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DAKOTA TERRITORY

IPTV Basics

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Overview

- What is IPTV?
  - OTT vs Facilities-Based
  - Why IPTV?
- CPE for IPTV
  - User Experience (UX / UI)
  - Managed Android STB
  - Wireless versus wired
  - Apps for 3rd party devices
- Video Delivery for IPTV
  - Codecs and Adaptive Bitrate (ABR)
  - Content Delivery Network
- IPTV DVR Features
  - nDVR
  - Start-Over / Catch-up and Pause
- Other IPTV Considerations
  - DRM
  - Ad Insertion
  - Network
  - Rollout and transition planning
- IPTV FAQ's and Summary

What is IPTV?

- IPTV: Internet protocol television. IP-delivery of digital video services to the customer. This is in contrast to the legacy QAM-based delivery methods that most operators have in place today.

- OTT: Over-the-top video delivery. IPTV over the current network infrastructure. This includes services like Netflix and Hulu, and Amazon Prime. Basically a 3rd party video provider leveraging someone else's network.

- Facilities-Based: An IPTV service that is built and maintained by a telecommunications company, utilizing the operator's own infrastructure, network, and video sources. Basically an IPTV service that is managed end-to-end by the Cable Co.

Why move to IPTV?

Flexibility!

- Delivery of a video product without the video specific access network. OTT Providers are doing this over our network today…. With success!
  - An operator IPTV product leverages the same concept as OTT
  - IPTV ultimately eliminates SC-QAM for video delivery

- Ability to offer video on managed and un-managed (BYOD) devices
  - Managed Android STB will be standard offering for many operators
  - Un-Managed App support for Apple TV, FireTV, Roku, Android TV, etc.

- Video product offering no longer tied to the CPE type
  - One low-cost IPTV STB can offer all services simply by provisioning
    *Live / Linear *VOD *DVR *Advanced UX/UI
  - Self-Installs are feasible
    - Wireless or wired network connection, no coax to the STB….

User Experience / User Interface

- UX / UI: User Interface. This is a broad term in the industry that defines the interface customers use to access video programming. In simple terms, the UI is the display on a customer's device that allows them to navigate content. This includes a program guide, search and browse features, content recommendation, etc. TiVo and X1 are good examples of a next-generation IP-based UI, but there are several others.

A user interface is like a joke. If you have to explain it, it's not that good.

- Selection of Advanced User Interface is 1st priority in IPTV planning
  - Technology is pointless without a compelling and scalable UI
  - Ensure that Business and Operations Support Systems (BSS/OSS), Content Management System (CMS), and video streaming sub-systems can be integrated with UI.
  - Content aggregation: The UI should bring together the operators video offering seamlessly with other sources like Netflix, Hulu, and YouTube.

IPTV Set-Top Box

- Managed Android STB
  - Becoming the weapon of choice for many operators
  - Relatively low-cost, but highly capable
  - Choice of many different UX options
  - Voice assistant functionality
  - Offers access to the Google Play Store with 3000+ apps…
  - Wired and wireless networking

- Android TV™
  - Google’s TV platform on Android
  - Includes Google Play Store, voice search, and many other features
  - Very tightly-controlled –requires Certification
  - Operator Tier**
    - Relaxes many of the rules around Android TV to all operators more control over the user experience

Wired versus Wireless IPTV STB

- Coax to the STB is no longer part of the equation with IPTV
  - Video is not on QAM carriers
  - Native IP
  - Typically DOCSIS or FTTH delivered, fixed wireless possible

- IPTV STB requires a network connection
  - Hardwired ethernet preferable. But….
  - Wireless is feasible and will be the most used
  - DIY customer installs possible… If done right!

- Wireless Performance is very important!
  - Wireless capability of the STB
    - Not all STB's are equal
    - Test and choose wisely!
  - Wireless capability of the home network
    - Older gateways and routers may not be acceptable
    - Whole-home wireless solutions may be needed in some cases

IPTV – Support for 3rd Party Devices

- IPTV opens up new platforms
  - Operator's video product no longer needs to be a tied to a STB
  - Generally rolled out in phases over time

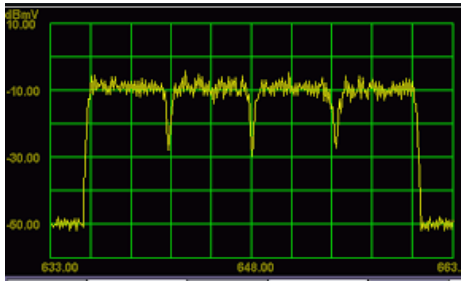
- Mobile Devices
  - iOS phones and tablets
  - Android phones and tablets

- Bring your own Device (BYOD)
  - Roku-type boxes
  - HDMI Dongles – Chromecast, Fire HD, etc.
  - Smart TV Apps

- Authentication with the Billing System and IPTV Backoffice is key
  - Business decisions and rules
  - In-home or out-of-home?
  - Content programming rights become a factor

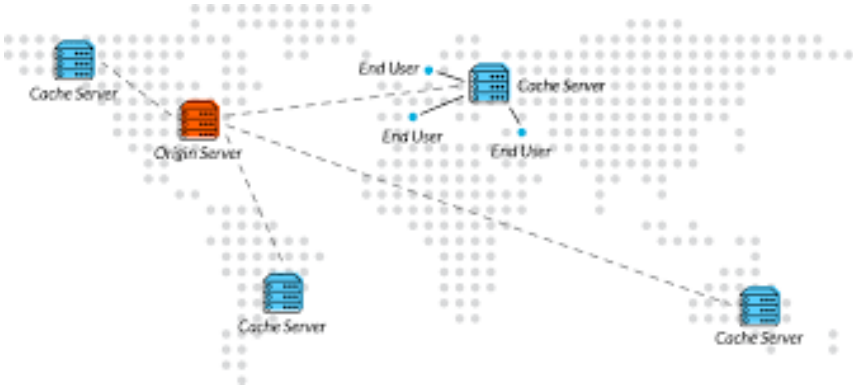
IPTV Video Delivery

- Current QAM RF video
  - Broadcasted in ‘always on’ manner over QAM carriers
  - Typically MPEG-2 encoding to support older STB’s
  - Single profile per channel – HD or SD
  - Delivered via multiprogram transport streams (MPTS) @ ~38 Mb/s
  - Not suitable for IPTV delivery



- IPTV Video
  - Only ‘on’ if a customer is requesting that programming
  - Typically MPEG-4 / H.264 encoding (HEVC and others in the future)
  - Multiple profiles to support different devices and network conditions
  - Delivery via HLS or MPEG-DASH protocols over IP

- IPTV CDN
  - Content Delivery Network (CDN) required for IPTV
  - Encompasses storage and streaming components
  - Origin: Main origination point, central to the system
  - Edge Cache: Localized to a market(s)
    - Stream replication
    - Storage of most commonly viewed files (VOD)



Video Processing for IPTV

- Video Sources
  - In most cases an operator will continue to use their existing video sources
    - Satellite feeds
    - Local broadcaster feeds
    - VOD video files
  - But… These will all need to be transcoded to a new format

- IPTV Codec
  - Typically MPEG-4 / H.264
  - MPEG-4 offers a ~40% reduction in bandwidth compared to MPEG-2
  - HEVC commonly used for 4K – more efficient than MPEG-4
  - Audio can be AC-3 or AAC

- Adaptive Bitrate (ABR) Transcoding
  - Multiple profiles for each video program
  - Typically 3-4 profiles for HD
    - Small screen mobile devices
    - Network impairments

IP Live HD (3 variant)				
H	V	FPS	Bitrate	Mp/s
1280	720	60	5	55.30
960	540	30	2	15.55
640	360	30	1	6.91
			8	77.76

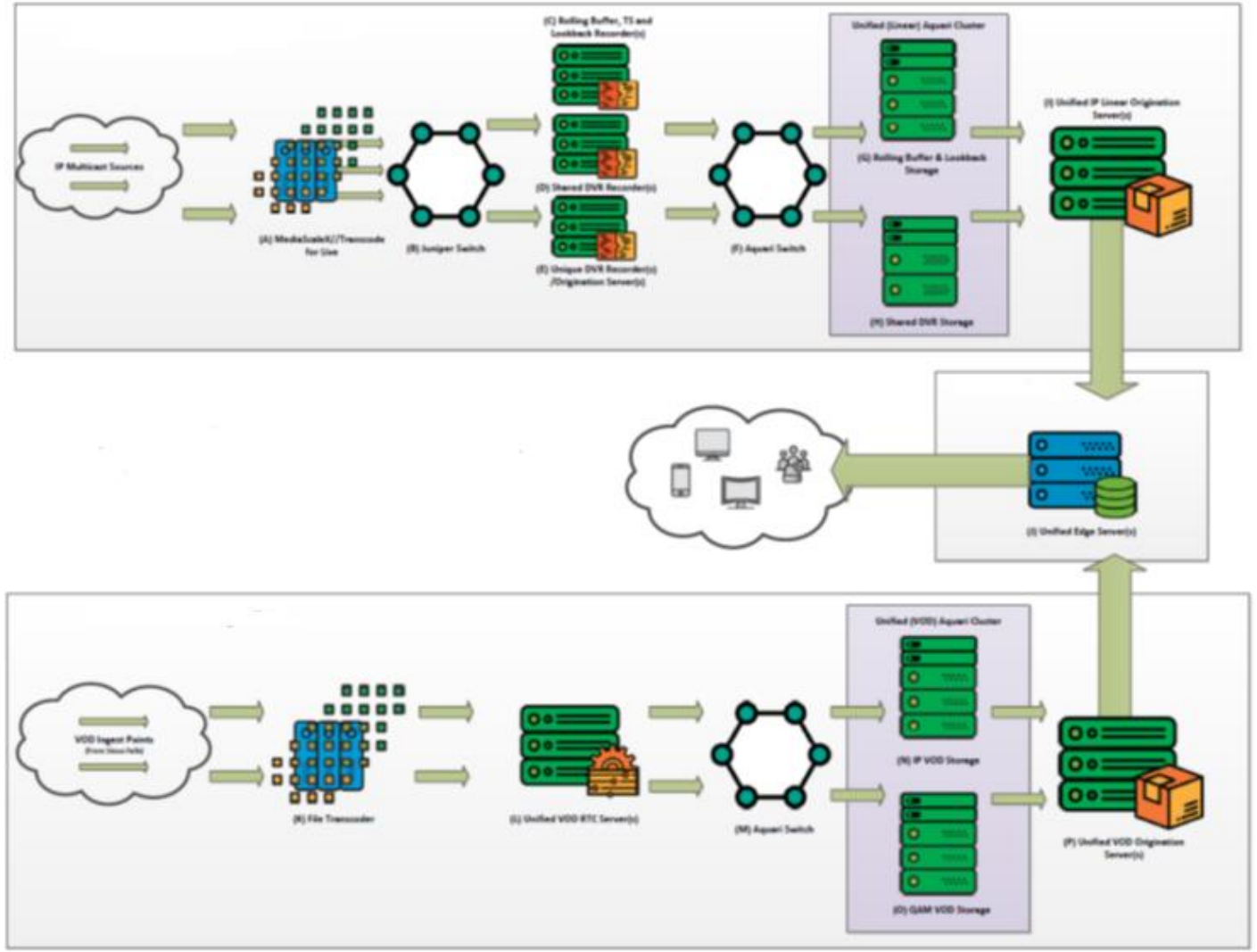
IP Live SD				
H	V	FPS	Bitrate	Mp/s
640	480	30	2	9.22
512	384	30	1	5.90
			3	15.11

IPTV Content Delivery Network

- Origin Storage and Streaming
  - The IPTV ‘headend’
  - Ingest live / linear channels from ABR transcoders
  - Storage for time-shifted TV
  - Storage for VOD asset files
  - Packaging for delivery
  - Manifest File – What URL is associated with each channel
    - How the end device figures out how to get the video stream
  - Tied into the IPTV backoffice for DVR configurations, etc.

- Edge Cache
  - Located at the ‘edge’ or hub site
  - Reduces network backbone loading
  - Caches commonly viewed VOD titles
  - Replicates linear streams
    - Only one stream from the origin
    - Many streams from the edge cache

IPTV Content Delivery Network Diagram



IPTV nDVR Functionality

- What is nDVR?
  - Network DVR, also known as cloud-DVR or remote-DVR
  - Recording is initiated by the STB, but not stored on the STB
  - Recorded programming stored in the origin storage complex
    - Origin storage redundancy is critical
    - Origin storage capacity can easily be many petabytes
  - Amount of DVR storage defined by business rules and not the STB model

- Why nDVR?
  - Eliminates the need for an expensive STB with DVR hard drive built-in
  - Whole-home DVR functionality by nature…
  - Allows access to recorded content on any authorized device
    - Managed Android STB
    - Smart phones and tablets
    - BYOD devices
  - An STB failure no longer means lost recordings!

Beyond nDVR – IPTV SoCu and Pause Live TV

- SoCu – Start-over / Catch-up
  - Start-over is the ability to watch a program from the beginning
  - Catch-up is the ability to go back several hours or days in the guide
  - SoCu is automatic – the user does not need to initiate a recording
  - Could be available on all channels, but likely not due to programming rights
  - SoCu helps reduce the need for a huge nDVR storage complex
    - Most consumers watch a recording within 3 days of the initial airing
    - The majority of DVR recordings are only watched once
    - If SoCu is available, customers will not 'DVR' as many shows

- Pause Live TV
  - Rolling buffer in the origin storage for each channel
  - Same functionality as current legacy DVR's
  - Configurable, but typically 30-60 minute pause maximum

IPTV Digital Rights Management

- What is Digital Rights Management (DRM)?
  - In a word - Encryption
  - But… It isn't the same encryption that is already being used for our legacy QAM-based video systems.
  - MediaCipher (Arris) and PowerKey (Cisco) are very strong AES-128 encryption systems, but rely on a secure key distribution system.
  - DRM encryption systems are designed to eliminate weaknesses in the key exchange mechanisms. Basically, it's harder to hack in an IP world!
  - Same concept as regular encryption
    - User / device authorization
    - Channel / package authorization

- Common DRM solutions
  - DRM is obviously necessary, but there are many flavors…
  - Widevine: Native Google DRM
  - PlayReady: Native Microsoft DRM
  - FairPlay: Native Apple DRM
  - Verimatrix: Widely deployed with many large operators in the industry
    - Native VMX DRM works with most industry vendor platforms
    - Plus multi-DRM solutions
  - Many others, choice will often depend on the rest of your vendor ecosystem and what devices you are supporting with IPTV.

WIDEVINE

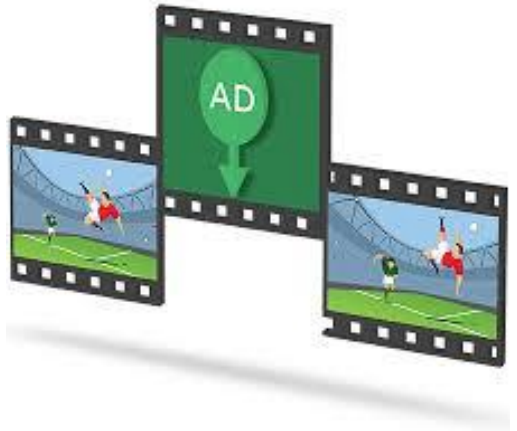
Microsoft PlayReady

FairPlay

verimatrix

IPTV Ad Insertion

- What is Ad Insertion?
  - Placement of 15 or 30 second localized advertisements based on triggers in the digital video transport stream and schedules within the ad insertion system.
  - Typically done on the most watched linear channels (ESPN, CNN, TBS, etc.)
  - Programming providers allow for ~4 advertising availabilities per hour
  - Source of revenue for operators
  - Already being done on QAM-based video in most systems
  - Typically zoned for a market or group of markets



- Ad Insertion in an IPTV world
  - Need to at least replicate what is being done on legacy QAM-based video
  - Technology is significantly different
    - Cannot insert on just one ‘stream’ as each customer receives a unique version
    - Involves manipulation of the manifest file – points STB to advertisement URL
  - Opens up the capability for dynamic / targeted advertising in the future
    - Rather than the same ad for an entire market zone, could have different ads for different groups of customers.
    - Based on customer demographics
  - More complex, but also more flexible than traditional ad insertion

IPTV Network Considerations

- Video is somewhat ‘siloed’ in a QAM-based environment
  - Legacy video may be transported on the network backbone, but….
  - Converted to QAM at the headend and delivered to home independent of DOCSIS high-speed data
  - Network considerations mostly limited to transport between processing equipment and hub headend

- Video is a pure network play in an IPTV environment
  - Video transport is over network components from end-to-end
  - A CDN is utilized to reduce network backbone bandwidth requirements between the centralized origin and the hub site edge caches
  - Delivery to the home is over DOCSIS, not separate video QAM carriers
  - Opens up video offering possibilities in IP-only distribution networks
    - Fiber-to-the-Home (FTTH) / EPON
    - Fixed Wireless
    - Direct network fiber connections to commercial properties

IPTV Network Considerations – DOCSIS and Wi-Fi

- Impact to the DOCSIS Network
  - IPTV will place a new load on the DOCSIS network
  - DOCSIS 3.0 versus 3.1
    - D3.0 will work, but should you require D3.1 modems for IPTV?
    - D3.1 offers much bigger spectrum and data pipe to support IPTV
  - Using a modem service class for IPTV traffic is a best practice
    - Isolates IPTV from internet bandwidth
    - Helps mitigate any impact to internet speeds
  - Capacity planning is critical, but difficult to execute prior to deployment
    - Actual customer usage patterns unknown until deployed at scale
    - Will node splits be required? Maybe at some point….

- Wi-Fi Considerations
  - Depends on STB specifications: 2.4 GHz and/or 5 GHz compatibility
  - Wi-Fi 5: 802.11ac+ @ 5 Ghz recommended
  - 2x2 versus 4x4 MIMO? 2x2 is sufficient
  - Wi-Fi extenders or whole-home solutions may be needed for some rooms
  - Older wireless modems and routers may need to be upgraded
  - Test, test, and test again….. Best to identify issues in the lab first!

IPTV Rollout and Transition Planning

- Rollout / Deployment Options
  - Cap and Grow
    - New customers get IPTV rather than legacy video
    - Existing customers can stay on legacy or upgrade to IPTV
  - Broadband-Only ‘Skinny Bundle’
    - Small low-cost IPTV package targeting broadband-only subs
    - Meant to go after cord-cutters
  - Residential versus Commercial
    - IPTV for Residential only to start?
    - IPTV for Commercial is more complicated, but has many benefits
  - Mixed deployment options encompassing everything above
  - Target one market to start with or rollout to entire footprint

- IPTV Transition
  - The ultimate goal is to eliminate legacy QAM-based video
  - Multi-year project (5-7+)
  - Fully leverage network capabilities by allocating entire spectrum to data carriers
  - Important factor in the path to 10G

IPTV FAQ's

- How much data does an IPTV video stream require?
  - ~5 Mb/s per HD stream at the highest profile with MPEG-4 encoding
- What about 4K?
  - IPTV is the best path to delivering 4K, but not commonly offered at initial launch
  - ~16 Mb/s with HEVC encoding
- Are IPTV streams unicast or multicast?
  - Typically unicast in most deployments, future upgrades may add multicast functionality
- What will likely be the biggest problems with IPTV?
  - The home network: Modem issues and Wi-Fi problems
  - New challenges and technologies for field techs to learn

IPTV Summary

- IPTV means delivering video via IP end-to-end
  - Facilities-based when it is an operator's offering, not OTT

- CPE and the UX
  - Advanced cloud-based User Interface
  - Managed Android STB
  - Apps for 3rd party devices

- IPTV Video Processing and Delivery
  - ABR Transcoders and Codecs
  - Content Delivery Network
  - Storage: nDVR and SoCu

- Don't forget…
  - DRM encryption
  - Ad Insertion
  - Network Architecture Considerations
  - You need to have a plan!!

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Questions / Comments?

Thank You!!

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