Using QUIC to Traverse NATs

IETF 118

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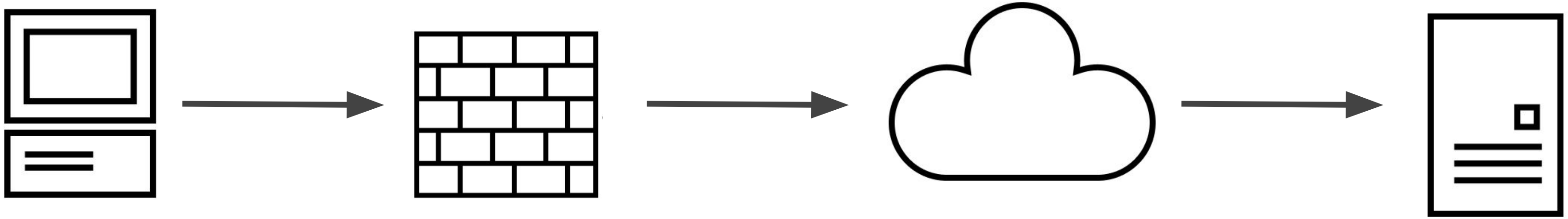
draft-seemann-quic-nat-traversal

QUIC v1 (RFC 9000)

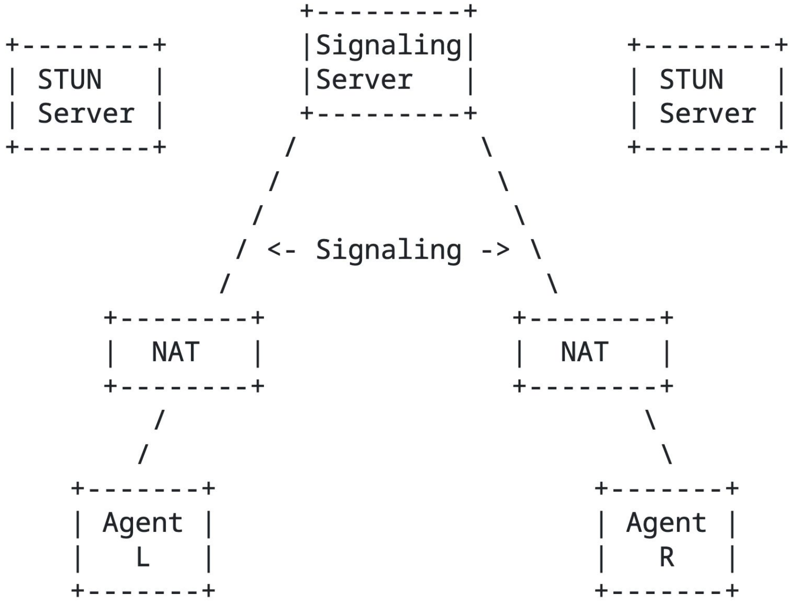
- Assumes that the server is always publicly reachable
- Only the client might be behind a NAT



- Defines how to handle NAT rebindings
- Defines how a client can actively migrate to a different path

ICE (RFC 8445)

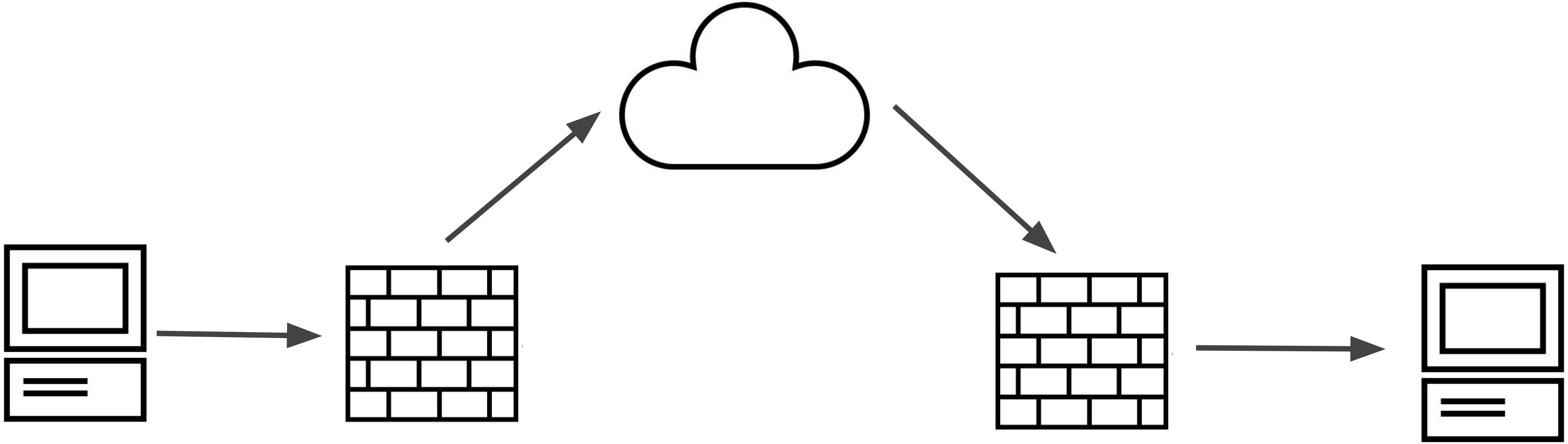
1. Peers gather candidates
2. Exchanges candidates between peers
   a. Match candidate pairs
3. Perform connectivity checks
4. Nominate candidate pair
5. Keeping paths alive



```
                         +---------+
       +--------+        |Signaling|         +--------+
       | STUN   |        |Server   |         | STUN   |
       | Server |        +---------+         | Server |
       +--------+       /           \        +--------+
                       /             \
                      /               \
                     / <- Signaling -> \
                    /                   \
             +--------+               +--------+
             |  NAT   |               |  NAT   |
             +--------+               +--------+
                /                             \
               /                               \
           +-------+                       +-------+
           | Agent |                       | Agent |
           |   L   |                       |   R   |
           +-------+                       +-------+
```

Figure 1: ICE Deployment Scenario

Purpose of this Draft



- Make it possible to use QUIC in a peer-to-peer setting
- Possible use cases:
    - Building block for WebRTC over QUIC
    - … lots of other p2p protocols

But... do we need to do anything?

1. Use ICE to do all the NAT traversal
2. Run a QUIC handshake on ICE's nominated address candidate pair

⊖ Requires running ICE

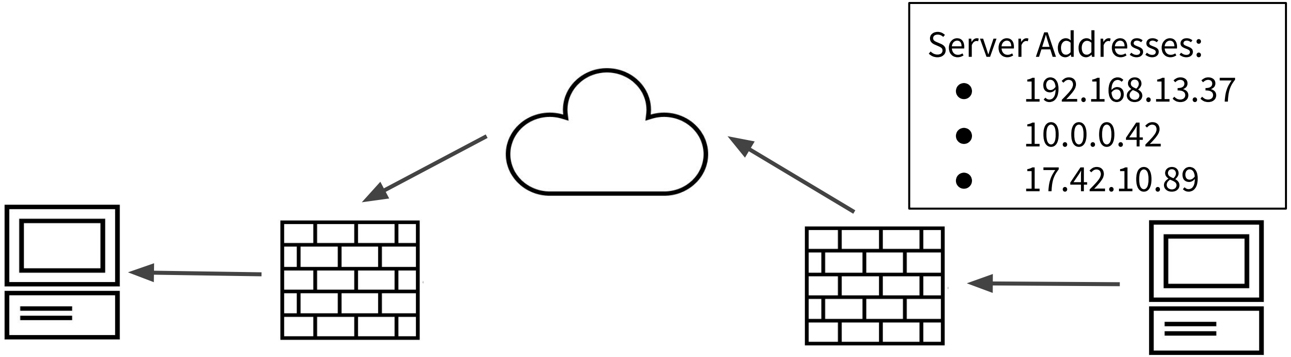
⊖ Requires running a (non-QUIC) signaling server

⊖ Lots of round trips

What if we do it in QUIC?

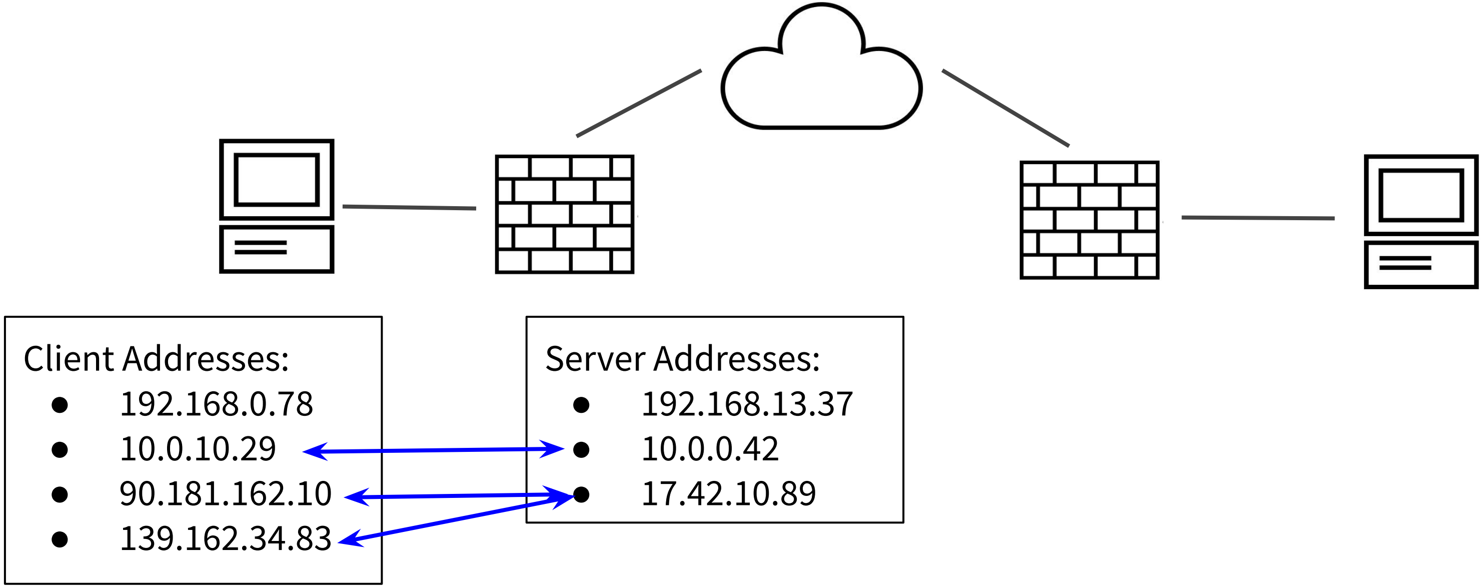
1. Use a proxied QUIC connection for signaling
   - for example: connect-udp-listen
2. Use QUIC path probing to create the NAT binding
   - Requires the server to send a probe packets
3. Then use QUIC connection migration

Step 1: Address Discovery



- The server sends all its addresses to the client
  - The draft defines an ADD_ADDRESS frame
  - This allows trickling of addresses
- No addresses are sent from the client to the server

Step 2: Address Matching



Client Addresses:

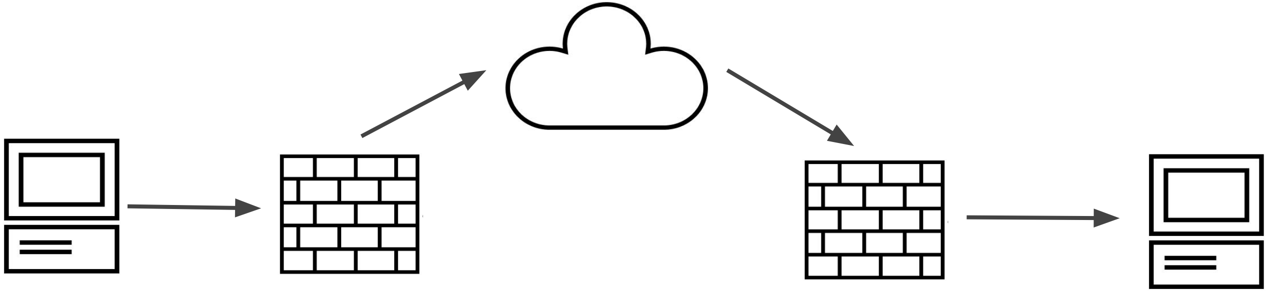
- 192.168.0.78
- 10.0.10.29
- 90.181.162.10
- 139.162.34.83

Server Addresses:

- 192.168.13.37
- 10.0.0.42
- 17.42.10.89

- Happens on the client side
- MAY use ICE's address matching logic

Step 3: Traversing the NAT



Candidate Pairs:

- 10.0.10.29 ↔ 10.0.0.42
- 90.181.162.10 ↔ 17.42.10.89
- 139.162.34.83 ↔ 17.42.10.89

- Both peers send probe packets for each candidate pair
- If the hole punching is successful, a new QUIC path is established
- The client may now initiate QUIC Connection Migration

Does this require QUIC Multipath?

It's not necessary. But potentially beneficial.

	QUIC v1	QUIC Multipath
Client can probe (multiple) paths	✅	✅
Server can probe paths	❌	❌

Open Questions

- Probing paths requires a lot of Connection IDs, which might clash with the *active_connection_id_limit*
- Bandwidth requirement of path probing
- Asking a peer to dial many addresses is an amplification vector