

# Project Achievements



## Traffic Measurements and Models in Multi-Service Networks

The main objective of TRAMMS was to model traffic in multi-service IP networks, and to develop tools for monitoring of QoS and bottlenecks in networks. The models are built upon data acquired in different parts of Europe and combined with the new tools developed in the project, they bring significant new insight into network traffic, bottleneck analysis, user behaviour and QoS monitoring.

### Main focus

The idea behind the concept of a converged infrastructure is that a single network should support (in principle) all applications. It will have to carry traffic from different terminals and a great variety of applications. Traditionally, lack of knowledge regarding traffic patterns in multi-service IP networks has been compensated by massive over-provisioning of resources in order to decrease the likelihood of QoS violations. Understanding the user traffic patterns and how they aggregate on different levels will imply a competitive advantage when deploying broadband networks and applications since the investment costs will be lower.

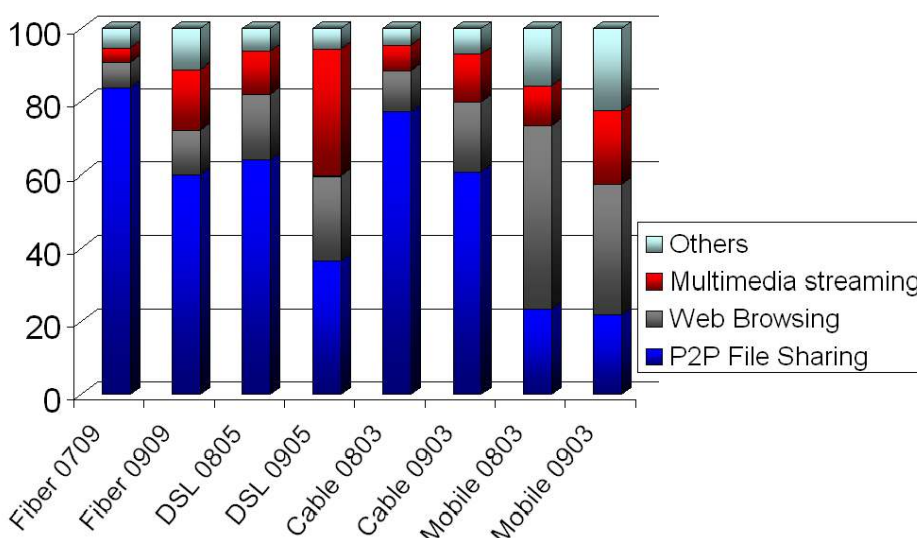
The main focus in TRAMMS has been to

increase the knowledge of traffic patterns and possibilities for traffic management and QoS monitoring of IP networks. This has been realized through development of low cost tools for analyzing e.g. QoS parameters, available bandwidth on end-to-end links, routing events, as well as using available state-of-the art deep packet inspection devices to analyse actual traffic in live access networks.

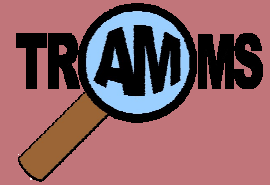
### Approach

A unique feature of the TRAMMS project has been the combination of hardware and software development and theoretical analysis. In this way, the project has contributed to development of new advanced and low cost tools for bottleneck analysis at the same time as it has contributed to an increased insight into user behaviour in IP access networks in Europe. The databases with traffic data built up within the project are unique, since access to this kind of data is very rare and usually limited to the operators. The data collection and analysis effort that was carried out in the project is believed to further advance the European position in the forming of the future Internet.

### Relative share of traffic (volume %)



Traffic mix in the downlink direction in some different networks in Spain (Cable and Mobile) and in Sweden (FTTH and DSL). For more detailed info on the results, please refer to our web page and public deliverables.



## TRAMMS

Project ID: CP4-025

Start Date: 1 January 2007

Closure date: 31 December 2009

### Partners:

Acreo AB, Sweden

Budapest University of Technology & Economics, Hungary

Ericsson AB, Sweden

Euskaltel, Spain

GCM Communications Technology, Spain

Lund University, Sweden

Procera Networks, Sweden

Fundación Robotiker, Spain

Telefónica I+D, Spain

Telnet-RI, Spain

Universidad Autónoma de Madrid, Spain

### Co-ordinator:

Andreas Aurelius

Acreo AB, Sweden

E-mail: [Andreas.Aurelius@acreo.se](mailto:Andreas.Aurelius@acreo.se)

### Project Website

[www.celtic-initiative.org/projects/tramms](http://www.celtic-initiative.org/projects/tramms)

## Achieved results

The project has impacted 7 product lines in 5 different companies. All of these products are aimed at finding the bottlenecks in the network and monitoring traffic and QoS parameters, and they complement each other in a very nice way to get a complete picture of the status of your network. The QoS related products include the CM-100, CompactSAE and SAE chassis from TELNET, the Accu-Qos from the recently formed startup Naudit. These products monitor QoS parameters by sending and analyzing probe packets. The BGP probe by GCM is a silent listener that can easily be installed near the border router to record and analyse BGP routing events. This information is collected and presented in a nice way to use for e.g. forensic activities for analysing routing events etc. BART ("Bandwidth Available in Real Time") is an active method for estimating end-to-end available bandwidth and tight link capacity in real time over packet-switched network paths. As part of the TRAMMS project BART has been evaluated in realistic field tests, and further developed to improve accuracy in high speed networks. Ericsson has promoted standardization of active end-to-end capacity measurement methods in the International Telecommunication Union (ITU-T). The main result so far is the acceptance and inclusion of the "IP-layer capacity framework" in ITU-T Recommendation Y.1540. The knowledge gained in the project has been used to further de-

velop and improve the PacketLogic product from Procera, mainly regarding its statistics functionality.

Measurements from the application to the packet level per household

form and share the measurements with other partners, as well as to prepare them for a later analysis, while preserving the user privacy and respecting the privacy policies of the operators. TRAMMS has



*MetroSAE chassis, one of the 7 product lines impacted by the project.*

were collected in real networks located in different countries (Sweden and Spain) covering different types of access (FTTH, xDSL, CMTS, GGSN, university network). Measurements from a large amount of users were gathered for long periods of time (close to 3000 TiB of traffic volume was analysed in Spanish and Swedish networks in 2007-2009 in periods ranging from several days to several years). A common methodology was established between the different partners in order to per-

contributed as a participant to the creation of the ISG MOI group under the ETSI framework.

## Impact

As stated above, TRAMMS has impacted 7 product lines in 5 companies. These products bring new tools for European industry to stay on top in analysing bottlenecks, and keeping track of traffic and QoS in your network. Apart from that, standardisation contributions have been made to ITU-T and ETSI ISG MOI. Network operators are usually reluctant to provide access to their network measurements to external entities. The TRAMMS results prove that it is possible to perform measurements in commercial operator networks without affecting their correct operation and respecting their privacy policies, as well as the privacy of the users. To understand end user behaviour is of key importance for operators in order to provide the needed capacity in the right time and for system and equipment vendors in order to develop products that will be able to handle the foreseen increase in capacity for both fixed and mobile broadband networks. A number of scientific papers and public traffic reports have been issued in order to increase the overall knowledge in today's IP traffic and user behaviour in Europe.

## About Celtic

Celtic is a European research and development programme, designed to strengthen Europe's competitiveness in telecommunications through short and medium term collaborative R&D projects. Celtic is currently the only European R&D programme fully dedicated to end-to-end telecommunication solutions.

**Timeframe:** 8 years, from 2004 to 2011

**Clusterbudget:** in the range of 1 billion euro, shared between governments and private participants

**Participants:** small, medium and large companies from telecommunications industry, universities, research institutes, and local authorities from all 35 Eureka countries.

## Celtic Office

c/o Eurescom, Wieblinger Weg 19/4,

69123 Heidelberg, Germany

Phone: +49 6221 989 405, e-mail: office@celtic-initiative.org

www.celtic-initiative.org

