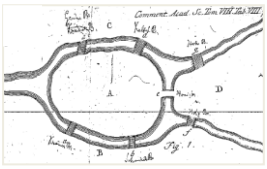


THE EULER NEWSLETTER

In this issue

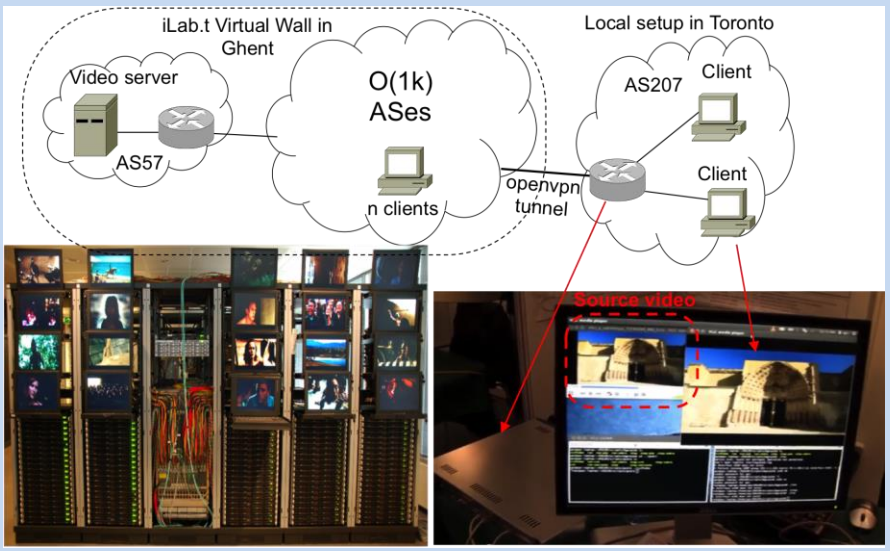
Report of the EULER demos

During the last two years, EULER partners realised several technical demonstrations to validate the tools and protocols developed in the project and other additional demonstrations are planned to be showcased in the near future in international events. In this newsletter, we briefly present these demos and the outcomes/feedbacks for demos already realised.

Two presentations have been proposed during the **Measurement-based Experimental Research workshop** organized in the framework of the Future Internet Week in Aalborg, Denmark, on 10 May 2012. The first one concerned the new tool, named UDP Ping (**http://www.mtoolsanddata.org/projects/udpping/**), able to reveal the interface of targeted router in Internet. The demo focused in particular to the way this novel tool can be used in a coordinated campaign in order to reveal the number of interfaces of a sample of core router in the Internet. It requires several monitor and, by means of a coordinating use of UNIX script, it allows to perform the measurements and infer a precise estimation of the degree distribution of a core router. The second demo showed the use of a new simulator of network's dynamics, named DRMSim (**http://www.mtoolsanddata.org/projects/drmsim/**). This simulator intends to model at the same time the modifications occurring in real networks such as Internet and also the dynamics occurring on the network, such as the dynamics of routing. During the demo, it has been showed in particular that the simulator is able to account for load balancing phenomena.

In the context of the **Hands on FIRE** demo area of the Future Internet Week in Dublin, Ireland, on May 8-10, 2013, EULER succesfully showcased the first prototype of the Greeedy Compact Multicast Routing (GCMR) scheme (see Newsletter No. 3 for the details). The demo consisted of an execution of the GCMR scheme and the evaluation of its basic functionality on the iLab.t virtual wall (VW) platform compared to the standard PIM-SSM (RFC 4607) combined with Multiprotocol BGP (RFC 2858) and IGMP (RFC 3376). iLab.t VW is a large-scale experimental Linux machine-based emulation testbed located in Ghent, Belgium (see Newsletter No. 7 for details). The prototypes of the GCMR and PIM routing engines have been developed using the libraries of the Quagga open source routing suite (see Newsletter No. 10 for details). As reported in Newsletter No. 10, the GCMR scheme provides a better performance compared to PIM-SSM in terms of the memory space it requires to locally store the routing information, the stretch factor increase multicast routing paths it produces, and the limited number of re-routinge events it requires in case of link failure. The scenario consisted of 207 routers (each one belonging to a different AS), one video server, and two video clients. The emulation platform emulates 206 routers and two hosts, one running the video server and the other the video client. At Dublin, we brought one router and two video clients (running on the same computer). The experimental aimed at showing that BGP+PIM-SSM multicast session recovery time leads to traffic disruptions lasting up to 1 min compared to the sub-second recovery time achievable using GCMR.

Final version of the GCMR prototype was successfully showed at the **Demo Session** event at the **IEEE Infocom 2014** held in Toronto, Canada, on April 27-May 3, 2014. In this demo, two additional features were added to GCMR: 1) An improved implementation of the adaptability mechanism allowing the dynamic rearrangement of existing multicast trees in the advent of topology changes such as link failures or clients leaving the multicast group; 2) A host-initiated GCMR subscription feature to extend the GCMR scope up to the clients (it can be seen as a substitute of the IGMP or MLD protocols usually adopted in multicast). As shown in the below figure, the demo consisted again of two parts, the iLab.t VW and the local setup at the conference booth. A large-scale topology mimic a realistic portion of the Internet was setup in the iLab.t VW. Several hosts were also setup in the iLab.t VW. One of them was a video server while the others clients. The local setup consisted of a Linux router and 2 clients. The main goal was to compare the performance of GCMR againts PIM (with MBGP and IGMP). Our demo was presented during the first of the three sessions. We were located in a room with other 6 demos. The demo session lasted 3 hours; during this period our demo worked perfectly. Around 15 group of persons expressed interested in our demo. Some were PhD students but some others were researchers or senior researchers. In particular, one industrial (working in unicast/multicast management) was particularly interesting as the main issues they expirience with multicast is the lack of feedbacks from receivers (or intermediate nodes), so they cannot verify the quality of the multicast reception. This aspect was considered in GCMR as clients have the possibility to reintiiate join requests on alternate segments but the messaging requires extensions to transmit upstream information about stream quality. This extensions will be added in the next release of the protocol specification.



Demo setup at IEEE Infocom 2014

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Planned demo events

As part of the project dissemination activities, we have planned three additional demos solicited by upcoming international conferences and events.

1) Participation to the **IEEE MASCOTS 2014** conference (International Symposium on Modeling Analysis And Simulation of Computer And Telecommunication Systems) held in Paris, September 2014. This presentation follows from a submitted paper entitled "UDP Ping: a dedicated tool for improving measurements of the Internet topology" (F. Tarissan, E. Rotenberg, M. Latapy and C. Crespelle). In this demo, the use of the tool "UPD Ping" developed in the context of the EULER project is presented. Demo execution scenarios will show how to use this tool i) to measure the interface of a given target router directed toward a monitor which send the probe, and ii) to coordinate a measurement campaign designed to discover all the interface of a target router.

2) Present a demo at **IETF 90 Bits-N-Bytes** session to be held in Toronto (ON), Canada on July 20-25, 2014. The goal is to demonstrate successful operation of geometric routing on content locators. In this demo, we propose an alternative model for the content-centric networking in which content names are assigned locators and geometric routing is performed on these locators. This means that the routing decision is performed on locators while avoiding name-to-locator resolution by intermediate nodes. The operation of this scheme consists of three steps: i) registration, ii) resolution and iii) delivery. Geometric routing is the scheme used in all of these steps. Using the notion of distance defined in geometric routing for selection of servers to get the content from, leads to several competitive advantages compared to current CCN approaches. In this demo, we present the successful operation of geometric routing on content locators over a large network topology (O(100) nodes). We also demonstrate the performance gain when using content locators and caching on bandwidth utilization and compare it with a scenario of content-centric networking based on BGP where no notion of distance between requestor and content host is defined. The demo is performed on iLab.t virtual wall platform located in Ghent, Belgium. The network topology consists of hundreds of nodes each running a Quagga daemon and a Click instance to forward traffic. Different hosts setup using the virtual wall, play the following roles: i) clients (start content request/video request in demo), ii) content servers (start video streaming), and iii) request handlers (reply to client requests with a list of servers). In this demo, Apache http servers are used as content servers, and Python http-servers as Request handlers. Clients run VLC player to send the request for content (video-on-demand) and telnet-based Python script is used as IP-to-locator mapping server. The successful functionality of geometric routing on content locators is exhibited by receiving video on clients; we visualize the more balanced traffic on links using Networkx (a Python library for creation, manipulation and visualization of networks).

3) Submit a demo paper as explained in previous subsection to the **CNERT 2014 workshop**. The workshop co-located with the 22nd IEEE International Conference on Network Protocols (ICNP) will be held at the Research Triangle, North Carolina on October 21-24, 2014.

Call for papers

Int. Conf. Computing, Netw. & Commun. (ICNC) **05/07/2014**
http://www.conf-icnc.org/2015/
February 16.-19, 2014, Anaheim, CA, USA

ACM W. Hot Topics in Netw. (HotNets) **16/07/2014**
http://conferences.sigcomm.org/hotnets/2014/
October 27-28, 2014, Los Angeles, CA, USA

6th Reliable Netw. Design & Modeling (RNDM) **20/07/2014**
http://www.rndm.pl/2014/
November 17-19, 2014, Barcelona, Spain

18th Int. Conf. Principles Distr. Sys. (OPODIS) **23/07/2014**
http://opodis2014.dis.uniroma1.it/
December 17-19, 2014, Cortina d'Ampezzo, Italy

IEEE Infocom **30/07/2014**
http://infocom2015.ieee-infocom.org/
April 26-May 1, 2015, Hong Kong

EULER selected publications

The EULER project, started on October 1st, 2010, is approaching its end, scheduled by June 30, 2014. Following selected papers have been published during the last period (full reference available in the box below).

S. Sahhaf et al. proposed recovery techniques in geometric routing to deliver packets to the destination in case of failures. In this paper, they perform an analysis on the availability of the proposed protection techniques on the Internet graph. The results show that the proposed scheme performs reasonably well compared to the shortest cycle scheme and significantly enhances the availability compared to geometric routing without any protection.

Following joint cooperation between A-LBELL and UdG partners, M. Camelo et al. focus on Cayley Graphs (CG) as models for large-scale interconnection networks. CGs present excellent properties and very efficient routing schemes and, in this scope, the authors study a fast general-purpose shortest path routing scheme for CG with compact routing tables. Such scheme uses the concept the Automatic Structures (AS) of a group and the authors evaluate which structures are space-efficient to implement the scheme, and how the size of such structures depends on the so-called k-fellow traveler property.

F. Becker et al. study distributed algorithms on massive graphs where links represent a particular relationship between nodes. Since such graphs are massive they need to be processed in a distributed and streaming way. The goal is to model and analyze the computational power of such distributed systems where one computing unit is assigned to each node.

D. Papadimitriou and B. Fortz focus on how to modify the routing decision process to include optimization objectives and how to make the optimization problem aware of the distributed nature of the online routing decision process under dynamic conditions. As a first evolution in that direction, the authors propose a new combined optimization model that integrates network design decisions and routing decisions, with time-dependent demands. As part of they main contribution, the proposed model keeps in sight the need for a distributed routing function, through the use of scalable routing tables.

Finaly, D. Papadimitriou analyzes the geometric properties underlying information networks to define a distributed information localization algorithm.

The complete list of publications by EULER project partners during this quarter can be found at: **http://www.euler-fire-project.eu**.

EULER selected publications

S. Sahhaf, W. Tavernier, D. Colle, M. Pickavet, P. Demeester, "Availability analysis of resilient geometric routing on Internet topology", in *Proc. DRCN 2014*, Ghent, April 1-3 2014.

M. Camelo, P. Vilà, L. Fàbrega, D. Papadimitriou, "Cayley graph-based data centers and space requirements of a routing scheme using automata", in *Proc. 4th Int. W. DCPerf 2014*, Madrid, Spain, June 30, 2014.

F. Becker, A. Kosowski, M. Matamala, N. Nisse, I. Rapaport, K. Suchan, I. Todinca, "Allowing each node to communicate only once in a distributed system: shared whiteboard models", *Distributed Computing*, June 2014.

D. Papadimitriou, B. Fortz, "Time-dependent combined network design and optimization", in *Proc. 2014 IEEE ICC*, Sidney, Australia, June 10-14, 2014.

D. Papadimitriou, "Geometric foundation to information networks", in *Proc. SIAM Conference on Discrete Mathematics*, Minneapolis, MN, USA, June 16-19, 2014.

Forthcoming EC and FIRE events

Fed4FIRE-GENI Research Experiment Summit **07-11/07/2014**
http://www.ict-fire.eu/events.html
Ghent, Belgium

ICT Proposer's Day 2014 **09-10/10/2014**
http://ec.europa.eu/digital-agenda/en/news/ict-proposers-day-2014
Florence, Italy

2nd FIRE Forum 2014 **15/10/2014**
http://www.ict-fire.eu/events/eventview/article/fire-forum-2014.html
Brussels, Belgium