Aggregated Option for SYN Option Space Extension
draft-nishida-tcpm-agg-syn-ext-00

Yoshifumi Nishida

nsd+ietf@gmail.com

Purpose

- Provide a solution for limited option space in SYN segments
  - Options not appeared in SYN will not be activated

Previous Approach for SYN Option Space Extension

- Extending header format of SYN segment
  - Use Payload for additional option space
    - Override DataOffset field in TCP header

- Sending multiple SYN or SYN-like segments
  - Send multiple packets to carry more options

- Combination of above
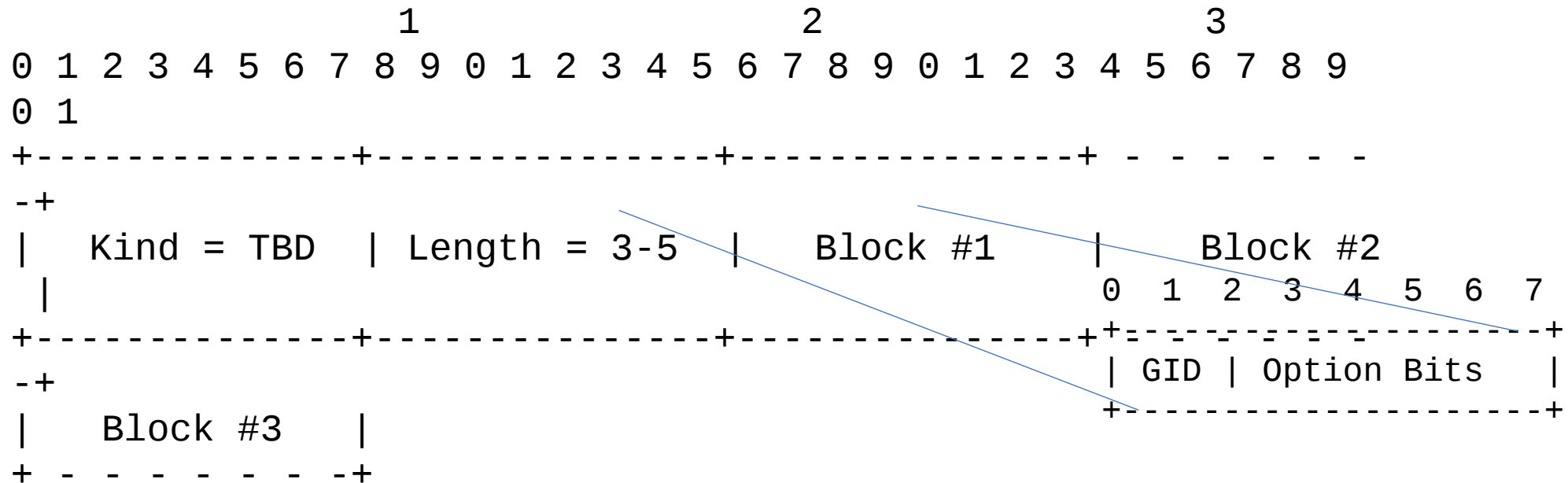
Our Approach to Save Option Space in SYN

- Aggregated Option
  - Compress Options in SYN segments

- Delayed Option Negotiation
  - Move some parts of options in SYN to non-SYN segments
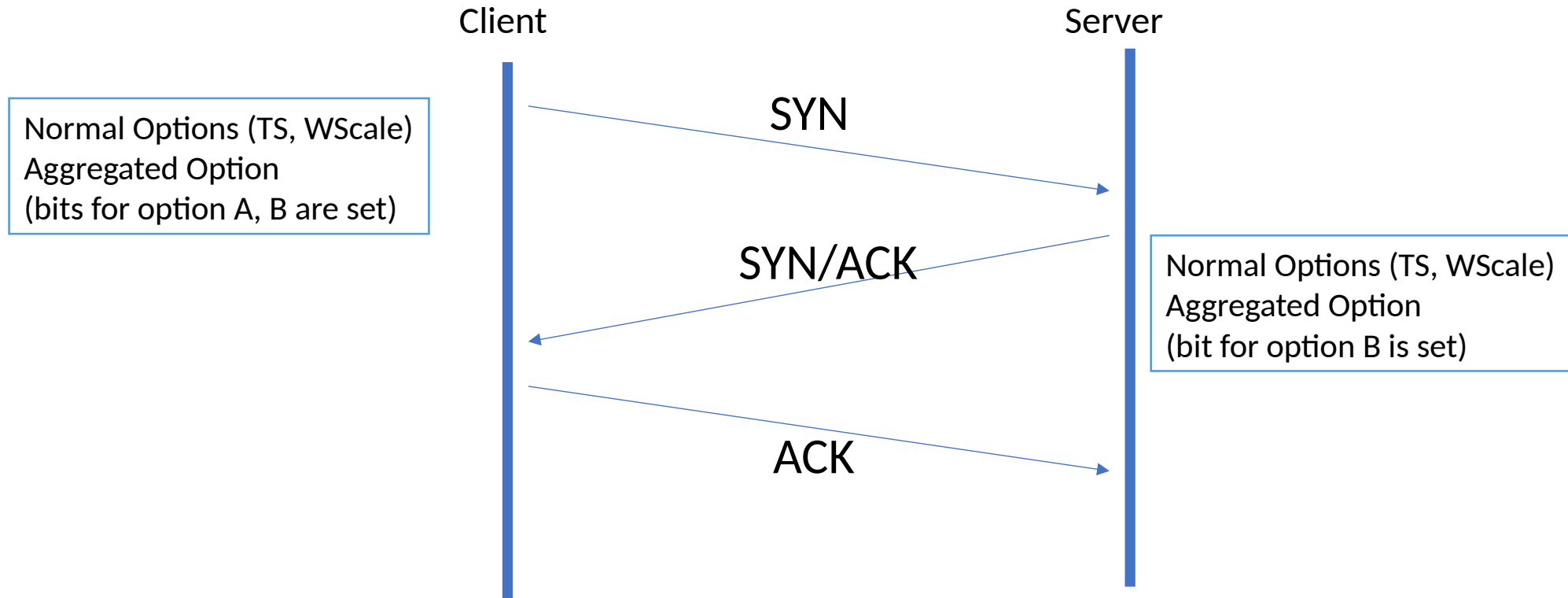
Aggregated Option

- Some Options have very simple formats in SYN
  - e.g. SACK-Permit (RFC2018), Fast Open Cookie Request (RFC7413), EDO (draft-ietf-tcpm-tcp-edo), TARR (draft-gomez-tcpm-ack-rate-request)

- These Simple Options are just used for "indication of the feature"
  - Indicate that it is prepared to send and receive the feature
    - This is 1 bit information
    - But, each option consumes 2 or 4 bytes or more option space
      - Option with EXID will have at least 4 bytes length

- Aggregating them into a single option can create more option space

Aggregated Option Format

- Consist of 1-3 blocks
    - Each block has 1 byte length
    - Each block has 2 bit GID field and 6 Option Bits
        - GID represent Group ID for option groups
        - Each Option bit represent a TCP option (e.g. bit 3 is option *A*, bit 4 is option *B*, etc)

```
                        1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9
 0 1
 +---------------+---------------+---------------+ - - - - - -
 -+
 |   Kind = TBD  | Length = 3-5  |    Block #1   |    Block #2
  |                                                 0  1  2  3  4  5  6  7
 +---------------+---------------+---------------+---------------------+
 -+                                             | GID | Option Bits   |
 |    Block #3   |                              +---------------------+
 + - - - - - - -+
```

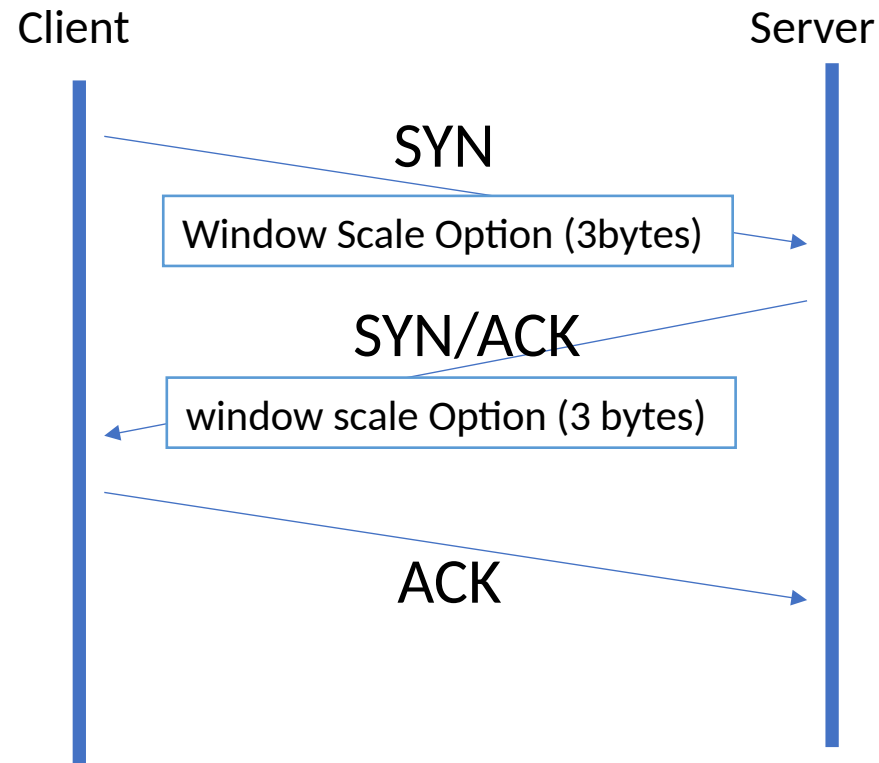# Aggregated Option Example Usage

- In this example, Option B will be used in the connection through Aggregated Option

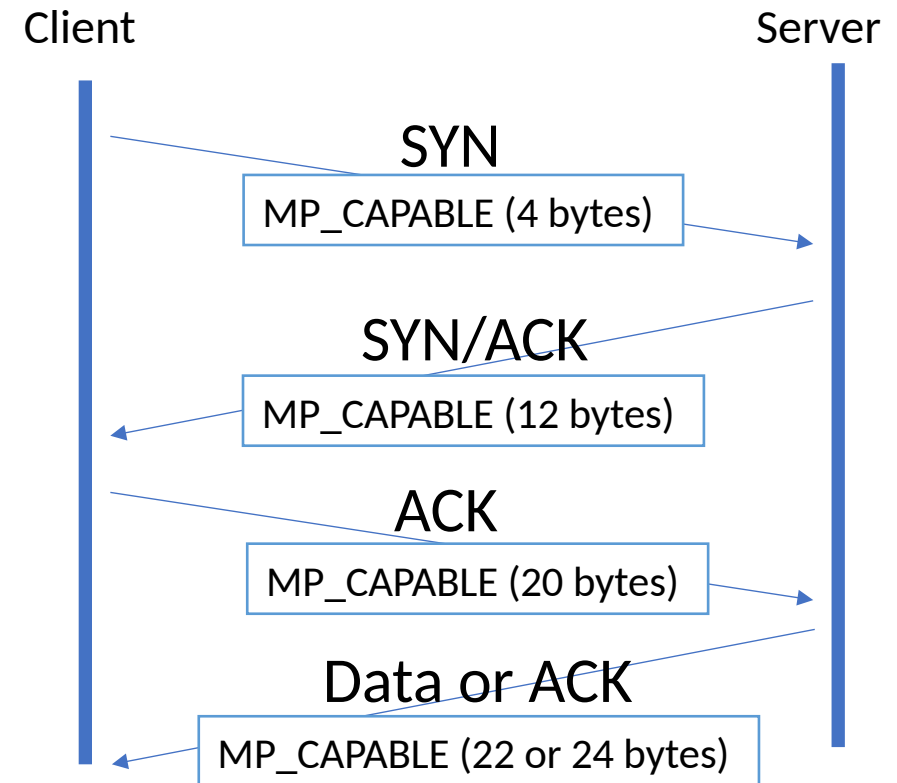# Delayed Option Negotiation

- Key Features

    - Extend MPTCP option exchange scheme for generic purpose

    - Will be easy to implement

    - Middlebox friendly

TCP Option Exchange Examples

Window Scale Option Exchange

Client   Server

SYN

Window Scale Option (3bytes)

SYN/ACK

window scale Option (3 bytes)

ACK

MPTCP Option Exchange

Client   Server

SYN

MP_CAPABLE (4 bytes)

SYN/ACK

MP_CAPABLE (12 bytes)

ACK

MP_CAPABLE (20 bytes)

Data or ACK

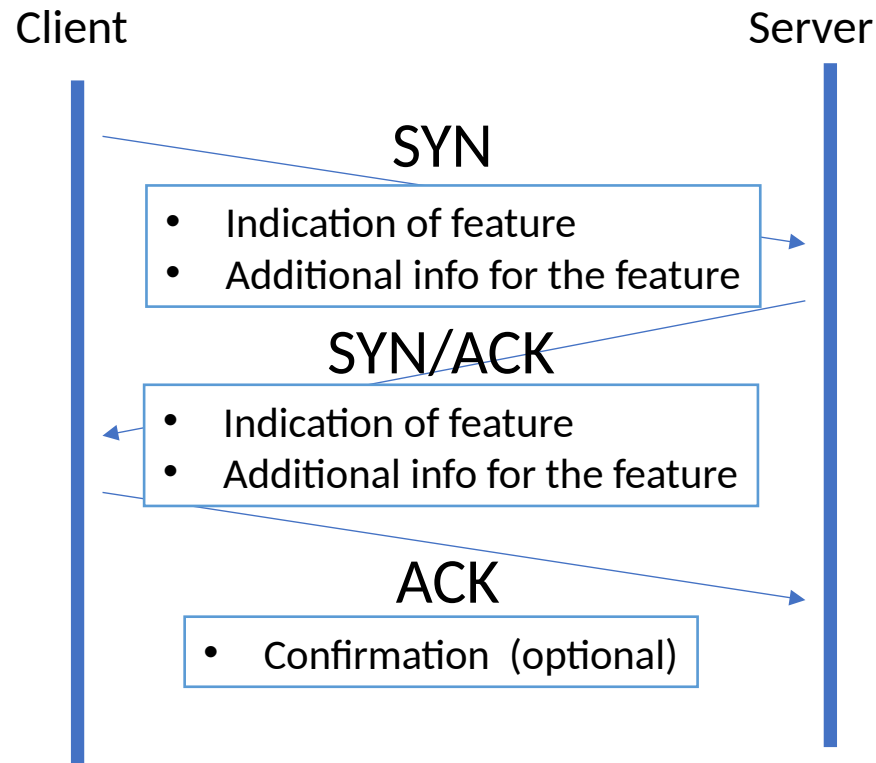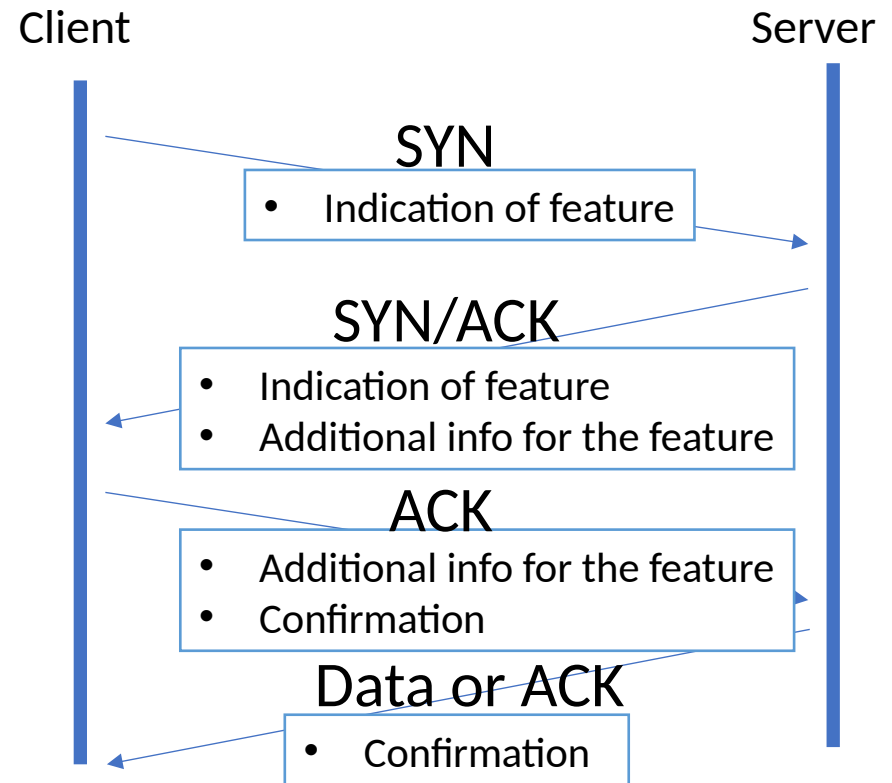MP_CAPABLE (22 or 24 bytes)

Window Scale Option Exchange

MPTCP Option Exchange

Abstractive View of TCP Option Exchange

MPTCP delays sending additional info so that it can save option space in SYN

Client   Server

SYN
- Indication of feature
- Additional info for the feature

SYN/ACK
- Indication of feature
- Additional info for the feature

ACK
- Confirmation (optional)

Generic Option Exchange

Client   Server

SYN
- Indication of feature

SYN/ACK
- Indication of feature
- Additional info for the feature

ACK
- Additional info for the feature
- Confirmation
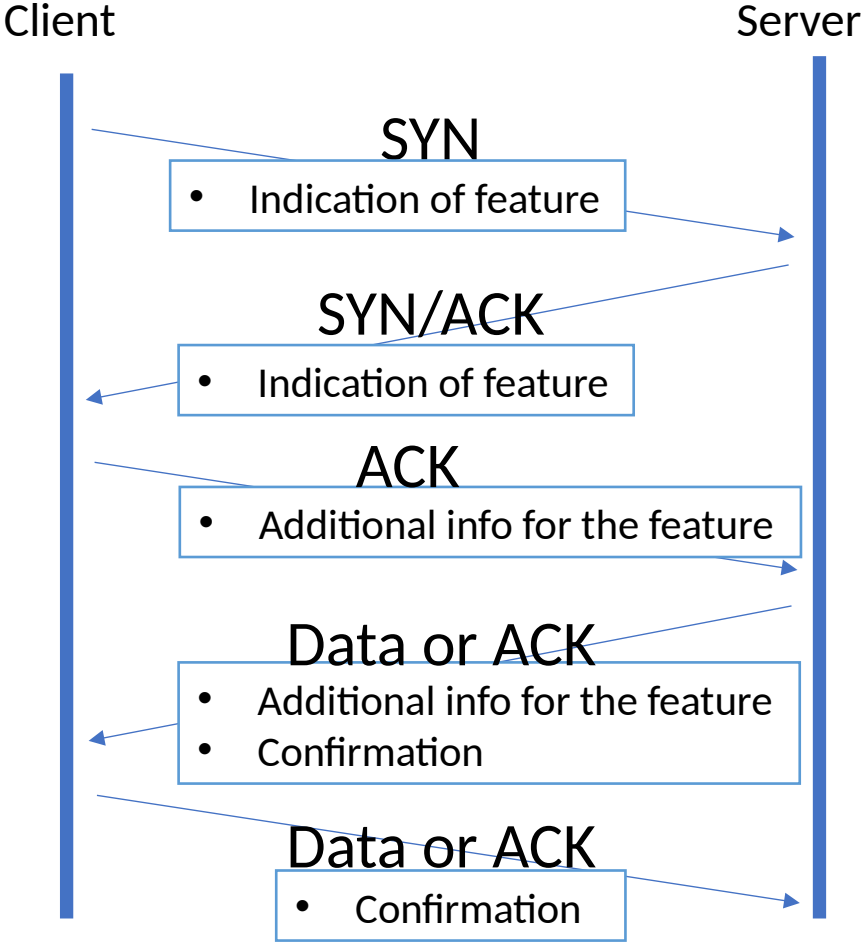
Data or ACK
- Confirmation

MPTCP Option Exchange

Delayed Option Negotiation

- Utilize MPTCP option exchange scheme for generic purpose
- Support two additional option negotiation schemes to save option space in SYN
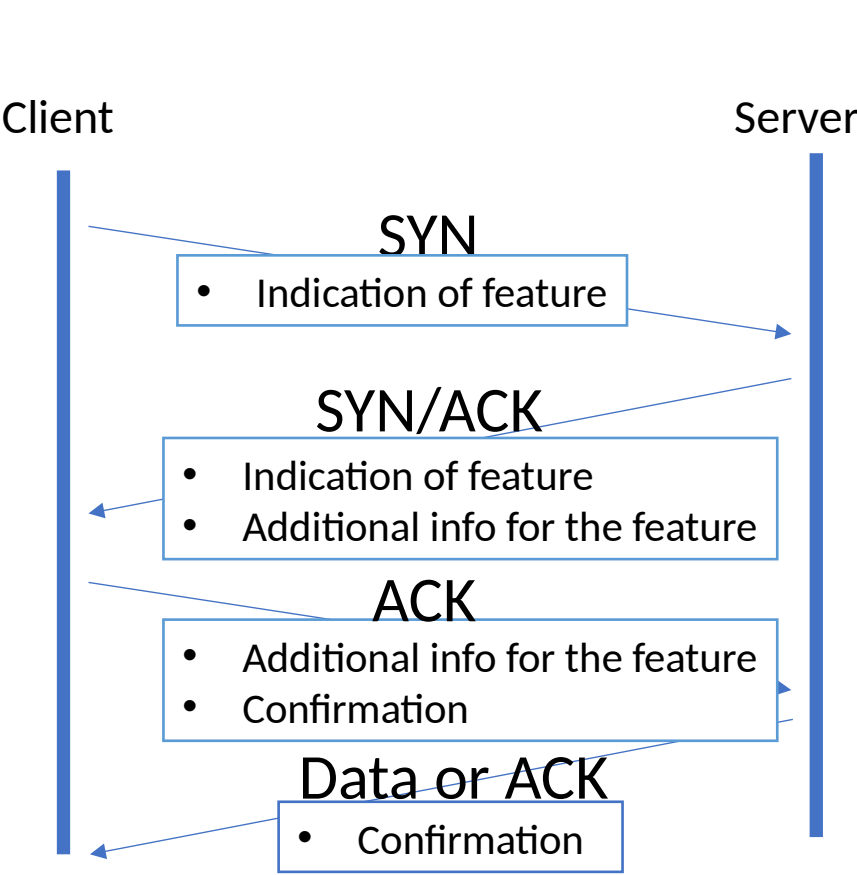
4 Way Exchange

5 Way Exchange

Delayed Option Negotiation Option Format

- Use the same code points of Aggregate Option
  - Define new two formats
    - 2-Byte Aggregated Option
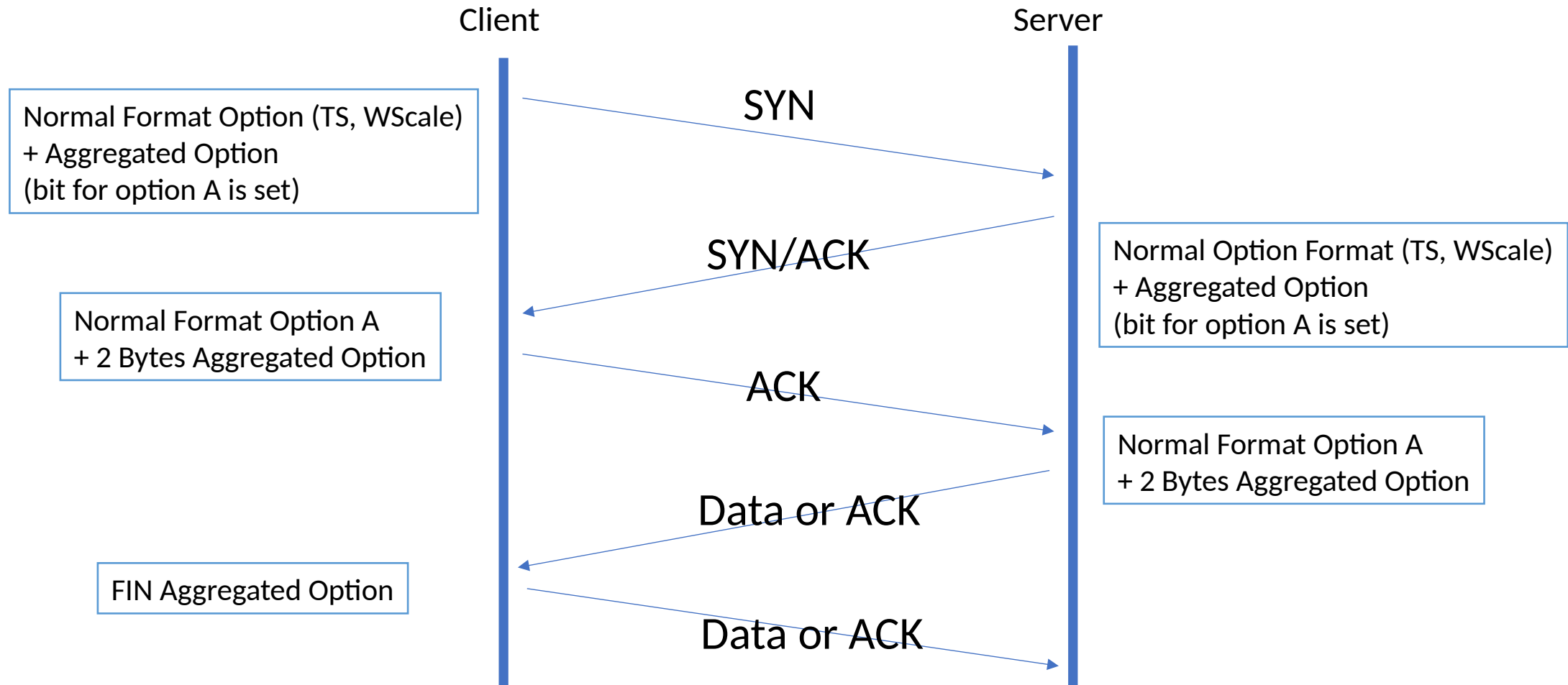   - Used to indicates the packets contains additional information

```
0                               1
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6
+---------------+---------------+
|   Kind = TBD  | Length = 2    |
+---------------+---------------+
```

  - Fin Aggregated Option
    - Used for confirmation of additional information arrival

```
                    1                               2
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4
+---------------+-----------------+-----------------+
| Kind = TBD    | Length = 3      |1 1 0 0 0 0 0 0 |
+---------------+-----------------+-----------------
```

Delayed Option Negotiation Example Usage

- 5 Way Option Negotiation Examples

Conclusion

- This approach do not extend option space in SYN, instead
  - Compress Options in SYN
  - Move some parts of options in SYN to non-SYN segments
    - For non-SYN segments, EDO will be applicable for further option space

- We believe this is a practical approach
  - Extending option space in SYN would be tricky

- For more detailed information, please read the draft!