



QPACK

draft-bishop-quick-http-and-qpack

Resilient Header Compression

HPACK

- Inserts always append to the dynamic table
- On-stream operations modify the table
- Table size managed implicitly
 - If the table overflows, drop oldest value
 - Indices change over time

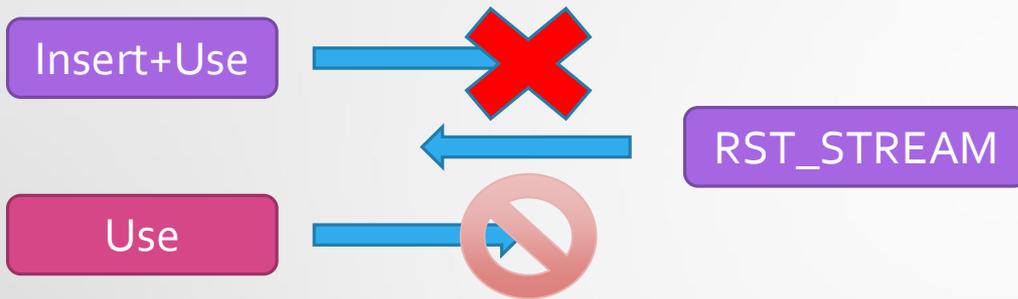
QPACK

- Inserts are to an explicit index
- Table management on a dedicated stream
 - On-stream operations never modify table state
- Table size managed by explicitly deleting entries
 - If the table overflows, kill the connection
 - Indices are consistent over time

Index	Horizon	Stream Refs	Key	Value
...

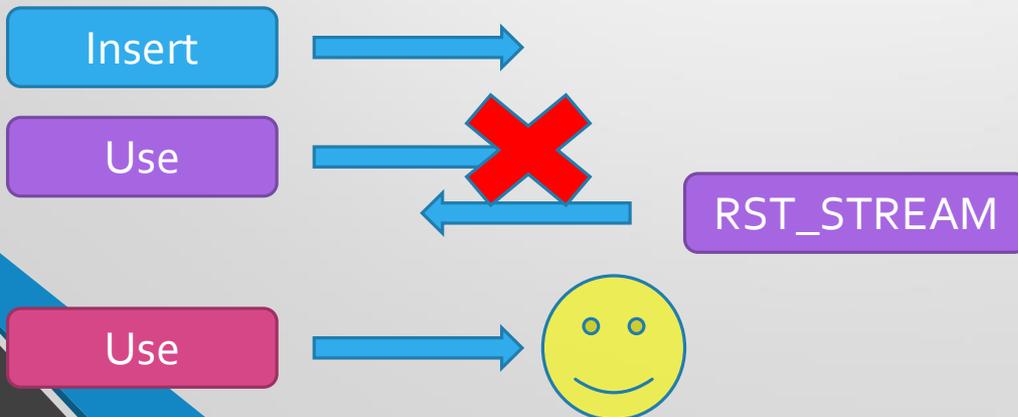
Reset-Independent

HPACK



No control stream can ever be reset safely!

QPACK



Protect critical content on a single shared control stream

Order-Independent

Index	Horizon	Stream Refs	Key	Value
...

M: KEY=VALUE at INDEX

INDEX

KEY

VALUE

5: Reference INDEX

INDEX

KEY

VALUE

9: Reference INDEX

INDEX

KEY

VALUE

M: Delete INDEX (From 0: 5, 9)

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Insert Reordering

Index	Horizon	Stream Refs	Key	Value
...

5: Reference INDEX

INDEX



KEY

VALUE

M: KEY=VALUE at INDEX

INDEX

KEY

VALUE

9: Reference INDEX

INDEX

KEY

VALUE

M: Delete INDEX (From 0: 5, 9)

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- References block if the field isn't defined yet

Delete Reordering

Index	Horizon	Stream Refs	Key	Value
...

M: KEY=VALUE at INDEX

INDEX			KEY	VALUE
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5: Reference INDEX

INDEX			KEY	VALUE
-------	--	--	-----	-------

M: Delete INDEX (From 0: 5, 9)

INDEX	0	5, 9	KEY	VALUE
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9: Reference INDEX

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- Deletes specify the streams with references
- If not all references have arrived yet, deletes deferred until the last one arrives
- Insert/Delete on same stream, so Delete can't arrive before Insert

When can you delete?

- Delete contents:
 - For headers and trailers separately:
 - Starting value (Horizon)
 - List of references since Horizon
- Delete can complete when these streams have been processed:
 - All streams before Horizon
 - All streams listed
- Encoder considers space freed only once decoder declares delete completed

Attack! Attack!

Index	Horizon	Stream Refs	Key	Value
...

M: KEY=VALUE at INDEX

INDEX			KEY	VALUE
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M: Delete INDEX (From 0: 5, 9, 13, 17, 21, 25, 29, 33, 37, 41...)

INDEX	0	5, 9, 13, 17, 21, 25, 29, 33, 37, 41, 45...)	KEY	VALUE
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- Initially looks like you can cause the decoder to remember arbitrarily-long lists of stream IDs
- Memory consumption attack?

...or not.

Index	Horizon	Stream Refs	Key	Value
...

M: KEY=VALUE at INDEX

INDEX			KEY	VALUE
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Delete INDEX (From 0: 5, 9, 13, 17, 21, 25, 29, 33, 37, 41, 45...)

INDEX	4097	{0}	KEY	VALUE
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- Horizon value allows lists to be condensed as much as either party chooses
- Used to say “no knowledge prior to stream...”

A land of trade-offs...

- Shared code with HTTP/2 versus best use of QUIC
- Design effort around reordering versus frequency of reordering
 - Google suggests that reordering is rare, but has noticeable impact when it occurs
- Flexibility to handle reset streams versus difficulty of recovery