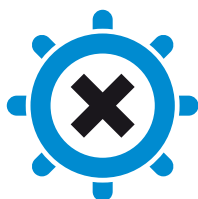


ENDEAVOUR: Towards a flexible software-defined network ecosystem



ENDEAVOUR

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Executive Summary

This deliverable presents plans on exploitation and dissemination activities as well as describing the progress on the plans implementation. These include scientific papers, journals and conferences of interest, press releases, etc... Both future and current to-date activities are presented, targeting different scientific communities, students, stakeholders, IXP operators, IXP members and decision makers. ENDEAVOUR dissemination and exploitation plans aim at ensuring that all relevant stakeholders, decision makers, IXP operators, IXP members and communities are informed about project activities and outcomes. ENDEAVOUR dissemination consists of activities of project promotion as a whole, and dissemination of specific and innovative results (e.g., scientific papers).

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1 Dissemination Plan

During the first year, ENDEAVOUR has to focus on spreading the project ideas and use case scenarios through publishing news on different project / platform websites, forums, etc. Specifically, the main dissemination goal is to create a group of followers (network providers, network operators, IXPs, end-users) eager to use our results for their own network management and operation activities, services and deployment. A secondary goal is to collect requirements express by IXP operators and IXP end users, and issue related use cases. To this end, the dissemination plan of the partners of the ENDEAVOUR project consists of the following activities.

- Publishing premier high-quality papers in major international conferences and journals in the area of networking to promote new ideas and concepts stemming from project activities and outcomes.
- Gaining requirements from IXP operators and members.
- Dissemination of results and prototype implementations to companies for possible industrial exploitation.

1.1 Logo

To clearly identify the project in all dissemination activities, the name ENDEAVOUR is used as a reference.

Also, a logo has been designed (Fig. 1). The purpose of our logo lies on the target we want to achieve. The cross in the middle of the logo represents the new IXP fabrics that ENDEAVOUR aims to build, and that interconnects members, collects the traffic and forwards it to its destination. The boat wheel around explains that the main part of the work deals with finding out new ways for managing the IXP fabrics, and for driving the whole IXP ecosystem.

1.2 Project presentations

Project presentations include poster, flyer, fact-sheet, press releases, and announcements. This activity has the twofold objective of developing contacts in the research community involved in activities within the scope of the project, namely academics and data scientists working on IXP, and reaching a wider audience potentially interested in applying the outcomes of the project in possibly different contexts.



Figure 1: The ENDEAVOUR logo

First, a poster, a flyer and a fact-sheet (ENDEAVOUR deliverable 5.1) presenting the main motivations behind the project have been produced and are available for download at <https://www.h2020-endeavour.eu/press-desk>.

For reaching a wider audience, DE-CIX issued a press release on its ENDEAVOUR activity for announcing its research work for renewing its IXP fabric and management. The press release is available at <https://nyc.de-cix.net/news/latest-news/news/article/de-cix-develops-new-tools-for-controlling-data-traffic-1/> or from the ENDEAVOUR website at <https://www.h2020-endeavour.eu/press-desk>.

Three other press releases have also been issued since the beginning of the project, but this time by companies not involved in the ENDEAVOUR project, and Bloggers in the networking area. It includes the press release from the Pica8 US company (<http://www.pica8.com/company/press-releases/pica8-powers-sdn-driven-internet-exchange.php>), the Reyno report (<https://www.sdxcentral.com/articles/rayno-report/pica8-pushes-out-cisco-at-touix/2015/06/>), and the LightReading blog (<http://www.lightreading.com/carrier-sdn/sdn-technology/french-exchange-sees-classic-sdn-benefits/a/d-id/716901>).

Finally, a Twitter account has been created and is regularly updated in order to reach a wider public and let followers of the project stay up to date. It is available at https://twitter.com/h2020_endeavour.

1.3 Project Website

The ENDEAVOUR public portal (<https://www.h2020-endeavour.eu/>) offers an extensive compilation of relevant information for project members, part-

ners, reviewers (European Commission) and anybody else interested in the ongoing research carried out at the ENDEAVOUR project. A detailed description of this portal can be found in the ENDEAVOUR deliverable D5.2. As a key aspect, the ENDEAVOUR portal contains links to the main communication channels for dissemination and feedback. This website, publicly accessible at <https://www.h2020-endeavour.eu/>, describes the main goals of the ENDEAVOUR project. It also features a collaborative tool for the consortium members. The portal is based on Drupal, an open source CMS tool.

Reserved access



Figure 2: Main menu of ENDEAVOUR website

When the portal is accessed, users will first find a homepage with recent news/events and the Main Menu. This menu is structured in basic sections

or categories which are, (see Fig. 2):

- Home
- Objectives
- Consortium
- Deliverables
- Dissemination
- Events
- Resources
- Contacts
- Reviewer Area

1.4 Conferences, workshops, and journals

One of the important dissemination activities deals with publishing premier high-quality papers in major international conferences and journals, and giving talks in workshops in the area of networking to promote new ideas and concepts stemming from project activities and outcomes. This dissemination activities also include giving talks, making demos, or presenting tutorials.

Currently published papers are listed below:

- Canini, M., Kuznetsov, P., Levin, D., Schmid, S. (2015). “A Distributed and Robust SDN Control Plane for Transactional Network Updates”. In The 34th Annual IEEE International Conference on Computer Communications (INFOCOM 2015).
- Dang, H. T., Sciascia, D., Canini, M., Pedone, F., Soul, R. “NetPaxos: Consensus at Network Speed”. In The Symposium on SDN Research (SOSR 2015).
- Capelle, M., Abdellatif, S., Huguet, M. J., Berthou, P. “Online Virtual Links Resource Allocation in Software-Defined Networks”. In The 17th Annual IFIP International Conference on Networking (NETWORKING 2015).

- Castro, I., Panda, A., Raghavan, B., Shenker, S., Gorinsky, S. “Route Bazaar: Automatic Interdomain Contract Negotiation”. In 15th Workshop on Hot Topics in Operating Systems (HotOS XV). USENIX Association.

The current list of demos performed is listed below:

- Antichi, G., Rotsos, C., Moore, A. W. (2015, August). “Enabling Performance Evaluation Beyond 10 Gbps”. In Proceedings of the 2015 ACM Conference on Special Interest Group on Data Communication (pp. 369-370). ACM.
- Han, J. H., Antichi, G., Zilberman, N., Rotsos, C., Moore, A. W. (2015, April). “An Integrated Environment for Open-Source Network Softwarization”. In Network Softwarization (NetSoft), 2015 1st IEEE Conference on (pp. 1-2). IEEE.

Talks given are listed below:

- Antichi, G., “OSNT: A Community-owned Platform for High- performance and Low-cost Network Testing”, RIPE Meeting (Open Source Working Group), May, 2015. Amsterdam, NL.
- King, T., “jFlowlib”, RIPE Meeting (Open Source Working Group), May, 2015. Amsterdam, NL.
- Dietzel, C., “Measuring Delay and Packet Loss at an IXP”, RIPE Meeting (MAT Working Group), May, 2015. Amsterdam, NL.
- King, T., “Making Route Servers Aware of Data Link Failure at IXPs”, RIPE Meeting (Open Source Working Group), May, 2015. Amsterdam, NL.
- J. Rabadan, Ed.: S. Sathappan, K. Nagaraj, W. Henderickx, T. King, D. Melzer, “Operational Aspects of Proxy-ARP/ND in EVPN Networks”, BESS Workgroup, July, 2015.
- Bruyere, M., “SDN with Pica8”, France-IX General Meeting, 18th September 2015, Paris, France.
- Harald A. Summa, Arnold Nipper, “DE-CIX update and outlook”, DE-CIX summit 2015.
- King, T., “Software-Defined Networking”, Insider Talk Episode 3, 2015.

- Canini, M., “ENDEAVOUR: Towards a flexible software-defined network ecosystem”, SWITCH SDN Workshop, 11th June 2015, Bern, Switzerland.
- Canini, M., “NetPaxos: Consensus at Network Speed”, Microsoft Research, 16th June 2015, Redmond, WA, USA.
- Canini, M., “NetPaxos: Consensus at Network Speed”, VMware Research, 18th June 2015, Palo Alto, CA, USA.
- Canini, M., “iSDX: An Industrial-Scale Software-Defined IXP”, SWITCH SDN Workshop, 13th November 2015, Zurich, Switzerland.
- Canini, M., “ENDEAVOUR: Towards a flexible software-defined network ecosystem”, RIPE Meeting (Plenary Session), 17th November 2015, Bucharest, Romania.
- Canini, M., “NetPaxos: Consensus at Network Speed”, KTH, 27th November 2015, Stockholm, Sweden.
- Canini, M., “ez-Segway: Decentralize for Faster Consistent Updates”, Telecom ParisTech, 29th November 2015, Paris, France.

Two conferences tutorials have also been given in two conferences:

- Zilberman, N., Antichi, G., Rotsos, C., “Open Hardware Networking”, Tutorial in The 2015 ACM Conference on Special Interest Group on Data Communication, ACM.
- Zilberman, N., Antichi, G., Rotsos, C., “Open Source Networking”, Tutorial in Network Softwarization (NetSoft), 2015 1st IEEE Conference on, IEEE.

1.5 Open source releases

The software developed within ENDEAVOUR will be released as open source as much as possible to foster dissemination.

During the first year of the project, jFlowLib has been issued. JFlowLib is a Java library to parse and generate sFlow and IPFIX data. It is freely available at <https://github.com/de-cix/jFlowLib>, or from the ENDEAVOUR website at <https://www.h2020-endeavour.eu/software>.

1.6 ENDEAVOUR Workshops

The ENDEAVOUR consortium has been involved in the organization of four workshops, in which the ENDEAVOUR activities and results have been promoted. The rest of this section just lists these four workshops contribution without entering into details. For a detailed presentation, interested readers can refer to ENDEAVOUR deliverable D5.3.

1.6.1 Workshop DE-CIX Customers

During the first workshop [3], ENDEAVOUR met with DE-CIX customers in Cologne on the 19th of February 2015. With more than 600 customers, DE-CIX is one of the largest IXPs worldwide, and hence an ideal player for ENDEAVOUR. During this workshop, the ENDEAVOUR consortium presented the project to a group of ISPs and explored their interest and expectations on how to benefit from the outcomes of the project.

1.6.2 12-14 April 2015: 26th Euro-IX Forum

The Euro-IX Association [2] was formed to develop and strengthen the IXP community. Declared objectives are to promote open exchange of ideas and experiences, develop common procedures, gather information on regulatory issues affecting IXPs, and develop common procedures.

The Euro-IX Association organizes meetings for its members to contribute and benefit from the community's expertise and experience. The members meet twice a year at the Euro-IX Forums and gather a large and heterogeneous audience. While the Euro-IX meetings take place at different European locations it includes IXPs from all over the world. The 26th Forum took place in Marseille [1] and we seized this opportunity to present ENDEAVOUR in an interactive plenary talk. The audience we addressed during this meeting is shortly described within the next section.

At the 26th Euro-IX Forum, 126 attendees from 68 organizations came together. Dominated by European IXP operators, the audience of this second ENDEAVOUR workshop, was highly complementary to the one of the previous workshop and benefited from the comprehensive scope of the Euro-IX Forum, bringing together IXPs from all over the world, but also IXP members such as Microsoft, Google or Schneider Electrics, and equipment vendors such as Alcatel-Lucent or Cisco. The nature of the discussion reflects the heterogeneity of the audience, and while dominated by technical topics, non-technical ones such as regulation, are also within the scope of the forum.

1.6.3 24 September 2015: 6th BNIX Networking Event

Belnet organized a meeting with more than 75 attendees representing the customers and users of BNIX (Belgian National Internet eXchange). During the event, the ENDEAVOUR consortium introduced the project in an informal settings.

1.6.4 25-27 October 2015: 27th Euro-IX Forum

Same objectives as for the 26th Euro-IX Forum, the 27th edition was organized in Berlin from the 25th to 27th of October 2015. The 27th Euro-IX was a great success with a record of 140 attendees representing 65 organisations (including 47 IXPs from 36 countries).

1.6.5 20 November 2015: ENDEAVOUR BoF session at RIPE71

RIPE 71 was organized in Bucharest on the 20th of November 2015. BoF (Birds of a Feather) sessions are held at RIPE Meetings to start an informal discussion on a topic of shared interest among RIPE Meeting attendees. If a BoF attracts sufficient interest, it might become a RIPE Task Force or Working Group. The ENDEAVOUR project organized one of the BoF sessions.

1.6.6 Outlook

With the first ENDEAVOUR workshops we seized the opportunity to involve small to medium IXP members as well as IXP operators. Additionally, our direct contacts enriched our perspective by reaching to other Internet stakeholders. This valuable input will be used to align our use cases even further to their needs and thus make them more relevant for practical application in the future. Notably, WP4 benefits directly from the workshops and will feed its outcomes directly into the desired SDN architecture of WP2.

Furthermore, we brought ENDEAVOUR widely to the attention of the IXP community. We arouse awareness of the benefits that SDN has to offer and got feedback on the concerns regarding its implementation. Our experience proves that it is important to keep the community in a close feedback loop to achieve the desired impact. The rather big players have not been in the focus of our dissemination yet, however this remains one goal for the near future.

1.7 Standardization

ENDEAVOUR also contributed to a standardization working group at the IETF: the BESS WG. It leads to issuing an Internet draft:

- Rabadan, J., Sathappan, S., Nagaray, K., Henderickx, W., King, T., Melzer, D., “Proxy-ARP/ND function in EVPN networks”, IETF Internet draft, BESS WorkGroup, 2015

1.8 Other activities

ENDEAVOUR consortium launched a survey for network operators. As part of our effort to bring SDN into IXPs, we want to create a broad picture of the operational challenges currently faced when peering at IXPs.

Specifically, our goal is to understand:

- what are the current limitations at IXPs?
- what services do you expect to see at IXPs in the next years?

Survey results will help us to drive our efforts in characterizing the use cases of the ENDEAVOUR project. This survey also serves to help us to understand our audience better; by indicating where network operators consider their core business, this helps us to understand if we are talking to the right people and using the right language.

The survey is anonymous unless answering organizations desire to reveal their identity. The data we acquire will be treated confidentially and only reported in aggregate statistics and anonymized format.

The survey is available at: <https://www.h2020-endeavour.eu/launching-survey-network-operators>.

2 Exploitation plans

2.1 Academic Partners

Academic partners have common objectives in terms of dissemination and exploitation. As such, for all academic partners involved in the ENDEAVOUR project, dissemination and exploitation plans include:

- Publishing premier high quality papers in major top conferences and journals in the area of networking, security, and QoS to promote our new disruptive ideas and concepts.

- Gaining significant skills in the area of IXP fabrics building and management, and all related applications and services. Such skills and knowledge will lead to new courses to be held to PhD students thanks to summer schools, or to undergraduate students of universities and engineering schools.
- Finding new research directions and prospecting for new academic and industrial partners for future research projects based on skills and results gained in ENDEAVOUR.
- Disseminate our upcoming results and prototype implementation to company for possible industrial exploitation.

Details on the status of this dissemination and exploitation plans for each academic partner are given in the following.

2.1.1 Queen Mary University London

The Queen Mary University of London exploitation plans include:

- The publication of academic papers, some of which will be submitted soon.
- Talks on topics related to ENDEAVOUR.
- Collaboration with potential industrial partners: the Queen Mary University of London collaborates with the TouIX IXP in Toulouse, CNRS and Cambridge in the design of the UMBRELLA architecture.

2.1.2 Université catholique de Louvain

For its exploitation purposes, the UCL plans include:

- Papers that have been published and other papers that will be submitted soon.
- Talks on topics related to ENDEAVOUR.
- Achieve a positive impact on IXP operations at DE-CIX.
- Collaborations with new partners: the UCL has collaborated with Princeton University and ETH Zurich on the design of iSDX, a scalable SDX design and open source implementation that has already spurred early adoption in a US government agency. The UCL has also started

collaborating with Università della Svizzera italiana and attracted the interest of a potential industrial partner, Netronome, for the work on NetPaxos.

2.1.3 University of Cambridge

University of Cambridge started gaining contributions for its exploitation purpose:

- Papers are in the process of being submitted shortly.
- Talks, Tutorials and Demo have been carried out successfully.
- Dealing new possible industrial partners: University of Cambridge together with CNRS collaborate with the TouIX IXP in Toulouse. In particular, the design of the UMBRELLA architecture, where UCAM has been actively involved, helped to create a strong relationship with the aforementioned IXP. While the ENDEAVOUR consortium can benefit demonstrating its outcomes on a small environment, TouIX can benefit demonstrating new technologies thus potentially attract new customers.

2.1.4 CNRS

As shown in this deliverable, CNRS started gaining contributions for its exploitation purpose:

- Papers have been published or are in the process of being submitted shortly.
- For academic teaching, even if no specific lecture has been yet included for students at university or engineering schools, the way networking is taught takes into consideration the new requirements that network operators, IXP operators, and end users expressed.
- Dealing with prospection for new industrial partners, CNRS is now involved in a project with the TouIX IXP in Toulouse. The development objectives of TouIX and ENDEAVOUR being very close, and CNRS being involved in both projects, we are trying to set-up a win-win strategy between the two projects. Thus, ENDEAVOUR consortium largely benefits from being able to take advantage of a small and open IXP for testing some of the solution that it designed (for instance the UMBRELLA architecture). On the other side, TouIX can demonstrate

the benefits of such new technologies to its members, and potentially gain new members.

- CNRS and TouIX have been selected for organizing the Euro-IX event in 2017. This will be a premier exposure for ENDEAVOUR results.

2.2 Industrial Partners

Beside the industrial focus, ENDEAVOUR's industrial partners also have a strong research interests, which is in-line with the academia exploitation plan including:

- Publication of high-quality papers in major top conferences and/or workshops.
- Talks, tutorials and/or demos on topics related to ENDEAVOUR's goals.
- Exploiting new research directions in the area of SDN at IXPs.
- Collaborations with new partners: establish close cooperations with academic partners for ongoing research activities as well as future EU-funded projects, for instance in the field of networking, SDN and monitoring.

2.2.1 DE-CIX

The DE-CIX exploitation plans include:

- Extend DE-CIX's peering platform, services, and development activities with the ideas, concepts, and prototypes developed by ENDEAVOUR. DE-CIX focuses on bringing those prototypes to a production-ready state for commercial deployment. DE-CIX operates IXPs at various locations at different scales, thus enabling to deploy SDN at smaller IXPs first, while exploring possibilities to scale the technology to larger IXPs successively.
- Contribute to standardization processes at the IETF to make the outcomes of the ENDEAVOUR project available to a wider audience with a strong practical focus.
- Giving talks at operator centric conferences, such as RIPE, NANOG, or EURO-IX to promote the results of ENDEAVOUR.

- Discuss the ENDEAVOUR outcomes with IXP members to align with their requirements for the future. Furthermore, DE-CIX targets SDN deployments in particular with a direct benefit for its members in mind.
- Closely cooperate with hardware vendors to support them building SDN capable hardware suited for the needs of IXPs, especially in terms of scalability and feature support.

2.2.2 IBM Research

The IBM Research exploitation plans include:

- Exploring potential use cases and applicability of ENDEAVOUR to IBMs product portfolio, in the areas of datacenter networking, Cloud and High-Performance Computing (HPC) interconnects. IBM may exploit the ENDEAVOUR results for their developments of IT systems for Cloud, datacenter, virtualization, and Big Data appliances, potentially also including emerging trends in custom HPC.
- Provide input to SoftLayer and IBM labs (Cloud Innovation Lab, Watson) on ENDEAVOUR-related topics such as: 1) off-/on-line monitoring products, 2) improved management tools for multitenant datacenters, 3) the next-next-generation of virtualization extensions to be added to the currently limited SDN/OpenFlow, as well as monitoring and sampling (sFlow, AQM/RED) networking standards and 4) potentially helping IEEE, IETF, ITU and the other standardization bodies with the results acquired in the area of SDN and distributed high speed (beyond 10Gbps) monitoring.

The commercial impact of these plans could be witnessed in:

- Lower IBMs Cloud TCO and power consumption.
- Increased security of the multitenant datacenter, while improving the workload/traffic observability - hence securing better QoE per tenant and lower management costs for Cloud operators.
- Enabling the standardization of IBM's next generation of monitoring for 100/400Gbps/1Tbps Converged Enhanced Ethernet architectures.

3 Acronyms

IXP Internet eXchange Point

CMS Content mangement System

SDN Software Defined Network

BoF Bird of Feathers

QoS Quality of Service

QoE Quality of Experience

SDX Software Defined eXchange

TouIX Toulouse Internet eXchange

RIPE Réseaux IP Européens

NANOG North American Network Operating Group

HPC High Performance Computing

AQM Active Queue Management

RED Random Early Detection

IETF Internet Engineering Task Force

ITU International Telecommunication Union

References

- [1] 26th Euro-IX Forum, Marseille, France-IX. <https://www.euro-ix.net/events/52>, 2015.
- [2] Euro-IX: European Internet Exchange Association. <https://www.euro-ix.net/>, 2015.
- [3] Workshop: The Next Generation of Interconnection. <https://de-cix.eco.de/2015/events/workshop-the-next-generation-of-interconnection.html>, 2015.