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ENDEAVOUR: D5.6 - Progress on exploitation and dissemination plans (year 2)

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ENDEAVOUR: Towards a flexible software-defined network ecosystem

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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 Introduction

This deliverable aims at presenting the progress on the exploitation and dissemination plan of the ENDEAVOUR project. It complements the results presented in deliverable D.5.4 that was devoted to the first year of the project. This deliverable focus on the second year activity.

2 Dissemination Plan

During the second 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.

2.1 Project Website

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

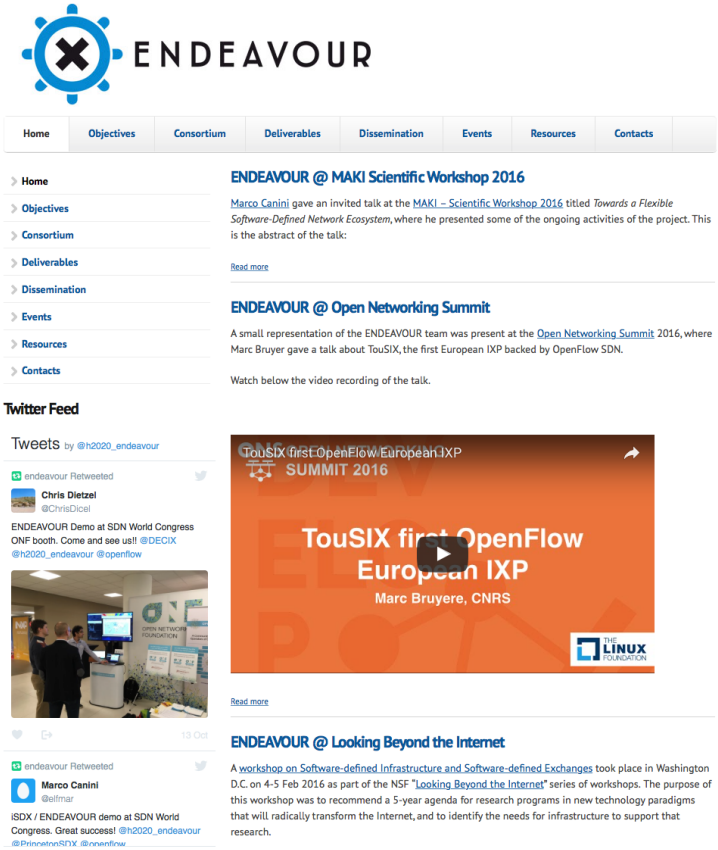

Figure 1: Main menu of ENDEAVOUR website

The project web site is kept up to date so as to provide an accurate view on the work performed and the results achieved in the ENDEAVOUR project, as reflected by Figure 1.

2.2 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:

- Fernandes, E.L., Antichi, G., Castro, I., Uhlig., "Horse: towards an SDN traffic dynamics simulator for large scale networks". In ACM Special Interest Group in Communication (SIGCOMM 2016), poster session.

- Gupta, A., Rüdiger, B., Canini, M., Feamster, N., Mac-Stoker, C., Willinger, W., "Network Monitoring As a Streaming Analytics Problem". In ACM Workshop on Hot Topics in Networks (HotNets 2016).

- Chiesa, M., Nikolaevskji, I., Mitrovic, S., Gurtov, A., Madry, A., Schapira, M., Shenker, S., "On the Resiliency of Static Forwarding Tables", In IEEE/ACM Transaction on Networking. To appear.

- Chiesa, M., Rétvári, G., Schapira M., "Lying Your Way to Better Traffic Engineering", In International Conference on emerging Networking EXperiments and Technologies (CONEXT 2016). To appear.

- Chiesa, M., Dietzel, C., Antichi, G., Bruyère, M., Castro, I., Gusat, M., King, T., Moore, A. W., Nguyen, T. D., Owezarski, P., Uhlig, S., Canini, M., "Inter-domain Networking Innovation on Steroids: Empowering IXPs with SDN Capabilities", In IEEE Communications Magazine - October 2016.

- Nguyen, T. D., Chiesa, M., Canini, M., "Towards Decentralized Fast Consistent Updates", In Applied Networking Research Workshop (ANRW '16).

- Chiesa, M., Gurtov, A., Madry, A., Mitrovic, S., Nikolaevskji, I., Schapira, M., Shenker, S., "On the Resiliency of Randomized Routing Against Multiple Edge Failures", In the 43rd International Colloquium on Automata, Languages, and Programming (ICALP 2016).

- Liu, Y., Li. Y., Canini, M., Wang, Y., Yuan, J., "Scheduling Multi-flow Network Updates in Software-Defined NFV Systems", In The 1st

International INFOCOM Workshop on Software-Defined Flexible and Agile Networking (SWFAN 2016).

- R. Lapeyrade, M. Bruyère, P. Owezarski, "OpenFlow-based migration and management of the TouIX IXP", IFIP/IEEE International Workshop on Management of the Future Internet (ManFI?2016) - Management of SDN/NFV-based Systems, Istambul, Turkey, 25 April 2016.
- Dang, H. T., Canini, M., Pedone, F., Soulé, R., "Paxos Made Switchy", In SIGCOMM Comput. Commun. Rev. 2016.
- Dietzel, C., Feldmann, A., King, T., "Blackholing at IXPs: On the Effectiveness of DDoS Mitigation in the Wild", In Passive and Active Measurements Conference (PAM 2016).
- Gupta, A., MacDavid, R., Birkner, R., Canini, M., Feamster, N., Rexford, J., Vanbever, L., "An Industrial-Scale Software Defined Internet Exchange Point", In The 13th USENIX Symposium on Networked Systems Design and Implementation (NSDI 2016).
- Chiesa, M., Nikolaevskji, I., Mitrovic, S., Panda, A., Gurtov, A., Madry, A., Schapira, M., Shenker, S., "The Quest for Resilient (Static) Forwarding Tables", In The 35th Annual IEEE International Conference on Computer Communications (INFOCOM 2016).

The current list of demos performed is listed below:

- Chiesa, M., Demmler, D., Canini, M., Schapira, M., Schneider, T., "Towards Securing Internet eXchange Points Against Curious onlooKers". In Proceedings of the Applied Networking Research Workshop (ANRW '16), July 2016.

Talks given are listed below:

- Canini, M., "SDN is dead. Long live SDX!", Workshop on Software-defined Infrastructure and Software-defined Exchanges, Washington D.C., February 2016.
- Bruyère, M., "TouSIX: First OpenFlow European IXP", Open Network Summit, Santa-Clara, CA; USA, 14-17 March 2016.
- Canini, M., "Towards a Flexible Software-Defined Network Ecosystem", MAKI ? Scientific Workshop 2016, Darmstadt, Germany, April, 2016.

- Bruyère, M., "Open-IXSDN Umbrella IXP Fabric", Africa Peering and Interconnection Forum (AfPIF) Dar Es Salaam - Tanzania- 30th August- 1st September 2016.
- Bruyère, M., "Update on SDN IXP", General Meeting France-IX - Paris - France - 30th September 2016.
- Canini M., "iSDX/ENDEAVOUR demo", SDN congress, The Hague, The Netherlands, October 2016.
- Bruyère, Lapeyrade, Owezarski, "UMBRELLA: A Resilient SDN Fabric for IXPs", SDN day, Chatillon, France, 23 November 2016.

2.3 Open source releases

The software developed within ENDEAVOUR will be released as open source as much as possible to foster dissemination. A GitHub repository is used for that purpose and is directly accessible from the ENDEAVOUR web site.

2.4 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.

2.4.1 30/06/3016: Demonstrator Feedback Workshop with External Advisory Board and invited participants

ENDEAVOUR seeks to obtain as much feedback of experts in a very early stage of the implementation.

ENDEAVOUR organized the second feedback workshop in Toulouse, hosted by CNRS-LAAS. The workshop participants are experts from academia as well as from industry. After a brief update on the status of the ENDEAVOUR platform, the core of this presentation focused on the integration of the iSDX and the Umbrella components, followed by a detailed overview of the use cases.

The strong interest of the audience on ENDEAVOUR was shown by the multitude of high quality and deeply technical comments. In general, the feedback has been largely positive. As a result, we will proceed with the

implementation, address the feedback, and prioritize according to the input of the workshop while accounting for the resources of the consortium.

Details about the content of this workshop are presented in ENDEAVOUR D.5.5 deliverable [1].

2.4.2 October 2016: SDN world congress

The ENDEAVOUR consortium presented a demonstration of the project at the Layer123 SDN World Congress event at The Hague, Netherlands during 11-13 October 2016. Our participation was supported by the Open Networking Foundation (ONF) in the context of the close relation between ENDEAVOUR and the OpenSourceSDN.org iSDX project. We presented at the ONF booth and gave demonstrations of how ENDEAVOUR improves security by blocking DDoS attacks and permits high-speed, fine-grained traffic monitoring and enables new applications, such as application-specific peering and fine-grained traffic engineering. Our project won the "Best in Showcase" award, which earned us the opportunity to present the project during one of the main stage sessions This presentation was attended by about 50 people and our booth demonstration engaged with an equally large audience that included representatives from the operator, vendor and academic communities.

3 Exploitation plans

3.1 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.

3.1.1 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.

3.1.2 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 attraced the interest of a potential industrial partner, Netronome, for the work on NetPaxos.

3.1.3 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 benefits demonstrating its outcomes on a small environment, TouIX can benefit demonstrating new technologies thus potentially attract new customers.

3.1.4 CNRS

As shown in this deliverable, CNRS gained 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.

- CNRS and IBM found common interest in machine learning based traffic characterization and anomaly detection. The requirements of the use case which IBM is working on significantly overpass the scale of the experiments that CNRS did performed in the framework of the ENDEAVOUR project. Big data techniques could then be one solution to study and integrate. CNRS is also a partner of the European FP7 ONTIC project that specifically deals with issuing new algorithms for traffic classification in big data environments. ONTIC specifically takes advantage of the Hadoop facilities. For that purpose, CNRS then is developing a new version of its ORUNADA algorithm so as to take advantage of Hadoop Storm. A large scale experiment will then be run, expecting that the performance results will match the IBM requirements.

3.2 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.

3.2.1 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.

3.2.2 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 IBM's 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.

4 Acronyms

IXP Internet eXchange Point
CMS Content mangement System
SDN Software Defined Network
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 Telecomunication Union
ORUNADA On-line real-time Unsupervised Network Anomaly Detection
ONTIC Online Network TraffIc Chracterization
DDoS Distributed Denial of Service
ETH Swiss Federal Institute of Technology
ONF Open Network Foundation
iSDX Industrial Software Defined eXchange
ACM Association for Computing Machinery
NFV Network Function Virtualization
TCO Total Cost Ownership

References

[1] ENDEAVOUR consortium. D.5.5: Report from the Demonstrators for Implementation Feedback Workshop. *Deliverable of the H2020 ENDEAVOUR project*, 2016.