

# ERCIM “Alain Bensoussan” Fellowship Scientific Report

Fellow: Despoina Triantafyllidou

Visited Location : VTT Technical Research Centre of Finland, Oulu

Duration of Visit: 1/11/2009 – 31/10/2010

## **I - Scientific activity**

Our work focused on admission control assisted by real-time QoS measurements. We exploited a passive QoS monitoring tool (QoSMeT) in a reactive measurement-based scheme, to trace the performance degradation induced by incoming flows and to react appropriately.

The term reactive implies a regression AC scheme which initially applies unconditional acceptance of the flows -at the higher quality class. At the other end, a QoS monitoring entity can indicate whether the new flow harmed the existing ones.

The system consists of three modules; the QoS monitoring tool, the traffic identification and classification tool, and the reactive admission control, which exploits the information of the former two, in order to evaluate the impact of any new flows to the network's QoS level, and treat them appropriately.

The system is implemented and tested on a real test bed with video streams requesting sources from a server located behind the -bottlenecked- core network. It proves to have a realistic match between the network's QoS and the users' QoE, and a timely reaction to sustaining the existing clients' QoS.

We introduce two novel ideas in this work. First, the act of regression in admission control is not yet met, in the bibliography. Second, the accurate translation of the QoS parameters to the actual video quality (user experience) is based on own measurements upon a test bed, and is original.

Further from this task, we were concerned with testing, in a simulation environment, a scheme for TCP-efficient routing in ad hoc networks. The scheme was proposed in past research work, and we were occupied with obtaining and studying results out of its performance evaluation. The results were published, as below indicated.

As a secondary task, we studied the newly proposed content centric paradigm, and related it with other data-centric communication paradigms. One of main interest was the NetInf architecture, developed by VTT in the context of the FP7 s4WARD project. As this architecture proposes a peer-to-peer data sharing, the main objective was –and still is- to merge the ideas of the content-centric approach to NetInf. A few first steps towards this were made, e.g. handling multiple identical requests from different clients, by the tracker.

## **II- Publication(s) during your fellowship**

A conservative scheme for distributed low-delay routing in MANETs.  
Despina Triantafyllidou and Khaldoun Al Agha.  
In IEEE PIMRC'10.

Abstract:

Delay-based routing is proved to improve the network's round-trip time without enhancing its throughput [1]. The reason is that optimising the end-to-end delay, as any load-based metric, creates route instability which results in packet reordering. This problem is detrimental for TCP. In the present work, we couple delay-based routing with a mechanism that locks, upon each node, the next-hop for each TCP flow, unless that hop becomes unavailable. The routes for future flows are proactively discovered by optimized link-state routing (OLSR) and reside in the node's routing table, so the proposed mechanism is fully distributed. Simulation experiments in static and mobile scenarios for small pedestrian networks show that the use of path-locking in conjunction with delay-based routing alleviates the route oscillations and improves the TCP's throughput.

## **III -Attended Seminars, Workshops, and Conferences**

IEEE PIMRC'10, 26-30 Sept. 2010, Istanbul, Turkey.

CWC GIGA2010 Seminar, 11 Jan. 2010, University of Oulu, Finland.

## **IV – Research Exchange Programme (12 month scheme)**

**University of Bern (SARIT), 1-7 February 2010, Switzerland. Host: Prof. Torsten Braun.**

Description:

Meetings with all the team members were planned. The purpose was to identify common fields of knowledge and research. We found out that the data dissemination techniques proposed for the recent content-centric networking paradigm, i.e., one of the VTT's objectives, have common –if not identical- characteristics with the directed diffusion, widely used in sensor networks for over a decade. The University of Bern (UniBe) has been active in these techniques, so we obtained valuable feedback.

An area where future cooperation between the two institutes became possible was in an effort to support real-time communications in wireless mesh networks, from UniBe. The proposed ATOM architecture of Unibe required a passive measurement tool for connection monitoring and dynamic adaptation of video encoding and of path selection. The QoSMeT measurement tool, developed by VTT, was planned to be integrated into the ATOM architecture for this purpose. The installation and testing period of QoSMeT has been completed, and UniBe is in the face of integration.

**SICS Stockholm, 16-22 August 2010, Sweden. Host: Bengt Ahlgren.**

**Description:**

Meetings with all the team members were scheduled. The purpose was to identify common fields of knowledge and research. SICS has cooperated with VTT during the FOREWARD project, for the design and implementation of the NetInf architecture, so this was one of the common topics of discussion and brainstorming. We further thought about data dissemination algorithms and scenarios for TV-distribution.

Moreover, SICS experience on statistical data analysis matched with our current efforts to translate QoS measurements (quantitative information) to qualitative estimation about the user's experience, e.g. video quality. SICS can provide their expertise with either on-line analysis or off-line data mining over VTT's QoSMeT measurement sets.

A third common point was in the evaluation and comparison of simulation models for the wireless MAC layers. SICS has developed validation tool-sets for COMNET and NS-2, which we could directly relate with our previous experience of OPNET.

Finally, we discussed on ad hoc routing; load-based metrics and avoiding path oscillations, vs. traffic matrix estimation, currently proposed by SICS.