European
Commission

ENDEAVOUR

The focus of ENDEAVOUR is to enable added-value services to be provided thanks to SDN, on top of Internet Exchange Points and other network interconnection fabrics. The services would relate not only to the flexibility of the interconnection fabric, but most importantly to enable the content and data center ecosystem that is present at the interconnection fabric to collaborate. The ultimate goal is to create a service marketplace on top of the ecosystem composed of Cloud/data centers, networked applications, and the interconnection fabric.

AT A GLANCE

Project title:
Towards a flexible software-defined network ecosystem

Projects coordinator
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Partners from:
Queen Mary University London (UK); Université Catholique de Louvain (BE); University of Cambridge (UK); LAAS-CNRS (FR); DE CIX (DE); IBM (CH)

Duration:
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Total cost:
4,29 m€

EC Contribution:
4,29 m€

Programme:
H2020-ICT-2014-1

Further information:
https://www.h2020-endeavour.eu/

Context and motivation

The rise of the IXP
Internet eXchange Points (IXPs) originate at the time the Internet transitioned from an academic/research network into today's commercial infrastructure. Over the past 20 years, as the Internet grew by any imaginable metric, NAPs (Network Access point) were replaced by modern IXPs. **The critical role** they have played **in the Internet ecosystem** has until recently gone largely unnoticed by the Internet community at large.

**Cloud & datacenters in the Internet**
To cope with the increasing demand for content, content delivery infrastructures (including Content Delivery Networks (CDNs), datacenters, and Cloud providers) deploy massively distributed server infrastructures. IXPs already play a key role in inter-connecting the infrastructures that host content and applications with the ecosystem that consumes this content or relies on these applications. IXPs will become even more critical when tighter delay constraints are necessary and more support from the network is required by applications running in the Cloud.

Software-Defined Networking (SDN)
Software-defined networking has attracted a lot of attention in the networking community over the last few years. With attention also comes myths and misunderstanding, which we will attempt to clarify below by defining the main characteristics of SDN.

Challenge

The objective of ENDEAVOUR is to address current limitations of the Internet interconnection model (see figure), as well as to open the possibility for novel services, creating the possibility for new economic models around the created ecosystems.

ENDEAVOUR approach for dynamic network interconnection
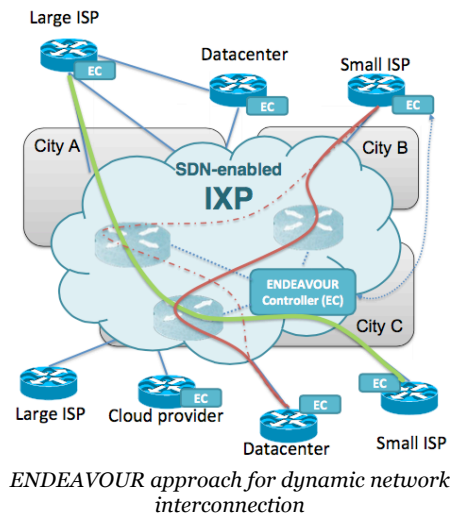
Solution

Interdomain SDN control plane
ENDEAVOUR will research, develop, and evaluate an SDN architecture for the network ecosystem of a large IXP and its members. It includes:
• Distributed SDN Control Plane
• SDN Programming Abstractions

Scalable fine-grained monitoring
ENDEAVOUR will develop a Monitoring Platform for the SDN-enabled IXP. To enable new networking services and technology, monitoring tools need to be flexible in what/how much information is collected, while being able to operate at the high-speed data rates and massive data volumes happening at current and future IXPs. This objective can be broken down into the following specific objectives:
• High Speed Data Plane Monitoring System
• Open and Extensible Monitoring Toolbox

Flexible IXP management for operators

The operation of an IXP is complex, given the volume of data involved, and the number and diversity of members that peer through its infrastructure. Currently, IXPs lack the awareness and manageability to make their operations more efficient and resilient. We will develop specific use cases that demonstrate how the ENDEAVOUR SDN and monitoring tools can greatly facilitate the internal management of IXPs.
• IXP Protection against Member's Equipment Misconfiguration
• Internal Traffic Visibility

Network services offered to IXP ecoystem
ENDEAVOUR will implement a set of use cases that showcase the types of novel interdomain network services that can be offered to the IXP ecosystem. We will explore multi-homing, application-level traffic engineering, and flow anomaly detection.

Expected impact

ENDEAVOUR will have direct benefits for IXPs, Cloud providers and ISPs, but given the fun- damental role of the Internet in our society and economy, the benefits of research work, if successful, will likely extend to virtually any community of Internet users. As such, our poten- tial beneficiaries include the general public, governments, industry, academia and the third sector. More concretely, the expected impact of ENDEAVOUR includes:
• Creating new economic models in the form of marketplaces to meet offer and de- mand between Cloud/application providers and ISPs.
• Enabling regional networks to be more competitive by exchanging traffic directly. This is crucial to keep small regional networks simple, e.g., not having to run their own BGP domain.
• Improving the quality and resiliency of the communication infrastructure, ultimately aiding to reduce the digital-divide.
• The way IXPs work will change completely from a basic best-effort switching fabric to a manageable and controllable network that provides enhanced traffic engineer- ing services. This will change the architecture of the Internet, by enabling intelligent services within the network connectivity fabric.