mami

Measurement and Architecture for a Middleboxed Internet

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Standardization, Dissemination and Exploitation Report

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Executive Summary

This deliverable covers the activities related to exploitation and standardisation of the project, also the key aspects of the dissemination strategy implemented in the first six months of the project's lifetime. The three aspects mentioned before are detailed with respect to target stakeholder groups through the relevant channels identified.

Further, a Data Management Plan has been provided in deliverable D4.1, in line with the requirement for projects participating in the Open Research Data Pilot in Horizon 2020.

1   Introduction

The MAMI project seeks to restore balance among end-user privacy concerns in the face of pervasive surveillance, innovation in network protocols in the face of increasing ossification, and the provision of in-network functionality in a cooperative way. The main goal of the project is to do this through the development and experimental deployment of a middlebox cooperation protocol (MCP) embedded in a more flexible transport layer, to be used together with ubiquitously deployed encryption, based on large-scale middlebox impairment measurements.

In this deliverable we report the activities related to the external communication and dissemination of project results during the first six months of the project. Further plans of WP4 activities for the next period include:

– Identification of potential needs/opportunities for new work to provide appropriate technical contributions to publish/influence new standards: e.g. IETF and IRTF groups
– Support of the standardisation of a middlebox cooperation protocol as a basis for large-scale deployment
– Visibility of the project and the project's results in the research and scientific community
– Exploitation of project results by industry through collaboration with other organizations, key market players and potential users of the technology
– Identification of key application(s) of the project results

2 Standardization

Given that the deployment of the changes to the Internet protocol stack as foreseen by MAMI's architecture work package will require independent action from vendors and operators outside the project, and the measurement work on middleboxes is useful for a variety of protocol engineering efforts even beyond the project, a strong focus on standardization is essential to ensure the project's impact. To this end, MAMI actively participates in the Internet Engineering Task Force (IETF), Internet Research Task Force (IRTF), and European Telecommunications Standards Institute (ETSI).

Many MAMI partners are very experienced in these standards organizations, so the groundwork for some of this effort already started before the project began. MAMI partner ETH co-organized a Birds of a Feather (BoF) session at IETF 92 in Dallas in March 2015 on Substrate Protocol for User Datagrams (SPUD), a concept which has evolved into the MAMI Middlebox Cooperation Protocol (MCP), and which is still under discussion within the IETF. This session was also attended by UNIABDN and ALCATEL/Nokia. MAMI partner ETH organized a proposed Research Group (RG) called How Ossified is the Protocol Stack (HOPSRG) within the IRTF to discuss empirical measurements of middlebox impairment in the Internet. This proposed RG met at IETF 93 in Prague in July 2015 and IETF 94 in Yokohama in November 2015. MAMI partners ULg, TID, UNIABDN, and ETH presented work on middlebox measurement at HOPSRG meetings. MAMI partner TID co-chairs the Network Function Virtualisation (NFV) RG at the IRTF. This group coordinates research activities on NFV-based technologies and applications, in coordination with the research agenda of the ETSI NFV Industry Specification Group (ISG). These efforts continue.

With respect to the MCP, MAMI partner ETH co-organized a BoF called ACCORD ("Alternatives to Content Classification for Operator Resource Deployment") to continue the discussion of what types of information an MCP could be used to expose, particularly in the context of mobile network optimizations, at IETF 95 in Buenos Aires in April 2016. Another BoF called Path Layer UDP Substrate (PLUS) continues the work on standardizing an MCP within the IETF, and will be held at IETF 96 in Berlin in July 2016. This BoF, organized by MAMI partner ETH, has the aim of forming a Working Group (WG) for the definition and standardization of middlebox cooperation techniques. We intend the MAMI MCP to be broadly compatible with the outcome of this WG, should it be chartered. MAMI partner UNIABDN continues to contribute to these activities.

MAMI partner UNIABDN hold a co-chair position of the Transport Area Working Group (tsvwg) which handles general transport topic such as (guidelines for) UDP encapsulation and maintains of Explicit Congestion Notification (ECN). tsvwg as well as the IETF working group for TCP Maintenance and Minor Extensions (tcpm) are both inportant working groups for MAMI fto contribute mostly with respect to the flexible transport layer but also regarding ths MAMI MCP. Further, MAMI partner ETH will also co-chair a BoF for the eventual standardization of the QUIC UDP-based transport protocol at IETF 96 in Berlin in July 2016. While QUIC has been and will be developed independently from the MAMI MCP, it may be an important source of requirements for future MCP development.

With respect to measurement activities within the IRTF, the HOPS RG has been reconstituted as the Measurement and Analysis for Protocols (MAP) RG, with a slightly wider scope. ETH continues to co-chair this proposed RG, which met at IETF 95 and will meet at IETF 96; we hope to confirm the final creation of the RG after this meeting. ETH also presented measurement

results at the MAP RG meeting at IETF 95.

MAMI partners ETH, UNIABDN and SRL participate in the Transport Services (TAPS) WG at the IETF. The design of the MAMI Flexible Transport Layer (FTL) will strive to interoperate with the TAPS facility where appropriate. This is also an area of cooperation with the H2020 NEAT project on middlebox traversal (linking to work by MAMI partners UNIABDN and SRL).

MAMI partner TID and ALCATEL/Nokia participated in the Limited Use of Remote Keys (LURK) BoF at IETF 95, and will continue to follow developments in the creation of a LURK WG. The protocols defined there may be useful for establishing cryptographic contexts among groups of endpoints and middleboxes for use with the MCP; if so, the MCP will strive to be LURK compliant.

With respect to experimentation with NFV approaches for deployment of the MCP, the NFV RG is an ideal forum to share results from MAMI that related to NFV with the wider IETF and IRTF communities, validating and refining them for further standardisation. The results of the MAMI activities directly connected with NFV will constitute a valuable input to the standardisation effort of the ETSI NFV ISG. The MAMI consortium is in a good position in this respect, as representatives of TID are currently chairing the ETSI NFV ISG Technical Steering Committee, and the Working Group on Testing, Experimentation and Open Source. In the other hand, some groups related to software-based networks, like the Mobile Edge Cloud (MEC) ISG at ETSI, are also targets for the standardization activities.

The Protocol Optimisation Project (POP) is a newly formed GSM Association (GSMA) working group. It is tasked to identify differences and possible impacts between mobile network implementations and IETF protocols. POP will look at the interaction between IETF protocols and 3rd Generation Partnership Project (3GPP) protocols in real deployments, defining and running a set of specific experiments. The collected data are of great importance for the definition of MCP. ALCATEL/Nokia and TID are contributors to this working group.

Table 2 lists standardization document work in progress.

Body/Group	Document name	MAMI partners involved
IETF TAPS	draft-ietf-taps-transports	ETH, UNIABDN
IETF TCPM WG	draft-tcpm-accurate-ecn	ETH
IETF PLUS BoF	draft-trammell-spud-req	ETH
IETF PLUS BoF	draft-kuehlewind-spud-use-cases	ETH
IETF individual	draft-trammell-mplane-protocol	ETH

Table 1: Overview of standardization document work in progress.

3 Industrial and Academic Exploitation

This section describes exploitation steps taken to date by each partner, organized by partner type (industrial, or academic). Given the early stage of the project, these descriptions also include basic exploitation plans going forward.

3.1 Industrial Exploitation

3.1.1 Telefónica I+D (TID)

TID aims to apply the MAMI results to network services provided by Telefonica Business Units along two main directions, utilizing and contributing to measurement data in the MAMI Observatory as well as the application of the MCP to NFV and cloud based services Telefonica offers, as further described below.

MAMI Observatory and measurement data

TID is working with Telefonica Business Units on requests for trustworthy and independent data sources to evaluate the network impact of the currently on-going stack evolution, and most specifically pervasive end-to-end encryption, and potentially resulting changes on the services they provide and the management techniques they apply. TID plans to build awareness about the MAMI Observatory among these Business Units, fostering not only their utilization of measurement data, but also their participation with own measurement campaigns that can be contributed to the MAMI Observatory, as well as future consolidation of the measurement data beyond the project lifetime. Here, especially the collaboration with industry associations like GSMA is an important argument for these activities. The analysis of these measurement data can be used to influence the evolution of Telefonica's plans for its next-generation integrated telco cloud and the services hosted by it.

Application of MCP

For the application of MCP in Telefonica's network/services, there are three work areas, as listed below, that are mostly independent and therefore can be processed in parallel, though there are clear synergies among them that will be utilized.

1. The Telefonica Global CTO team is starting the deployment of UNICA, an integrated telco cloud infrastructure intended to support a large variety of network elements and applications, including management tools and NFV-based services. TID will explore the application of MCP to address endpoint-middlebox cooperation in UNICA with the goal to enhance software-based service provisioning, simplify network management tasks, and take advantage of NFV to address network service personalization.

2. Several Telefonica service providers are about to launch Niji, an anonymisation and optimisation service for web access, as a commercial offering onto their 3G/4G networks. TID plans to illustrate how MCP can be applied to improve Niji user experience and facilitate the evolution of the service, especially facing the current trends around evolution of new, encrypted transport protocols as well as others applications

of encryption. Since Niji will eventually be hosted on the UNICA infrastructure, there is a clear opportunity for aligning both exploitation efforts.

3. TID has already completed a commercial pilot deployment of a virtualized home environment (VHE), applying NFV principles to provide network services to residential and SME customers. The pilot is planned to be generalized into a commercial service of Telefonica, and TID aims to demonstrate how the incorporation of MCP capabilities can enhance user experience and address additional services. The VHE is one of the major virtualization projects in Telefonica, related to lowering operational costs and supporting much faster updates of protocols and services. All current home environments run several middleboxes (NATs, firewalls, parental control sytems) that can benefit from additional middlebox signaling provided by MCP.

3.1.2 ALCATEL/Nokia

Nokia (was Alcatel) can exploit the results of MAMI in many different sectors of its product portfolio including, but not limited to, mobile edge and core, Software Defined Networking (SDN), IP video.

In particular, as far as the latter is concerned, Nokia plans to integrate MAMI deliverables into the Velocix product line (Content Delivery Network (CDN), multicast Adaptive Bit Rate (mABR) and Personalisation Platform) at least at two levels. First, taking advantage of the enhanced cooperation with the mobile network to provide better Quality of Experience (QoE) and expand the number of adaptation/personalisation functionality for Over-The-Top (OTT) video delivery. Secondly, using the technology proposed for standardisation in LURK, Nokia plans to change the way encrypted traffic negotiation is handled at edge locations of its CDN and mABR products.

Apart from the direct impact on its product line, Nokia has a vested interest in gathering measures related to the 0-bit/1-bit topic (see Internet Architecture Board (IAB) MarNEW workshop and IETF Alternatives to Content Classification for Operator Resource Deployment (ACCORD) BoF) which is directly related to one of MAMI's main use cases on enabling better support for low latency services. Nokia is one of the leaders of the Protocol Optimization Project in GSMA currently focusing on defining and executing the "1-bit Experiment". The objective of this experiment is to verify (or refute) the hypothesis that explicit packet markings are beneficial to QoE as well as energy and scheduling efficiency in the radio segment (including eNodeB and Terminal Equipment (TE)), compared to 0-bit approaches like, for example, best effort or the use of modern Active Queue Management (AQM) mechanisms.

3.2 Academic Exploitation

3.2.1 ETH Zurich

ETH Zurich has, since the beginning of the project, based two semesters' thesis projects (to end July 2016) and one masters' thesis project (to end August 2016). The semesters' thesis projects involve MCP prototyping and middlebox measurement using Pathspider. The masters' thesis project includes implementation and proof of concept operation of the Path Transparency

Observatory in WP1, together with ZHAW. The ETH exploitation plan going forward includes further semesters' and masters' thesis work in the area of the project as well as a potential doctoral thesis position.

3.2.2 ZHAW

At ZHAW, we have been involving students in MAMI by offering a number of Bachelor and project theses. (Depending on the student's involvement, the thesis can be either a Project Thesis or a Bachelor Thesis.) The theses are offering work in Linux kernel development, acquiring expertise in equipping a modern Linux kernel with new networking protocols; using state-of-the-art libraries to create client-side visualisations from the observatory, either as a general framework or as a concrete visualisation project; and further work on the observatory, together with ETH. As the project progresses, we plan on offering more Bachelor and Project Theses, depending on the project's needs.

In teaching, the MCP will serve as an example of a protocol that is being deployed with full knowledge of nation-state adversaries, and the attendant need for security and risk analsysis, so that protocol users have a realistic sense of what kind of security they can expect.

3.2.3 University of Aberdeen

UNIABDN uses the results of this project to contribute to its portfolio of research and standardisation activities. These activities are key to the School of Engineering, as identified in its REF2010 research exercise. MAMI-focused research will also further the work of postgraduate students.

3.2.4 Simula Research Laboratory

SRL expects both to widen its network of research partners in Europe, and to use MAMI results and experience in future project proposals at the national and European level. SRL will also provide contributions to the PhD summer school that will be organised later in the project.

3.2.5 University of Liege

As a university, ULg leverages the knowledge and experience acquired within MAMI in advanced networking courses. In particular, research activities on measuring middleboxes interference and modeling those middleboxes are included in a "Network and Monitoring Measurements" and "Computer Security" courses given to Master Students.

In addition, Master theses and research projects are currently being proposed to students for next academic year (starting in September 2016). Those offer opportunities to students to help implementing the middlebox simulator, as well as analyzing the large middlebox dataset that is currently collected in WP1.

4 Dissemination and Communication

MAMI has fostered collaborations with academia, industry and other representative groups to ensure its results are well known by all the stakeholders that are relevant to the project. To ensure visibility of the project in the EU research landscape, MAMI participates in EC clustering initiatives, such as the FIRE Dissemination Working Group (DWG), and develops cooperative relationships with related EC-funded projects with special consideration of the relationship with the Measuring Mobile Broadband Networks in Europe (MONROE) project. SRL provides the primary point of contact with MONROE and UNIABDN also recently joined the MONROE project as an associated experimenter.

4.1 Communication Actions

The objectives, goals and early results of the project have already been disseminated through different channels. Given the early state of this project, the dissemination especially focused on invited talks and the use of social media like Twitter so far.

4.1.1 MAMI Web Site

The MAMI website `https://mami-project.eu/` is on-line since September 2015 and it is the main promotional tool for publishing project information and research results. The mami-project.eu domain name has been secured, currently including the project Web site, the project repository and the Observatory site that will provide access to the MAMI measurement data.

In January 2016, the MAMI webpage was updated to contain more information on the project's objectives, work package structure as well as standardization efforts. Since then, it has been continuously updated with relevant information on communication and dissemination activities.

The project website is the single point-of-entry to our activities. We have conceived it as a blog where we include significant events where we are present, results from our studies published in papers, etc. It also includes an interface to our Twitter account and github repositories. In addition, the web page also includes sections on our standardisation efforts and the tools we produce. Finally, it also includes access to papers and public deliverables produced by the project.

4.1.2 Twitter

The project uses Twitter for the dissemination and communication activities, as well. The profile `https://twitter.com/mamiproject` was created in March 2015, during the bid proposal phase. As of 29 June 2016, the channel had 47 followers. We had 108 tweets in our profile and got 52 likes.

4.1.3   Industry Events

MAMI, represented by ETH, shared a booth with the MONROE project at the NetFutures event at The Egg in Brussels, 20-21 April 2016. MAMI presented project concepts to NetFutures attendess; the materials used are available at `https://github.com/mami-project/roadshows/tree/master/NetFutures`

4.2   Software

The publication of software is an important dissemination channel for the project, as well. The following subsections detail software-related activity during the period.

4.2.1   GitHub

The MAMI organization hosted on github.com (`https://github.com/mami-project/`) was created in February 2015, and contains several repositories for open-source software and public information created by the project. MAMI intends to publish several open source releases throughout the lifespan of the project that will include full source code, documentation for usage, installation and integration.

Table 2 list all repositories available in github as well as the MAMI partners that are currently working on the respective software or study. This is only a current snapshot as project and cooperation on these software project will change over the lifetime of MAMI.

4.2.2   Software Distribution Systems

MAMI also attempts to distribute measurement tools developed during the project via packages in software distribution systems, for example the Debian Operating System[1] and the Python Package Index[2]. These systems make it easier for others to reproduce experimental results and to develop extensions to the tools by providing an easy path to installing the software.

As part of these efforts, `python-libtrace`, a dependency of the PATHspider tool being developed, has been made available via the Debian package system by UNIABDN and a package for `python3-scapy`, another dependency of PATHspider by UNIABDN, is awaiting approval for inclusion from Debian.

It should be noted that these software repositories are operated by external organisations, so MAMI cannot guarantee inclusion of software in these repositories, but packages will be built and submitted on a best-effort basis.

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[1] `https://www.debian.org`
[2] `https://pypi.python.org/`

Repo	Description	Partner(s)
pto-core	Core components for the MAMI Path Transparency Observeratory	ETH, ZHAW
pto-web	Web frontend for the MAMI Path Transparency Observatory	ZHAW
observatory-upload	Upload handling for the MAMI Path Transparency Observatory	ZHAW
udptun	TCP tunneling over UDP	ULg
udpdiff	Scripts and data for differential UDP/TCP performance measurements	ETH, ULg
ecn-conspiracy	Scripts and data for measuring ECN negotiation and connectivity dependency	ETH, ULg
pathspider	PATHspider Tool for A/B testing of path transparency	ETH, UNI-ABDN
tracebox	Tracebox over Scamper	ULg
KeyServer	Key Server - TLS Session Key Interface (SKI) (see draft-cairns-tls-session-key-interface-00)	TID
mplane-sdk	mPlane protocol software development kit (for future use with PATHspider	ETH
mplane-protocol	mPlane architecture and Protocol Specification (v2, Internet-Draft)	ETH
roadshows	Public slideware (including templates and logos)	all

Table 2: List of public MAMI software and documentation repositories in github

4.3   Publications and Talks

This section provide an overview of the scientific output of the project in form of presentation given and papers that are already accepted or under submission.

4.3.1   Conference, Workshop, and Journal Papers

As the project is just starting out, we have no published papers at the time of publication of this deliverable, but four accepted for publication, as shown in table 3, and two under submission, as shown in table 4.

4.3.2   Talks given

MAMI partners also gave several talks, both invited and referred in academic as well as industrial fora, about the project objectives and planned work as well as first results such as middlebox impairment measurements. These talks listed in table 5 and slides are available on github as well as referenced on the project website. During these events, MAMI partners also spoke in the hallways with attendees about the project, and even passed out popular laptop stickers (see `https://twitter.com/mamiproject/status/744080123876544512`)

Venue	Date	Title	Authors
ANRW'16	16.7.16	**PATHspider: A tool for active measurement of path transparency**	I. Learmonth (UNIABDN), B. Trammell (ETH), M. Kühlewind (ETH), G. Fairhurst (UNIABDN)
		While classical network measurement tools are often focused on absolute performance values, we present a new measurement tool, called PATHspider that performs A/B testing between two different protocols or different protocol extensions to perform controlled experiments of protocol-dependent connectivity problems as well as differential treatment. PATHspider is a framework for performing and analyzing these measurements, while the actual A/B test can be easily customized.	
ANRW'16	16.7.16	**Multipath bonding at Layer 3**	M. Bednarek (ETH), G. Barrenetxea, M. Kühlewind (ETH), B. Trammell (ETH)
		We propose an approach to do interface bonding at layer 3, design a scheduling algorithm to shift traffic between fixed and mobile lines, implemented Linux-based bonding gateways, and tested them within a testbed on Swisscom's production DSL and LTE networks.	
ANRW'16	16.7.16	**Towards an Observatory for Network Transparency Research**	S. Neuhaus (ZHAW), R. Müntener (ZHAW), K. Edeline (ULg), B. Donnet (ULg), E. Gubser (ETH)
		To date, no one seems to have a truly global view of what middleboxes do to packets on what Internet paths, which would however be an essential knowledge for new transport protocols to be successfully deployed.We describe the MAMI Path Transparency Observatory and a number of questions that we want to address with the data in that Observatory. Eventually, the project will provide public access to that Observatory so that researchers and the interested public can ask their own questions about path transparency issues and middlebox involvement.	
ANRW'16	16.7.16	**MpLb: a Multipath TCP Aware Load Balancer**	S. Liénardy (ULg), B. Donnet (ULg)
		With the rise of middleboxes and inherent Internet ossification, the large-scale deployment of MPTCP is difficult. In particular, a load balancer at the entry point of a data center may forward subflows to different servers, cancelling so the advantages of Multipath TCP. In this paper, we introduce MpLb, a Multipath TCP aware load balancer that fixes this particular issue without any modification to the Multipath TCP protocol itself. We demonstrate advantages of MpLb through a proof-of-concept.	

Table 3: List of accepted papers

Venue	Decision	Title	Partner(s)
IMC '16	29.7.16	**The Internet over UDP: Yes, We Can!**	ULg, ETH
CoNext '16	10.9.16	**Tracking the Big NAT across Europe and the U.S.**	SRL

Table 4: List of papers under submission

Venue	Date	Title	Speaker
Dagstuhl	5.1.16	**An Internet Path Transparency Observatory**	B. Trammell (ETH), M. Kühlewind (ETH)
Introduction to the MAMI Path Transparency Observatory at a Dagstuhl seminar on large-scale measurement. Slides at `https://github.com/mami-project/roadshows/dagstuhl-jan16`			
CleanSky Conference	29.2.16	**Middlebox Measurement and Cooperation**	M. Kühlewind (ETH)
Overview of the MAMI project at an academic conference organized by the CleanSky ITN project in Heidelberg, Germany. Slides at `https://github.com/mami-project/roadshows/cleansky-workshop-hd-feb16`			
ICIN'16	1.3.16	**A Vision for Explicit Path-Cooperative Transport**	M. Kühlewind (ETH)
Introduction to the MAMI MCP concept at an academic-industry conference in Issy-les-Moulineaux, France. Slides at `https://github.com/mami-project/roadshows/icin-paris-mar16`			
PolyX	8.3.16	**On Explicit In-Band Measurement**	B. Trammell (ETH)
Exploration of an application of the MAMI MCP to integration of measurement into the Internet protocol stack given at the inaugural Cisco – Ecole Polytechnique Networking Innovation and Research Symposium at the Paris Innovation and Research Lab (PIRL) in Issy-les-Moulineaux, France. Video available at `https://pirl.tech`			
MAP RG IETF 95	4.4.16	**Can we run the Internet over UDP?**	B. Trammell (ETH)
Initial results from UDP/TCP differential treatment measurements, focusing on RIPE Atlas derived results. Given at Measurement and Analysis of Protocols RG meeting in Buenos Aires, Argentine. Slides at `https://www.ietf.org/proceedings/95/slides/slides-95-maprg-3.pdf`			
RACI RIPE 72	24.5.16	**What if We Designed Measurement as a First-order Service?**	M. Kühlewind (ETH)
Exploration of an application of the MAMI MCP to integration of measurement into the Internet protocol stack, for a network operator audience at RIPE 72 in Copenhagen. Video available at `https://ripe72.ripe.net/archives/video/139/`			
MAT WG RIPE 72	25.5.16	**Internet Path Transparency Measurements using RIPE Atlas**	B. Trammell (ETH)
Initial results from UDP/TCP differential treatment measurements, focusing on RIPE Atlas derived results, for a network operator audience. Video available at `https://ripe72.ripe.net/archives/video/169/`			

Table 5: List of talks

5 Conclusion

This deliverable has reported the standardization, dissemination, and exploitation activities carried out in the MAMI project for the first six months. A summary of output that is currently visible to public is given in table 6; this table does not include open-source software projects as listed separately in table 2.

While the MAMI dissemination and exploitation actions are on-going, especially in form of communication actions in social media as well as scientific publications, we further will start the planning for a common workshop with the MONROE project focusing on middlebox measurement methodology and observations in the next reporting period (as inidcated in the Description of Work for month 18).

Specific Activity	Partner	Description
Standardisation	ETH	Proponents of PLUS BoF at IETF-96, authors of to SPUD Internet-drafts, co-chair of the proposed IRTF MAPRG, co-chair of QUIC BoF, talk at MAPRG, co-authors of an IETF TAPS working group documentand tcpm document related to MAMI's goal of a flexible transport layer
	TID	Lead contributions to standards for NFV and SDN in ETSI NFV ISG and as co-chair of IRTF NFVRG
	UoA	Contribution to PLUS/SPUD, co-authors of an IETF TAPS working group document and TSVWG documents related to the MCP, co-chair of the TSVWG
	ALCATEL	Contribution to the standardization of LURK in IETF; contributions to standards for NFV and SDN
Publications, Workshop and Conference Activities	ETH	Invited talks at ICIN'16, CleanSky Conference and PolyX; talks at IRTF and RIPE; papers at ANRW (1 long and 2 short papers); one paper under submission at IMC
	UoA	Short paper at ANRW
	ULg	Two short papers at ANRW; one paper under submission at IMC
	ZHAW	Short paper at ANRW
	SRL	One paper under submission to CoNext
Public Communication Activities	ETH	Maintainer of the MAMI webpage and MAMI Twitter account (based on input from all partners)
	TID	Coordination of activities and reporting (WP4 leader)
	UoA	Coordination of software distribution
	ZHAW	Development and maintenance of observatory infrastructure and query front-end

Table 6: Dissemination action per partner until end of June 2016