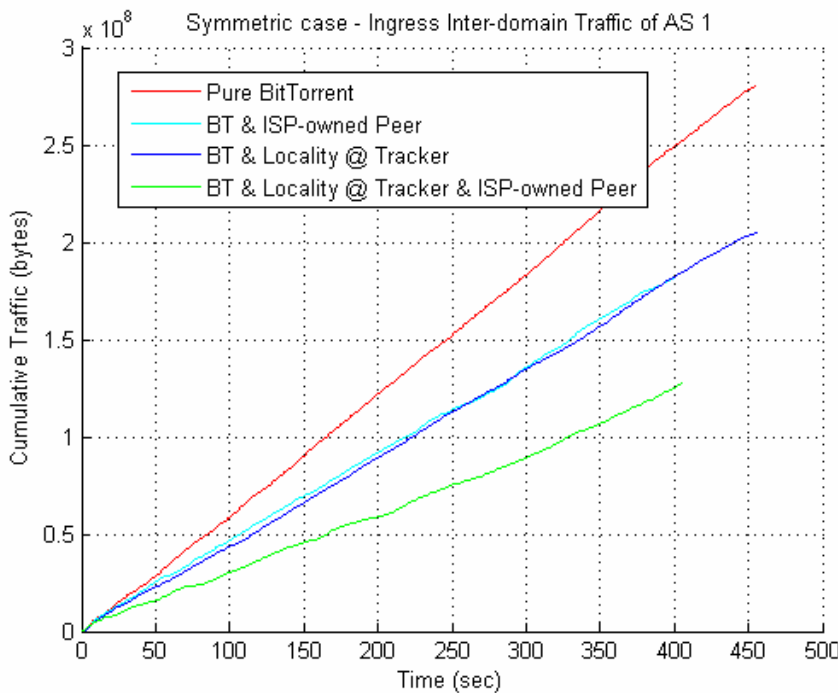
Simulation Parameters

Description	Value
Number of peers	50
Number of seeds	1
Number of ASes	2
Number of peers per AS	(25,25), (35,15)
Upload capacity of regular peers	512K
Download capacity of regular peers	4096K
File size	20M
Number of peers requested from tracker (Size of tracker's list)	25
Number of local peers replied by tracker	20
Number of connections	20
Choking interval	10
Number of unchoked connections permitted per peer	4, 10 (in case of IoP)
Number of ISP-owned peers	1
Upload/download capacity of ISP-owned peers	40960K



Inbound Inter-domain Traffic for AS 1

□ Symmetric, All-together

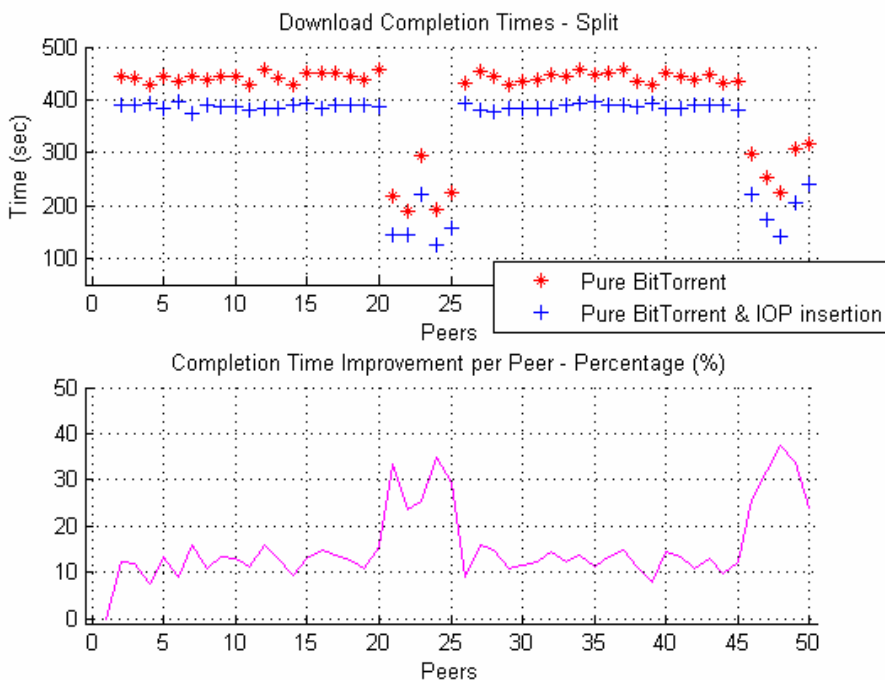


- Up to 35% traffic reduction when loP is inserted (either in BT or in BT&LA)
- Up to 50% traffic reduction when loP insertion is combined with LA vs. original BT



End-Users' Download Times

□ Symmetric, Split

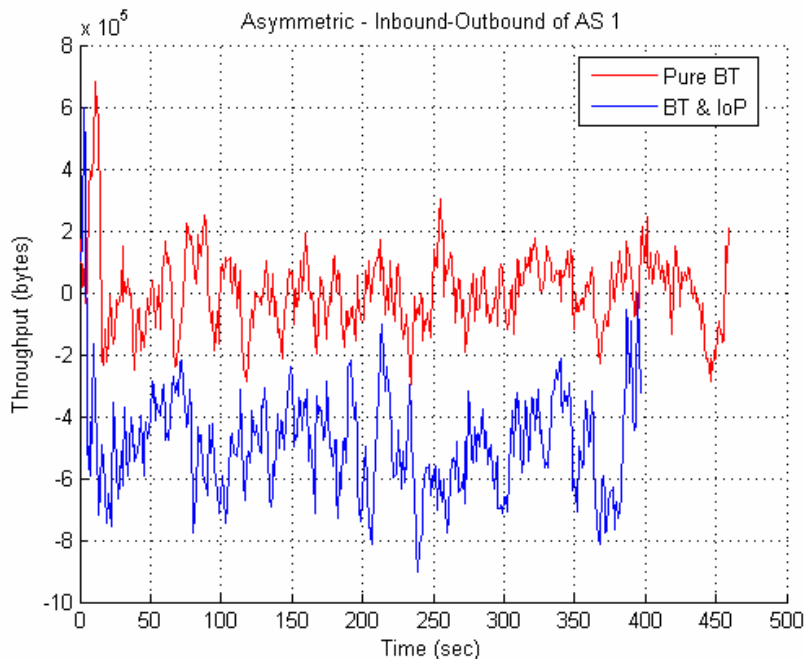


- Significant improvement especially for peers that enter the swarm later, when loP has already turned into a seed



Instantaneous Difference between Inbound and Outbound Traffic of AS 1

□ Symmetric, All-together



- Consider an interconnection charging scheme that takes into account the **difference** of inbound-outbound



Incentive Compatibility

□ IoP achieves simultaneously:

- Significant inbound inter-domain traffic reduction of the AS that deploys the IoP
 - Reduction of charges for inter-domain traffic under different charging schemes based on ingoing and/or outgoing traffic – *win*
 - Improvement of end-users' completion times – *win*
 - Investigation by means of simulations and theoretical modeling
- Technically doable and implemented
- Extension of this work for other types of traffic!



Tussle Analysis

(Thanks to initial SESERV work)



Stakeholders' Classification

□ Network Service Providers

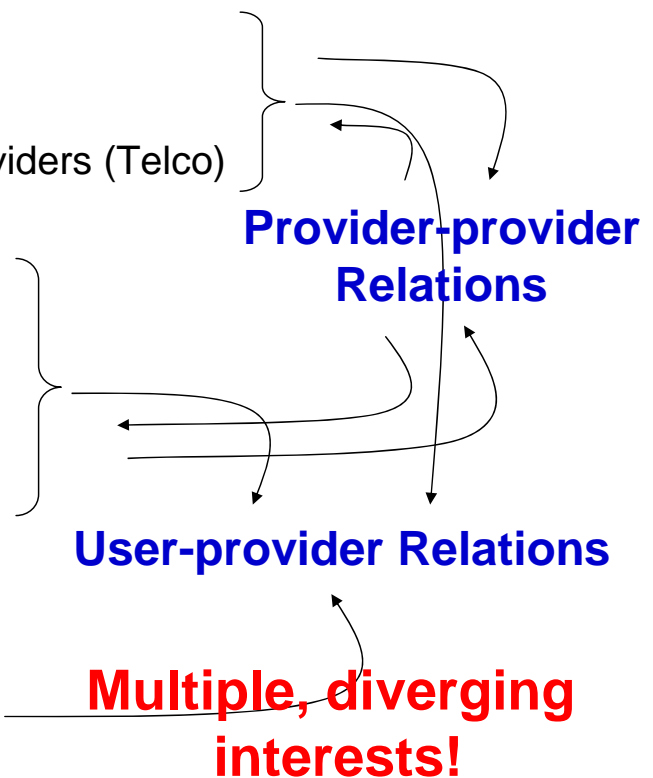
- Internet Service Providers (ISP)
- Telecommunication Service Providers (Telco)

□ Application Service Providers

- Content
- Service
- Overlay
- ...

□ User and customer

- Individual, residential
- SME, residential/commercial
- Corporate, commercial



Socio-economic Tussle Space

- **Economic tussles** refer to conflicts between stakeholders, motivated from an expected reward gained (or cost avoided) when acting rationally.
- **Social tussles** refer to conflicts between stakeholders that do not share the same societal values.
- We are interested at socio-economic tussles arising in the **Internet**.
- Some of the tussles exist naturally; the long-term question is “*How the Future Internet should deal with those tussles?*”.



Socio-economic Tussle (Samples)

- **ISP**
 - ISP (technology view): (expensive) traffic management needs
 - Per user, per session, per stream, per flow, per unit of interest
 - ISP (commercial view): optimizing revenues
 - Flat rate versus resource-based pricing
- **User**
 - QoS/QoE: local perception only
 - E.g., video traffic, social network messages, distributed games
 - Variety of rates, tariffs, and prices
- **Application providers**
 - Delivery of quality applications
 - Economically viable ratio between effort and revenue

Diverging optimization dimensions!

Preference levels of prices vs. quality



Preliminary Views

- User-to-user communications are a must – but technology choices vary a lot
 - P2P, e2e, client-to-client, ... users' choice, no ISP involved
- Users don't care about ISP issues
 - ... as long as perceived quality fits demands
 - Need to be (at least) transparent for the user
- ISPs care about costs related to inter-ISP traffic
 - Peerings vs. Contracts
 - Need for non-costly traffic optimizations

- Tussles determine a path for analyzing those sets.



Thank you for your attention!

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PRIMETEL
Total Communication



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