European Commission

Social-aware Economic Traffic Management for Overlay and Cloud Applications

Smarten IT

Socially-aware Management of New Overlay Application Traffic combined with Energy Efficiency in the Internet

SmartenIT

Project Coordinator

Prof. Dr. Burkhard Stiller

University of Zürich, CSG @IFI, CH

Tel: +41 44 635 6710

Fax: + 41 44 635 6809

Email: stiller @ifi.uzh.ch

Project Website: http://www.smartenit.eu

Partners:

University of Zürich, CH
Athens University of Economics and Business, GR
University of Würzburg, DE
Technische Universität Darmstadt, DE
AGH University of Science and Technology, PL
Intracom Telecom, GR
Alcatel Lucent Bell Labs France, FR
Institute of Bioorganic Chemistry Polish Academy of Sciences, PL
Interoute Spa, IT
Telekom Deutschland GmbH, DE

Duration: *November 2012-October 2015*

Funding scheme: *STREP*

Total Cost: 4.5 M€

EC Contribution: 3.0 M€

Contract Number: CNECT-ICT-*317846*

Main Objectives

The Internet has seen a strong move to support overlay applications, which demand a coherent and integrated control in the underlying heterogeneous networks in a scalable, resilient, and energy-efficient manner. A tighter integration of network management and overlay service functionality can lead to cross-layer optimization of operations and management, thus, being a promising approach to offer a large business potential in operational perspectives for all players involved.

Therefore, SmartenIT targets an incentive-compatible cross-layer network management for providers of overlay-based applications (*e.g.*, cloud applications, content delivery networks, and social networks), for network providers, and for end-users to ensure QoE-awareness (Quality-of-Experience), by accordingly addressing load and traffic patterns or special application requirements, and exploiting at the same time social awareness (in terms of user relations and interests).

SmartenIT targets an incentive-compatible cross-layer network management of overlay-based applications.

Moreover, the energy efficiency with respect to both end-user devices and underlying networking infrastructure is tackled to ensure an operationally efficient management. Incentive-compatible network management mechanisms for improving metrics in all layers and on an inter-domain basis for Internet Service Providers and telecommunication providers serve as the major means to deal with real-life scenarios. Such metrics and mechanisms encompass:

1. Inter-cloud communication through many operators where applications demand for dedicated Quality-of-Service (QoS) levels.

2. An integrated and energy-aware traffic management considering limited energy resources of mobile devices accessing the cloud.

3. The exploitation of meta-information by network operators for the purpose of socially aware traffic management.

Selected scenarios are ported into test-beds, in which the effectiveness of appropriate traffic management mechanisms, integrated in an innovative architecture, is demonstrated. This will lead to benefits in cost and service quality for various stakeholders, including network and overlay application providers as well as end-users – all of which are relevant players in Europe and world-wide.

SmartenIT Requirements and Goals

The three SmartenIT requirements encompass:

1. Detailed understanding of overlay-based applications' management demands in terms of traffic, QoE, and user behavior.

2. Network management support for cloud-based applications being seamlessly integrated into heterogeneous network management approaches of existing networks.

3. Cross-layer, operational, incentive-compatible, and efficient network management mechanisms for dealing with inter-domain ISPs functionality.

The design, implementation, and evaluation of networking functionalities for improving this management support of massively adopted applications generating large traffic volumes, such as content delivery, can be achieved by exploiting cloud computing and social networking principles. In turn, key SmartenIT requirements have led to the SmartenIT key design goals:

a) Incentive-compatible network management mechanisms for end-users, overlay service providers, and network providers, which are based on a well-defined and open protocol like ALTO and support an operational framework for agile connectivity, distributed management, and a better control of heterogeneous networks.

b) QoE-awareness by monitoring the key influence factors like end-user equipment capabilities or traffic load (covering bursty traffic situations and congestion cases) and social awareness, especially awareness of user relations and interests.

c) Energy efficiency with respect to networking infrastructure as well as wireless and wired end-user devices, which includes flexibility in terms of adaptability to changing application requirements.

SmartenIT Scenarios

SmartenIT started with a set of major scenarios in place, which are driven by technology demands.

Energy-aware Traffic Management

Addressing the trade-off between energy efficient computation in the cloud and energy consumption on mobile end-user devices.

Social-aware Traffic Management

Through the exploitation of meta-information extracted from online social networks by network operators.

Inter-cloud Communications

Through many operators. where applications demand for dedicated traffic quality levels.

SmartenIT Architecture

SmartenIT's high-level, initial architecture (see figure below) outlines the key properties and functionality of SmartenIT's approach, each of which span one or multiple domains out of the overlay/cloud domain, the core network domain, and the user/access network domain. Those key architecture properties include the three main SmartenIT objectives, all of which are equally relevant in all three domains. Key functionality of the overlay/cloud domain (with overlap to the core network domain) includes overlay management and cloud traffic management. Likewise, key functionality rooted in the core network domain (with overlap to the overlay/ cloud domain) includes content delivery/caching, network traffic management, and traffic monitoring. Finally, key functionality in the user/access network domain includes quality management and mobile traffic management.

Expected Outcomes

The set of outcomes SmartenIT plans to develop include appropriate management mechanisms to qualify and quantify the selected use cases, which will be dependent on those scenarios as outlined above: They will be demonstrated as an implemented prototype for the proof-of-concept.