SOCKS Protocol Version 6 (update)

draft-olteanu-intarea-socks-6-01

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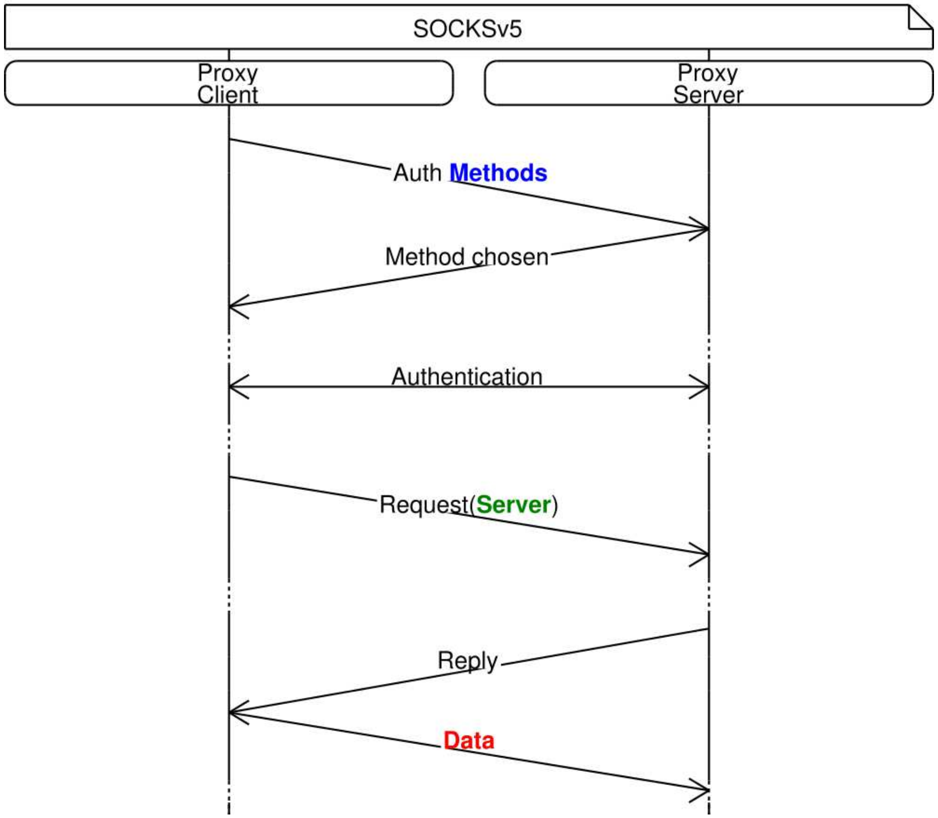
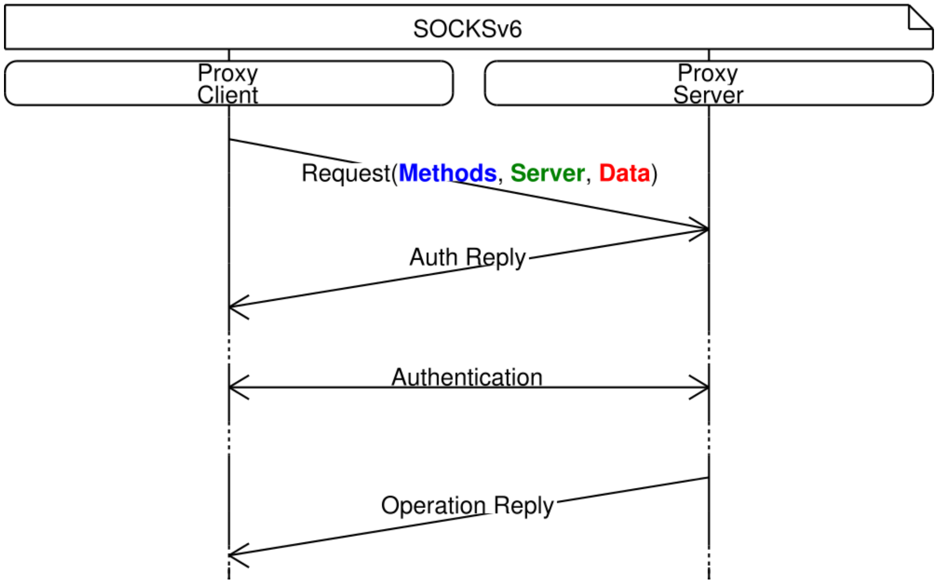
Improvements over v5

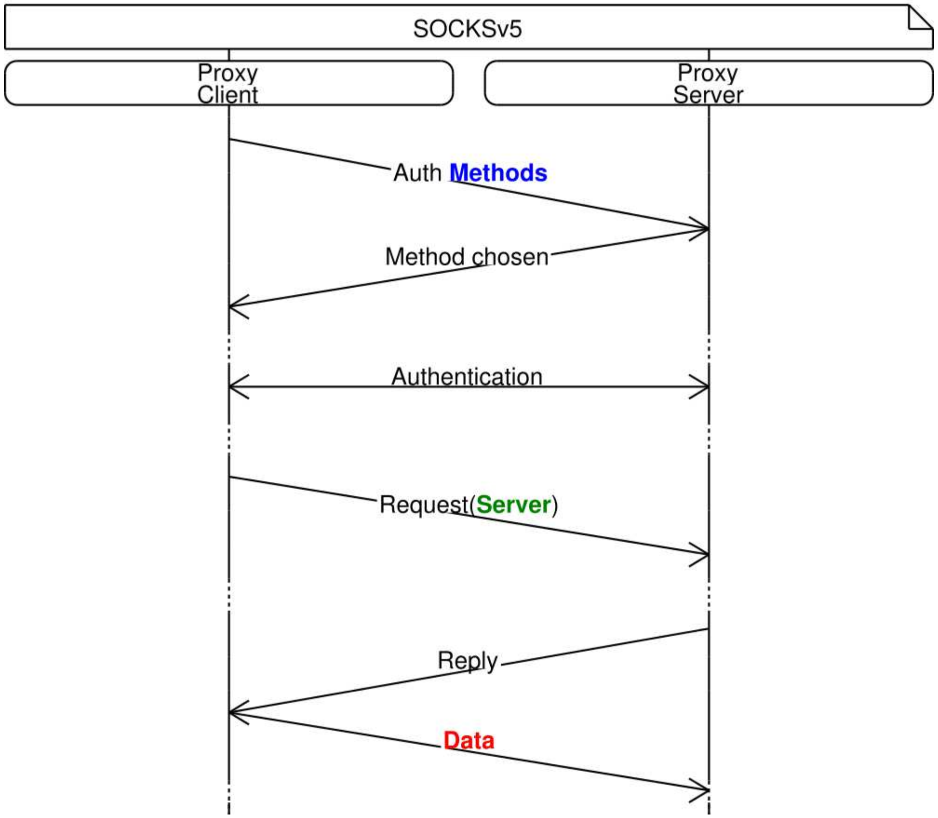
- Shave off RTTs: Client sends as much information as possible upfront
  - Optimistic, doesn’t wait for authentication to conclude
  - Method advertisement, server address, some application data
- Client can specify if it wants TFO on the proxy-server leg
- Extensible: TCP-like options
- 0-RTT authentication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

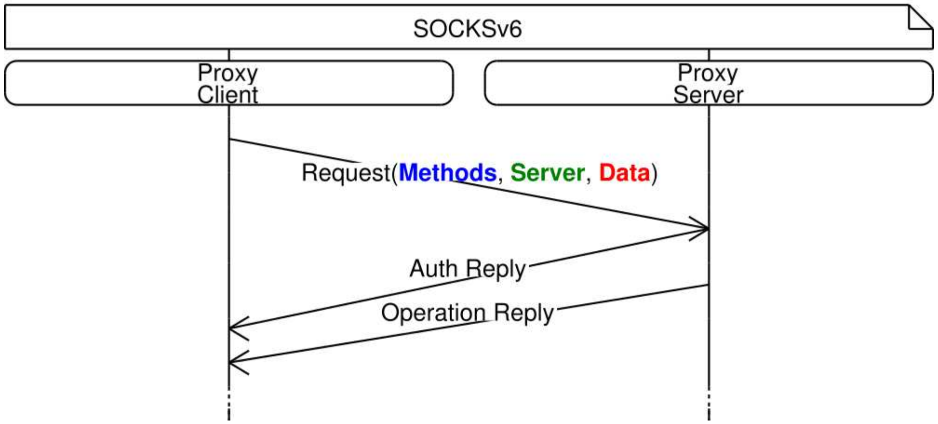
SOCKSv5 vs. SOCKSv6 [1/2]





SOCKSv5 vs. SOCKSv6 [2/2]





- Can include authentication data in the request on subsequent connections

New Security Features

- Deprecate support for encryption
- Just run SOCKS over TLS
  - Request new port from IANA

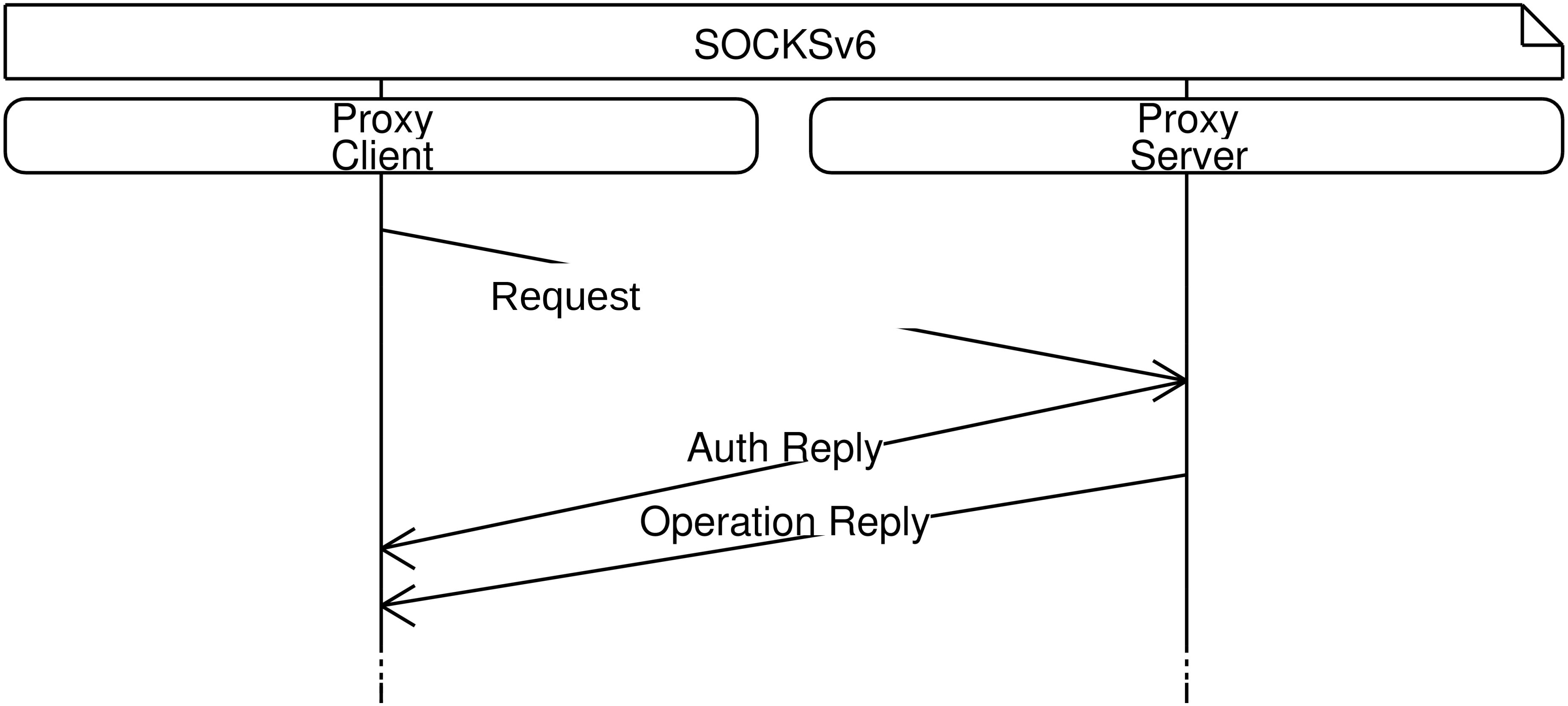
- TLS 1.3 has support for early data
  - 0-RTT overhead
  - Likely to contain a full SOCKS request
  - Prone to replay attacks
- Need mechanism that makes SOCKS requests idempotent

SOCKS Request idempotence

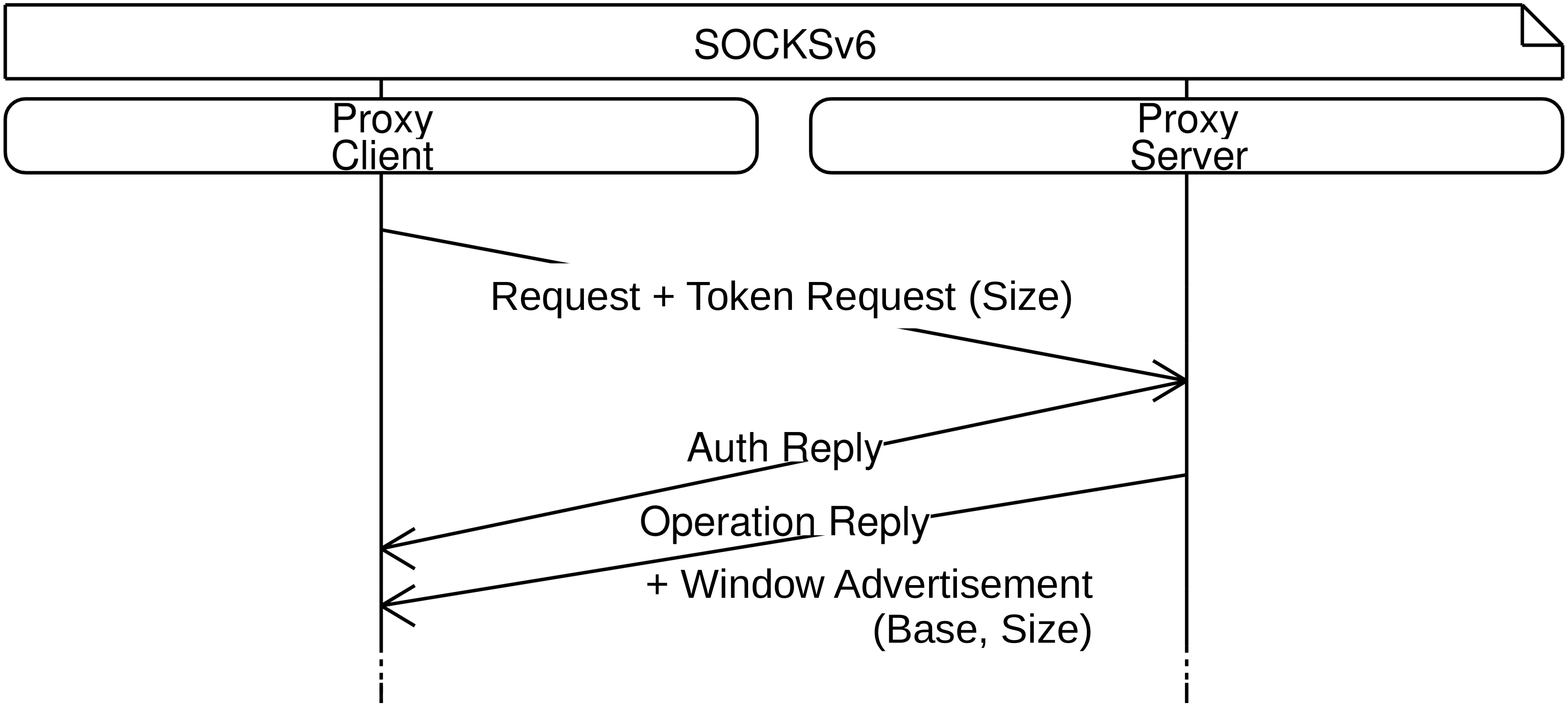
- Leverage SOCKS options

- **Authenticated** clients can be granted single-use tokens
  - Tokens are assigned on a per-user basis
- A token can only be spent on a single operation
  - Proxies and clients keep track of spent tokens

Requesting Tokens



Requesting Tokens



Token Request

```
+---------------+------+-------------+
| Kind | Length | Type | Window Size |
+------+--------+------+-------------+
|  1   |   1    |  1   |      4      |
+------+--------+------+-------------+
```

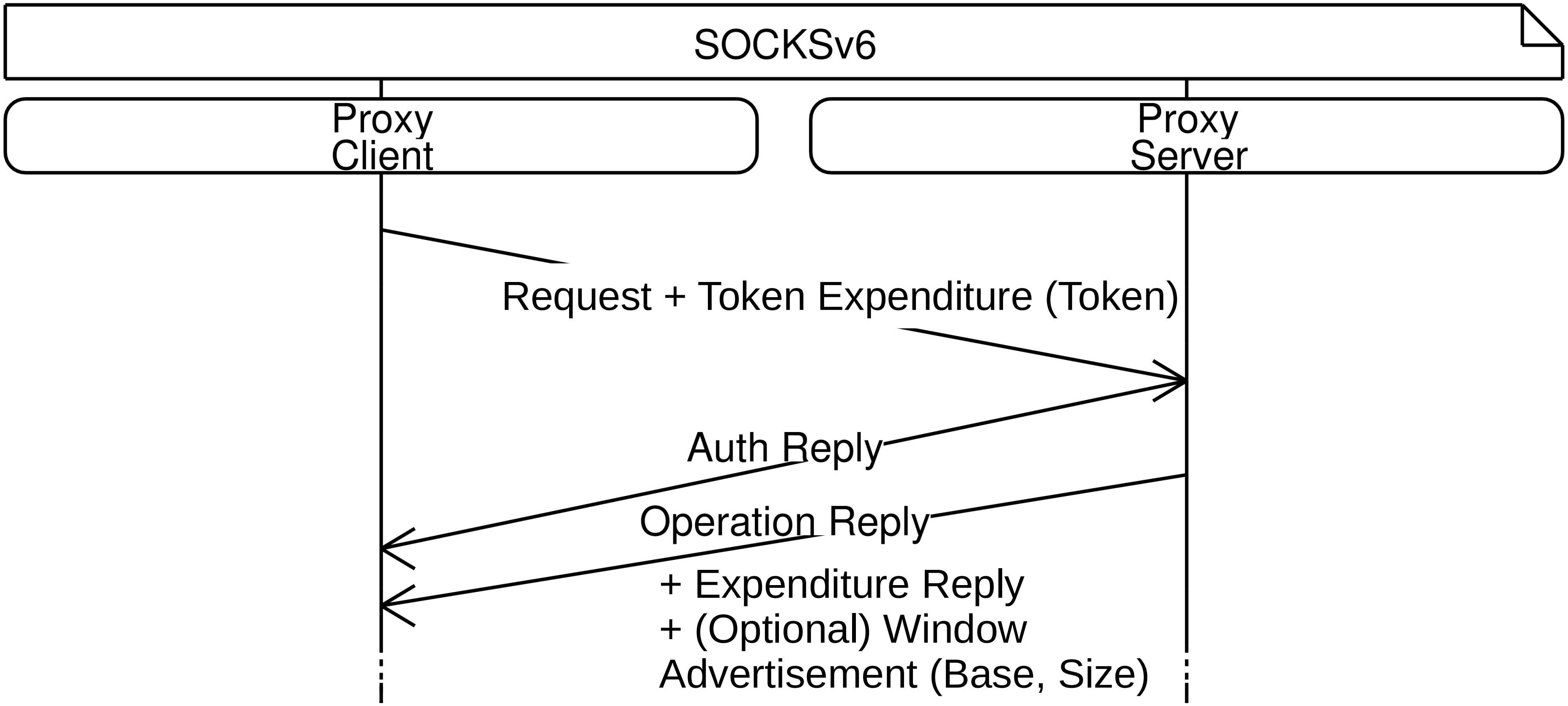
- Client starts by requesting a number of tokens
  - Can be done as part of a NOOP request
  - Only needs to be done once (or in corner cases)
  - Secure, as long as TLS early data is not used

Token Window Advertisement

Kind	Length	Type	**Window Base**	**Window Size**
1	1	1	4	4

- Proxy offers a number of consecutive Tokens
  - Window Base: first token
  - Window Size: number of tokens
- E.g.: base=10, size=5 means that the following tokens are available: 10, 11, 12, 13, 14

Spending Tokens



Token Expenditure

Kind	Length	Type	**Token**
1	1	1	4

- Client spends Tokens on Operations
  - Clients SHOULD attempt to spend tokens in order

Token Expenditure Reply

```
+---------------+------+---------------+
| Kind | Length | Type | Response Code |
+------+--------+------+---------------+
|  1   |   1    |  1   |       1       |
+------+--------+------+---------------+
```

- Server replies:
  - Duplicate or out-of-window tokens are rejected

Shifting the token window

Kind	Length	Type	**Window Base**	**Window Size**
1	1	1	4	4

- Proxies can **unilaterally increment** the Window Base
  - Lowest-order tokens are discarded, new high-order tokens are created
  - Send unsolicited Token Window Advertisements to let clients know
- Use cases
  - Ideal: Lowest-order Tokens are spent; shift the base past them
  - The client has begun spending higher-order tokens; shift window past low-order gaps

What’s next?

- Options for influencing the proxy’s behavior
  - MPTCP Path Manager
  - MPTCP Scheduler
- Better reverse proxy support
- Ability to listen() on a socket and have connections forwarded

Comparison to 0-RTT TCP converters

- draft-bonaventure-mptcp-converters-02

- Similarity: No control data aside from initial exchange
- Different starting point: purely layer 5 protocol
  - Can be run over TLS
  - TFO data not required, but highly beneficial
  - Midllebox doesn’t kill TCP => middlebox doesn’t kill SOCKS

Extra Slides

Token Space

- Tokens are
  - 32-bit unsigned integers
  - in a 32-bit modular space
- x < y if (y-x) < 2^31