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ATSC Mobile DTV Overview

Jay Adrick, VP Broadcast Technology


atsc
MOBILE DTV

aka

“ATSC M/H”

“MPH”

“ATSC Proposed Standard A/153”

ATSC M/H Overview

DTV stations transmit mobile TV signal with addition of ATSC M/H system

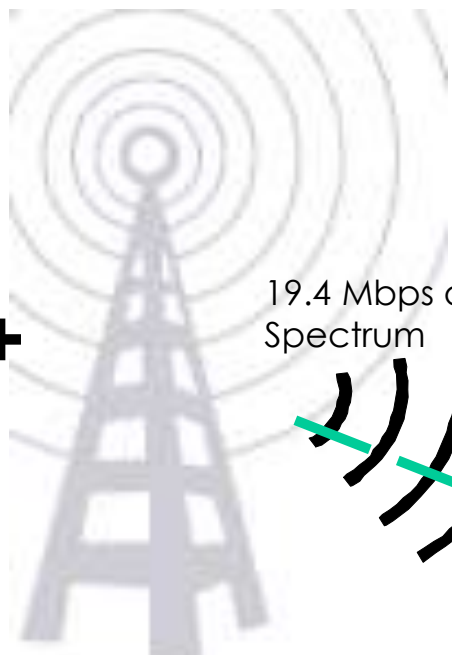
Consumers receive mobile TV signal on many different devices via ATSC M/H chip and module

ATSC DTV Broadcast System

ILLUSTRATIVE EXAMPLE OF SPECTRUM SPLIT

ATSC M/H System

+



19.4 Mbps of Spectrum

Remaining digital transport is used to deliver mobile signals

M/H chip and module

A portion of digital transport is used for traditional TV signal

Mobile phone

Portable media player

Laptop computer (dongle)

GPS device

Automobile-based TV

What is ATSC M/H

- Optimized Mobile / Pedestrian / Handheld (MPH) transmission and reception system
- Embellishment to ATSC DTV standard
- Mobile DTV service within broadcasters' existing DTV channel assignment and transmission infrastructure
- No outside service providers required but perhaps desired
- 100% backwards compatible addition to ATSC main transmission
- Transmitted spectrum identical to 8-VSB, so no additional FCC authorization

ATSC M/H Features

- Robust physical layer
  - High immunity to drop-outs and burst noise
  - No need for receiver antenna diversity
  - Up to 12.5 db system gain over regular ATSC channel
  - High-Speed reception – up to 300 km/h
- Data efficient and completely scalable
  - 3.667 Mbps of ATSC TS could provide up to 980 Kbps mobile/handheld service
  - Scalable coding
- Power savings for handheld devices due to bursted transmission
  - Allows receiver RF circuitry to be ON part-time to save battery life

ATSC M/H Features

- IP based mobile payload
  - Supports stream and non real time file delivery
  - Enables cross media compatibility
  - Utilizes efficient AVC h.264 video coding and AAC-HE audio coding
- Each RF channel is capable of delivering up to 8 mobile IP data streams with 630 kbps IP payload
  - While maintaining 4.7 Mbps program in the main stream
  - Each IP stream can support multiple services…Video+Audio, Audio only, Service Guide, NRT services, etc.
- System supports service protection which enables
  - Viewer identification
  - Access control
  - Paid service offerings

ATSC M/H Features

- Electronic Service Guide system based on OMA – Bcast standard supports a variety of features
  - rapid channel changing
  - video on demand
  - banner advertising
  - Datacasting & podcasting
  - voting
  - E-commerce

- Easy integration into ATSC broadcast systems
  - Encoder(s), signaling, ESG and Mobile adaptor at studio
  - No changes/additions to the STL
  - Replacement exciter at transmitter

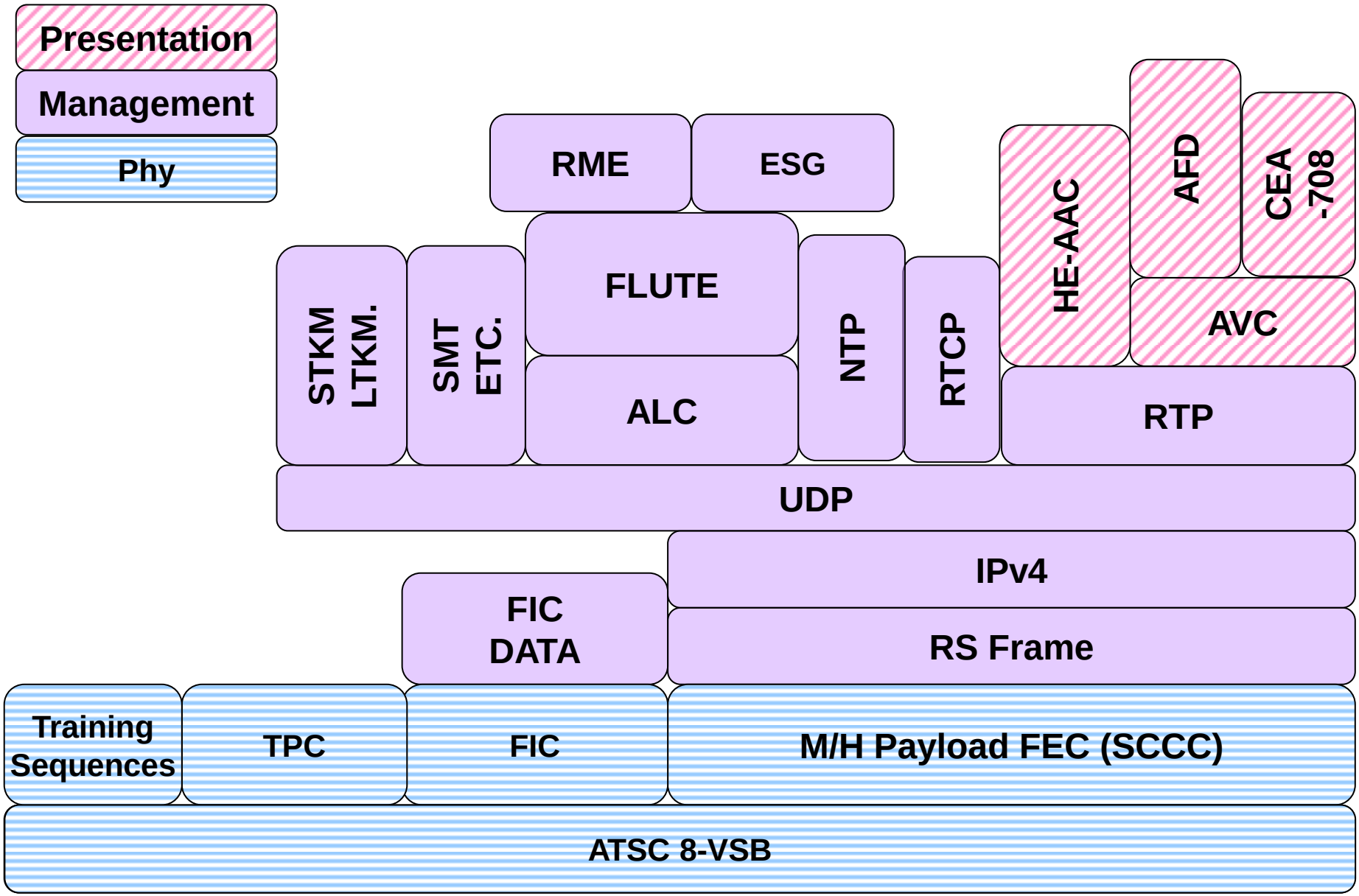
ATSC M/H Major Layers

Presentation Layer
Audio and Video Codecs
Captioning

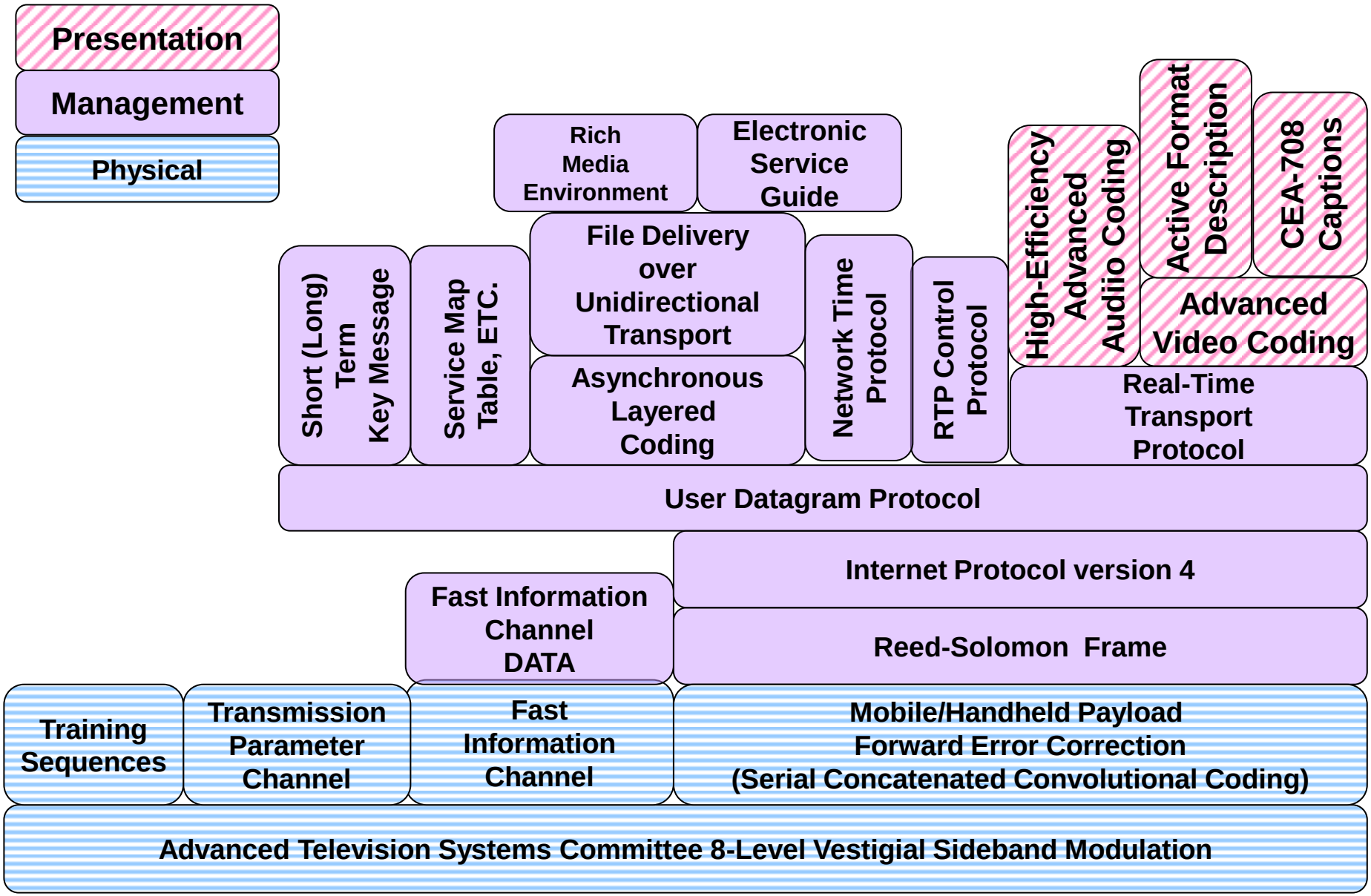
Management Layer
Transport
Streaming and Non-Real Time File Transfer
Electronic Service Guide

Physical Layer
RF Transmission and Forward Error Correction;
Compatibility with Legacy 8-VSB Receivers/Decoders

ATSC M/H Layer Stack



ATSC M/H Layer Stack Acronyms Deciphered



Current status within ATSC

- ATSC Technical Standards Group (TSG) S4 completed editorial changes and organized final documents during July – August for the Proposed Standard A/153.
- A ballot was issued in September to elevate the Proposed Standard to Full Standard Status.
  - Ballot closes 11:59PM 10/15/09

- Tomorrow ATSC A/153 is a STANDARD

Next Steps to Standardization and Commercialization

- OMVC establishes model station systems in Atlanta and Seattle
  - Atlanta WATL-DT and WPXA-DT On Air now
  - Seattle KONG-DT and KOMO-DT On Air now
- OMVC/CEA lab testing for transmission system to receiver interoperability
  - Completed August 2009
- SFN testing in Atlanta in conjunction with EchoStar
  - November December 2009
- Trial Market established in Washington DC – January 2010
  - 7 stations provide bandwidth
  - Local and national content
  - Carrier participation
  - Multiple receiver types provided to sample audiences

Next Steps to Standardization and Commercialization

- Early adopters sign on
  - At CES and NAB 2009, More than 75 stations in over 25 markets announced commitment to sign on before the end of 2009
  - OMVC announced that stations initial business model will be “free to air” replication of current stations program services
- Further development of business models
- Further development of partners
  - Content providers
  - Mobile phone carriers
  - Cable
  - Consumer sales channels

Prototype Consumer Receiving Devices

Consumer Devices

- DTV Mobile broadcasts can reach many varieties of devices with video capabilities
  - Mobile phones
  - PDA's
  - Laptops
  - Screens in vehicles (cars, buses, trains)
  - Portable DVD players
  - Handheld gaming devices
  - Other PMP's
  - Even Fixed TV's

- Broadcasters have not agreed on the specifics of devices or the relative importance of device classes
  - First devices are not likely to be Cell Phones

LG Voyager Mobile Phone

LG Maize Mobile Phone

LG Hero Mobile Phone

LG Portable DVD Player

LG USB Receiver for PC Reception

Dell Netbook Computer

Expected to be available 1Q 2010

List price under $400

Kenwood In-Car Receiver

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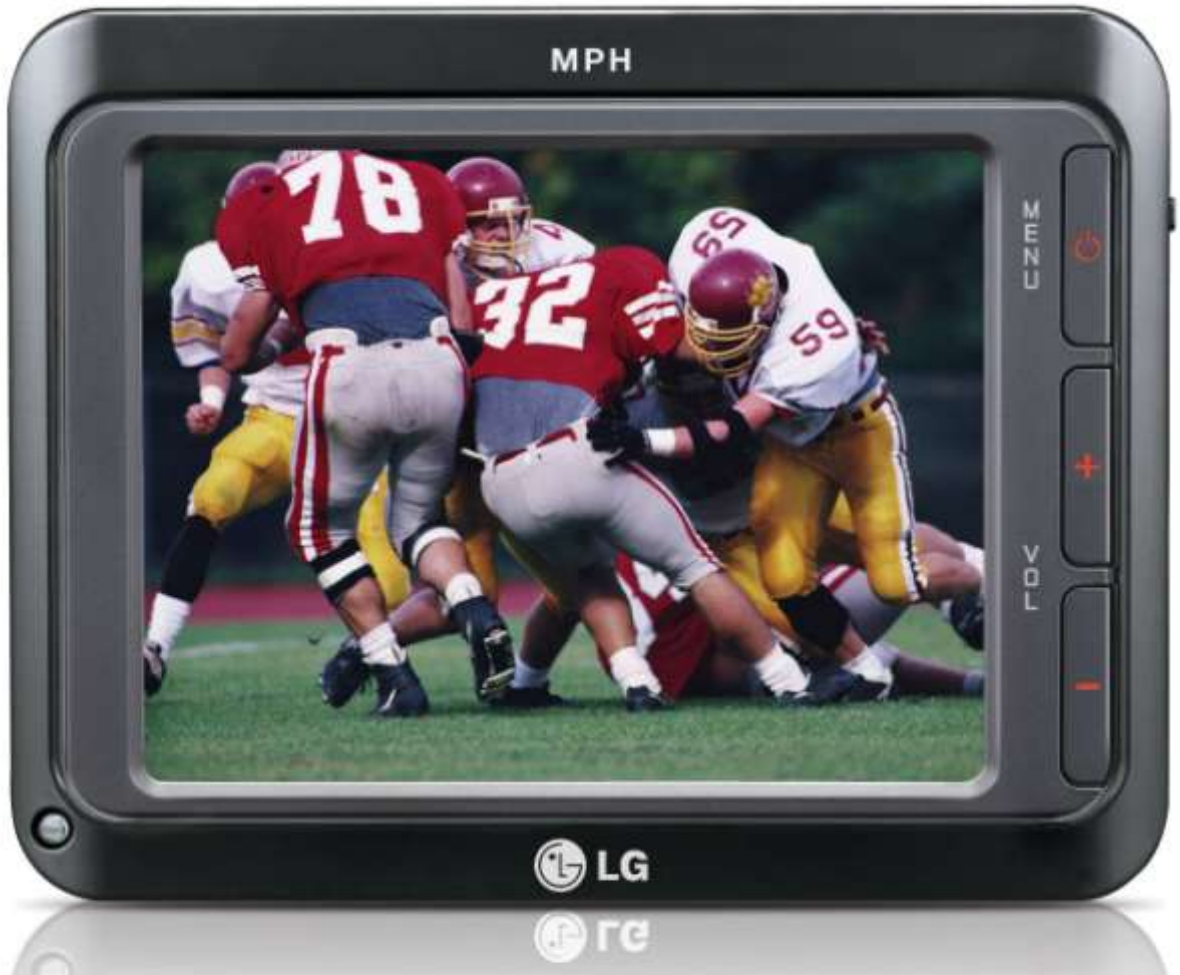
Infotainment system designed for back seat viewers

Kenwood is a leading after market automotive entertainment system supplier and an ATSC M/H supporting partner

In Car Infotainment System

LG Personal Media Player



Personal media player supporting live ATSC Mobile DTV with down loadable content and flashcard media

Samsung Mobile Phone Platform

Mobile DTV Business Models

Economic Impact

- Number of M/H DTV Receivers by 2012
  - Cellular Handsets – 130 million
  - Portable M/H Receivers – 25 million
- Incremental Additional Viewing – 1 hour/week
- Average Value of Additional Viewing Hours
- Growth of OTA Advertising through 2012
- Additional Advertising Revenues to
  - OTA Television Industry: **$2 billion**
  - Local Television Stations: **$1.1 billion**
  - Impact on Total Station Values: **$750 Million to $9.1 Billion**

NAB commissioned study - 2008

Market Based Broadcasters

- Broadcasters in a local market ban together to form an LLC to operate a mobile network
  - Each station contributes one or more of the following:
    - Content
    - Bandwidth
    - Management
    - Sales
  - Partners share in revenue or net profit based on contribution formula

Group Based Broadcasters

- Multiple groups with properties in multiple common markets form a single LLC to operate networks
  - Similar factors to previous example
  - Model has potential for centralized network operations center

Broadcasters and Cable

- Broadcasters in a market team up with the local cable operator
  - Cable partner provides subscriber management, billing and collection, national content, local ad sales and operates network
    - Ability to tap existing resources for above
    - Bundled services…Cable, internet, Telephone and Mobile video
  - Broadcasters provide local content, bandwidth and sales

Possible Partnerships

Broadcasters and Wireless Operators

- Broadcasters in a market team with local operator of wireless network
  - Wireless operator manages subscribers, billing and collections, provides back channel supporting interactive capability including on line purchasing
  - Wireless operator may also have MediaFLO as partner
    - Broadcasters provide local content providing balance to national service
    - Dual mode receiver platform and common program guide
  - Broadcasters monetize service through local advertising

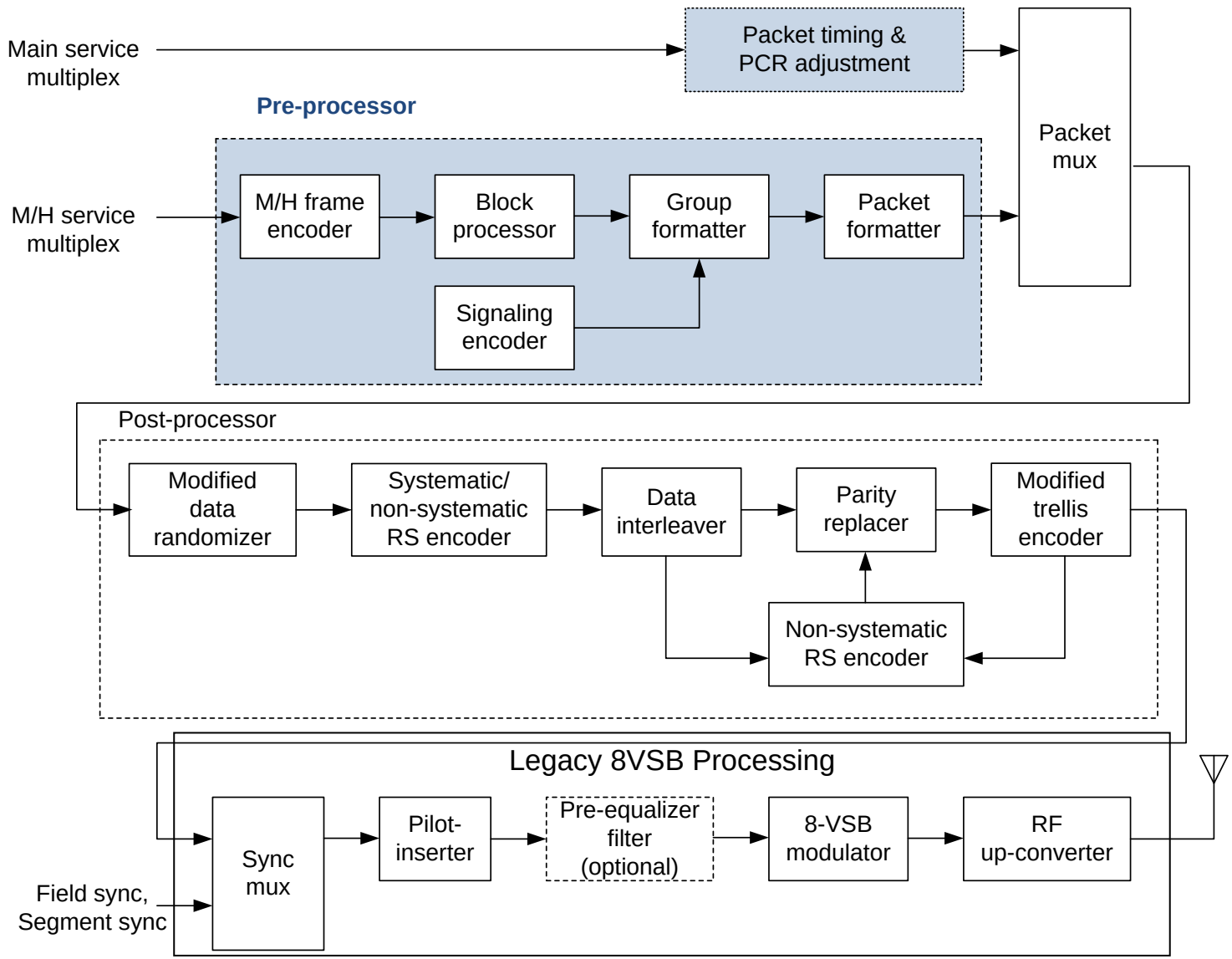
ATSC M/H Broadcast System Architecture

ATSC M/H Station Architecture

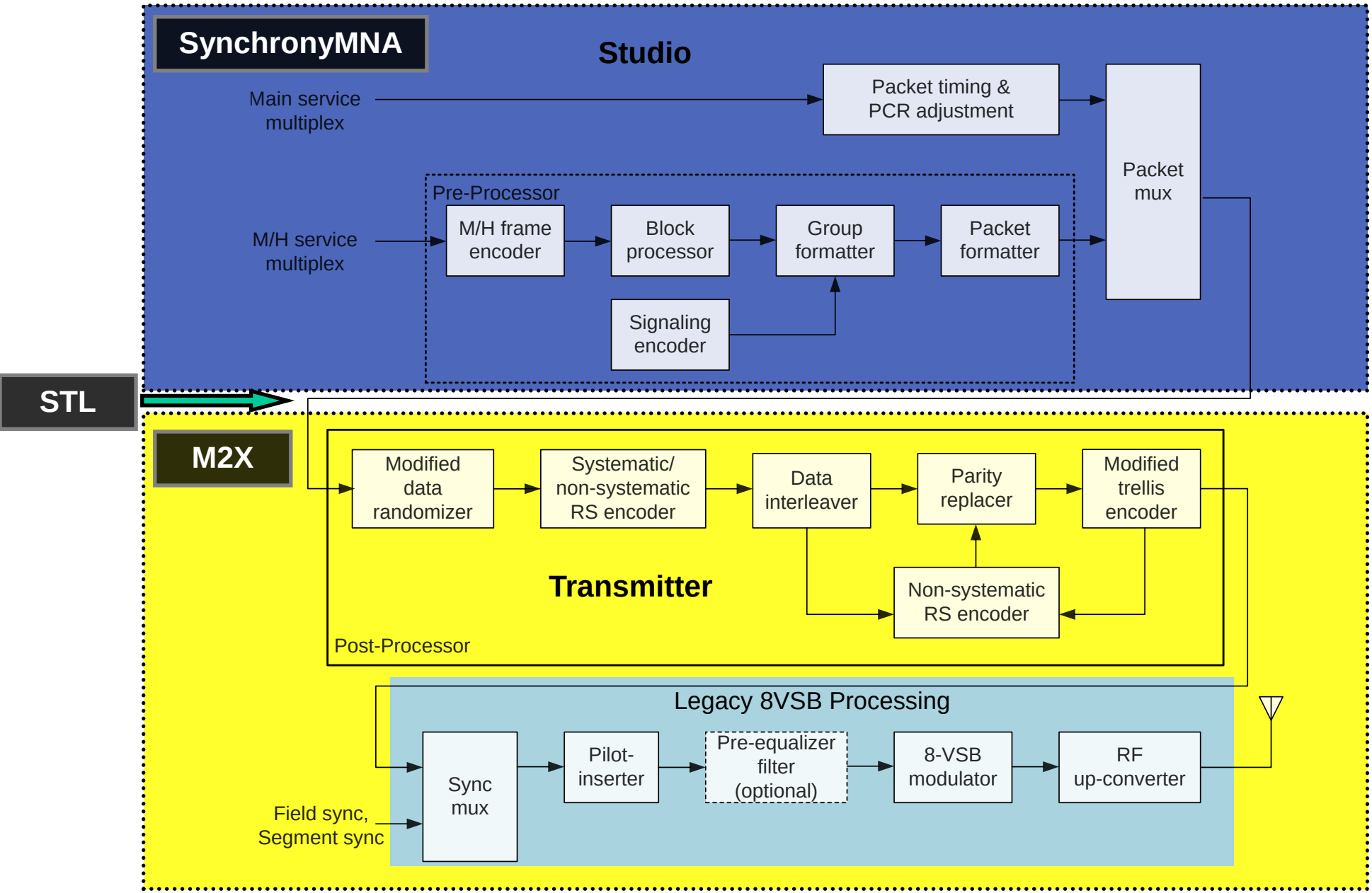
- ATSC M/H A/153 standardizes the characteristics of the emitted M/H signal and describes the functionality that resides within the signal.
  - A/153 does not standardize the method of implementation
  - It does guarantee transmission to receiver interoperability

- The following description of M/H station implementation reflects the product architecture that is being developed by Harris and our team partners.
- Other manufacturers may implement their products using another method.
- Currently, there is limited interoperability between some manufacturers
  - Interface interoperability will be developed through ATSC S5 activity

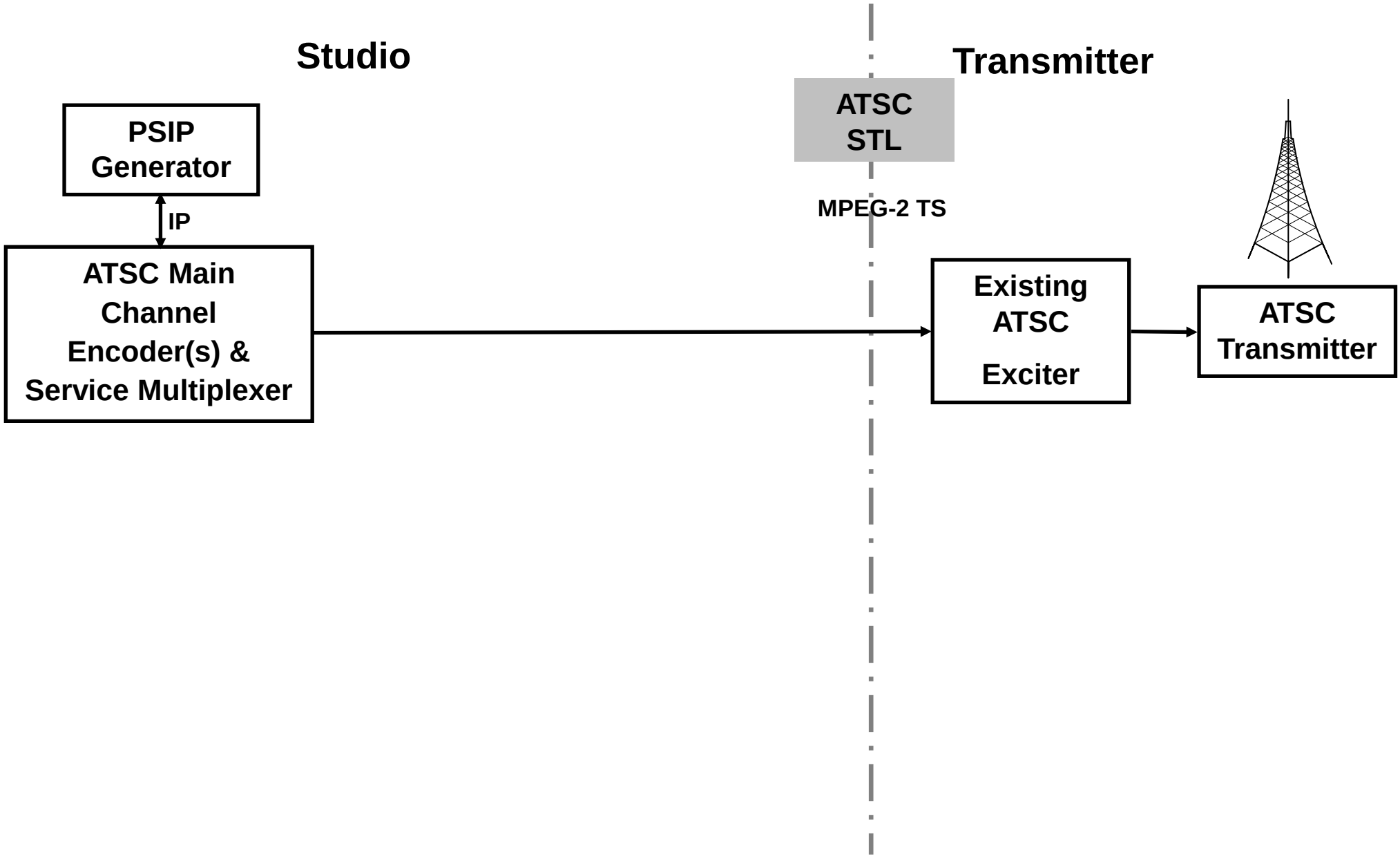
Transmission System Pre-Processing



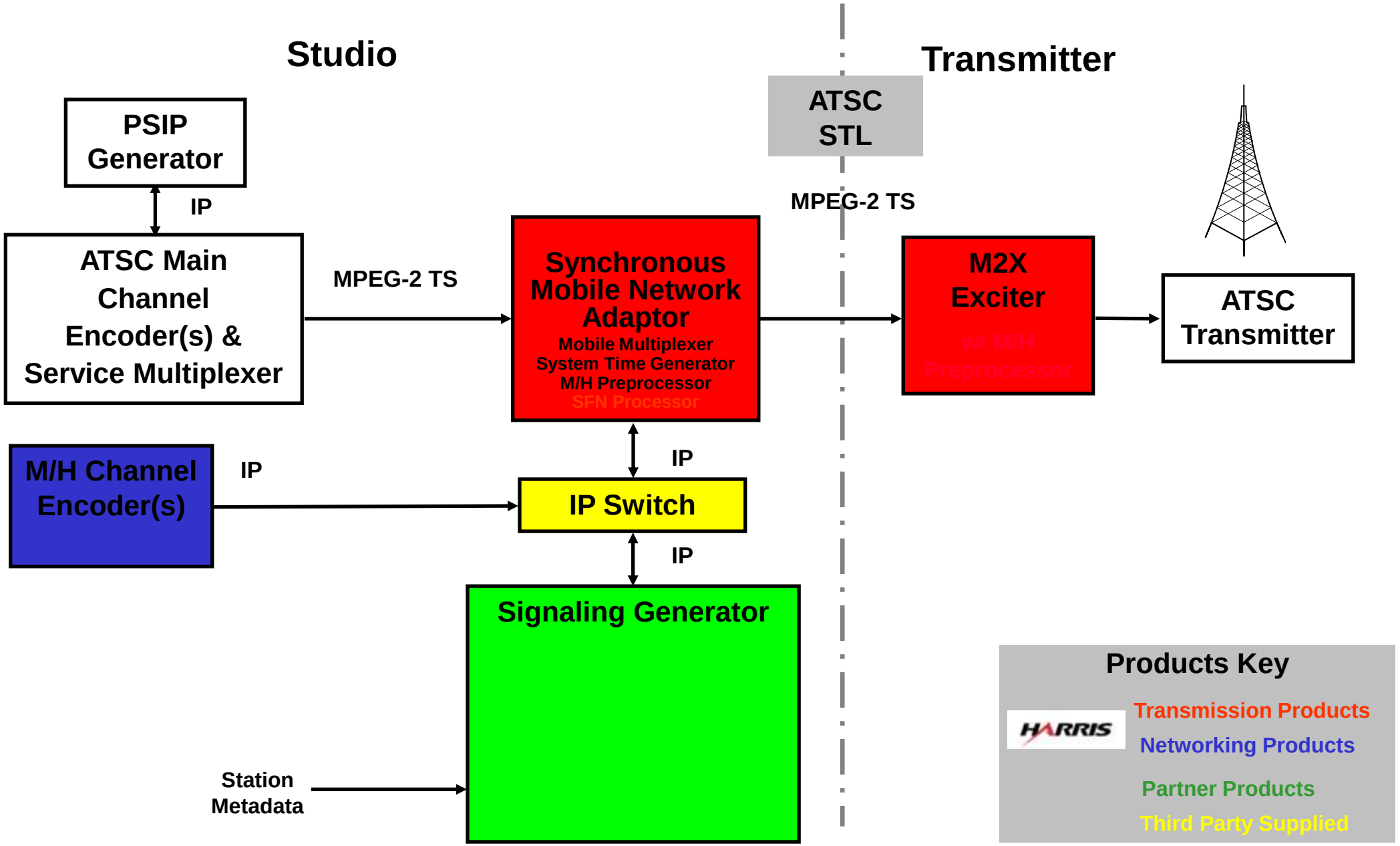
ATSC M/H Transmission System



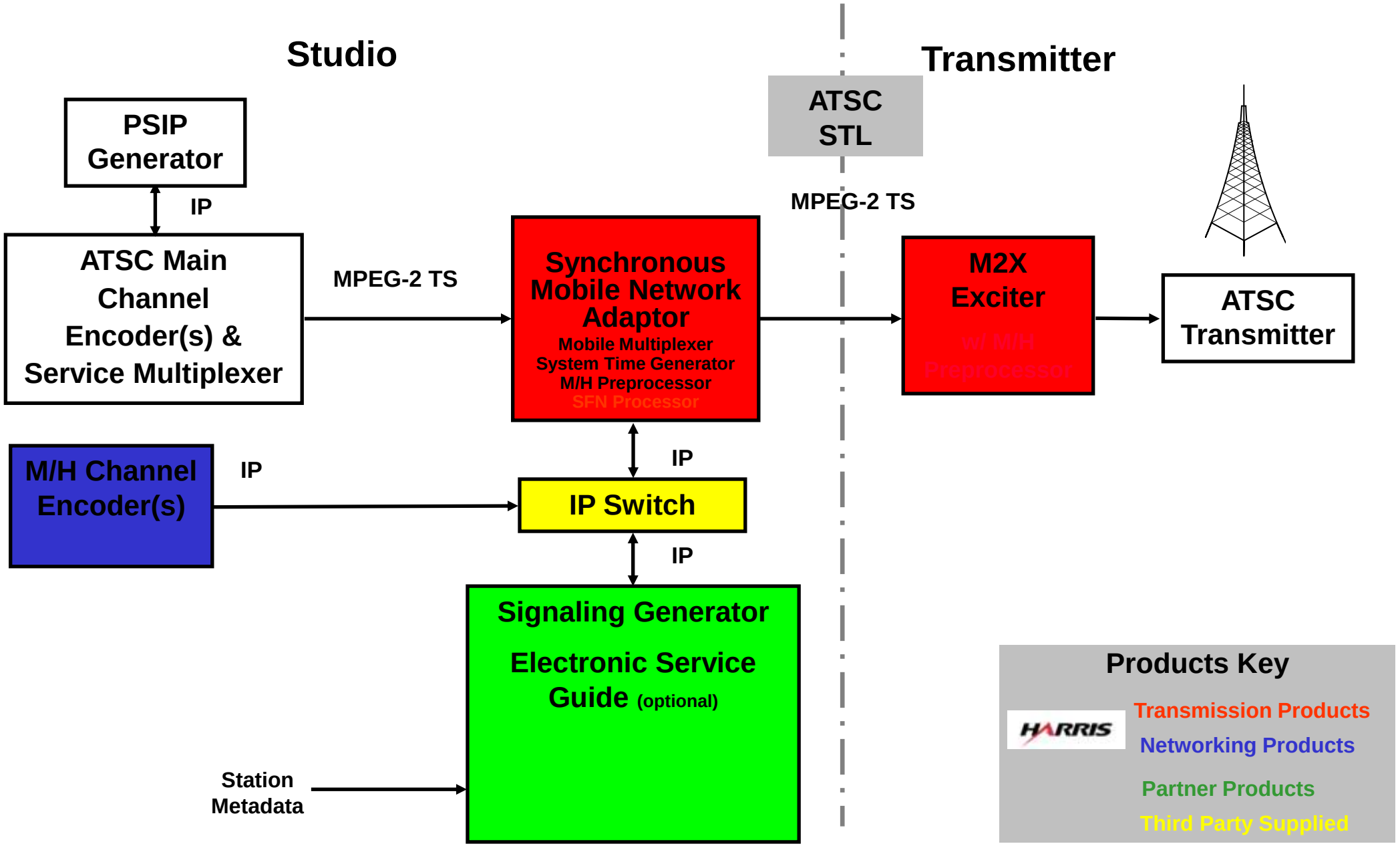
System Architecture - ATSC Only



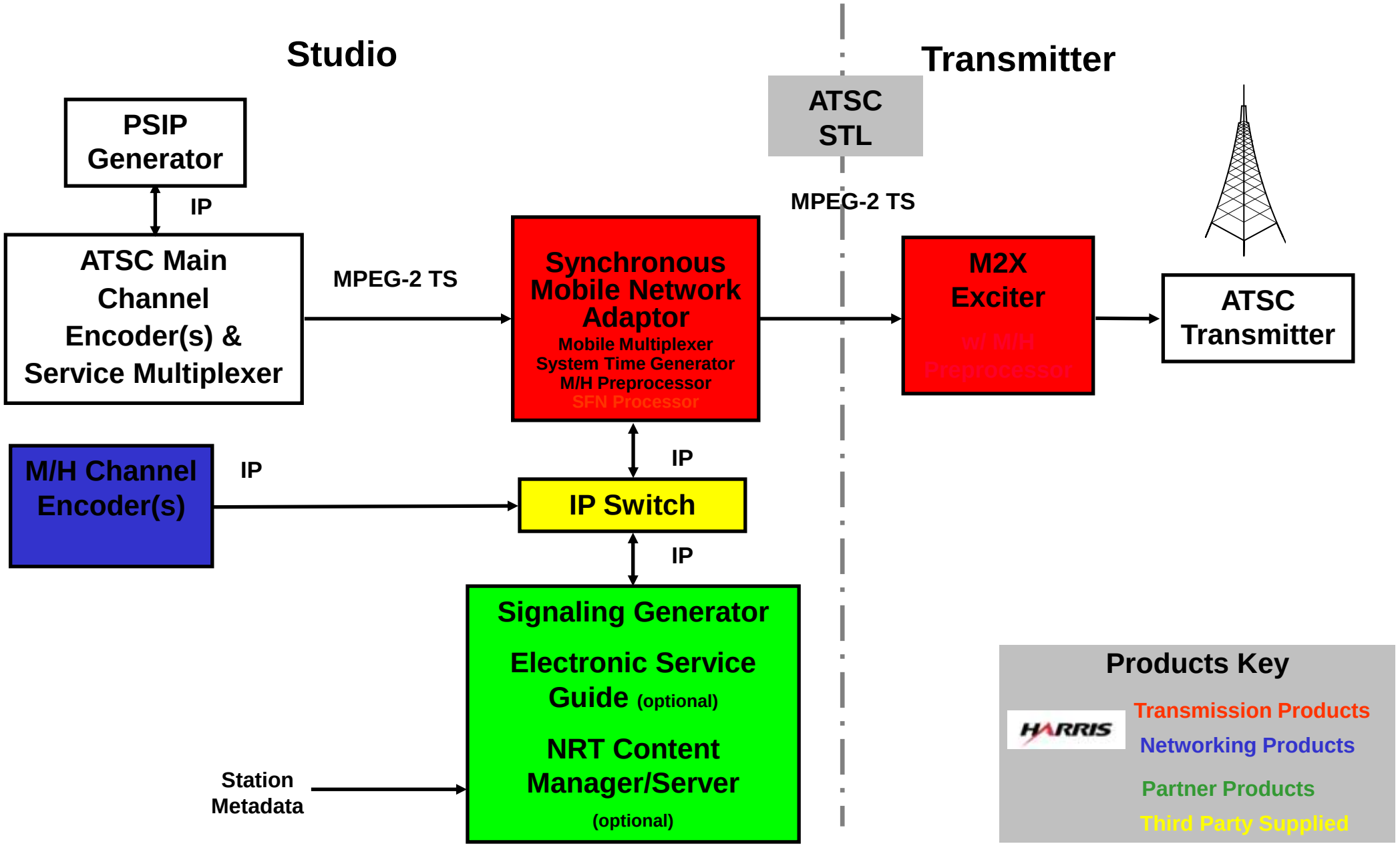
System Architecture with Basic ATSC M/H



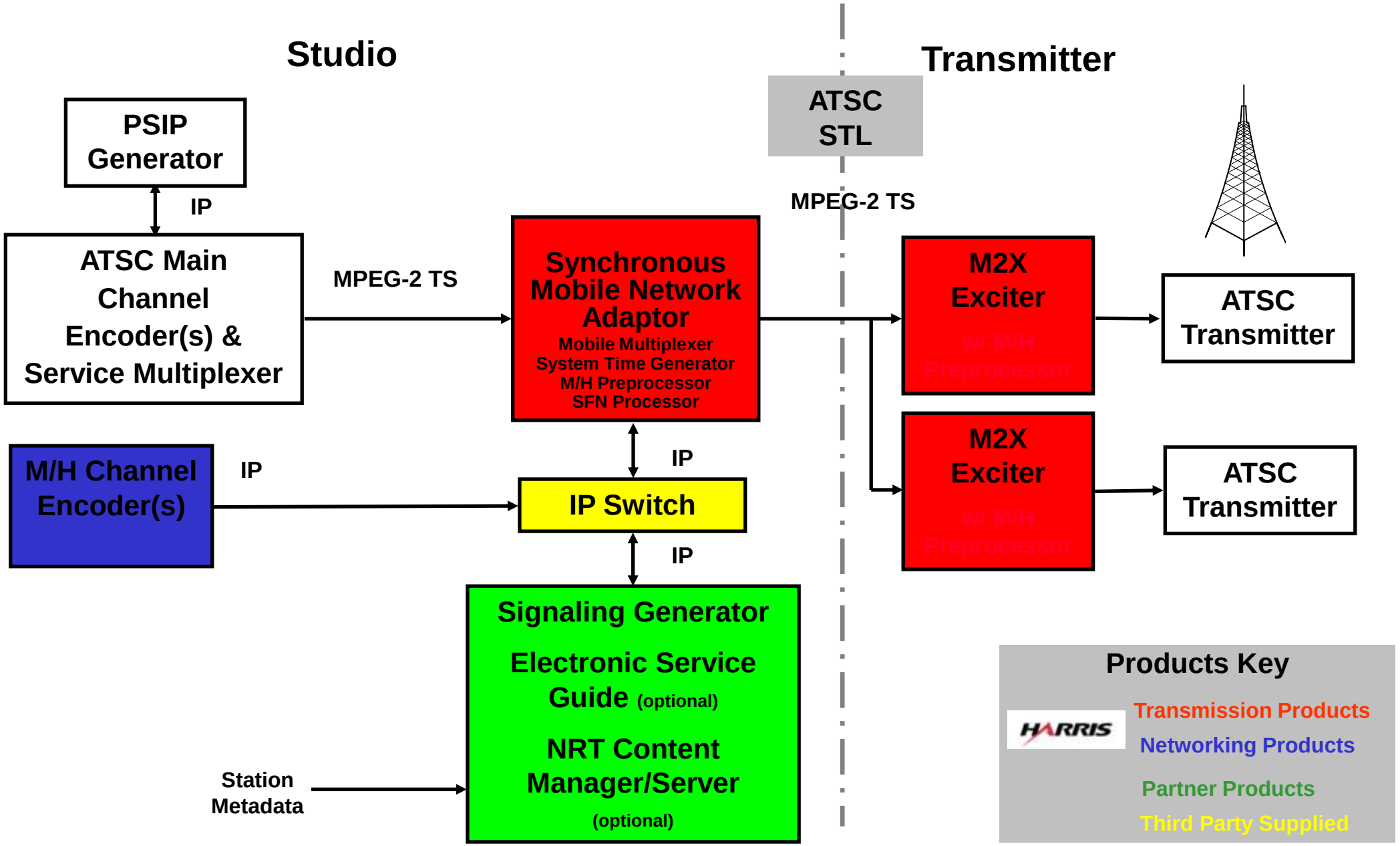
System Architecture with Advanced ATSC M/H



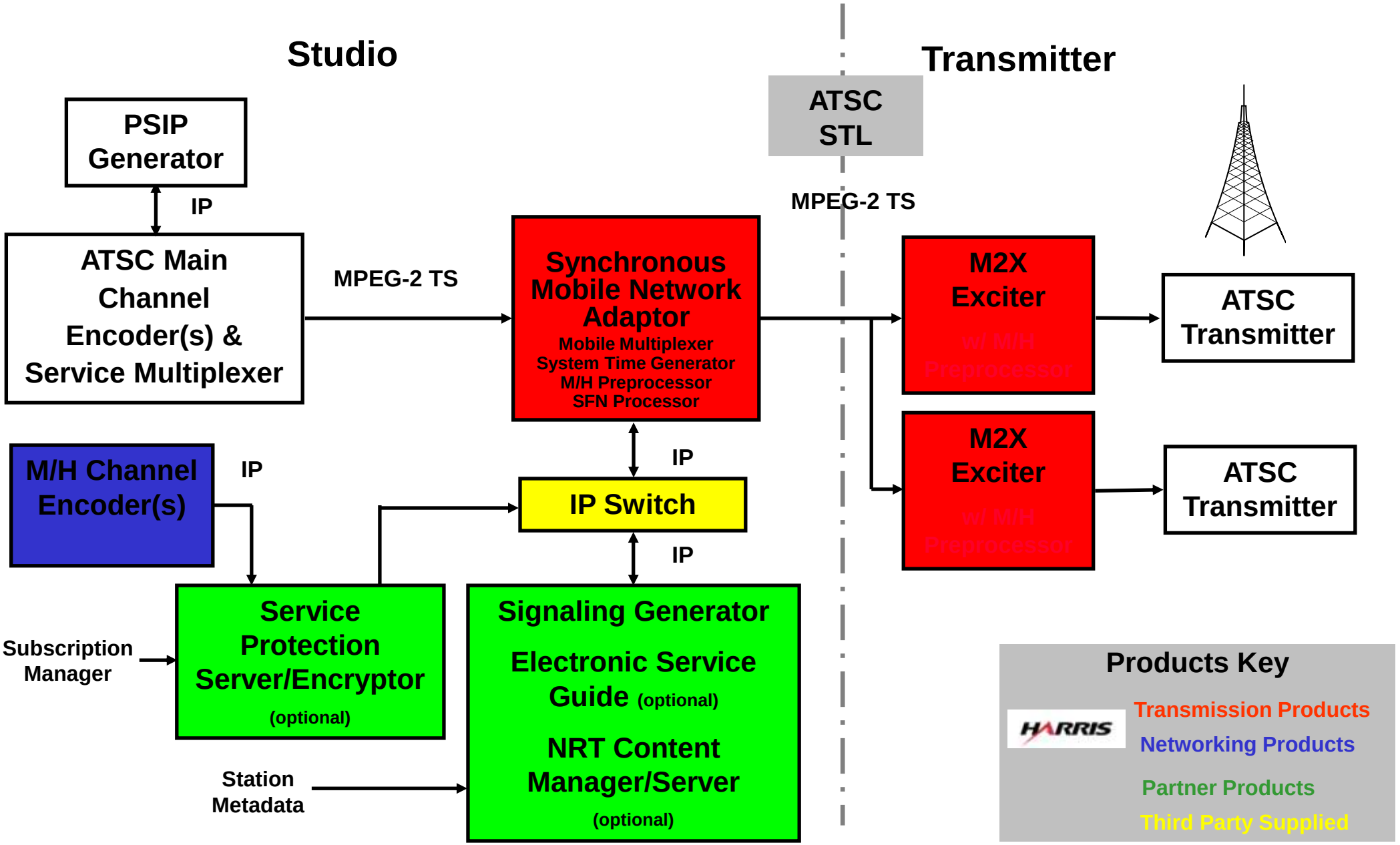
System Architecture with Advanced ATSC M/H



System Architecture with Advanced ATSC M/H & SFN



System Architecture with Full ATSC M/H & SFN



ATSC M/H Encoder

- Function: Compresses and encodes audio/video program content into low bit rate IP packetized data streams for transmission to ATSC M/H enabled receiving devices
- Requirement: One encoder for each real time program stream that is to be transmitted over the ATSC M/H system. Redundancy should be considered at n:1 level
- Detailed Specifications:
  - Video
    - Encoding format – MPEG4 h.264 base profile v1.3
    - Resolution – 416 x 240 Progressive scanning
    - Aspect ratio – 16 x 9 (Wide Screen)
    - Source video – Could be 1080I, 720P, 480P (ws) or 480I (ws)
      - Recommended to start with 16 x 9 format or convert prior to encoding
      - Encoder should respond to AFD (Automatic Format Descriptor)
    - Closed captioning – CEA 708 format

- Detailed Specifications cont'd:
  - Audio
    - Encoding format – HE AAC v2.0 (High Efficiency Advanced Audio Codec version 2.0)
    - Sampling Frequency – 16, 22.05, 24 KHz. with SBR & 32, 44.1, 48 KHz. w/o SBR SBR = Spectral Band Replication
    - Audio format – Mono or Stereo (capable of supporting parametric surround)
    - Source audio – analog or AES digital
  - Output
    - Packetized IP over UDP (User Datagram Protocol) with RTP (Real-time Transport Protocol)
    - RTP supports:
      - Payload-type identification - Indication of what kind of content is being carried
      - Sequence numbering - PDU sequence number
      - Time stamping - allow synchronization and jitter calculations

NetVX ATSC M/H Encoder-Mux

NetVX platform incorporates modules for :

- M/H real-time stream encoding
- M/H IP encapsulation
- M/H Multiplexing
- M/H Emission Control with Vidium s/w program
- Also capable of ATSC encoding and multiplexing

SynchronyMNA
Synchronous Mobile Networking Adaptor

- Function: Multi function platform that supports preprocessing of the M/H data, multiplexing of the processed M/H data into the ATSC transport stream, generation of FIC,TPC and Service ID signals, transmission of signaling tables, generation of ATSC system time and synchronization/timing adjustment of the ATSC transport for distributed transmission networking. The ATSC Mobile DTV processing and distributed transmission timing are each treated as an application. Three functional configurations are available:
  - ATSC Mobile Processing only
  - Distributed Transmission only
  - ATSC Mobile Processing with Distributed Transmission

The SynchronyMNA is initially available with M/H preprocessor and distributed transmission (SFN) configurations. Integrated mobile multiplexing, system time and basic signaling generation (FIC – TPC) will become available in Fall 2009. The NetVX platform supports those functions which are not currently available in SynchronyMNA.

SynchronyMNA
Synchronous Mobile Networking Adaptor

- Requirement: One system per station. Redundancy should be considered on a 1:1 level. Application options to be selected depending on system architecture
- Detailed Specifications:
  - Inputs
    - SMPTE 310M/ASI (selectable) for ATSC Transport Input
    - Ethernet port for ESG, Signaling Generator, Content protection and NRT system
    - Ethernet port for system configuration, monitoring and control
    - GPS antenna
  - Outputs
    - SMPTE 310M/ASI selectable X 4

Fast Information Channel

- Purpose: Rapid service scan, rapid service access
  - For each Ensemble
    - What Services (virtual channels) it contains
    - Whether it contains copy of GAT and/or SLT
    - Ensemble “protocol” version (structure of RS-Frame, etc.)
  - For each Service
    - Service ID
    - Status (normal/hidden, on/off air)
    - Whether or not it is access-controlled
    - Whether it is part of a multi-Ensemble service, and if so whether it is essential to a meaningful presentation

Transmission Parameter Channel

- Purpose: Carries data group and coding information
  - Subgroup, slot and parade numbers
  - Reed Solomon framing (inner code) numbers
  - SCCC (Outer code) details
  - FIC version number

APEX M2X ATSC M/H Exciter

- Function: Generates ATSC 8VSB main service signal modulation while processing M/H content with RS coding, trellis coding, serial concantinated coding and adds training signals for enhanced M/H reception.
- Requirement: One exciter per transmitter is required. Redundancy should be considered on a 1:1 level.
- Detailed Specifications:
  - Inputs
    - SMPTE 310M or ASI Transport stream (selectable)
    - Optional GPS antenna used for precise frequency or DTS (SFN) operation
    - External 10 MHz and 1 PPS reference
    - RF samples for adaptive correction
    - Ethernet for configuration, monitoring and control
  - Output
    - 8VSB modulated RF signal on assigned channel
      - .250 Watt maximum output power

APEX M2X ATSC M/H Exciter

ATSC M/H Signaling Generator

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- Function: Basic system provides metadata that is essential to mobile channel and program selection and change. This information includes channel ID and number, current program title and rating plus information that associates service elements.

  The Signaling Generator platform is the basis for adding on an OMA Electronic Service Guide with basic ESG or advanced ESG system features such as channel previews, web links, banner advertising, news and information summaries, interactivity, on line transactions and non real time delivery of data.

- Requirement: Basic signaling information is required for each station operating with ATSC M/H. Redundancy should be considered since receiver tuning is dependant on the tables generated by the Signaling Generator.

  A/153 specifies a Service Signaling Channel (SSC) in each ensemble:
  - SMT – Service Map Table (analogous to VCT)
  - GAT – Guide Access Table (sources of Service Guide data)
  - CIT – Cell Info Table (supports hand-offs when roaming)
  - SLT – Service Labeling Table (supports fast frequency scan)
  - RRT – Rating Region Table (standard A/65 RRT)

Other Tables from Signaling Generator

- NTP (Network Time Protocol) for Wall Clock Time
- GAT (Guide Access Table)
  - Accommodates multiple Service Guide (SG) data providers
  - Gives provider name and Service ID of each SG data service
- CIT (Cell Information Table)
  - Supports hand-off between transmitters when roaming
  - Tells about adjacent transmitters with same/similar services
- SLT (Service Labeling Table)
  - Allows receivers to display useful service list after brief RF scan
  - Gives service names in one ensemble; no need to visit all of them
- RRT (Rating Region Table)
  - Standard A/65 RRT

ATSC M/H Signaling Generator

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- Server Hardware Components
  - Platform: rack-mountable, minimum 2.0Ghz dual-core processor, minimum 80G hard-drive
  - OS: Red Hat Linux
  - Availability Options
    - Standard-Availability
    - High-Availability Configuration
- Server Software Components
  - Signaling Data Generator
    - Creates the tables that are sent to the Signaling Table Transmitter
  - Service Provisioning Interface
    - System configuration primarily from operator input.
  - Program Metadata Collector
    - Collects metadata from multiple sources
      - Listing Services…Gemstar, Tribune
      - Operator input
      - Main channel PSIP collected from Mobile Mux

Electronic Service Guide System

- Function: The Electronic Service Guide System (ESG) or (EPG) provides program guide and system announcement information about the programs that are in the mobile service to enable easy channel change capability. Basic features include delivery of channel icons, complete program titles, description, ratings and upcoming program information.

  Advanced system features add channel previews, web links, banner advertising, news and information summaries, interactivity, on line transactions, non-real time data delivery and a variety of exciting features which could be monetized.

- Requirement: Providing an Electronic Service Guide for the mobile DTV system is optional however the addition of an ESG greatly enhances the user experience. Redundancy should be considered if extensive commercial or revenue supported services are being provided.

- Detailed Specifications:
  - Extensive software based system running on a server
  - External information interfaces…TMS, TV Guide, station automation, traffic, etc.
    - Supports PMCP
  - Client work stations supported by Internet browser connection

ESG Relationship with Signaling

- Some overlap with Signaling layer:
  - IP multicast parameters
  - Title
  - Start time/duration
  - Genre category
  - Content advisory
- When there's conflicting info, receiver shall use Signaling
  - Service Signaling Channel always takes precedence over Announcement
- ESG and Announcement is not mandatory
- When used, it must be compliant with the following:
  - M/H Service Guide is compliant OMA BCAST Service Guide, as further constrained by A/153 Part 4
- More than one ESG is permitted
  - Receiver technology will support aggregation of guides

Mobile DTV Service Guidance

- **Lessons from CATV & Satellite**
  - #1 branding + discovery tool
  - 10% of total viewing time
  - 20% of total service satisfaction

- **ATSC-M/H enables multiple service guide models**
  - “Signaling”
  - “Announcement”
  - Time/Grid ESG
  - Models can be mixed & matched within a single market... And within a single device

A/153-3 Signaling

A/153-4 Announcement

Time/Grid ESG

Time / Grid Guide

- **Richest User Experience**
  - Achieves parity with CATV, Satellite, DVR, MediaFLO, DVBH…
  - But... requires either aggregated broadcasting or a back channel

Time Grid Guide = Ecosystem Opportunity For Mobile Operators

Branded Guide

Operator Services

SMS Interactivity

- **Mobile Operators are in a fantastic position to provide time/grid guidance**
  - Their devices inherently have backchannels!
  - Time/Grid ESG = opportunity to embrace the service in a rich, branded way
  - OMA-BCAST supports many operator-centric features within guide
    - Integrated unicast services + Application integration + SMS interactivity

Mobile DTV Widgets

Mobile DTV Widgets

- **ATSC Mobile DTV currently focuses on Television services…**
- **“Mobile DTV Widgets” add Non Real Time (NRT) data services to the mix**
- **Delivers the web-like, on-demand content experience consumers expect... But over broadcast networks!**

Mobile DTV Widgets
User Experience

KRBX is transmitting "Gossip Girl" program info and a catalog of data services including news, sports, weather, and traffic info.

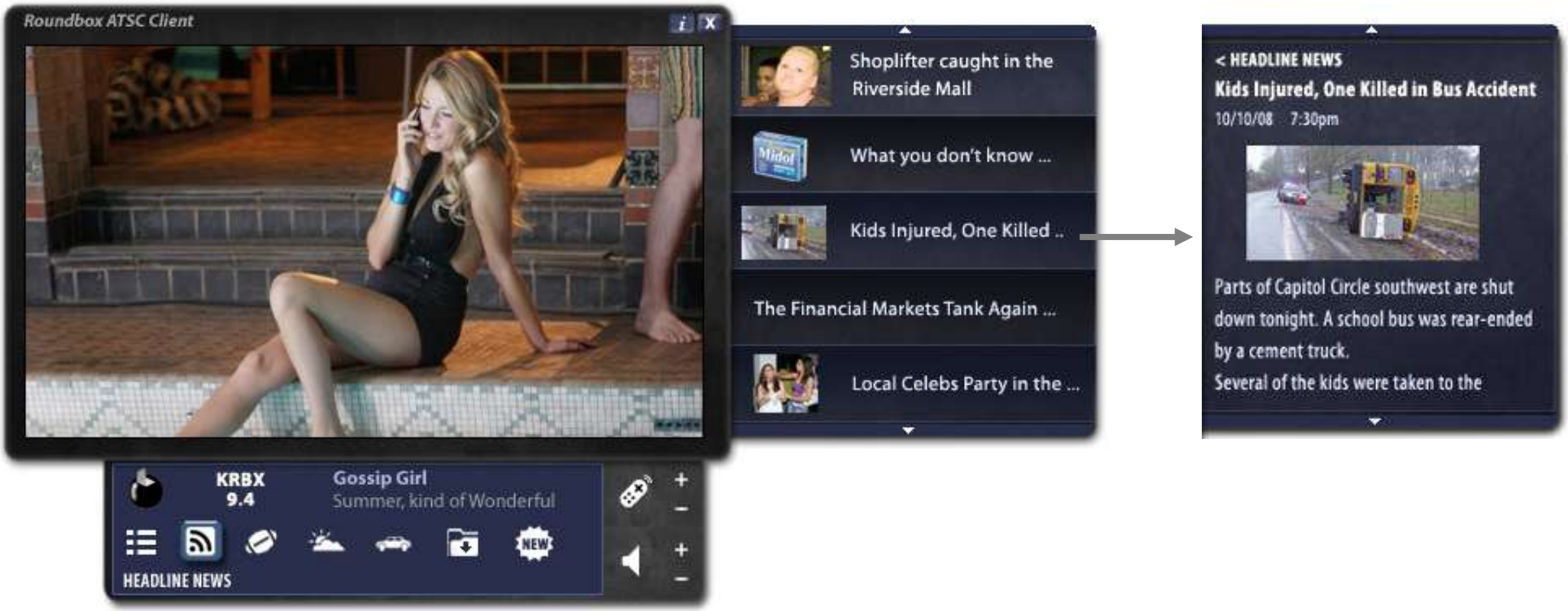
1 **When a user tunes to a supporting station, ATSC-M/H announcement data informs the receiver that a catalog of "widgets" are also available. The widget catalog provides widget icons and descriptions for the UI.**

Mobile DTV Widgets
User Experience - II

Selecting "news" pops up a list of headlines and summary graphics

2 **When a user selects the Headline News widget, the user interface displays a list of currently available article headlines.**

Mobile DTV Widgets
User Experience - III

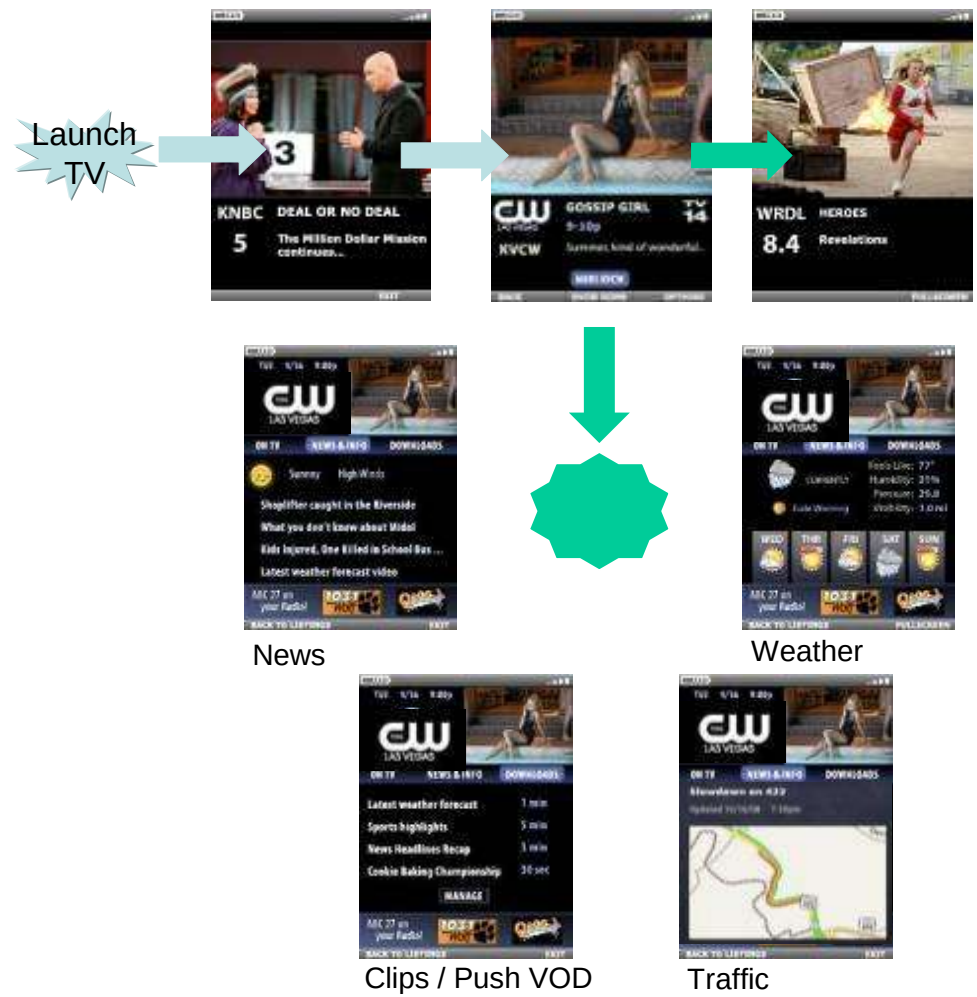


3 **Selecting a headline brings up a detailed view of the associated news article with a full-size image and article text.**

Widgets + Guide = A New Media Portal

- **Delivering the best of Broadcast + Mobile + Web**
  - Mobile DTV is far more capable than analog broadcast
  - Mobile receivers are far more capable than terrestrial TV's
  - Broadcast has unique, durable advantages delivering content to mobile devices

- **A new discovery model**
  - Internet: Portal → Media
  - Mobile DTV: Media → Portal



Widget-Ready Content
From Broadcasters Web Site

- Just as Mobile DTV easily leverages existing broadcaster DTV video...
- Mobile DTV Widgets easily leverages existing broadcaster web content
  - Assures immediate synergies between widgets & existing content production operations
- Content available through broadcaster web sites is often already in suitable format for distribution
  - RSS / ATOM new feeds
  - Video clips
  - Traffic images

Mobile DTV Widgets
Extensible to Many Service Types

News

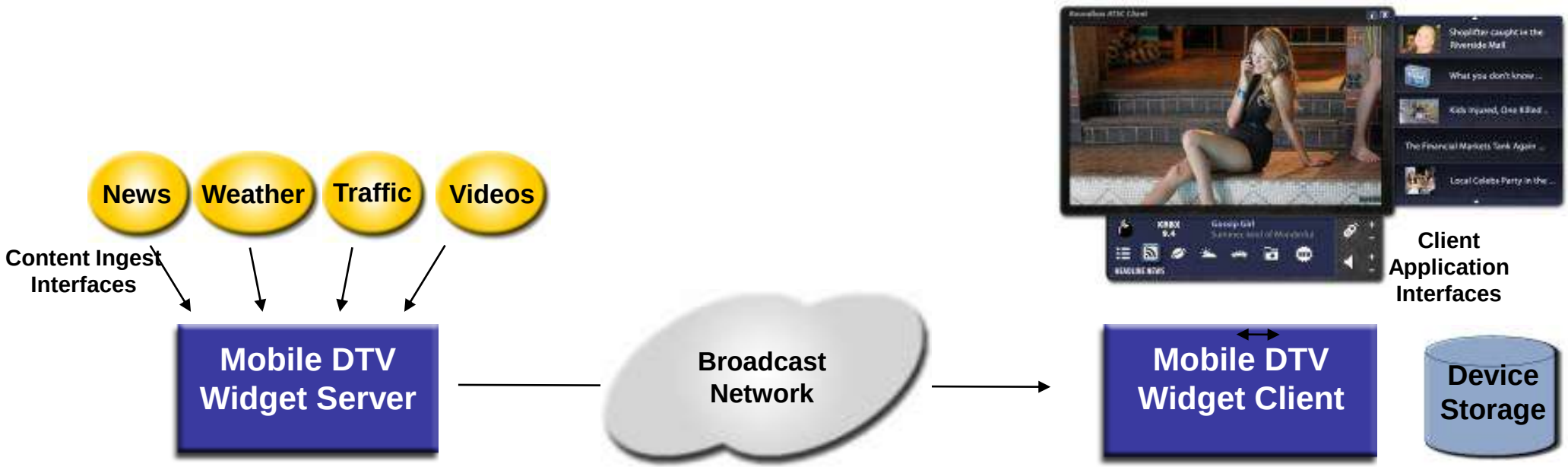
Traffic

Weather

What's New

- **Mobile DTV Widgets leverage popular, flexible, content formats**
  - RSS
  - HTML
  - Audio / Video Clips
  - Still Images
- **These content types enable a wide variety of non-real-time (NRT) content services**
  - News, Weather, Sports
  - Media Clips / Podcasts
  - Horoscopes
  - Traffic maps
  - Music clips
  - Event listings
  - Promotions…

Mobile DTV Widgets
Open Standards Based



DCD over BCAST File Distribution (FLUTE / ALC – A/153)

- DTV Widgets are based on the OMA Dynamic Content Delivery (DCD) specification and is being adapted within ATSC S13-1 (NRT) for DTV networks
- NRT standardization approach reuses core building blocks from ATSC A/153 (M/H) including FLUTE file distribution and OMA BCAST Service Guide
- Current Status: Tentative Decision reached in S13-1; Final standard in ~Q4 2009.

Widgets + Guide = New Ad Reach

- Widgets = local station content outside of the 6:00 news hour
  - Consumers can access content outside of the TV schedule
  - Content of arbitrary depth can be published
- New internet + video advertising inventory 100% owned by broadcaster
  - TV station internet ads recently crossed $1B threshold
  - Ads can be targetted to specific content (‘Traffic brought to you by BMW’)

Mobile DTV Widgets
Competitive Landscape

- **DTV Widgets address some key competitive threats & opportunities for the ATSC Industry**
- **Users are increasingly familiar with widgets from other sources & networks**
- **ATSC DTV Widgets can leapfrog other, competitive models & broadcast networks**
  - Power, reach & transport cost advantages over 3G/4G
  - Broadcaster programmed, local content is key

Apple Desktop Widgets


Windows Vista Widgets

Alltel "Phonetop"


Verizon FiOS TV Widgets


Intel + Yahoo TV Widgets


Broadcom HDTV Widgets


MediaFLO Datacast Demo

Non Real Time Content Delivery

Mobile Datacasting

Datacast – Leveraging Broadcast for "More than TV"

Videocast

Single Live Game
30 FPS
CD Audio

1 x 250kbps

Part of "Basic Mobile" Package?

Datacast

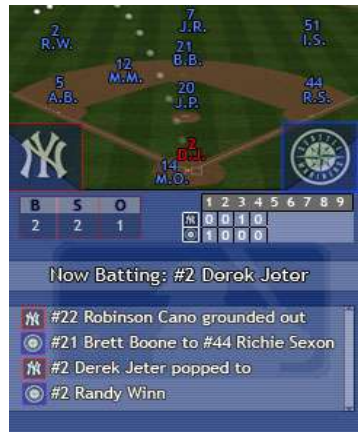
Every Live Game
Real-time Events
Audio Alerts

1 of 25 x 10kbps

Premium Service ($5/mo?)

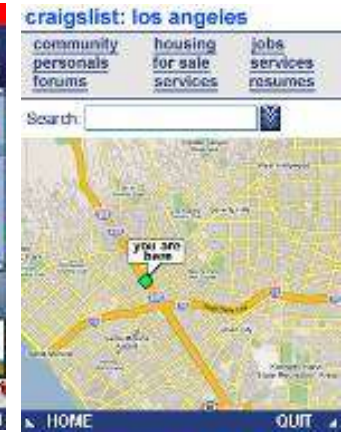
Potential Datacast Applications…

Active Wallpaper
Background distribute
Real time headlines



Real-time Sports
Datacasting

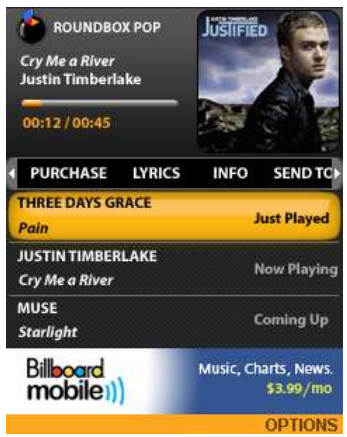
Stock Ticker -
Real-time + Filtering



Local Datacast –
Maps

Local + Real-time –
Maps + Traffic

Broadcast Storefront -
Background distribute
content teasers



Visual Radio

Real time TV “play along”

Sports “play along”

Homeland Security
Alerts

“Hot or Not”
real-time, group play along

Station Planning Factors

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Some Basics

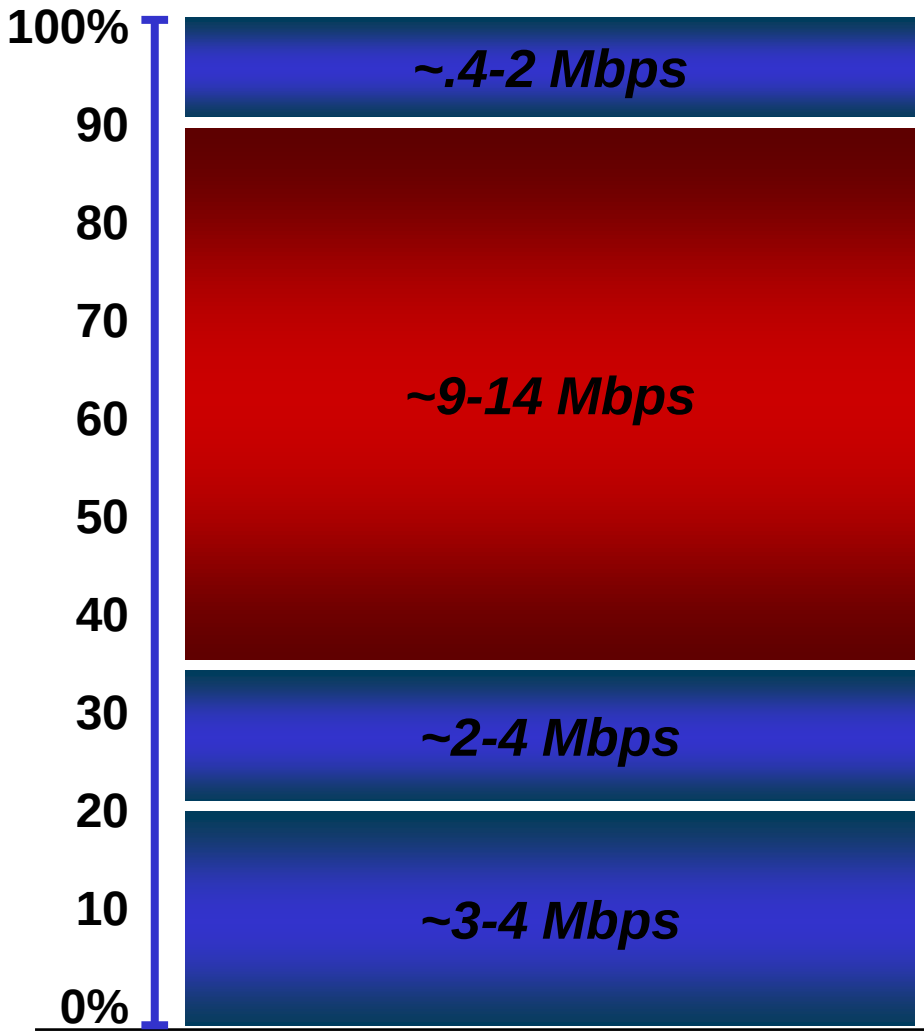
- The FCC requires all digital broadcasters to provide at a minimum 1 SD *NTSC quality* free-to-air program service
- ATSC transport has 19.39 Mbps payload capability
- ATSC program guide (PSIP) requires about 0.5 Mbps
- Typical SD service in MPEG2 requires 3-4 Mbps
- Typical HD service in MPEG2 requires 10-14 Mbps
- M/H mobile channels are scaleable in number and require about 2 Mbps of the ATSC transport per ensemble

DTV Spectrum Allocation

Illustrative

Independent

19.4 Mb/s DTV Spectrum per Station



- PSIP & ancillary data services
- **4 – 8 Mobile video channels**
- Additional SD multicasts
- Standard definition primary feed

DTV Spectrum Allocation

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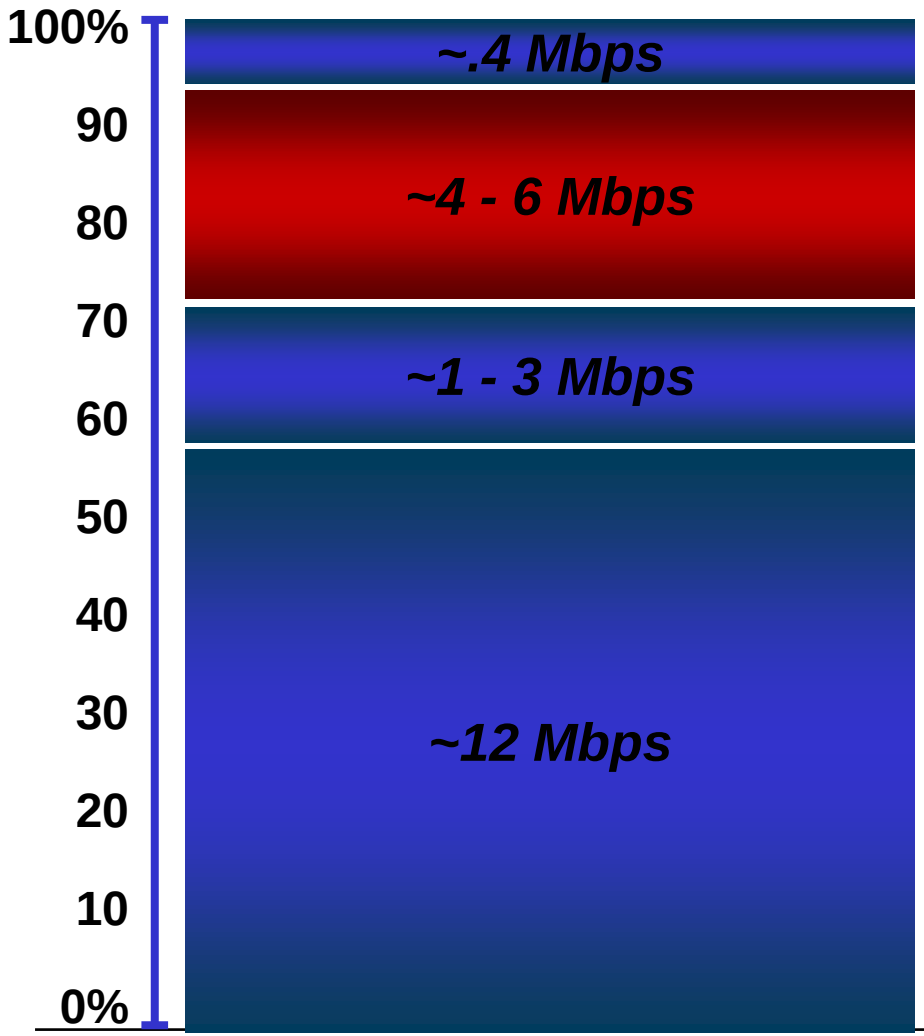
Illustrative

Network

19.4 Mb/s DTV Spectrum per Station



- PSIP services
- **2-3 mobile video channels**
- High-end hi def...
  or additional SD multicasts
- High definition primary network feed

More Basics

- M/H mobile program streams are scaleable in quantity and robustness,
- Supports different types of content aimed at different types of receiving environments
  - Entertainment to the backseat consumer
  - News, weather, sports, traffic to the handheld and mobile consumer

More Basics

- M/H mobile program streams can be free-to-air on all enabled mobile devices

OR

- M/H mobile program streams can be offered on a subscriber supported basis

OR

- They can be offered in a combination of both

More Basics

- Mobile/handheld reception is based on different planning factors than terrestrial DTV reception
  - Receive antenna height 45” to 6 ft. vs. 30 ft.
  - Receive antenna gain -10db to -3db vs. 0db
- Field testing has shown that the “radio horizon” is the limit to reliable mobile/handheld coverage
  - Typically line of sight from TX antenna to horizon

Rule #1

- UHF ATSC M/H transmission will typically out perform High Band VHF. Low Band VHF is not recommended

- Why:
  - Propagation is better suited to penetrate buildings
  - Spectrum noise level is much lower at UHF and very high at Low Band VHF
  - Receiver antenna performance is degraded at VHF compared to UHF

Rule #2

- Transmission antenna locations that are at the highest possible location and closest to the population center to be served will typically perform the best

Why: Mobile/handheld reception is highly dependant on "line of sight to the radio horizon".

Rule #3

- Develop your facility to operate with maximum authorized ERP by using lower transmission antenna gain and higher transmitter power levels

Why: Higher antenna gain will often result in shadowed areas for reception. The goal is coverage saturation…not distance.

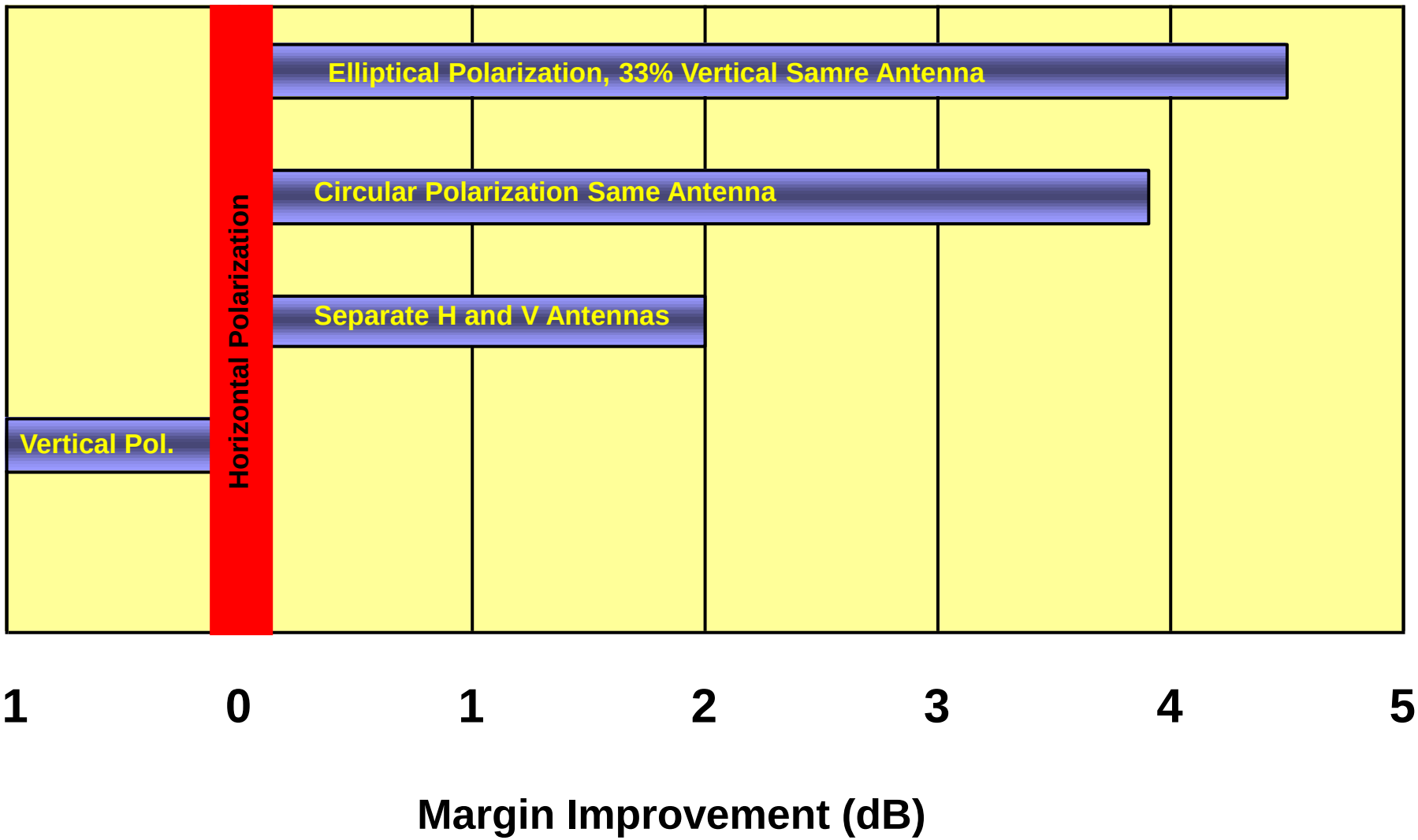
Rule #4

- Plan your transmission antenna system to include both horizontal and vertical polarization components

Why: Mobile/handheld reception is highly dependant on vertically polarized receiving antennas. You will get maximum mobile/handheld coverage if you are also transmitting in the vertical plane.

What is the Right Type of Antenna?

Expected margin improvement over horizontal polarization in a heavy scatter, depolarized environment when transmitting to a linearly polarized receiver



Is it CP or Horizontal +Vertical ?

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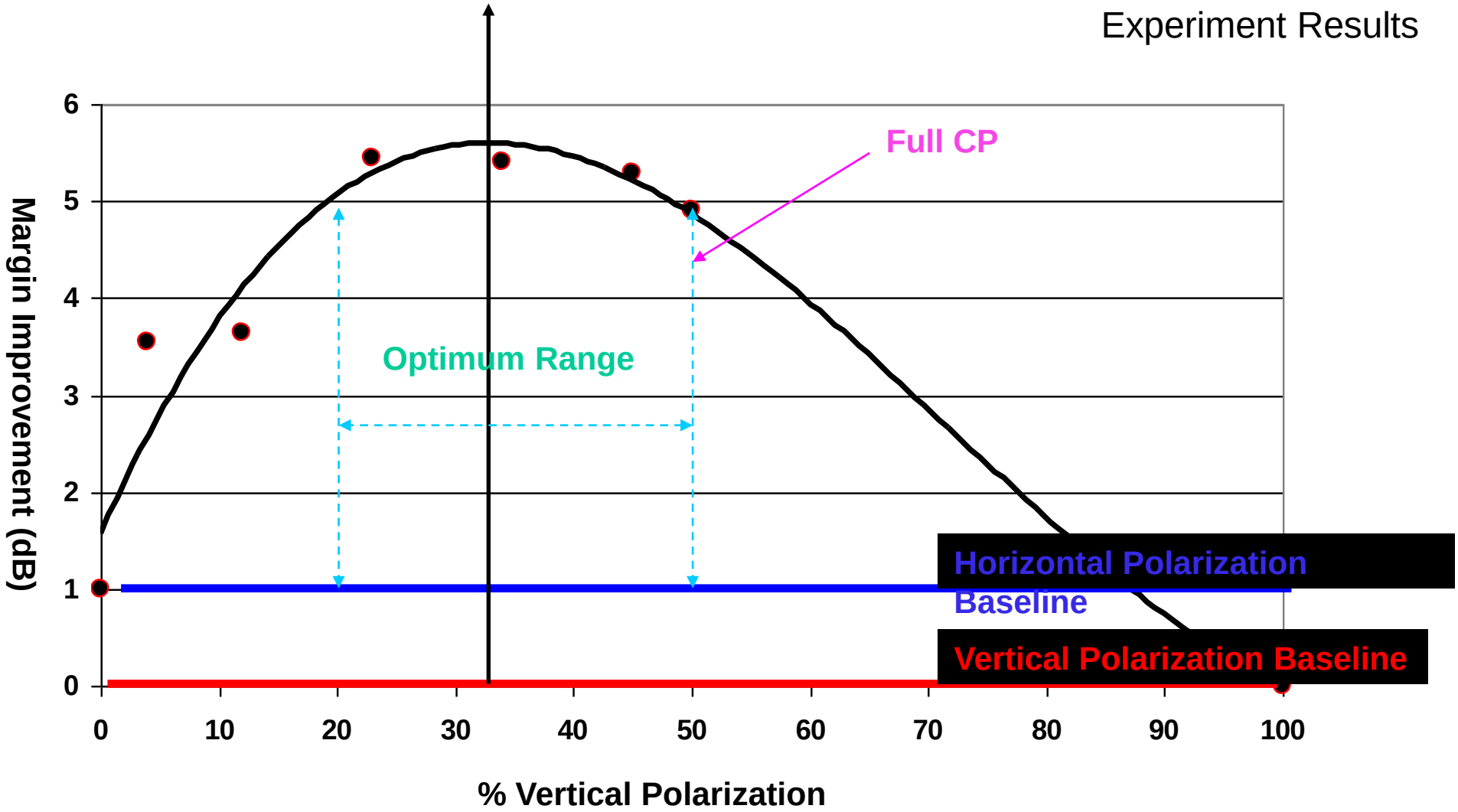
Greatest Margin Occurs at 33% Vertical Component

Experiment Results



More than 4 dB of margin improvement with 20% < Vpol < 50%

Rule #5

- Plan for system redundancy from the beginning of M/H operation

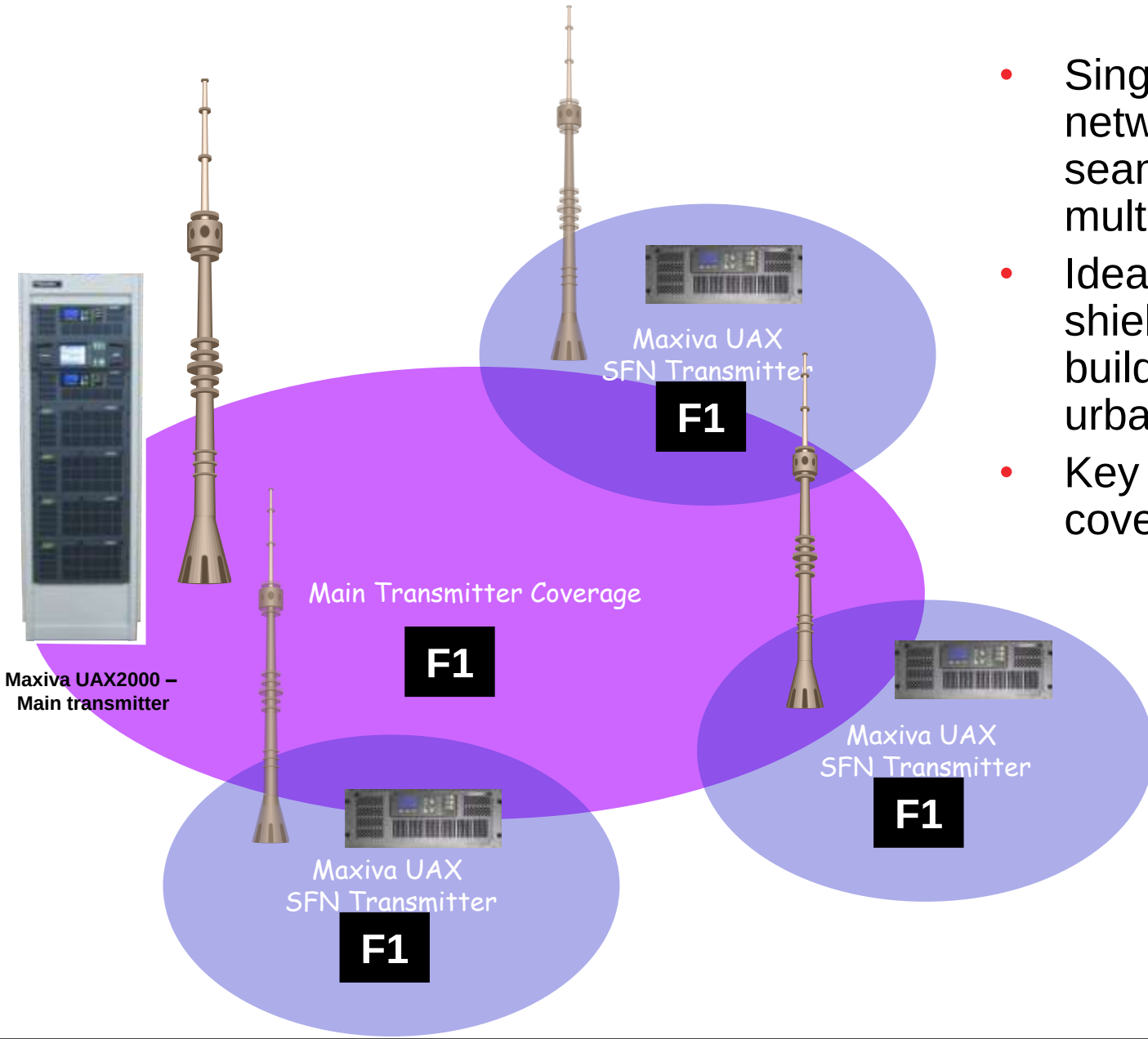
Why: ATSC M/H Mobile service is truly a wireless business. If you are off the air or limited in power, your mobile viewers will be lost. No cable TV distribution will support your wireless viewer base.

Rule #6

- Consider the use of “single frequency networking” (SFN) with multiple transmitters to provide coverage to areas that may be shadowed due to terrain or man made obstructions.

Why: Larger coverage area for the viewer without having to change channels to continue reception

Single Frequency Network



- Single Frequency networks provide seamless coverage from multiple transmitters
- Ideal to overcome terrain shielding situations, or building penetration in urban areas
- Key for good mobile TV coverage

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Questions?

ATSC Mobile DTV Overview

Jay Adrick, VP Broadcast Technology