Context-Aware HTTP Adaptive Video Streaming Utilizing QUIC's Stream Priority

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mhv/2023

Has the internet changed**?**

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Introduction

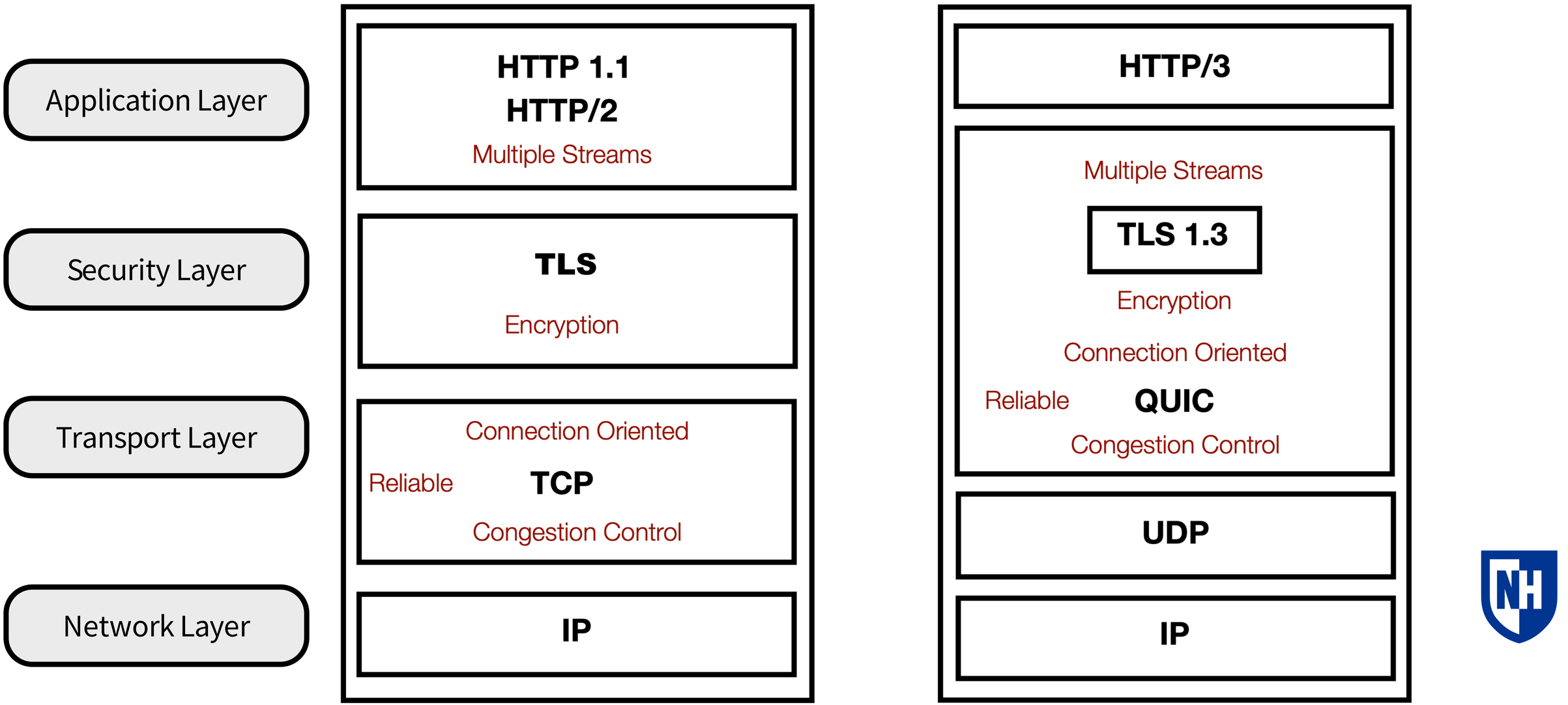
TCP
(Transmission Control Protocol)

- RFC in 1981
- Transport over IP
- Single Connection
- HTTP streams
- 3 way handshake
- Stream of bytes as clear text

QUIC
(Quick UDP Internet Connection)

- Google - 2013, WG -2015, RFC - 2021
- Transport over UDP
- Single Connection
- QUIC streams
- Lower connection establishment latency
- Encrypted

Under the Hood



Why HTTP/3?

Features	HTTP/2	HTTP/3
Transport	TCP	QUIC
Header Compression	HPACK	QPACK
Streams	HTTP	QUIC
Independent streams	No	Yes
Early data	No(typically)	Yes
Security	TLS 1.2(typically)	TLS 1.3

RFC 7540 - H2 Priority

- Server scheduling
- Dependency tree
- Bandwidth Distribution
    - parents are transferred in full before their children
    - sibling nodes share bandwidth
- Drawbacks
    - HoL blocking
    - Resource contention
    - Complex implementation
    - Limited browser support
    - Interoperability issues

RFC 9218 - Extensible Prioritization Scheme for HTTP

- Urgency - 0 to 7
    - Transmit HTTP response in the order of urgency
    - The smaller the value, the higher the precedence.
    - lowest urgency level (7) is reserved for background tasks
    - Default 3
- Incremental
    - HTTP response can be processed incrementally
    - Boolean
    - Default - false

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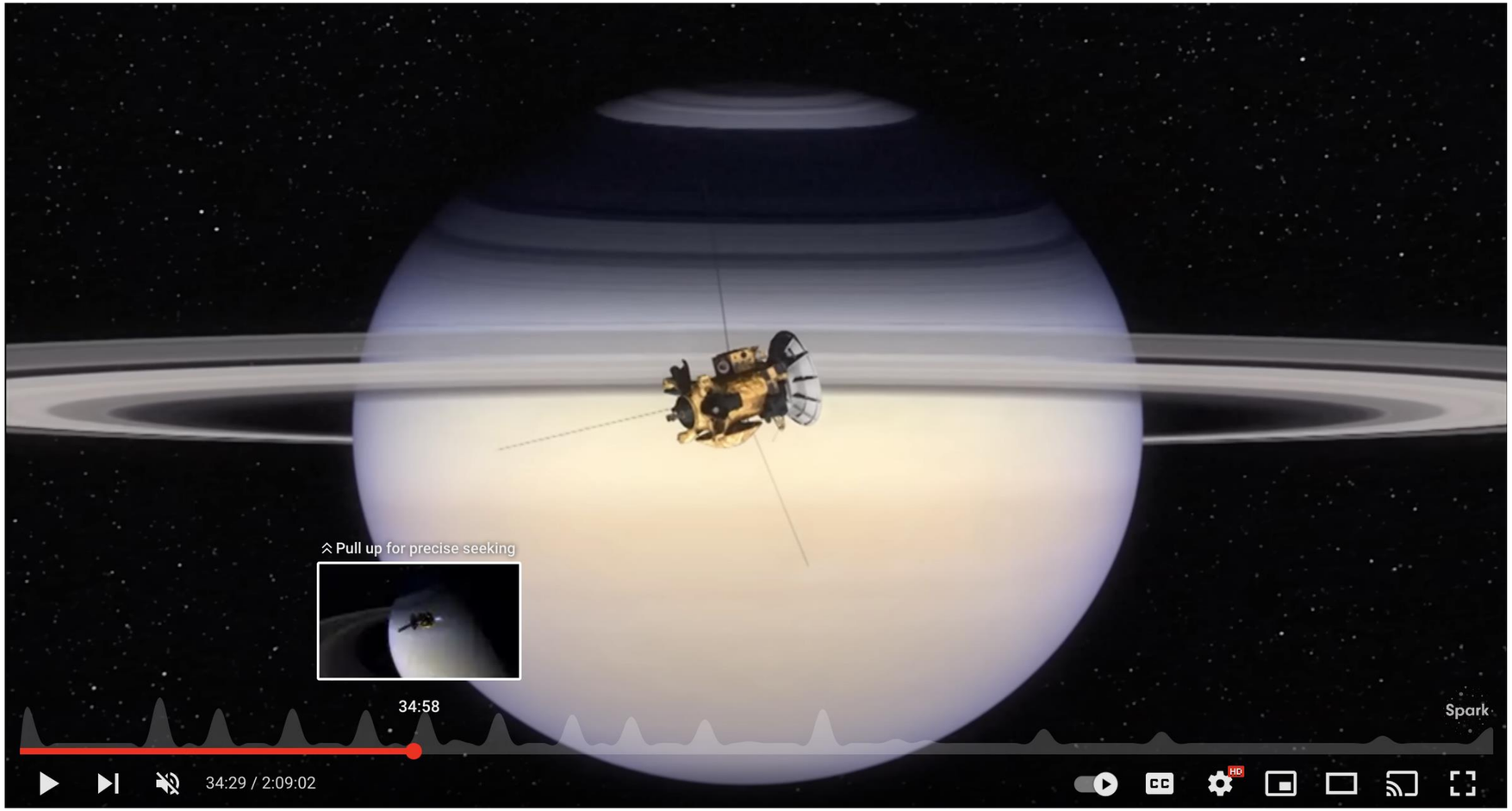
Motivation

Most replayed feature

Engagement graph



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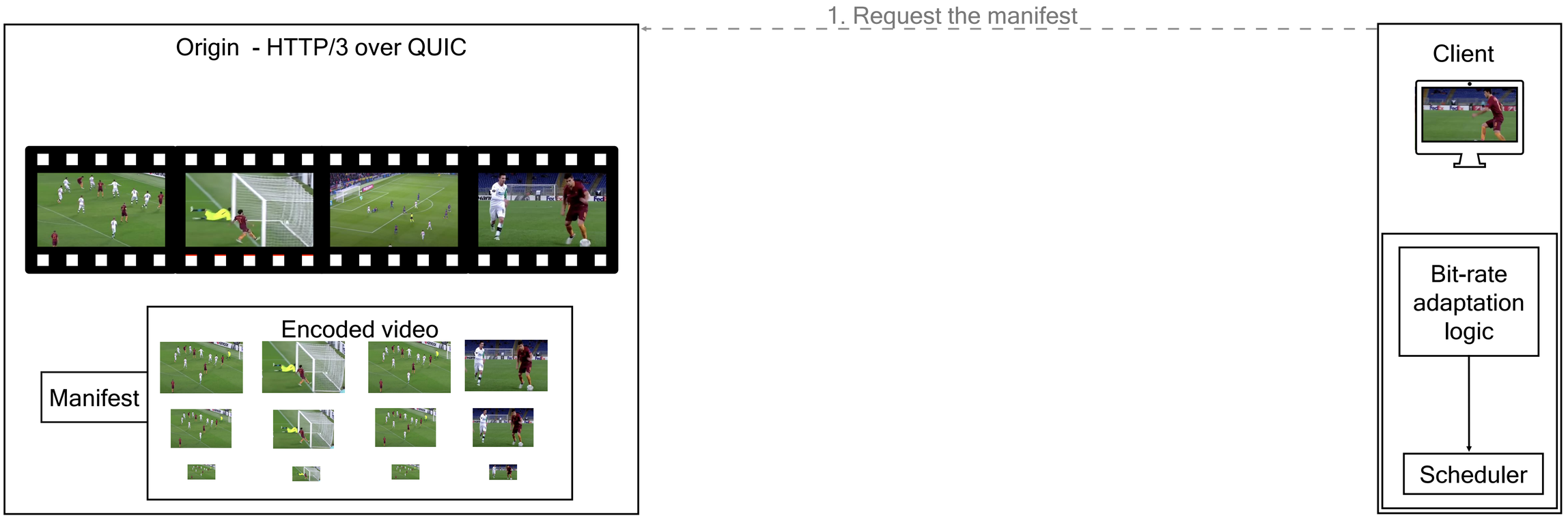
Sequential Behavior

Sequential Behavior



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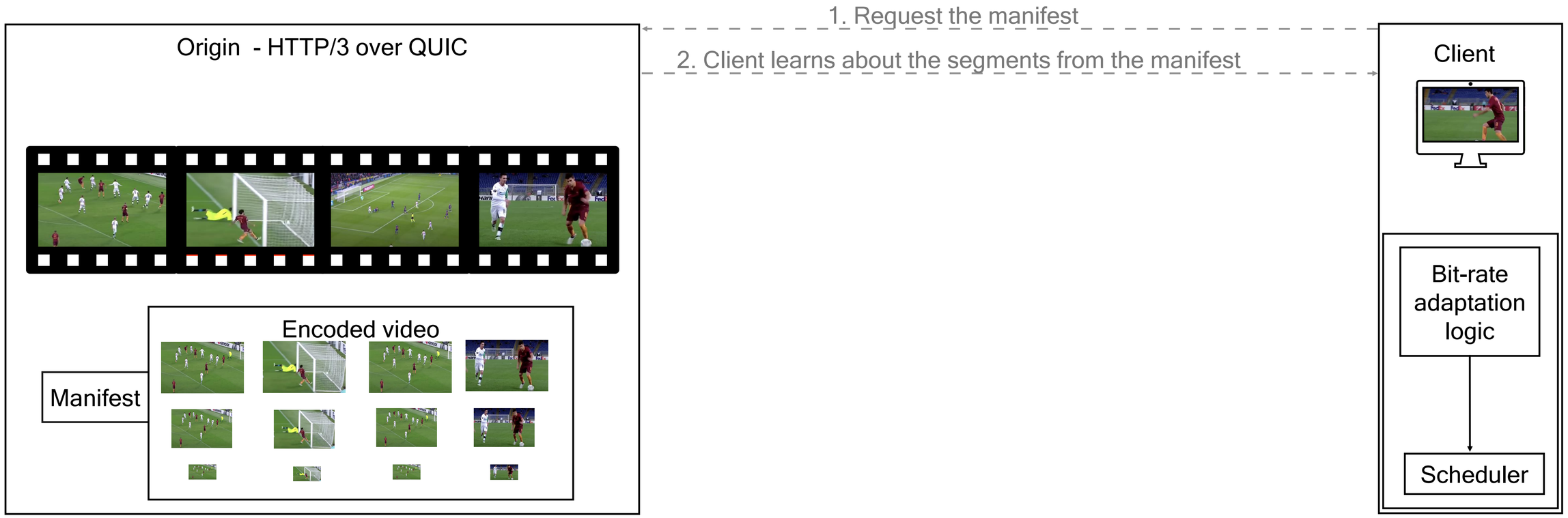

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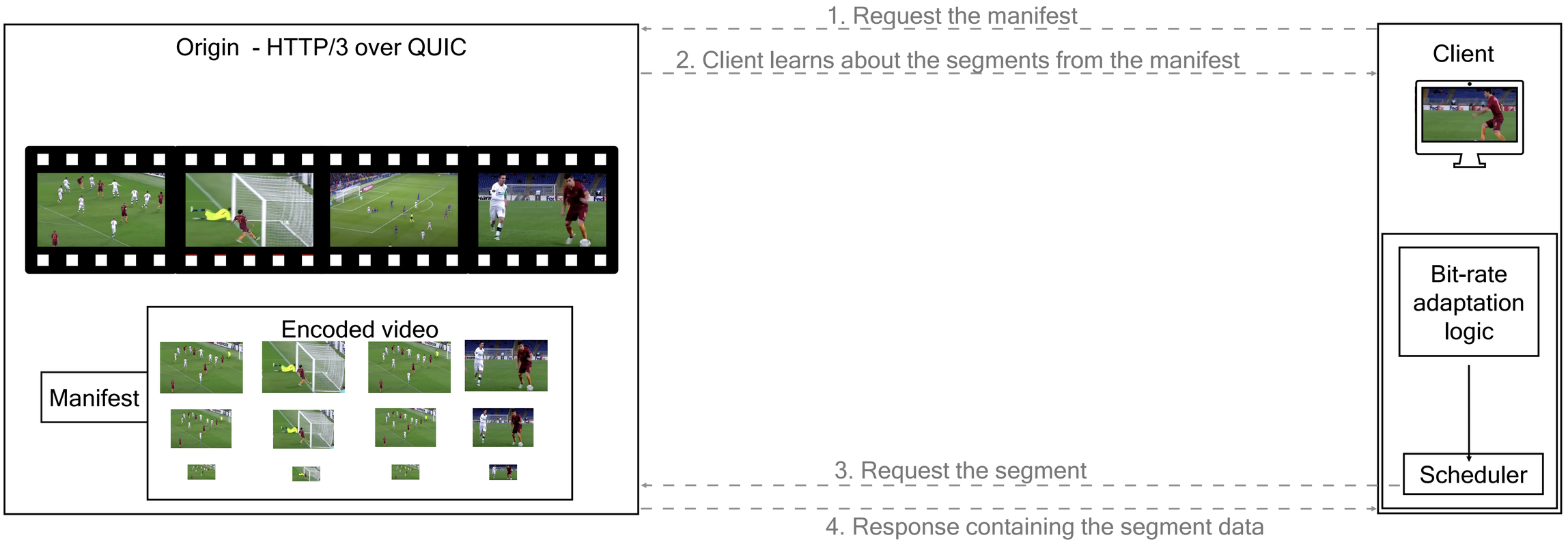

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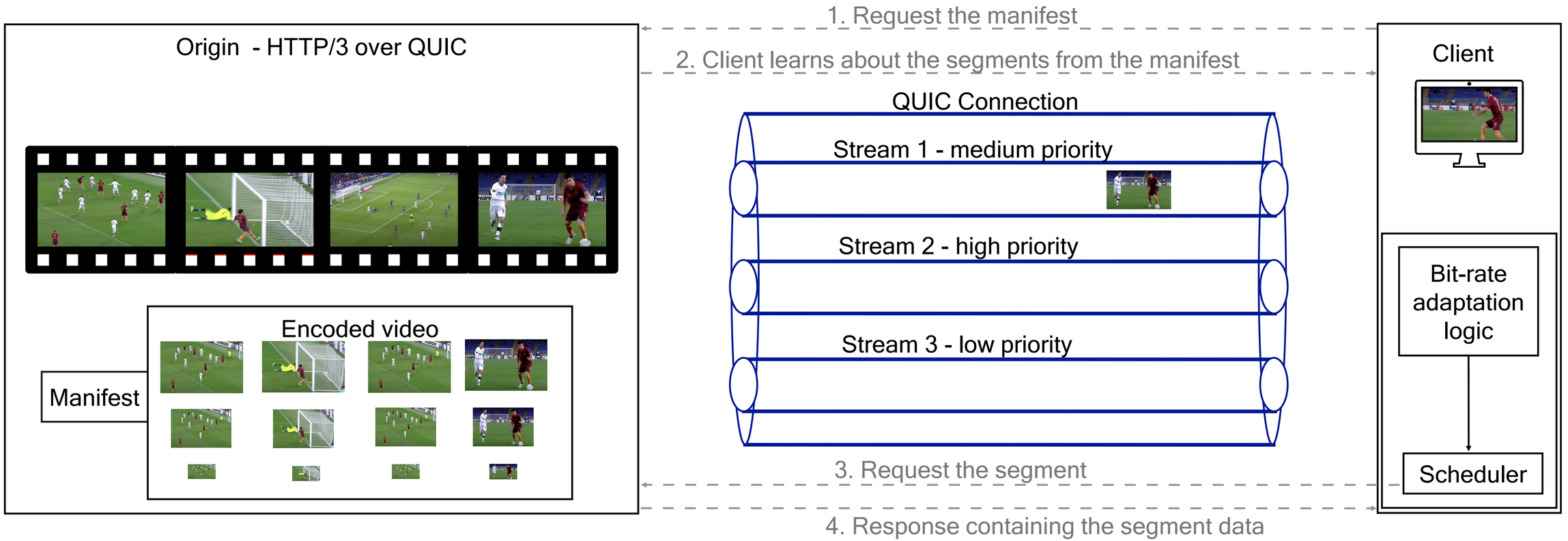

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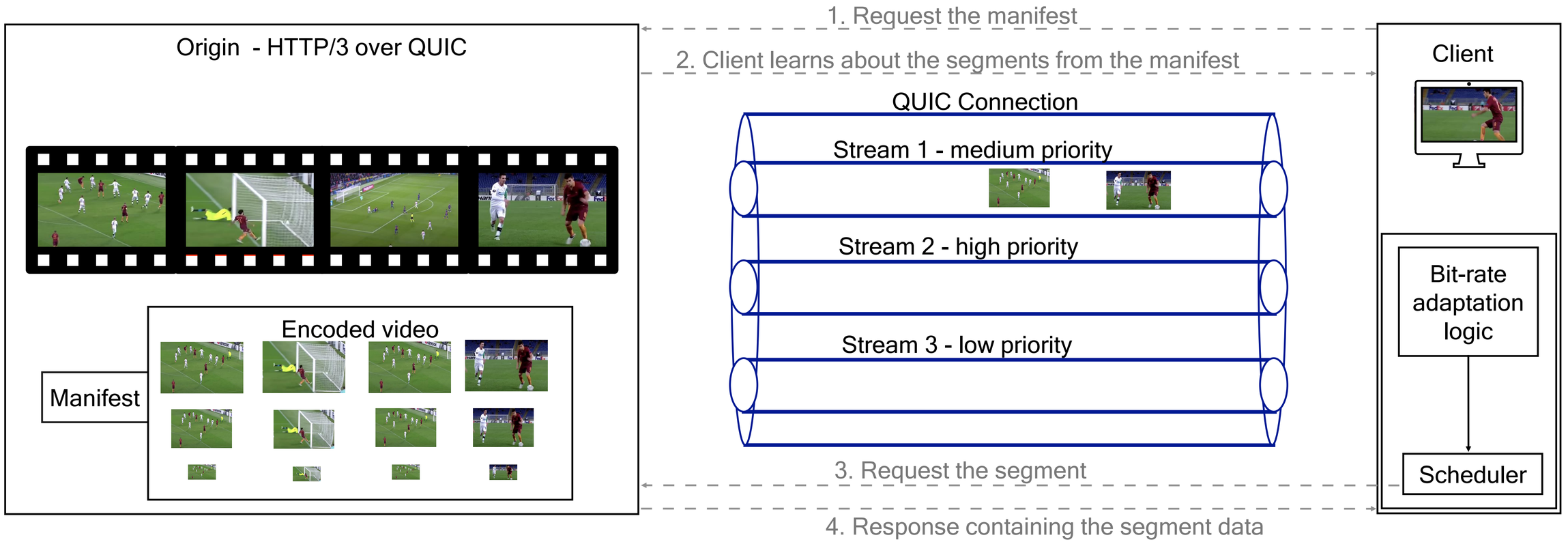

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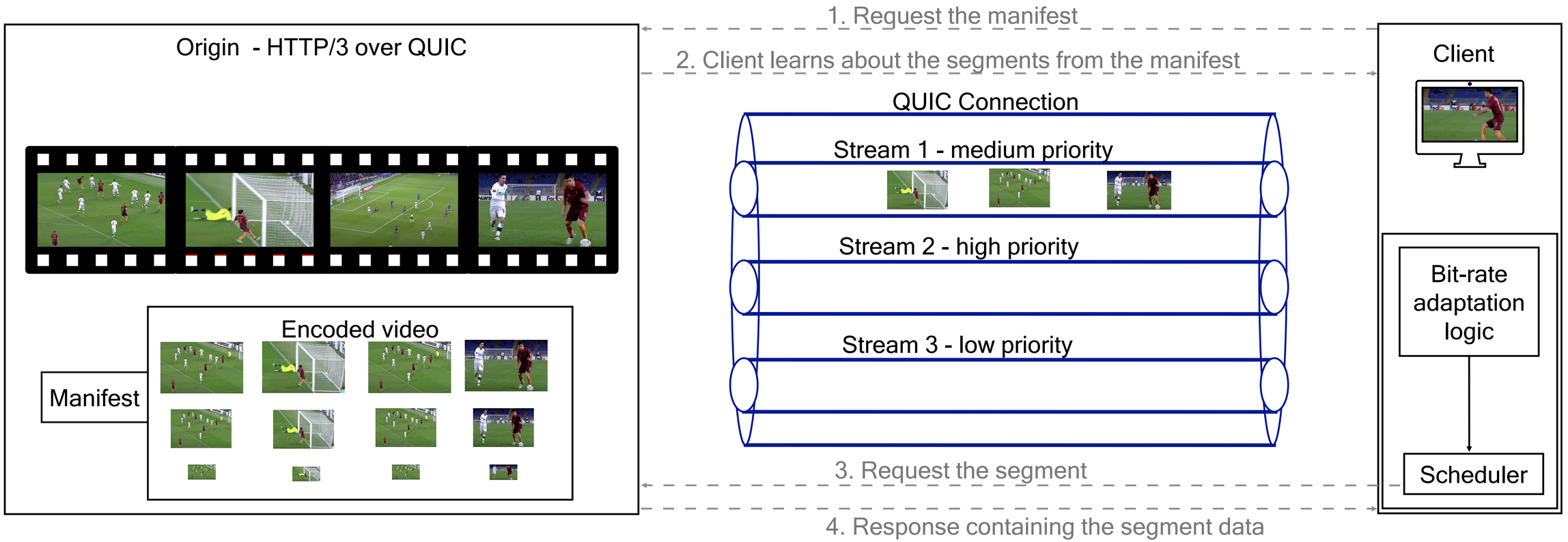

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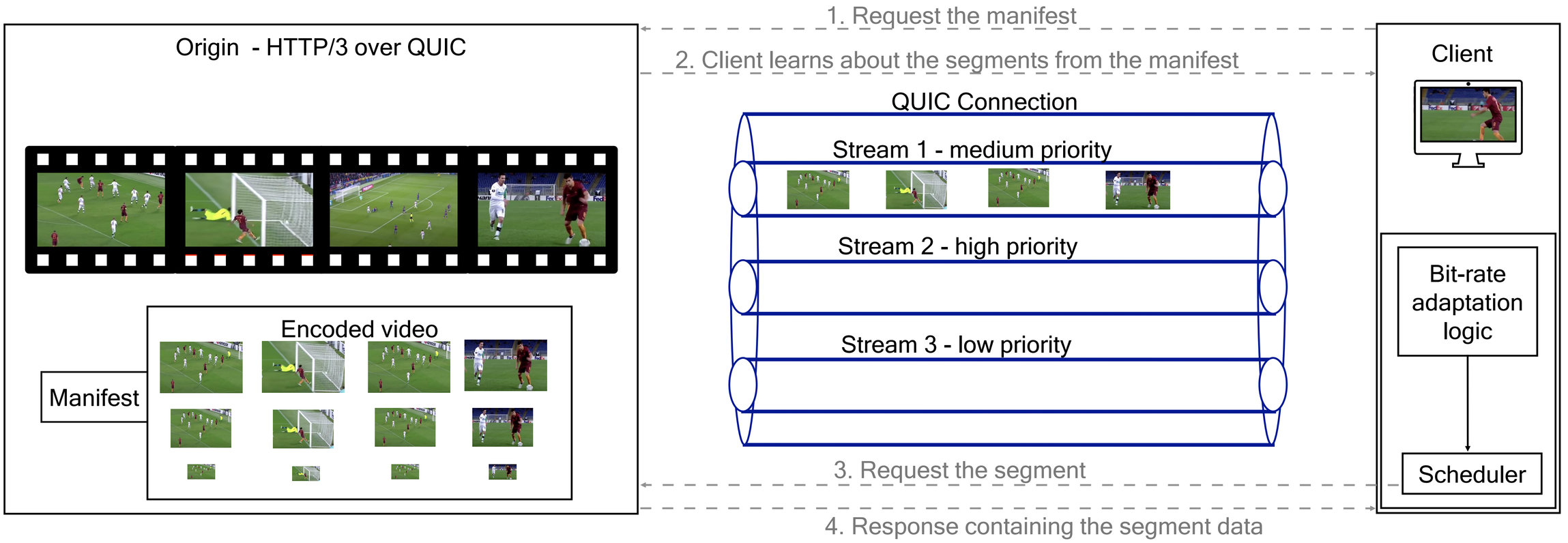

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Proposed Design

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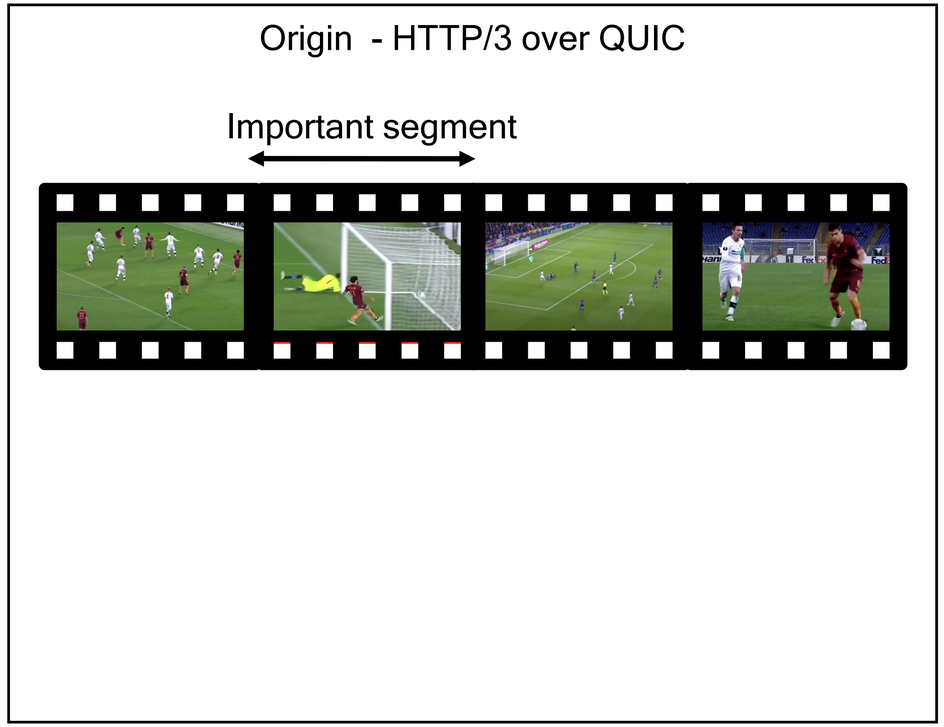

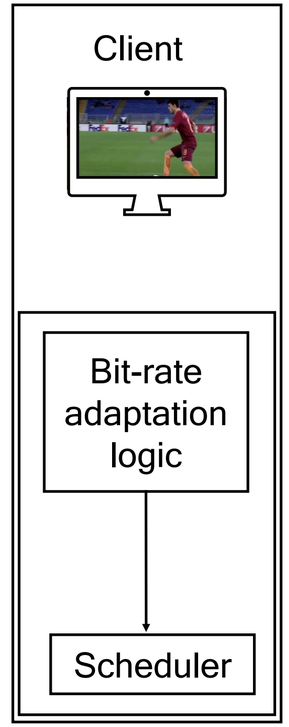

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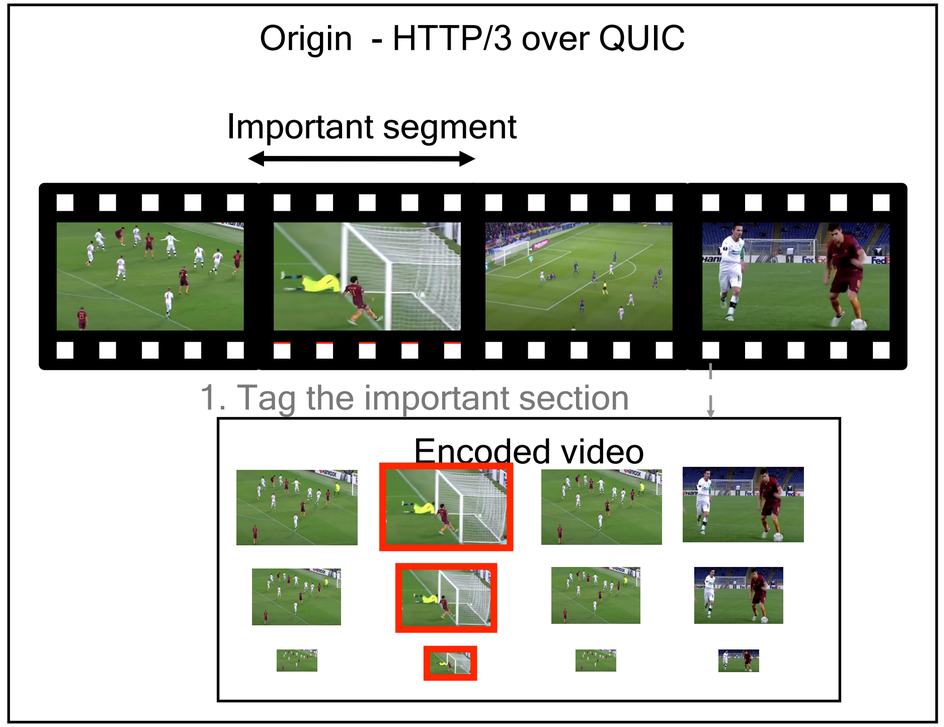

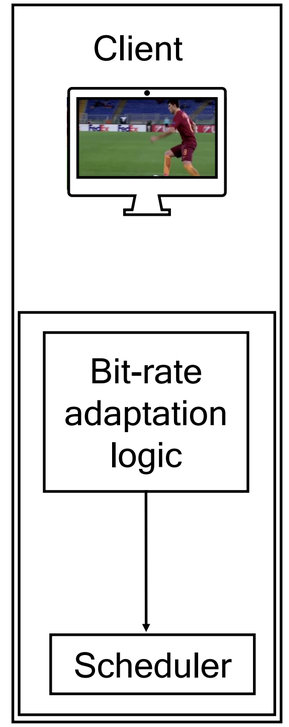

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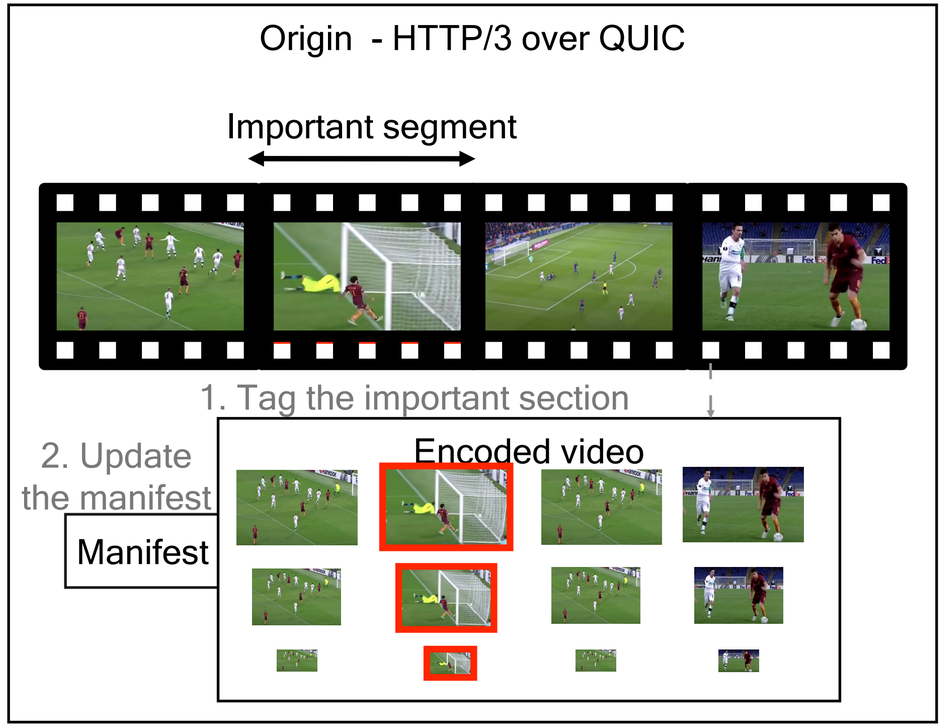

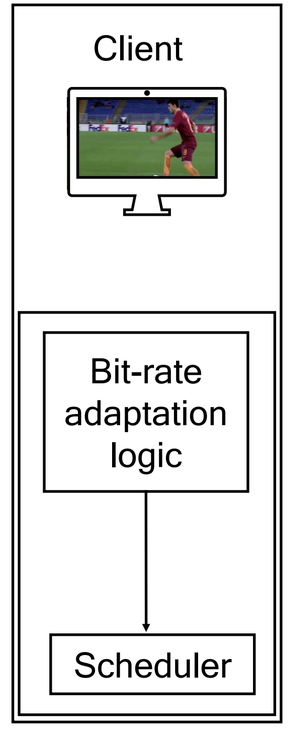

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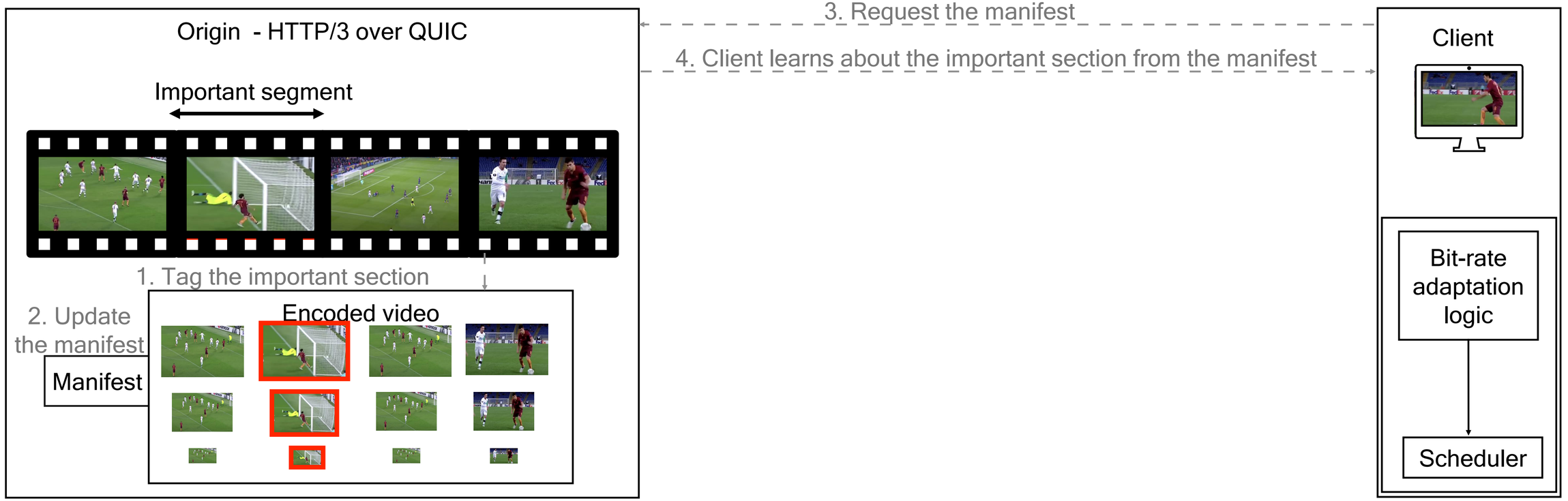
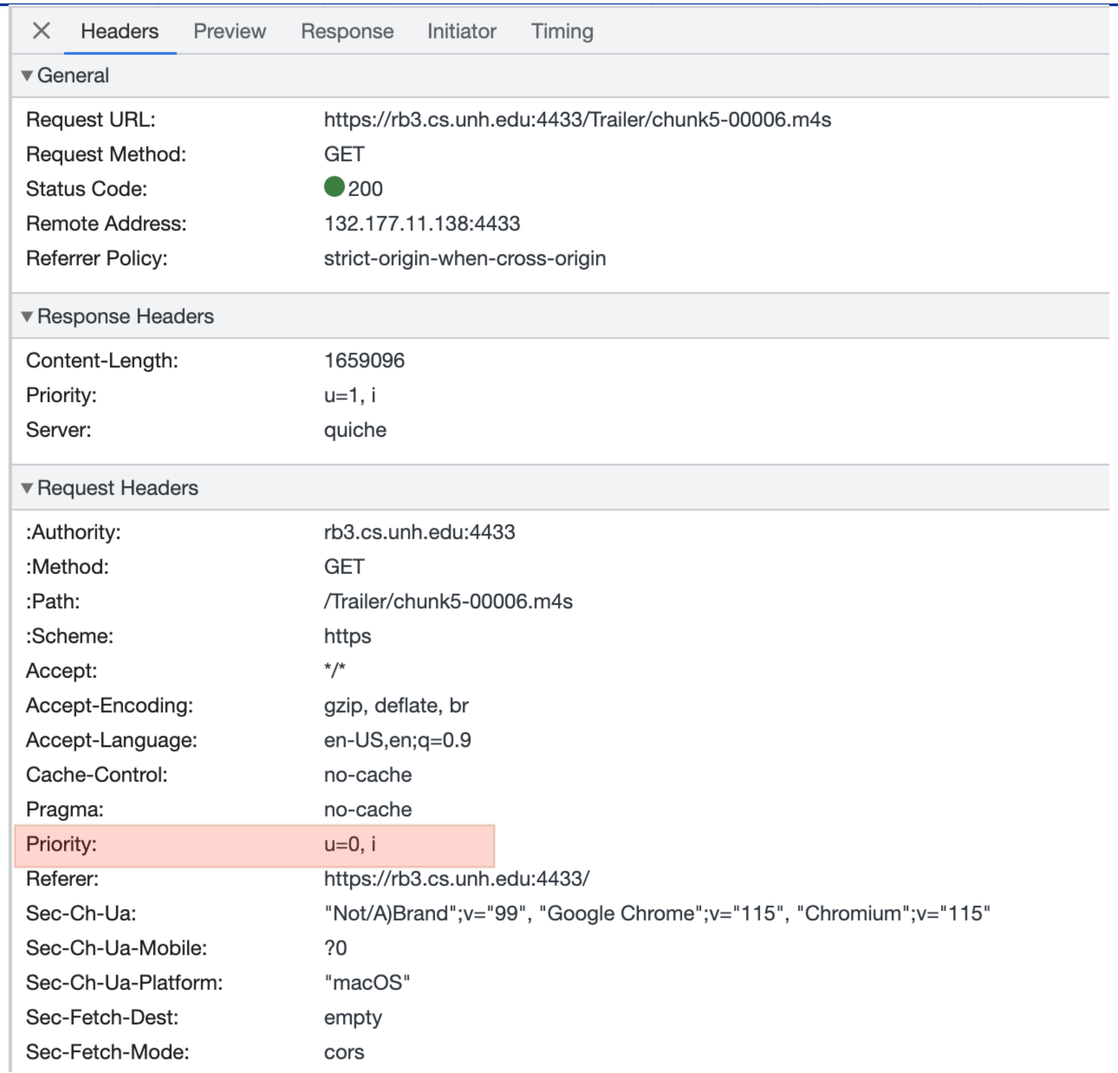


Proposed Design

Header with priorities



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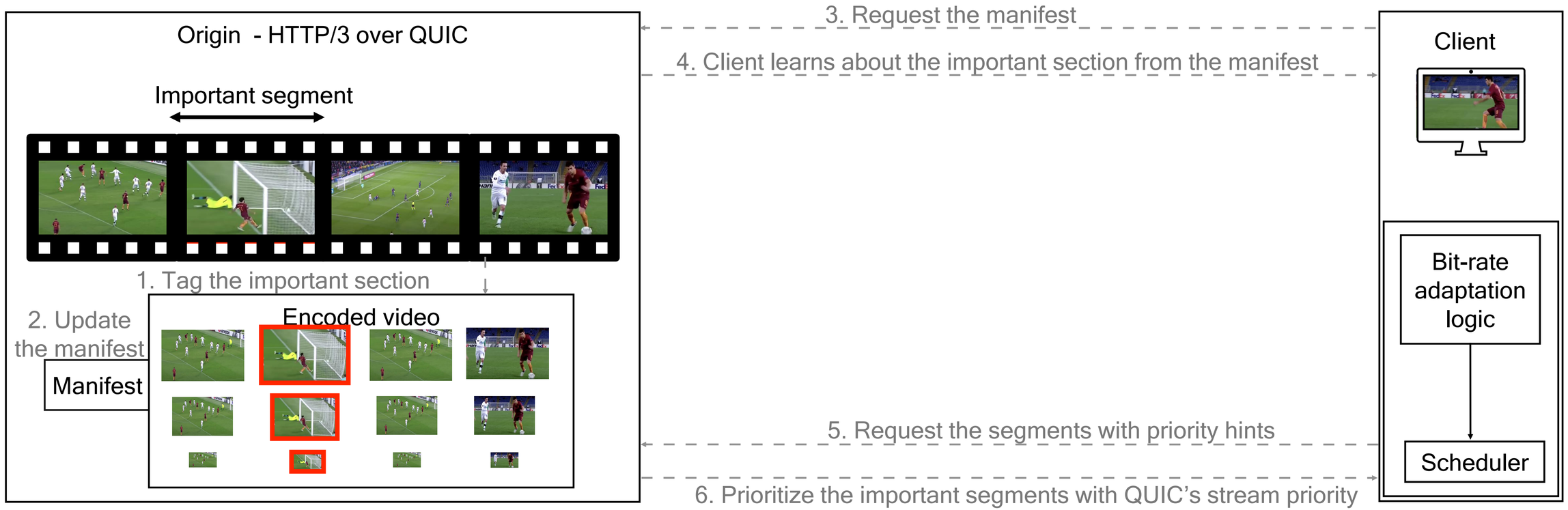

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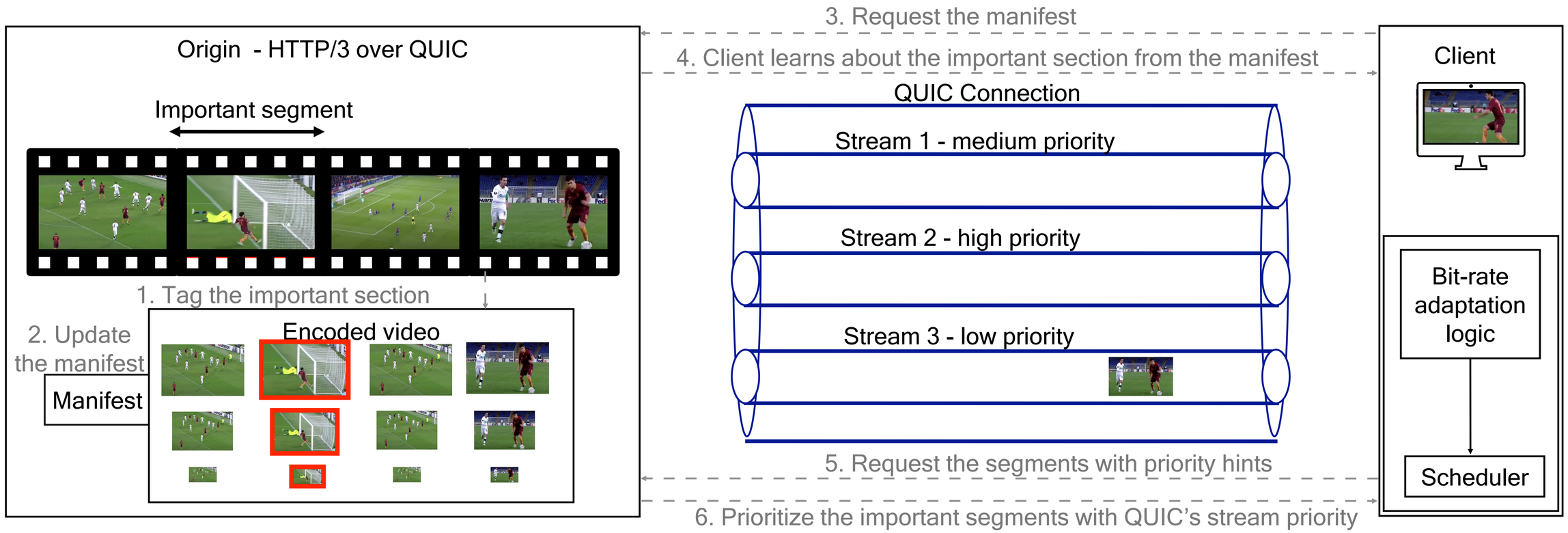

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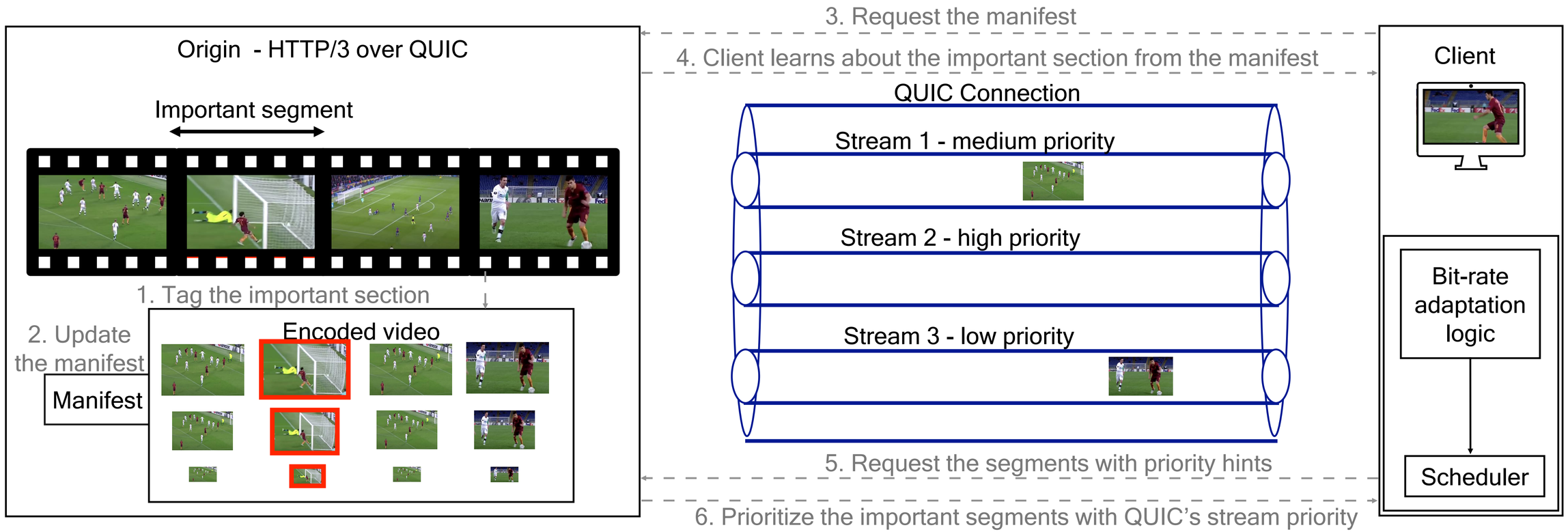

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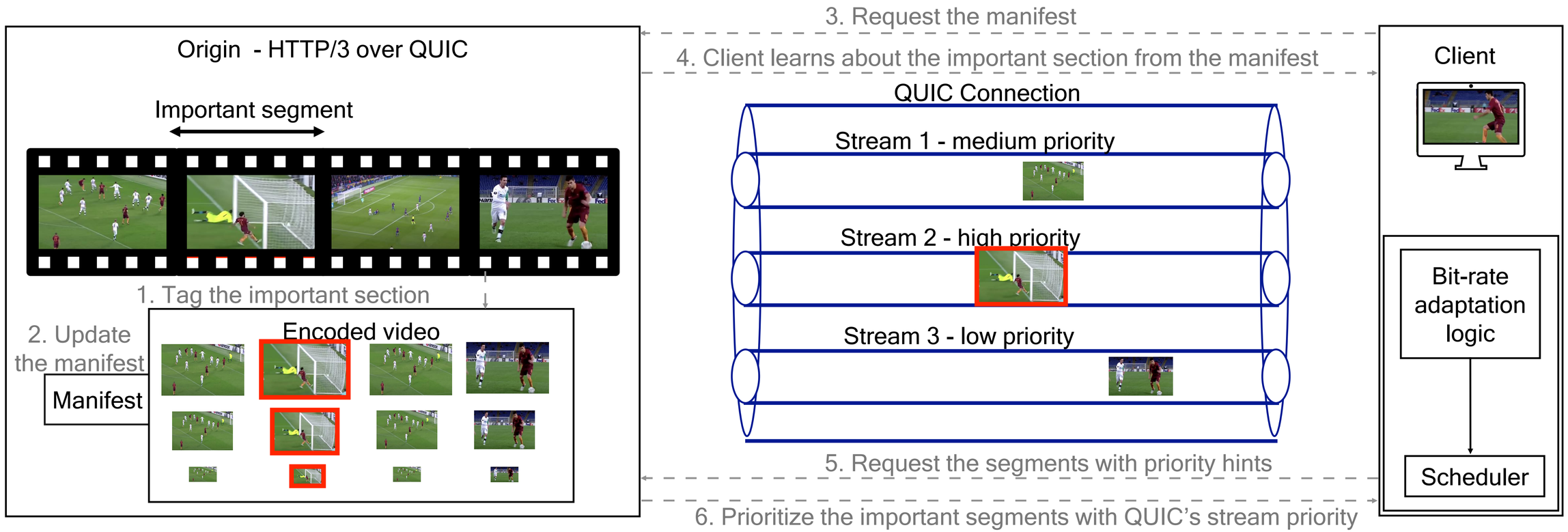

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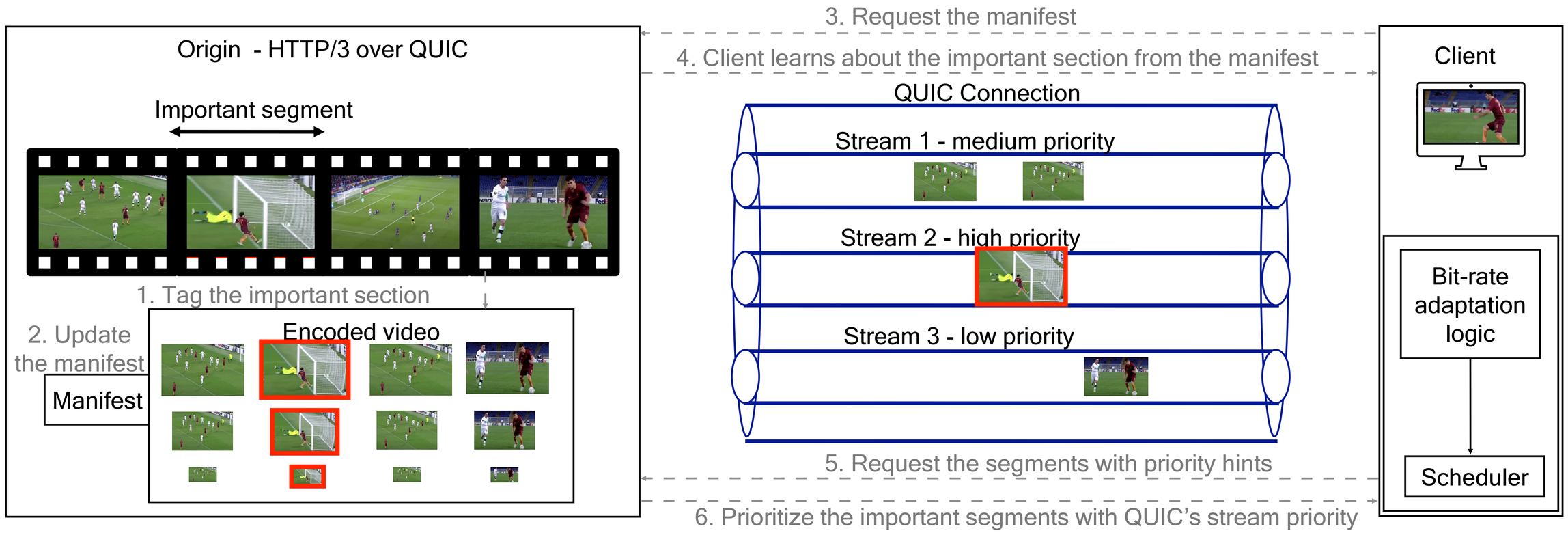

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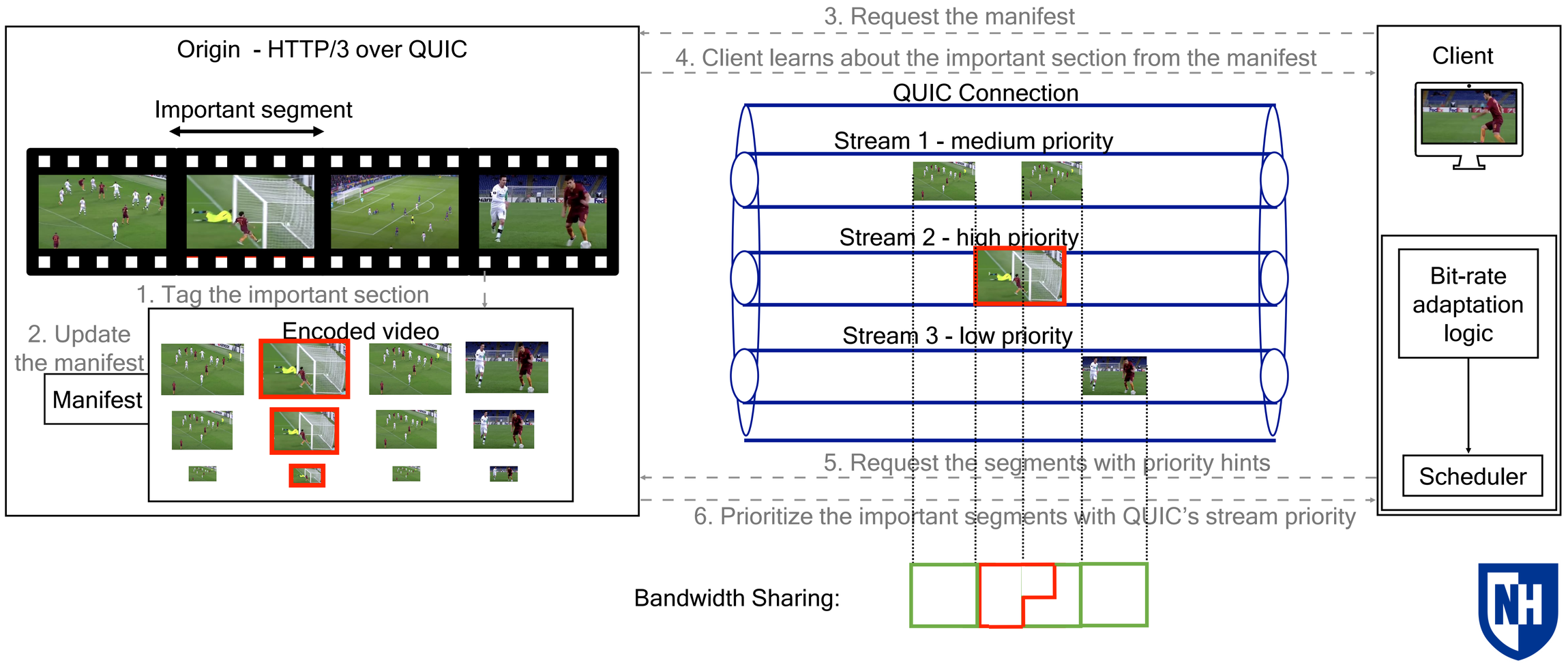

Contributions

(1) Make the client aware of the important segments

(2) Take advantage of QUIC’s stream priority while transmitting the important segments

(3) Modify the client-side to support the stream priority in QUIC

Future Work

- Integrate the proposed design with low latency algorithms
- Design an ABR algorithm to support the proposed design
- Extend to scenarios like - multiple clients, various combinations of prioritized segments
- Root cause analysis with Qlog and Qvis

THANK YOU