QUIC: its impact on satellite equipment vendors and operators

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Updated deck

What is QUIC?

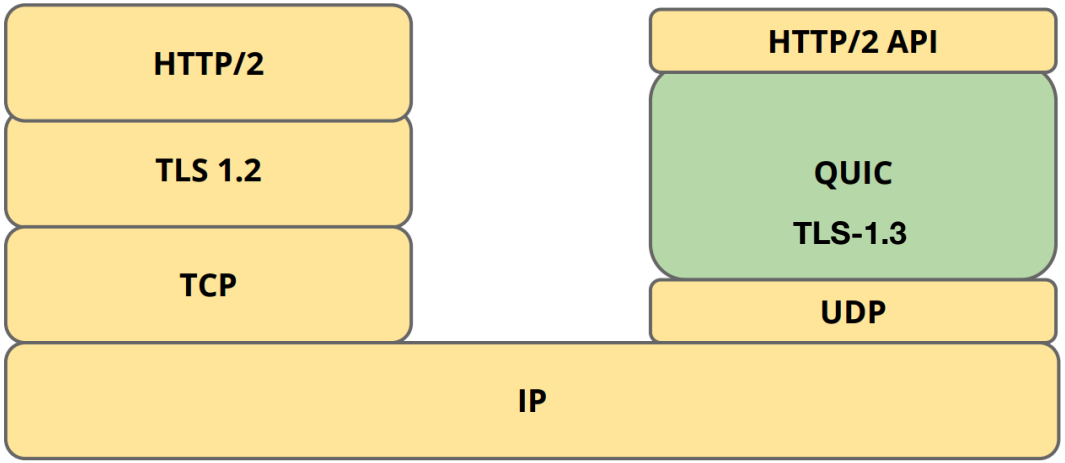
Explaining the Origins of QUIC

What is QUIC?

	HTTP/1	HTTP/2	HTTP/3
Year	(1.1) 1991	2015	2021
Data	ASCII	Binary	Binary
Security	TLS optional	TLS 1.2 Always	TLS 1.3 within QUIC
Transport	TCP	TCP	QUIC over UDP
Stream	1 stream over a TCP Connection	Multiple streams over one connection	Multiple streams over multiple streams

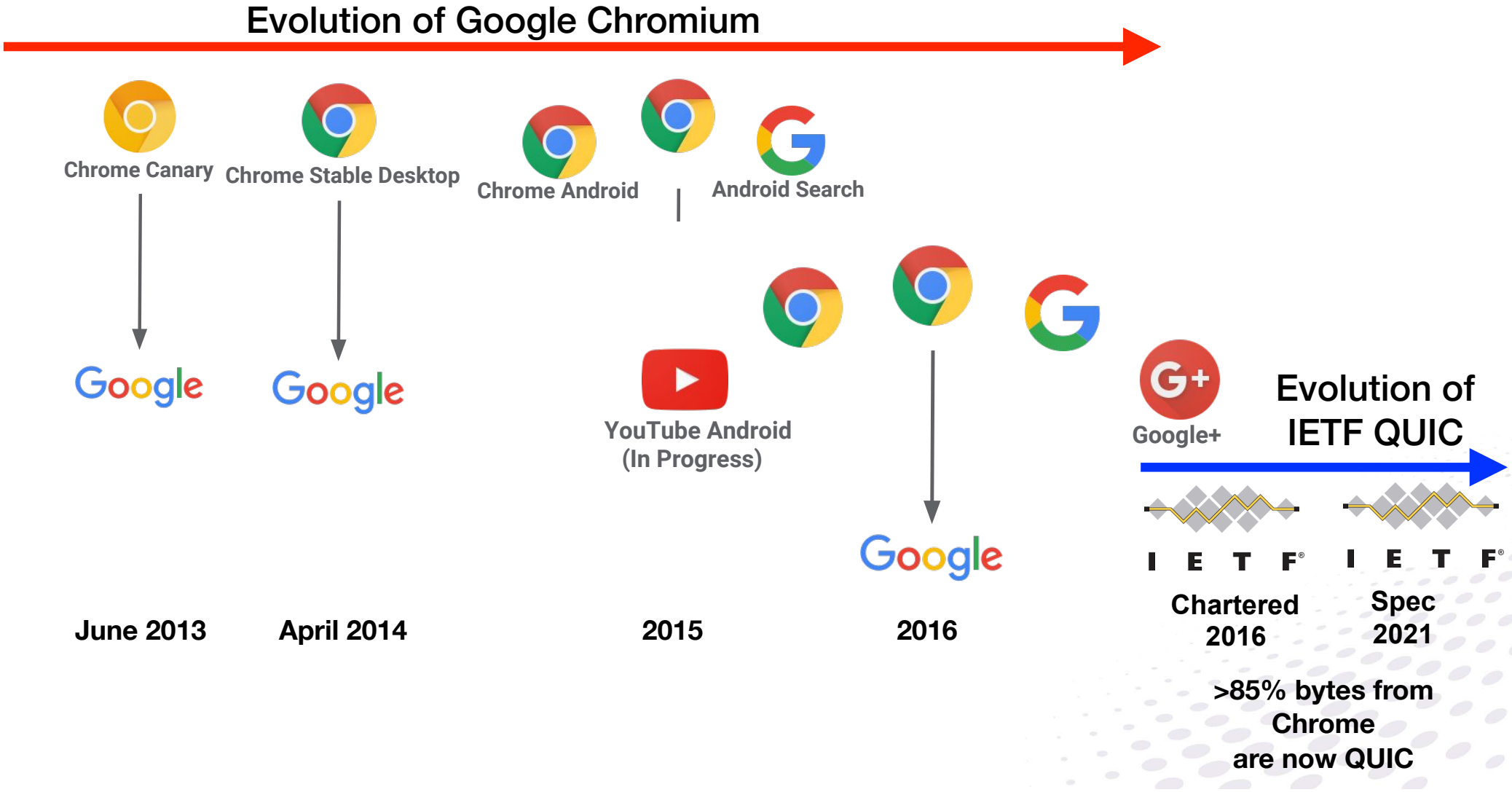
Web Transport Evolution

QUIC is emerging as a new transport protocol



QUIC provides security and protections against denial of service.

Evolution of QUIC…

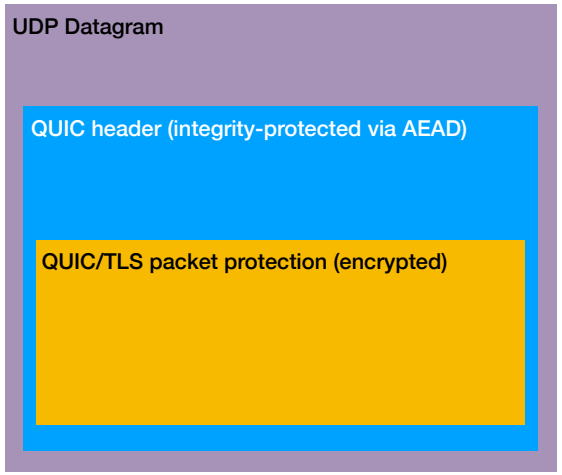


QUIC Packets

A **QUIC packet** is sent in the payload of a UDP Datagram

Packets can be coalesced into a datagram (there are rules)

One or more **QUIC Frames** are sent in a QUIC packet



Data is sent in **STREAM Frames**

A QUIC packet can include multiple STREAM frames from more than one stream

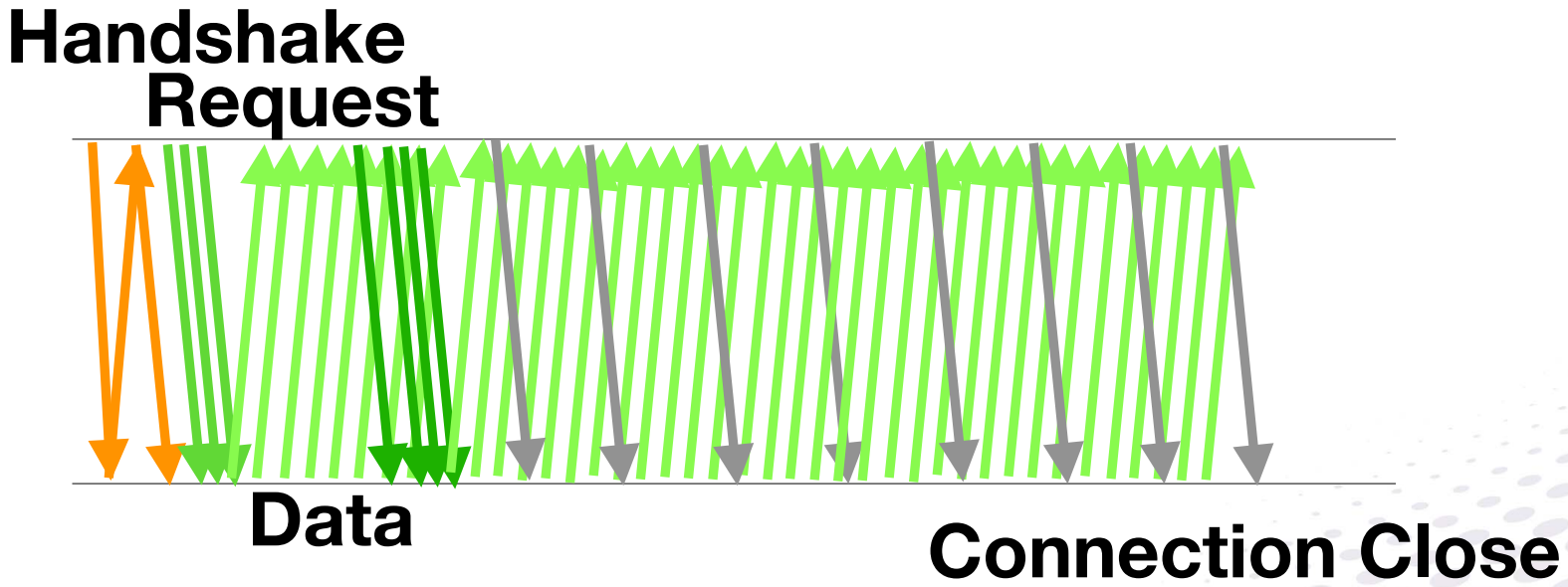
QUIC avoids head-of-line blocking across multiple streams

Packets can also carry other types of **QUIC Frames**

QUIC Connections

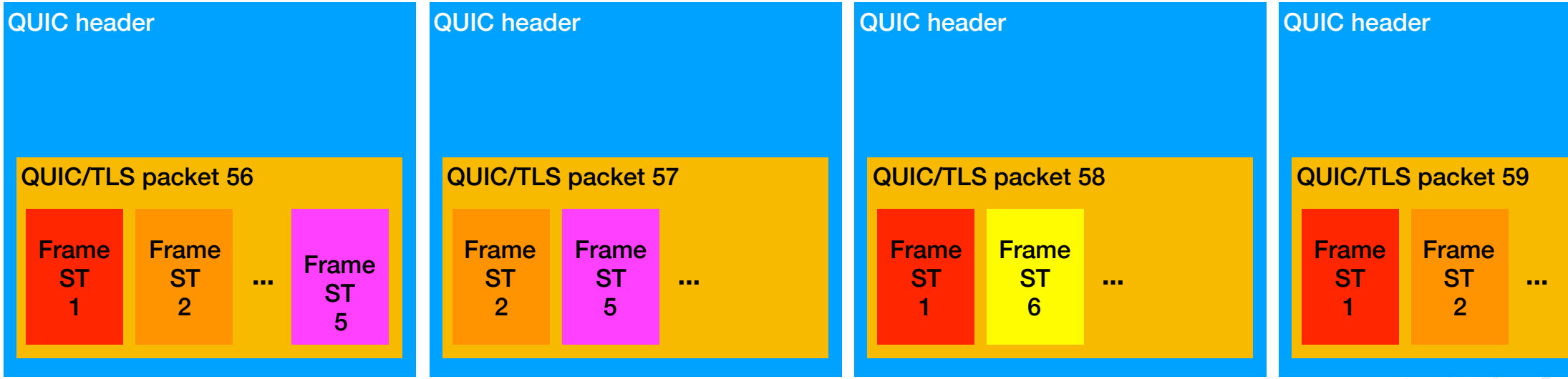
QUIC uses **Connections**

Each connection starts with a ***handshake phase***, similar to TCP
A connection can migrate to another network path after it connects



QUIC: Multi-streaming - Frames in Packets

Packets are containers for frames



Frames carry streams of data
Stream can be created, and deleted as needed - they are never re-used
Streams are normally congestion-controlled and Flow-Controlled

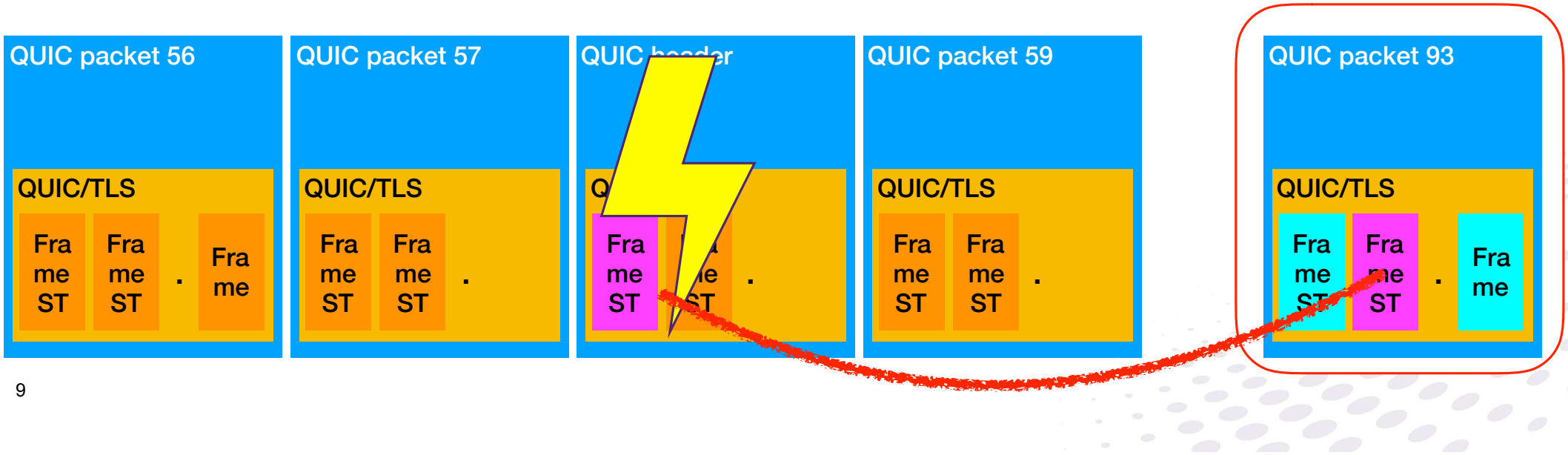
All STREAMS are Acknowledged

Endpoints acknowledge **all** packets received

ACK-eliciting packets cause an **ACK Frame** to be sent

Not all QUIC STREAMS are reliable

Packets are NOT retransmitted (the frames carried in packets CAN be retransmitted)



v1 Spec in 2020/21!
250+ pages

See IETF QUIC Working Group

draft-ietf-quic-applicability

Applicability of the QUIC Transport Protocol

draft-ietf-quic-http

Hypertext Transfer Protocol (HTTP) over QUIC

draft-ietf-quic-invariants

Version-Independent Properties of QUIC

draft-ietf-quic-manageability

Manageability of the QUIC Transport Protocol

draft-ietf-quic-qcram

Header Compression for HTTP over QUIC

draft-ietf-quic-recovery

QUIC Loss Detection and Congestion Control

draft-ietf-quic-tls

Using Transport Layer Security (TLS) to Secure QUIC

draft-ietf-quic-transport

QUIC: A UDP-Based Multiplexed and Secure Transport

What next?

QUIC v1 is being finalised (and deployed)

The QUIC WG is exploring new proposals and extensions

Features helpful for satellite could be discussed/developed/ deployed

There might be synergy here with mobile use-cases….

…. What issues are most important?
…. How do we move forward?

>15 implementations on their way:
e.g.
AppleQUIC (**Apple**)
ats (**Apache**)
lsquic
mozquic (**Mozilla**)
mvfst (**Facebook**)
ngtcp2
ngx_quic
Pandora
f5
picoquic
quant
quiche(**Cloudflare**)
quicly (**Fastley**)
quicr & Quinn
Winquic (**Microsoft**)
quic-go
nghq
nghttp3
ls-qpack
nghttp3

What's could be in QUIC 2?

Good things on the way:

- Better fairness with TCP
- Partial Reliability - e.g. for multimedia
- Multipath support (?Maybe?)
- Forward Error Correction (?Maybe?)
- Tunnels and Proxies …

Logging, and other useful stuff

Considerable interest in using QUIC for other applications

Still all being discussed - no decisions yet.

What do I need to do now that everyone (?) uses QUIC

A Set of Slides Explaining Network Implications

You can’t inspect QUIC

The benefits of encryption have side-effects.

- Can't debug or measure with common network tools
- Need access to keys from the handshake, or server logs

Can use pattern recognition of traffic (for now)

QUIC changes the way networks are used and how they need to operated

Firewalls and Malware detection

Network Management

Compliance and Troubleshooting

Passive Measurement

Legal Intercept

QUIC and Broadband Satellite

☺	QUIC has latest transport improvements
☺	QUIC has latest http improvements in H2/H3
☹	Current QUIC optimised for main use-case
☺	QUIC will continue to evolve, and may benefit satellite broadband users
☹	Operators no longer control trade-offs

Q&A