

Multipath extension for QUIC

Draft-ietf-quic-multipath-13

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Agenda

- ❖ Brief Summary: Changes from draft -11 to draft -13
- ❖ Hackathon Interop Reports: draft -13
- ❖ Issue
- ❖ Next Step

Diff from -11 to -12

1. Add PATH_CIDS_BLOCKED frame as an explicit signal for situations when endpoints don't have unused CIDs for the corresponding path
2. It is recommended to open a new path for active client migration.
3. Add guidance for handling PTO on multiple paths.

Clarifications:

4. Packets which only contains PATH_ACK frames are not congestion controlled, but senders should carefully consider the load induced by these packets.
5. When endpoint sends PATH_ABANDON frame but don't receive a corresponding PATH_ABANDON, it's left to the implementation when to release the path resources, but endpoints SHOULD wait at least 3 PTOs before remove the issued CIDs of the path.
6. It is recommended (SHOULD) to always send the PATH_ABANDON frame on another path than the to-be-abandoned path.

Updated transport parameter for the new version because of new frame.

Diff from -12 to -13

1. Add Next Sequence Number (i) field to the PATH_CIDS_BLOCKED frame
2. Recommend sending at least one unused CID for all paths up to the max path ID
3. Changed the error code for MP frames in 0-RTT to align correctly with RFC9000

Clarifications:

4. Around the use, acking, and retransmissions of the PATHS_BLOCKED and PATH_CIDS_BLOCKED, MAX_PATH as well as PATH_AVAILABLE, and
5. On the use of IV and nonce.

Update transport parameter for the new version because of change in frame.

<i>server</i>					
<i>client</i> ↓	xquic	picoquic	Rask	quiche	mp-aioquic
xquic	HVDCSUABL	HVDCSUABL	HDVCSUABL	HVDCSUABL	HVDCSUAB
picoquic	HVDCUA	HVDCU	HVDCUA	HVDC	
Rask	HVDCSURMB	HVDCSURM	HVDCSURMB	HVDCSUR	
quiche	HVDCISRA	HVDCISRA	HVDCISRA	HVDCISRA	HVDCIRA
mp-aioquic					

Core Features Tested																			
Feature	code	details																	
Handshake	H	The handshake completes with successful negotiation of enable_multipath transport parameter (both ends indicate 0x01)																	
Path Validation	V	Client sends PATH_CHALLENGE frame to open a new path and server replies with PATH_RESPONSE																	
Send data	D	Stream data (of one of more streams) is send on all paths; ACK_MP frames are sent and processed																	
Path Close	C	Client closes a path with PATH_ABANDON frame																	
Optional Features Tested																			
Feature	code	details																	
CID change	I	A server offers new CIDs for a path using PATH_NEW_CONNECTION_ID to a client in advance. Upon some events, the client starts using a new server CID on one path																	
Path status	S	Client sends PATH_BACKUP and PATH_AVAILABLE frames																	
Key Update	U	One endpoint updates keys and sends at least one packet with the new key on all active paths																	
Multipath ACK	A	One endpoint sends data and the other endpoints sends PATH_ACK (randomly) on all path independent of where data is received																	
CID retirement	R	One endpoint send an PATH_RETIRE_CONNECTION_ID for an active path																	
Migration	M	Change CID and 4-tuple e.g. port on an existing path																	
Paths Blocked	B	Server configures a path limitation of two paths, client is configured to open three or more paths. When unable to open requested number of paths it sends PATHS_BLOCKED and server logs or increases number of paths by announcing more using PATH_NEW_CONNECTION_IDS.																	
		A sender can send a PATH_CIDS_BLOCKED frame (type=0x15228c0e) when it wishes to open a path with a valid Path ID or change the CID on an established path but is unable to do so because there are no unused connection IDs available for the corresponding Path ID.																	
Path CIDs Blockec	L																		

Issue 500: Is **PATH_CIDS_BLOCKED** frame really needed?

- Peer should provide at least one unused CID for all active paths, otherwise this seems to be rather an implementation error.
- We now recommend to provide CIDs for all unused Path IDs below the max limit of both side (see merged PR #501)
 - If you want to limit the number of paths, just set a lower max Path ID Limit.
- Still potential relevant use case: You want to open a new path but didn't get any CIDs for any unused Path ID (below max value)?

Proposed solution: Keep it for now as we already have it...

- A client can choose to not implement and a server can choose to ignore the frame.

Next Steps

- Full editorial review on-going (including some restructuring of sections)
- Next version ready for WGLC!