

# 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)

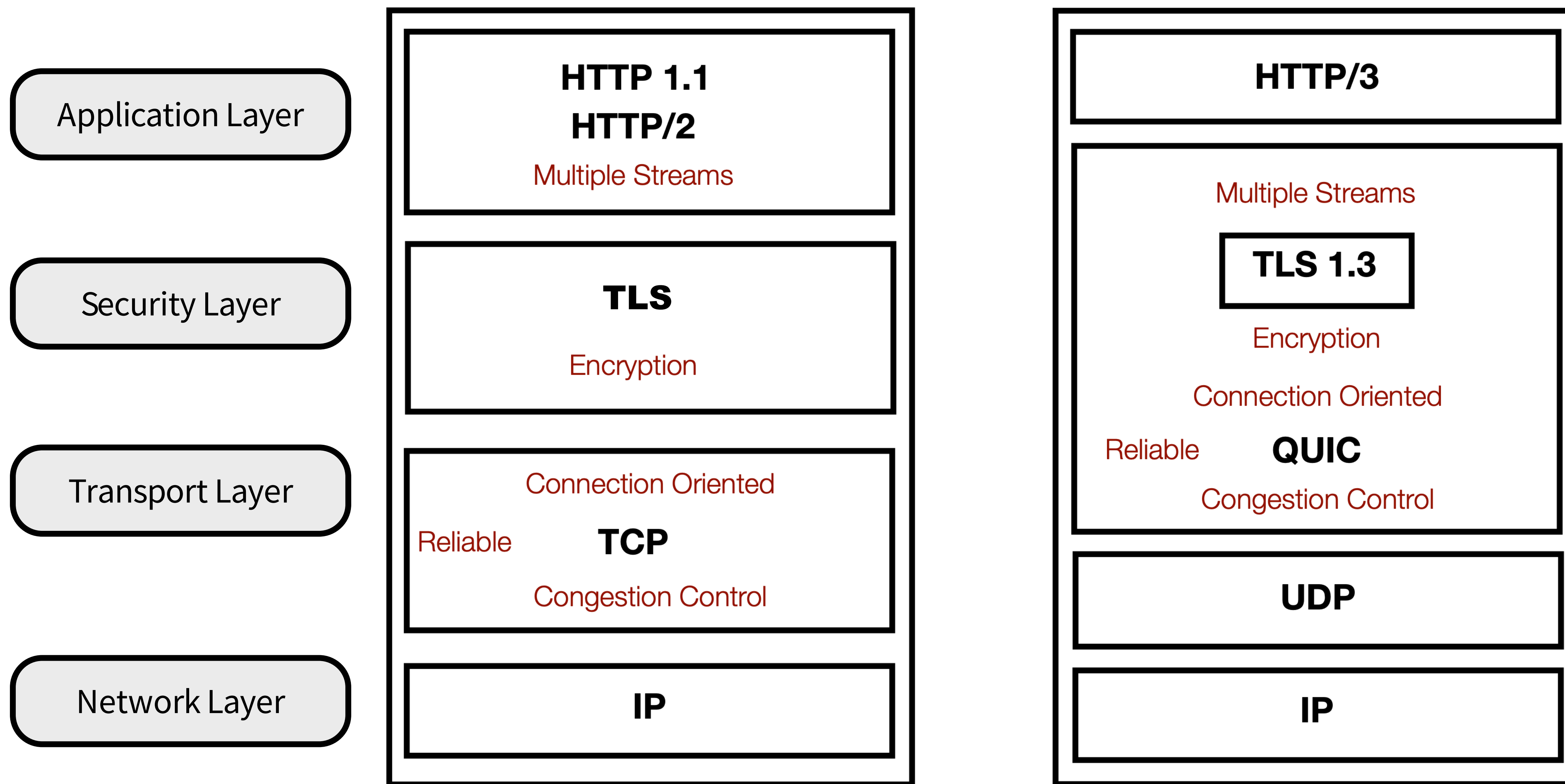
- RFC in 1981
- Transport over IP
- Single Connection
- HTTP streams
- 3 way handshake
- Stream of bytes as clear text

## 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

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- 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

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- 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

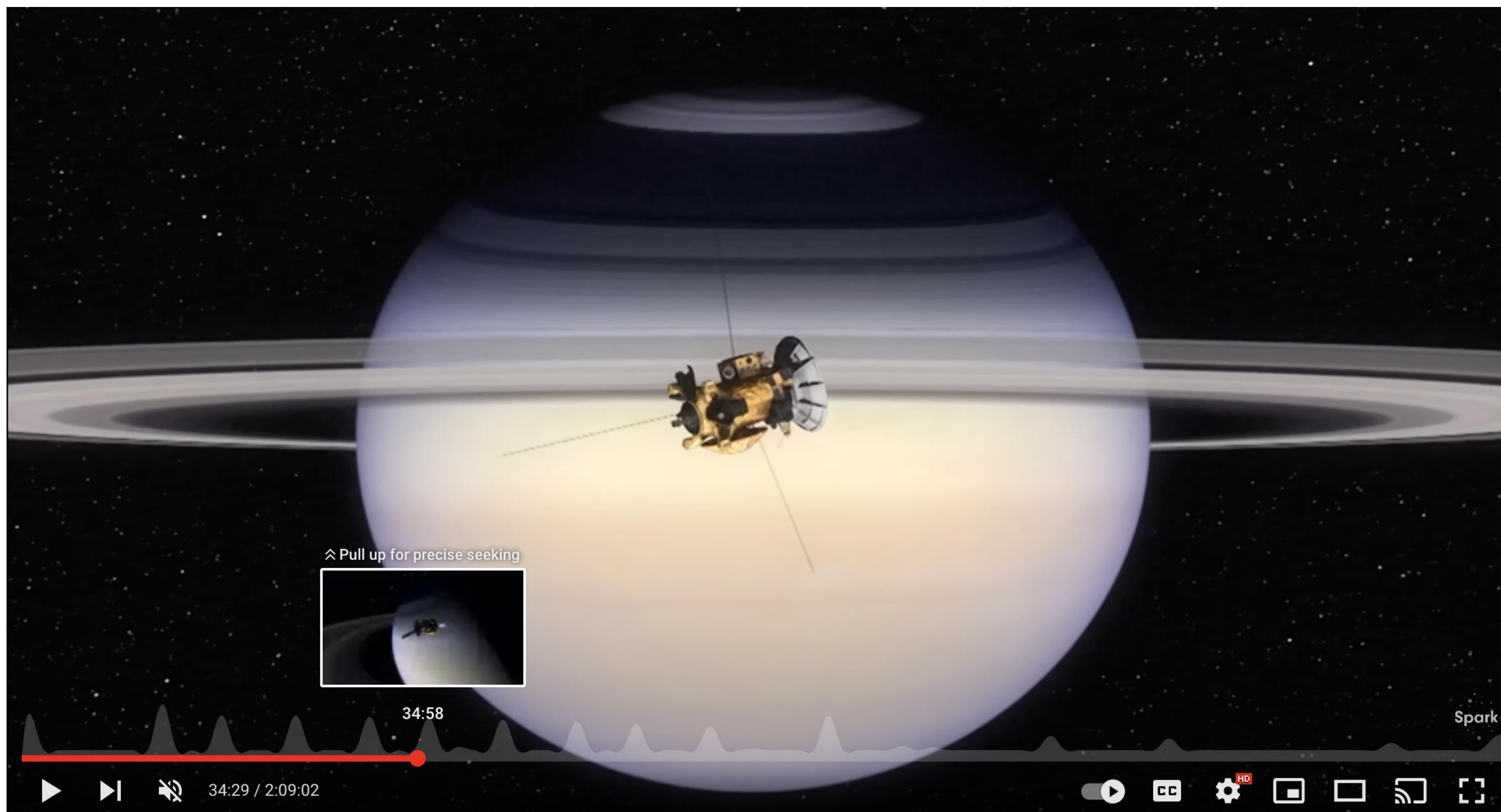
# Most replayed feature

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# Engagement graph

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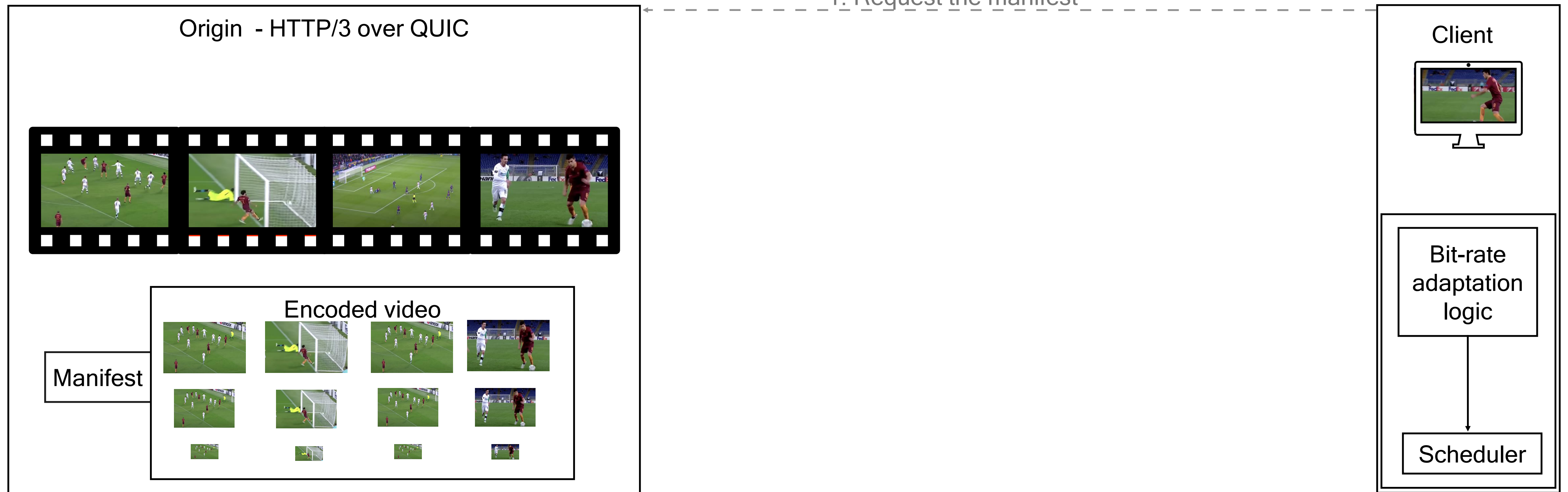


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# Sequential Behavior

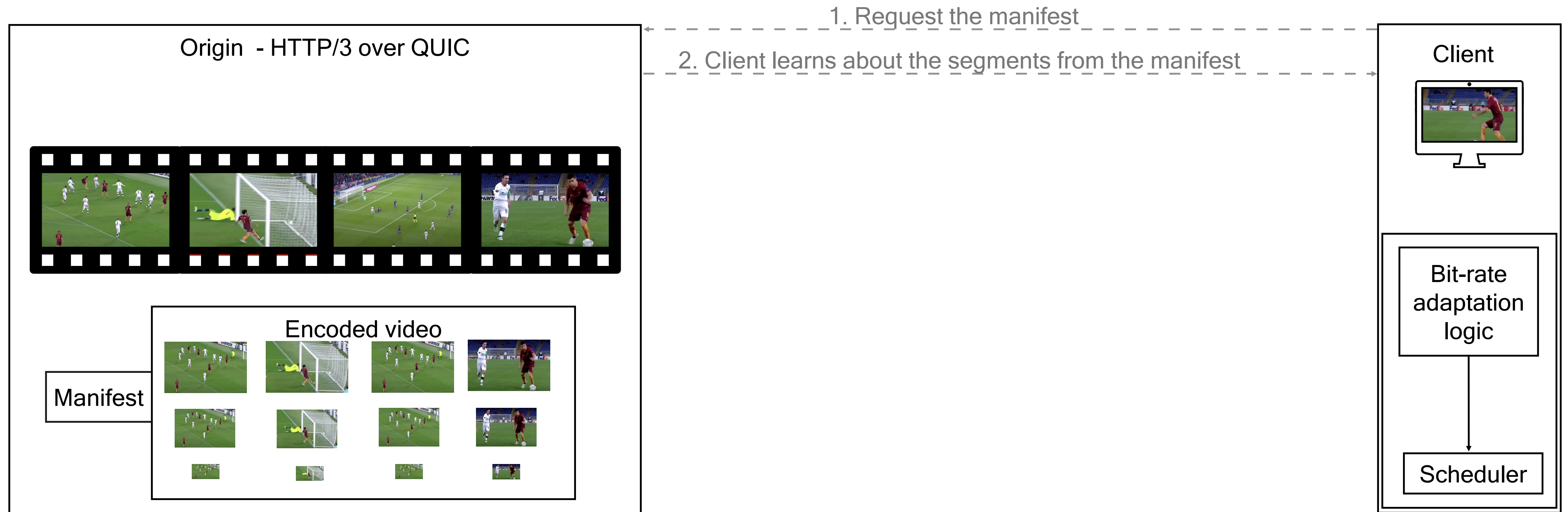
# Sequential Behavior

1. Request the manifest





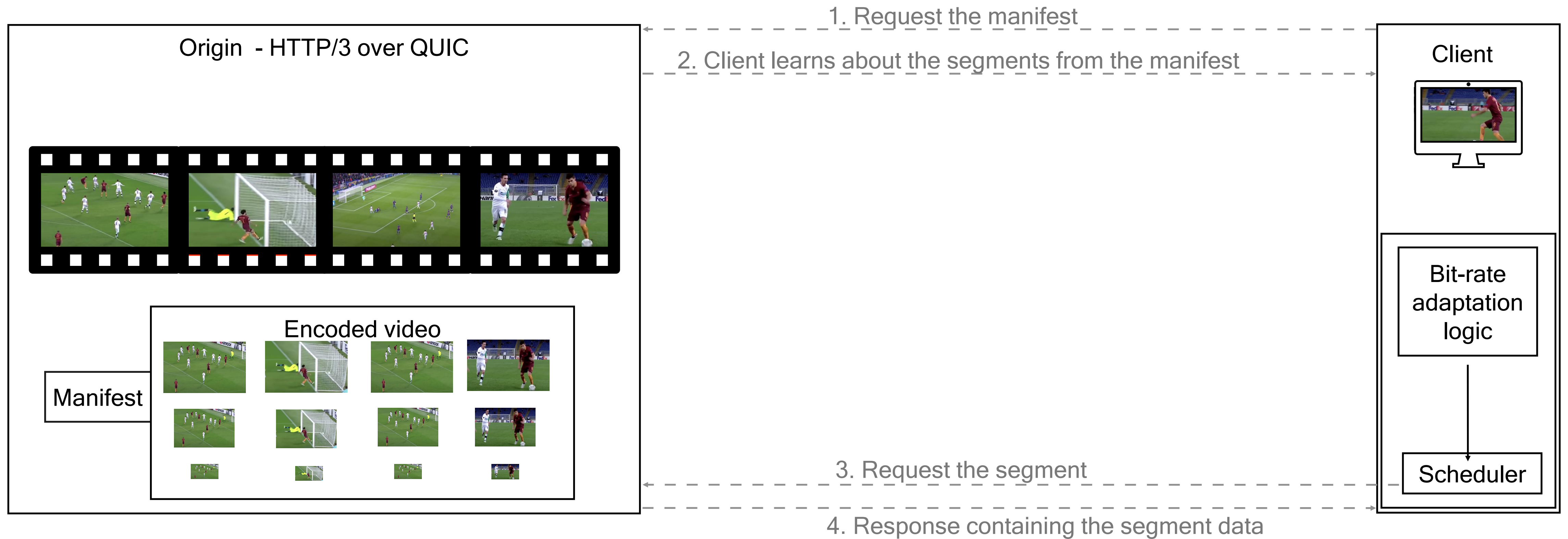
# Sequential Behavior



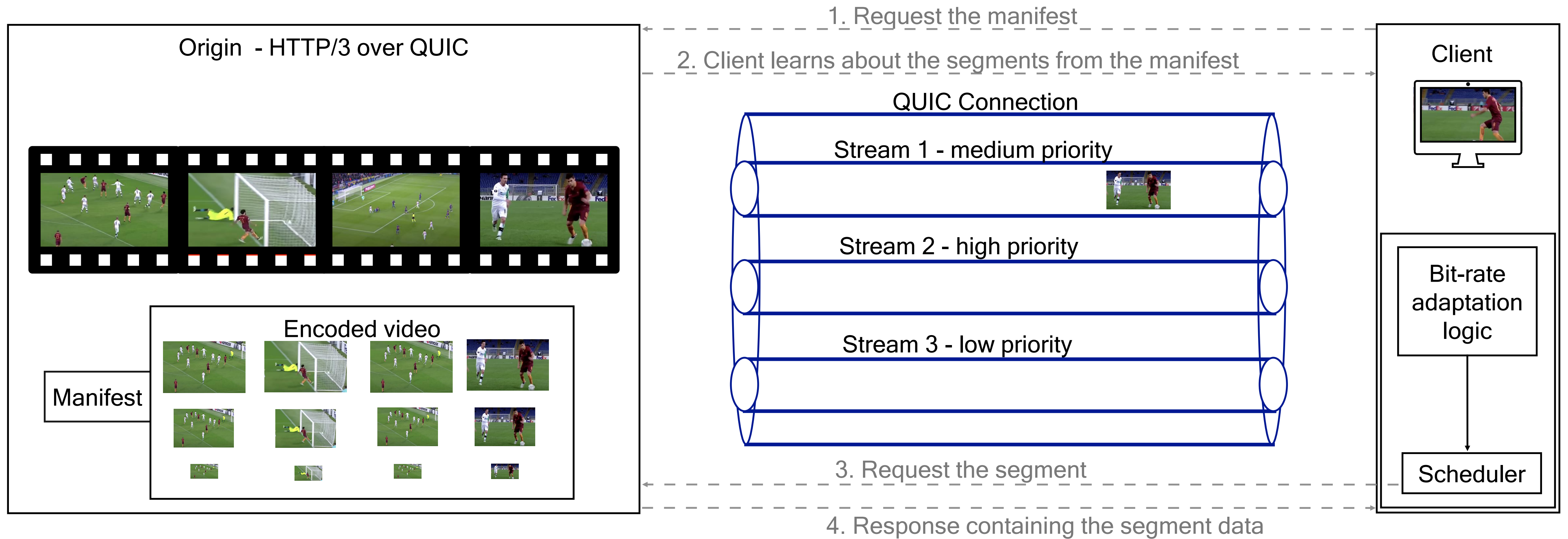
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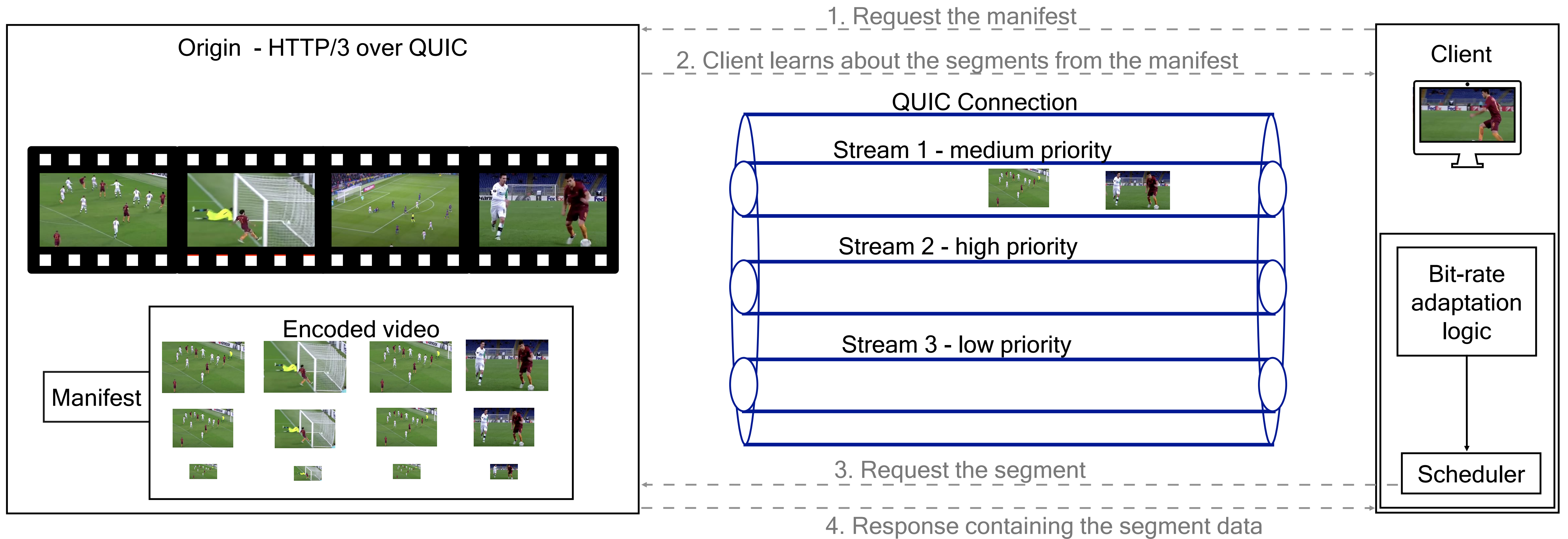


# Sequential Behavior



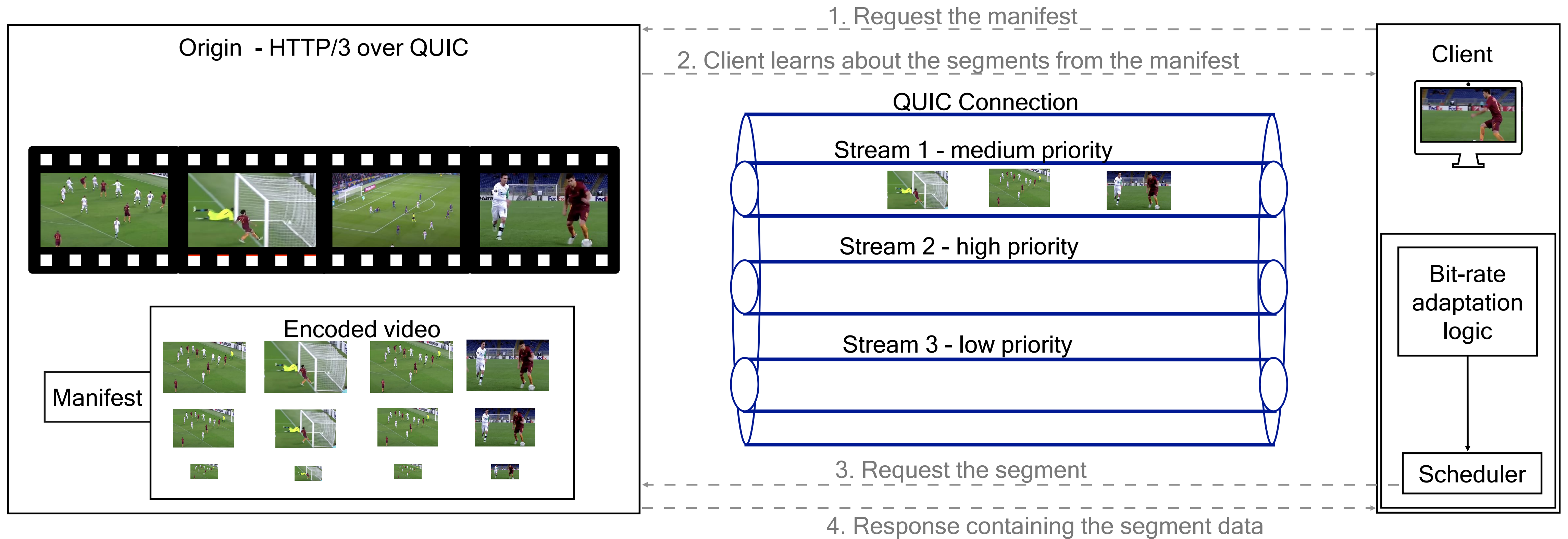


# Sequential Behavior

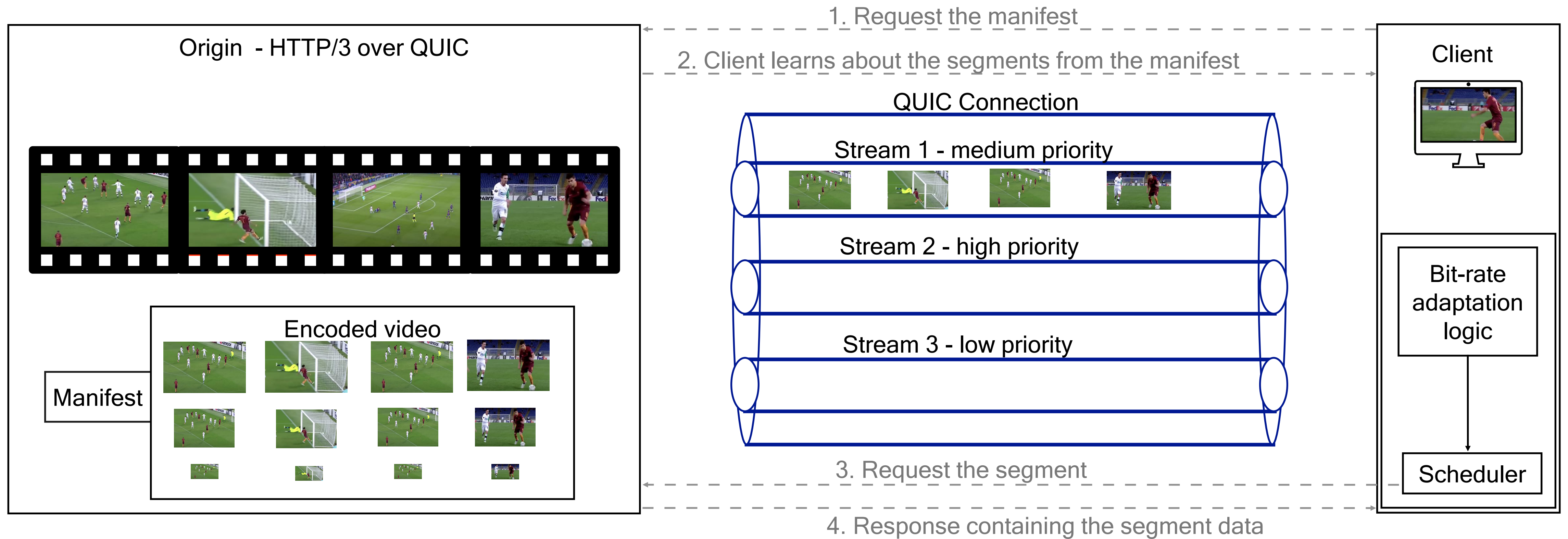




# Sequential Behavior



# Sequential Behavior



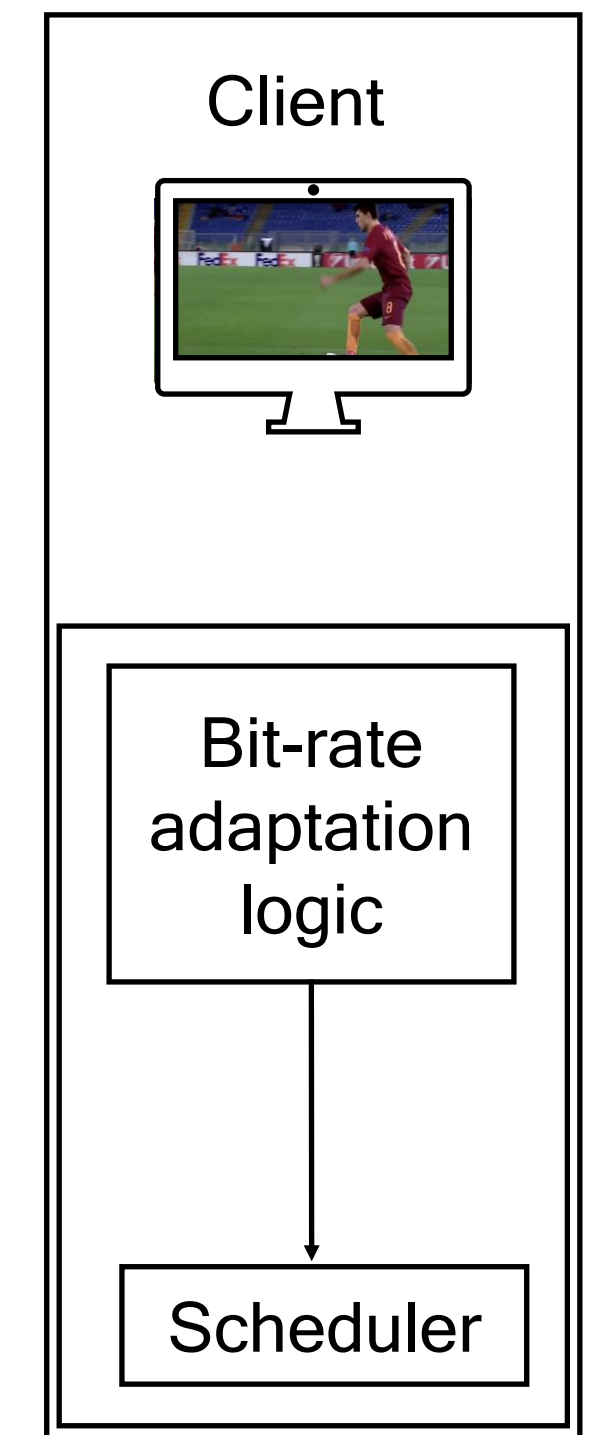
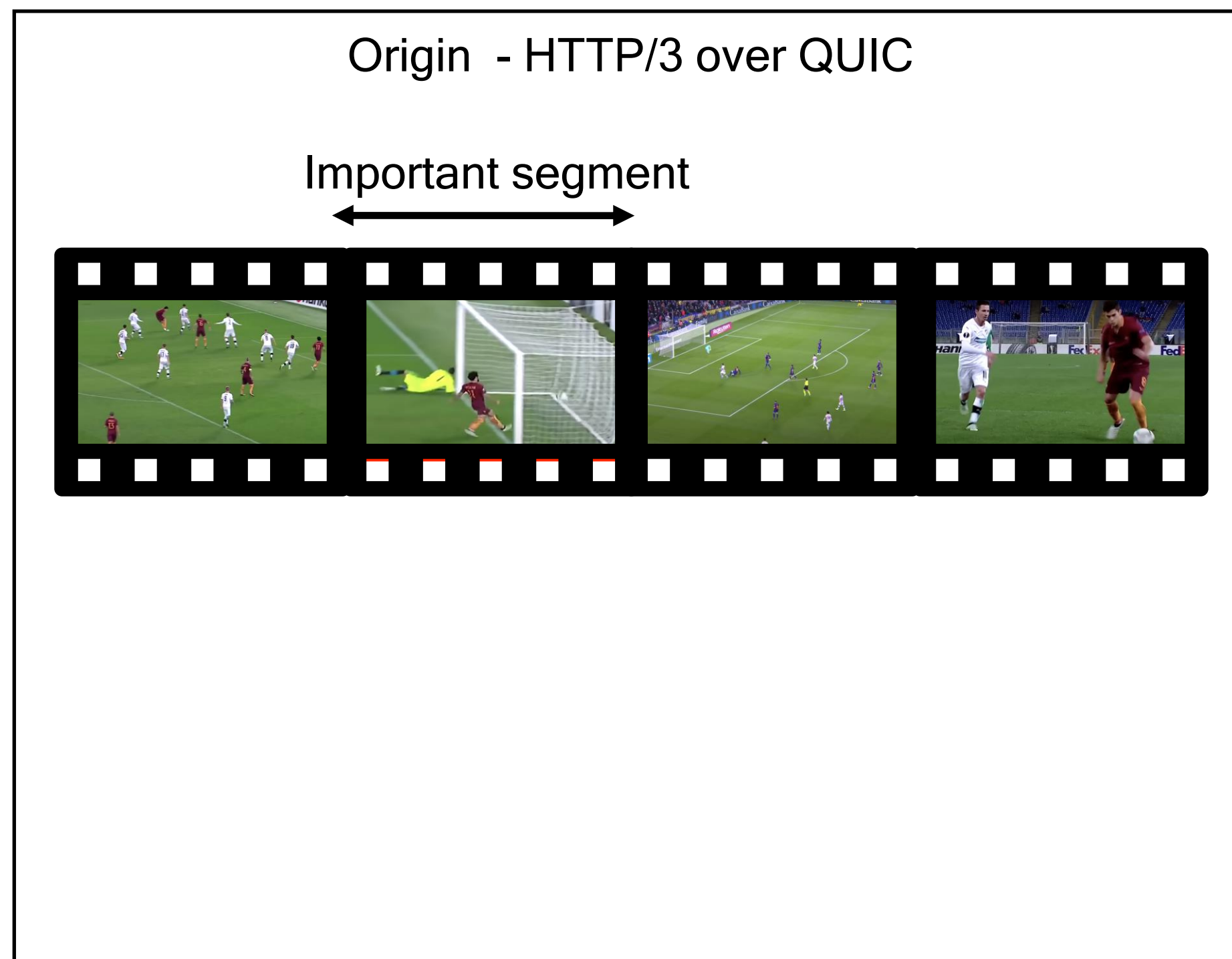


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# Proposed Design

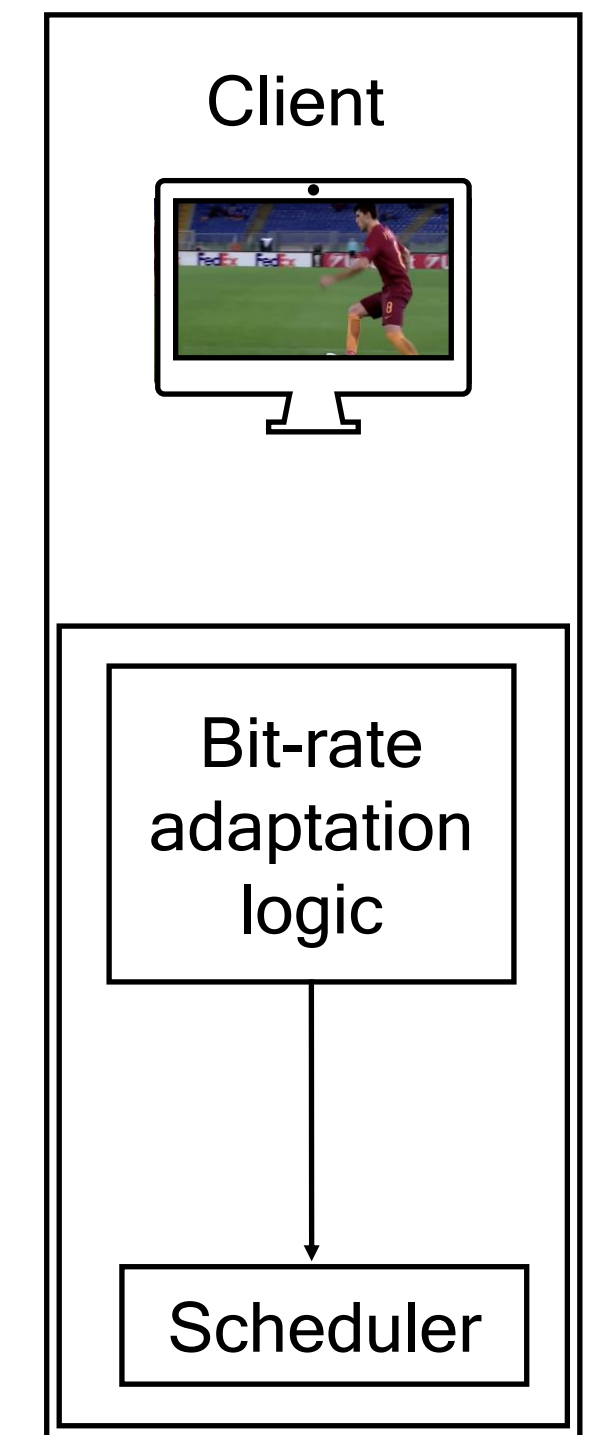
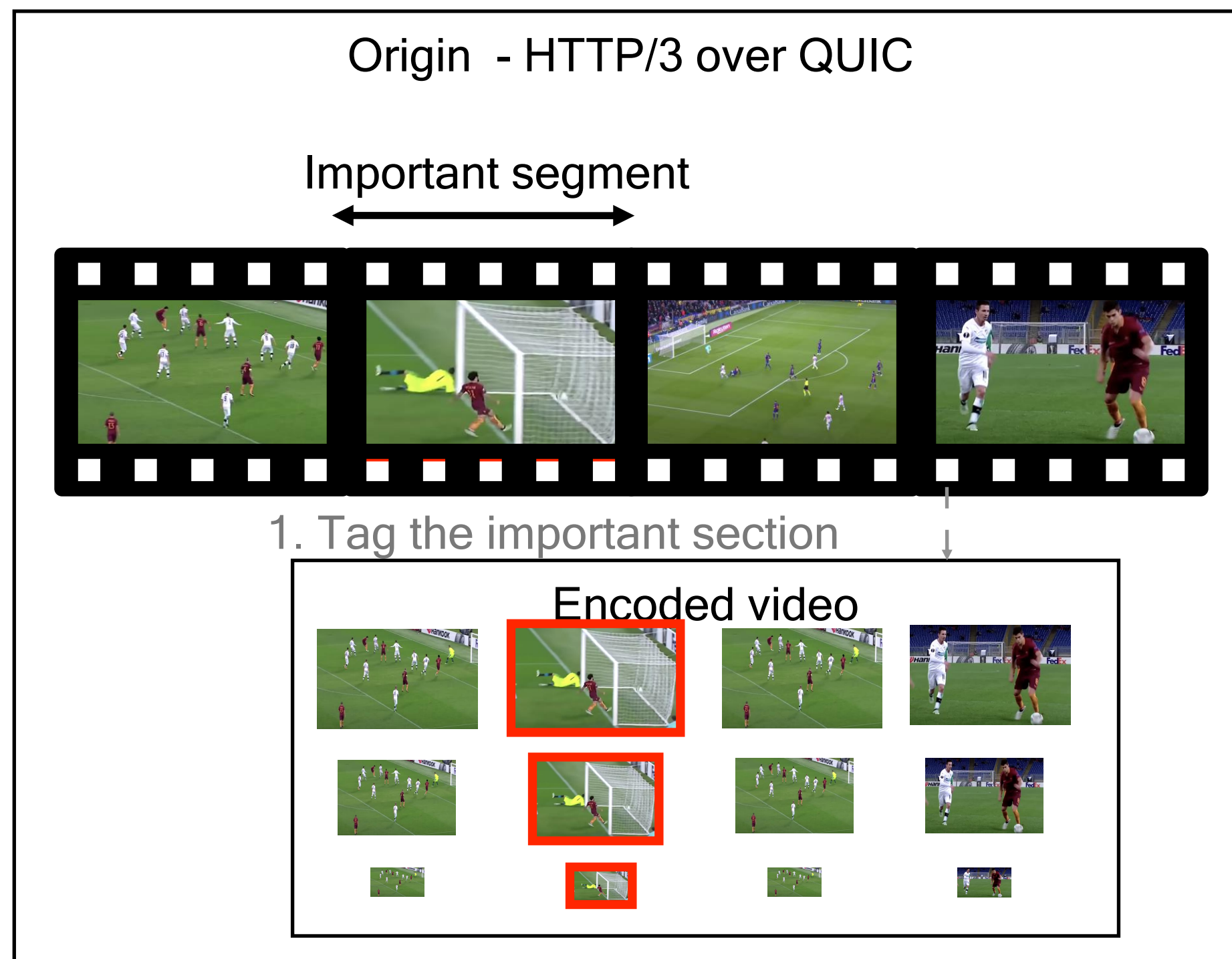
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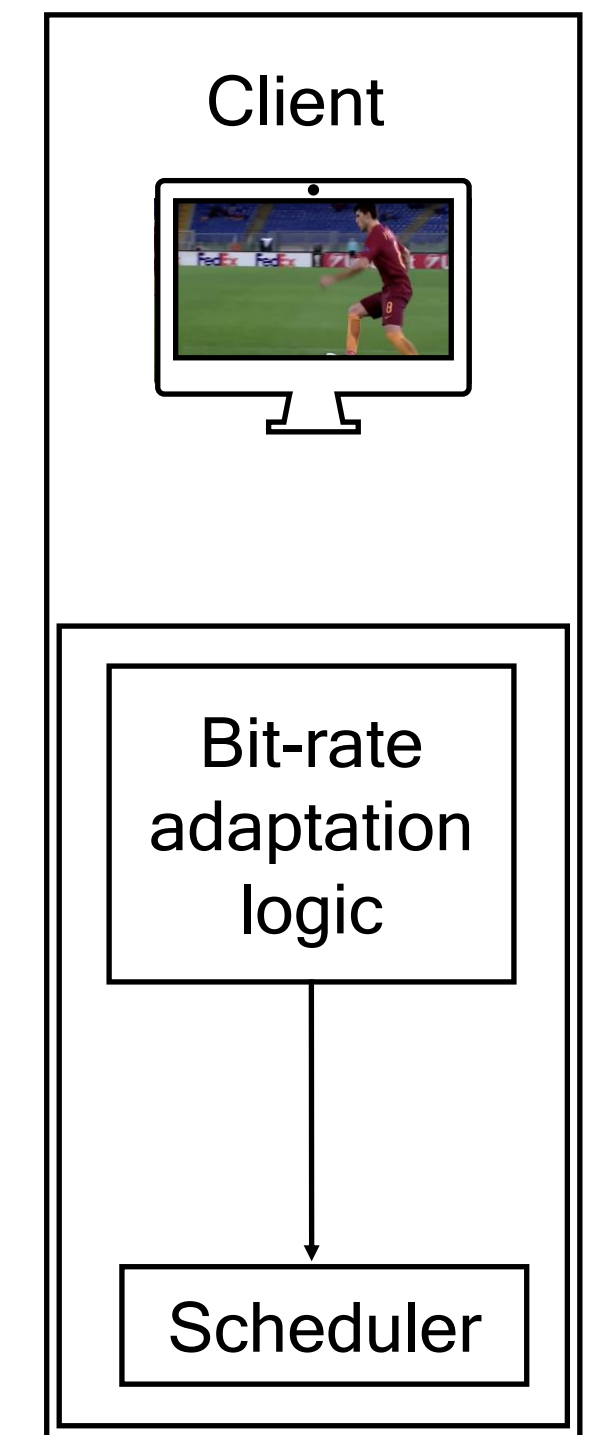
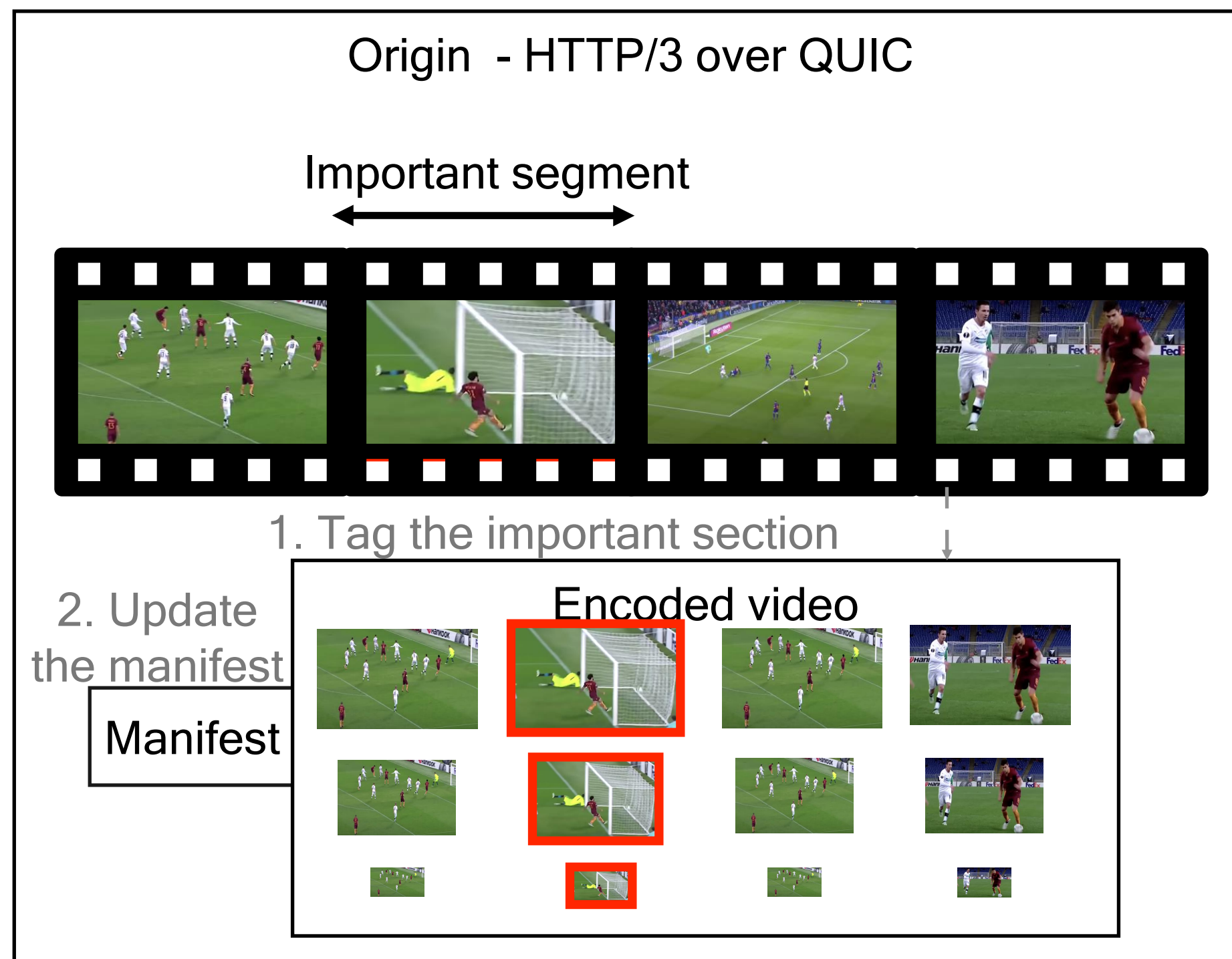


# Proposed Design





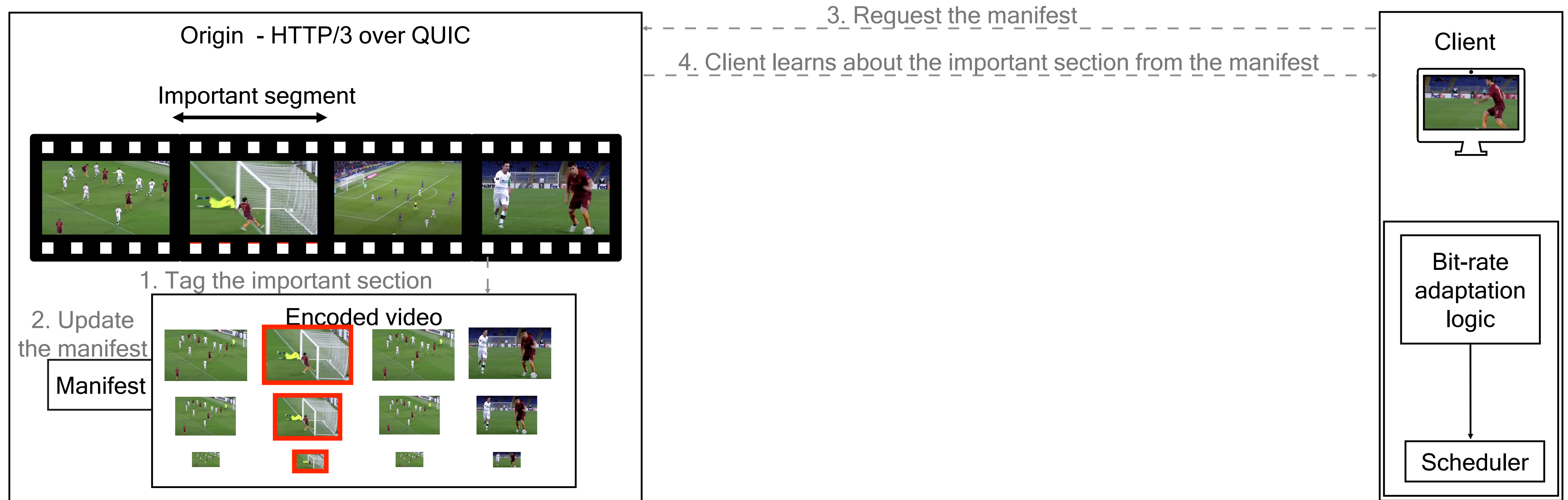
# Proposed Design



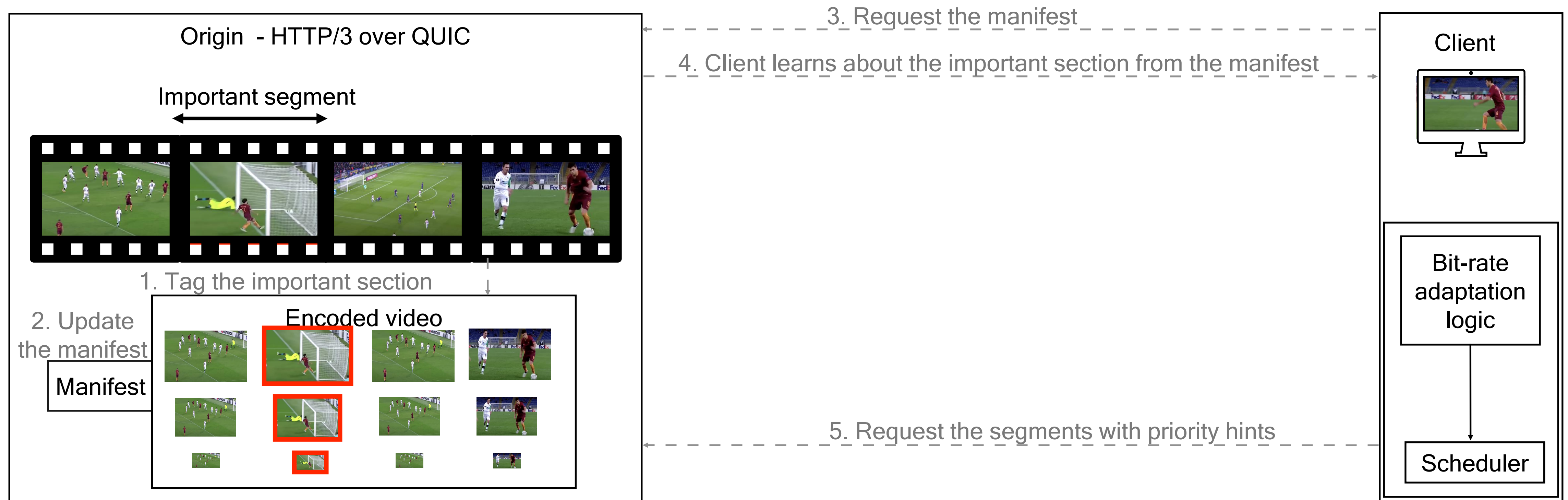
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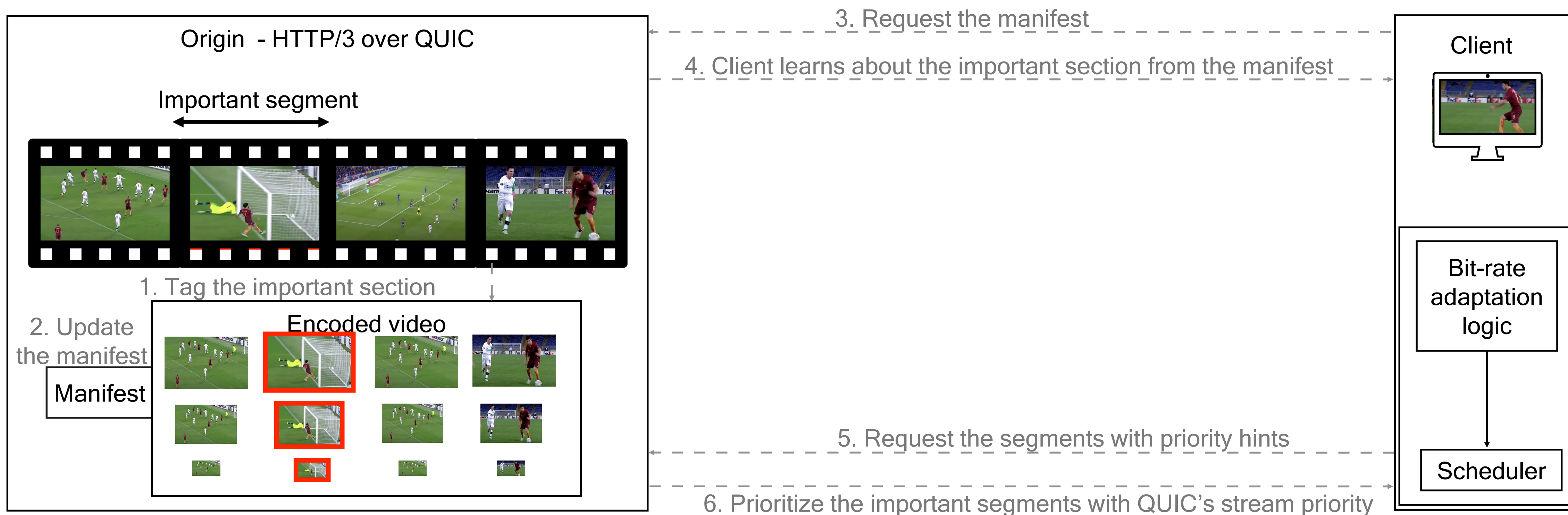


# Header with priorities

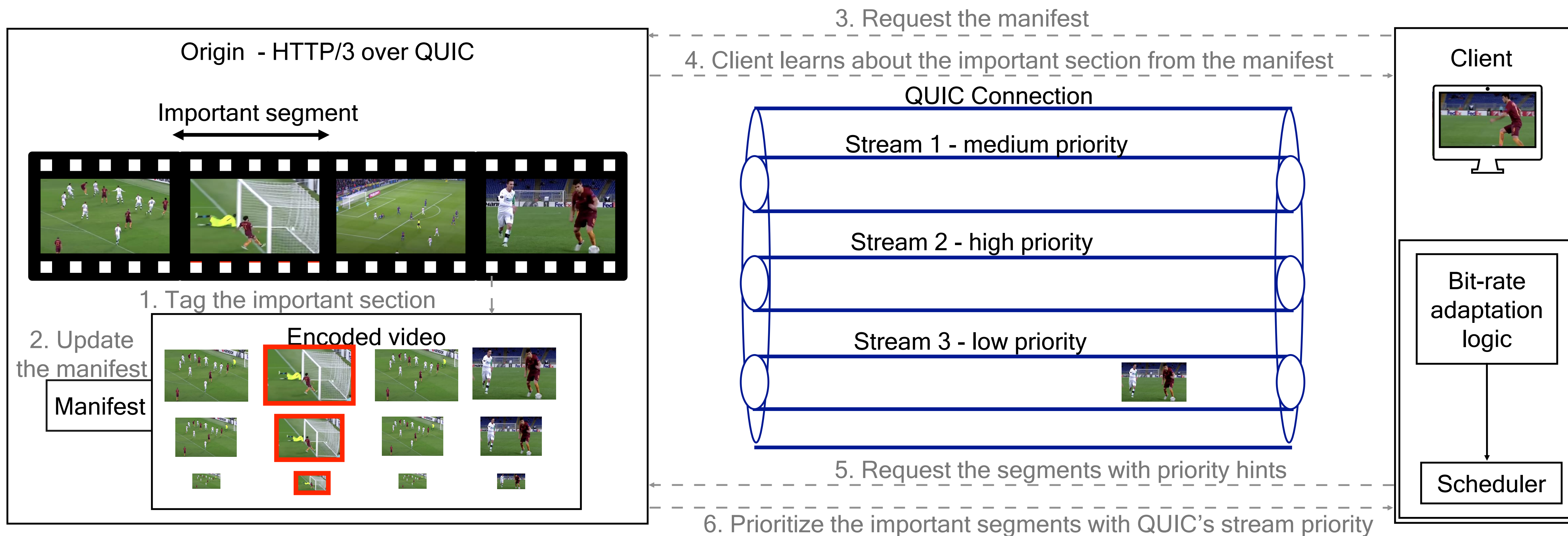
×	Headers	Preview	Response	Initiator	Timing
▼ General					
Request URL:	https://rb3.cs.unh.edu:4433/Trailer/chunk5-00006.m4s				
Request Method:	GET				
Status Code:	● 200				
Remote Address:	132.177.11.138:4433				
Referrer Policy:	strict-origin-when-cross-origin				
▼ Response Headers					
Content-Length:	1659096				
Priority:	u=1, i				
Server:	quiche				
▼ Request Headers					
:Authority:	rb3.cs.unh.edu:4433				
:Method:	GET				
:Path:	/Trailer/chunk5-00006.m4s				
:Scheme:	https				
Accept:	/*/*				
Accept-Encoding:	gzip, deflate, br				
Accept-Language:	en-US,en;q=0.9				
Cache-Control:	no-cache				
Pragma:	no-cache				
Priority:	u=0, i				
Referer:	https://rb3.cs.unh.edu:4433/				
Sec-Ch-Ua:	"Not(A)Brand";v="99", "Google Chrome";v="115", "Chromium";v="115"				
Sec-Ch-Ua-Mobile:	?0				
Sec-Ch-Ua-Platform:	"macOS"				
Sec-Fetch-Dest:	empty				
Sec-Fetch-Mode:	cors				



# Proposed Design

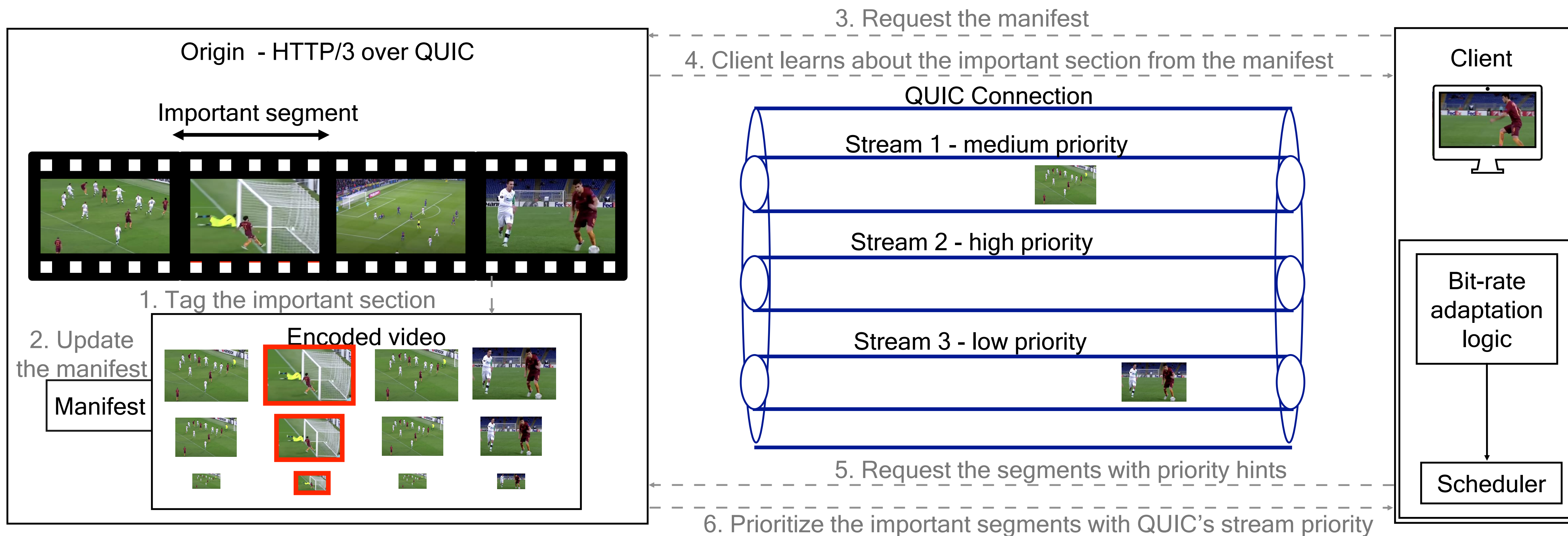


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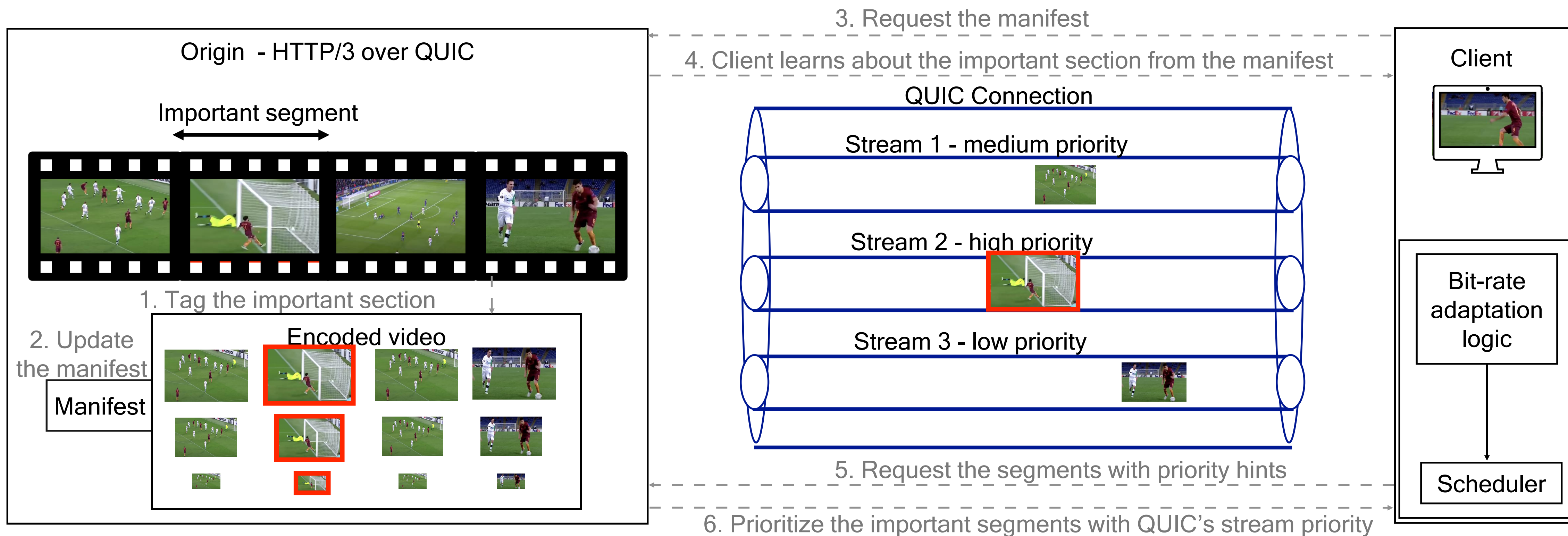


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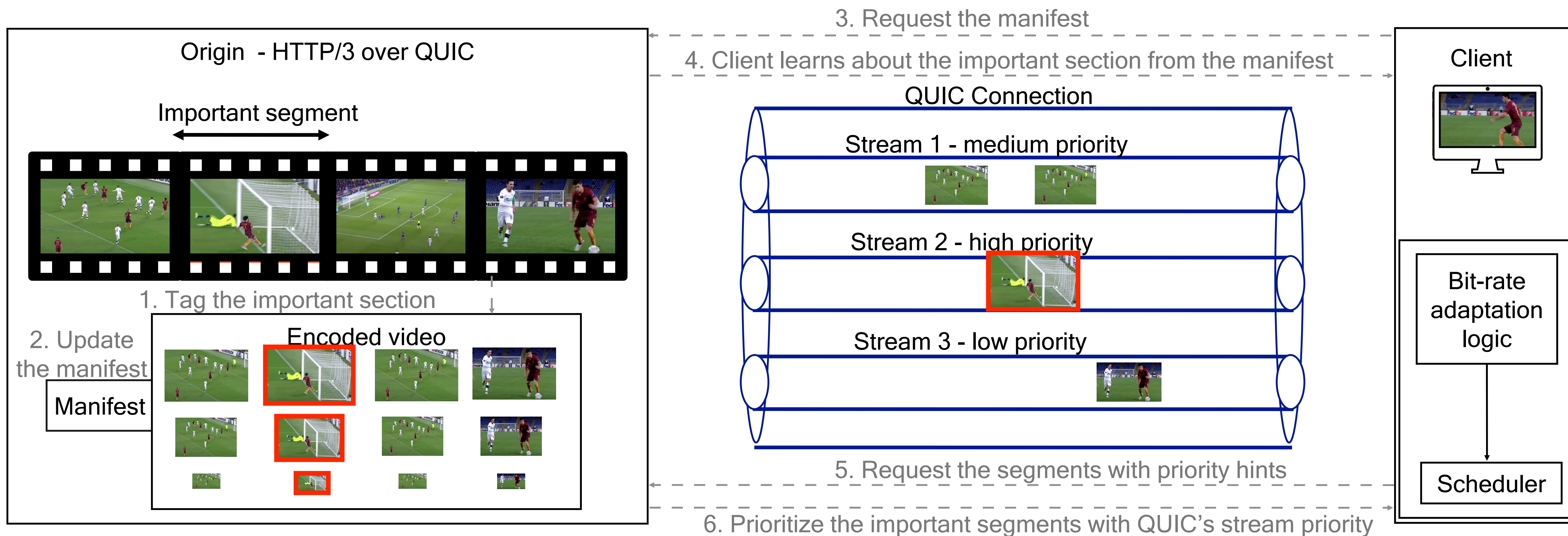




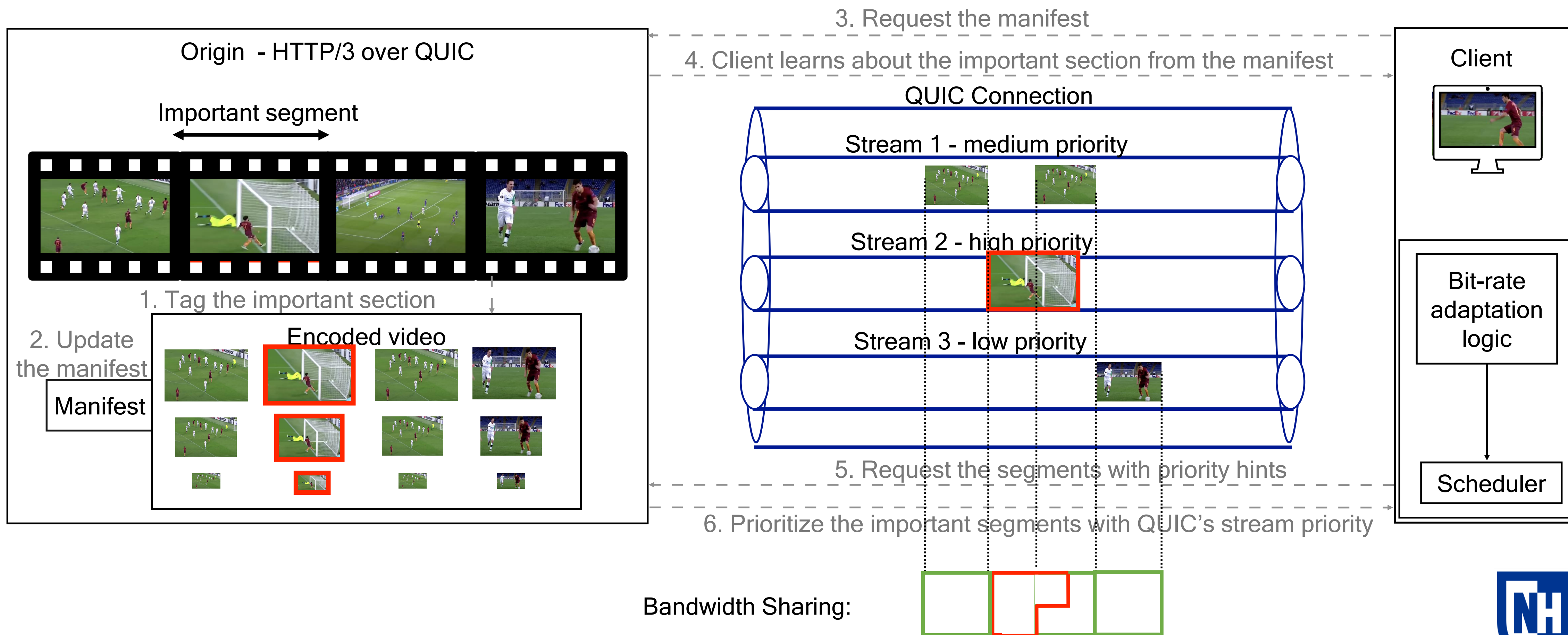
# Proposed Design



# Proposed Design



# Proposed Design





# Contributions

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- (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

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- 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



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**THANK YOU**

