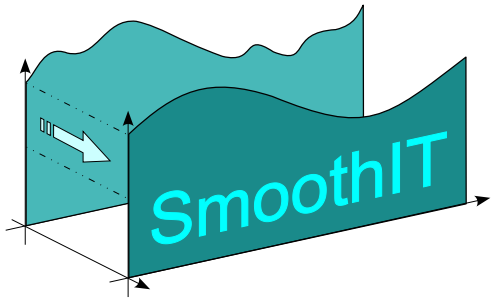
Simple Economic Management Approaches of Overlay Traffic in Heterogeneous Internet Topologies

European Seventh Framework STREP FP7-2007-ICT-216259



Economic Traffic Management for the Future – The SmoothIT Project

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

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Outline

- Motivation
- Objectives
- Stakeholders and Incentives
- TripleWin
- Economic Traffic Management
- Classification and Synergies

Motivation

- P2P applications have become very popular, but lead to:
  - Significant and increasing amount of P2P traffic
  - Suboptimal selection of peers due to information asymmetry
    - Underlay *topology* unknown to overlay
    - Overlay *requirements* unknown to underlay
- Consequence: Non-optimized overlay traffic in the underlay:
  - Higher costs in the underlay for the ISP
  - Lower QoS in overlay for the application provider and his users
- Conventional traffic management techniques not suitable
  - Tussle between ISPs and overlays

SmoothIT Objectives

***S**imple Economic **M**anagement Approaches **o**f **O**verlay **T**raffic in **H**eterogeneous **I**nternet **T**opologies*

- Main objectives:
  - Bridge information gap between overlay and underlay
  - Optimize overlay traffic (file-sharing and Video-on-Demand), in mutually beneficial way for all ISP, user, overlay provider
    → win-win-win situation

- Approach: Economic Traffic Management (ETM)
  - Main tool: incentives of stakeholders

Incentives & Stakeholders

- Incentive mechanism:

  Offers selections to participating agent

  - Each agent responds selfishly

    → Performs selections so as to improve own benefit

  - Individual benefit may also depend on other agents' decisions

- Stakeholders: ISP, overlay provider, user

  - Users and the application provider have compatible incentives

  - Overlay and ISP may have conflicting incentives

Classification of Incentives

- Economic incentives classification:
  1. Monetary
     - Reduction of providers' costs, increase of their income
     - Value-for-money for users
  2. Performance-related
     - Applies to both overlay and underlay
     - Of particular interest to users
  3. Reputation
     - Applies to providers → leads to increased user-base

- Increase of providers' monetary income can be attained with performance differentiation

Win-win-win (TripleWin) Situation

- Incentives of all stakeholders promoted simultaneously
  - possibly heterogeneous incentives
- Example: “Locality aware” file-sharing:
  Promoting downloading from local peers may:
  - improve overlay performance

    and
  - reduce ISP inter-domain traffic (and its charge ?)
  - May not apply if locality is promoted excessively. Should avoid:
    - network separation
    - performance deterioration for other traffic

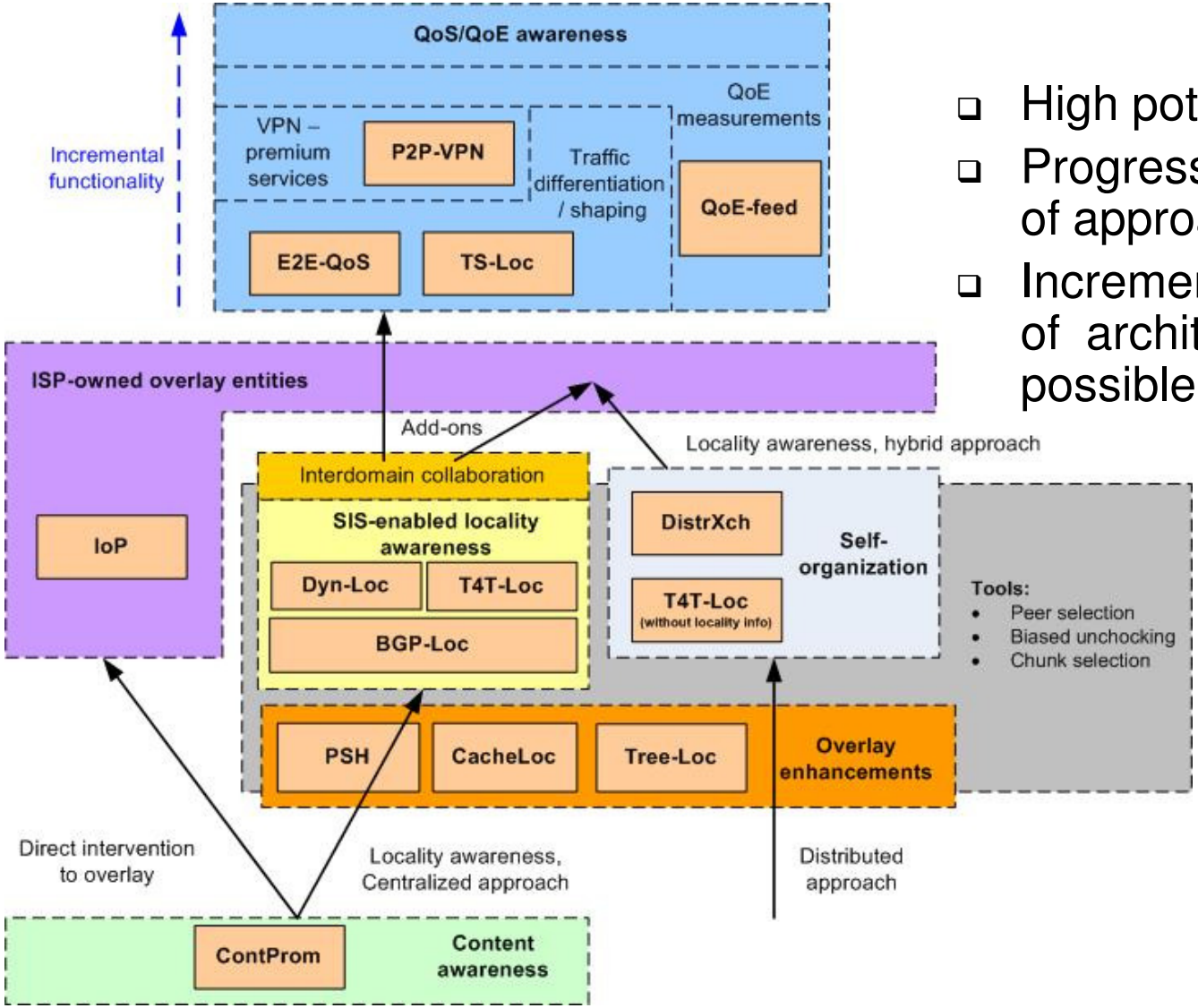
Economic Traffic Management (ETM)

- Employs economic incentives' mechanisms for overlay traffic control and management

- Desired effect:
  1. User selects the individually optimal choice
  2. This affects the traffic patterns beneficially for the ISP

- ISP, through ETM, shapes users' behavior and drives system to a desired state by means of:
  - providing underlay information; e.g. RTTs
  - employing underlay policies; e.g. QoS differentiation

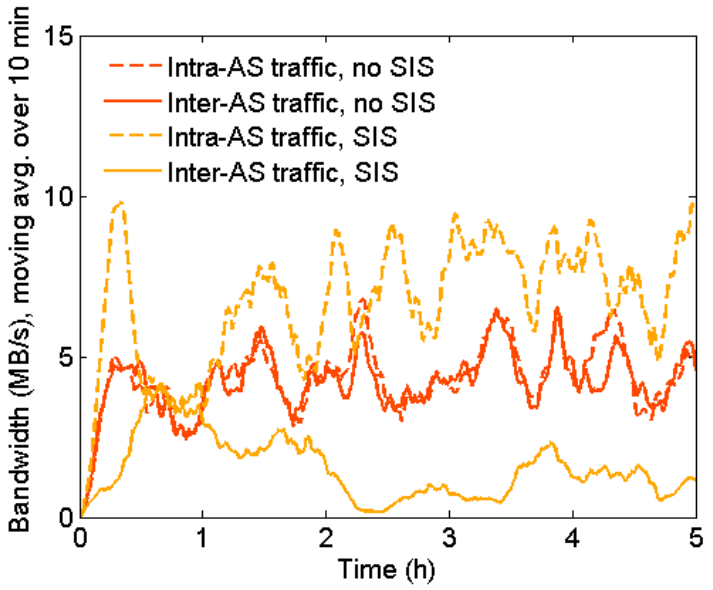
Classification of ETMs and Synergies



- High potential for synergies
- Progressive development of approaches is possible
- Incremental enhancement of architecture is also possible

Selected Results

- BGP-based Mechanism
  - BGP protocol provides locality and AS information
  1. Peer sends to SIS a list of other peers' IP addresses
  2. The SIS assigns a value to each peer of the list, and sorts the list in decreasing order
  3. The querying peer employs sorted list
- Simulated Scenario:
  - 2 autonomous systems, ~100 peers
  - Locality awareness at the uploading peer
- Considerable reduction of inter-domain traffic and possible improvement of:
  - Download time (for files)
  - Stall times (for videos)



Thank you for your attention!