QUIC Tracker

An active test tool for QUIC

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Complexity of the QUIC specification

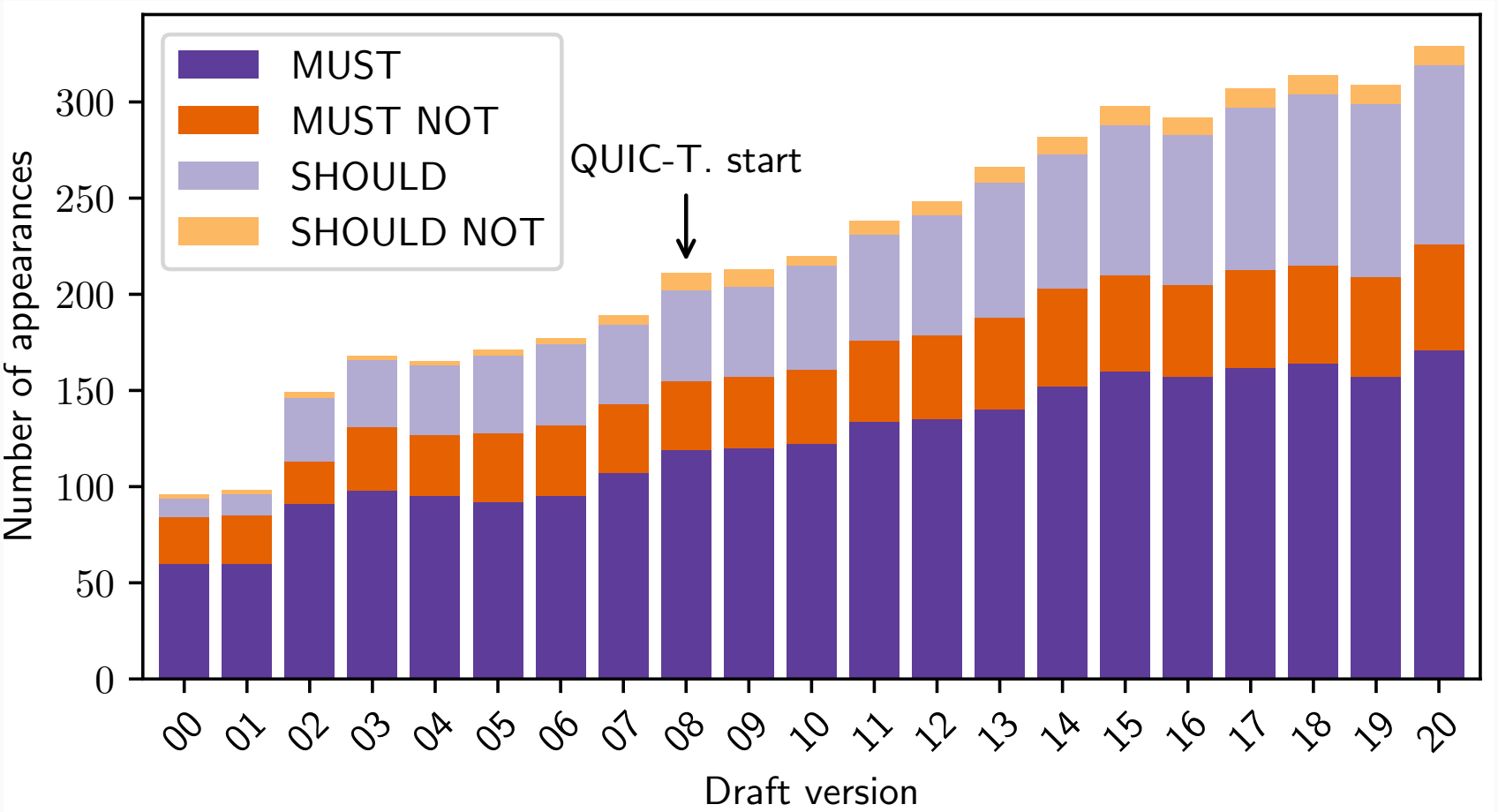


Figure 1: Evolution of keywords in `draft-ietf-quic-transport`.

QUIC implementations are evolving rapidly

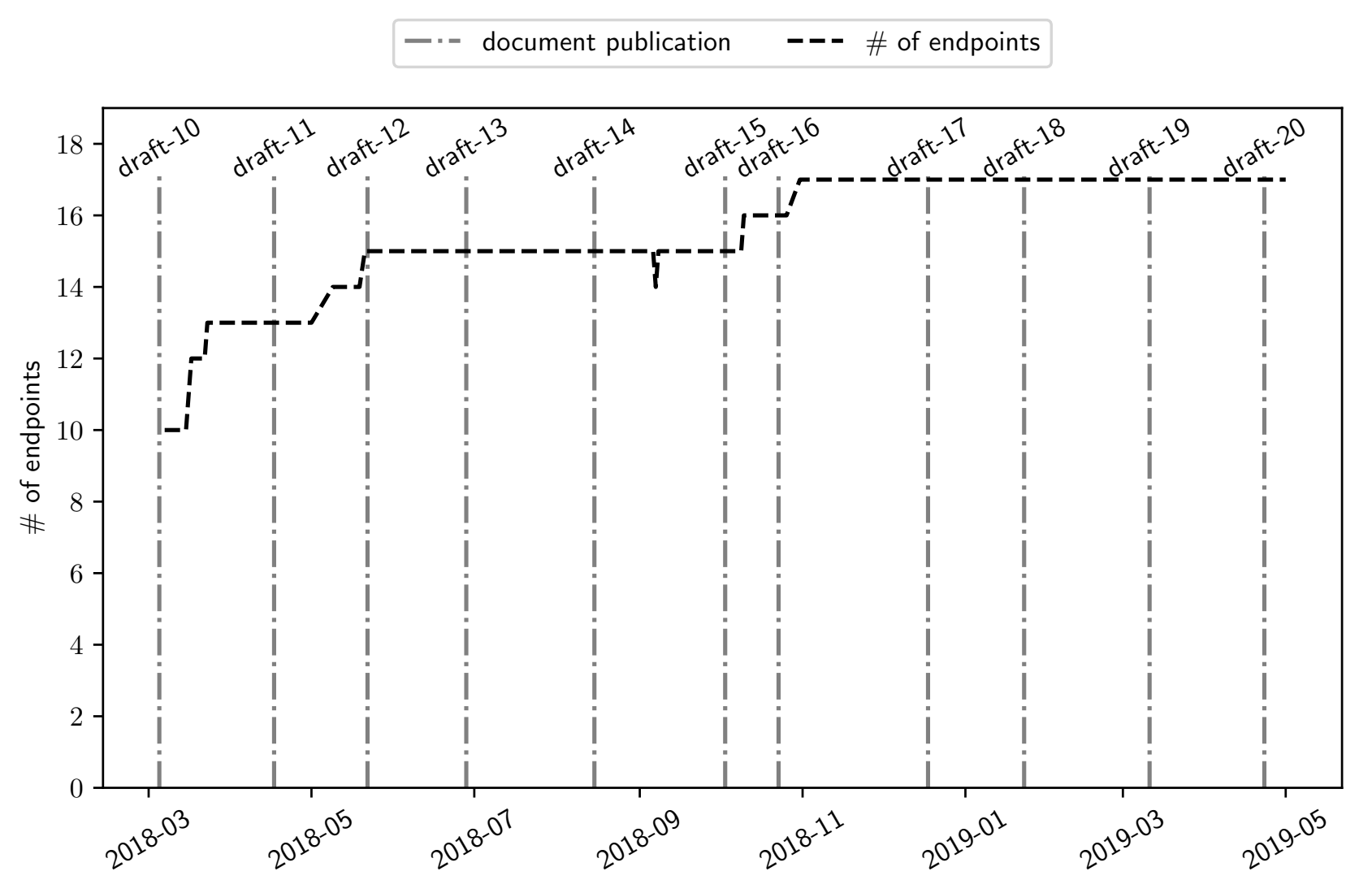


Figure 2: Evolution of QUIC versions.

QUIC implementations are evolving rapidly

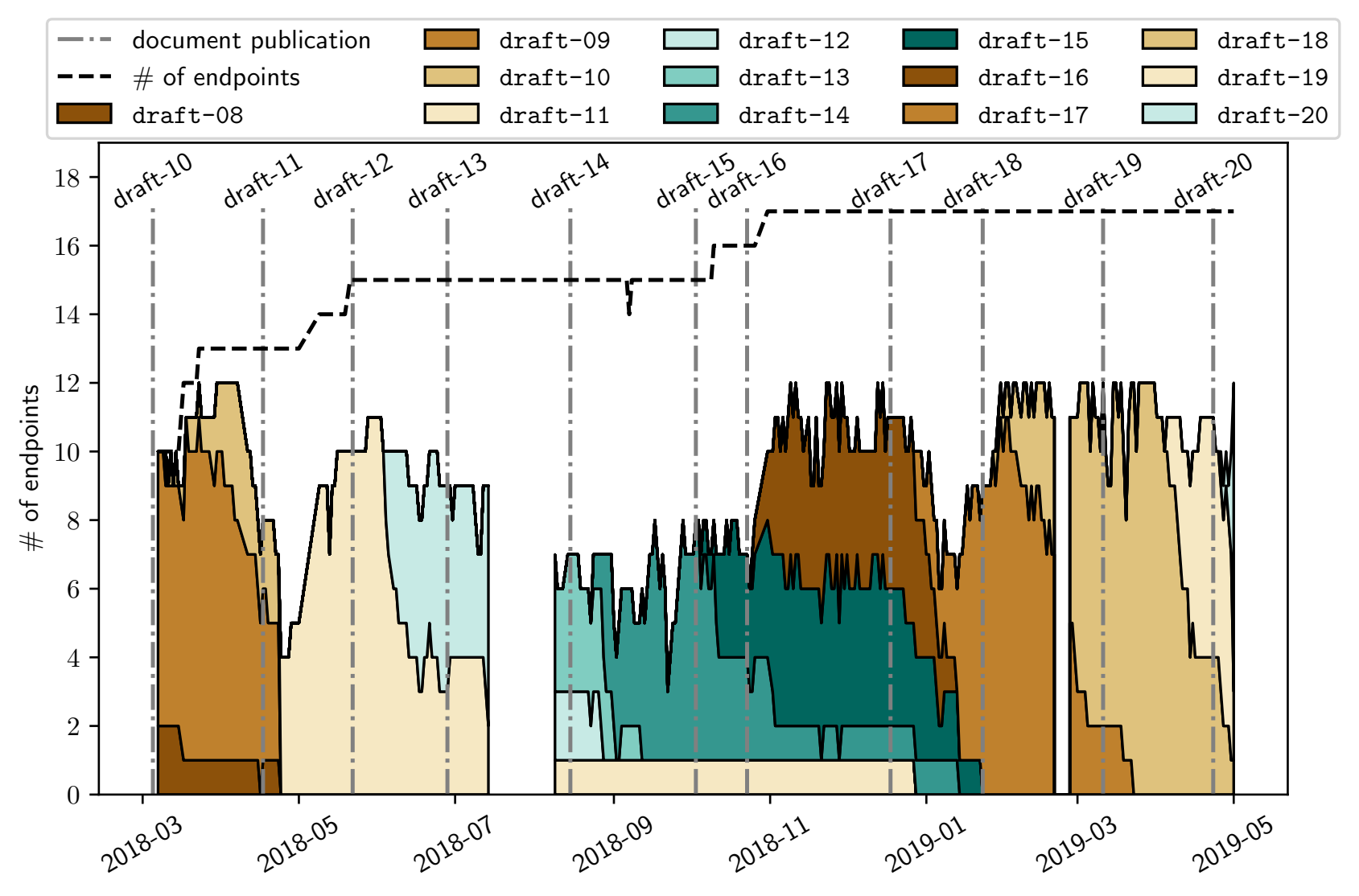


Figure 2: Evolution of QUIC versions.

Contributing to the QUIC effort

- We propose an active test tool called **QUIC Tracker**.
- It exchanges packets with server implementations to test them.
- The tool runs daily and its results are public.

Results grid

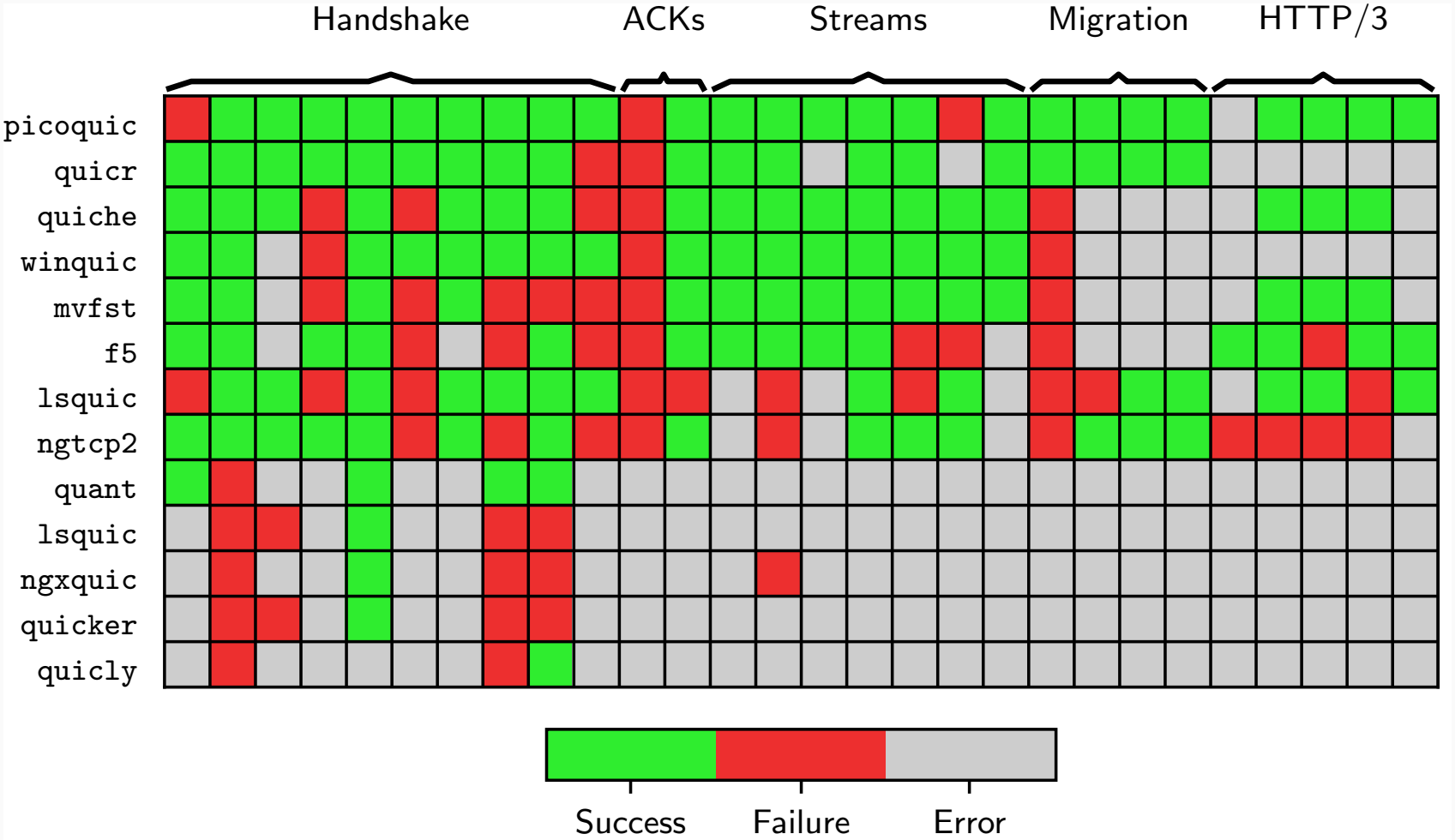


Figure 3: Results grid on the 2nd of May.

QUIC Tracker architecture

Architecture

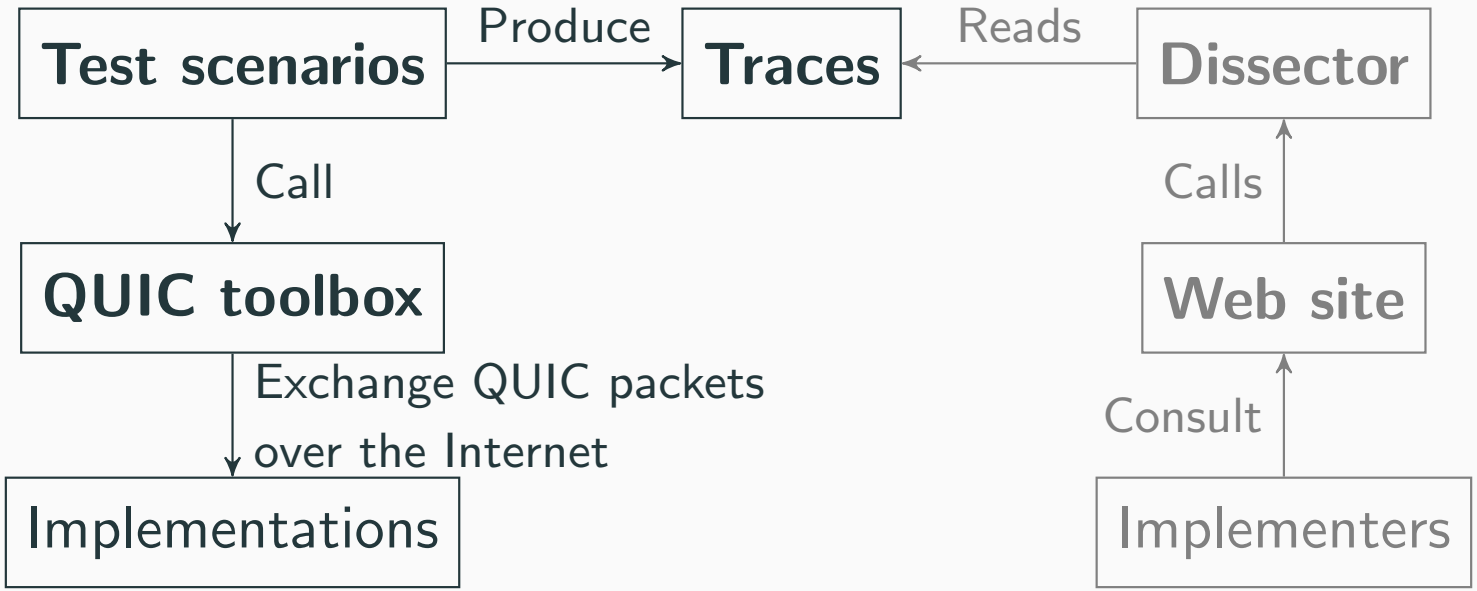
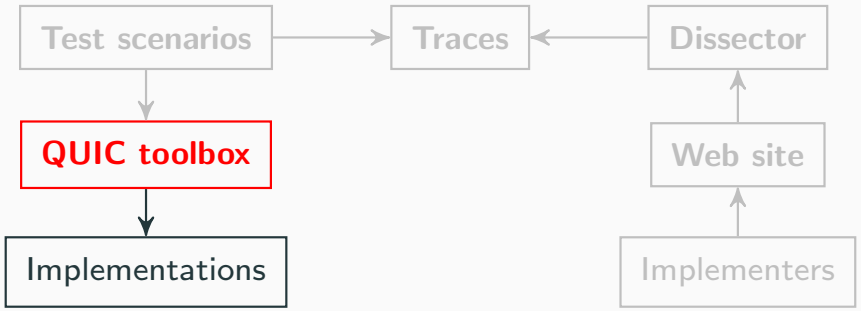


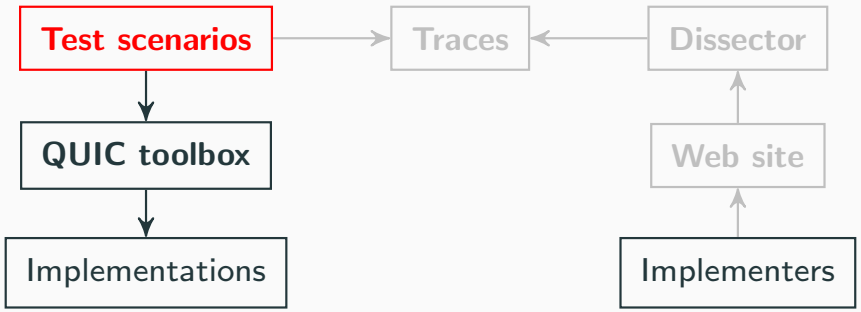
Figure 4: Tools forming QUIC Tracker.

Architecture – QUIC toolbox



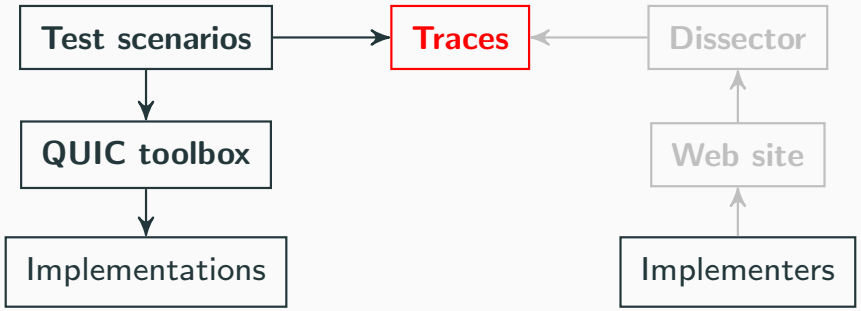
- A library built in Go to implement QUIC clients.
- It provides a high-level API to manipulate QUIC packets.
- It implements all types of connection establishment, streams, recovery, acknowledgements and HTTP/3.
- The library consists of 5000 lines of code.

Architecture – Test scenarios



- There currently exist 28 test scenarios.
- We derive rules that should not be violated from the specification.
- Each test is executed in a separate connection.
- Each test targets a particular feature of QUIC.
- A test is 56-line long in average.

Architecture – Traces



- We defined a JSON trace format common to all tests.
- A trace contains an error code summarising its outcome.
- Scenario-specific data can be embedded, e.g. list of supported versions.
- The exchanged packets are recorded inside the trace.

Recent improvements

Recap since EPIQ'18

- `draft-20` is supported.
- We are phasing `hq`-based tests out in favour of HTTP/3.
- Test scenarios development has been further simplified.
- 5 more tests were added.
  - Spin bit
  - IPv4 $\rightarrow$ IPv6 migration
  - Two HTTP/3 greasing tests
  - Client flow control violation

Bringing declarative programming to QUIC Tracker

- Declarative programming seems a natural fit for test suites.
- E.g. `quic-go` uses `Gomega` for its internal test suite.

Bringing declarative programming to QUIC Tracker

```
var firstCrypto bool
for _, f := range p.GetAll(qt.CryptoType) {
    if f.(*qt.CryptoFrame).Offset == 0 {
        firstCrypto = true
        break;
    }
}
```

Figure 5: Imperative programming

Bringing declarative programming to QUIC Tracker

```
var firstCrypto bool
for _, f := range p.GetAll(qt.CryptoType) {
    if f.(*qt.CryptoFrame).Offset == 0 {
        firstCrypto = true
        break;
    }
}
```

Figure 5: Imperative programming

```
firstCrypto := Expect(p.GetAll(qt.CryptoType))
    .To(ContainElement(MatchAllFields(IgnoreExtras, Fields{
     "Offset": Equal(uint64(0)),
})))
```

Figure 6: Declarative programming

Bringing declarative programming to QUIC Tracker

- Declarative programming seems a natural fit for test suites.
- E.g. `quic-go` uses `Gomega` for its internal test suite.
- QUIC Tracker is already quite simple.
- There is no clear benefit in switching to declarative programming.
- `Gomega` cannot be reused as is in QUIC Tracker.

Future prospects

Introduce a DSL for test scripting

- QUIC Tracker is not `packetdrill` (yet).
- QUIC semantics are far more complex than TCP's.
- *Can we invent a syntax rich enough to express them ?*

Test QUIC clients

- Advertisements on a popular web site can force clients to connect to the tool.
- We should be careful not to mess with the clients too much.
- How to distinguish between the clients ?

Study the usability of QUIC from different ASNs[1]

- By using QUIC Tracker from different ASNs, one could map the usability of QUIC in the Internet.
- UDP blockage or more advanced middleboxes interferences could be detected using the test scenarios.
- A mobile deployment would help the data gathering.

[1] https://github.com/QUIC-Tracker/quic-tracker/issues/11

Conduct active measurements in the wild

- Several works studied TCP deployment and configuration in the past
- Similar measurements could be conducted for QUIC
- E.g. measuring the *initial congestion window*.

Using and improving QUIC Tracker

- QUIC Tracker is a free and open-source tool.
- You are encouraged to submit ideas, suggestions and PRs.
- Its development is happening at `github.com/QUIC-Tracker`.
- `quic-tracker.info.ucl.ac.be/blog` contains a tutorial on adding new scenarios.