The IETF and Transport

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Overview

- The Internet Engineering Task Force (IETF)
- The Transport Area
- „Mayor Transport Attractions“ at IETF-96 in Berlin, July 17-22
- Measurement and Architecture for a Middleboxed Internet (MAMI): EU-H2020 Project

Internet Engineering Task Force (IETF)

The goal of the IETF is to make the Internet work better.

- formed in 1986
- organized activity of the Internet Society (ISOC)
- ~ 8000 RFCs (Request For Comments)
  - technical and organizational notes about the Internet
- 7 Areas: GEN, ART, INT, OPS, RTG, SEC, TSV
- "*We reject kings, presidents and voting. We believe in rough consensus and running code.*“ (David Clark)

Internet Engineering Steering Committee (IESG)

- Technical management of IETF activities and the Internet standards process
  - incl. final approval of specifications as Internet Standards

- **General Area (gen):** Jari Arkko (Ericsson), IETF and IESG Chair.
- **Applications and Real-Time Area (art):** Ben Campbell (Oracle), Alissa Cooper, (Cisco), Alexey Melnikov (Isode)
- **Internet Area (int):** Suresh Krishna (Ericsson), Terry Manderson (ICANN)
- **Operations and Management Area (ops):** Benoit Claise (Cisco), Joel Jaeggli (Fastly)
- **Routing Area (rtg):** Alia Atlas (Juniper Networks), Deborah Brungard (AT&T), Alvaro Retana (Cisco)
- **Security Area (sec):** Stephen Farrell (Trinity College Dublin), Kathleen Moriarty (EMC Corporation)
- **Transport Area (tsv):** Spencer Dawkins, Mirja Kühlewind (ETH Zurich)

Internet Architecture Board (IAB)

- 12 members + IETF chair + liaison positions/ex-officio members
- Confirm IESG Appointment
- Architectural Oversight
- Standards Process Oversight and Appeal
- RFC Series and IANA
- ISOC liaison and external liaisons

Internet Research Task Force (IRTF)

- promotes research of importance to the evolution of the Internet
- 10 (long-term) research groups: CFRG, GAIA, HRPC, ICCRG, ICNRG, NFVRG, NMRG, NWCRG, SDNRG, T2TRG
  - 2 proposed research groups: MAPRG, NMLRG
- managed by the IRTF Chair (Lars Eggert, NetApp)
  in consultation with the Internet Research Steering Group (IRSG)

RFC series

- IETF stream: work group documents or AD-sponsored
- IAB stream
- IRTF stream
- Independent Submission stream

Documents Status

- Standard track and Best Current Practice (BCP)
- non-Standard track: informational, experimental, historic

IETF Challenges

- Provide value for open source projects
- Better integration of running code in the IETF process (Rule of Code): CodeMatch
- Develop interfaces, model, and solution for Software Defined Networks (SDN)
- Allow permission less innovation (outside the IETF)
- Quality of specification needs cross-area review and wide interest of participants
- General: make it easier for people to be involved in the IETF
  - online cooperation, virtual meeting, remote participation, local hubs, increase diversity, and make IETF sponsorship independent from meetings

The Transport Area - Scope

- One of the oldest IETF areas
  - Maintenance and development of “core” transport protocols: TCP, UDP, SCTP, DCCP, MPTCP, tcpinc
  - Congestion Control and Queue Management
  - Quality of Service and Signaling: DiffServ, RSVP, ECN
- Today also
  - NAT Traversal (ICE/TURN), UDP Encapsulation and Tunneling
  - P2P-Networking and Application Level Transport Optimization
  - Delay-tolerant Networking and Storage Networking

The Transport Area - Working Groups (WGs)

Transport Protocols and Congestion Control

- TCP Maintenance and Minor Extensions (tcpm)
- Multipath TCP (mptcp)
- TCP Increased Security (tcpinc)
- RTP Media Congestion Avoidance Techniques (rmcat)
- Transport Services (taps)
- Transport Area Working Group (tsvwg)

Network Support and Measurements

- Application-Layer Traffic Optimization (alto)
- Active Queue Management and Packet Scheduling (aqm)
- Delay/Disruption Tolerant Networking (dtn)
- TURN Revised and Modernized (tram)
- IP Performance Metrics (ippm)

Storage Networking

- Network File System Version 4 (nfsv4)

Transport Area Birds of a Feather (BoFs) - IETF96

https://trac.tools.ietf.org/bof/trac/

- **Low Latency Low Loss Scalable throughput** (L4S) - Not-WG-forming
  - New service to complement best efforts: new AQM isolates more scalable traffic (DCTCP-like congestion control) in term of latency
- **QUIC** (current Google transport) - WG-forming
  - UDP-based transport protocol; encrypted and optimized for HTTP/2
- **Path Layer UDP Substrate** (PLUS) - WG-forming
  - new shim layer (atop UDP): transport-independent signaling of flow semantics to middleboxes (under transport and application control)
  - enable the deployment of new, encrypted transport protocols
- **Information-Centric Networking** (ICN) - NOT APPROVED (in ICNRG)

Information Centric Networking (ICN)

- **Baseline scenarios** (RFC 7476): social networking, real-time comm./ video, infrastructure sharing, content dissemination, mobile/vehicular networking, delay- and disruption-tolerance, IoT, smart city
- **Protocol specifications:** CCNx Messages in TLV format, CCNx Semantics (Core concepts of the CCNx architecture and minimum network protocol based on two messages: Interest and Content Object)
- **Newly proposed topics:** Manifests, chunking, fragmentation, versioning, user privacy, access control, name resolution, named function networking
- **Open source code:** CCNx-1.0 (PARC), CCN-lite (University of Basel), NDN NFD (NDN project)

Documenting use cases &

Evolving research

Creating interoperable platforms for

Evolving ICN concepts and

Internet of Things (IoT)

- IoT Semantic Interoperability (**IoTSI**) Workshop, March 2016
  - Interoperability at application layer: common data and information models
  - Workshop report: draft-iab-iotsi-workshop-00

- **T2TRG**: Thing-to-thing research group
  - adaptation layer connecting devices to IP, application layer with architectures, APIs

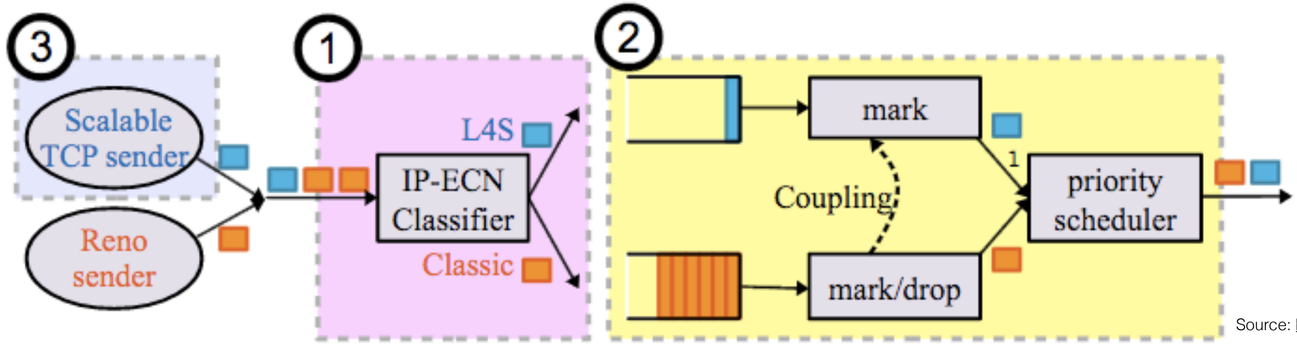
- INT: Intelligent Transportation Systems (**ITS**) 2. BoF
  - standardize and/or profile IP protocols for establishing direct and secure connectivity between moving networks

- INT: Low-Power Wide Area Networks (**LPWAN**) 2. BoF
  - wireless access technologies with low-rate connectivity to vast numbers of battery-powered devices over distances that may span tens of miles, using license-exempt bands
  - LPWA Gap analysis of IETF technologies and analysis of IPv6 over LPWA

Support for Low Latency

- **rmcat:** RTP Media Congestion Avoidance Techniques
  - Hybrid (delay and loss) congestion control for WebRTC/real-time video
  - Goal: maintain low latency and co-exists with traditional loss-based traffic

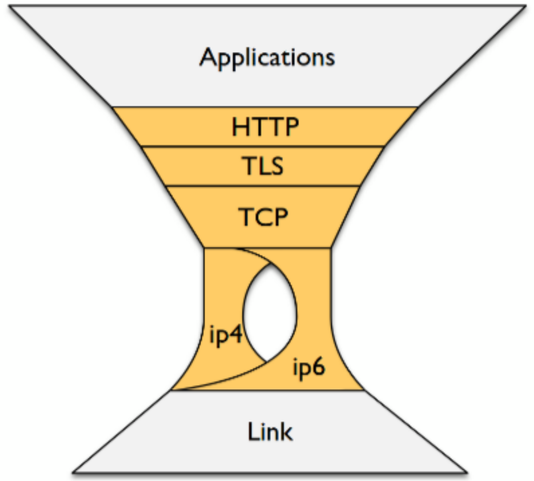
- **L4S:** Low Latency Low Loss Scalable throughput
  Problem Statement: draft-briscoe-tsvwg-aqm-tcpm-rmcat-l4s-problem



Source: http://bobbriscoe.net/presents/1604ietf/1604-l4s-bar-bof.pdf

1. **tsvwg:** ECN-based Identifier (draft-briscoe-tsvwg-ecn-l4s-id)
2. **aqm:** DualQ-Coupled AQM (draft-briscoe-aqm-dualq-coupled)
3. **tcpm/ICCRG:** Scalable, DC-TCP-like congestion control and AccECN

Stack Evolution

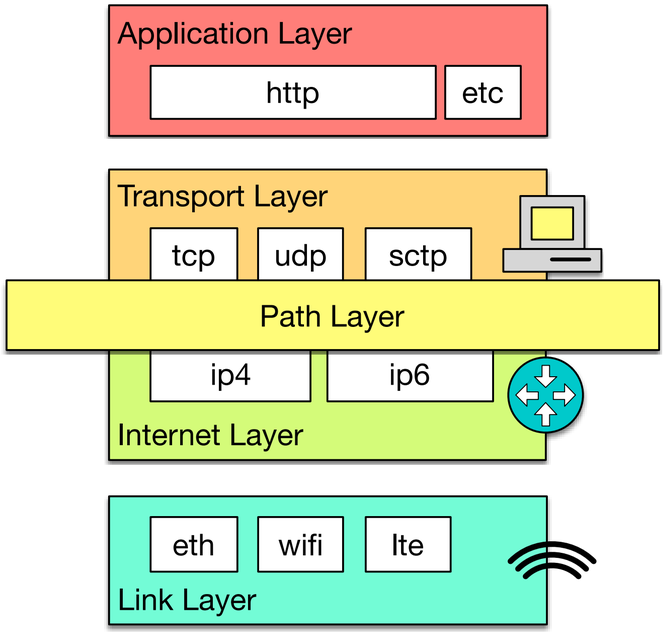


- Protocol stack is ossified by middleboxes mangling and inflexible interfaces for developers
- IAB Stack evolution program
  - Providing architectural guidelines
  - Principles for deployability: RFC5218, iab-thaler-transition-principles
- Stack Evolution in a Middlebox Internet (**SEMI**) workshop, Jan 2015
  - Workshop report: RFC7663
- Managing Radio Networks in an Encrypted World (**MaRNEW**), Sep 2015 (with GSMA)
  - Workshop report: draft-nrooney-marnew-report-01

Enabling and Handling Encryption

- **Accord** BoF (IETF95): Alternatives to Content Classification for Operator Resource Deployment
- **tcpinc:** TCP increased security
  - opportunistic, unauthenticated encryption of TCP payload
- SEC: Limited Use of Remote Keys (**lurk**) 2. BoF
  - Multiple distributed instances of the service (content hosting, delivery networks)
  - "offload TLS without giving the CDN my private key" use-case
- SEC: SIP Best-practice Recommendations Against Network Dangers to privacY (**SIPBRANDY**) - working group in formation
- **PLUS**: enable the deployment of new, encrypted transport protocols, while providing a transport-independent method to signal flow semantics to middleboxes

Transport Diversity and UDP Encapsulation



- **PLUS**
  - *Path layer* for explicit cooperation with middleboxes instead of implicit assumptions
  - Userspace implementation of new (UDP-based) transport protocols
- **QUIC**
  - New UDP-based transport protocol
  - Development based on deployment experience of Google
- **taps**: Transport Services
  - goal: (abstract) interface for applications to make use of (a set of) *Transport Services*
  - experimental support mechanisms for e.g. transport selection and TCP-fallback mechanism
- **MAPRG**: Proposed Measurement and Analysis for Protocols (MAP) RG
  - Measurement of middlebox impairments with the aim to inform protocol engineering and practice

The MAMI Project

Measurement and Architecture for a Middleboxed Internet

measurement

of deployed middleboxes

architecture

for middlebox cooperation

experimentation

of use case applicability and deployability

- Strong interaction with relevant standards organizations for impact on deployment
- FIRE testbed (MONROE) support for measurement as well as experimentation, especially on mobile broadband access networks
- Learn more at **http://mami-project.eu/**

Middlebox Measurements: Golas and Overview

1. Large-scale measurements of path impairments

- using FIRE MONROE as well as RIPE Atlas, CAIDA Ark…
- UDP/TCP/SCTP connectivity, TCP options (e.g. TFO, MPTCP), and other protocol (ICMP, DNS, …)

2. **Development of new measurements tools:** https://github.com/mami-project/

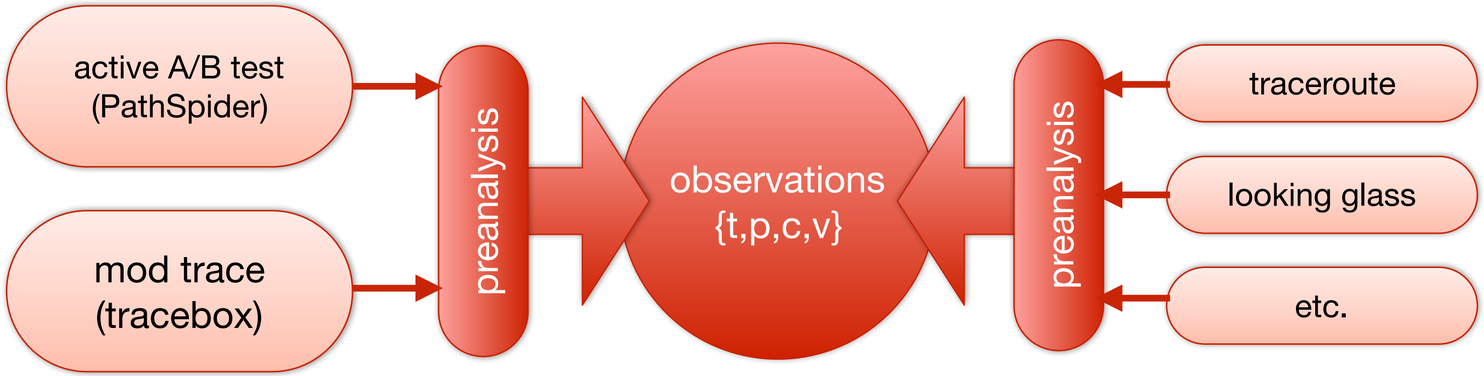
- Tracebox: tracing + impairment analysis
- PathSpider: A/B testing (currently on ECN support)

3. **Path Transparency Observatory**

- Active measurements by the project + external measurements
- Query interface to access observations on path impairments:
  - *What is the likelihood that a certain path impairment impacts my traffic* (modifications/stripping/dropping/blocking)?

Path Transparency Observatory

- Observatory (public release end 2016) to derive common ***observations*** about *conditions* on a given *path* at a given *time*
- Combining disparate measurements leads to better insight
  - e.g. own measurement data, traceroutes, BGP, traces



Follow http://mami-project.eu and @mamiproject for availability!

Middlebox Cooperation: Architectural Considerations

1. Shim Layer for Explicit Middlebox Cooperation

- Transport and applications can selectively expose semantic information to middleboxes
- Higher layers can fully be encrypted

2. Flexible Transport Layer (FTL)

- Maintain connectivity (even if the MCP is not supported)
  e.g. fallback or happy-eyeball mechanisms
- Provision of encryption context for different layers/protocols