

WP4: Standardisation, Dissemination & Exploitation

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measurement and architecture for a middleboxed internet

measurement

architecture

experimentation

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The WP4 Goal: Maximizing MAMI Impact



- Applicability of the PTO
 - Measurement collection
 - Support data-enabled analyses
- Standardisation of the principles for path-endpoint cooperation
 - Essentially within the IETF
 - And beyond
- Result dissemination
 - Independent measurements, experiment repeatability, impairment analysis...
 - Open source availability
 - Scientific publication and social media
- Industrial influence
 - Diffusion of principles around path-endpoint cooperation
 - Application of results in network gear, services and experimentation and testing frameworks

WP4 Tasks



- T4.1 Standardization
 - Focused on MCP and its ancillary support
 - NFV applications and implementations
- T4.2 Publications, Workshop and Conference Activities
 - Journals, magazines, conferences, and workshops as well as operator conferences
- T4.3 Exploitation and Innovation Management
 - Identify and collaborate with other organisations, key market players and potential users
 - Identify key application(s) of the project results and define the maturity of the technology
- T4.4 Academic Exploitation
 - Integrate aspects of the research into advanced teaching modules of involved academic partners
 - PhD school on measurement infrastructure and datasets, and about middlebox (co-)operation
- T4.5 Public Communication Activities
 - Visual and Internet identity: Website, social networking and general promotion material
- T4.6 Middlebox Observatory Web Site Development and Maintenance
 - Making datasets accessible and usable

A Few Remarks on the WP4 Tasks



- Standardisation
 - Key aspect, taking into account project technical goals
 - Significant results from all the other WPs
- Publications, Workshop and Conference Activities
 - Supported by previous encouraging results
- Exploitation and Innovation Management
 - Connected with ongoing initiatives of the industrial partners
- Academic Exploitation
 - Activity follow-up through the project collaboration mechanisms
- Public Communication Activities
 - Steps taken even before the official start of the project
- Middlebox Observatory Web Site Development and Maintenance
 - Data management and accessibility

Standardisation Intents



- IETF stack evolution
 - QUIC WG and other related activities
- IETF transport groups
 - TAPS and TSVWG
- IETF security groups
 - ACME and TLS
- IRTF groups
 - Path Awareness (PANRG), Measure and Analysis (MAPRG), NFV (NFVRG)
- Collaboration with other activities
 - ETSI TC-CYBER
 - IEEE ETI
 - And GSMA

Standardisation: Internet Stack Evolution



- Contributions most focused on the QUIC WG
- QUIC applicability document
 - Going beyond HTTP
- QUIC manageability document
 - Provide a guide to the QUIC wire image
- The spin bit controversy
 - Support for independent measurability of round-trip times
 - Addressing concerns on privacy
- IAB document on the wire image of a protocol
 - And the interactions with network elements
- Collaboration with the GSMA on the implications

Standardisation: Transport Layer



- Transport service model (TAPS WG)
 - Service architecture
 - Abstract interface to the transport layer services
 - An implementation of this interface
 - Consolidating, RFCs expected in 2019
- Other contributions in transport protocols
 - Transport encryption analysis
 - MTU discovery
 - UDP options
 - Reports on the spin-bit and LoLa issues

Standardisation: Security



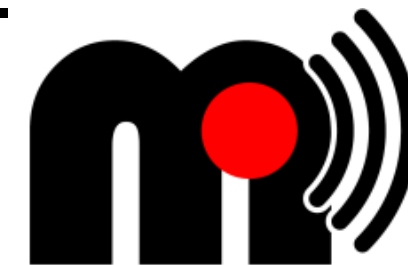
- The STAR protocol
 - Extension to ACME certificate management mechanisms
 - Supporting trust link delegation to unattended devices
 - Full control by the delegating entity
- DTLS connection id
 - Improve security association selection
- The efforts for a "middlebox security protocol"
 - ETSI TC-CYBER-0027-x
- Encrypted traffic inspection
 - IEEE ETI

Pre-Standardisation



- Two research groups within the IRTF
 - Both initiated by the project, and already formally chartered
- PANRG
 - Application of path information at the endpoints
 - Trust links
 - Implications for protocols and best practices
- MAPRG
 - Research evidence on Internet measurements
 - Applied to protocol engineering and practice
- And contributions to NFVRG
 - NFV descriptors as enablers for experiment repeatability and reproducibility

Direct Industrial Applications



- Application of path-awareness principles
 - Enhanced cooperation with the mobile network in the Velocix product line
 - Better QoE
 - Expand the number of adaptation/personalisation functionality for OTT video delivery
 - Deployment of NFV-enabled middleboxes
 - Home environments
 - vCPE and uCPE services
- Applications of the MAMI PTO and measurement data
 - Trustworthy data sources to evaluate the impact of pervasive encryption
 - Collaboration with the MONROE project for mobile Internet evidences
 - Application of the QUIC spin bit to measurement systems

Additional Industrial Applications



- STAR-based trust link management
 - Encrypted traffic negotiation at edge locations in CDN and mABR systems
 - Secure browsing
 - NFV deployments
- DTLS connection identifier
 - IMPACT IoT product line
- NFV-enabled experimentation
 - Repeatability for evaluation and demonstration purposes
 - Application of the *Traffic* tool, leveraging 5TONIC and the 5GINFIRE project

Industrial Outreach



- Introduction to the path-aware networking concept
 - MPLS+SDN+NFV World Congress, Paris
 - As a continuation of previous introductions to MAMI in other events
- Three whitepapers addressed to the networking industry
- *Challenges in Network Management of Encrypted Traffic*
 - Conclusion of the Management and Measurement Summit
- *Analysis and Consideration on Management of Encrypted Traffic*
 - Advocating the application of path-aware networking as a way for a more open and sustainable Internet environment
- *Security and Privacy Implications of Middlebox Cooperation Protocols*
 - Middlebox cooperation can make a passive adversary's job easier, but it does not enable entirely new attacks.

Software and Other (Public) Repositories



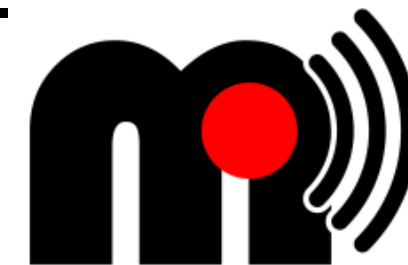
- MAMI organization hosted on github.com
 - <https://github.com/mamiproject>
 - Open-source software and public information created by the project
 - 45 active during this last period
 - Several of them at *wide external use* (or more mature) level
- PATHspider releases already made available through software distribution systems
 - PATHspider releases up to the current 2.0.1 are available for installation from PyPI
 - PATHspider 1.0.1-1 is included in the latest stable version of the Debian operating system
 - These packages were published to the Debian Operating System with MAMI acknowledgement:
 - python-libtrace
 - scapy3k
 - scapy
 - pycurl
- Regular participation in IETF Hackathons to socialise ideas and code related to MAMI activities

Publications and Workshops



- Sixteen different publications and conference participations
 - IEEE Communications, INFOCOM, Internet Measurement Conference, Mobicom, ACM CoNEXT EPIQ, USENIX NSDI, GSMA Packet...
- The MAMI Management and Measurement Summit
 - Different stakeholders: researchers, engineers
 - Challenges to network measurement and management by strong encryption, in breadth and depth
- The MAMI Summer School on Internet Path Transparency Measurements
 - Focused on the project tools: Tracebox, PATHspider and the PTO
- Second edition of the joint workshop with MONROE on Mobile Network Measurements
 - WebRTC measurements, network QoS and mobile coverage, multipath and application performance
- Tutorial on Repeatability and Comparability in Measurement (RCM)
 - At SIGCOMM 2018
 - Introducing MAMI tools
- PATHspider hackathon
 - Jointly with the OONI (Open Observatory of Network Interference) project

Academic Exploitation



- ETH Zurich
 - Four student projects performed, supporting the development of PATHspider, the PTO, and passive measurability for QUIC
 - Work in. passive network measurement contributed to the research performed for an on-going PhD thesis
- ZHAW
 - One master student involved in the project, resulting in a master thesis on how to fuzz shim-layer protocols in general.
 - ZHAW will operate the PTO after the end of the project.
- University of Aberdeen
 - Will continue to explore important lines of research developed in MAMI, which will form the basis of new research proposals.
 - MAMI research will continue to be used in advanced undergraduate teaching and to support the work of postgraduate students.
- Simula Research Laboratory
 - Will apply MAMI results when developing future project proposals and for its graduate education activities.
 - MAMI results are being, fully integrated in MONROE, to be supported by the new MONROE alliance
- University of Liege
 - Will use MAMI project results in follow-up research activities and for teaching purposes
 - The middlebox simulator is at the heart of a course on traffic engineering, and will be used labs in Computer Security
- UC3M
 - Tools (Trafic, NEMO compiler, VPP QUIC...) transferred to the 5TONIC labs at IMDEA Research, to be used in the context of 5G research projects.
 - Results will be reflected in different Bachelor and Master theses

Online Presence



- The MAMI domains and website
 - <https://mami-project.eu/> is updated with information on publications, standardisation efforts, events, and a lively blog used to disseminate MAMI research results and activities.
 - <https://observatory.mami-project.eu/> (the MAMI PTO), available since May 2016
 - Other related websites (PATHspider, Tracebox, Eyeorg, HTTP2 Dashboard) at <https://mami-project.eu/index.php/weblinks/>
- The MAMI Twitter account
 - @mamiproject was created in March 2015
 - Cumulated stats by 20 December 2018
 - 244 followers
 - 3686 tweets

WP4 in Numbers



	Last Period	Total
Standards contributions	23 (1 final)	37 (2 final)
Software repositories	45	69
Scientific publications	16	49
Workshops and events	5	7
Tweets (and followers)	3453 (+109)	3686 (244)
Industrial whitepapers	3	3
Industrial presentations	2	4