ALPHAS and ARTEMIS: Adaptive Bitrate Ladders for Live Video Streaming

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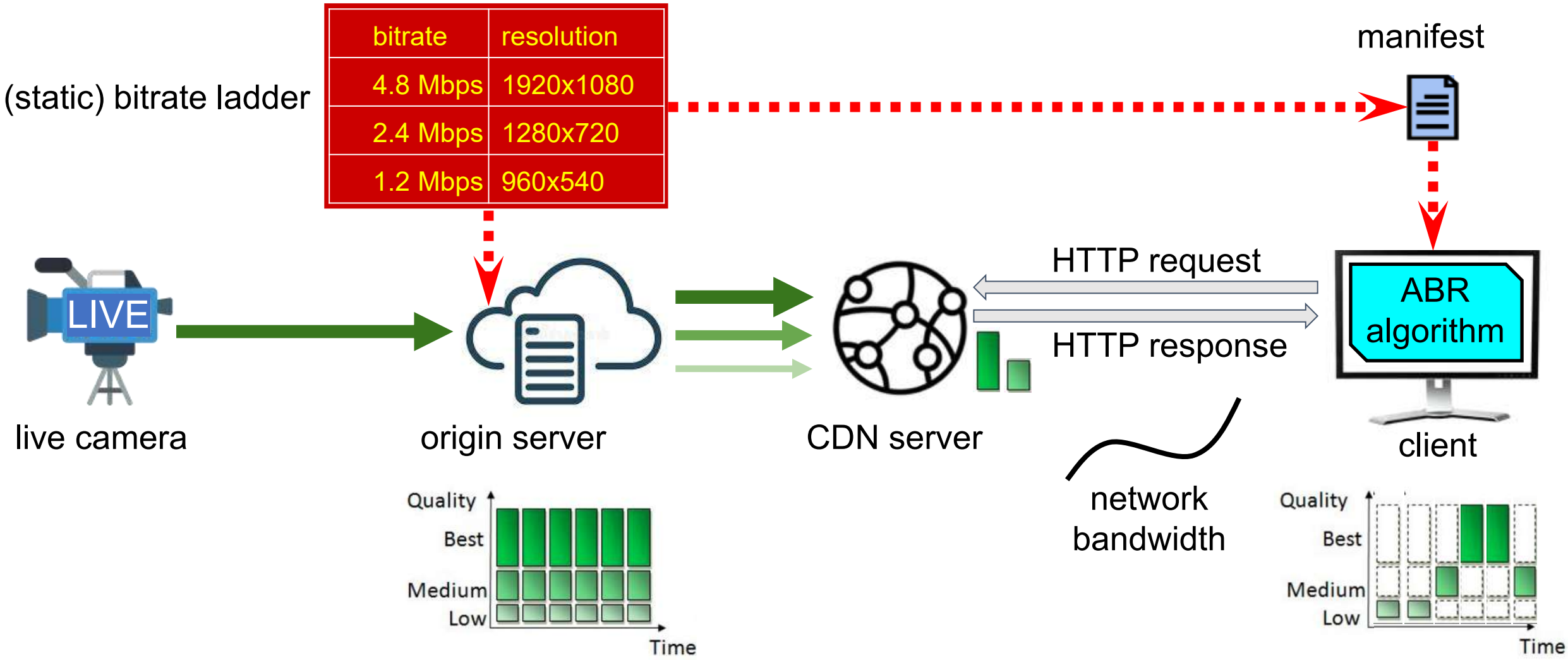
Live Video Streaming Pipeline



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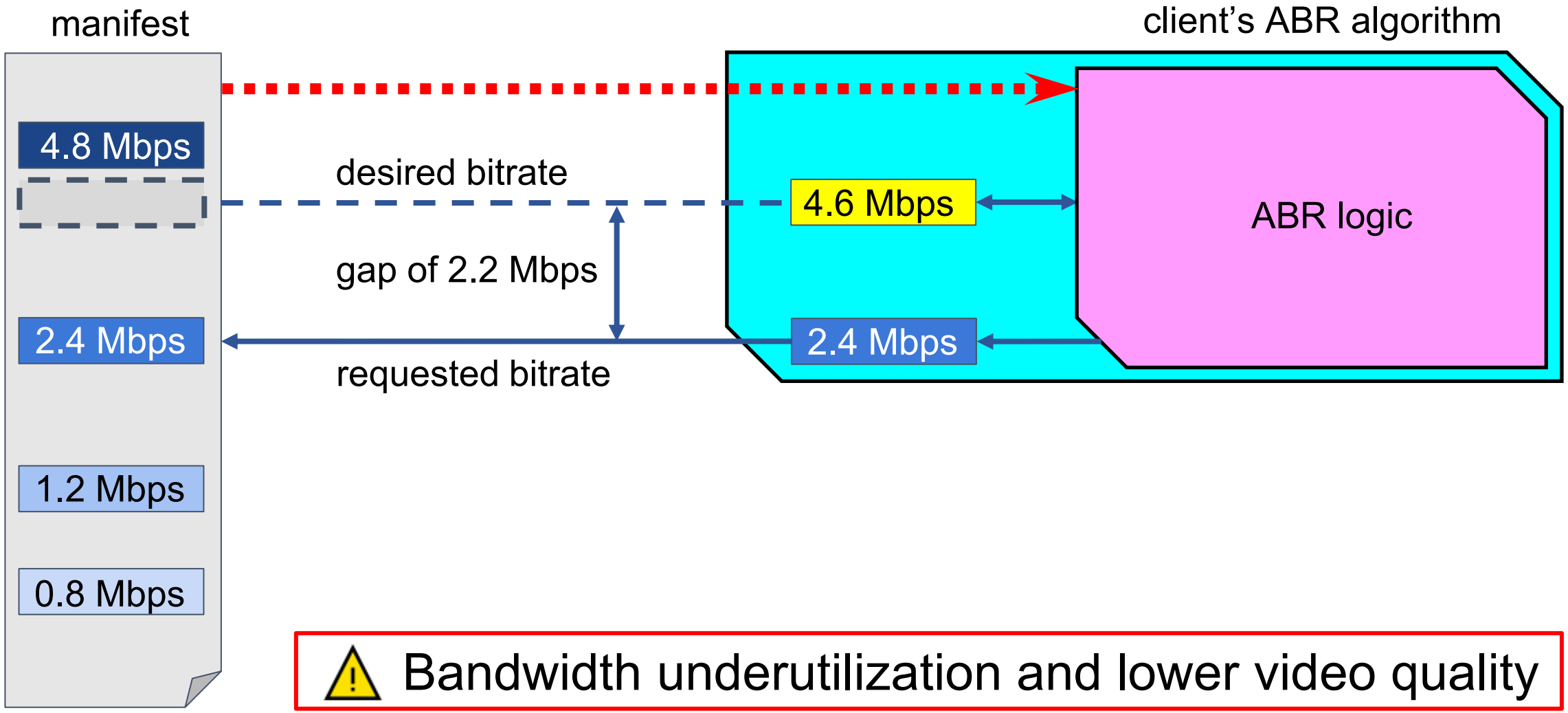
Desired Bitrate Falls between Available Ones



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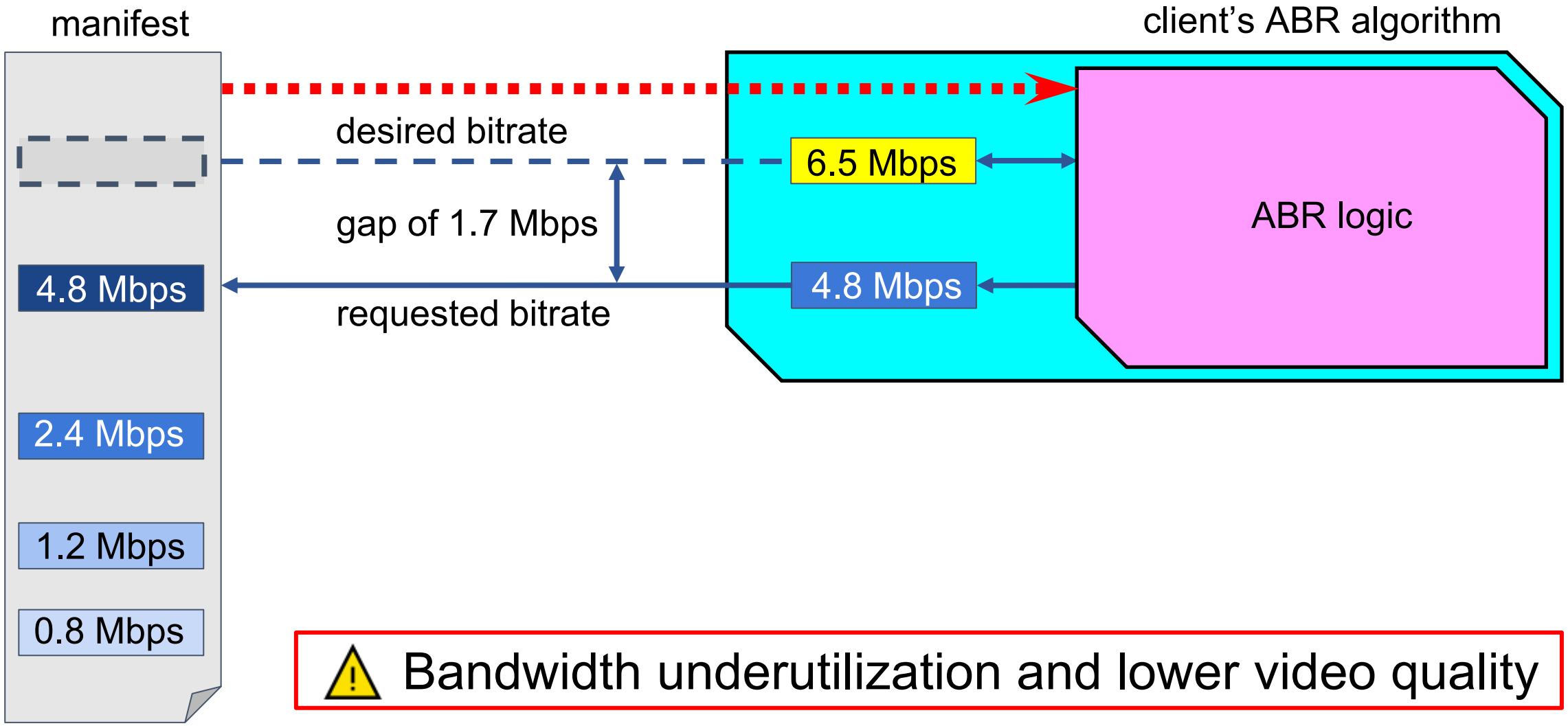
Highest Bitrate Might be Too Low



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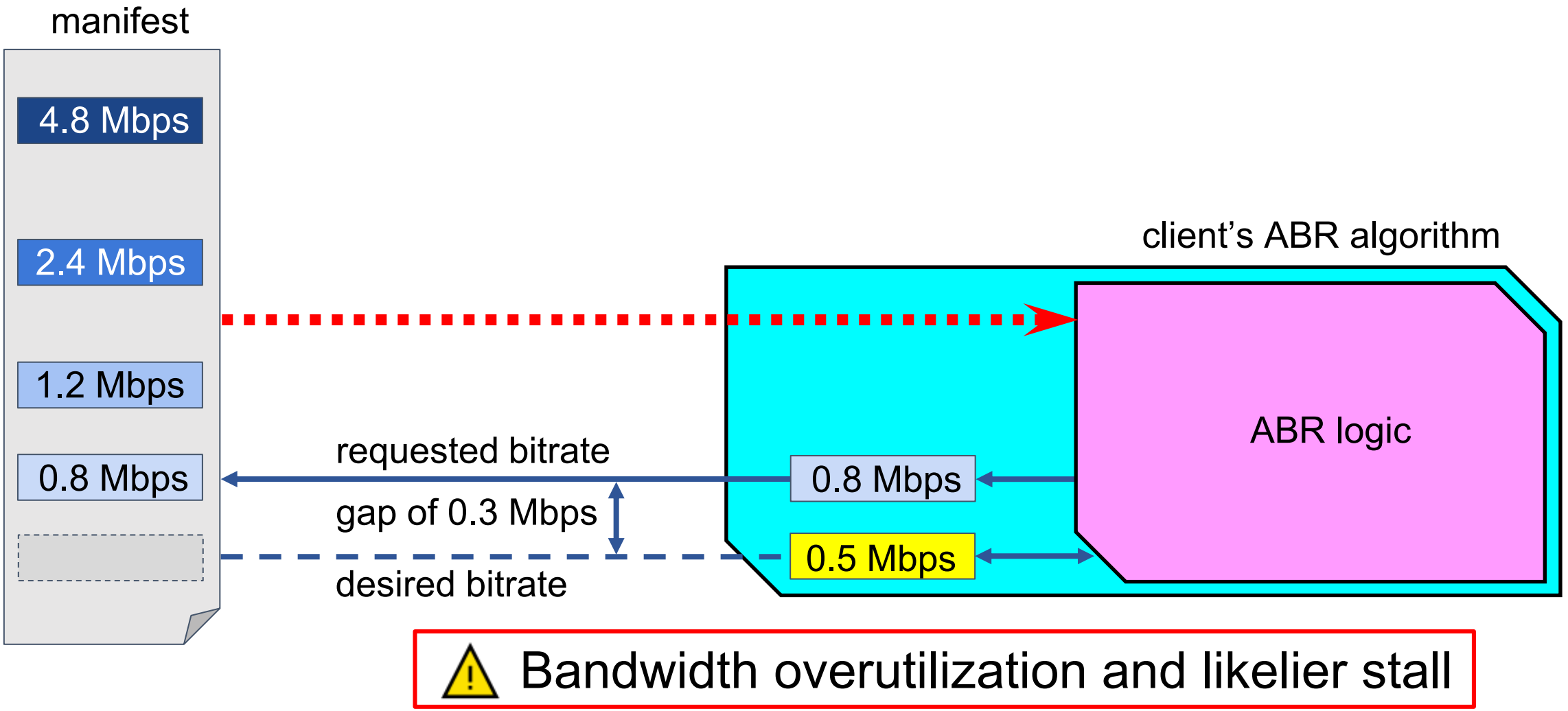
Lowest Bitrate Might be Too High



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First, There Was ARTEMIS

ℹ️ Adaptive bitrate ladder optimization for live video streaming

✅ Advertisement of many representations via a mega-manifest

→ to solicit clients' fine-grained bitrate requests

→ agnostic of clients' ABR logic

✅ CDN-aggregated feedback on bitrates and stalls

→ from clients to CDN edge servers via CMCD-compliant HTTP requests

→ from the CDN to ARTEMIS server via CDN logs

✅ Dynamic configuration of the bitrate ladder

→ from a small subset of the mega-manifest representations

→ also accounting for video quality via PSNR

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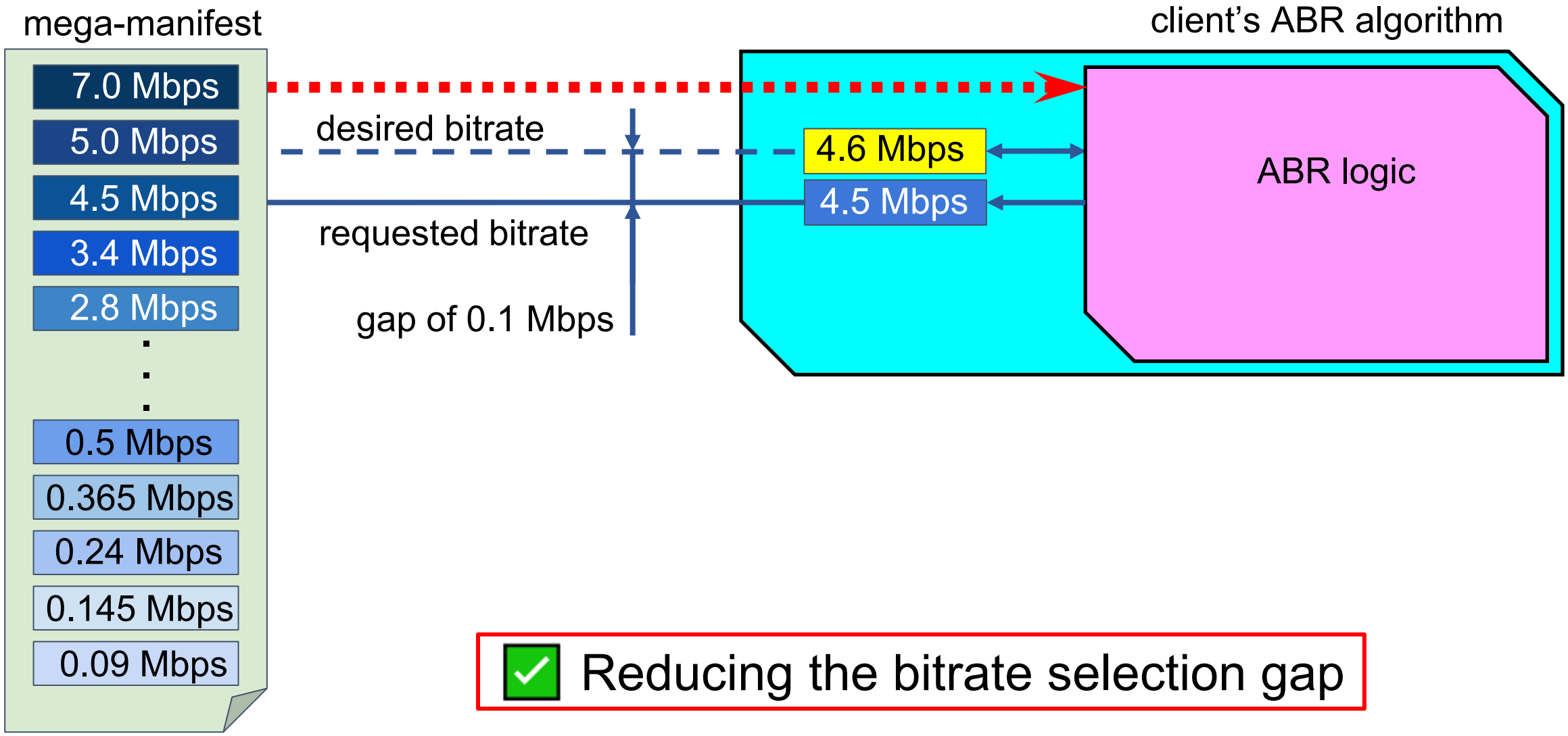
Mega-Manifest for Better Bitrate Alignment



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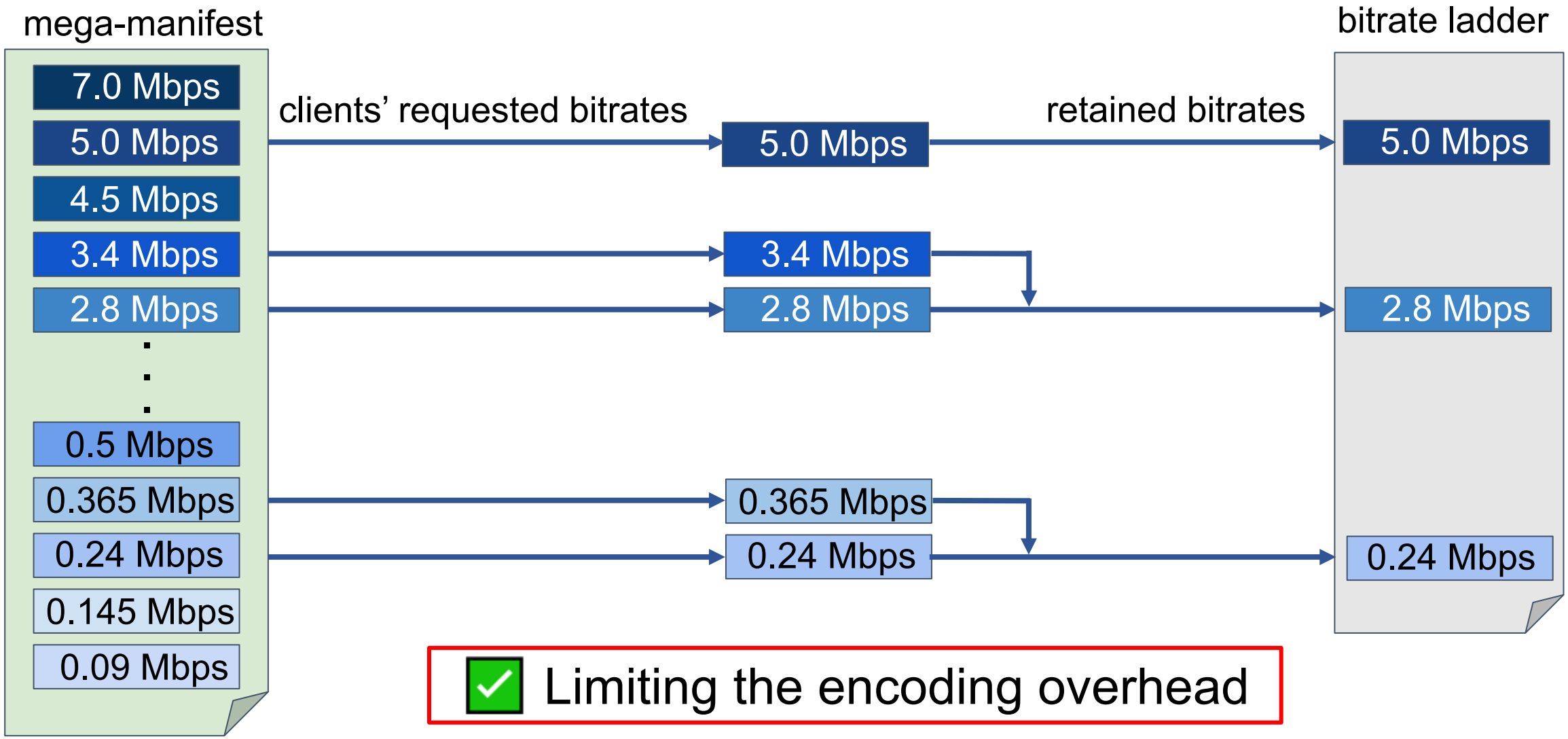
Configuring a Bitrate Ladder



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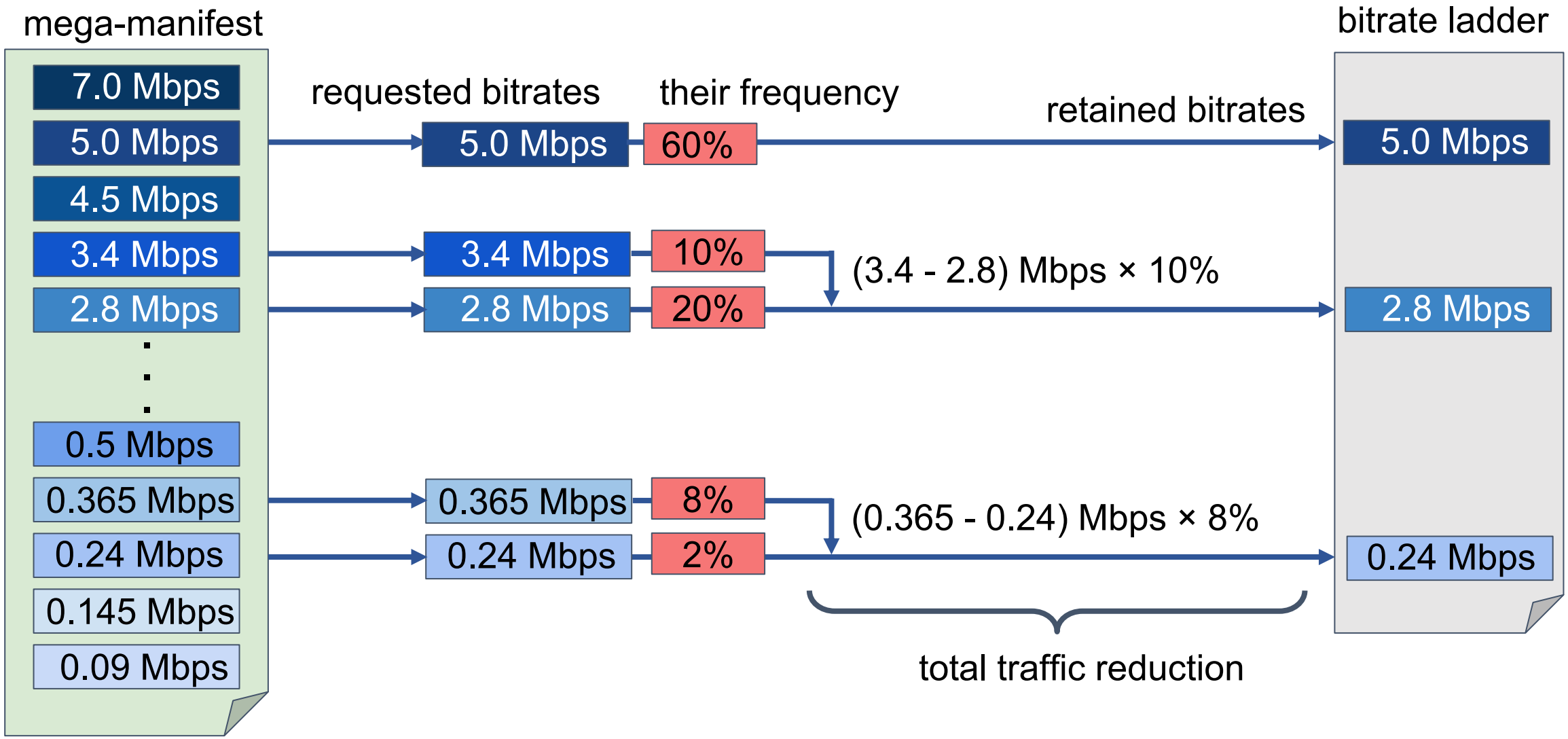
Traffic Reduction with the Shorter Ladder



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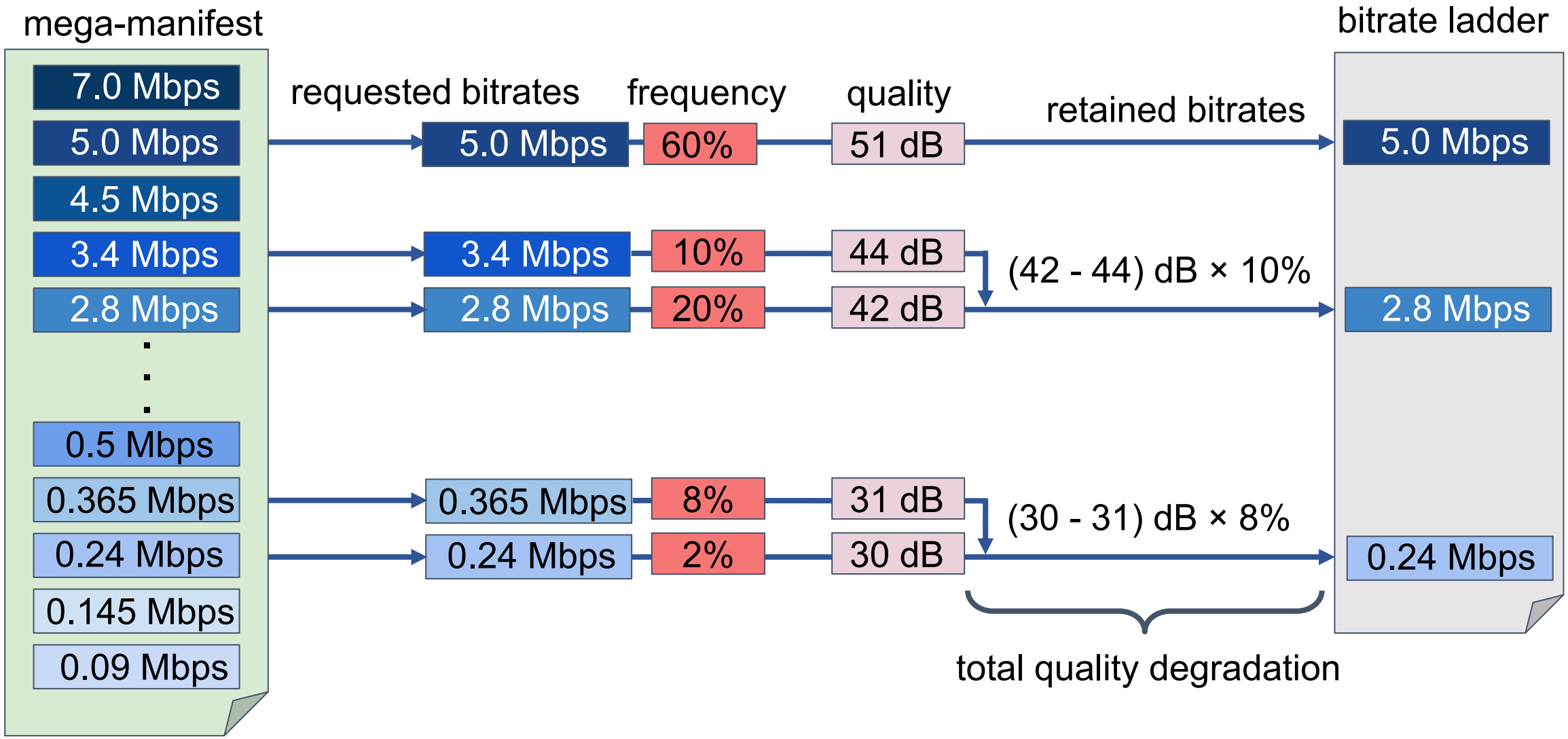
Stall-Sensitive Balancing of Traffic vs. Quality



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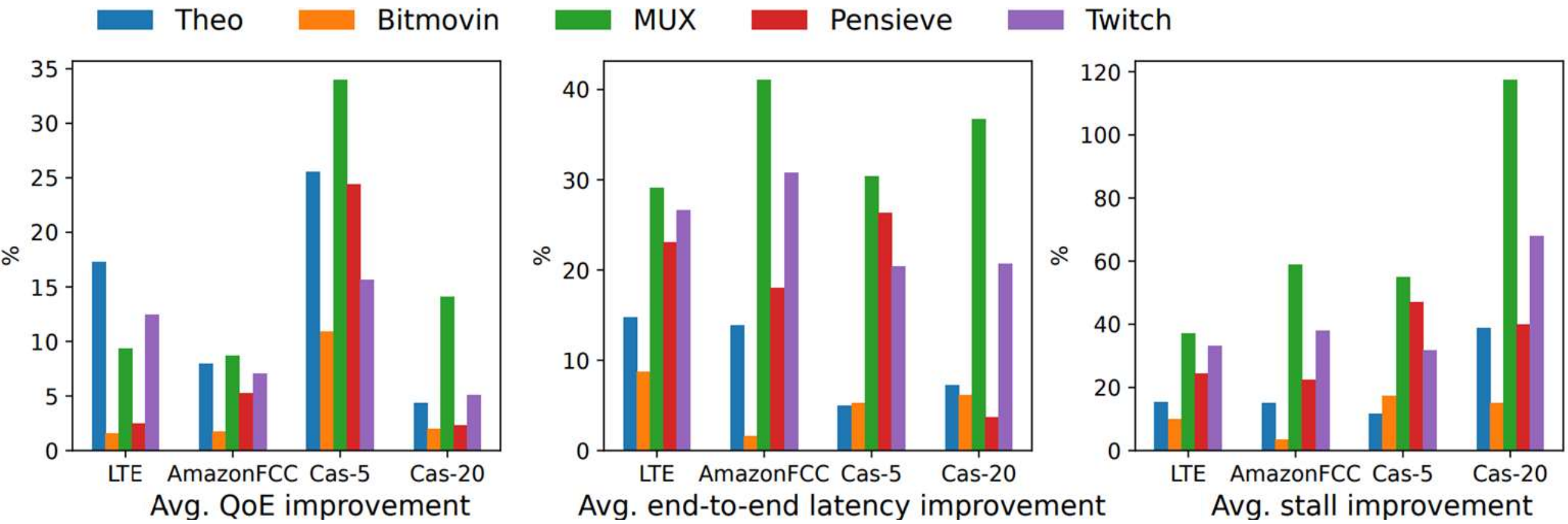
Quality of Experience (QoE), Latency, and Stall



QoE ↑ 11%

latency ↓ 18%

stall ↓ 36%

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Then, There Was ALPHAS

ℹ️ Adaptive bitrate ladder optimization for multi-live HAS

✅ CDN-assisted adaptation for multiple live streams

→ multiple streamers

→ different client zones

→ bandwidth constraints of CDN edge servers

→ computational capabilities of the encoding service

✅ Formulation as an integer linear program

✅ Real-time approximation using the submodular structure

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Acknowledgments

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Conclusions

✅ Real-time adaptation of the bitrate ladder in live video streaming

➜ mega-manifest to solicit fine-grained bitrate requests

➜ CDN-assisted feedback from clients

➜ quality-aware optimization to configure a short bitrate ladder

✅ ARTEMIS

➜ single live stream

✅ ALPHAS

➜ coordination across multiple live streams