# Simple Economic Management Approaches of Overlay Traffic in Heterogeneous Internet Topologies

SmoothIT addresses innovatively the detailed economic and technical mechanisms for a flexible, secure, and scalable traffic management of overlay networks in tomorrow's ISPs and telecommunication operators networking infrastructure.

At A Glance: SmoothIT

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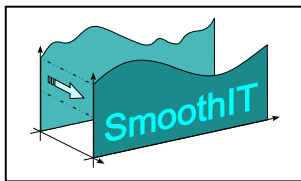
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Duration: *Jan, 2008 – Dec, 2010*

Total Cost: *€4.4m*

EC Contribution: *€3.0m*

Contract Number: INFSO-ICT-216259

Main Objectives

The Internet traffic stemming from overlay-based applications, *e.g.*, Peer-to-Peer applications, increases rapidly with the increase of available bandwidth of end-nodes. For today's Telecommunication Service Providers (telco) and Internet Service Providers (ISP) the issue arising is: how to **control and manage network traffic** stemming from **overlay-based applications**. As the structure of overlays determines the traffic flows in ISP networks, it is highly efficient for an ISP to **influence overlay configuration** based on information on their structure. Overlays have to be managed to maximize the benefit for multiple operators/ISPs involved, and to increase the capability to withstand faults, and balance the network load.

Therefore, SmoothIT pursues the following major objectives:

1. SmoothIT will **structure overlays** in a way that is efficient or **optimal**, both for user communities and for ISPs. This is to be attained by means of incentive mechanisms.

2. SmoothIT will study and **define key requirements** for a commercial application of **Economic Traffic Management (ETM)** schemes for ISPs and telcos.

3. In order to advance traffic management beyond traditional limits, specialized **economic theory** will be applied for building in a **fully decentralized** way network efficient Internet-based overlay services in **multi-domain scenarios**, solving the information asymmetry problem.

4. SmoothIT will **design, prototype, and validate** the necessary networking infrastructure and their components for an **efficient** implementation of such economic traffic management mechanisms in an **IP testbed and trial** network.

5. SmoothIT will develop an optimized **incentive-driven signaling approach** for defining (theory) and delivering (technology) economic signals across domain boundaries in support of **co-operating and competing providers** in an interconnected **heterogeneous network environment**.

6. SmoothIT will stress **operator-orientation** by verifying key results of the work through ISP and telco requirements as well as its supporting technology.

... an optimized incentive-driven signaling approach for defining (theory) and delivering (technology) economic signals across domain boundaries in support of co-operating and competing providers to manage overlay traffic…

Technical Approach

The technical approach designed for the SmoothIT project consists of five work packages. WP1 investigates, specifies, and applies traffic analysis methods for overlay applications which are subject to ETM mechanisms. Detailed traffic requirements are determined and utilized to provide an objective basis for rating overlay traffic. WP2 specifies ETM mechanisms, develops the respective theory for incentive-based schemes, evaluates their performance through simulation, and provides applicable parameterizations for the test-bed and trial. WP3 specifies, develops, implements, and evaluates the flexible set of networking protocol and a systems architecture being able to perform measurements, accounting, and charging for overlay networks, forming the basis for the test-bed and trial. WP4 specifies and runs two trials in two interlinked phases. A first internal trial will be performed within the test-bed for parameter finding and tuning (at the middle of the project) and a second external trial one will be run (at the end of the project) to collect and assess practical-applicable results in a larger scale. WP5 is responsible for all project management, dissemination, standardization, and exploitation activities.

Based on those objectives defined above, the overall SmoothIT roles and relationships is envisioned as shown in Figure 1. The important interactions between telecommunication networks (representing operators), the overlay service (representing an application-driven support), and the group of users are outlined.
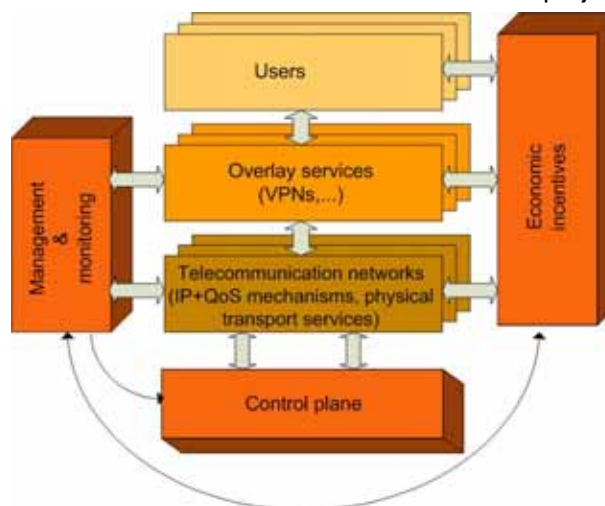

Figure 1: Interactions between Roles and Technical as well as Economic Mechanisms.

Key Issues

Key issues of SmoothIT cover the theory and modelling of the new ETM mechanism to be designed as well as the technical aspects of its implementation and evaluation. These are:

- The design of a **flexible, secure, and scalable** economic management mechanisms to enable ISPs to **reduce their service provisioning and maintenance costs**, thus, leading towards a highly competitive market advantage.

- The definition of appropriate **incentives schemes** to motivate collaboration among ISPs (which may also be competing ones at the same time) and between ISPs and overlay networks, thus solving the information asymmetry problem.

- The provision of **security, privacy and trust for economic management schemes** and their implementation in a fully **decentralized** and competitive **multi-provider** domain.

- The exploitation of network-related and management protocol, such as traffic measurement, AAA (Authentication, Authorization, and Accounting), QoS, and network management systems; based on the underlying infrastructure in order **to support the widest possible range of inter-domain and inter-provider solutions**.

Expected Impact

The SmoothIT project will have a considerable strategic impact regarding **theoretical concepts and results**, since it will focus on and promote the state-of-the-art of ETM. This approach involves decentralized decision-making guided by incentives and enabled by means of appropriate mechanisms, which are based on pricing and reciprocation. The project will also have significant strategic impact on the **players** involved, since it will provide (a) practical mechanisms, which will be prototyped and (b) theoretically justified ETM mechanisms promoting overall efficiency.

Three **envisioned measurable impacts** are:

1. **Cost saving for ISPs**: *lower operation costs*, due to ETM based traffic engineering, *lower interconnection costs*, as traffic can be kept inside an ISPs domain, and *lower capacity extension cost*, as capacity requirements can be forecasted with much higher accuracy.

2. **Lower prices for end users**, due to competitive pricing by ISP that are enabled by new ETM mechanisms.

3. **Better QoS** for overlay based applications across ISP domains, due to the usage of ETM based traffic engineering. This leads to an improved media consumption experience for the end users.