WP4: Standardisation, Dissemination & Exploitation

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mami

measurement and architecture for a middleboxed internet

measurement **architecture** **experimentation**

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

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 (*draft-ietf-quic-applicability*)

  - Going beyond HTTP

- QUIC manageability document (*draft-ietf-quic-manageability*)

  - Provide a guide to the QUIC wire image

- The spin bit controversy (*draft-ietf-quic-spin-exp*)

  - Support for independent measurability of round-trip times

  - Addressing concerns on privacy

- IAB document on the wire image of a protocol (*draft-iab-wire-image*)

  - And the interactions with network elements

- Collaboration with the GSMA on the implications

Standardisation: Transport Layer

- Transport service model (TAPS WG)

    - Service architecture (*draft-ietf-taps-arch*)

    - Abstract interface to the transport layer services (*draft-ietf-taps-interface*)

    - An implementation of this interface (*draft-ietf-taps-impl*)

    - Consolidating, RFCs expected in 2019

- Other contributions in transport protocols

    - Transport encryption analysis (*draft-ietf-tsvwg-transport-encrypt*)

    - MTU discovery (*draft-ietf-tsvwg-datagram-plpmtud*)

    - UDP options (*draft-fairhurst-udp-options-cco*)

    - Reports on the spin-bit and LoLa issues (*draft-fossati-tsvwg-lola*)

Standardisation: Security

- The STAR protocol (*draft-ietf-acme-star*)
    - Extension to ACME certificate management mechanisms
    - Supporting trust link delegation to unattended devices
    - Full control by the delegating entity (*draft-ietf-acme-star-delegation*)
- DTLS connection id (*draft-ietf-tls-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 MAMI 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 *Trafic* 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 MAMI 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
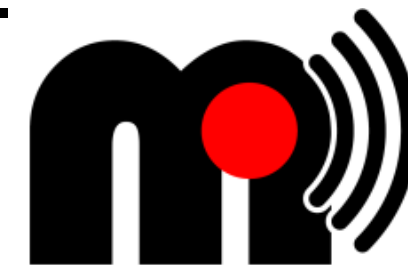
- ETH Zurich
  - Four student projects performed, supporting the development of PATHspider, the PTO, and passive measurability for QUIC
  - Work in. passive network measurement contributed to the research performed for an on-going PhD thesis

- 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)
  - 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, 11 adopted)
Software repositories	45	69
Scientific publications	16	45
Workshops and events	5	7
Tweets (and followers)	3453 (+109)	3686 (244)
Industrial whitepapers	3	3
Industrial presentations	2	4

As a Conclusiom

- 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