ATSC 3.0
Next Generation Digital Terrestrial Broadcasting

Joel Wilhite
Harmonic Inc.
Viewer Habits

• Viewing habits are changing as the population ages

• New viewers are born everyday - Gen X, Millennials, etc.

• Disenfranchised viewers will turn to other outlets if they can’t find content in the OTA broadcast

• Most ethnic/foreign (LPTV/Translator) viewers will suffer the most from the repack / virtual channel reductions
When is this happening…?

• The next transition has started and the standard along with the companion consumer devices exist, and this time with no tuner mandate.

• More ATSC 3.0 services will be available this year in select markets under STA on both FP and LPTV’s

• The *receivers* will need to support a wide range of services the ATSC 3.0 specification provides with UHD being only 1 of those services
Coordination

• The transition is phased schedule and market-by-market with the many of the broadcasters scrambling to manage those changes

• Some stations will continue operation in ATSC 1.0 for many years (2024-?) while others move to change

• Other stations will begin to offer **AVC** channels in 8VSB for channel sharing or to improve channel density/coverage
ATSC 3.0 Status
ATSC 3.0 Layers

- Media Processing Unit (MPU)
- MPU mode payload
- MPEG Media Transport (MMT)
- UDP
- IP
- Data Link Layer (e.g. GSE or TLV or ALP)
- Physical Layer (e.g. ATSC 3.0)

Signaling
- NRT
- HTTP
- TCP
- IP

DASH
- NRT
- Signaling

ROUTE (ALC/LCT)
- UDP
- IP

Physical Layer (e.g. ATSC 3.0)

{ Broadcast } { Broadband }
The Standards

Draft Standard – just getting started to cover the requirements
Candidate Standard – allows us to start banging on it
Proposed Standard – we think we got it right
ATSC 3.0 Modulation

• Supported bit rates in a 6 MHz channel are …
  – Min ~830 kb/s using QPSK, coderate 2/15, 8K FFT, 300usec GI
  – Max ~57 Mb/s using 4096QAM, coderate 13/15, 32K FFT, 28usec GI

• A ~25Mbps service in 6 MHz is a reasonable use case
• Receivers will support a minimum of 4 PLP’s per service
• Single Frequency Networks were a big consideration
• The modulation “frame” allows extensibility (256/6MHz)
UHD alone is NOT enough...

- 1080p is a very HOT topic with high power but they want more...
- Viewing distance and TV screen size has led to the conclusion that 4K resolution alone is not enough (just ask those who have seen 8k)...
- Solutions to this problem...
  - **Wide Color Gamut** – larger pallet of color range - BT.2020
  - **High Frame Rate** – more temporal data – 120 Hz.
  - **High Dynamic Range** – more contrast ratio – 1k or more nits
Audio Compression

• Better compression ratios – AC-4 is half the rate from AC-3
  – 384k was generous, 256k was good enough
  – AC-4 (in 5.1 mode) at 192k is “impressive”

• Audio Channels versus Objects
  – Audio channels are discreet speaker locations (e.g. stereo is 2.0, multi channel is 5.1)
  – Audio objects are the parts and pieces of audio events which can be acted on in different ways and directed to ANY number of speakers

• Both are supported simultaneously in the 2 competing choices
  – Audio objects allows for any variety of decoders to use what they need to produce the right effect
  – The combination of channels and objects allows for transition services and additive layers as the decoders come up to support
Broadcast Infrastructure

A view from a major manufacturer…
Flexibility and Diversity

- Multi channel services per carrier are the norm… (16SD, 4HD) - thank you repack!!!!
- The pressure to deliver MUCH higher video compression ratios is higher than ever before
- By 2020 a larger number of changes will occur…
  - OTA – broadcast facilities will homogenize products from multiple companies
    - How do they share bandwidth? (high efficiency statmux)
  - OTT – forcing trends in spending (a-la cart) and viewing habits (cord cutting)
    - How do they expect to quickly scale into live broadcast? (native cloud)
  - MVPD – will be chasing dwindling content contracts to maintain subscriptions
    - More data service with higher bit rates at last mile connectivity
- As UHD production ramps, UHD channels will use HEVC to make it survive

Here comes HEVC. Are you ready?
Tracking the High End CPU Market

- Spikes continue to show up in the CPU performance
- Prices stay relatively the same at the top of the market
- The CPU power of today will eclipse the installed base from 2 years ago

Source - http://www.cpubenchmark.net/high_end_cpus.html
COTS Blade Server Advantages

- 70-80% less networking
- Hardware de-coupled from encoding technology vendor
- Common compute across applications
- Simplified Servicing
Virtualization Advantages

- Easily upgrade underlying hardware
- Rapid deployment and scalability
- Applications can share compute cycles
- Enables expanded commercial terms for encoding technology
Software Versatility

- Faster rate of Video Quality innovation
- Dynamically balance efficiency and resource utilization
- Codec investment outlives underlying infrastructure
Virtualized Video Infrastructure

FROM:
Discrete proprietary video appliances

Device specific software
Hardware defined architecture
Bespoke processors / ASICs
Fixed functional devices
Custom video technologies

TO: Integrated & virtualized video services infrastructure

Common software platforms
Software defined architecture
Common processors
Functional collapse
IP & standardization
Next Steps

Repack – CSA - Build Out – Rinse - Repeat
New Business Demands Flexibility

• This transition will be challenging to say the least …
  – Financial investment – it’s a horse race against an agile market place - $$$ will fly
  – Technical hurdles – there are new problems to understand and overcome – S/W tools
  – Business model –

• Broadcasters require flexible / reliable products and adjust their transmission model over time to meet the demands of the industry AND the audience they serve

• Transmission system flexibility will allow the broadcaster to maintain service to serve new formats but introduce new issues
Collaborative Effort

• Broadcasters are not alone in making the transition a success

  – The on-air demos have started in various locations to support demonstrations, testing / interop along with consumer devices

  – All the various standards are nearly finished and we are moving fast

  – The CE industry is a big part of the planning of the transition as well they have to ramp the development and delivery to deliver to consumers

  – The content is there and more is coming – it’s breathtaking
Transition Scenarios

- The simulcast of ATSC 1.0 and 3.0 on a single 6 MHz allocation is impossible.
- Stations are moving to share post-auction spectrum to operate some number of the most popular channels, the market decides.
- The main goal of any transition plan would not require the viewers to acquire a new converter box or TV over night.
- The repack will likely cause some issues to be resolved on a case by case business and will spill into
- ATSC 3.0 helps maximize the performance of the remaining RF landscape
- Translators operation with transcoding multiplexers, tunable mask filters and wide band amplifiers and antennas eases the solution requirements – it may cost more up front but then making changes is easier
ATSC 3.0 Gateway

• A device to tune ATSC 3.0 carrier(s), connect to broadband (internet) to either …
  – Decode to HDMI to your current flat panel display
  – Convert stream to IP for home delivery to an application running on your smart phone / tablet
• The gateway is also little server as it has several unique features
  – Targeted advertising – allows ads to be replaced based on consumer heuristics
  – Can include pre-loaded content under DRM and triggered for big events
  – Can include or be connected to storage to create a whole house DVR
• The typical statistical multiplex is not typical anymore…
  – Stations co-location, mixed multiplexes - asking how best to interconnect and maintain quality
  – The CSA agreement includes the word “sharing”, and CBR encoding is a very poor choice
  – Translators will need to track along with the collapsing RF landscape – statmux the statmux
• A very strong case can now be made for a unified receiving / encoding / transcoding / statmux multiplex delivery system all built into a compact translator facility to maximize the quality of service and variety of services with flexibility in mind
• The ATSC 3.0 technology will allow for SFN to build Distributed Transmission Systems (DTS) and channel bonding to allow the creation of a MEGA-multiplex 12-24MHz wide
Summary
The Separation of Production and Transmission

- Content Network A
- Multiplex A
  - Tower Company A: 24Mhz /6MHz
- Multiplex B
  - Tower Company B: 24Mhz /6MHz
- Multiplex C
  - 3x 6MHz

Content Network B
- D
- E
- Tower Company A
- Multiplex A: 24Mhz /6MHz

Content Network C
- F
- G

Tower Company B
- 24Mhz /6MHz
- 3x 6MHz
The Transcoding Multiplexer for Translators with …

HIGH-DENSITY STREAM PROCESSOR

ProStream 9100

High-performance, highly versatile stream processing in a compact package
Thank You

Joel Wilhite
Harmonic Inc.
joel.wilhite@harmonicinc.com