XIA-NP Video Deployment

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New Challenges

• Video is diverse
  – E.g., live vs VoD, short vs long, “channels”, UGC ...

• Problems may be spread everywhere
  – E.g., CDN, ISP, player

• Need to be “aware” of user experience
  – E.g., mobile vs TV, sports vs movies?

• Control loops cause undesirable interactions
  – E.g., DASH vs HTTP, CDN vs ISP

New Opportunities

• XIA ➔ Flexibility in service “locations”
  – Multiple CDNs
  – Federated ISP-CDNs
  – Geo-diverse CDN servers
  – On-path caches and servers

• Measurement-driven optimization
  – Shared performance discovery
  – Better rate adaptation
  – Proactively detect quality issues

• ...
XIA Video Delivery Network (XIA-VDN)

- Analysis and Optimization
- Video Control Plane
- Monitoring
- Control
- Player, ISPs, CDNs, Content Owner

XIA-VDN Themes

- Big-Data + Measurement-Driven
  - Evaluate user experience at scale
  - Predictive decision making for better QoE
- Centralized, video-specific optimization
  - Global view helps coordinate distribution
  - Hybrid control
  - Leverage new cross-layer opportunities
    - CDN*CDN, ISP*CDN, User*CDN

A “BigData” Approach To Measure User-Perceived Effectiveness

- Analysis and Optimization
- Video Control Plane
- Monitoring
- Control
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Objective Scores (e.g., Peak Signal to Noise Ratio)

Subjective Scores (e.g., Mean Opinion Score)

Engagement (e.g., fraction of video viewed)

Internet video changes QoE

New Quality metrics e.g., Buffering, Switching, Avg Bit Rate
Extracting QoE model

Engagement

Quality Metrics

Machine Learning

QoE model to inform control
Evaluate different alternatives

Measurement Driven Control and Optimization

Confounding Factors

Predictive Decision Making

Challenges of Wide-Area Centralized Control
XIA-VDN Hybrid Control Plane

Example: Live Streaming

Central Optimization

Hybrid Control

Topology and channel info

Distribution Trees

XIA-VDN Data Plane

Server design? Does federation help? In-network caching?

Analysis and Optimization

Monitoring

Control

Player

ISPs

CDNs

Content Owner

Video Control Plane

Video Data Plane
Summary of XIA-VDN Deployment

• New challenges
  – Heterogeneity of users, videos, networks
  – Improve user experience

• New opportunities
  – More “knobs” → XIA enablers
  – App-specific + cross-layer optimizations

• XIA-VDN deployment themes
  – Big-data approaches to capture user experience
  – Hybrid control + Measurement-driven optimization
  – Revisiting data plane strategies