

# Exchanging Congestion Control Data in QUIC

draft-yuan-quic-congestion-data-00

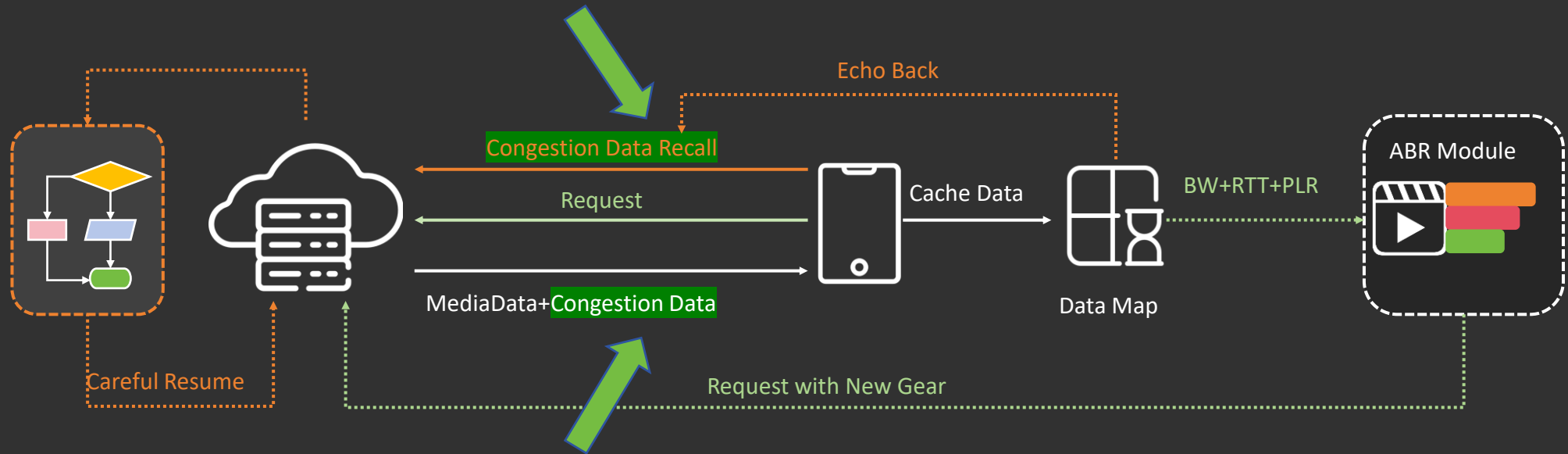
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# Background

- Careful Resume provides a mechanism to use **remembered congestion control parameters** to warm up the slow-start phase.
- The **most reliable and direct** information will be **samples from the congestion controller**, such as congestion window size and observed throughput
- Clients often connect to a manageable number of servers and can retain such state, servers typically service orders of magnitude more clients and cannot feasibly retain such information.

How to achieve distributed storage and interaction of congestion information?

# Introduction



# Mechanism

- This draft presents this information as two new QUIC Frames:
  - *CONGESTION\_DATA Frame*: Allows the sender to export its congestion control state in an integrity-protected manner
  - *CONGESTION\_DATA\_RECALL Frame*: Assist its peer to recall the information necessary to perform Careful Resume

*CONGESTION\_DATA Frame* is not encrypted to the client, making it possible to be exposed to application layer for more scenarios (like ABR).

# Transport Parameter

- support\_congestion\_data(i): A variable-length integer
  - *CONSUME (0x01)*: The sender is interested in receiving *CONGESTION\_DATA* frames for its own uses during the current connection, independent of the receiver's ability to reuse the data in the future.
  - *CACHE (0x02)*: The sender is willing to receive *CONGESTION\_DATA* frames and potentially return the contents in a *CONGESTION\_DATA\_RECALL* frame on a subsequent connection.
  - *CONSIDER (0x04)*: The sender is willing to have values it may have provided on a previous connection returned to it in a *CONGESTION\_DATA\_RECALL* frame.

# Network Statistics

Each network statistic is structured as a TLV:

```
Network Statistic structure {  
    Type (i),  
    Length (i),  
    Value (...)  
}
```

Type	Name
+=====+	+=====+
0xc8	Timestamp
+-----+	+-----+
0xca	Path Tuple
+-----+	+-----+
0xcb	Slow Start Status
+-----+	+-----+
0xcc	Network Type
+-----+	+-----+
0xcd	Maximum Congestion Window
+-----+	+-----+
0xce	Maximum In-Flight Data
+-----+	+-----+
0xcf	Smoothed RTT
+-----+	+-----+
0xd0	Minimum RTT
+-----+	+-----+
0xd1	RTT Variance
+-----+	+-----+
0xd2	Latest Bandwidth
+-----+	+-----+
0xd3	Maximum Bandwidth
+-----+	+-----+
0xd4	Throughput
+-----+	+-----+
0xd5	Send Rate
+-----+	+-----+
0xd6	Receive Rate
+-----+	+-----+
0xd7	Input Rate
+-----+	+-----+
0xd8	Loss Rate
+-----+	+-----+
0xd9	Buffer Length
+-----+	+-----+

Table 3

# CONGESTION\_DATA Frame

```
CONGESTION_DATA Frame {  
    Type (i) = TBD1,  
    Protected Count (i),  
    Protected Network Statistics  
        (...) ...,  
    [Integrity Tag (1..)],  
    Unprotected Count (i),  
    Unprotected Network Statistics  
        (...) ...,  
}
```

- *(Un)Protected Count*: A variable-length integer representing the number of *Network Statistics* in the *(Un)Protected Network Statistics* field.
- *(Un)Protected Network Statistics*: A sequence of *Network Statistics* objects whose length is given by the *(Un)Protected Count*.
- *Integrity Tag*: A message integrity check

# CONGESTION\_DATA Frame

- *CONGESTION\_DATA* frame **is not retransmittable**
- *CONGESTION\_DATA* frame can be sent at any point in the connection after 0-RTT or 1-RTT keys have been established
- *CONGESTION\_DATA* frame MUST NOT be received in an Initial or Handshake packet
- If an endpoint sets **CACHE** flag, the peer SHOULD put its desired recall statics into the *Protected Network Statistics field* and calculate an *Integrity Tag*.
- If an endpoint sets the **CONSIDER** flag, the peer SHOULD put any other statistics it's willing to share in the *Unprotected Network Statistics*
- Receiver can parse these frames, use the data, and store the protected fields for use in the *CONGESTION\_DATA\_RECALL* frame.



# CONGESTION\_DATA\_RECALL Frame

```
CONGESTION_DATA Frame {  
    Type (i) = TBD2,  
    Protected Count (i),  
    Protected Network Statistics  
        (...) ...,  
    Integrity Tag (1..),  
}
```

- *CONGESTION\_DATA\_RECALL* frame contain a list of *Network Statistics* values which the sender **received from the recipient** during a previous connection.
- This frame **SHOULD** be sent as early as **possible** in the connection once 0-RTT or 1-RTT keys are available.
- Receiver **MUST** check the *Integrity Tag* before use its value for Careful Resume

# Comparing Recall Approaches

- QUIC address validation tokens:
  - Opaque to client
- CONGESTION\_DATA frame:
  - visible to clients; usable by application layer
  - MAY choose not to return frames with statistics they cannot interpret
- Similar privacy implications: SHOULD discard when other potential tracking mechanisms (e.g. HTTP Cookies) are cleared by the user.

# Next Steps

- Probably need to make some changes 😊
- Seeking WG adoption.