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When it comes to DTV… we clearly set the standard.

Agenda

- Overview of the ATSC
- Key DTV Standards
- DTV Audio Initiatives
- ATSC Strategic Plan
- ATSC-M/H
- ATSC Non-Real-Time
- Status of the DTV Transition

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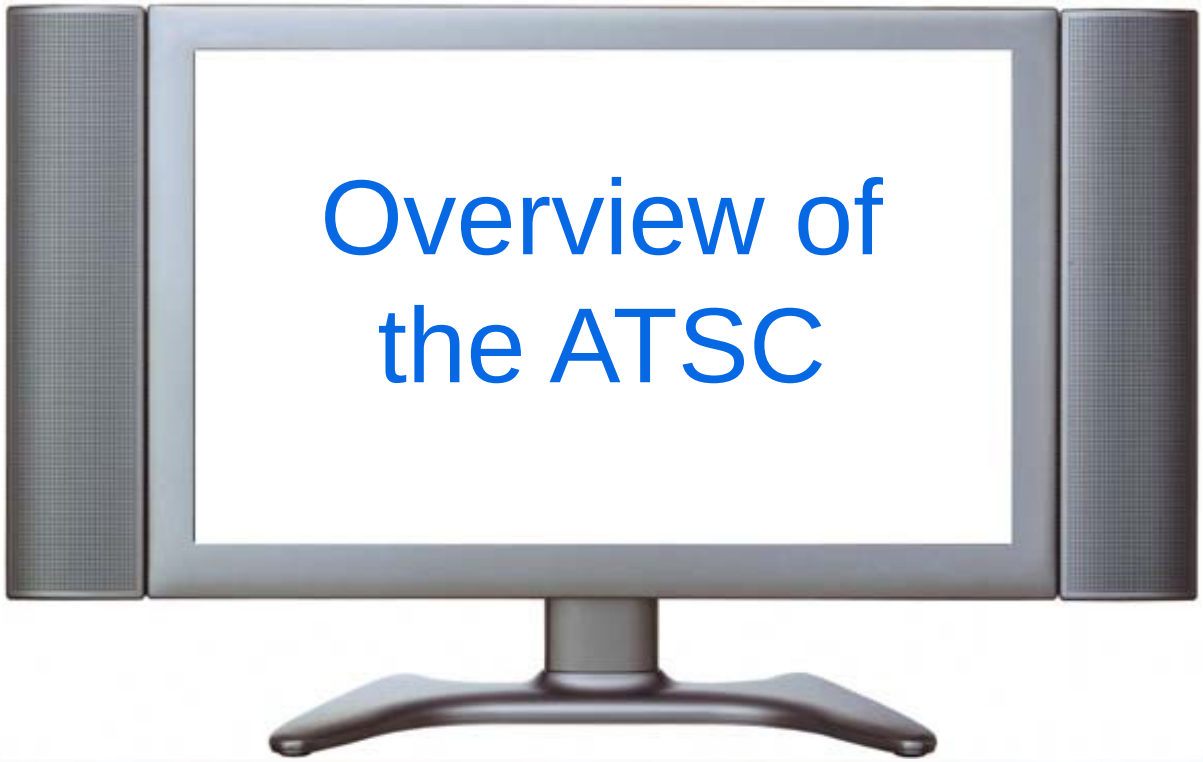


Overview of the ATSC

The ATSC

- Standards development organization (SDO) for digital television:
  - Founded in 1983
  - Focused on terrestrial digital television broadcasting
  - ATSC is an open, due process organization.
    - ✓ Open to all organizations with a direct and material interest in the work
  - All Standards and RPs are available free of charge at www.atsc.org
    - ✓ Informational documents are available at no charge

ATSC Membership

- Founded by CEA, IEEE, NAB, NCTA, and SMPTE
- Approximately 195 members:
  - Broad, cross-industry participation
    - ✓ Broadcasters
    - ✓ Cable and satellite
    - ✓ Motion picture
    - ✓ Consumer electronics
    - ✓ Computer
    - ✓ Automotive
    - ✓ Professional equipment manufacturers
  - International in scope

atsc
Advanced Television Systems Committee

ATSC DTV

- The ATSC DTV Standard has been adopted by:
  - United States
  - Canada
  - Mexico
  - Argentina
  - Honduras
  - South Korea

Courtesy NAB

ATSC Board of Directors

- Glenn Reitmeier, NBC Universal, Chair

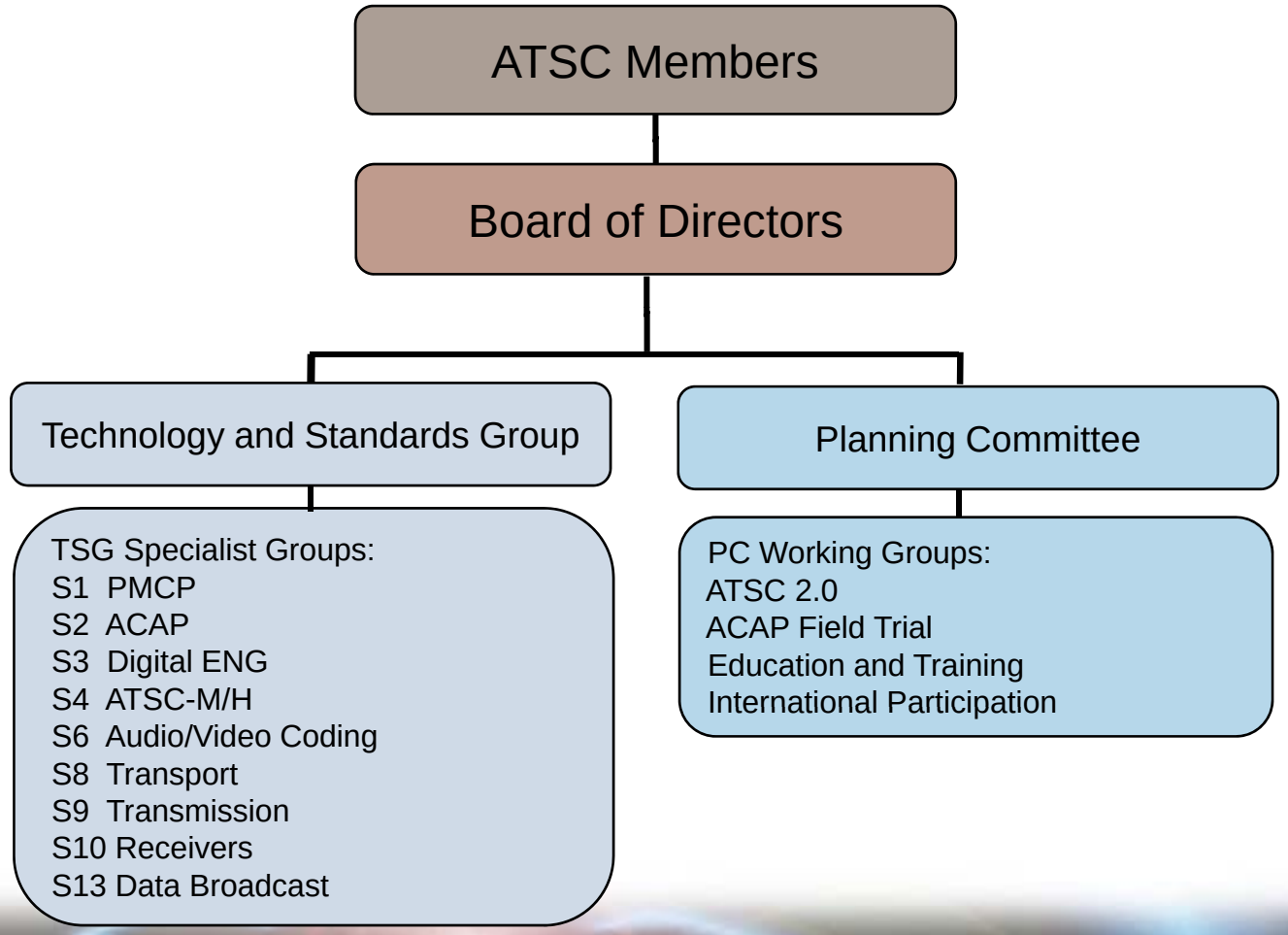
- Lynn Claudy, NAB
- Brian Markwalter, CEA
- Jay Adrick, Harris
- John Godfrey, Samsung
- Wayne Luplow, Zenith
- Craig Todd, Dolby
- Michael Isnardi , IEEE
- Andy Scott, NCTA
- Wendy Aylsworth, SMPTE
- Sterling Davis, Cox Broadcast
- Joseph Flaherty, CBS
- Victor Tawil, MSTV
- Ed Barrett, Sony
- Adam Goldberg, Pioneer

ATSC Staff

- Mark Richer, President

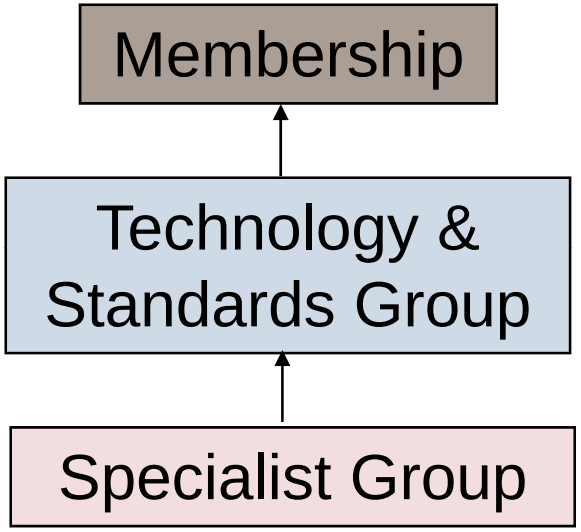
- Jerry Whitaker, VP for Standards Development
- Lindsay Shelton-Gross, Director of Communications
- Daro Bruno, Office Manager

ATSC Organization

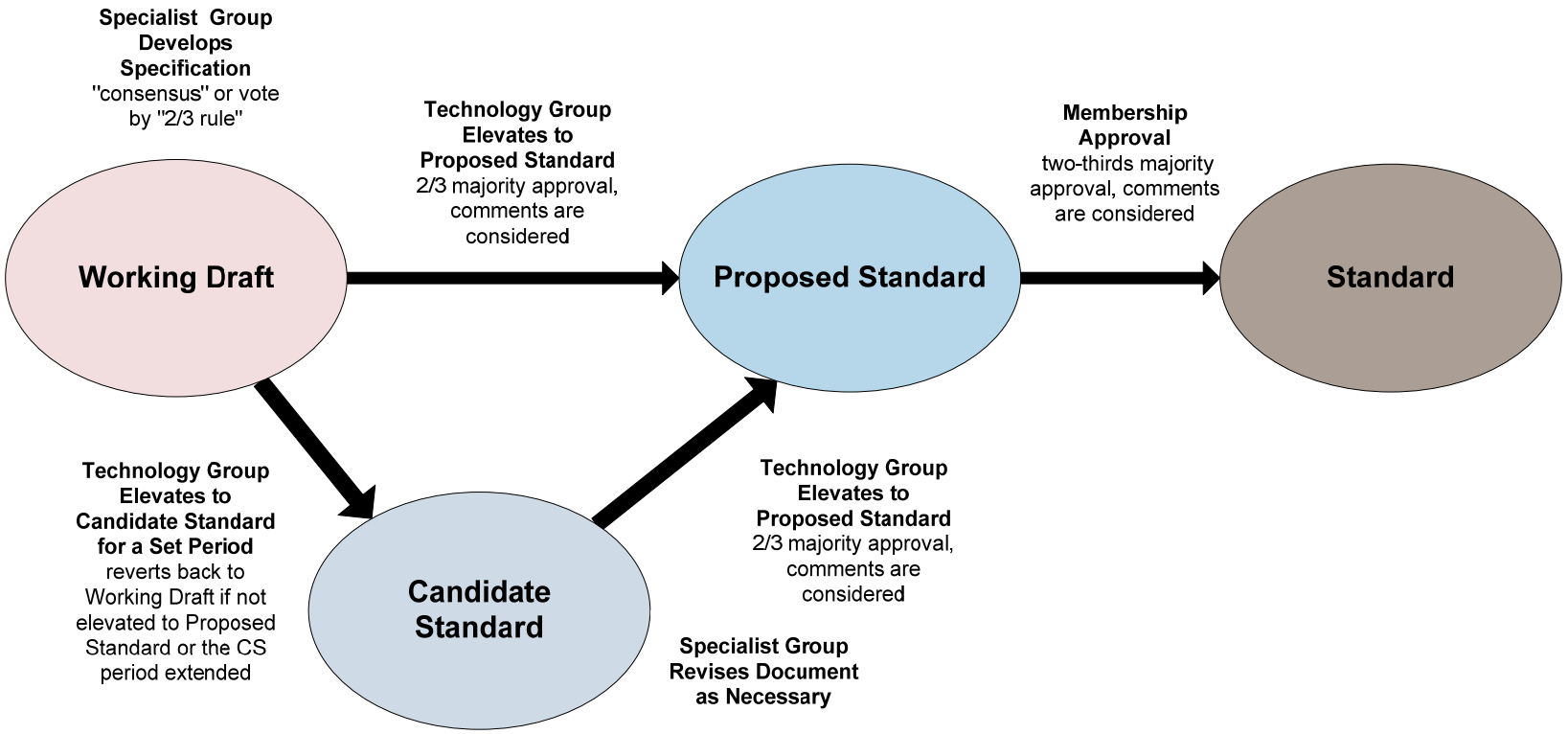


ATSC Approval Process

- Standards and Recommended Practices require three levels of approval before publication:
  - Specialist Group
  - Technology and Standards Group
  - Full ATSC membership



ATSC Due Process



Technology & Standards Group

- TSG develops and recommends voluntary, international technical standards for the distribution of television programs to the public using advanced television technology.
  - Technologies considered may be improvements to current systems or entirely new systems.
  - All forms of distribution systems may be considered.
  - Sound, vision, display, conditional access, and data sub-systems may be considered.

TSG Leadership

- John Henderson, CEA, Chair

- Rich Chernock, Triveni Digital, TSG Vice-Chair
- Jerry Whitaker, ATSC, Secretary

TSG Specialist Groups

- Active TSG Specialist Groups:
  - TSG/S1 PSIP Metadata, Art Allison, NAB
  - TSG/S2 ACAP, Thomas Jung, Alticast
  - TSG/S3 Digital ENG, Dane Ericksen, H&E (SBE)
  - TSG/S4 Mobile & Handheld, Mark Aitken, Sinclair
  - TSG/S6 Video and Audio Coding, Pat Waddell, Harmonic
  - TSG/S8 Transport, Mark Eyer, Sony
  - TSG/S9 RF Transmission, Charles Einolf, MSTV
  - TSG/S10 Receivers, John Henderson, CEA
  - TSG/S13 Data Broadcasting, Michael Dolan, TBT

Planning Committee

- PC explores applications of digital broadcast technology:
  - Considers business opportunities, with a focus on new applications that may be enabled by DTV standards.
  - Makes recommendations to the ATSC Board regarding development of voluntary standards, recommended practices, and/or informational documents.
  - Responds to inquiries about market requirements from TSG and other groups.
  - Supports the use of ATSC Standards through education, training, and demonstration projects.

PC Leadership

- Graham Jones, NAB, Chair

- Jim Kutzner, PBS, Vice-Chair
- Jerry Whitaker, ATSC, Secretary

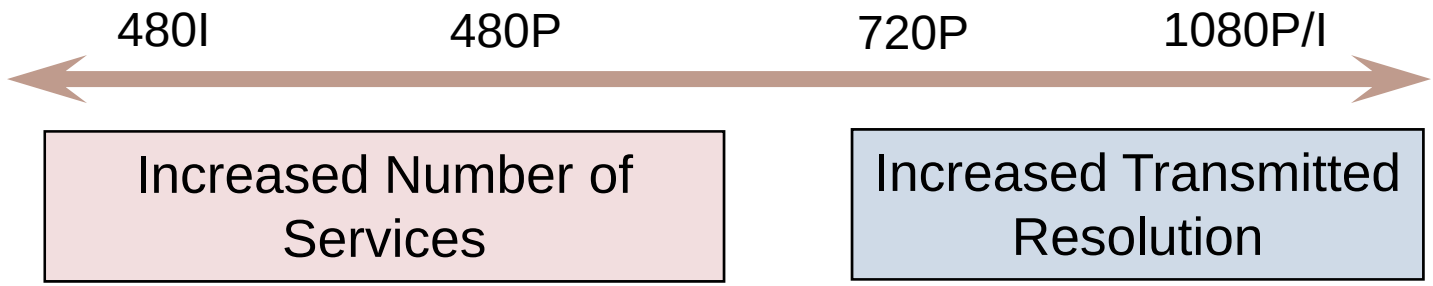
PC Working Groups

- ATSC 2.0 (PC-4): Walt Husak, Dolby
- Education and Training: Jerry Whitaker, ATSC
- International Participation: Wayne Luplow, Zenith

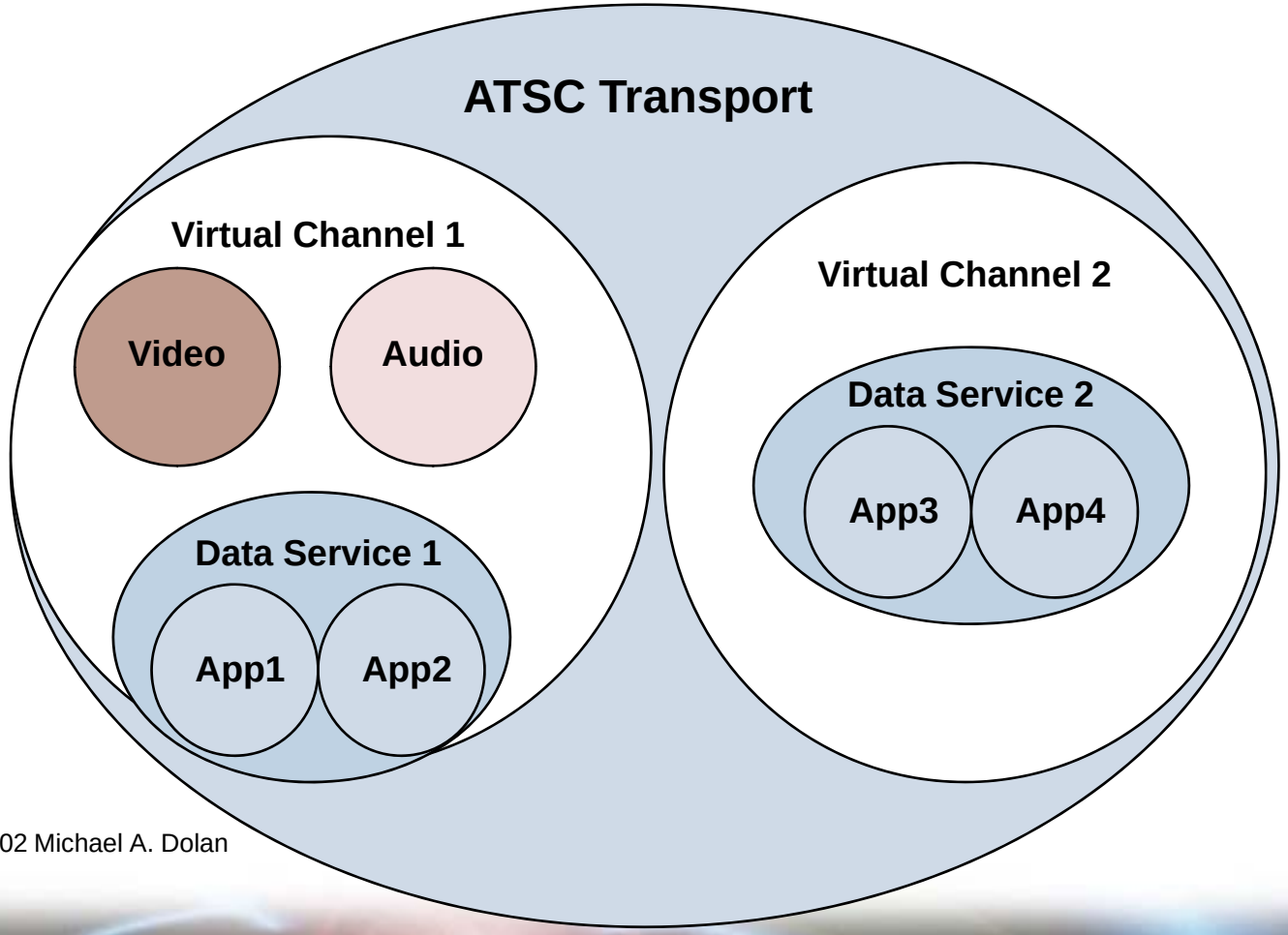
The Lessons of Digital Television

- Quality counts:
  - High-definition television (HDTV)
  - 5.1 Dolby digital sound
- Quantity counts:
  - Multicasting
  - Multiple SDTV
  - HDTV and SDTV
- Data is important:
  - Enhanced and interactive services
  - Program related services/non-program related services

Programming Options



One Channel, Multiple Services



Key DTV Standards

A/52 – AC-3 Standard

- ATSC Digital Audio Compression (AC-3, E-AC3) Standard:
  - AC-3 is the audio coding system used in the ATSC DTV Standard.
  - It is widely used in various audio systems around the world.
  - Revision B includes enhancements to AC-3 that are designed to provide improved performance and increased flexibility (Enhanced-AC-3).

A/53 – DTV Standard

- ATSC Digital Television Standard:
  - A/53 is the core document for digital television.
  - It describes the key system characteristics of DTV.
- A/53 is organized in “Parts”:
  - Part 1 – System
  - Part 2 – RF/Transmission System Characteristics
  - Part 3 – Service Multiplex and Transport Subsystem Characteristics
  - Part 4 – MPEG-2 Video System Characteristics
  - Part 5 – AC-3 Audio System Characteristics
  - Part 6 – High Efficiency Audio System Characteristics

A/65 – PSIP

- Program and System Information Protocol (PSIP) is mandated by the FCC for U.S. broadcasters.
- Primary features:
  - Preserves channel branding
  - Allows navigation and access to each of the services within the transport stream
  - Program guide (from 12 hours to 16 days)
  - Gives the user information for browsing and selection
  - Conveys rating and content advisory information
  - Supports closed captioning

A/72 – Advanced Video Codec

- Describes the video system characteristics of AVC when used in the ATSC DTV system
- AVC (also known as H.264) can provide high image quality using fewer bits than MPEG-2
- A/72 was published last month:
  - Part 1, Video Coding Characteristics
  - Part 2, Transport
- A/72 is intended for new services, and countries that have not yet launched a digital TV service.

A/76 – PMCP

- Programming and Metadata Communication Protocol:
  - Provides the means to integrate the various information sources that are needed to compile the key PSIP tables.
  - PMCP is designed to permit broadcasters, professional equipment manufacturers, and program service providers to interconnect and transfer data among systems that eventually must be communicated to the PSIP generator.
- The overall goal is to ensure proper PSIP implementation while requiring minimum manual intervention by the broadcaster.

A/78 – TS Verification

- Transport Stream Verification Recommended Practice:
  - Outlines a common methodology for describing transport stream conformance criteria for digital television.
  - Explicitly describes the elements and parameters of ATSC Standards A/53 and A/65 that should be verified in a transport stream for it to be considered a proper emission.
  - Does not cover RF, captioning, or elementary streams.

A/82 – Digital ENG

- Automatic Transmitter Power Control Data Return Link Standard:
  - Specifies a mechanism for basic identification and power control of TV Broadcast Auxiliary Service (BAS) transmitters
    - ✓ Either an automatic or manual mode.
  - Permits the carriage of specialized private data
    - ✓ Camera control information and operator communications.

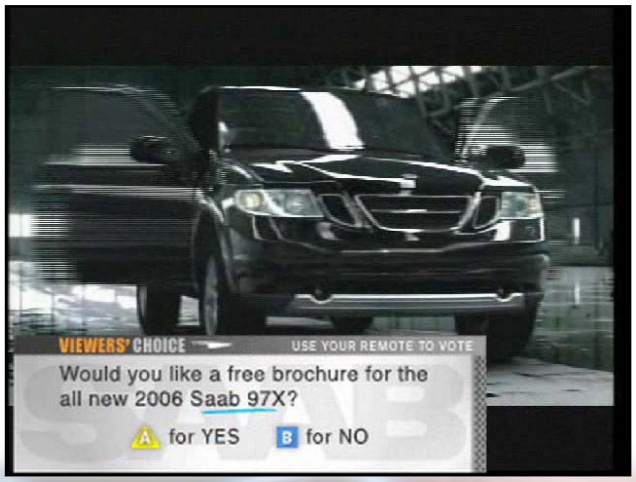
A/101 – ACAP

- Advanced Common Application Platform:
  - An interactive TV (ITV) standard for terrestrial broadcasting
  - Based on Java / JavaTV code
  - A method of delivering OCAP applications to cable MSOs thru the affiliates
  - Update to A/101 developed; ballot authorized by TSG

Example ACAP Applications

Courtesy NBC

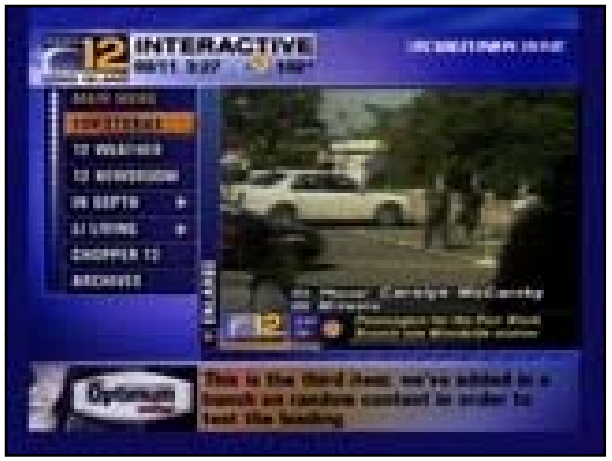
Courtesy NBC



Courtesy NBC

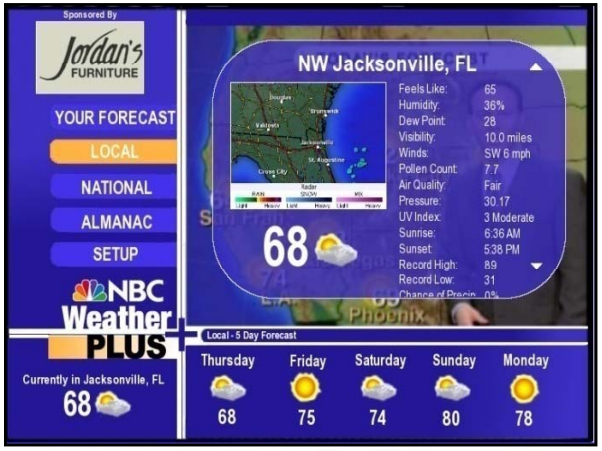
Courtesy KBS

ACAP for News and Sports



Courtesy NBC

Courtesy NBC



Courtesy NBC

Courtesy KBS

DTV Audio Initiatives

DTV Audio Loudness

- Ad Hoc group formed under TSG/S6 to study loudness issues:
  - Chaired by Jim Starzynski of NBC Universal
  - Wide participation from the ATSC membership and other interests
  - Scope:
    - ✓ The S6-3 AHG on Audio Loudness will investigate issues relating to variations in reproduced audio levels within the ATSC Digital Television System. This work is expected to ultimately result in the drafting of a Recommended Practice on Audio Loudness.
  - Work on a draft RP is currently underway

DTV Audio Lip-Sync

- Ad Hoc group formed under TSG/S6 to study lip-sync issues:
  - Chaired by John Henderson representing CEA
  - Wide participation from the ATSC membership
    - ✓ Broadcasters, manufacturers, test equipment vendors
  - The group is
    - ✓ Working through the limited data available from 3rd parties
    - ✓ Examining a variety of potential sources of the lip sync problem, including MPEG-related causes
  - CEA has established a Working Group focused on A/V synchronization

One More Thing…

- For the record—just in case we forget:
  - These are non-trivial problems
  - There is no one solution
  - They took time to create
  - They will take time to fix

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ATSC Strategic Plan

Executive Summary

- The ATSC Board of Directors developed a strategic plan to serve as a guideline for future work of the organization:
  - The plan takes into account both the likely progression of technology and the importance of backwards compatibility with existing DTV consumer receivers.
  - The Board believes that ATSC should focus on comprehensive solutions that enable compelling services and products.

Major Recommendations

- Focus on documentation of *service levels* that group standards together to form a logical bundling of features and functions:
  - **ATSC 2.0**: New services for the conventional fixed DTV receiving environment.
  - **ATSC-M/H**: Delivery to mobile and handheld devices.
- Development of a standard for non-real-time (NRT) delivery of services.

About ATSC 2.0

- ATSC 2.0 will be a complete suite of next generation services for the conventional fixed DTV receiver viewing environment.
  - ATSC 2.0 might include, for example:
    - ✓ Advanced video/audio codecs
    - ✓ Interactive (ACAP)
    - ✓ Non-Real-Time (NRT)
- The Planning Committee is the process of developing a set of specific requirements.
- ATSC 2.0 will specify the transmission elements of these services.

ATSC 2.0 Poll

- The Planning Committee conducted a poll of ATSC members to see what features would be desirable. Top items were (tentative sort):
  - Advanced video codec
  - Non-real-time services
  - Advanced audio codec
  - AFD and bar data
  - Transmission-side reception enhancements
  - Interactive capabilities
  - Defined return path for interactive services
  - Software download

The Future of Broadcasting

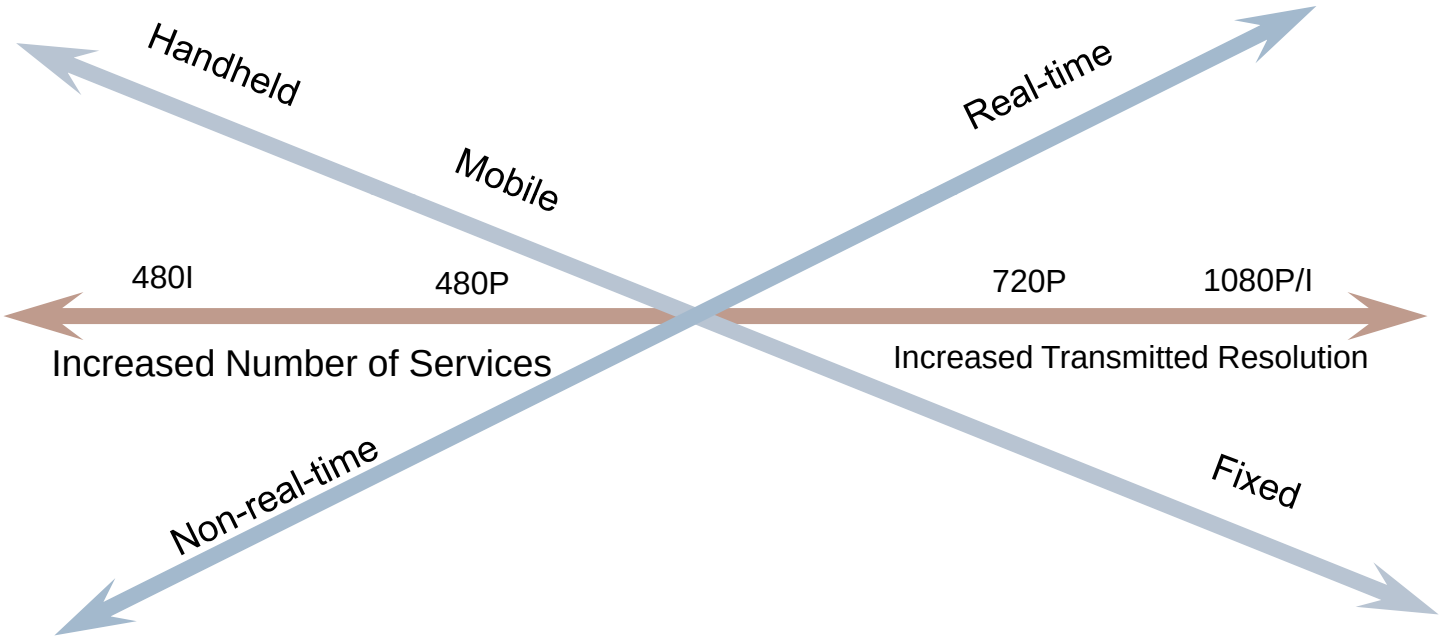
- Going forward, the broadcasting industry must leverage
  - Local
    - ✓ Content
    - ✓ Brand
    - ✓ Sales contacts
  - Un-tethered nature
    - ✓ It's wireless (before wireless was cool)!

Leveraging Wireless




Target devices that move!

ATSC Programming Options



ATSC-M/H

- ATSC is developing a standard for delivery of real-time and non-real-time television content and data to mobile and handheld devices (ATSC-M/H).
  - ATSC-M/H services will be carried in DTV broadcast channels.
  - ATSC-M/H will be backwards compatible.
    - ✓ The presence of these services will not preclude or prevent operation of current ATSC services in the same RF channel or have any adverse impact on legacy receiving equipment.

ATSC-M/H Details

- The ATSC-M/H standard will specify:
  - Physical layer (modulation and FEC).
  - Transport, signaling, and announcement (including EPG) optimized for mobile and handheld services.
  - Other parameters as necessary for carriage of video, audio, and data essence and metadata.
- The ATSC-M/H standard will reference other standards to maximize interoperability, including those from other standards developing organizations.

ATSC-M/H Applications

- Potential applications for ATSC-M/H include:
  - Free (advertiser supported) television services delivered in real-time.
  - Non-real-time content download for later playback.
  - Mobile and handheld subscription-based TV, such as:
    - ✓ Video-on-demand (VOD)
    - ✓ Pay-per-view (PPV)
    - ✓ Electronic sell-through (EST) services
  - Interactive television.
  - Real-time navigation data for in-vehicle use.

TSG/S4

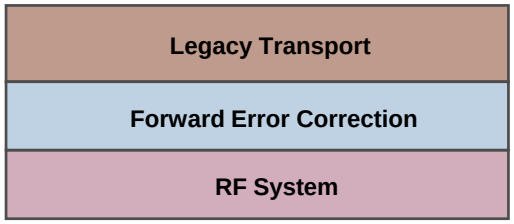
- Last year TSG formed the Specialist Group on Mobile and Handheld (TSG/S4):
  - Mark Aitken, Sinclair Broadcast Group, Chair
  - Dan Borowicz, ION Media, Vice-Chair
  - Jerry Whitaker, Secretary
- TSG issued a request for proposals (RFP):
  - Based on requirements developed by the ATSC Planning Committee and approved by the Board of Directors.
  - Ten proposals were ultimately received.
  - Some proposals addressed all elements of the ATSC-M/H system; others focused on a single layer.

TSG/S4 Work Plan

- Schedule for the work was based on the premise that broadcasters would like to announce new mobile and handheld services by February 2009.
- The work of TSG/S4 has been divided into the following major elements:
  - Physical Layer
  - Management Layer
  - Presentation Layer
  - Systems Layer

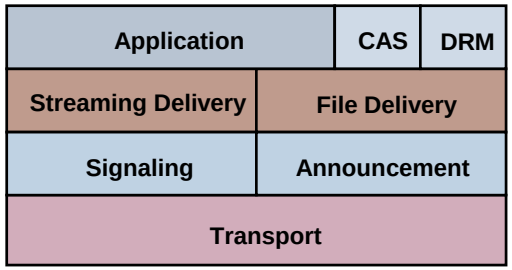
TSG/S4 Physical Layer

- The Physical Layer encompasses the backward-compatible additions to the DTV emissions stream to facilitate mobile and handheld reception.
- S4-1, the Physical Layer Group, is led by Michael Doerr of Coherent Logix as Chair and Bruce Franca of MSTV as Vice-Chair.



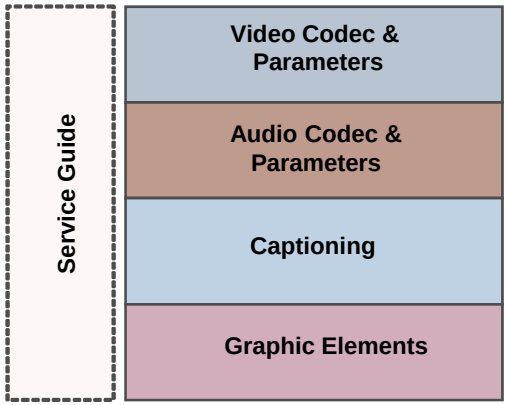
TSG/S4 Management Layer

- The Management Layer includes signaling, announcement, file delivery, and other functions such as conditional access and content protection.
- S4-2, the Management Layer Group, is led by Rich Chernock of Triveni Digital as Chair and Alan Moskowitz of MobiTV as Vice-Chair.

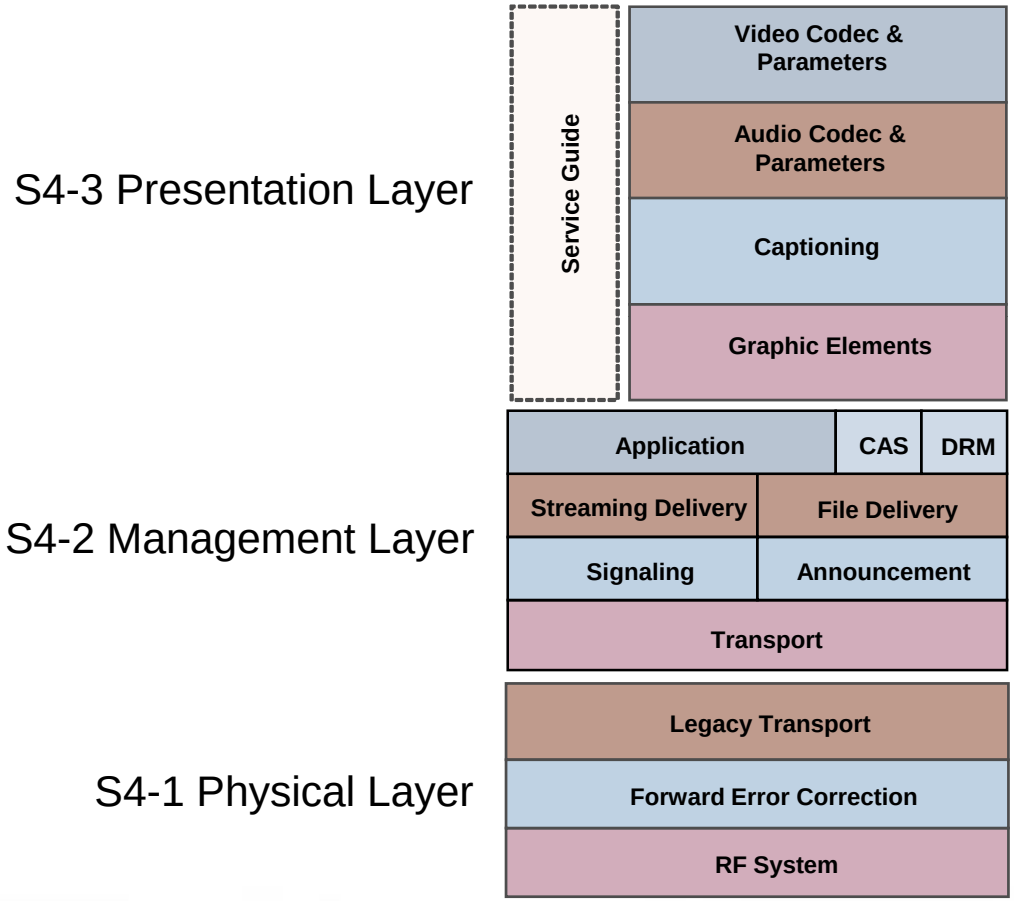


TSG/S4 Presentation Layer

- The Presentation Layer focuses on the video and audio decoding systems.
- S4-3, the Presentation Layer Group, is led by Brett Jenkins of ION Media as Chair and Dakx Turcotte of Neural Audio Corporation as Vice-Chair.



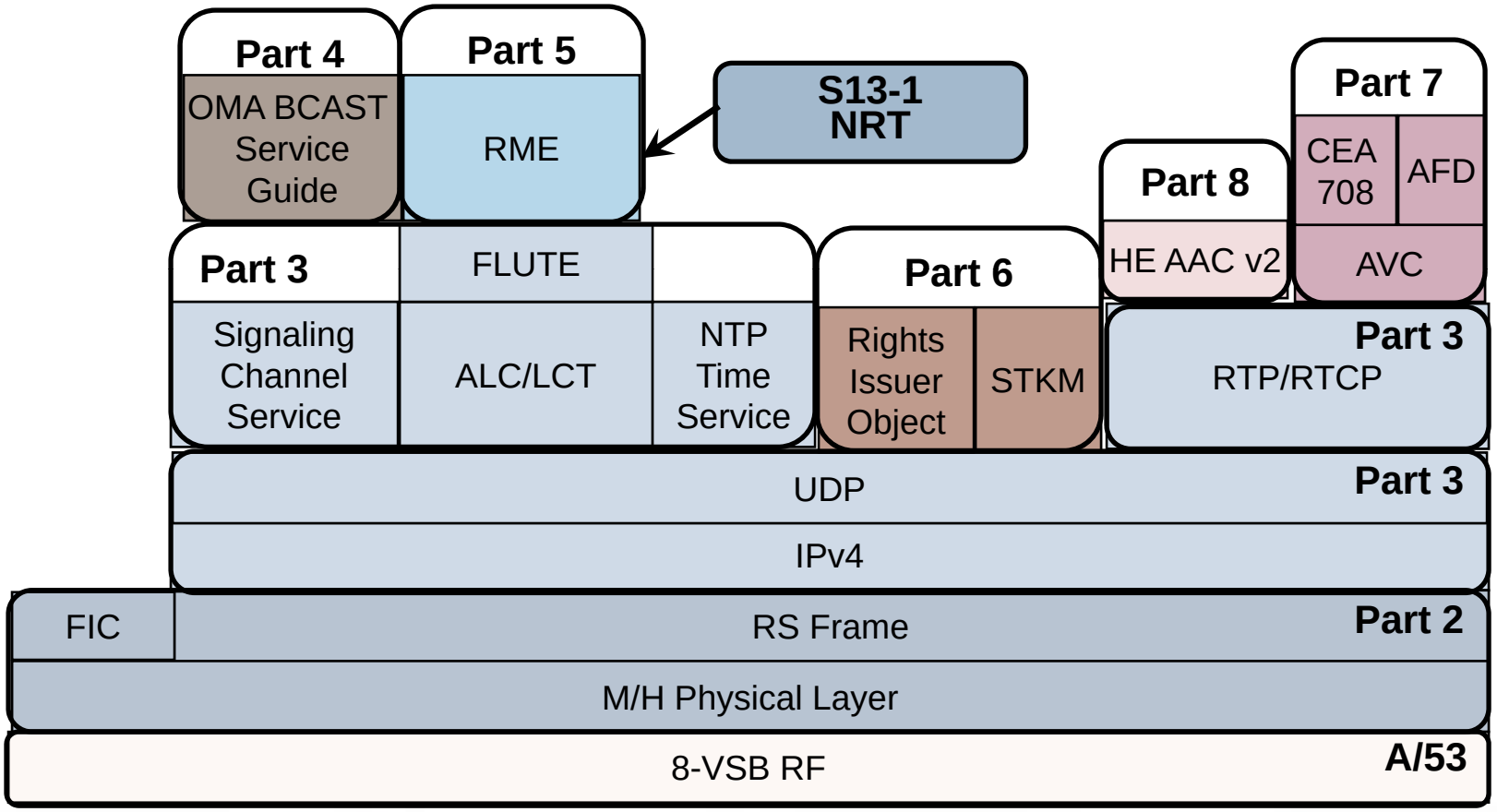
ATSC-M/H Layer Stack



A/153 Parts

- Part 1 – “Mobile/Handheld Digital Television System”
- Part 2 – “RF/Transmission System Characteristics”
- Part 3 – “Service Multiplex and Transport Subsystem Characteristics”
- Part 4 – “Announcement”
- Part 5 – “Presentation Framework”
- Part 6 – “Service Protection”
- Part 7 – “Video System Characteristics”
- Part 8 – “Audio System Characteristics”

Inside the A/153 Parts



A/153 Status

- TSG has authorized a letter ballot on A/153 Parts 1 – 8 as a Candidate Standard for a period of time ending 20 May 2009.
- Ballot will close in late November.

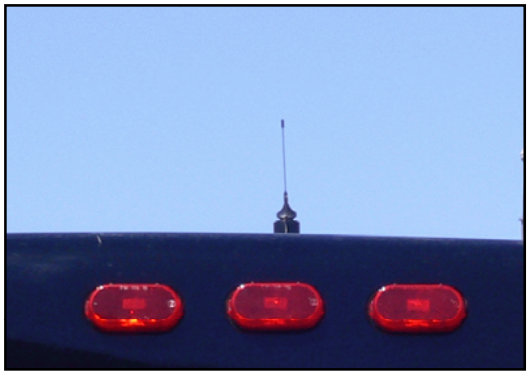
Candidate Standard

- A Candidate Standard is a specification that has received significant review within an ATSC specialist group.
  - Advancement of a document to Candidate Standard is an explicit call to those outside of the related specialist group for implementation and technical feedback.
    - ✓ This is the phase at which the specialist group is responsible for formally acquiring that experience or at least defining the expectations of implementation.
    - ✓ ATSC member companies are already thinking about possible steps they can take to make sure that the ATSC-M/H system functions as intended, and to identify any elements that might require additional work.

IDOV

- The Open Mobile Video Coalition (OMVC):
  - OMVC is an alliance of U.S. commercial and public broadcasters (representing more than 800 stations) committed to the development of mobile digital television.
- OMVC sponsored an Independent Demonstration of Viability (IDOV) earlier this year:
  - Goal was to ensure that the technical proposals under consideration could be realized to enable mobile/handheld services in 2009.
- OMVC has announced plans for trial implementations of ATSC-M/H in the coming months.

Mobile DTV Demonstrations



Photos courtesy of LG and Samsung

Advantages and Challenges

- ATSC-M/H Advantages:
  - Broadcasters already have the spectrum
  - The major investment in DTV has already been made
  - Strong brand name in the local markets

- Challenges
  - Building out single-frequency networks as needed
  - Managing the use of bits

Handheld Receivers

- Wide range of receiving devices:
  - Handheld entertainment devices
  - Laptop computers
  - Mobile phones
- ATSC-M/H vehicular integration:
  - Vehicle entertainment
  - Navigation
  - Messaging and information systems

Rethinking Real-Time

Most broadcast programming does not need to be delivered in real-time

The NRT Business Case

- Consumers have an increasing desire for “everything-on-demand”.
  - “I want what I want, when and where I want it.”
- Technology is rapidly changing to enable new business models.
- Low cost, high capacity storage is practical for inexpensive consumer devices.
- These factors combine to allow a shift from linear TV viewing to on-demand consumption of content.

ATSC-NRT

- TSG has begun a formal standards development effort on a non-real-time broadcast service:
  - Backward compatible with the ATSC DTV system
  - No negative impact on performance of legacy DTV systems
- Work being conducted in the ATSC Specialist Group on Data Broadcasting (TSG/S13):
  - Mike Dolan, TBT, Chair
  - Rich Chernock, Triveni Digital, group leader

Potential NRT Services

- A number of *service scenarios* have been identified for NRT offerings:
  - News, weather, traffic, and sports clips
  - Long form entertainment programming download
  - Telescoping ads
  - Targeted advertising
  - Downloaded games from broadcasts
  - Downloaded music
  - Downloaded web content

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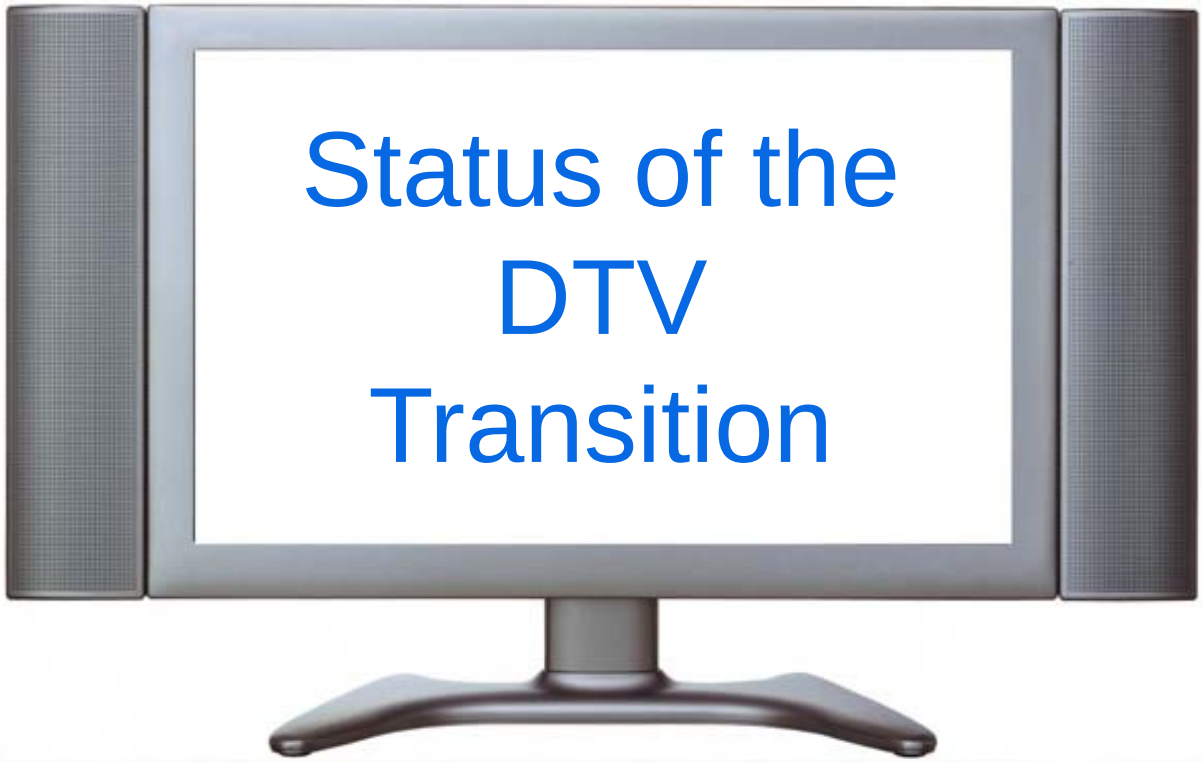

Status of the DTV Transition

U.S. DTV Deployment

- 1631 stations on the air
- In 211 markets
- DTV Television Transition and Public Safety Act:
  - Sets deadline for end of analog broadcasts of February 17, 2009
  - U.S. Government goal is to reclaim spectrum
    - ✓ Channels 52 - 69 (698-806 MHz)
- Industry focus is on HDTV:
  - HDTV is the “killer app”
    - ✓ Terrestrial broadcast, cable, and satellite are quickly migrating to HDTV

HDTV: It's Everywhere

Courtesy CBS

Courtesy PBS

Courtesy Fox

Courtesy The WB

Local News in HDTV

Courtesy WUSA.

It's Not Just HDTV

- Many broadcasters are offering HDTV plus multiple standard-definition (SDTV) services:
  - Weather
  - Local news
  - Music videos

Courtesy NBC.

- Public Television stations and other broadcasters are offering HDTV and multiple SDTV services.

New Antenna Concepts

Smart Antenna Technology

- CEA-909:
  - Standardized interface allows TV to automatically control antenna
  - Can optimize reception characteristics for each channel

Laptop DTV

Small Receivers

Digital-to-Analog Converters

- NTIA is managing a program for households to obtain coupons that can be applied toward the purchase of digital-to-analog converter boxes to serve existing NTSC analog TV sets:
  - Limit of two $40 coupons per household
  - Maximum $1.5 billion for coupon program

Courtesy NAB

What About Those Old TV Sets?

http://www.mygreenelectronics.org

Summary

- A Strategic Plan was developed by the ATSC Board in 2006 and recently updated:
  - The ATSC is launching a *second wave* of major standards.
    - ✓ First wave was intended to replace analog TV broadcasting with a superior DTV service, notably HDTV.
    - ✓ Second wave is intended to more fully exploit the capabilities inherent in digital broadcasting, focusing on next-generation services while preserving all existing services.
- The DTV transition is moving into high gear.
- There a very bright future for over-the-air terrestrial television.

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