

# Transport Considerations for IP and UDP Tunneling



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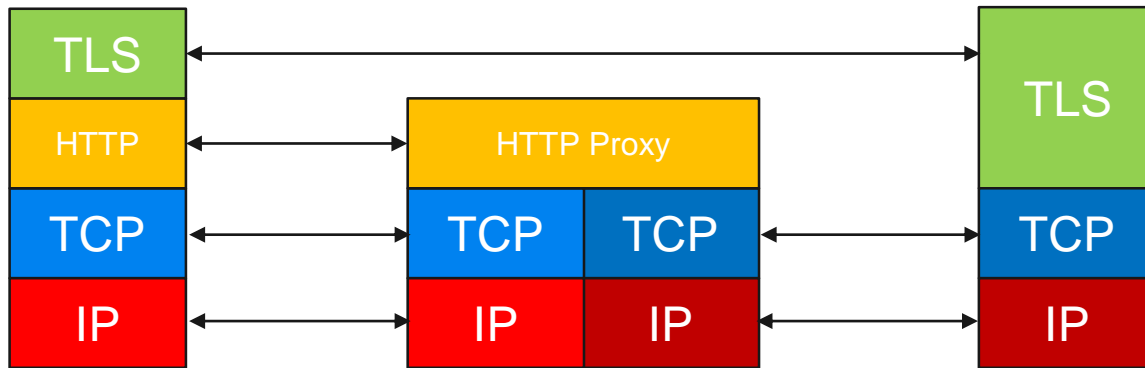
[draft-westerlund-masque-transport-issues-00](#)

# Outline



- Connect-UDP is NOT HTTP Connect
- Terminology
- IP Header
  - ECN
  - DSCP
  - Fragmentation & MTU
  - Options
  - Hop Limit
- UDP Header
- ICMP
- Conclusions

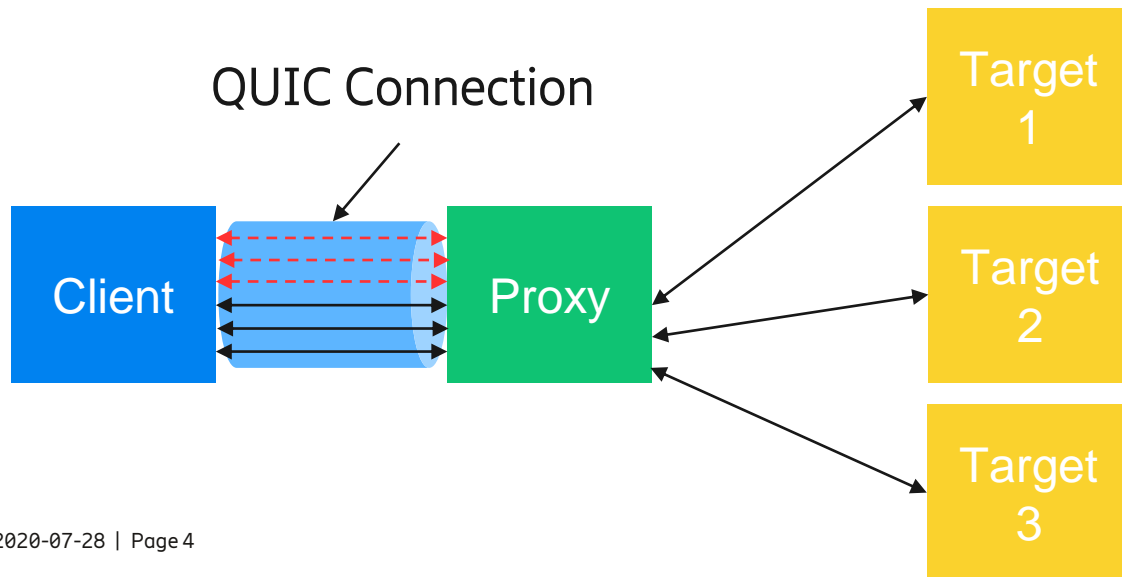
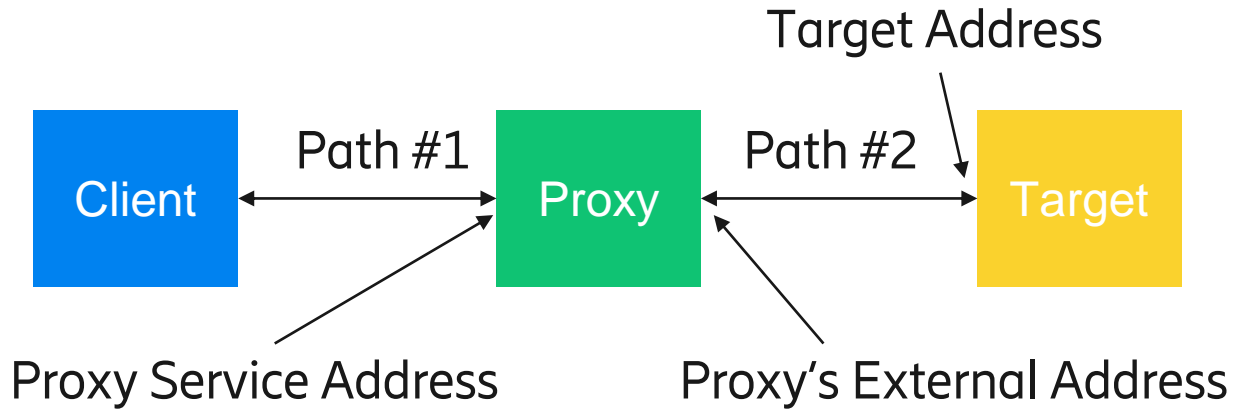
# Why Connect-UDP is not Connect



- HTTP Connect
  - Provide end-to-end byte stream semantics
  - Back to back TCP/QUIC sessions
  - Consumption of IP header fields for transport by individual transport connections
  - TCP/QUIC support only single QoS Level

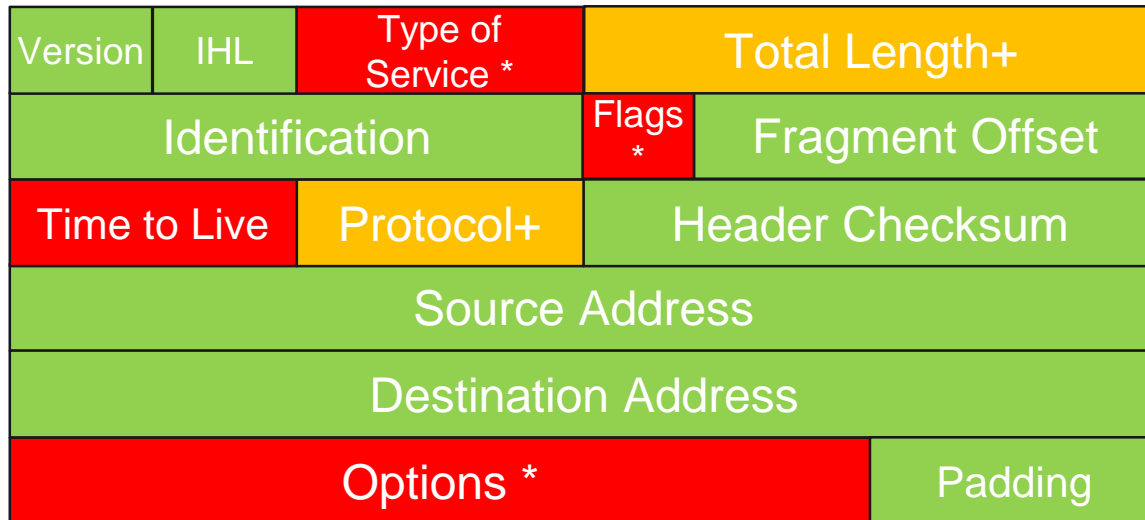
- Connect-UDP
  - Providing end-to-end datagram transport
  - Network to end-point signals need to reach endpoints
    - ECN
    - ICMP
  - Endpoint to network signals
    - DSCP

# Terminology



- Proxy = Masque Server
- Address
  - IP address + UDP Port
  - Domain names + UDP Port
- IP Flow = 3-tuple (source, dest. address, IP vers)
- UDP Flow = 5-tuple (Src + Dest Addr + Port, UDP)
  
- Datagram flow
- Signaling flow
  - Flow establishment
  - Asynchronous Events

# IPv4 Header



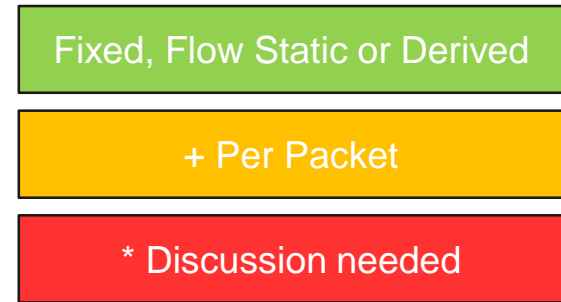
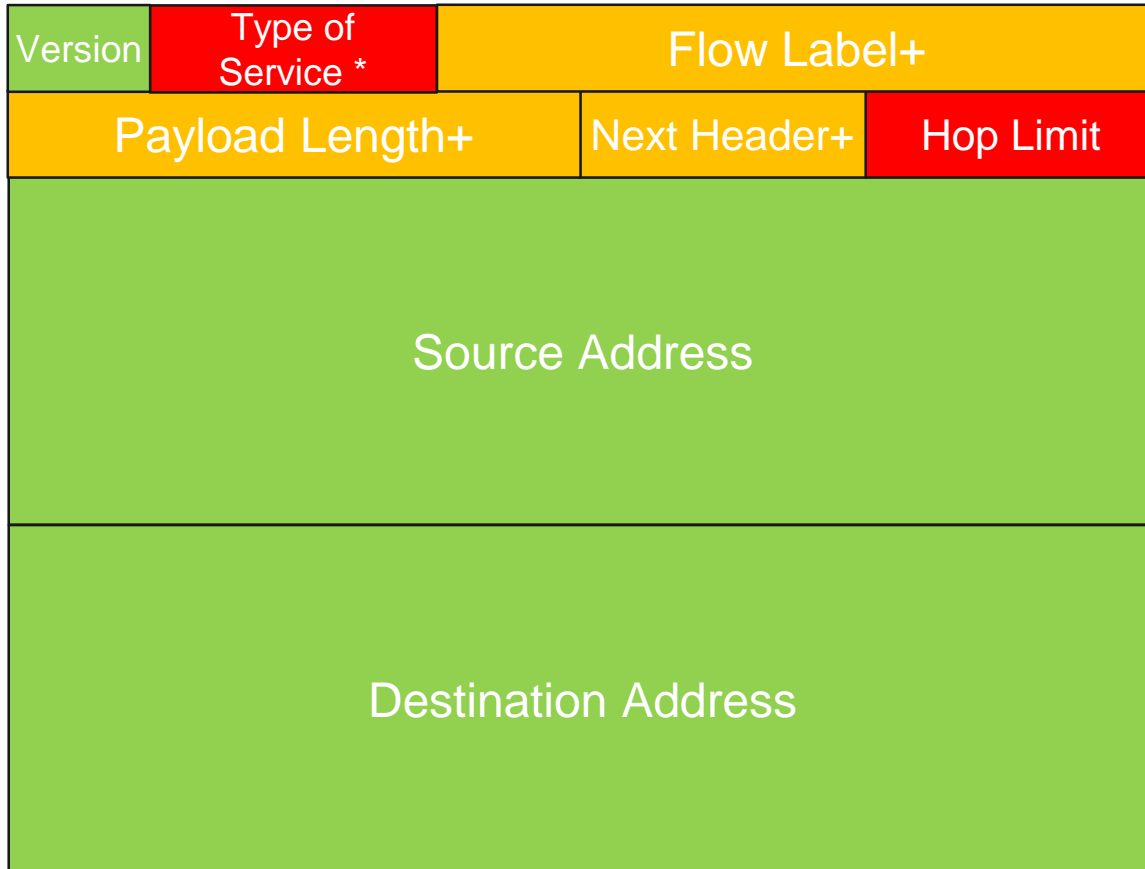
Fixed, Flow Static or Derived

+ Per Packet

\* Discussion needed

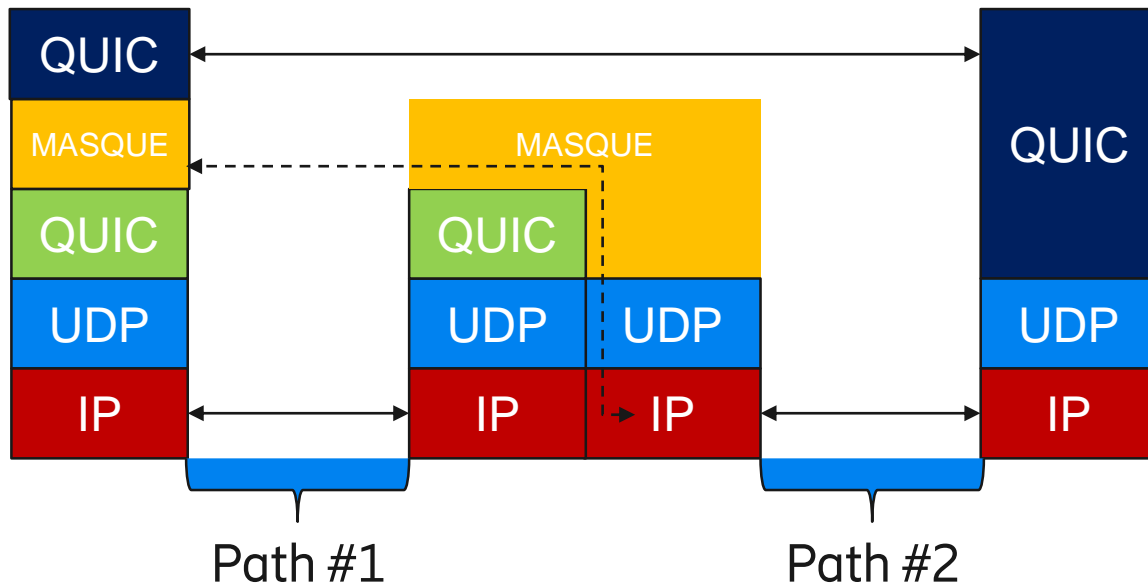
- Version = Fixed
- IHL = Derived
- Type of Service = DSCP + ECN
  - Needs discussion
- Total Length = Per Packet
- Identification = Sender assigned
- Flags = Fragmentation including Don't Fragment
- Fragment Offset = Derived when fragmenting
- Time to Live = Sender assigned
- Protocol = Per Packet / Fixed (UDP)
- Header Checksum = Derived
- Source Address = Flow Static
- Destination Address = Flow Static
- IP Options = Discussion needed

# IPv6 Header



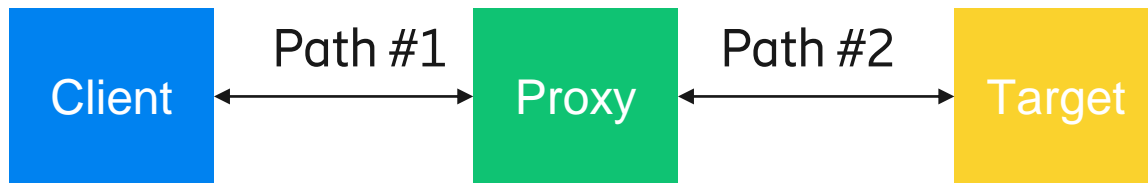
- Version = Fixed
- Type of Service = DSCP + ECN
  - Needs Discussion
- Flow Label = Per ULP flow / Flow Static (UDP)
- Payload Length = Per Packet
- Next Header = Per Packet / Fixed (UDP)
  - Extension Headers (Needs Discussion)
- Hop Limit = Sender Assigned
- Source Address = Signaled Static
- Destination Address = Signaled Static

# Type Of Service - ECN



- ECN on Path#1 is dealt with MASQUE's QUIC connection
  - CE marks impacts congestion state
- To enable ECN on Path#2
  - On request of Upper Layer using MASQUE
    - Set ECT(0/1) in Proxy to Client direction
    - Change during flow lifetime
  - Proxy read incoming ECN value in Target to Proxy direction
    - Propagate per packet ECN value to MASQUE client to upper layer

# Type Of Service - DSCP



- Path #1

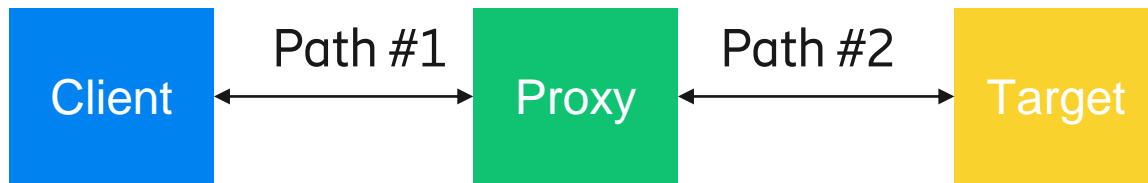
- RFC 7656 applies to QUIC tunnel
  - Use multiple QUIC connection, one per forwarding behavior
- Setting DSCP to use in Proxy to Client
- Not necessary to support

- Path #2

- Setting Proxy to Target DSCP to send with
  - Authorization to use DSCP
  - DSCP to forwarding behavior mapping
- Target to Proxy packets
  - Read DSCP and propagate to Client
  - Upper Layer Protocol needs to know Forwarding behavior applied
    - To ensure different CC state
- Priorities in Packet scheduling in Client and Proxy of aggregated flows



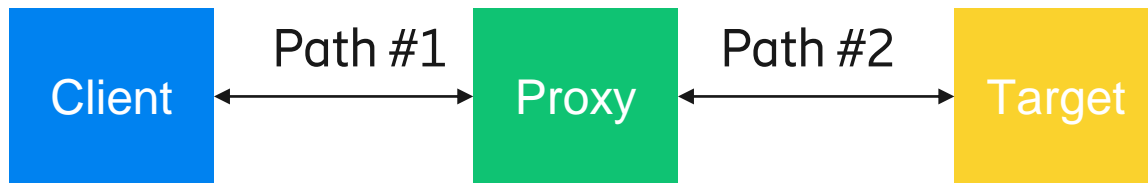
# Fragmentation and MTU



- Control IP fragmentation
  - DPLPMTUD requires Don't Fragment
  - Some upper layer application may lack fragmentation support and require relying on IP fragmentation mechanism

- MASQUE Tunnel has its MTU
  - Using Streams up to 64K
  - Using QUIC Datagrams Path MTU – Overhead
  - Needs API to upper layer
- Proxy's external interface has its MTU
  - Should be conveyed to client
- Control over DF bit on Proxy to Client path
  - Per Packet in some cases
  - Per Default value

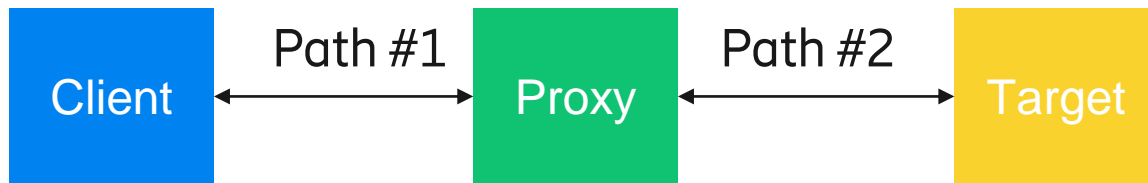
# IP Options / Extension Headers



- Are there IP Options or Extension headers that upper layer request be add to the IP header?
  - IPv6 minimum Path MTU HBH ([draft-ietf-6man-mtu-option](#))
  - Network Tokens ([draft-yiakoumis-network-tokens](#))
  - Other Options / Extensions?

- IPv6 minimum Path MTU HBH Option
  - Data center targeted initially
  - To be added in outgoing packets
  - Target can echo value in the option in next returning packet, needing propagation
- Network Tokens for Path #2 would need MASQUE support
  - Indicate which packets the HBH Extension header is to be added and its value
- What functionality is required here?

# Time to Live / Hop Limit



- The usage of Time to Live / Hop Limit
  - Primary Prevent ever living packets in routing loops
  - Path change indicator
    - Currently no transport appear to use it

- Path #1 TTL is directly readable by Client and Proxy on reception
  - Sent value is not known and usually OS specific
  - No special function needed
- Path #2
  - If Client want to know received value
    - Would require MASQUE to propagate
  - Appear to be insufficient need to motivate functionality

# UDP Header

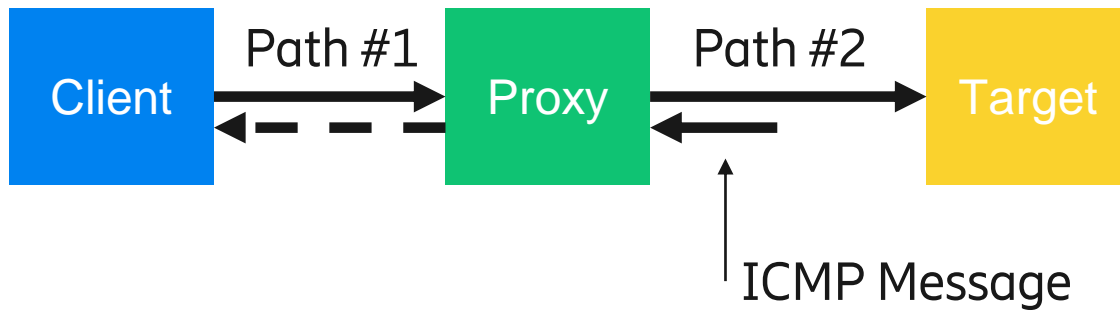


Source Port	Destination Port
Length	Checksum

- Source Port = Flow Static
- Destination Port = Flow Static
- Length = Per Packet
  - UDP Options ([draft-ietf-tsvwg-udp-options](#)) utilize UDP Length to indicate options area
  - How to support UDP Options?
- Checksum = Calculated per Packet

Fixed, Flow Static or Derived
+ Per Packet
* Discussion needed

# ICMP



- ICMP provides network to endpoint signaling
- Primary case to consider is the case depicted
  - IP/UDP packets on Path #2 from proxy to target that triggers ICMP message transmission
    - On Path: Packet Too Big, Destination Unreachable, TTL Expired
    - End-point (Target): Port unreachable
- Proxy matches ICMP to a tunneled flow
  - Needs asynchronous signal from proxy to client to convey the ICMP information

# Categorization IP/UDP flow



- Static - Flow Establishment
  - IP version
  - IP Source address
  - IP Destination address
  - ECN to send
  - Default Don't Fragment
  - Default DSCP
  - IPv6 Flow Label
  - TTL / Hop Limit
  - UDP source port
  - UDP destination port
- Per Packet
  - ECN
  - IP Packet length
  - TTL received
  - DSCP to send
  - DSCP received
  - IP Options / Extension headers
  - UDP Length
  - UDP Options
- Asynchronous Signaling
  - ICMP Received
    - Packet too Big (size)
    - Destination (Port, Address) unreachable
  - ECN to send (change)
  - Don't fragment bit (change)
  - DSCP to send (change)

# Categorization IP Tunneling



- Static - Flow Establishment
  - IP version
  - IP Source address
  - IP Destination address
  - Default DSCP
  - ECN value to send
  - Default Don't Fragment
  - IPv6 Flow Label
  - TTL / Hop Limit
- Per Packet
  - ECN
  - Don't Fragment bit
  - IP Packet length
  - IP TTL received
  - IP Protocol / Next Header
  - IPv6 Flow Label
  - DSCP to send
  - DSCP received
- Asynchronous Signaling
  - ICMP Received
    - Packet too Big (size)
    - Destination (Port, Address) unreachable
  - ECN to send (change)
  - Don't fragment bit (change)
  - DSCP to send (change)

# Conclusions



## Summary

- IP and UDP headers include fields that needs to be consumed by the upper layer protocol, e.g.
  - ECN
- IP and UDP headers include fields where the upper layer can set them on per packet basis
  - DSCP
  - Don't fragment
- There exist asynchronous feedback from the network that can speed up endpoint behaviors
  - ICMP Packet to Big and Destination / Port Unreachable

## Requirements

- **Need per flow bi-directional signaling**
  - Asynchronous signaling for events
  - Change of default used values when sending flow
- **Need Flexible and Extensible inclusion of per packet information for the encapsulation**
  - Different from Default Value
  - Extension headers or UDP Options
- **Flow Establishment need Extensibility**
  - Enable extension of functionality



