NEXTGEN TV OVERVIEW & INTERACTIVITY INTRODUCTION

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ATSC 3.0 Summary: Broadcasting in the Internet Age

Physical Layer – flexible, configurable, world's most efficient one-to-many DTT system

Transport – IP-based protocol via MMPT and ROUTE/DASH

Video - UHD, HDR, WCG, HFR, scalable video coding via HEVC H.265

Audio – immersive audio, personalization via Dolby AC-4, MPEG-H Audio

Apps – web-based interactivity via HTML5, CSS, JavaScript and WebSocket APIs

Accessibility – IMSC1 captions, new capabilities for visually and hearing-impaired audiences

Advanced Emergency Messaging – new rich media capabilities and receiver "wake-up"

Evolvability – clever signaling design enables new features to be added over time

Benefits of ATSC 3.0

Broadcast TV is undergoing a major technology transformation

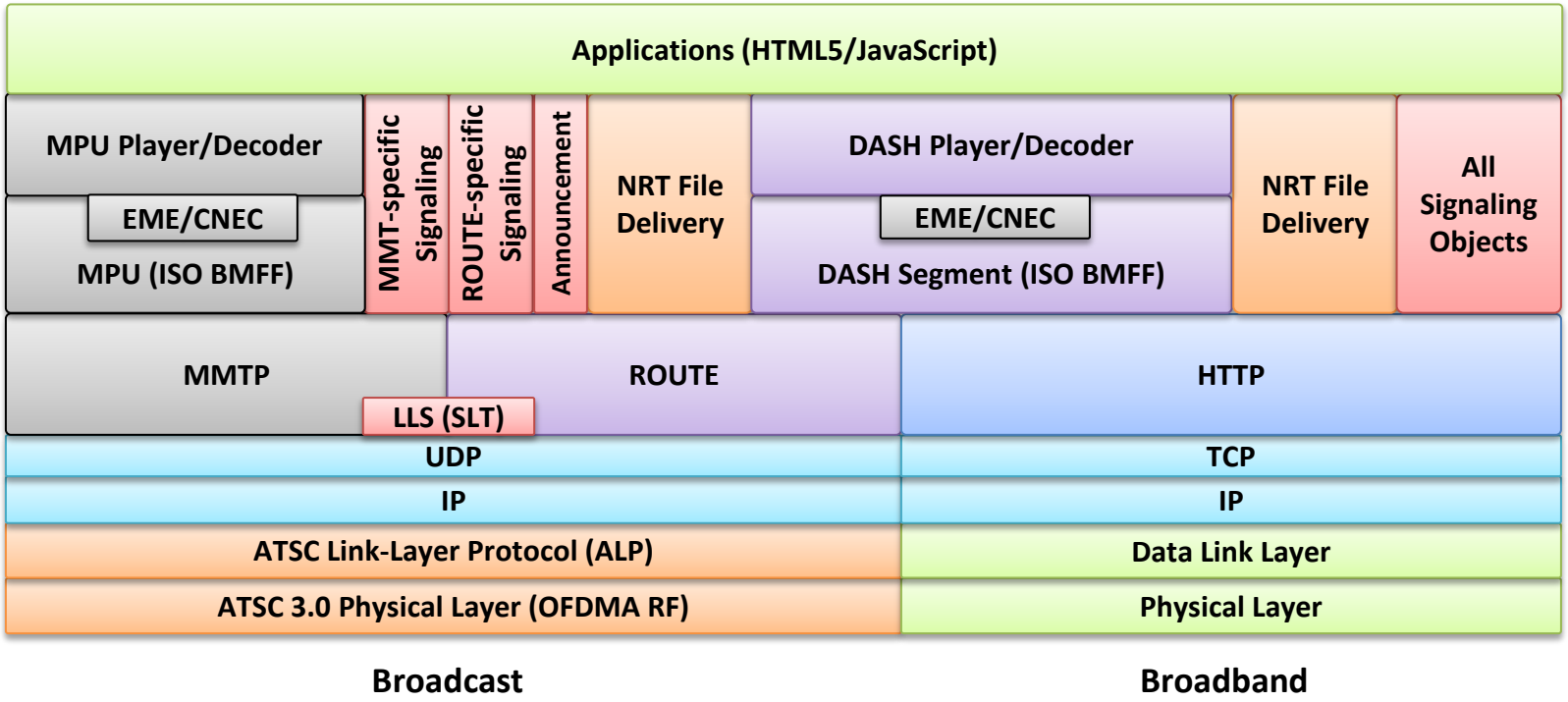
ATSC 3.0 is a Platform that evolves

- More efficient spectrum usage
- Higher power, denser signals
- Deeper building penetration
- Single Frequency Networks
- Mobile reception on phones and tablets
- Native IP transport
- Built-in hooks for LTE/5G and Internet integration
- Hybrid broadcast / broadband services
- Conversion with web technologies (HTML, JavaScript, CSS)
- Advanced Public Alerting

ATSC 3.0 – The Standard

- ATSC 3.0 is a Large Standard
  - 20+ Documents including recommended practices
  - Most contain metadata, aka signaling, of some kind
  - In comparison, HDTV (ATSC 1.0) consisted of 2 core standards
    - There are roughly 24 standards defined on atsc.org divided among ATSC 1.0, Datacasting, DASE, M/H and 2.0
    - ATSC 3.0 spans all that functionality plus much more
- What was learned over the last 20 years is now encompassed by ATSC 3.0 – with capability of future extension

ATSC 3.0 Protocol Stack



ATSC 3.0 Interactive Content – Key Features

- Describes the conceptual application operating environment
- Standard W3C User Agent – HTML5, CSS & JavaScript
- Supports seamless, secure delivery of interactive content from broadcast and broadband
- Provides a separate, unique context for each application
- Defines a WebSocket API to manage the receiver features
- Enables distributed receiver architectures

ATSC 3.0 Interactive Content – Fundamental Concepts

Broadcaster Application (BA)

- HTML5 including JavaScript and CSS

Receiver supplies W3C User Agent (Browser) to display and "run" BA [CTA-5000]

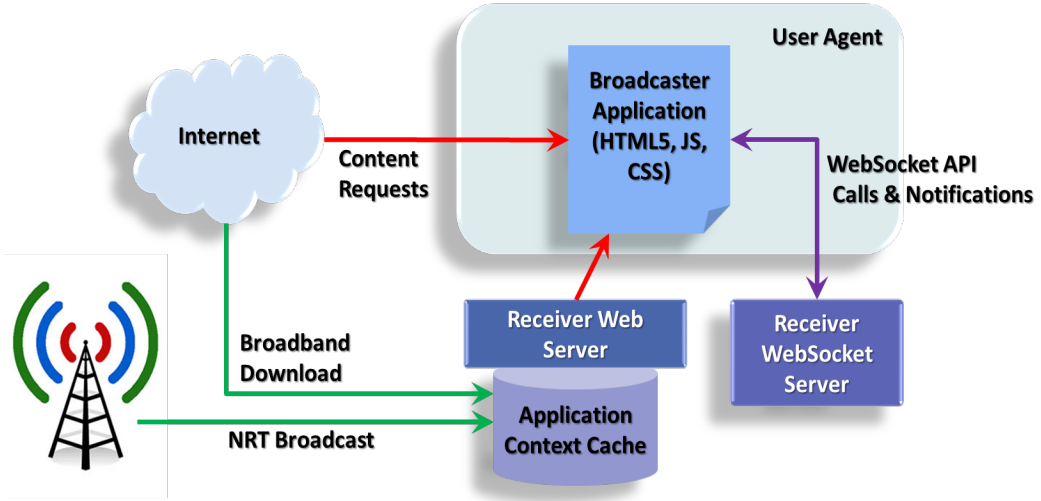
- BA programmed as if it were running in a "standard" browser (Chrome, FireFox, MS Edge, …)

Receiver is a Web Server

- Broadcasters "publish" web content, aka the BA, in secure, signed NRT data streams
- Receiver makes content available via HTTP
- Signaling "launches" Broadcaster Application (A/331 HELD table)
- Each BA operates in a separate sandbox called the Application Context

Web Socket Control and Notification Interface

- BA interacts with receiver via Web Socket API



ATSC 3.0 Interactive Content – Display Model