# Welcome to EPIQ 2021!

Please, join us on the SIGCOMM slack channel for discussion, see epiq21.github.io for details!

We will use Zoom chat to ask questions after presentations though!

If there are any practical issue, let me know via Zoom chat ASAP!

**We will start at 12:15 sharp!**

# EPIQ'21

## 3rd Workshop on the Evolution, Performance and Interoperability of QUIC

Robin Marx robin.marx@kuleuven.be
Christopher Wood caw@heapingbits.net

CoNEXT, 7 December 2021

Now:

IETF Chairman

Now:

CoNEXT Chair

*Soon*:

President of the

Free World

*Soon*:

The Next

Tim Berners-Lee

Now:

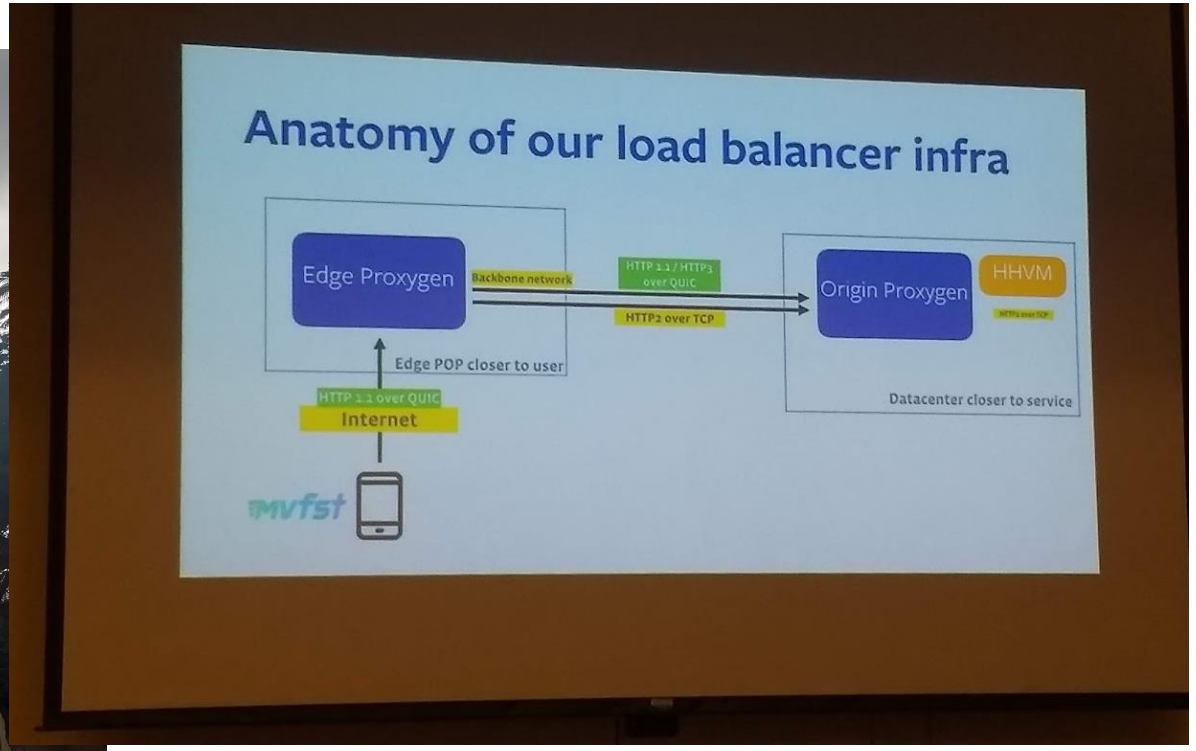
IETF Chairman

Now:

CoNEXT Chair

- Anna Brunström, Karlstad University
- Stephen Farrell, Trinity College Dublin
- Oliver Hohlfeld, Brandenburg University
- Jana Iyengar, Fastly
- Mirja Kühlewind, Ericsson
- Jan Rüth, RWTH Aachen
- David Schinazi, Google
- Felix Günther, ETH Zurich
- Martin Thomson, Mozilla
- Cristina Nita-Rotaru, Northeastern University
- Colin Perkins, University of Glasgow
- Michael Welzl, University of Oslo
- Vidhi Goel, Apple
- Nick Banks, Microsoft
- Quentin de Coninck, UCLouvain
- Antoine Delignat-Lavaud, Microsoft

# EPIQ'18




https://www.youtube.com/watch?v=8lYHNzoPS2o


RFC 8999

**RFC 9000**

RFC 9001

RFC 9002


RFC 8999

**RFC 9000**

RFC 9001

RFC 9002

# HTTP/3 protocol - OTHER

Upcoming version of the HTTP networking protocol, which is currently a draft. Previously known as HTTP-over-QUIC. Uses QUIC as its transport layer protocol.

Current aligned | Usage relative | Date relative | Filtered | All

| IE | Edge * | Firefox | Chrome | Safari | Opera | Safari on iOS * | Opera Mini * | Android Browser * | Opera Mobile * | Chrome for Android |
|---|---|---|---|---|---|---|---|---|---|---|
| | 12-18 | | 4-78 | | | | | | | |
| | 2 79-84 | 2-71 | 2 79-84 | | 10-72 | | | | | |
| | 3 85-86 | 1 72-87 | 3 85-86 | 3.1-13.1 | 3 73 | 3.2-13.7 | | | | |
| 6-10 | 87-95 | 88-93 | 87-95 | 4 14-15 | 74-81 | 14-14.8 | | 2.1-4.4.4 | 12-12.1 | |
| 11 | 96 | 94 | 96 | 4 15.1 | 82 | 15.1 | all | 96 | 64 | 96 |
| | | 95-96 | 97-99 | 4 TP | | | | | | |

Microsoft

https://www.smashingmagazine.com/2021/09/http3-practical-deployment-options-part3/

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**David Schinazi, is that you?**

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| | aioquic | google | lsquic | mvfst | ngtcp2 | picoquic | quic-go | quiche | quicly | quinn |
|---|---|---|---|---|---|---|---|---|---|---|
| **Flow Control category (FC)** | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 |
| **Multiplexing scheduler** | SEQ | RR | RR | RR | SEQ | SEQ | RR | RR | RR | RR |
| **Retransmission approach (RA)** | 2 | 1 | 2 | 3 | 2 | 2 | 2 | 1 | 2 | 2 |
| **0 RTT approach (ZR)** | 1 | 1 | 2 | 3 | 1 | 2 | 2 | 1 | 2 | 1 |
| **DATA frame size** | large | medium | small | large | small | large | large | small | large | small |
| **Worst case packetization goodput efficiency** | 90.34% | 95.02% | 92.54% | | 90.88% | 87.94% | | | 91.52% | 83.92% |
| **Dynamic packet sizing (PMTUD)** | ✗ | ✗ | ✗ | ✗ | ✗ | ✓ | ✗ | ✗ | ✗ | ✗ |
| **Acknowledgment frequency (#packets)** | 1 | 2-10 | 2-8 | 10 | 2-4 | 2-6 | 2-9 | 1 | 2 | |
| **Congestion Control (CC) New Reno \| Cubic \| BBR** | ✓\|✗\|✗ | ✗\|✓\|✓ | ✗\|✓\|✓ | ✓\|✓\|✓ | ✓\|✗\|✗ | ✓\|✓\|✓ | ✗\|✓\|✗ | ✓\|✓\|✗ | ✓\|✗\|✗ | ✓\|✗\|✗ |


https://qlog.edm.uhasselt.be/epiq

**The Search of the Path MTU with QUIC**

Timo Völker, Michael Tüxen *(FH Münster University of Applied Sciences)*; Erwin P. Rathgeb *(University of Duisburg-Essen)*

**Tracking the QUIC Spin Bit on Tofino**

Ike Kunze, Constantin Sander, Klaus Wehrle, Jan Rüth *(RWTH Aachen University)*

**Verifying QUIC implementations using Ivy**

Christophe Crochet, Tom Rousseaux, Maxime Piraux, Jean-François Sambon, Axel Legay *(UCLouvain)*

**Evaluation of QUIC-based MASQUE Proxying**

Mirja Kühlewind, Matias Carlander-Reuterfelt, Marcus Ihlar, Magnus Westerlund *(Ericsson)*

**Days of Future Past: An Optimization-based Adaptive Bitrate Algorithm over HTTP/3**

Daniele Lorenzi *(University of Padua)*; Minh Nguyen, Farzad Tashtarian *(Alpen-Adria-Universität Klagenfurt)*; Christian Timmerer *(Alpen-Adria Universität Klagenfurt)*; Hermann Hellwagner *(Alpen-Adria-Universität Klagenfurt)*; Simone Milani *(University of Padua)*

*You all should probably have a meeting about whether or not this hyphen is needed...*

**Congestion Control for Real-time Media over QUIC**

Mathis Engelbart, Jörg Ott *(Technical University of Munich)*

https://epiq21.github.io/

# Will EPIQ remain EPIC?

## *Acceptance Rates*

**EPIQ '21 Paper Acceptance Rate 6 of 8 submissions, 75%**

## XLINK: QoE-driven multi-path QUIC transport in large-scale video services

SIGCOMM '21: Proceedings of the 2021 ACM SIGCOMM 2021 Conference • August 2021 • Pages 418–432 • https://doi.org/10.1145/3452296.3472893

## It's over 9000: analyzing early QUIC deployments with the standardization on the horizon

IMC '21: Proceedings of the 21st ACM Internet Measurement Conference • November 2021 • Pages 261–275 • https://doi.org/10.1145/3487552.3487826

**VOXEL: Cross-layer Optimization for Video Streaming with Imperfect Transmission**

long

Mirko Palmer (Max-Planck-Institut für Informatik), Malte Appel (Max-Planck-Institut für Informatik, IIJ), Kevin Spiteri (University of Massachusetts Amherst), Balakrishnan Chandrasekaran (Vrije Universiteit Amsterdam), Anja Feldmann (Max-Planck-Institut für Informatik), Ramesh K. Sitaraman (University of Massachusetts Amherst, Akamai Tech)

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# Nick Banks

# The Indomitable Nick Banks