

Transport Considerations for IP and UDP Tunneling



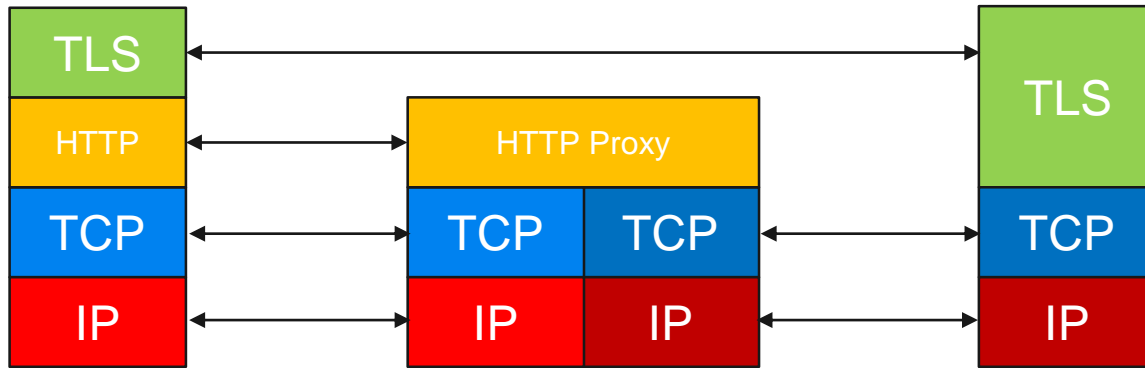
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Outline



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

Why Connect-UDP is not Connect



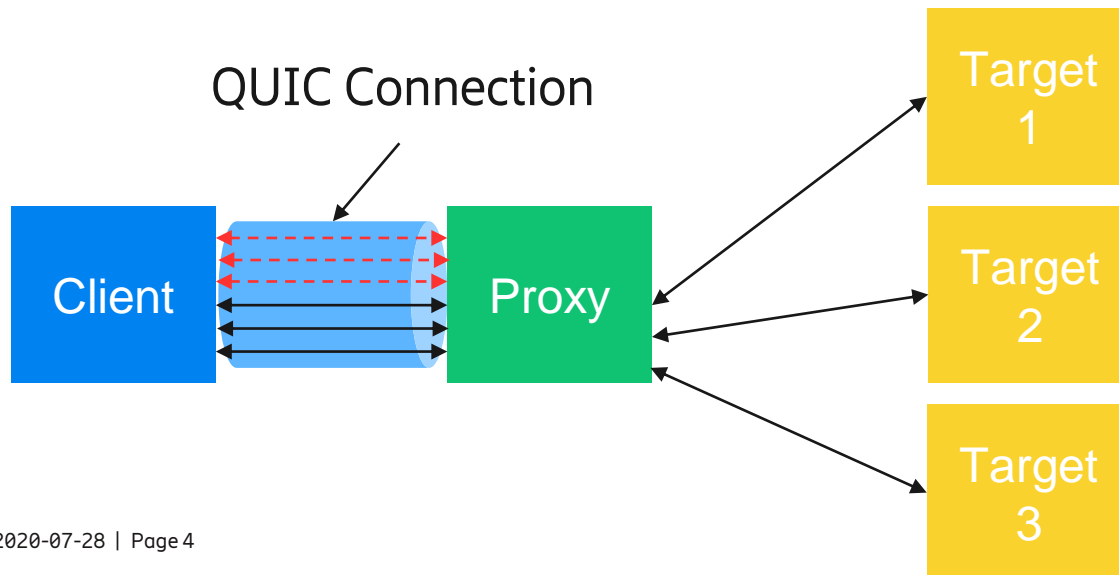
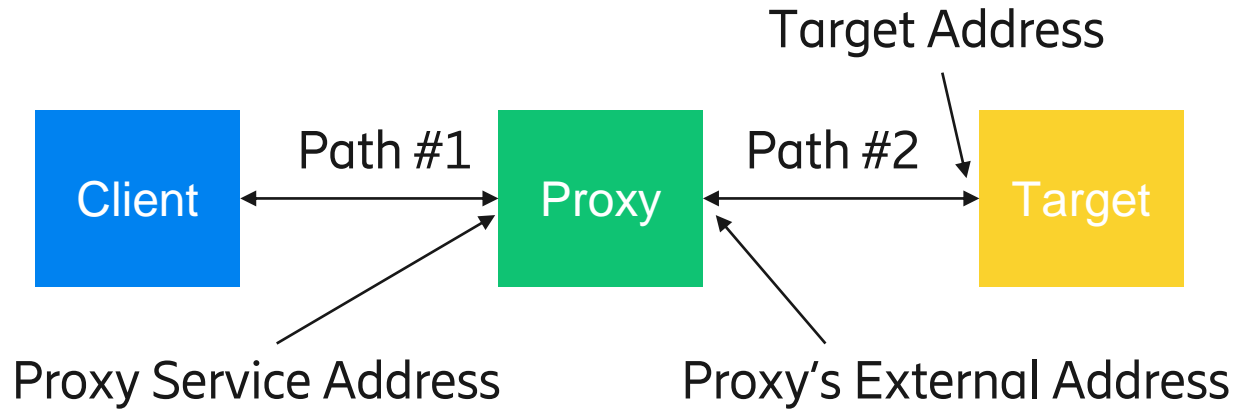
- HTTP Connect



- 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



Version	IHL	Type of Service *	Total Length+	
Identification			Flags *	Fragment Offset
Time to Live	Protocol+		Header Checksum	
Source Address				
Destination Address				
Options *				Padding

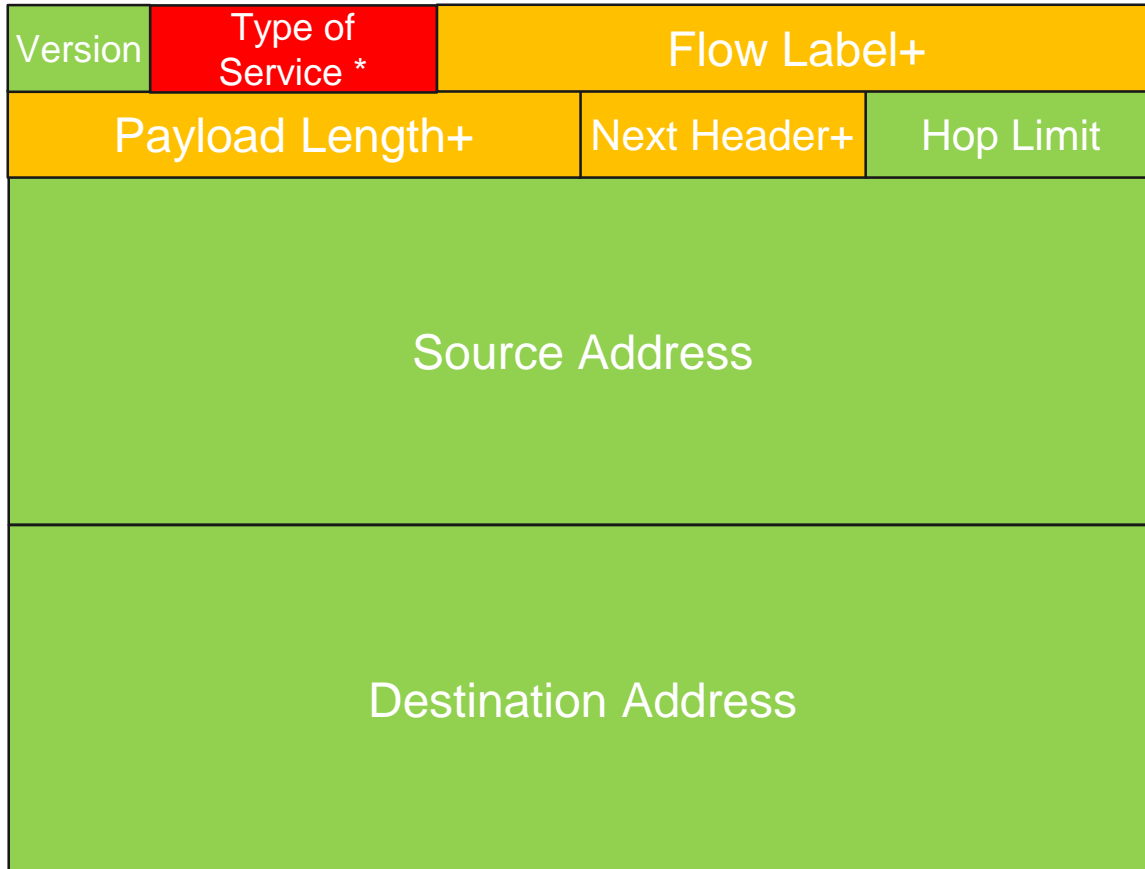
Fixed, Flow Static or Derived

+ 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



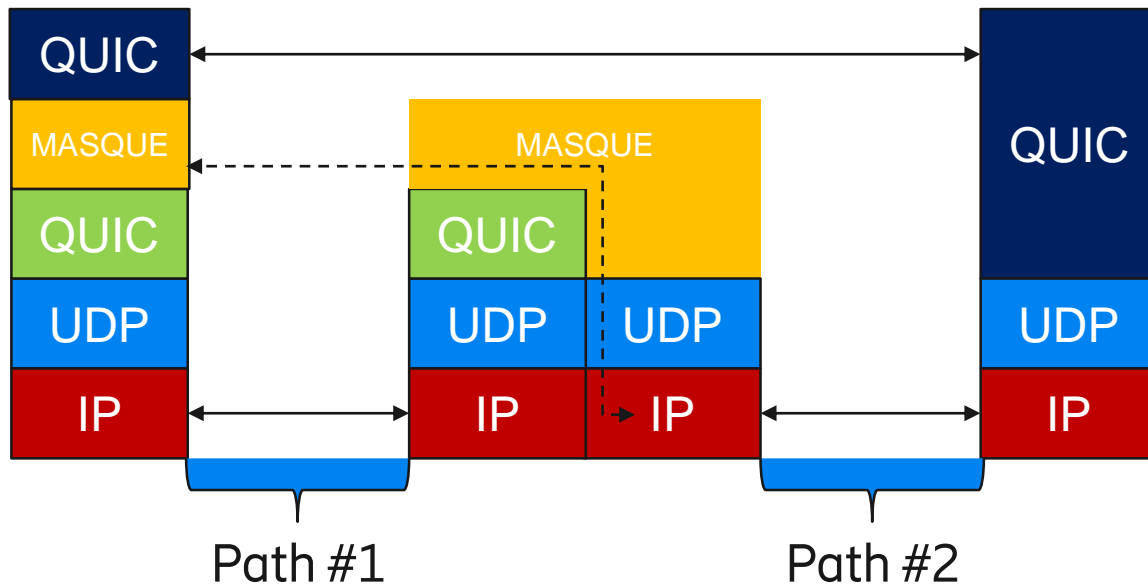
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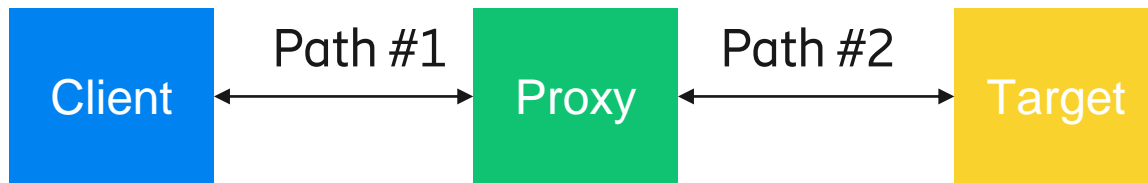
- Version = Fixed
- Type of Service = DSCP + ECN
 - Needs Discussion
- Flow Label = Per ULP flow / Flow Static (UDP)
- Payload Length = Per Packet
- Next Header = Per Packet / Fixed (UDP)
 - Extension Headers (Needs Discussion)
- Hop Limit = Sender Assigned
- Source Address = Signaled Static
- Destination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



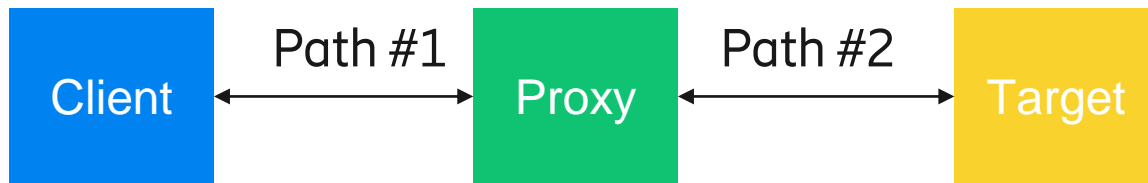
- Path #1

- 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

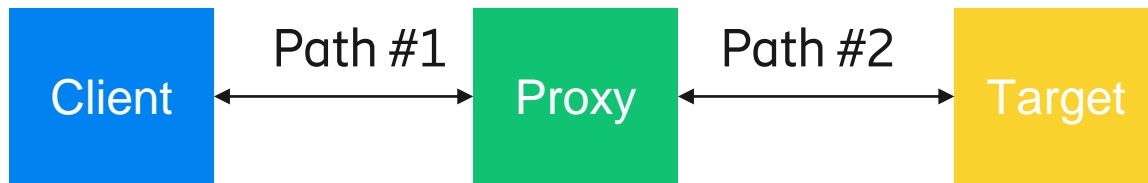
- Setting Proxy to Target DSCP to send with
 - Authorization to use DSCP
 - DSCP to forwarding behavior mapping
- Target to Proxy packets
 - Read DSCP and propagate to Client
- Upper Layer Protocol needs to know Forwarding behavior applied
 - To ensure different CC state
- Priorities in Packet scheduling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

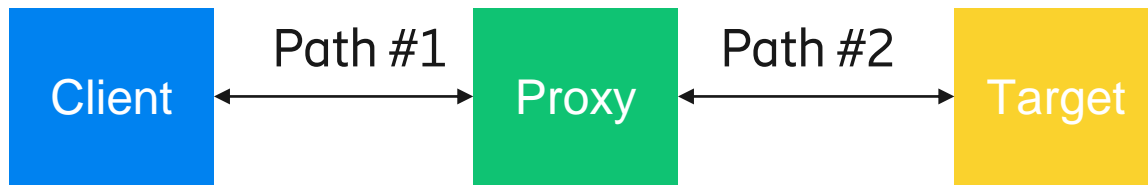
IP Options / Extension Headers



- 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

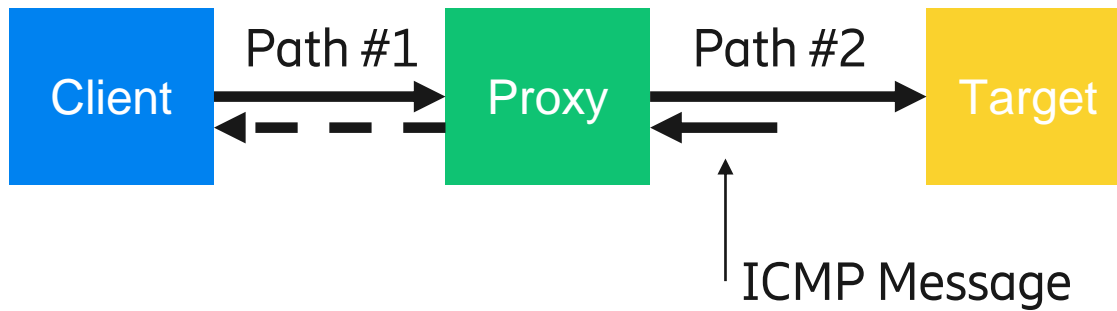
- Source Port = Flow Static
- Destination Port = Flow Static
- Length = Per Packet
 - UDP Options ([draft-ietf-tsvwg-udp-options](#)) utilize UDP Length to indicate options area
 - How to support UDP Options?
- Checksum = Calculated per Packet

Fixed, Flow Static or Derived

+ Per Packet

* Discussion needed

ICMP



- ICMP provides network to endpoint signaling
- What needs protocol consideration is the case on the left
 - IP/UDP packets on Path #2 from proxy to target that triggers ICMP message transmission
 - On Path: Packet Too Big, Destination Unreachable
 - 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

