OTT – Challenges & Technical Evolution

An insight into technical architecture behind modern streaming platforms and challenges faced by ISPs due to massive increase in video traffic

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Today’s Speaker

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Agenda

• An overview of Video Delivery Networks
  – Legacy Video Networks
  – Convergence of Video Networks over IP backbones
  – OTT Video Streaming technology stack

• Impact of ever rising multimedia traffic for ISPs and VSPs
  – Bandwidth congestions and service delivery for ISPs
  – Complicated & Power hungry datacentre Operations
  – QoE and QoS monitoring for Video Networks

• Key Research Areas
  – Efficient video codecs and transcoding mechanisms
  – Low latency video delivery networks
  – AI, Recommendation Engines and Marketing Avenues
Legacy Video Networks

- **Analog Video**
  - 80’s technology
  - PAL / NTSC
  - VCRs / VTPs, Tape Recorders/Players
  - Composite Signals

- **Digital Video**
  - Moving Picture Expert Group (MPEG) founded in 1988
  - Digital Video Broadcast (DVB) project founded in 1993
  - DVB Focused on standardization of Digital Video Delivery over Terrestrial, Satellite & Cable Networks
  - MPEG Focused on formulation of Audio / Video Codecs, encoders/decoders across TX/RX segments

Limitations & Challenges:
- Content Encryption & Anti-piracy efforts
- No two-way service offering like VOD, Catchup are possible
- Very high cost of transmission media, be it space segment, RF spectrum or coaxial network
Legacy Video Networks

Digital Video Broadcasting (DVB) - Architecture

Video Networks over IP

IPTV Overview
- Delivery of TV services over IP based access networks
- TS over Internet Protocol (TSoIP/MPEGTS over IP)
- Opened up avenues for non-linear, on-demand video delivery services for customers
- IPTV as a multicast service
- IPVoD as a unicast service using protocols e.g. RTSP
- Limitations & Challenges
  - Works on managed / closed loop networks
  - Proprietary technology stack such as media servers
  - Works on uncommon web protocols such as RTSP, RTMP which demands specific network policies
  - Sensitive to packet loss and delays with no support on server/client side to mitigate it
Video Networks over IP

IPTV System Architecture

OTT Streaming Tech Stack

• **What is OTT Streaming?**
  – Over-the-top (OTT) streaming is video delivery over Internet
  – Modern and latest mode of video content delivery
  – Works on common http protocol instead of proprietary or dedicated video protocols
  – Most common services are Netflix, YouTube, Amazon Prime, Foxtel, Stan etc.

• **How it’s different from IPTV and What problem it solves?**
  – Works on public internet so not a closed loop service
  – Better scalability and bigger footprint
  – No geographical limits as such
  – Better delivery mechanisms for enhanced QoS and QoE
  – Better business model and sales avenues due to technological advances
OTT Streaming Tech Stack

Key Component of an OTT Stack

- Video Transcoding
- Video Content Delivery Networks
- Middleware Platforms
- Digital Rights Management (DRM)
What is Video Transcoding?

"In the context of video - Transcoding refers to the process of compressing video files as much as possible at minimal quality loss to represent (and transfer) information by using less data."
**OTT Streaming Tech Stack**

**How Video Transcoding Works?**

- Almost all video codecs work on the principle of motion compensation.
- Treat video as a series of single pictures called frames.
- In plain English, H.26X, rather than updating the whole frame at every refresh, splits the screen into horizontal and vertical grids and only updates the grids with changes.
- The transcoding process scrapes redundant information intelligently which consequently saves the bandwidth required to carry information as well as storage space to store it.
- The efficiency of compression while maintaining visual perception of transcoded video varies codec to codec as well on transcoding solution.

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**Video Content Delivery Networks**

- Package Video Content into HLS / MPEG DASH / HDS
- Adaptive Bitrate (ABR) delivery
- Geo-fencing
- Playback URL protection
- Content Encryption Integration
- Analytics
OTT Streaming Tech Stack

What is Packaging?

- There are three components for ABR streaming protocol
  - Main manifest file (Playlist) referring to Child manifest files
  - Child manifest files (sub-playlist) being referred to video chunks
  - Segmented chunks of continuous video file/stream generally referred as *.ts or .mp4 chunks
OTT Streaming Tech Stack

What is ABR?

- Adaptive Bitrate (ABR) is the ability of client device (player) to dynamically adjust the video quality based on
- Available Bandwidth
- Network Condition
- User device performance
- Subscription level
- Transcoder provides multiple output profile against a single input to packager (CDN)
- Packager is responsible for multiplexing multiple profiles of input source into single manifest file
- The player on the client side, opts for the best suitable profile as per its conditions from the manifest

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Impacts of rising video traffic on ISPs & VSPs
Impacts of rising multimedia traffic

Global Internet traffic trends – May 2020

Challenges for ISPs and VSPs

- ISPs and Streaming service providers face capacity challenges on a continual basis
- COVID-19 put the networks and streaming providers to test their limits
- Lockdowns as one of the key reasons in spike in entertainment service consumption
- ISPs and VSPs are required to be ready for service consumption spikes
- OTT Service providers had to perform capacity management by
  - Restricting higher bitrate video profiles such as UHD, HD etc for users
  - Setting SD video profile as a default variant
  - Adjusting Video transcoding parameters
- VSPs need to invest continuously into transcode and packaging infrastructure
  - Transcoding is expensive, power and cooling hungry component in datacentres
  - Each new device to support additional transcoding, distribution and storage resources
- VSPs require proprietary/ purpose built QoS / QoE monitoring
- VSPs need to heavily invest in long term expensive content deals to retain market share

Source: Covid Internet Phenomena Report May 2020 by Sandvine
Key Research Areas

• Advanced Video Codecs
  – Modern video codecs like AV1, VVC
  – AV1 is ~30% more efficient than HEVC
  – If an UHD movie in HEVC codec need 25 Mbps internet connection, AV1 would take ~17.5 Mbps
  – Client device need to support decoding capabilities to fully roll out modern codecs

• Low Latency Video Delivery Networks
  – Every ABR streaming protocol e.g. HLS, MPEG DASH needs player to buffer content
  – Transcoding, Packaging, Encryption, Inherent latency in IP networks causes a lag in OTT content
  – New streaming protocols such as Low Latency ABR are seeking to solve this problem
Key Research Areas

- Recommendation Engines, Ad-tech & Analytics
  - Dynamic Content Recommendation based on user behaviour
  - Data Analytics and User behaviour analysis for Dynamic Ad-Insertion
  - Client side stats for optimizing streaming network design and performance

QUESTIONS?
Thank You! (>())