SOCKS Protocol Version 6

draft-olteanu-intarea-socks-6-00

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Motivation

- SOCKSv5 makes liberal use of round trips
  - Authentication method negotiation
  - Authentication
  - Remote connection establishment

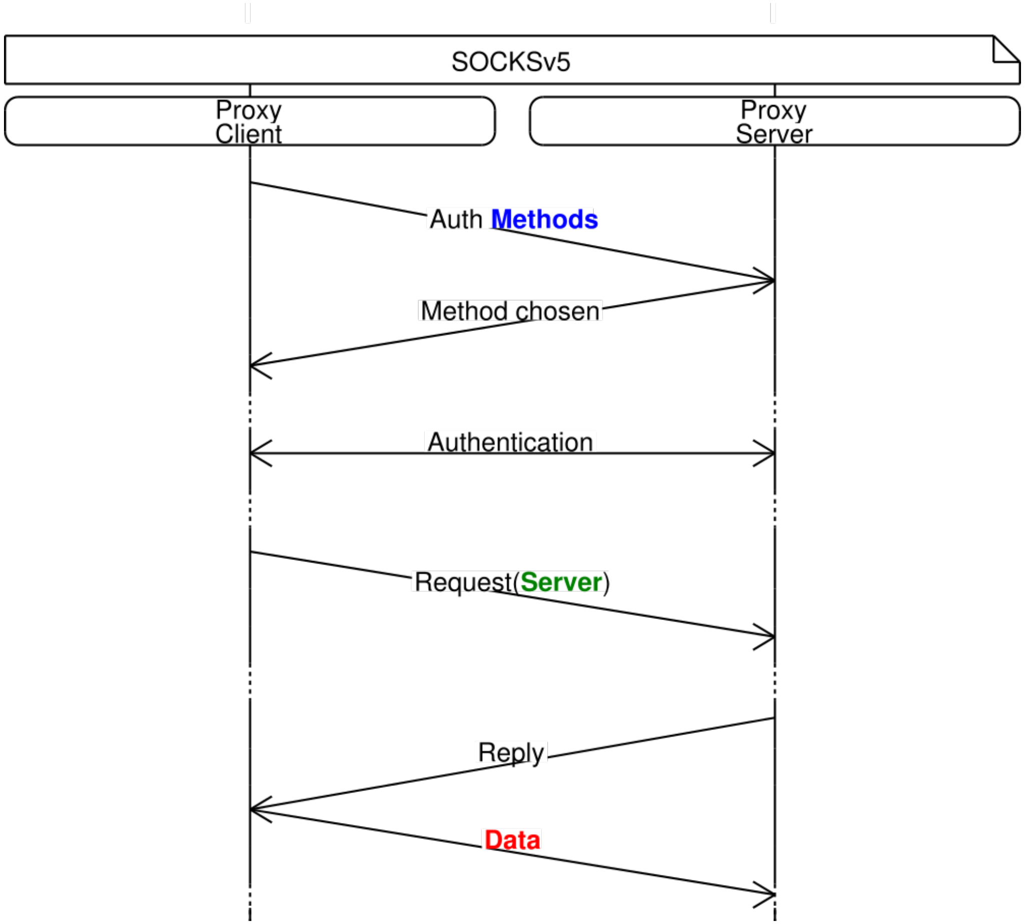
- 0-RTT authentication possible after pre-negotiation

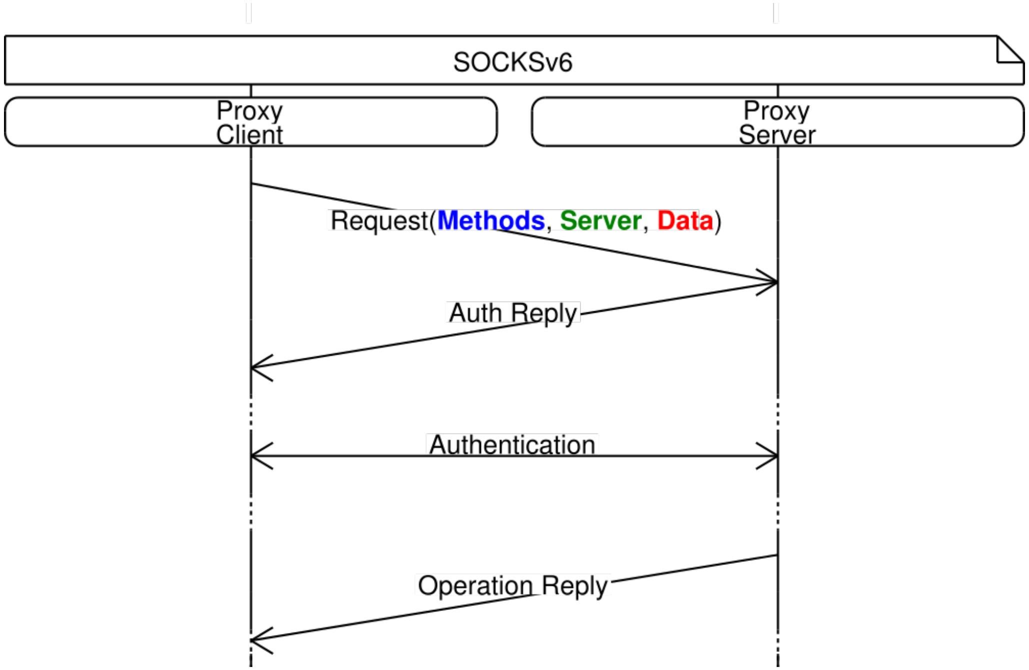
- Hot use case: “Bond” 3G/4G/LTE and WiFi using MPTCP
  - Little to no MPTCP support on the server side
  - Use proxy to convert to regular TCP
  - Mobile networks have high latency

Improvements over v5

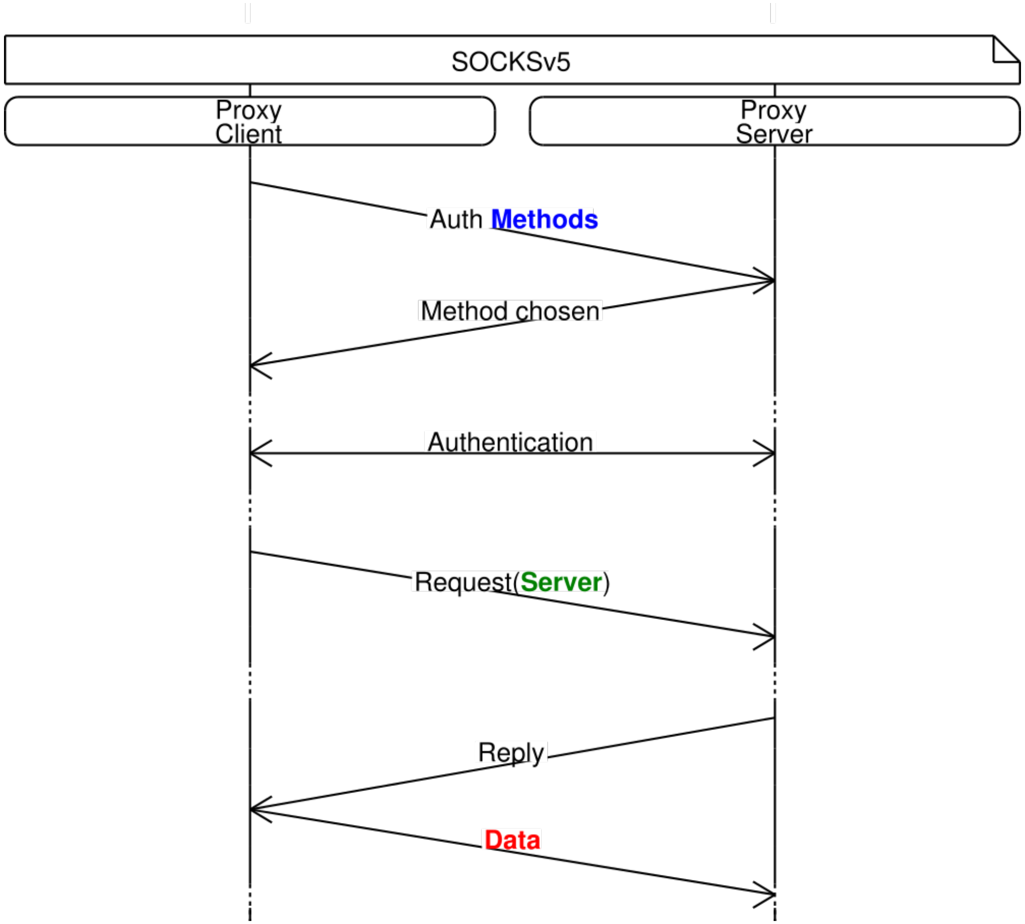
- Client sends as much information as possible upfront
  - Optimistic, doesn’t wait for authentication to conclude
  - Method advertisement, server address, some application data
- Client can specify if it wants TFO on the proxy-server leg
- Extensible: TCP-like options
- 0-RTT authentication support via options

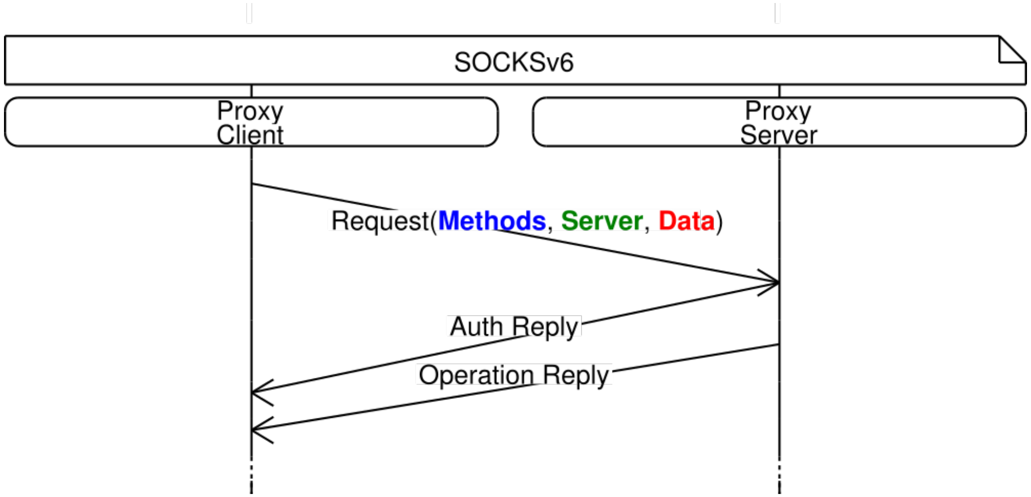
SOCKSv5 vs. SOCKSv6 [1/2]





SOCKSv5 vs. SOCKSv6 [2/2]





- Can include authentication data in the request on subsequent connections

SOCKSv6 Request

```
+---------------+-----------+----------+   +---------+-----+---------+----------+------+
|    Version    | Number of | Methods  |   | Command | TFO | Address | Address  | Port |
| Major | Minor |  Methods  |          |   |  Code   |     |  Type   |          |      |
+-------+-------+-----------+----------+   +---------+-----+---------+----------+------+
|   1   |   1   |     1     | Variable |   |    1    |  1  |    1    | Variable |  2   |
+-------+-------+-----------+----------+   +---------+-----+---------+----------+------+
+-----------+----------+--------------+--------------+
| Number of | Options  | Initial Data | Initial Data |
|  Options  |          |     Size     |              |
+-----------+----------+--------------+--------------+
|     1     | Variable |      2       |   Variable   |
+-----------+----------+--------------+--------------+
```

- Includes auth. method advertisement
- Includes initial data
- Options in TLV format
  - May include authentication data

SOCKSv6 Authentication Reply

```
+---------------+------+--------+-----------+----------+
|    Version    | Type | Method | Number of | Options  |
| Major | Minor |      |        |  Options  |          |
+-------+-------+------+--------+-----------+----------+
|   1   |   1   |  1   |   1    |     1     | Variable |
+-------+-------+------+--------+-----------+----------+
```

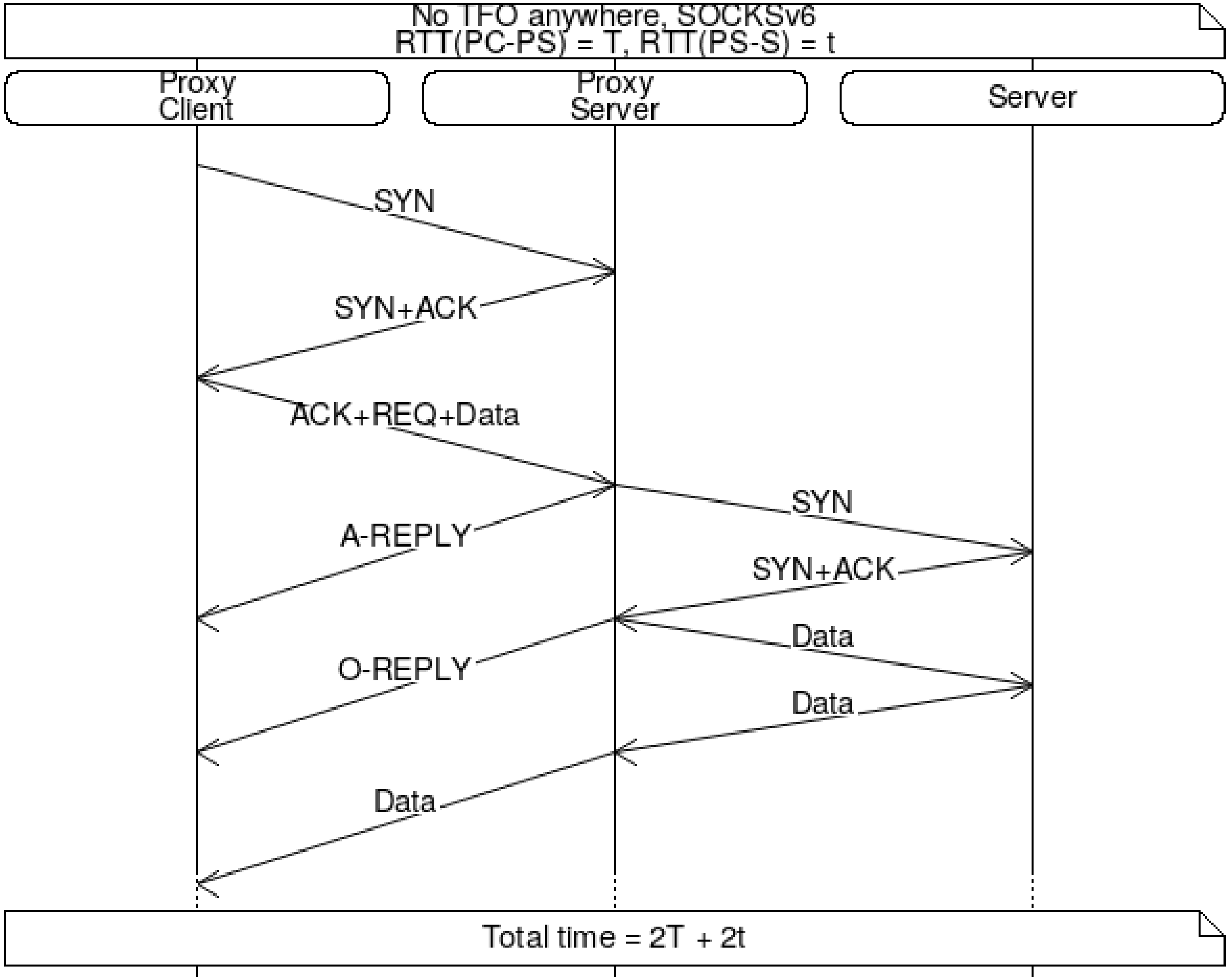
- Informs client whether more authentication is needed or not
  - If 0-RTT authentication failed: selects which authentication method to use
  - If 0-RTT authentication succeeded: informs client which method was used

SOCKSv6 Operation Reply

```
+---------------+-------+---------+----------+------+
|    Version    | Reply | Address |   Bind   | Bind |
| Major | Minor | Code  |  Type   | Address  | Port |
+-------+-------+-------+---------+----------+------+
|   1   |   1   |   1   |    1    | Variable |  2   |
+-------+-------+-------+---------+----------+------+
+-----------+----------+--------------+
| Number of | Options  | Initial Data |
|  Options  |          |    Offset    |
+-----------+----------+--------------+
|     1     | Variable |      2       |
+-----------+----------+--------------+
```

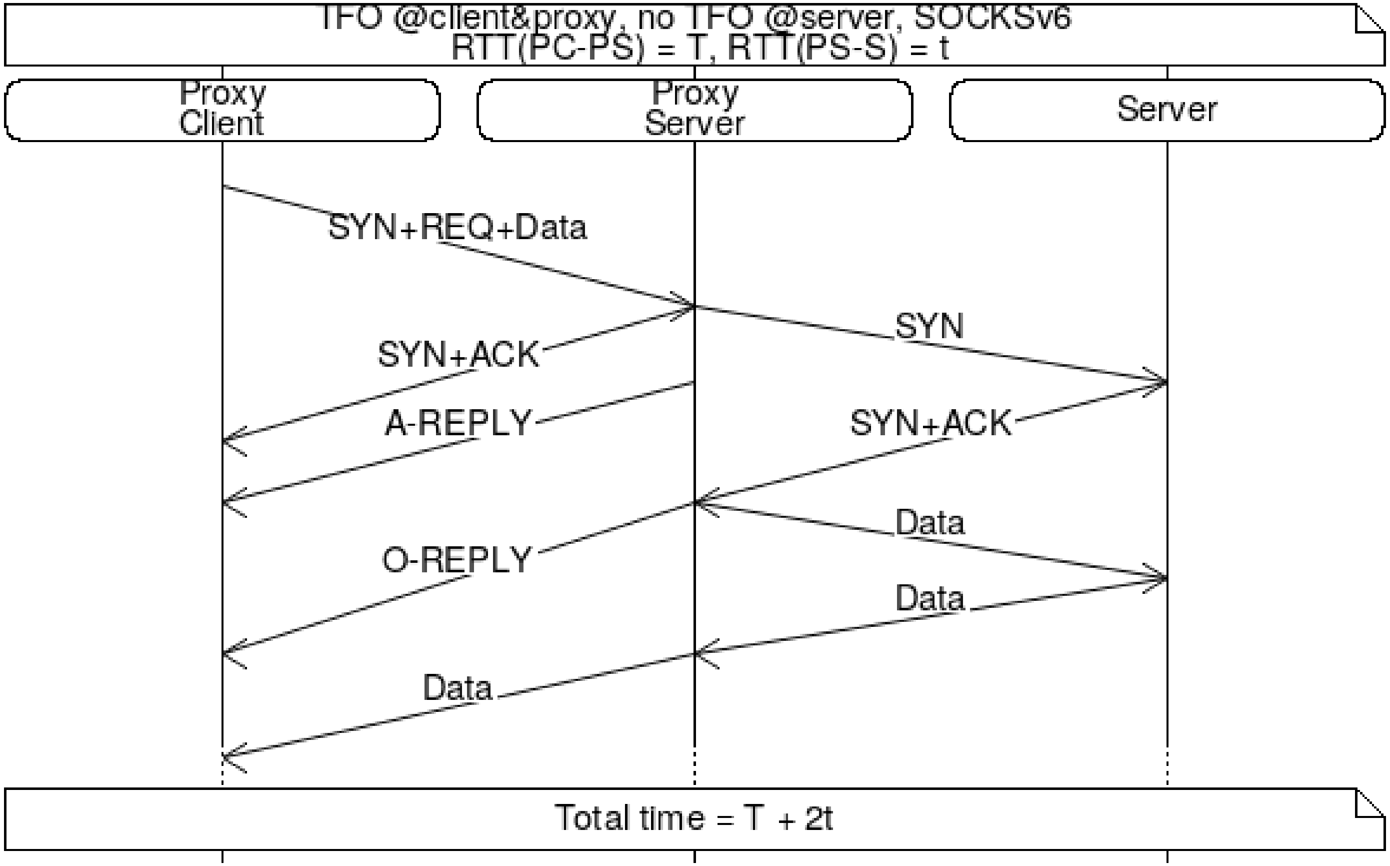
- Reply code indicates whether the connection was successful or not (and why: RST, timeout, etc.)
- Initial data offset lets the proxy avoid buffering data while the client authenticates

SOCKSv6 in action: no TFO anywhere



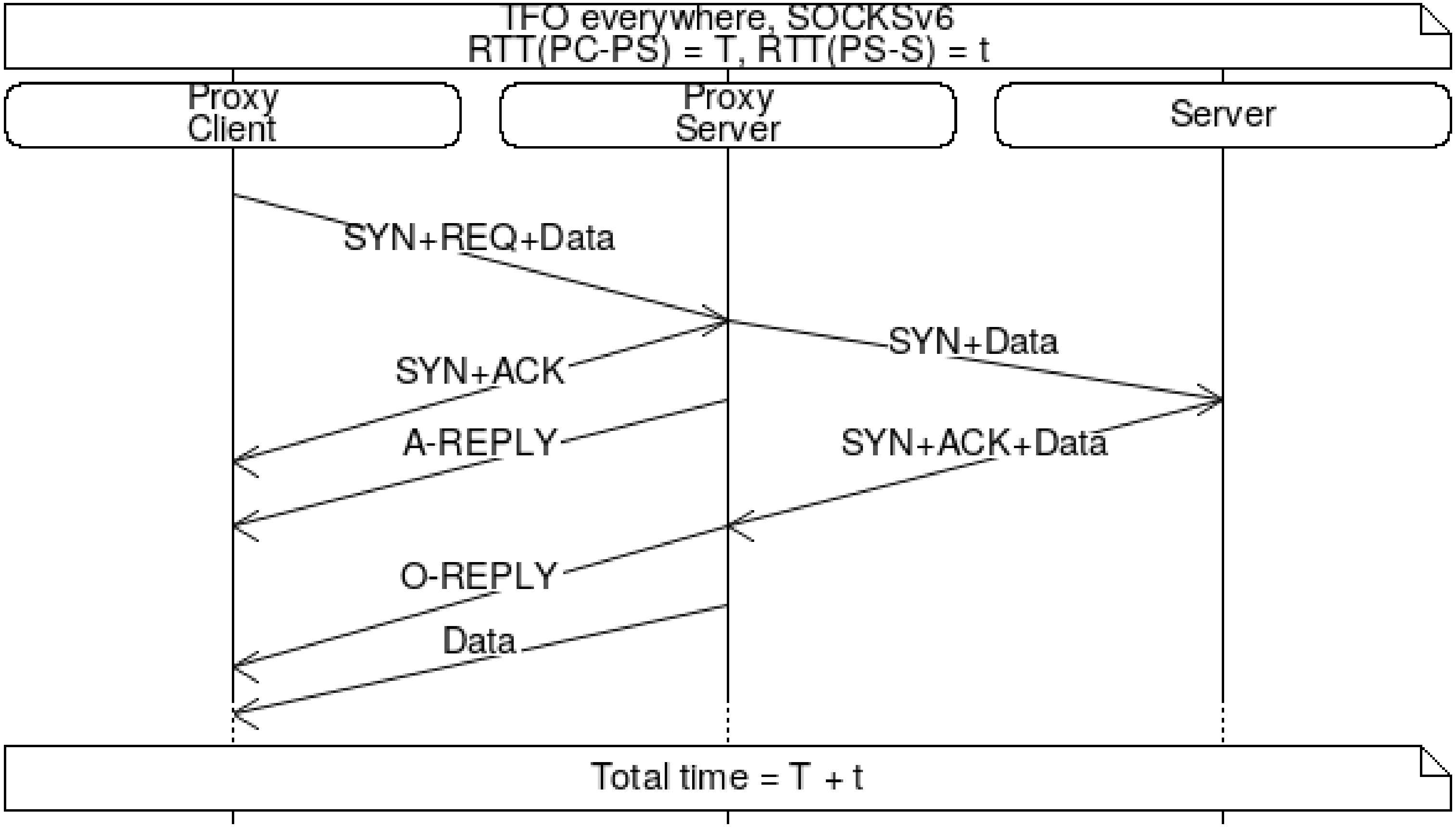
- Data reply in 2 RTTs
  - No worse than vanilla TCP

SOCKSv6 in action: TFO on proxy-client leg



- Data reply in 1 end-to-end RTT + 1 proxy-to-server RTT
  - **Negative overhead**: We save 1 client-to-proxy RTT, assuming the proxy is on path
  - Highly advantageous for mobile networks, where layer 2 has high delay

SOCKSv6 in action: TFO everywhere



- Data reply in 1 RTT
  - Same as when contacting the server directly

Implementation

- Early prototype (some differences from draft)
  - Message library: https://github.com/45G/socks105
  - Proxifier + proxy: https://github.com/45G/shadowsocks-libev