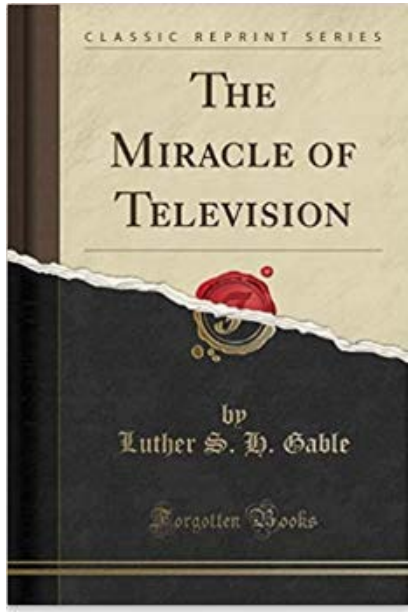



The wise ones are helping to build these and other marvels. The scoffer waits until others have taken all the good jobs and then complains of his “bad luck.” We are living today in a new age of which the prophets spoke, “In the last days, knowledge shall be increased, and men shall run to and fro.” And this new age is the mystic Electronic and Atomic Age, in which man is harnessing the powers of the universe – nuclear fission, dancing electrons – to attain wireless power, fuelless engines, bigger crops, and we hope, longer lives; for unless this new wisdom is tempered by due respect for the One True God and all His children – these could well be our last days.

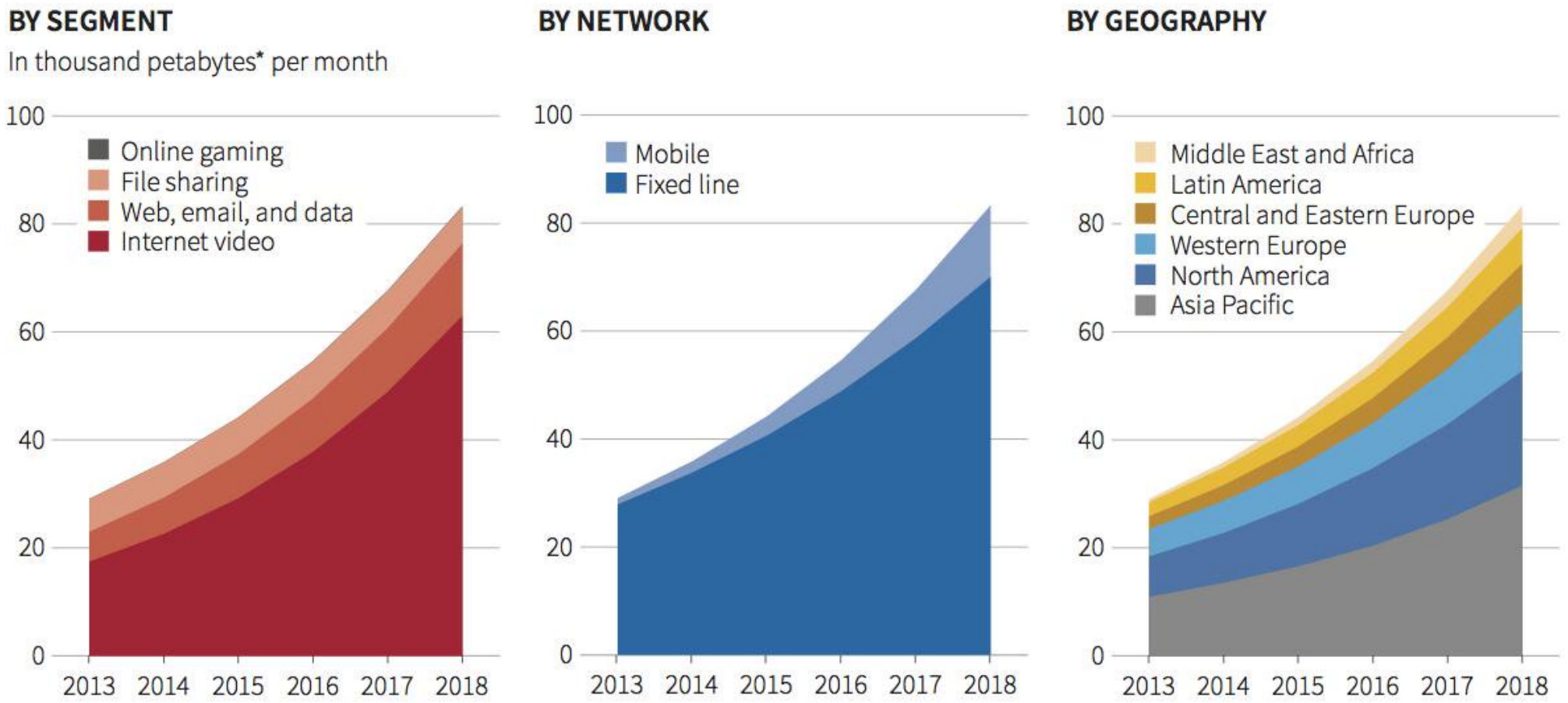
Marvel not at the prospect of nation-wide television’s becoming civilization’s greatest intercommunication system, employing millions. Study well and gain the scientific habit of mind. Question causes. Reject foolishness. It is the trained ones who will be the push-button engineers of this Electronic and Atomic age. They will help to raise human society to a common level of the best, whereas the godless and the indigent will seek to level society by tearing down the best and reducing them to the level of the lowest.

You can be a television engineer and show the world the great opportunities and beauty of the American Way. We are at the *crossroads.* With Atomic energy, we must “do or die.” Don’t be a scoffer. Think for yourself. Think constructively, and then *act*, before you, too, become an atomic ghost!

-- The Miracle of Television, Luther S. H. Gable Wilcox and Follette Co 1949

# Consumer internet traffic

Internet video traffic will rise from 60 to 75 percent of total consumer internet traffic by 2018, according to estimates by Cisco.




Source: Cisco. *Petabyte is equivalent to 1,000 terabytes.

C. Inton, 04/02/2015

REUTERS



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# Madison

*OCTOBER 2018*

Fred Baumgartner

ONEMedia

Get the app

Please come and go as you please. You can keep your fones on too.

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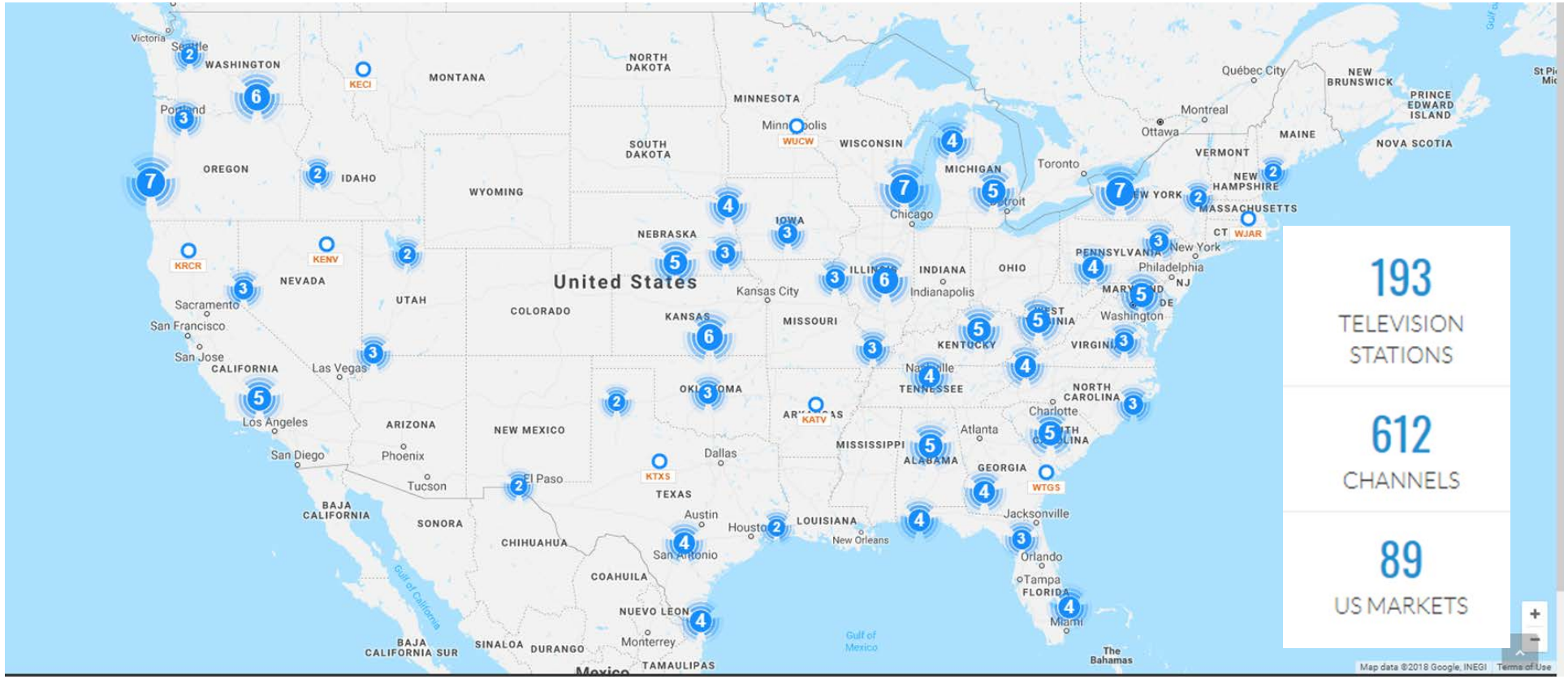
# Slide Zero -- Sinclair

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# Sinclair Subsidiaries


- Transmission System Services


- Transmission Antennas


- NextGen TV Innovation
  - Bootstrap


# *NextGen TV*

- I. **Sinclair – ONEMedia**
- II. Spectrum
- III. Standard
- IV. Transmission
- V. Platform (s)
- VI. Business
- VII. Media
- VIII. Significant and Useful Tangents

- 1. Lab
- 2. Viewpoint – “Televisioner”
- 3. Why



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# The Most Advanced ATSC 3.0 Lab

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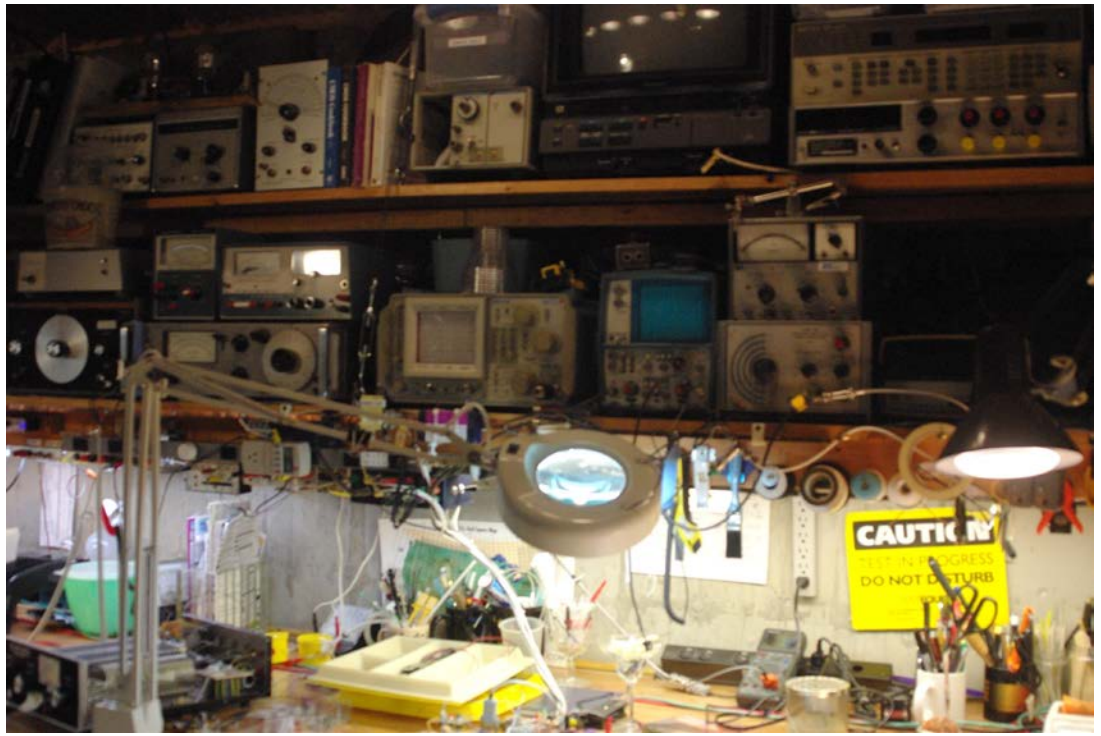
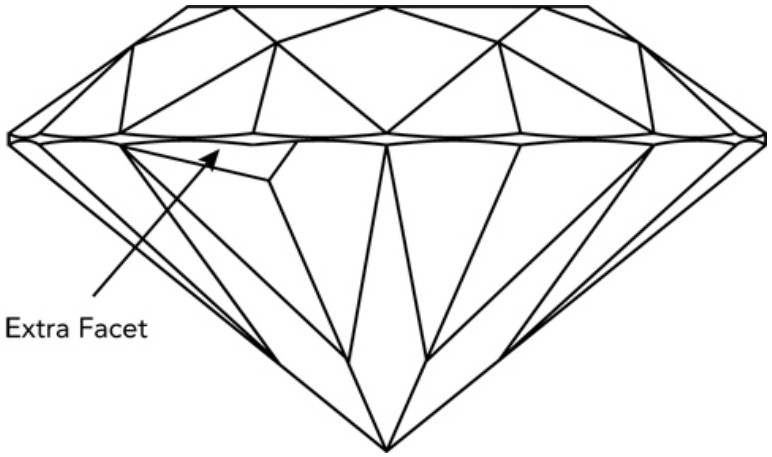
# While its all very Expensive
# There isn't all that much of it



# Slide One – Scene Setter




The difficulty is not on coming up new ideas, but to undo the old one.

# “Televisioners”

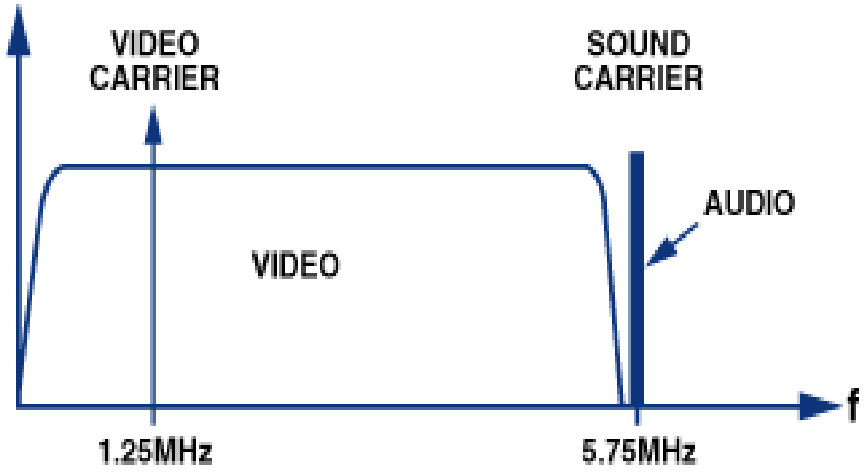
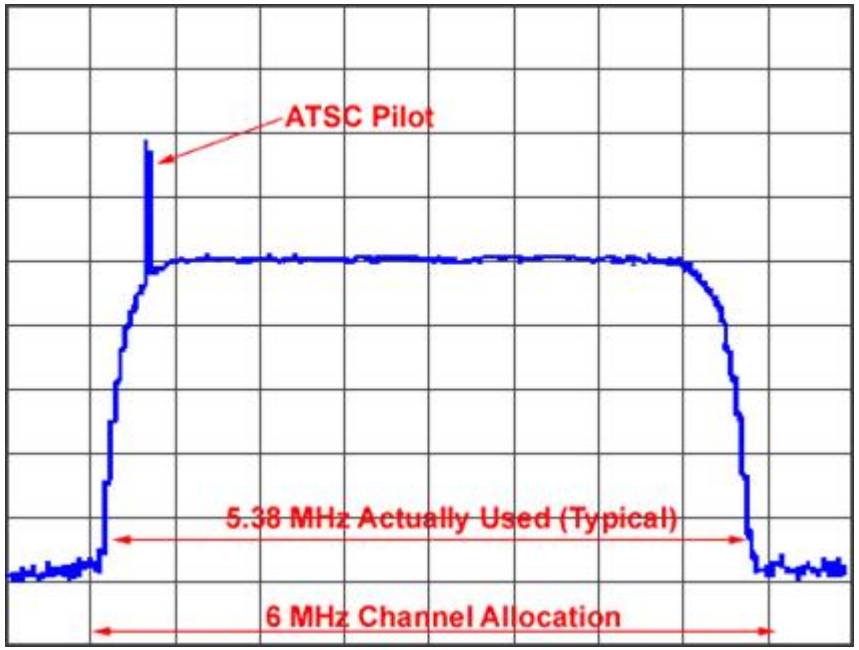



*Figure 1. NTSC spectrum for a television channel.*

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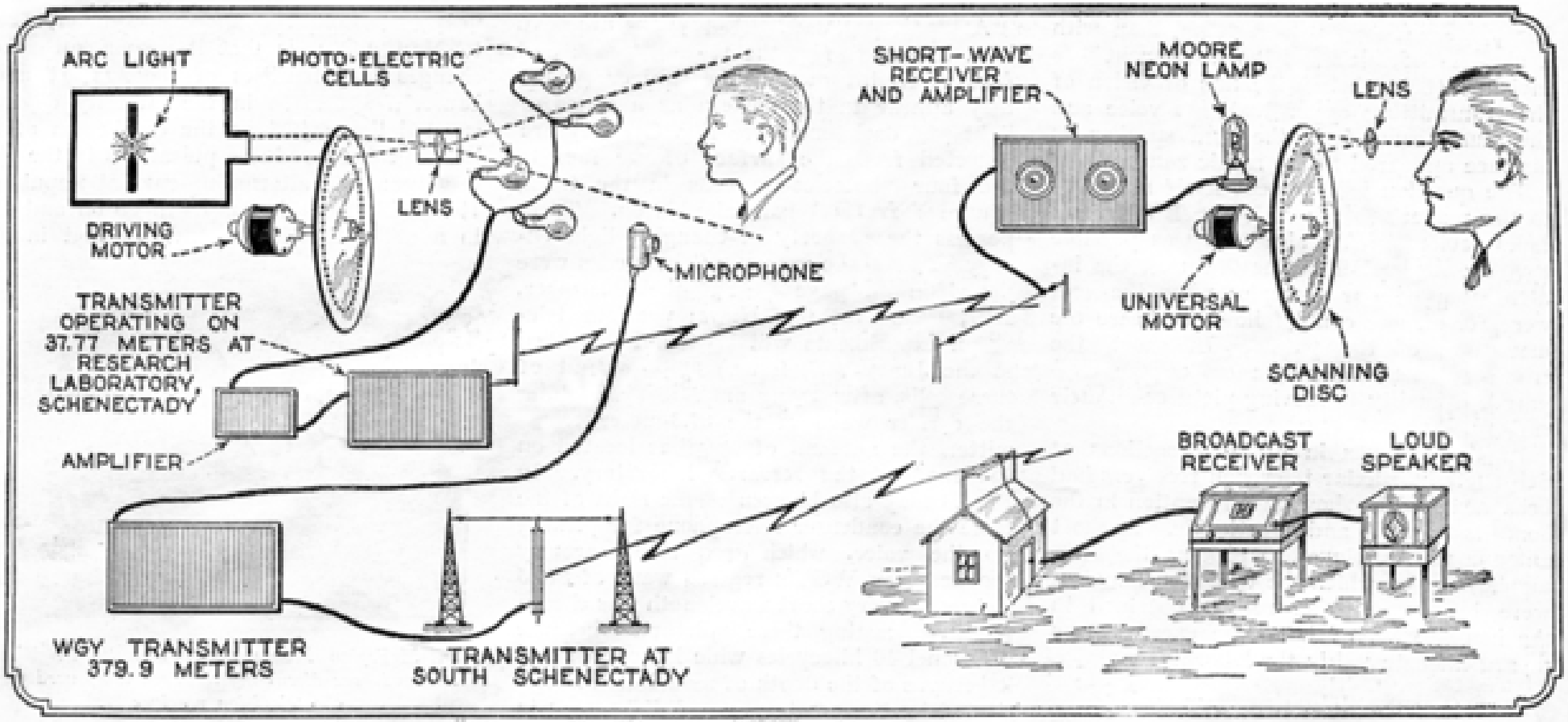
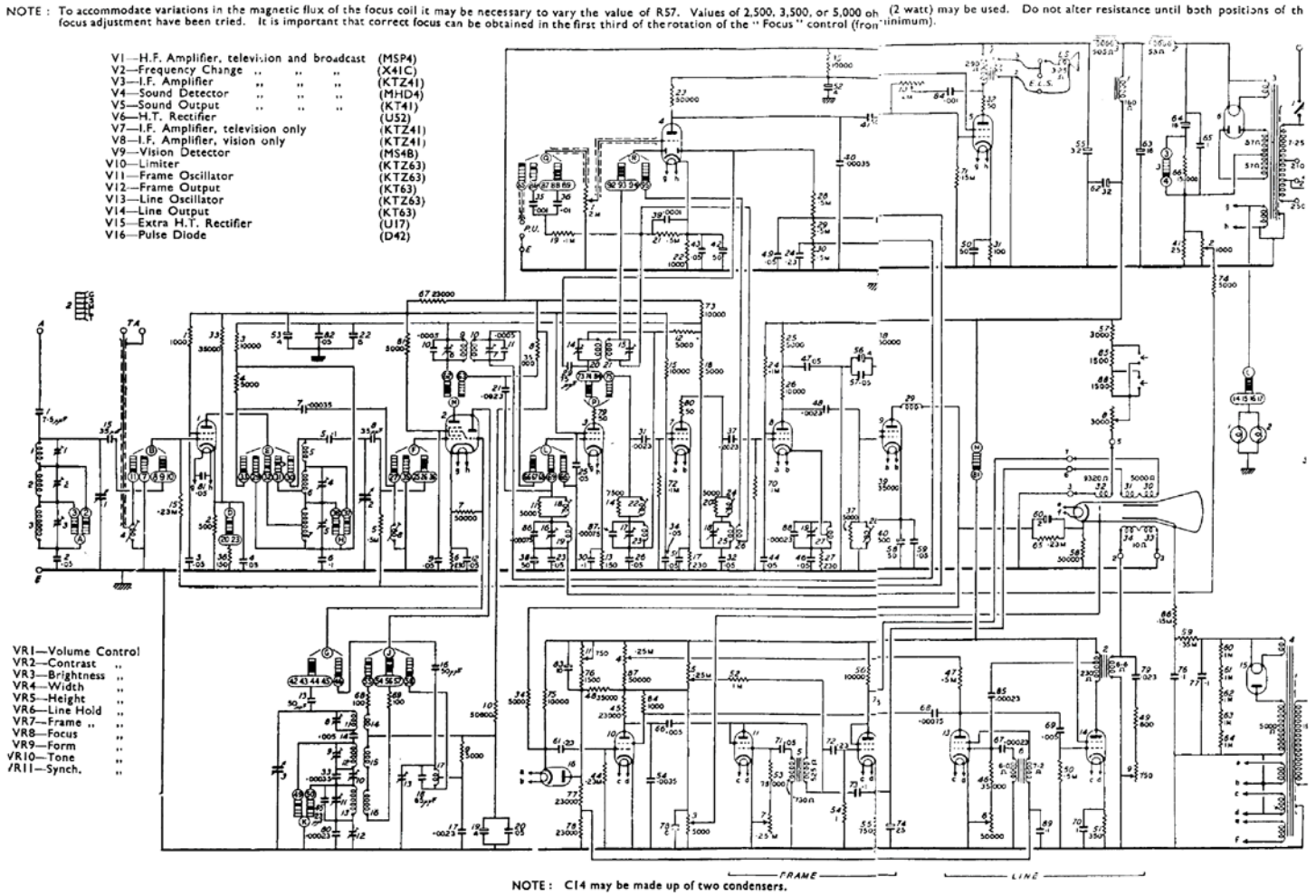
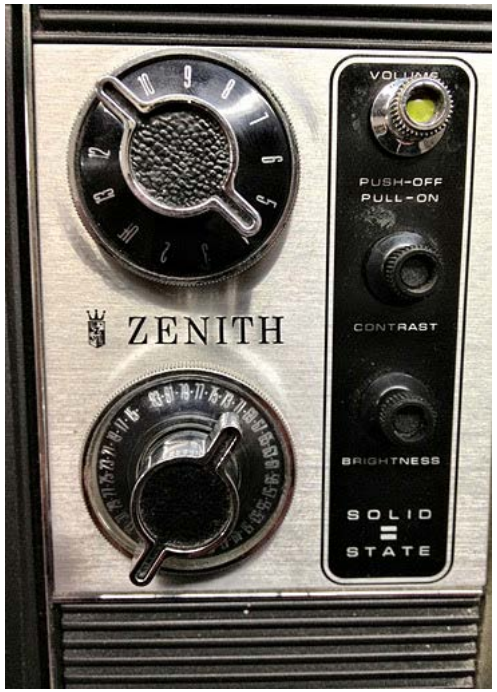



*A diagram of the Alexanderson method of operation in the transmission and reception of television. At the upper left are the transmitter for the image and the microphone for the voice, which is broadcast on a different wavelength. At the right are the receivers for television and speech.*

# The UX has Never Changed



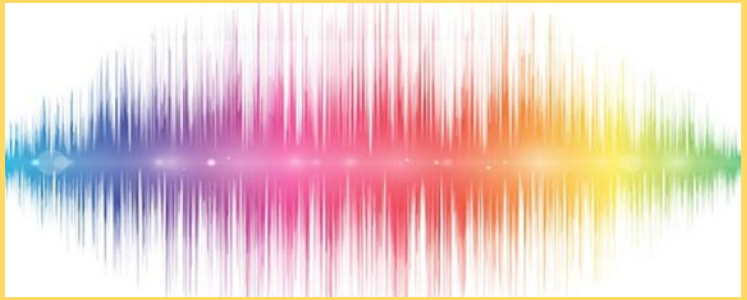
# Two Views of ATSC 3.0

- Technical… it's "10 dB" Better
- Art and Business of TV…It's a Brand New Medium

# *NextGen TV*

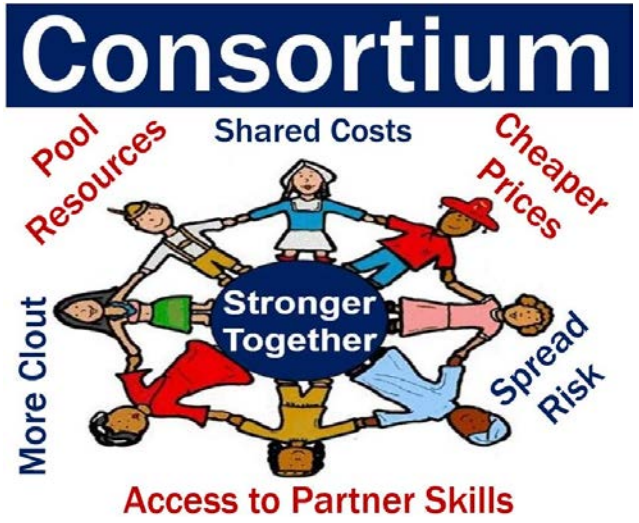
- I.  Sinclair – ONEMedia
- II. **Spectrum**
- III. Standard
- IV. Transmission
- V. Platform (s)
- VI. Business
- VII. Media
- VIII. Significant and Useful Tangents

- Consortium
- What We Have
  - Post Repack
  - VHF - UHF
- Clearing
  - Compression
  - Plans
- Bits Versus MHz



# Consortium

- *"SpectrumCo"* – John Hane President
- Aggregate Spectrum
- Create a pool of RF-IP distribution beyond "TV"
- Monetize this
- Split proceeds
  - Spectrum
  - Infrastructure Investors



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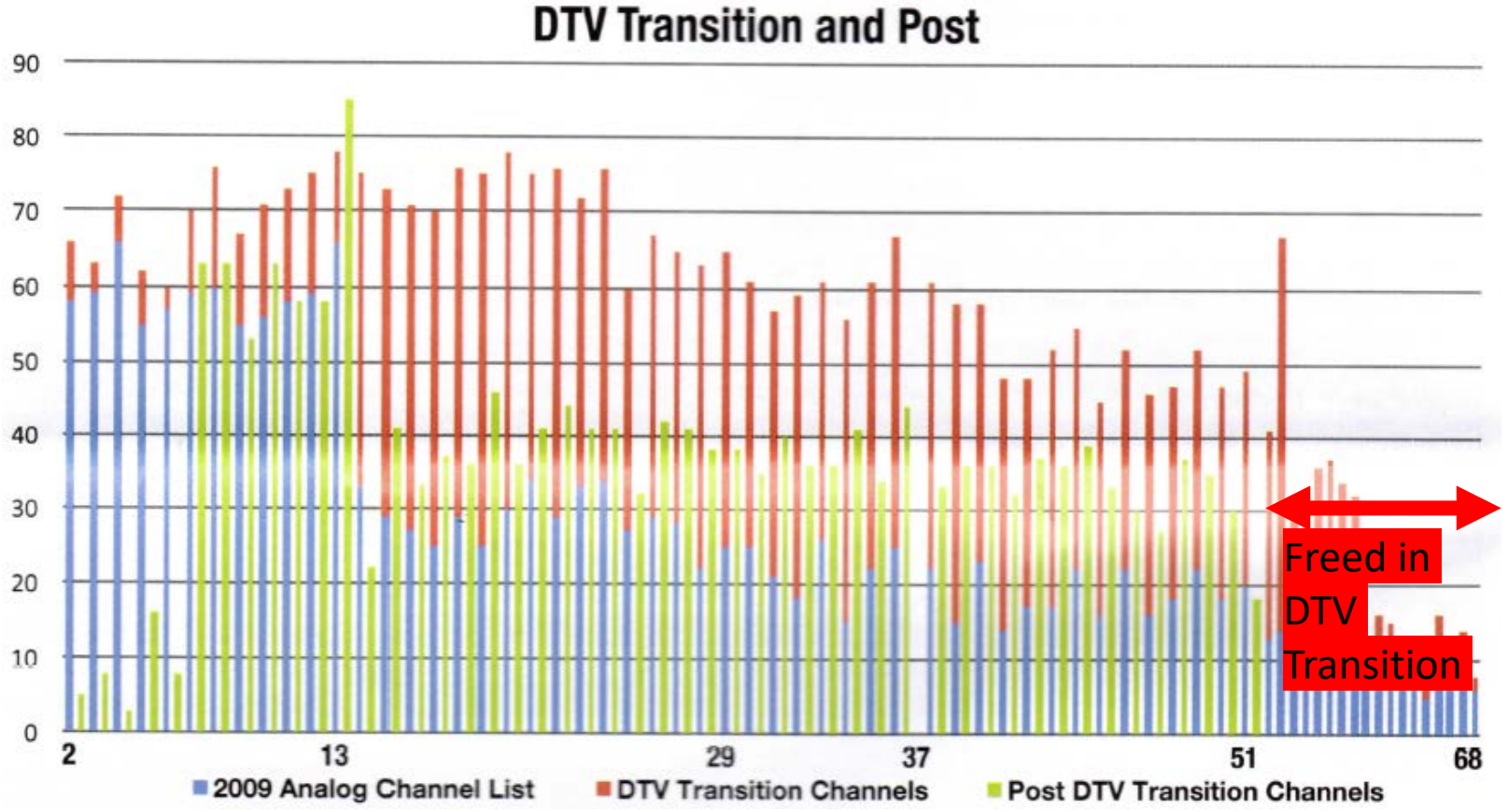
# TV Channel Occupancy Over Time

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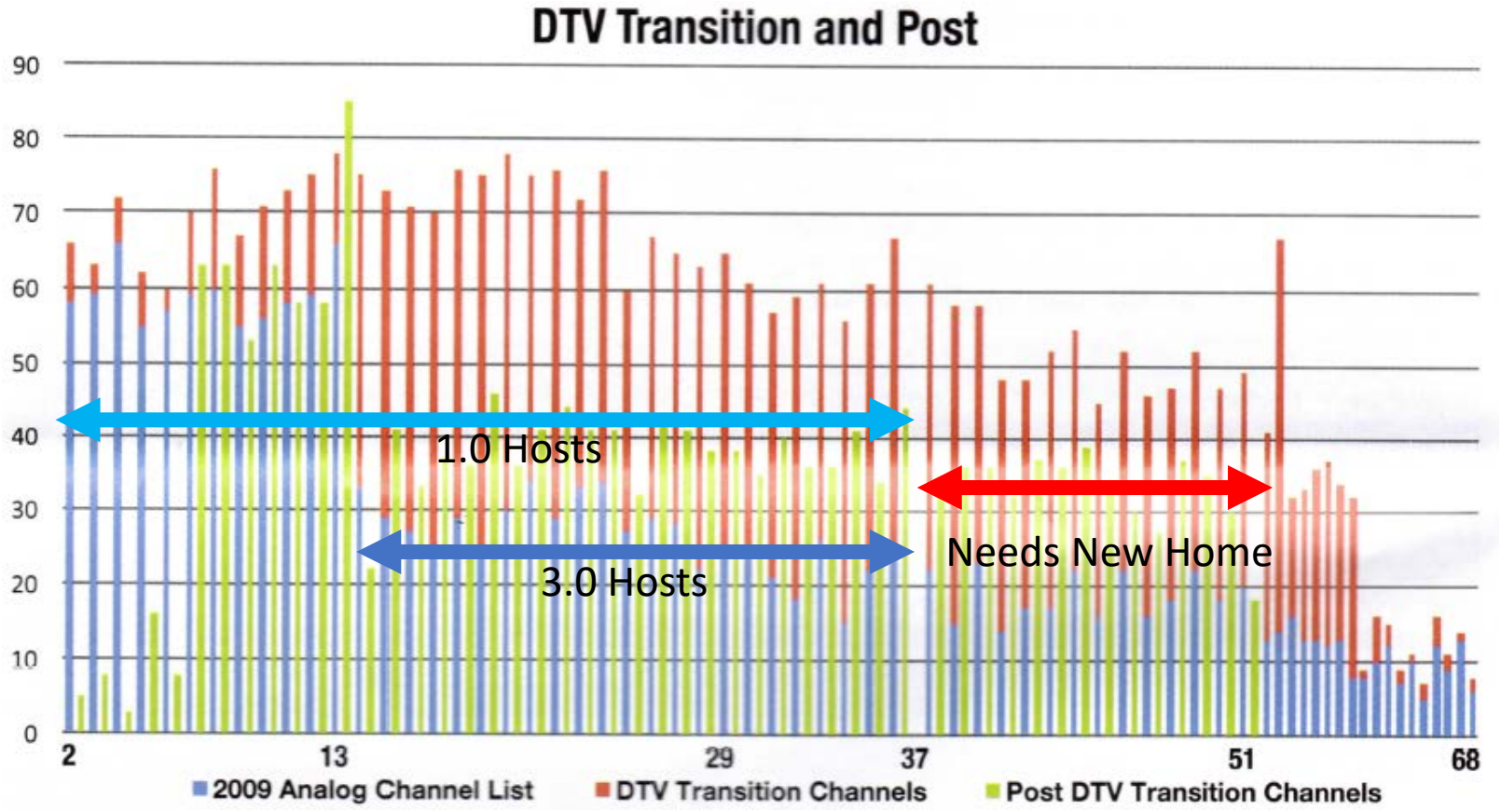
# TV Channel Occupancy Over Time

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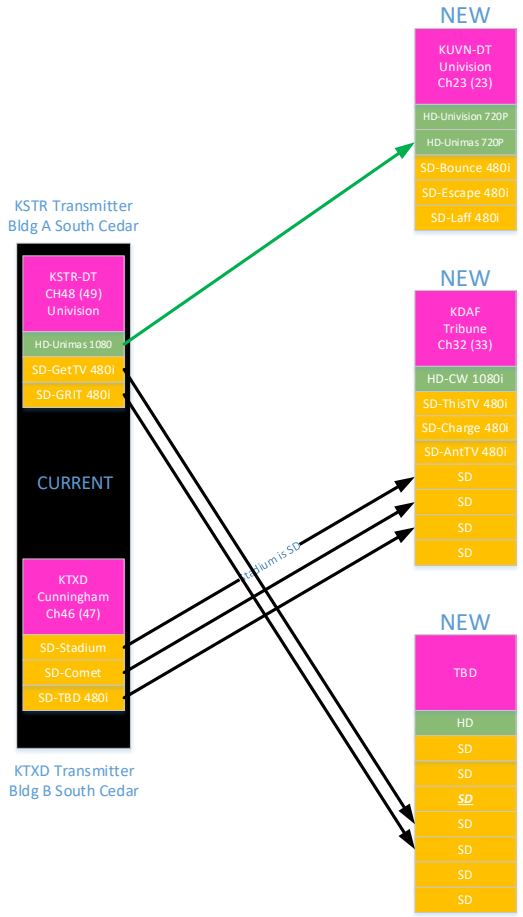
# Spectrum Rules

- Main Service
  - Simulcast
    - 1.0 Host
    - 3.0 Host
  - No quality requirement
  - 120 Day Notice to MVPDs
    (90 days if concurrent with Repack)
  - 30 days crawls and announcements
- Secondary Services
  - No requirements to preserve or simulcast



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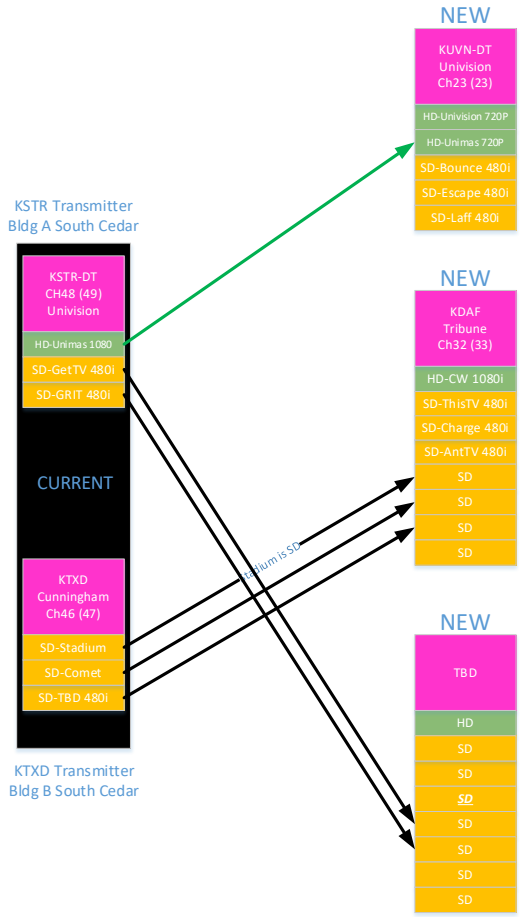
# Spectrum Rules

- LPTV & Translators can go directly to 3.0
- No notice requirements
- No tuner mandate



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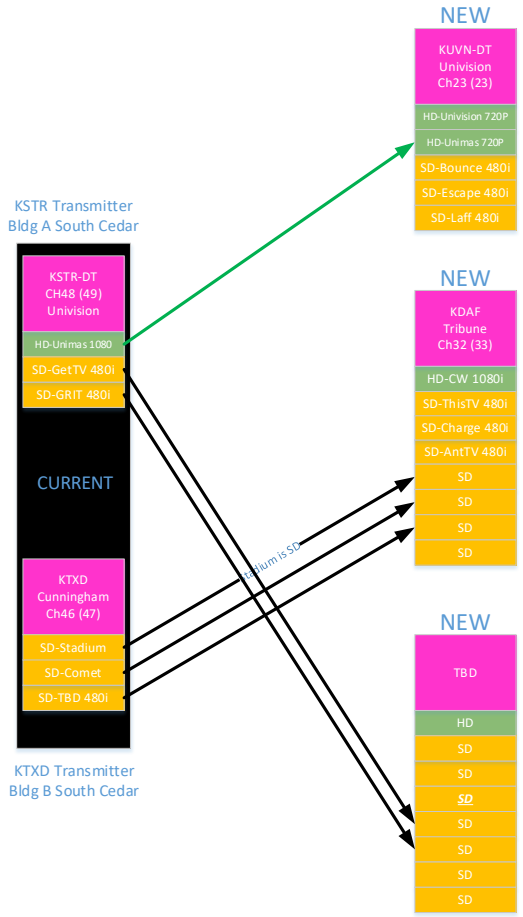
# Spectrum Rules

- 1.0 Host
  - 95% Pop = Expedited Process
  - Must cover MVPDs
  - Same DMA
  - Cover city of license



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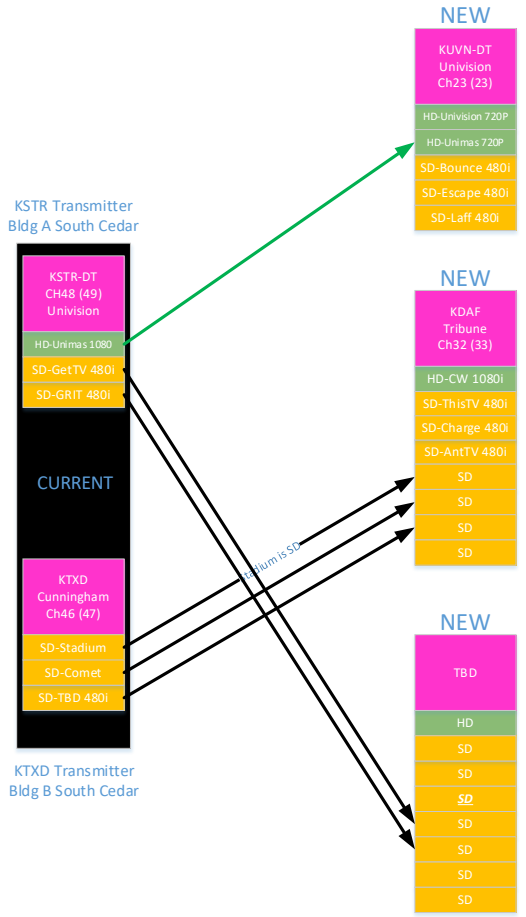
# Spectrum Rules

- FCC Form 2100
  - ~ 15 days to approve
  - Minor Change; no construction permit
- Experimental License
  - Easy, Fast, Fleeting
- STA
  - More complex filing
  - Path to permanence



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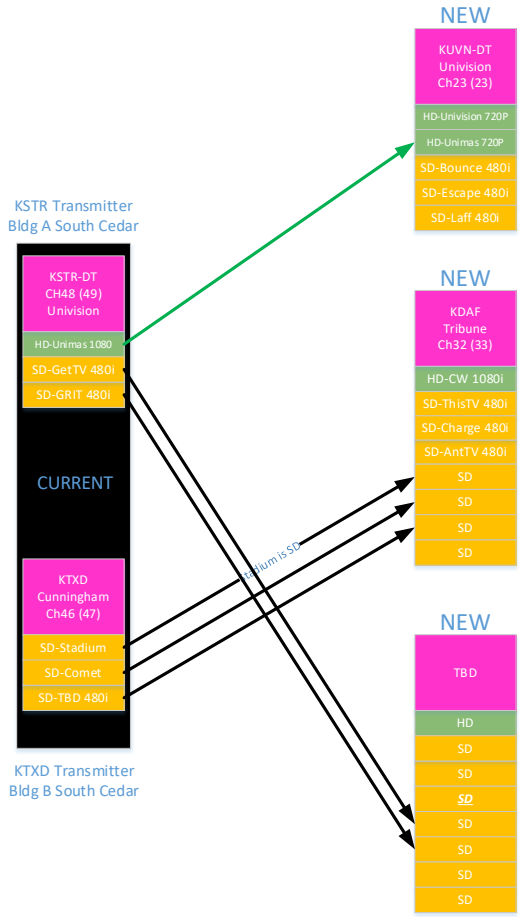
# Spectrum Rules

- Agreements
  - Basically, a Channel Sharing Agreement
  - Two or more separate Licenses on 1.0 Host
  - Two or more separate Licenses on 3.0 Host



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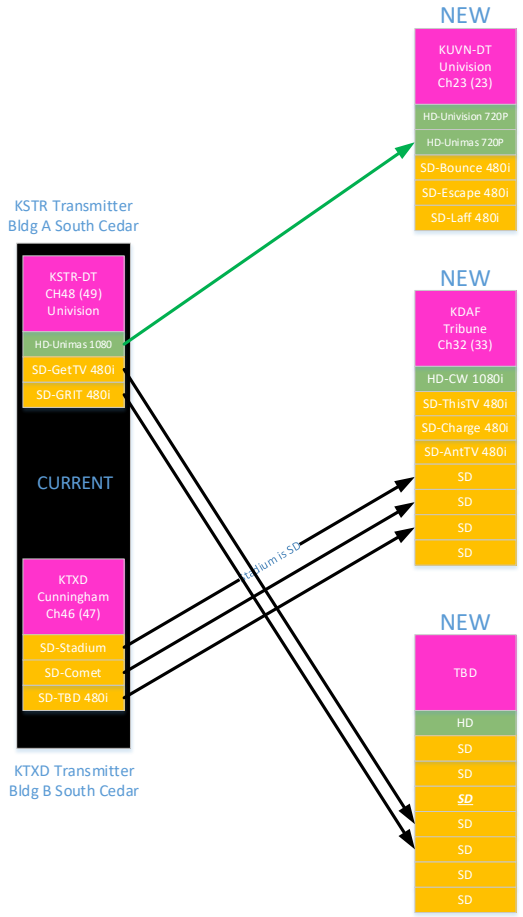
# Spectrum Rules

- Agreements
  - Addendum 1
    - Channel Lineup
    - Quality targets
  - Working combinations
    - 7 SD
    - 1 HD + 6 SD
    - 2 HD + 3 SD

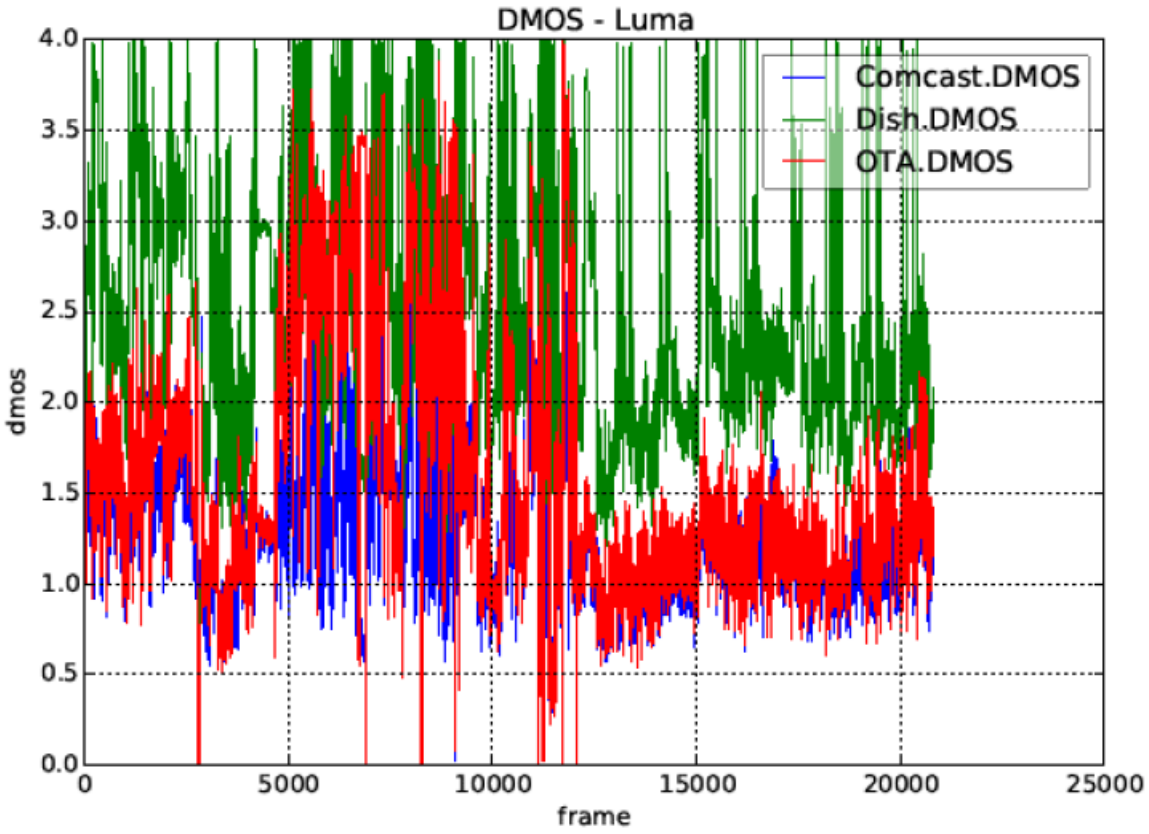


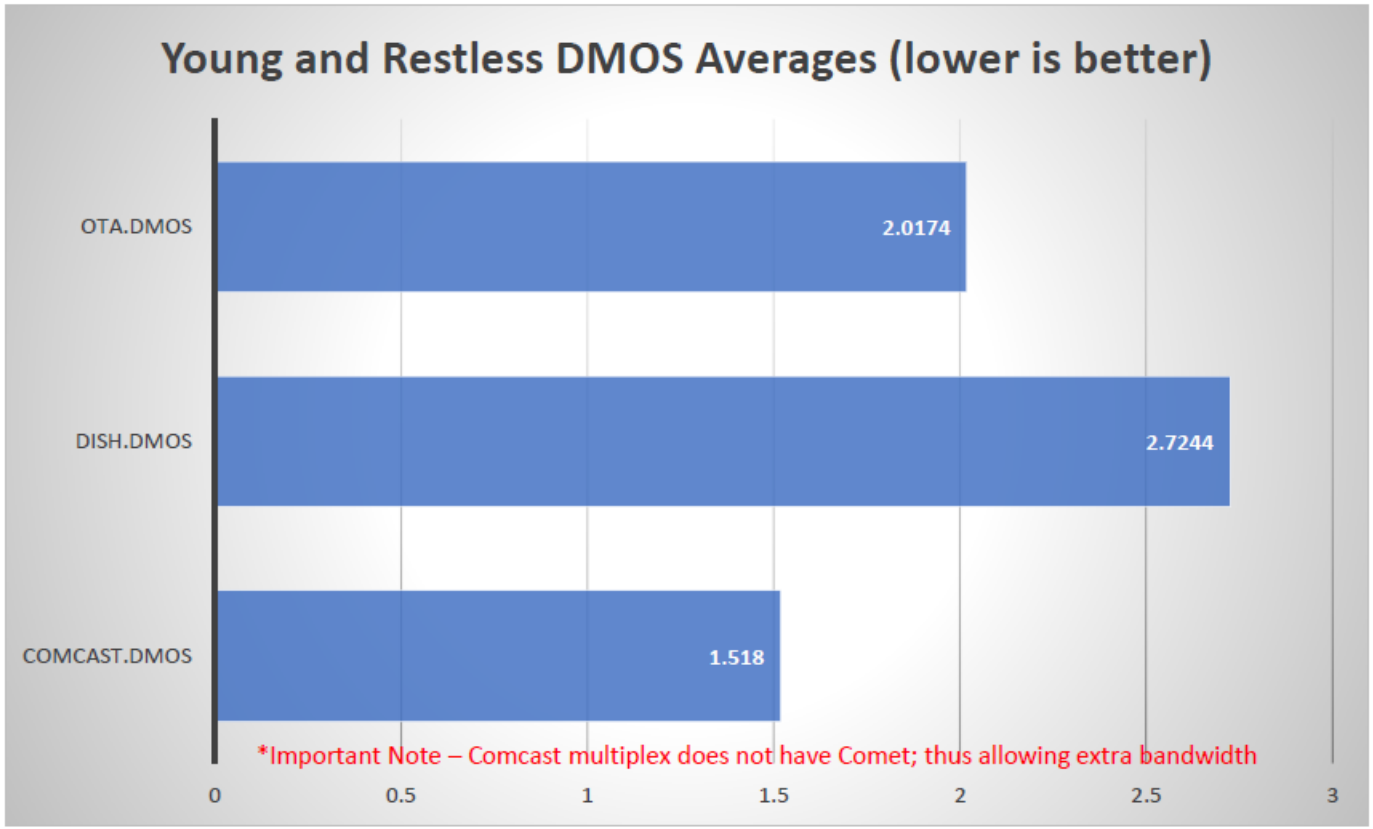
# The Semantics of  Video Quality

- TOV – Threshold of Viewability
- TOP – Threshold of Pain
- JND – Just Noticeable Difference
- Pristine

- Marquee – The Living Room Big TV with PBS Theater Something
- Video Wallpaper – Kitchen TV
  - Mostly Listen
    - No Dynamic Range wanted
  - Peek at it from time-to-time
    - SD almost too good
- Small Screens

# DMOS w/ Video Clarity

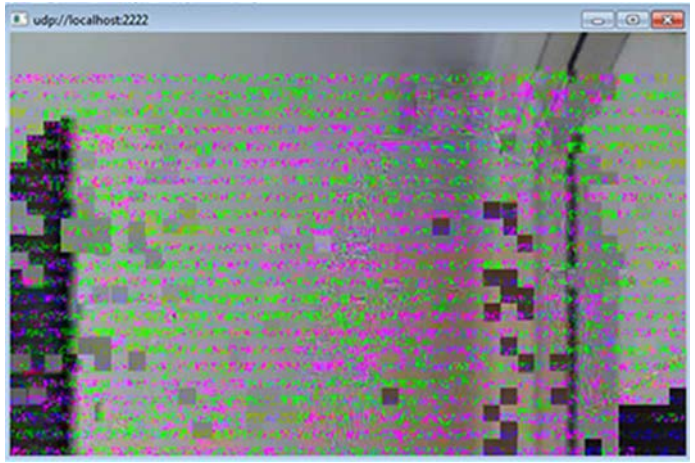


# The Authorities of Video Quality

- Some contracts specify a minimum average bit rate
  - Few provide a provision for accommodating more efficient encoders
- Noisy/Bad Video doesn't compress well

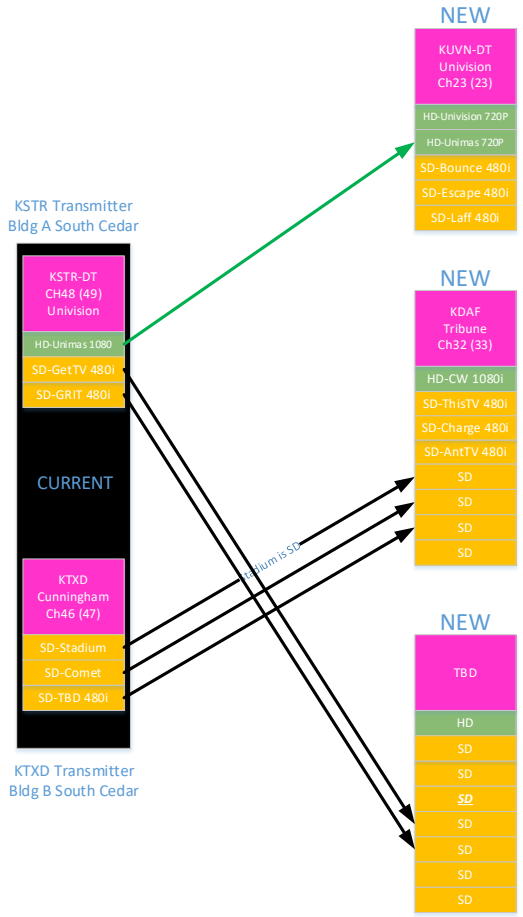
- Pathological Test Signals




- Test Suites
- If you work in TV, you are *not* qualified to judge viewer video

# Spectrum Rules

- Repack
  - Dallas is Round 3 4/13/19
  - Temp Ch 46 & 48
    - Move to 34 & 23
- Interference
  - Same as DTV

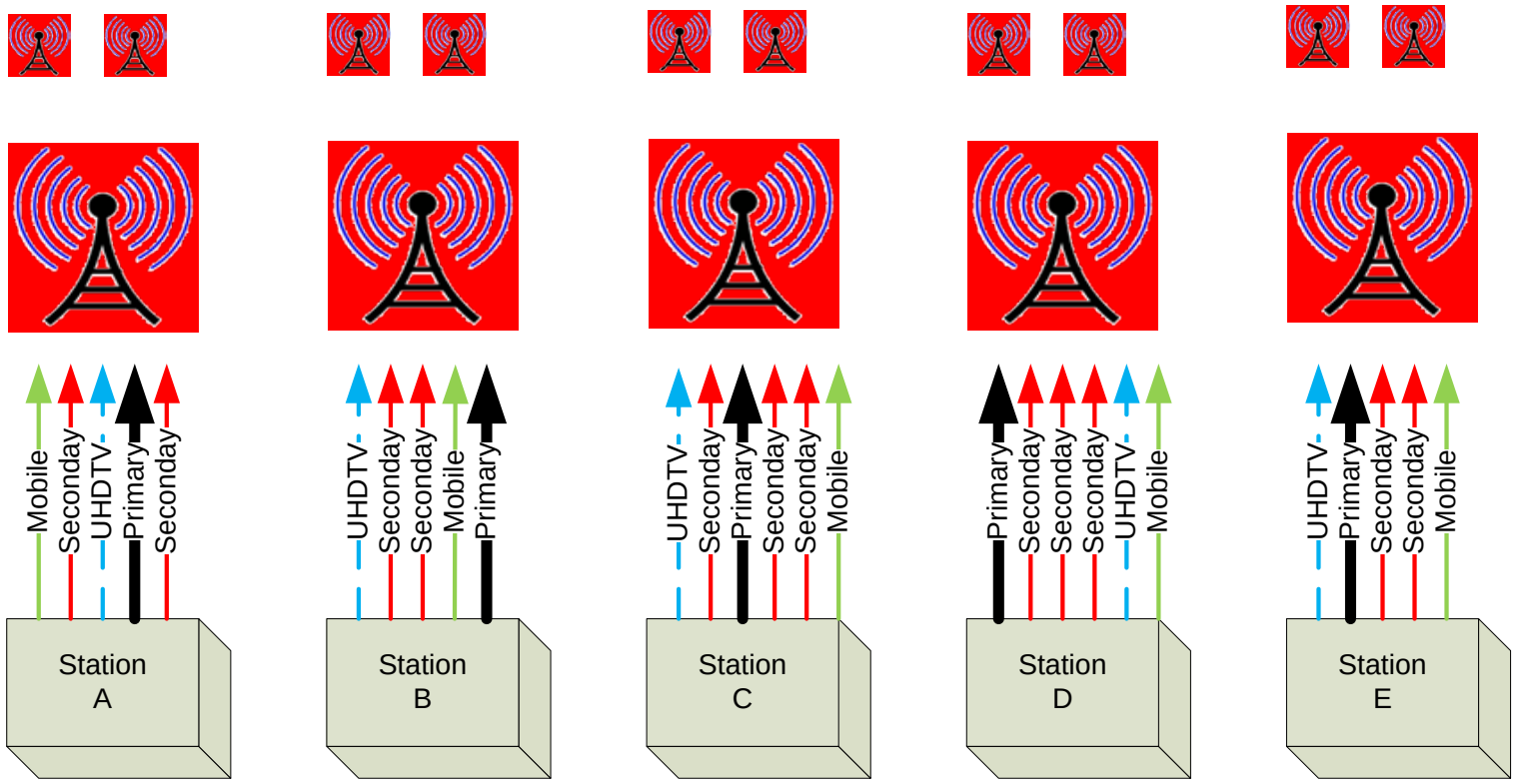


# Goal oriented proposal – by Service *not* Station

Beyond two cooperative stations scenario

Hits Mobile hard first – but also a marque UHDTV / HDR service

The SFN is designed, contracted and provisioned for the <u>end game</u>




This is the end game…

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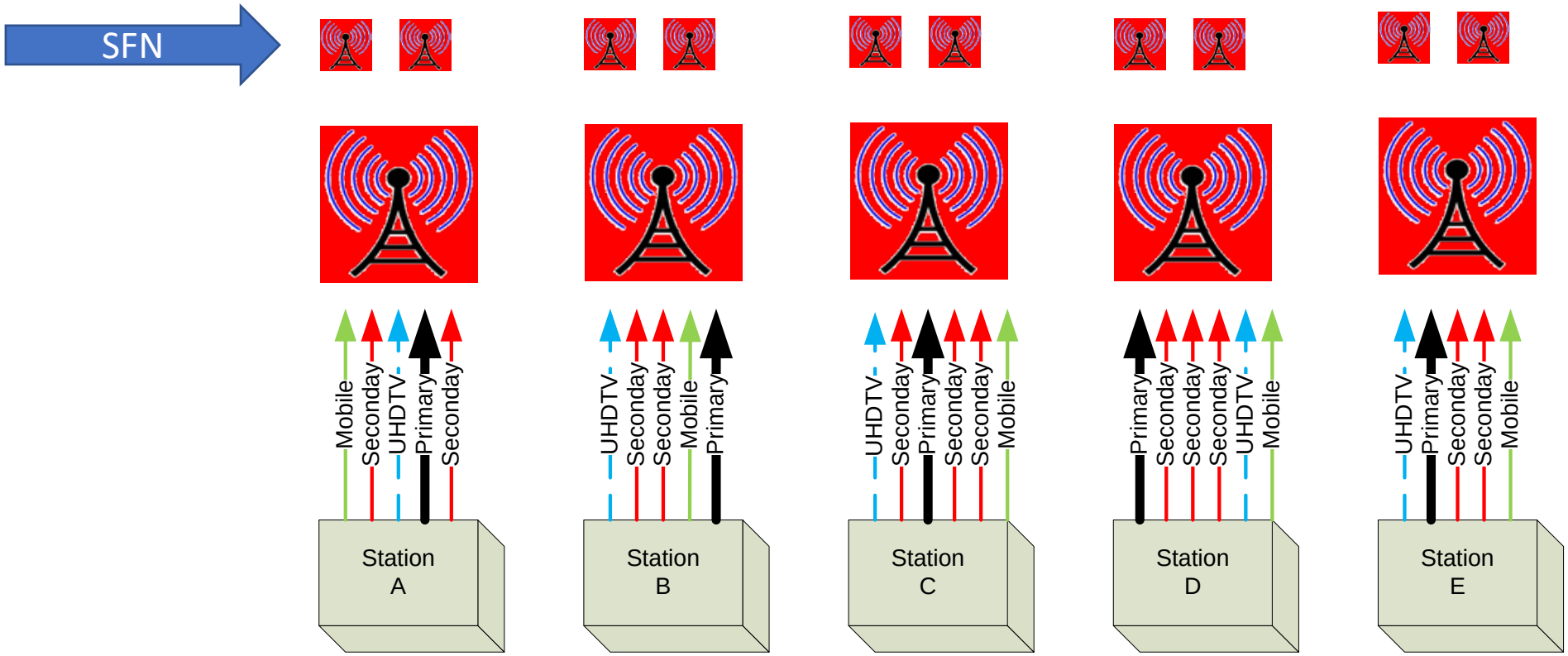


This is the end game…

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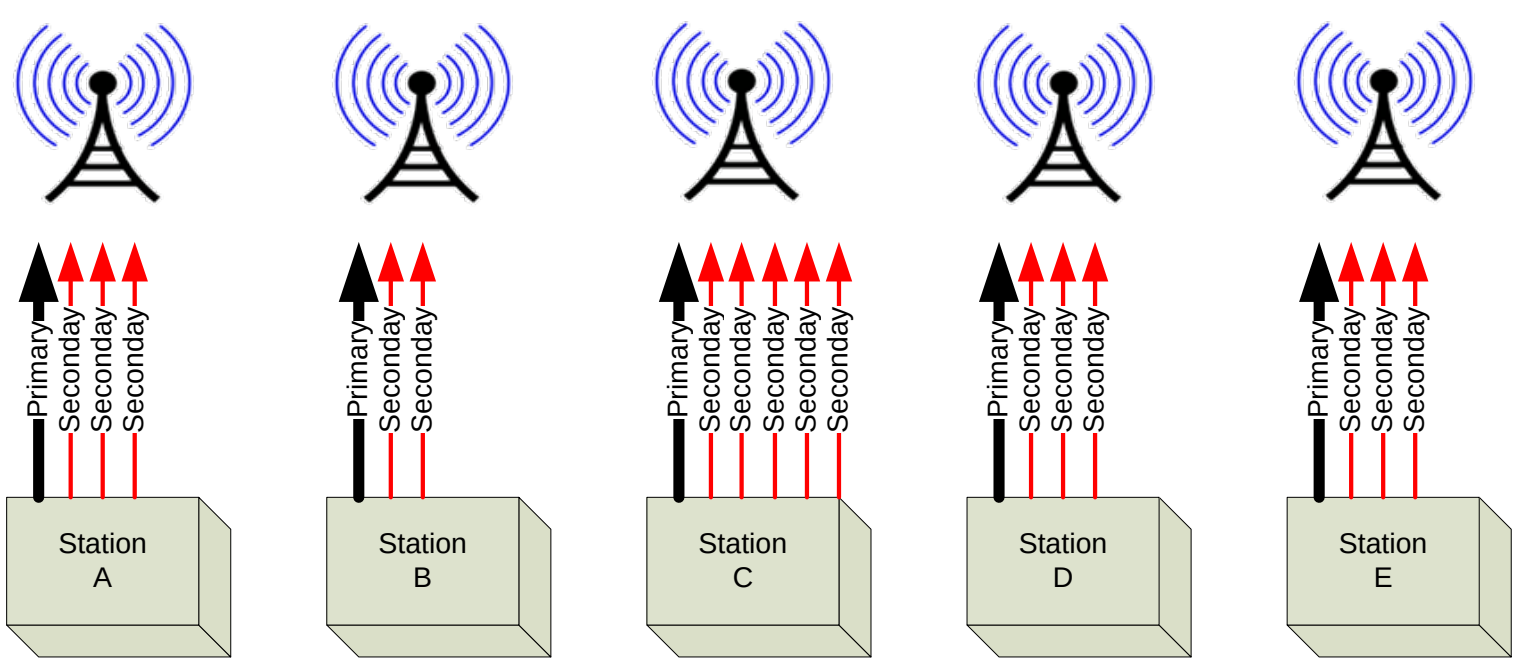
# Today

All 8VSB ATSC 1.0

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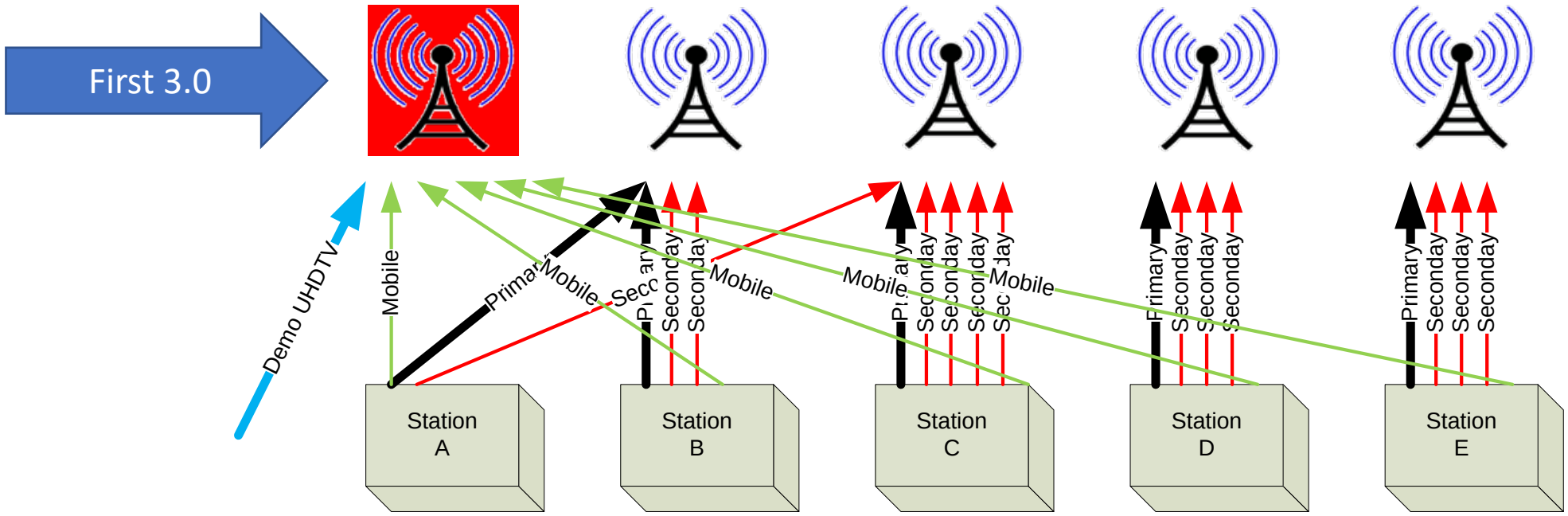
# Step 1, the ATSC 3.0 “Lighthouse”




This is all about store shelves… and devices

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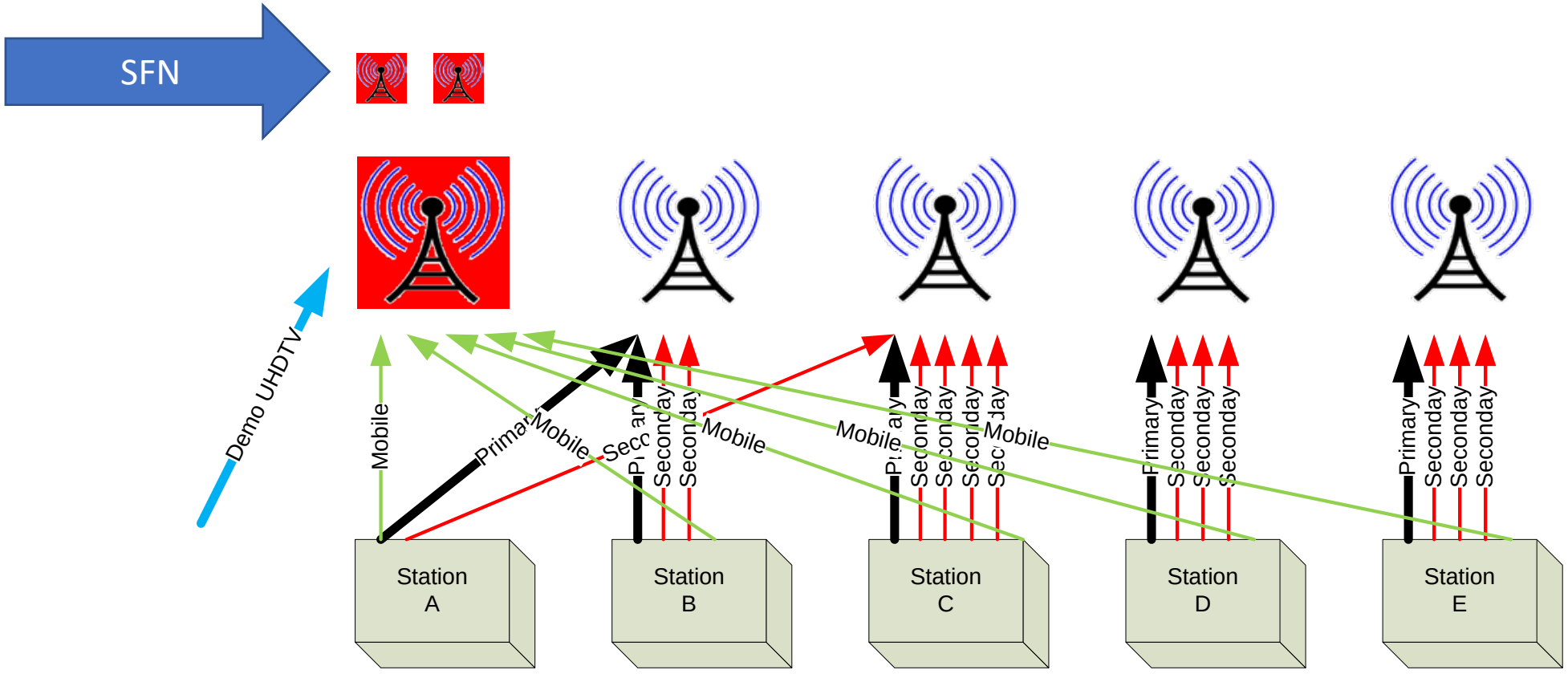
# Step 1, the ATSC 3.0 “Lighthouse” + SFN




This is so those devices work outside of the store

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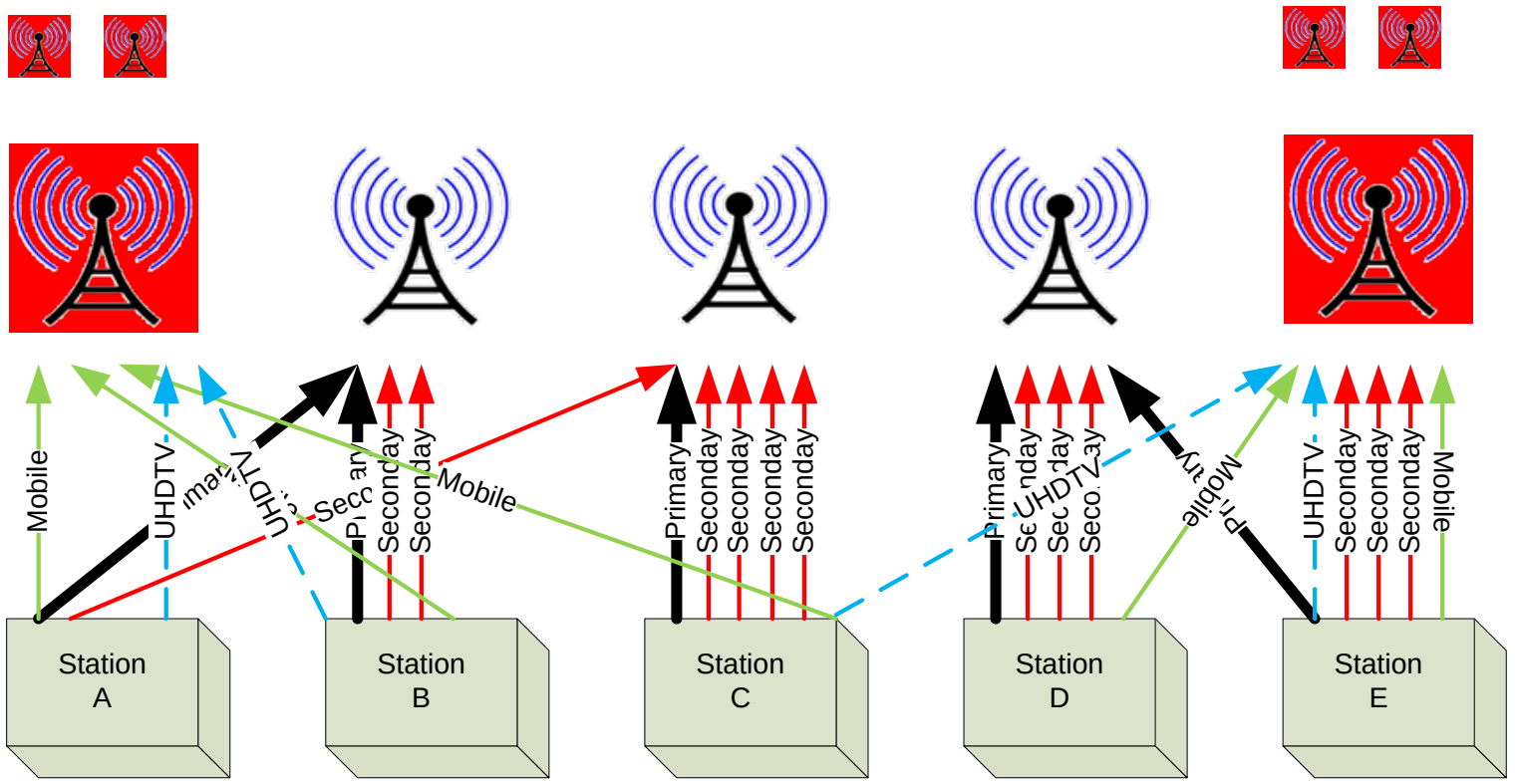
# Step 2, The Conversion Continues




This is about making those big TVs work

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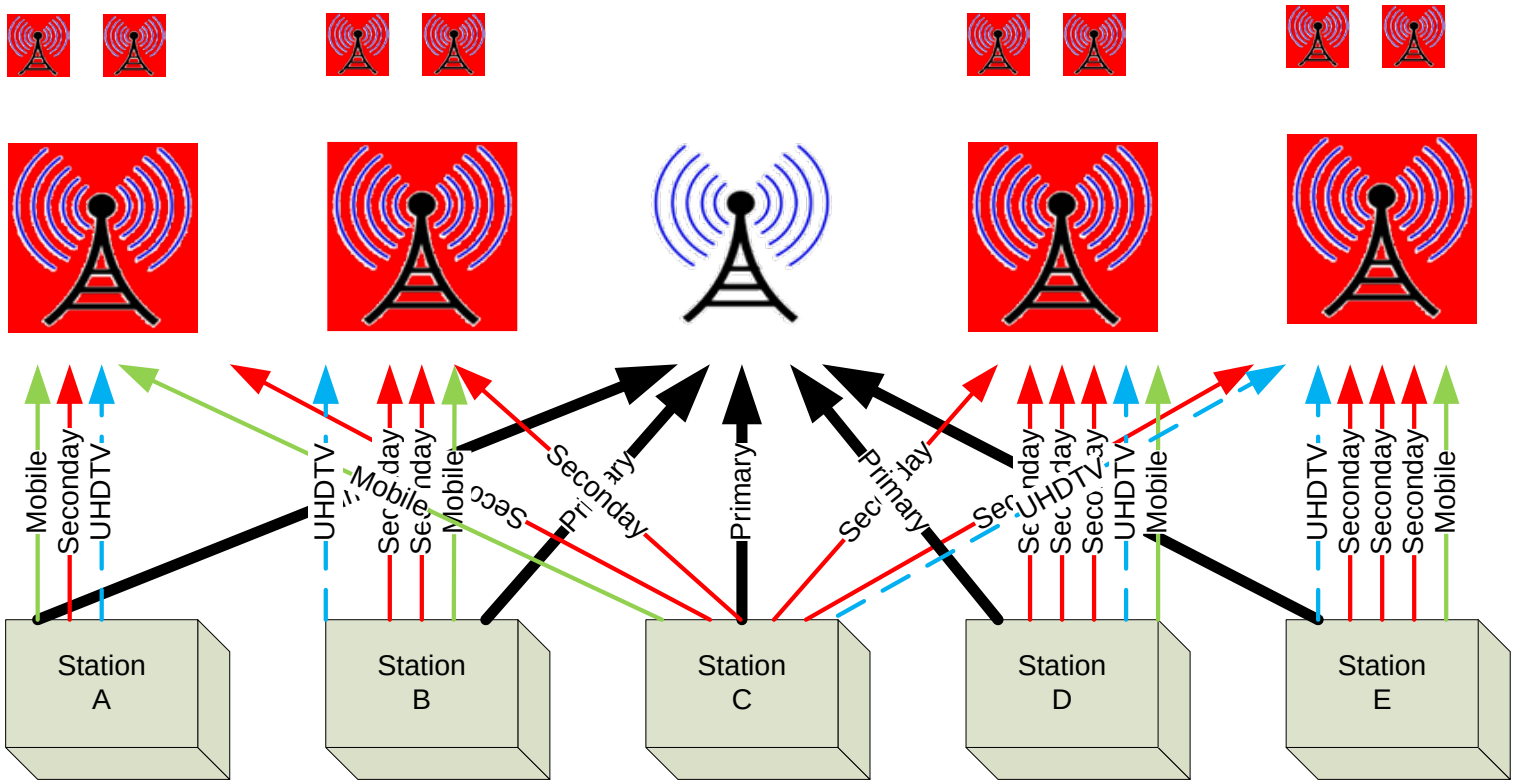
# Step 4, the last 8-VSB




This is all about supporting the last 8-VSB viewers

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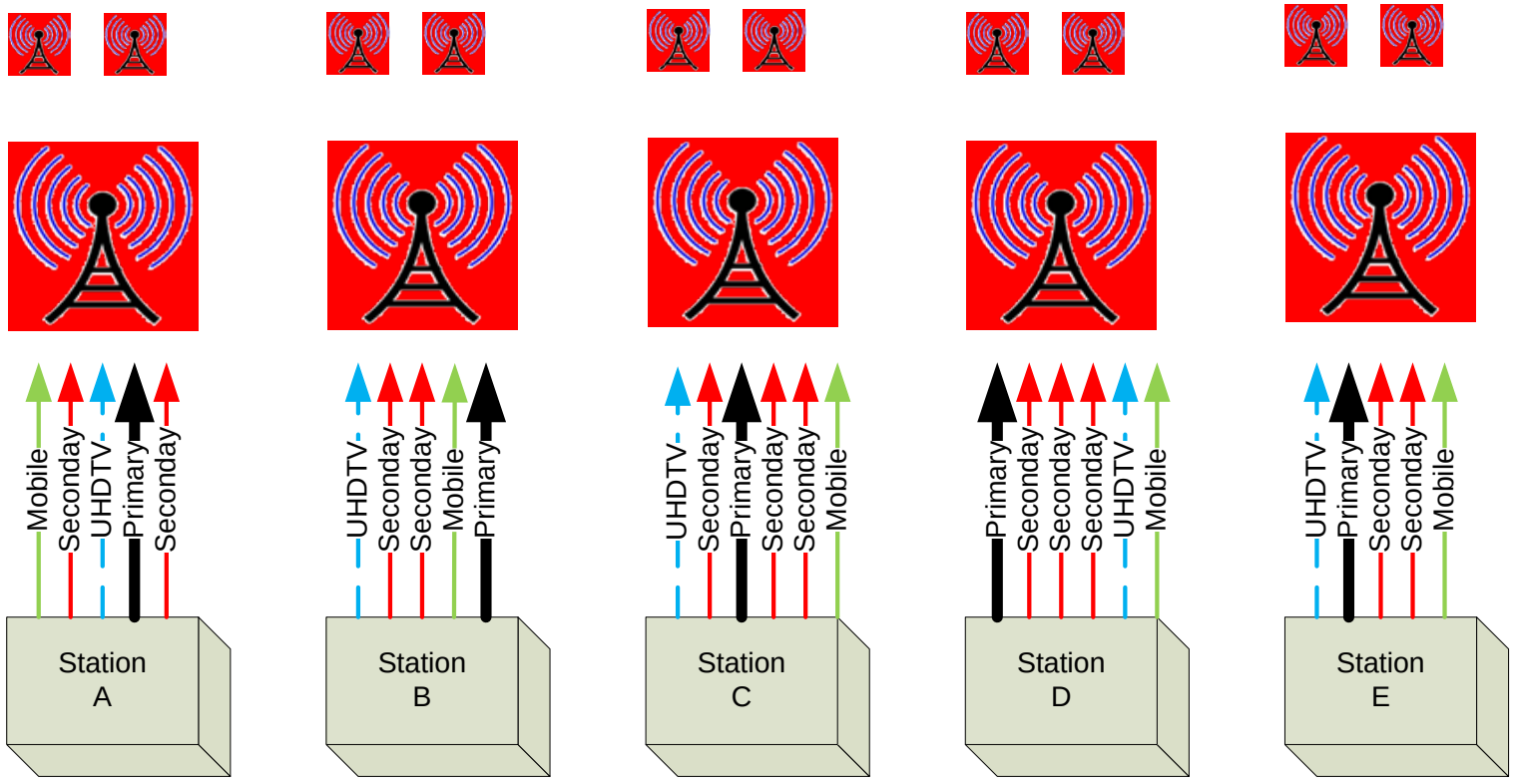
# Step 5, The New Normal




This is the end game… Soon, no one will even remember 8-VSB

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# The I Believe Button

- “TV” Has a common UX
- A common CIS (Customer Info Service)
- Common SFNs
- Bandwidth Sharing/Marketing

# Bit Rates

- ATSC's 8-VSB is fixed at 19,390,000 bits/second
- OFDM carriers can carry different number of bits
  - Fewer bits, better coverage
  - More bits, more payload
  - High bit rates coexist with low bit rates
- "Water Meter"
  - ATSC 1.0 – bits/time (Mb/s)
  - ATSC 3.0 – Hertz/time (MHz/Minute -- $/MHz/minute/pop)

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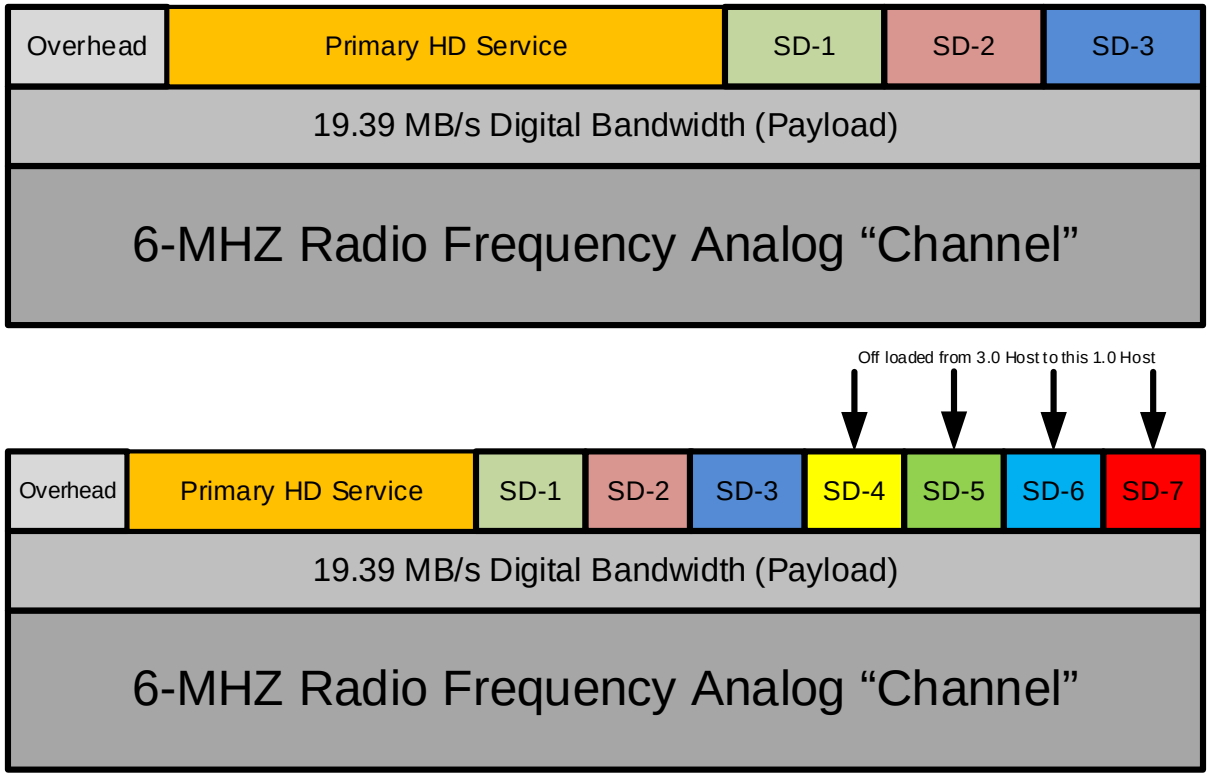
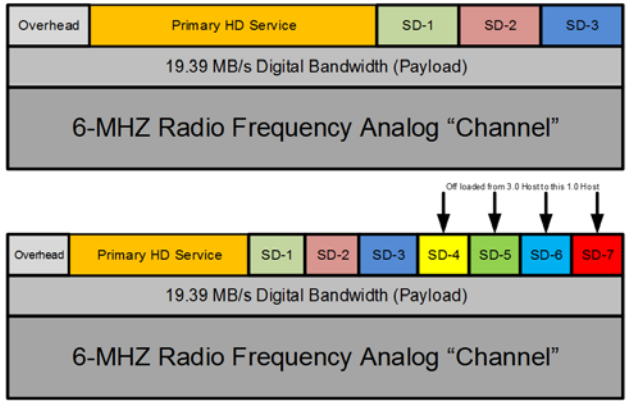
# Bits in 6 MHz
# 19.39 Mb/s = ~18.3 Mb/s



# Current 1.0 Max Loading

- 8 SD
- 1 HD + 7 SD
- 2 HD + 3 SD
- 3 HD ? (Testing in progress…)




- Language:
  - TOV- Threshold of Viewing
  - TOP- Threshold of Pain
  - JND- Just Noticeable Difference
  - Premier Quality

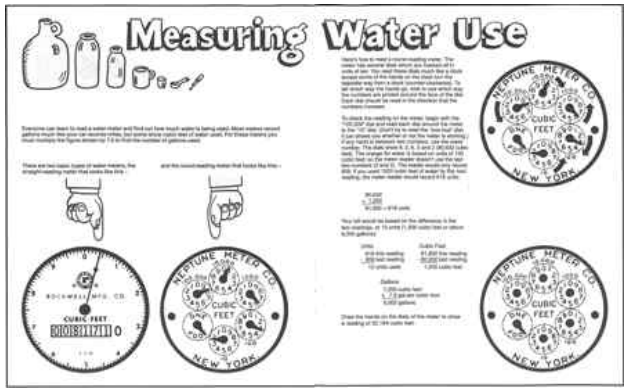
Ethnic - Specialty

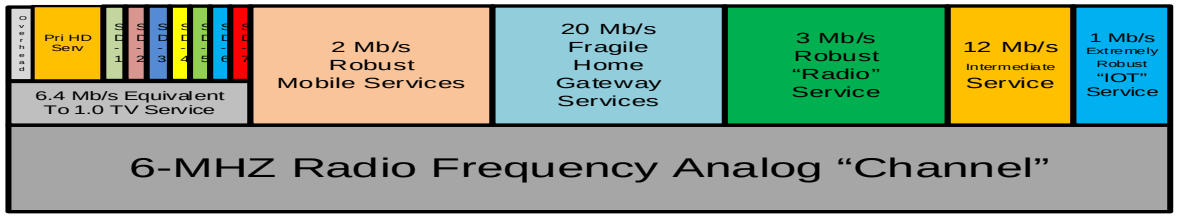
Most TV

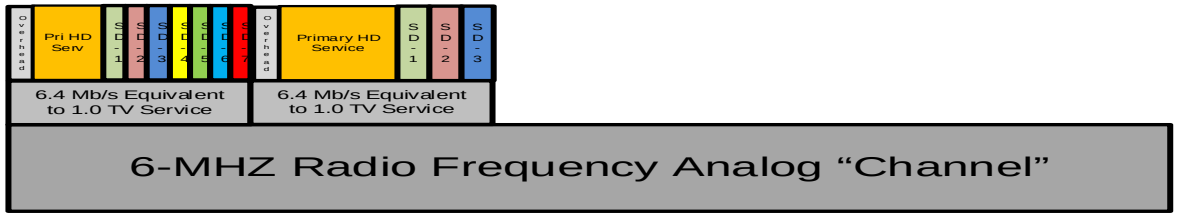
Sports, National Geo, Theater

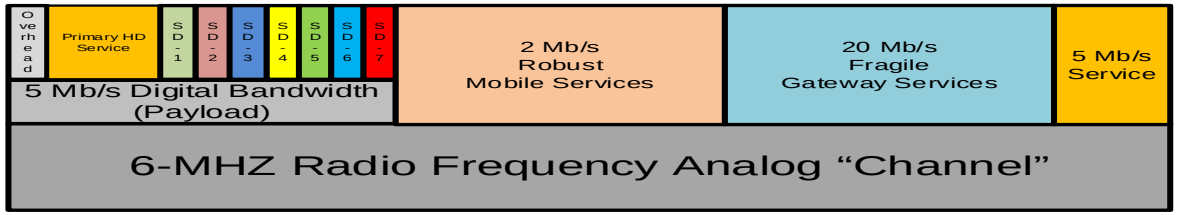
# Bits vs. MHz

The mod/cod 32K FFT 9/15 (64K Long) +BCH; NU256 provides 25.691 Mb/s for a 6-MHz NextGen channel. The performance for this mod/cod and current ATSC 1.0/8-VSB is both ~15.5dB AWGN. The coverage and penetration will be identical for a given transmission system (transmitter, tower, antenna) regardless of whether ATSC 1.0 or ATSC 3.0 with the given mod/cod is employed.



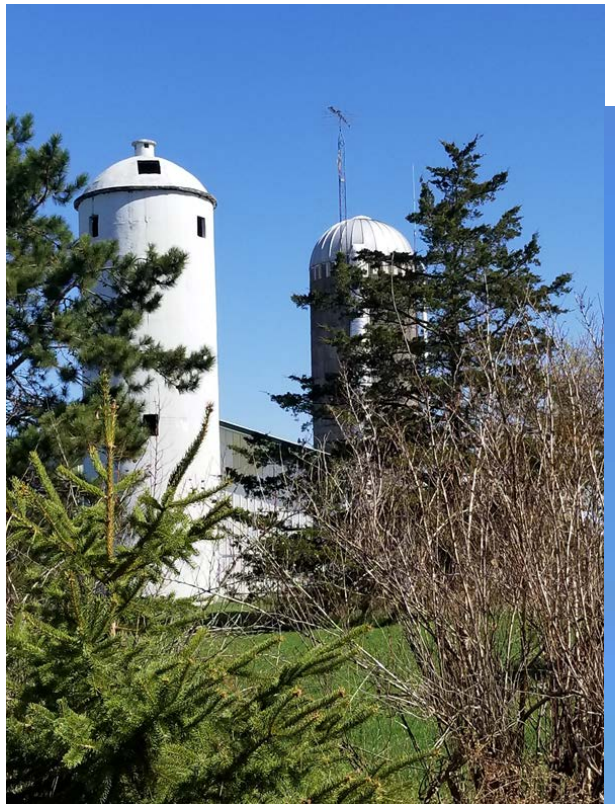




# VHF

- 1.0 Host
- STL
  - Serious Sinclair Patents
  - Feed 6 SFNs
    - For a very long way
    - Until Sporadic E hits
- Cheap Wireless Mics
- Garage Doors
- Remote Thermometers



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# *NextGen TV*

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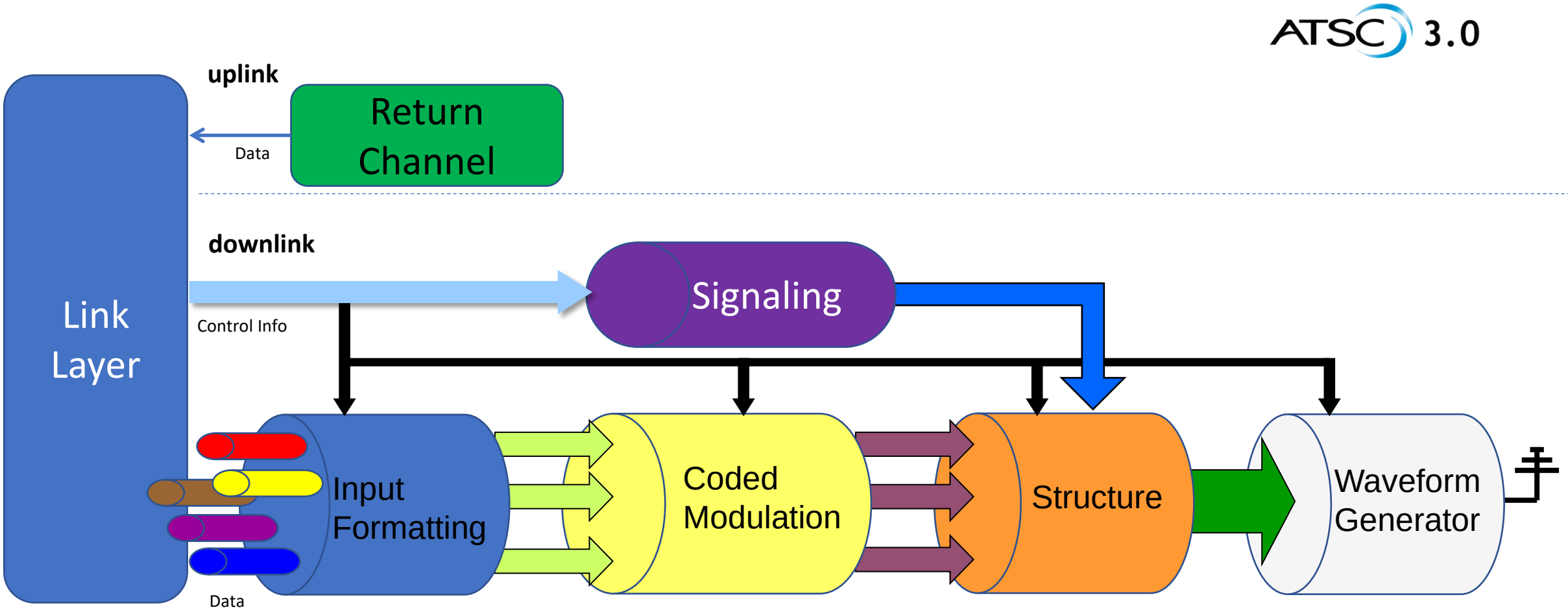
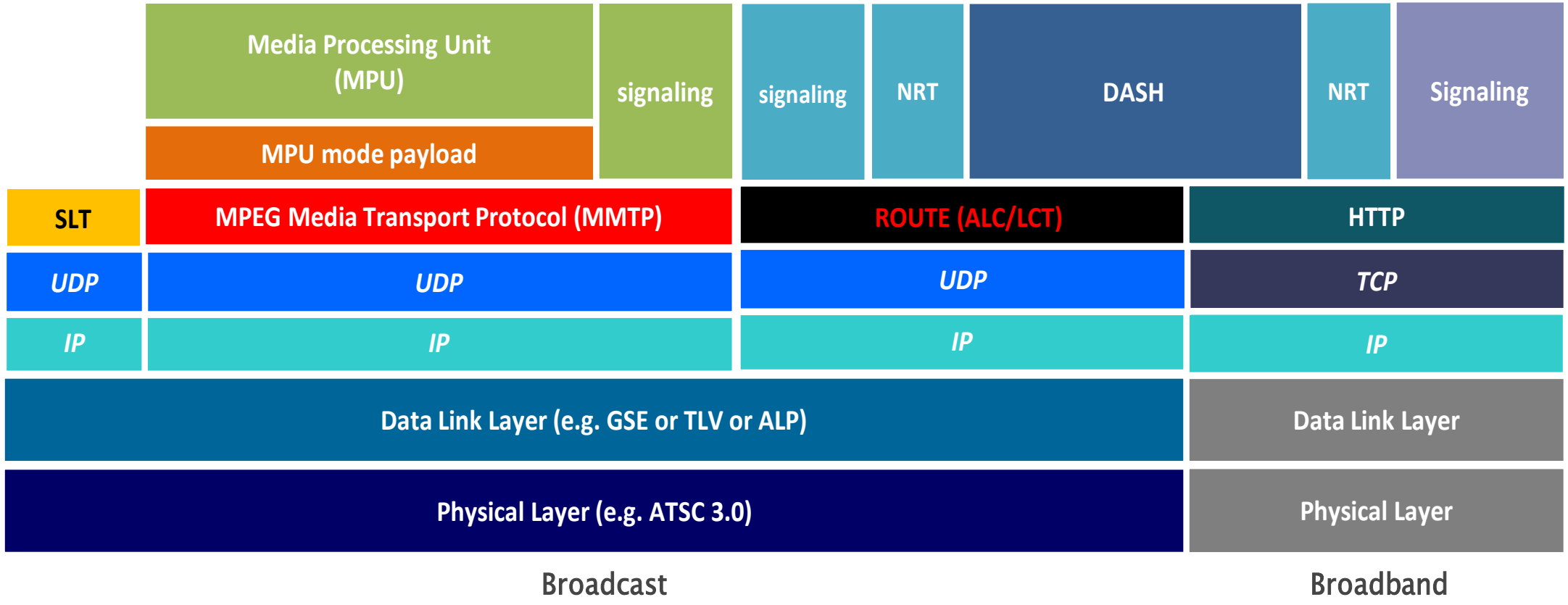
- II. Spectrum
- **III. Standard**
- IV. Transmission
- V. Platform (s)
- VI. Business
- VII. Media
- VIII. Significant and Useful Tangents

- Extensible
- Paths
  - ATSC 3.0 Stack
  - IP OTT Stack

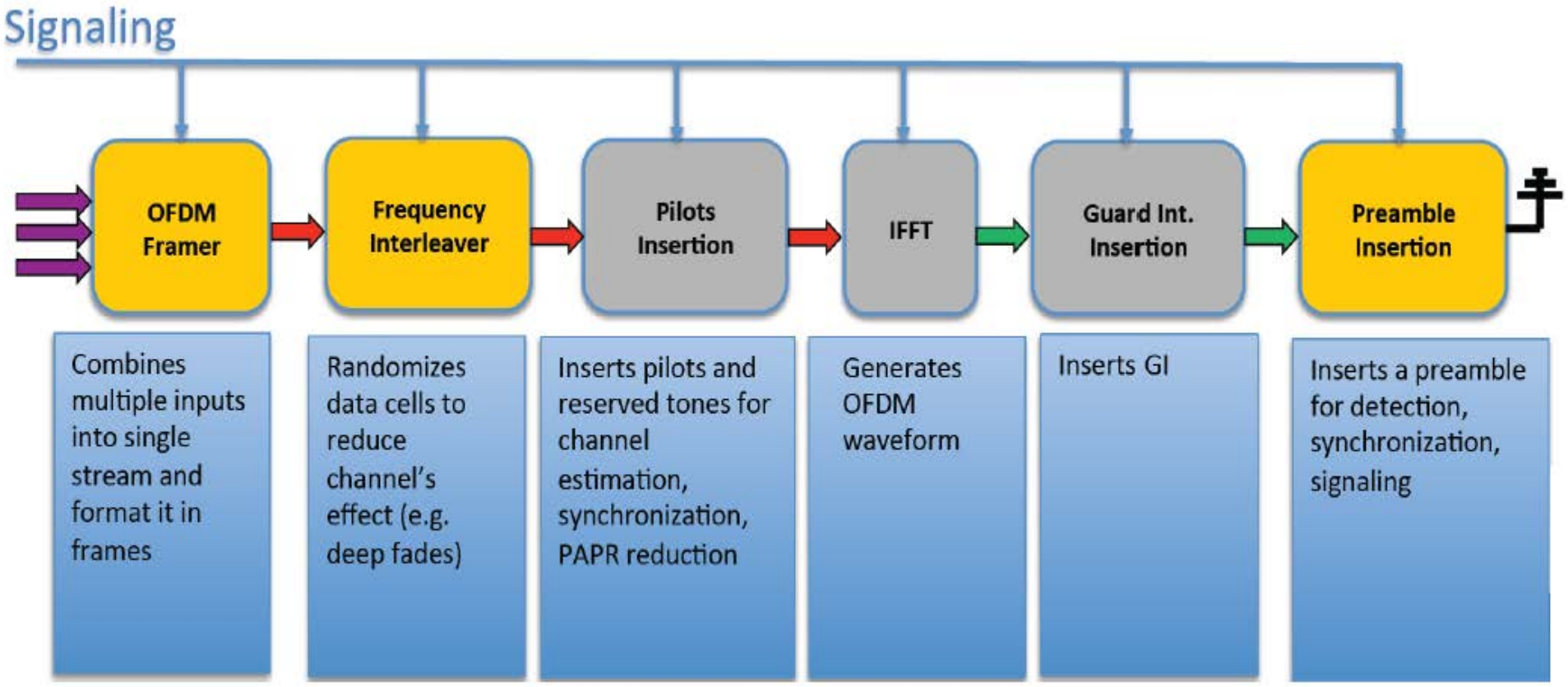
# PHY Layer Architecture



# “Transport” (Management and Protocol) Layer Stack



# Structure and Waveform

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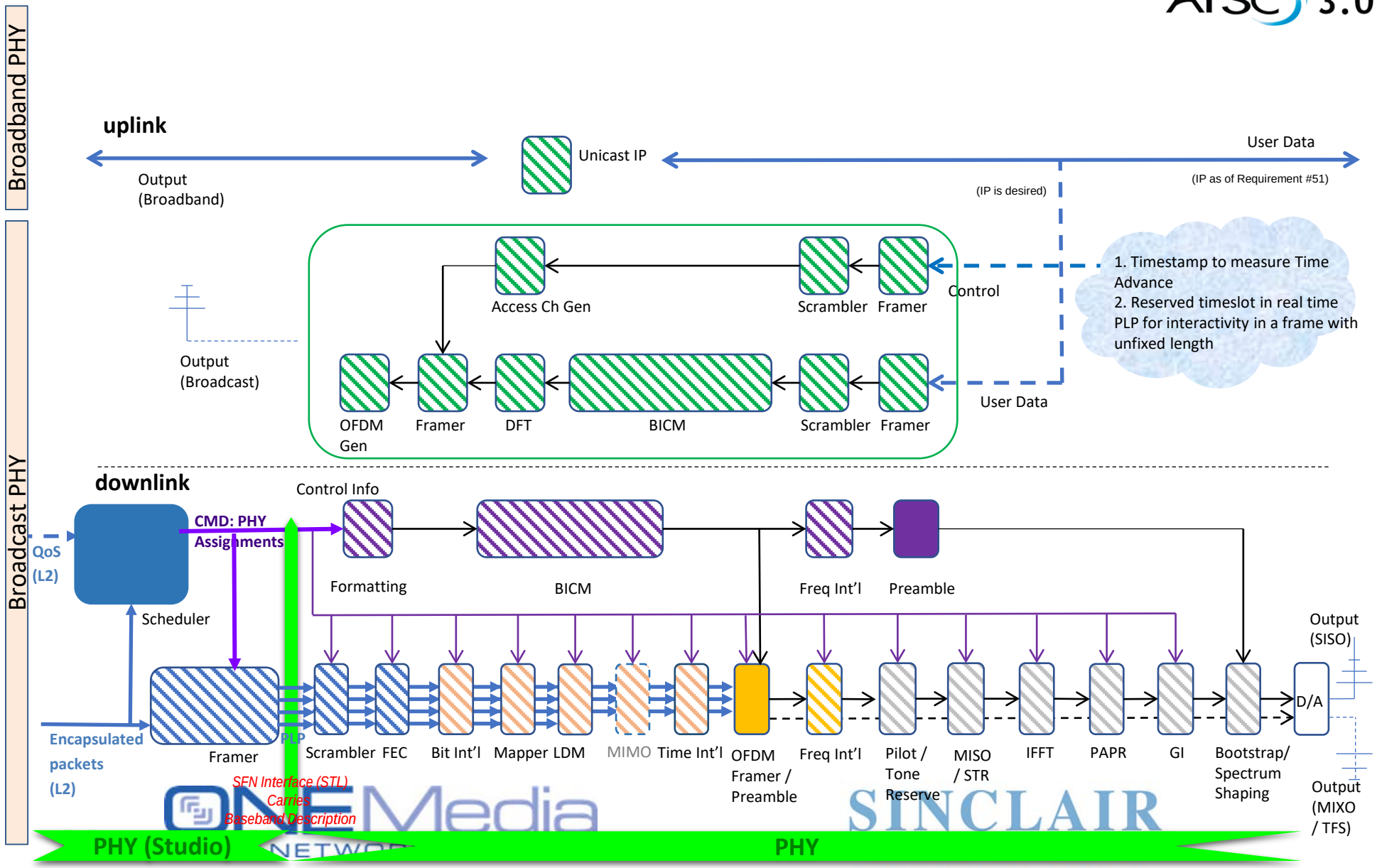
# PHY Layer Components



# What That Means

- Send different chunks of data at different rates and robustness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BROADCAST GROUP

# *NextGen TV*

- I. Sinclair – ONEMedia
- II. Spectrum
- III. Standard
- IV. **Transmission**
- V. Platform (s)
- VI. Business
- VII. Media
- VIII. Significant and Useful Tangents

- Propagation
  - TV
    - Dongle
    - 3.0 ready
    - MVPD Receivers
    - Chip
  - Use case –
    - Gateway
    - Mobile/portable
- Hybrid
  - NextGen doesn't require ATSC 3.0
- SFN
  - Boomers/Boosters/DAS
  - Seamless – State Wise
  - Shadows
  - Regulations



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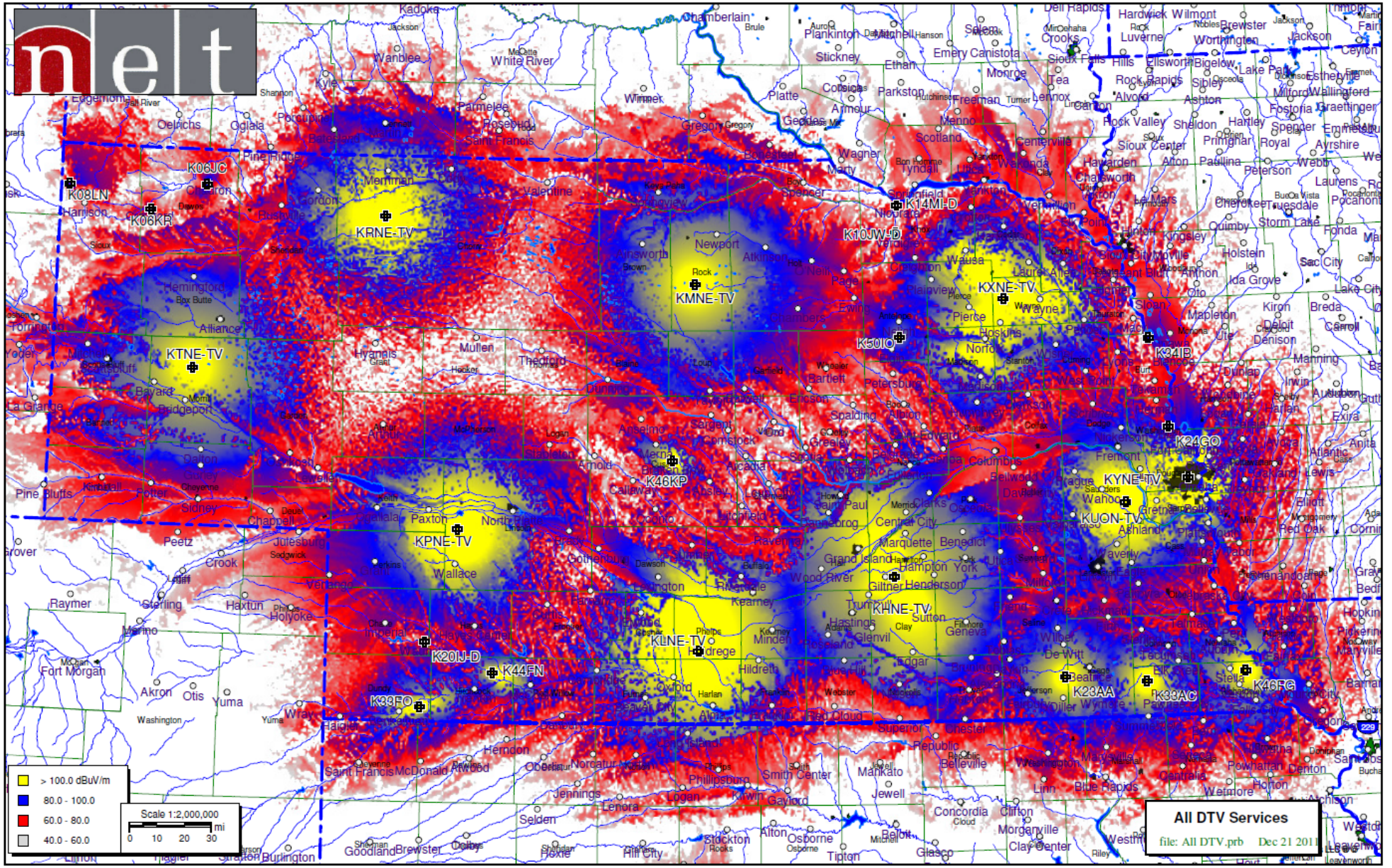
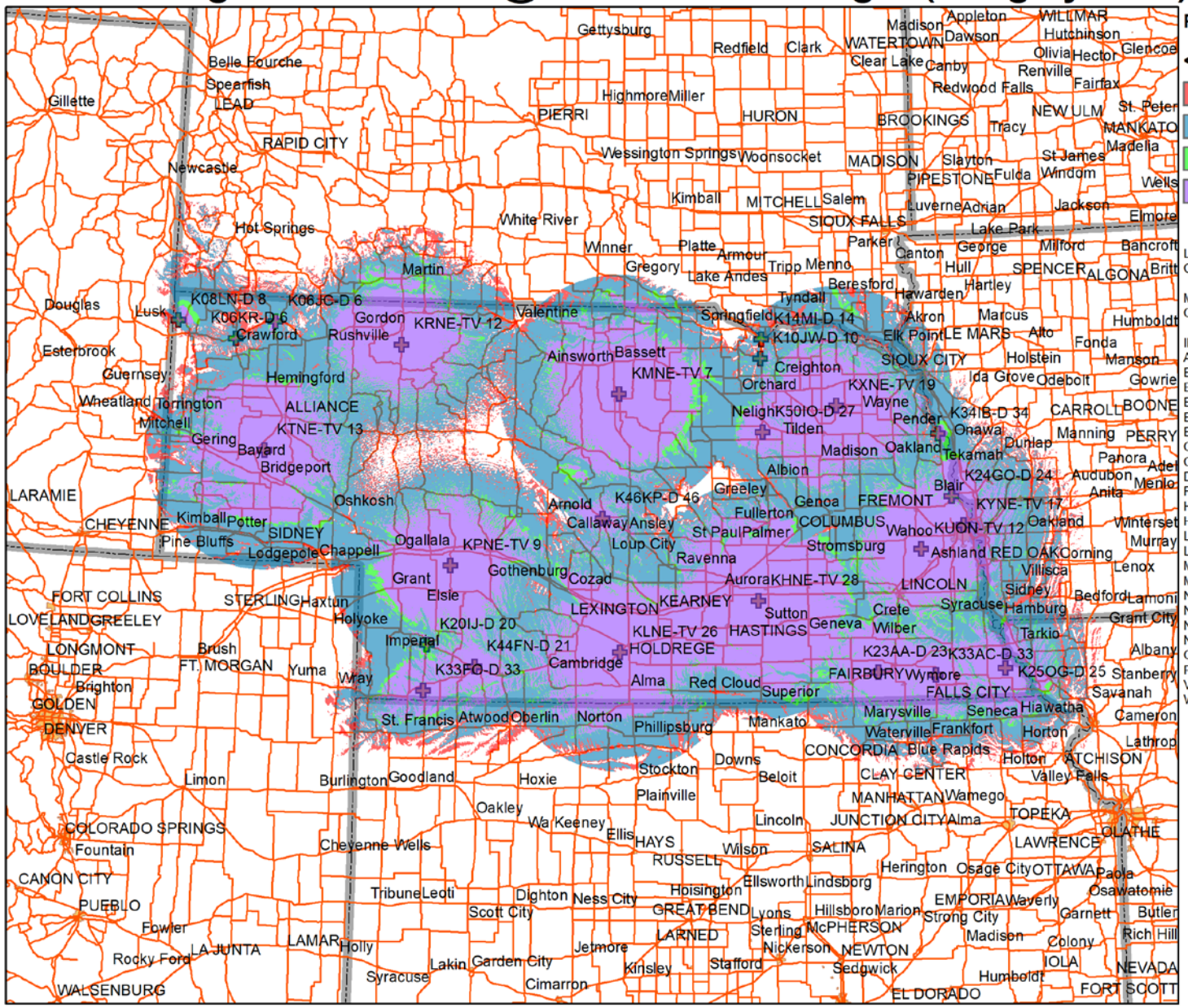

nelt
K06JC
K08LN
K06KR
KRNE-TV
KTNE-TV
KMNE-TV
K14MI-D
K10JW-D
KXNE-TV
K50IO
K24IB
K24GO
KYNE-TV
KUON-TV
K46KP
KPNE-TV
KHNE-TV
KLNE-TV
K20IJ-D
K44FN
K33FO
K23AA
K33AC
K46FG
> 100.0 dBuV/m
80.0 - 100.0
60.0 - 80.0
40.0 - 60.0
Scale 1:2,000,000
0 10 20 30 mi
All DTV Services
file: All DTV.prb Dec 21 201

# Field Strength Summation @ 10m Recieve height (Longley Rice)

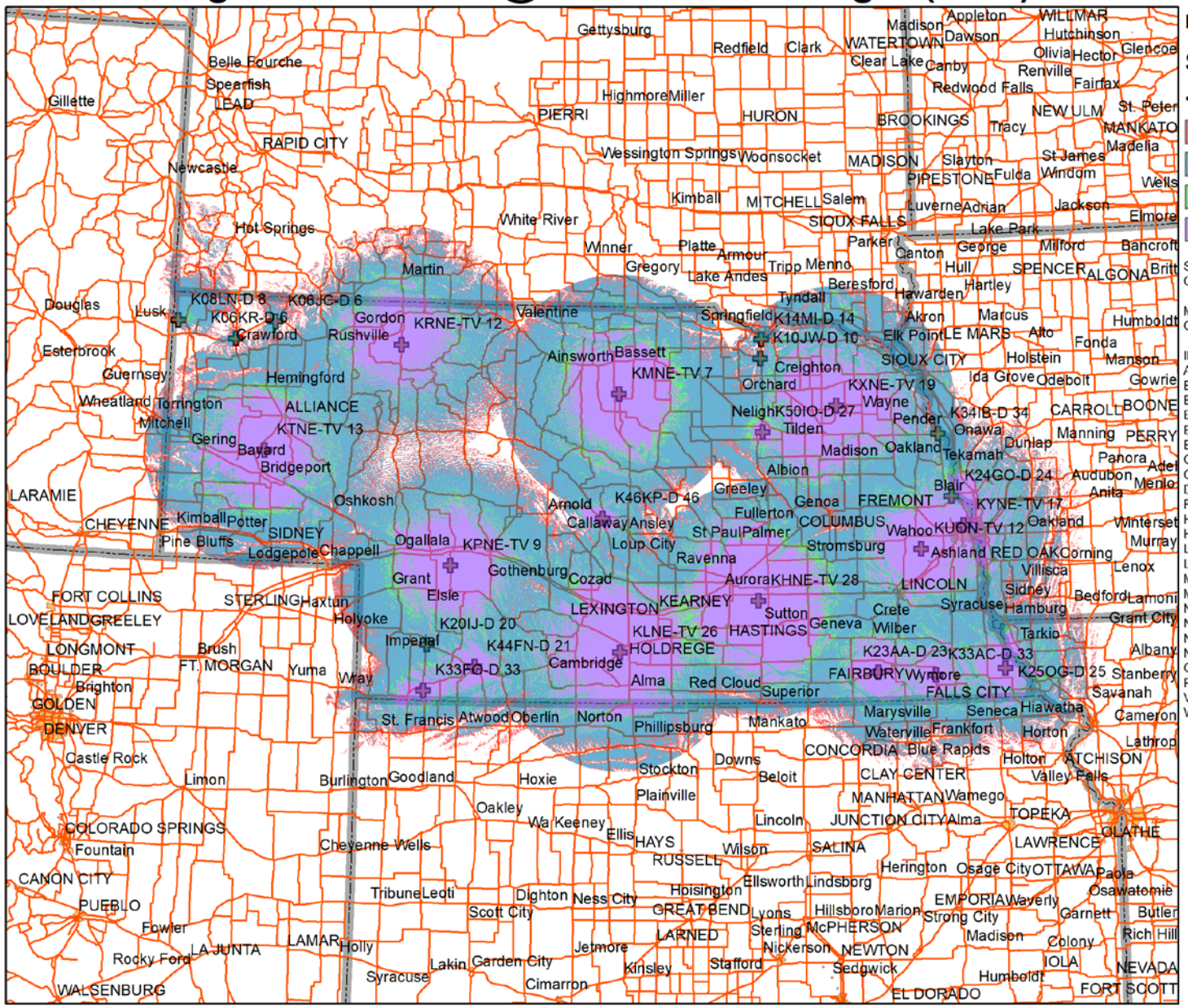



Longley Rice



ACRODYNE SERVICES

# Field Strength Summation @ 10m Receive height (CRC)




CRC



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# Use cases

- Using ATSC 3.0 calculators for “typical” parameters along with correction factors for a few use cases

| | Fixed rooftop | Home Gateway | Automotive/ Portable |
|---|---|---|---|
| FFT | 16k | 32k | 8k |
| MOD | 256QAM | 64QAM | 16QAM |
| COD | 10/15 | 11/15 | 8/15 |
| Capacity | 27Mbps | 24Mbps | 10Mbps |
| C/N | 18.5dB | 17.5dB | 10dB |
| Loc prob | 70% | 70% | 95% |
| FS at 1.5m | N/A | 56dBuV/m | 54dBuV/m |
| FS at 10m | 47dBuV/m | 73dBuV/m | 71dBuV/m |

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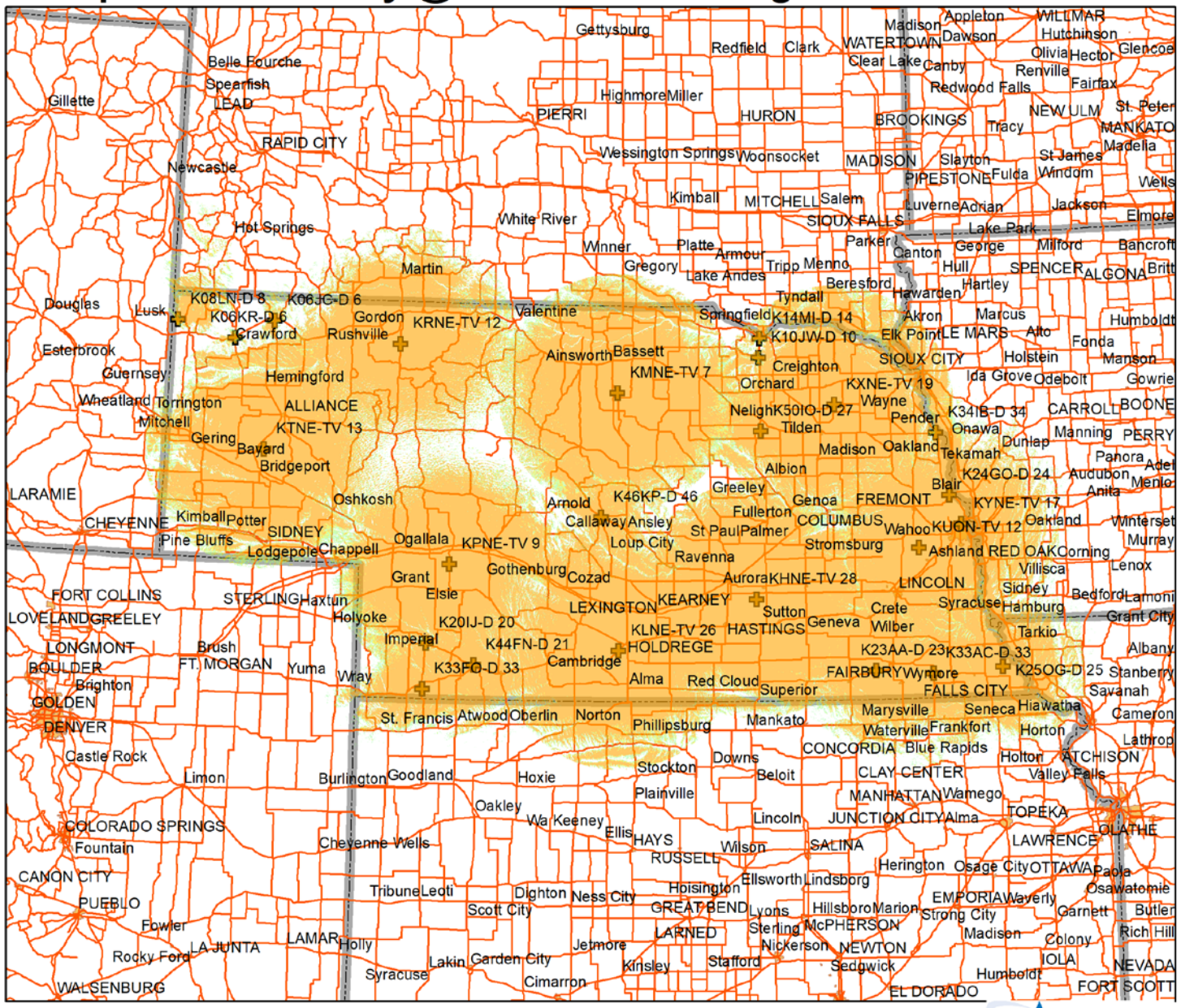
# Reception Probability @ 10m Recieve Height




**Coverage probability**

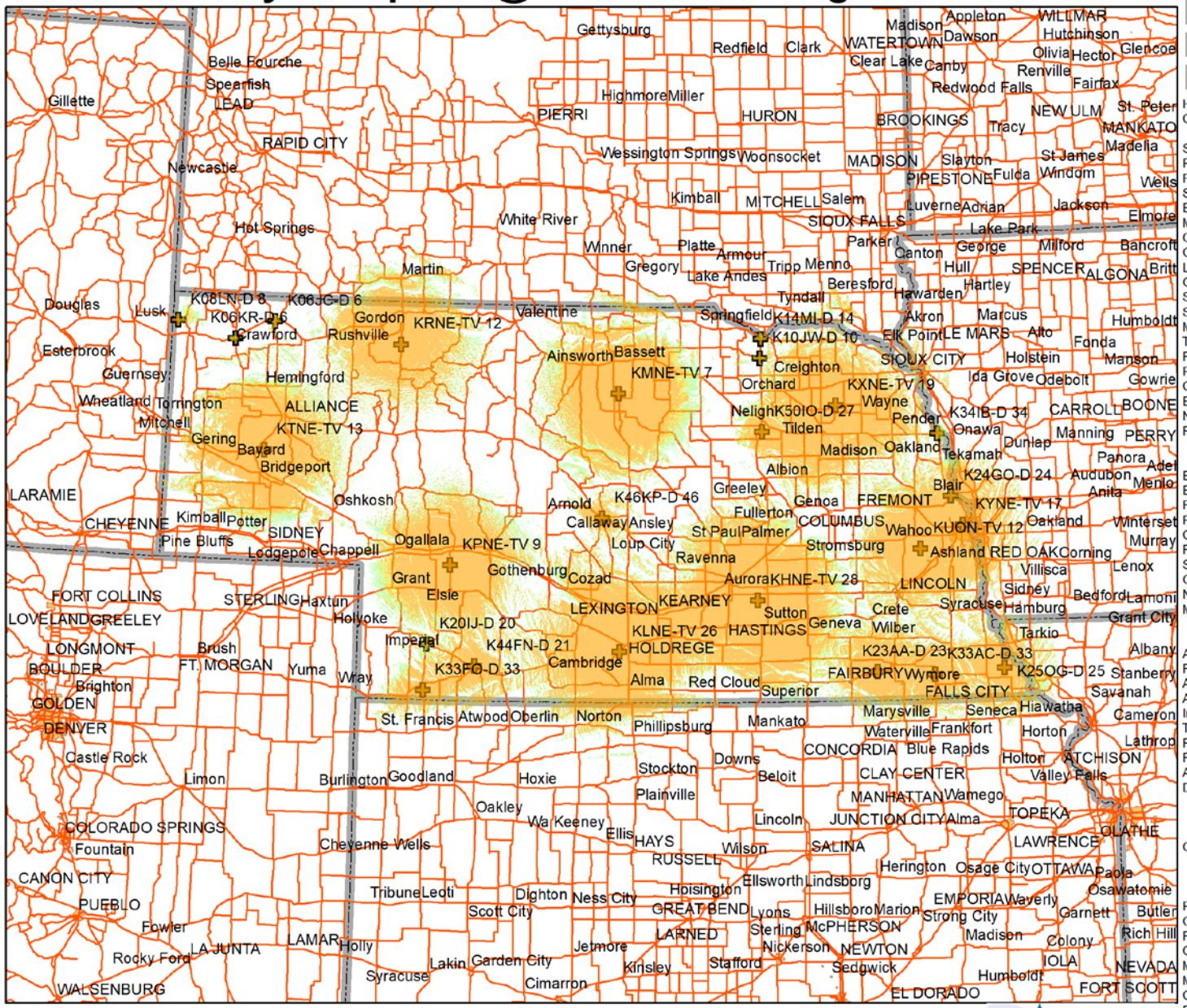
- 0.70 - 0.90
- 0.90 - 0.95
- 0.95 - 1

Rooftop (ATSC 3.0 Fixed, Coverage probability)
Calculation date: 2018-09-19 16:55:35

SYSTEM
Profile: Normal
FFT size: 32K
System bandwidth (MHz): 6
Bandwidth option: 0 - 100%
Modulation: 256-NUQAM
Code rate: 10/15
Outer code: None
LDPC frame length: 64800
Guard interval: GI7_2048 (296µs)
Scattered pilot pattern: SP12_2
Scattered pilot boost: 1
Multi antenna type: SISO
TDMA sub frame: False
Frame length: 250
PAPR reduction: None
Channel bonding: None
Backstop noise (dB): -38
Net bit rate (Mbit/s): 27.61
Required C/N (dB):
  Rice: 19.21
  Rayleigh: 21.88
EPT
EPT model: NONE
RECEIVER
Frequency (MHz): 503
Channel: 19
Receiving condition: Fixed
SFN synch method: First Tx
Guard interval model: Tf
Noise figure (dB): 7.0
Man-made noise margin (dB):
  Built-up area (dB): 0
  Other (dB): 0
Antenna gain (dBd): 10
Feeder loss (dB): 4
Amplifier gain (dB): 0
Antenna height (m): 10
Impl. margin (dB): 0
Tuner type: Silicon
Receive lower LDM level: False
FIXED RECEPTION
Antenna direction: Strongest Tx
Directivity discrimination: OET Bulletin 69
Orthogonal polarization discrimination: True
  Value (dB): -16
  Wanted Tx polarization: Individual
  Rx polarization: Same as wanted Tx
PROPAGATION
Outdoor standard deviation (dB): 5.5
Field strength correlation: 0
CALCULATION
Method: Log-normal
Max number of interferers: 3
Consider receiver overload: False
Raster type: Coverage probability
Minimum field strength (dBµV/m)
Emin: 43.0
Emed at 10 m, 95 % of locations: 52.1

24 Mb/s Home Gateway with Outdoor Antenna

# Home Gateway Reception @ 3m Receive Height




**Coverage probability**

- 0.70 - 0.90
- 0.90 - 0.95
- 0.95 - 1

Home Gateway (ATSC 3.0 Fixed, Coverage probability
Calculation date: 2018-09-19 16:02:15

SYSTEM
Profile: Normal
FFT size: 32K
System bandwidth (MHz): 6
Bandwidth option: 0 - 100%
Modulation: 64-NUQAM
Code rate: 11/15
Outer code: None
LDPC frame length: 64800
Guard interval: GI7_2048 (296µs)
Scattered pilot pattern: SP12_2
Scattered pilot boost: 1
Multi antenna type: SISO
TDMA sub frame: False
Frame length: 250
PAPR reduction: None
Channel bonding: None
Backstop noise (dB): -38
Net bit rate (Mbit/s): 22.78
Required C/N (dB):
Rice: 16.31
Rayleigh: 19.22
EPT
EPT model: NONE
RECEIVER
Frequency (MHz): 503
Channel: 19
Receiving condition: Fixed
SFN synch method: First Tx
Guard interval model: Tf
Noise figure (dB): 7.0
Man-made noise margin (dB):
Built-up area (dB): 0
Other (dB): 0
Antenna gain (dBd): 0
Feeder loss (dB): 1
Amplifier gain (dB): 0
Antenna height (m): 3
Impl. margin (dB): 0
Tuner type: Silicon
Receive lower LDM level: False
FIXED RECEPTION
Antenna direction: Strongest Tx
Directivity discrimination:
Angle lower (°): 30
Angle upper (°): 120
Gain (dB): -7
Orthogonal polarization discrimination: True
Value (dB): -3
Wanted Tx polarization: Individual
Rx polarization: Same as wanted Tx
PROPAGATION
Outdoor standard deviation (dB): 5.5
Field strength correlation: 0
CALCULATION
Method: Log-normal
Max number of interferers: 3
Consider receiver overload: False
Raster type: Coverage probability
Minimum field strength (dBµV/m)
Emin: 47.1
Emed at 10 m, 95 % of locations: 56.2

160 80 0 160 Miles

1 = 4,549,957

PROGIRA plan

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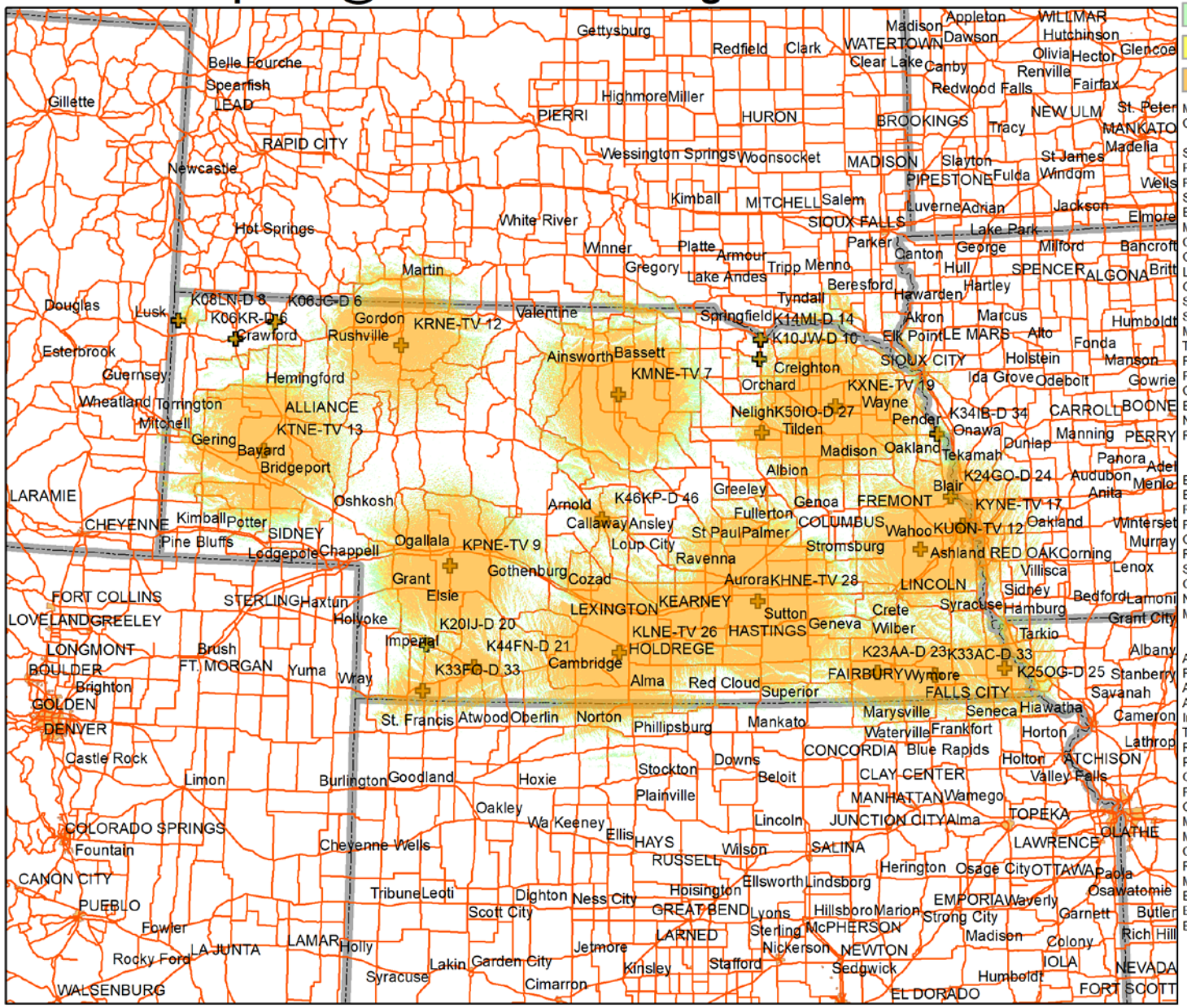
24 Mb/s Home Gateway With Window Antenna

# Mobile Reception @ 1.5m Receive height




**Coverage probability**

- 0.70 - 0.90
- 0.90 - 0.95
- 0.95 - 1

Mobile (ATSC 3.0 Portable outdoor, Coverage probabi
Calculation date: 2018-09-19 17:01:57

SYSTEM
Profile: Normal
FFT size: 8K
System bandwidth (MHz): 6
Bandwidth option: 0 - 100%
Modulation: 16-NUQAM
Code rate: 8/15
Outer code: None
LDPC frame length: 64800
Guard interval: GI7_2048 (296µs)
Scattered pilot pattern: SP3_4
Scattered pilot boost: 1
Multi antenna type: SISO
TDMA sub frame: False
Frame length: 250
PAPR reduction: None
Channel bonding: None
Backstop noise (dB): -38
Net bit rate (Mbit/s): 8.84
Required C/N (dB):
Rice: 8.16
Rayleigh: 10.19
EPT
EPT model: NONE
RECEIVER
Frequency (MHz): 503
Channel: 19
Receiving condition: Portable outdoor
SFN synch method: First Tx
Guard interval model: Tf
Noise figure (dB): 7.0
Man-made noise margin (dB):
Built-up area (dB): 0
Other (dB): 0
Antenna gain (dBd): 0
Feeder loss (dB): 3
Amplifier gain (dB): 0
Antenna height (m): 1.5
Impl. margin (dB): 0
Tuner type: Silicon
Receive lower LDM level: False
PROPAGATION
Outdoor standard deviation (dB): 5.5
Field strength correlation: 0
CALCULATION
Method: Log-normal
Max number of interferers: 3
Consider receiver overload: False
Raster type: Coverage probability
Minimum field strength (dBµV/m)
Emin: 43.0
Emed at 1.5 m, 95 % of locations: 52.0
Emed at 10 m, 95 % of locations: 68.1

10 Mb/s
Mobile

PROGIRA | plan

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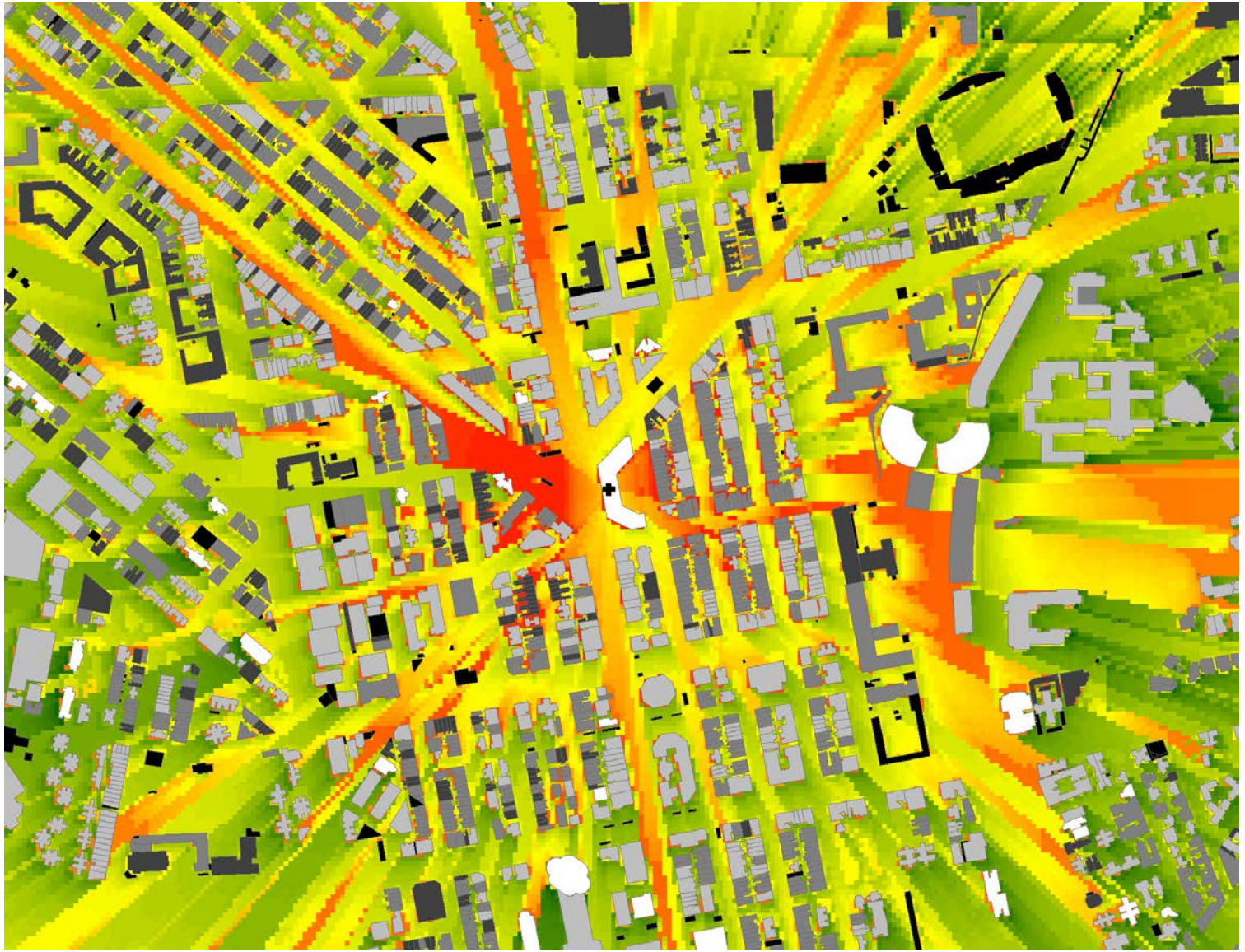
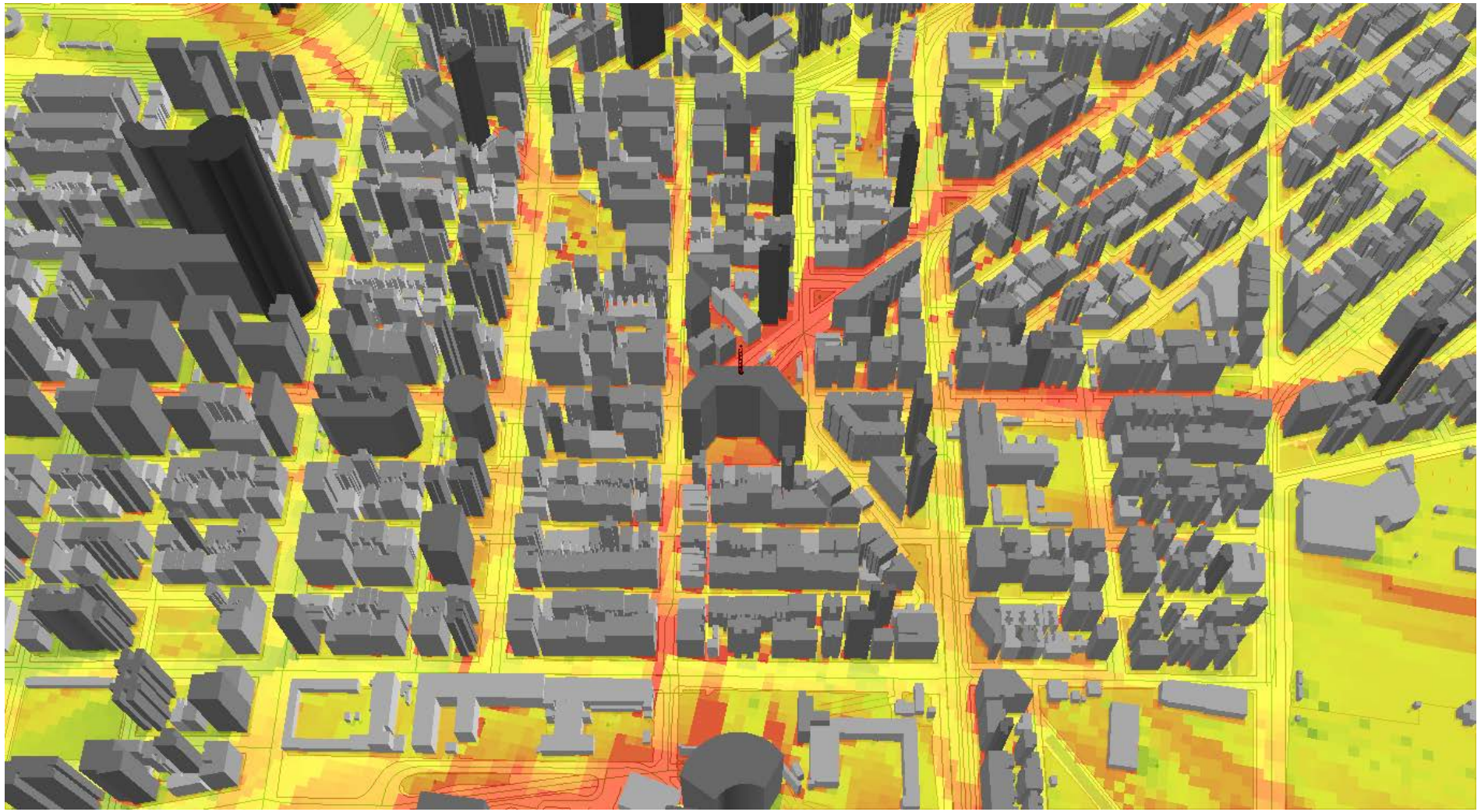
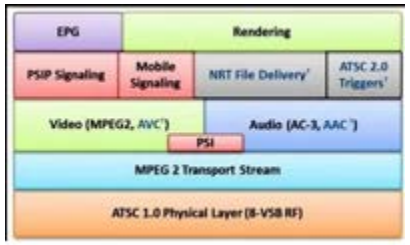
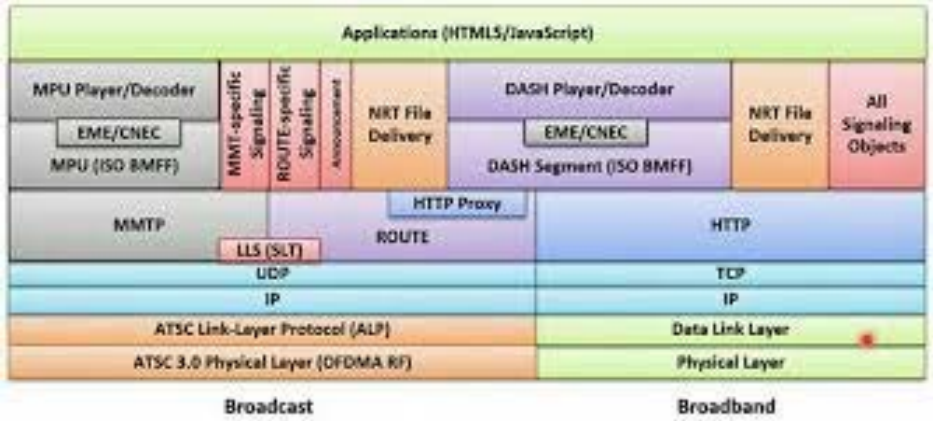


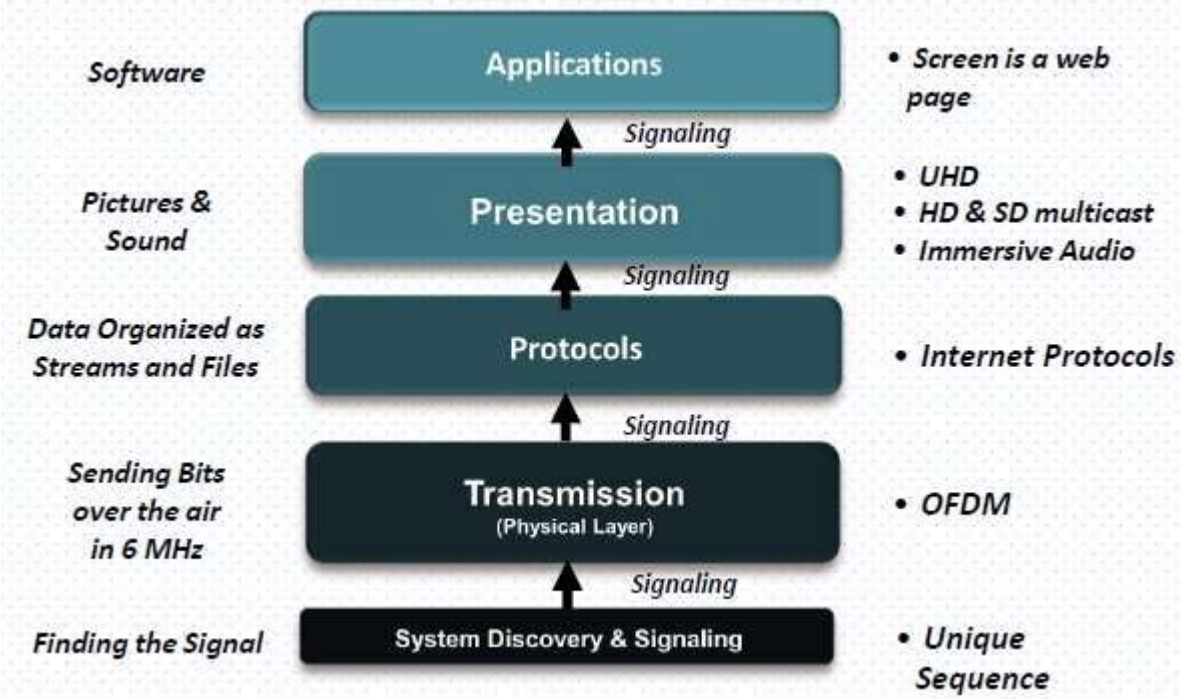


# What is the Next Media Distribution? 5G? -- ATSC 3.0? -- Both?

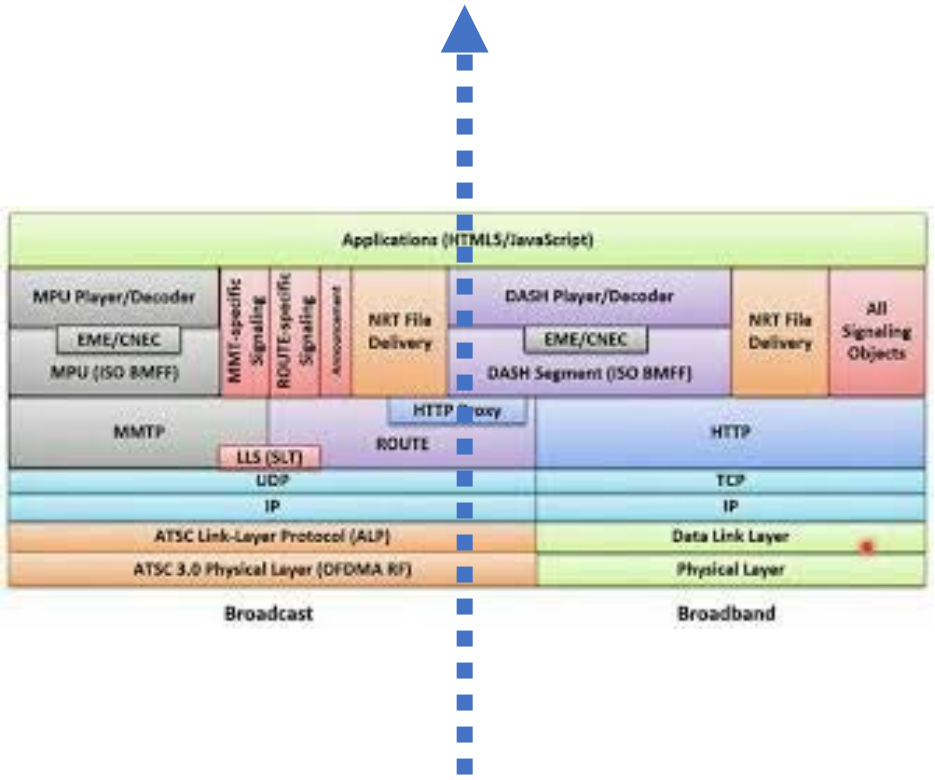


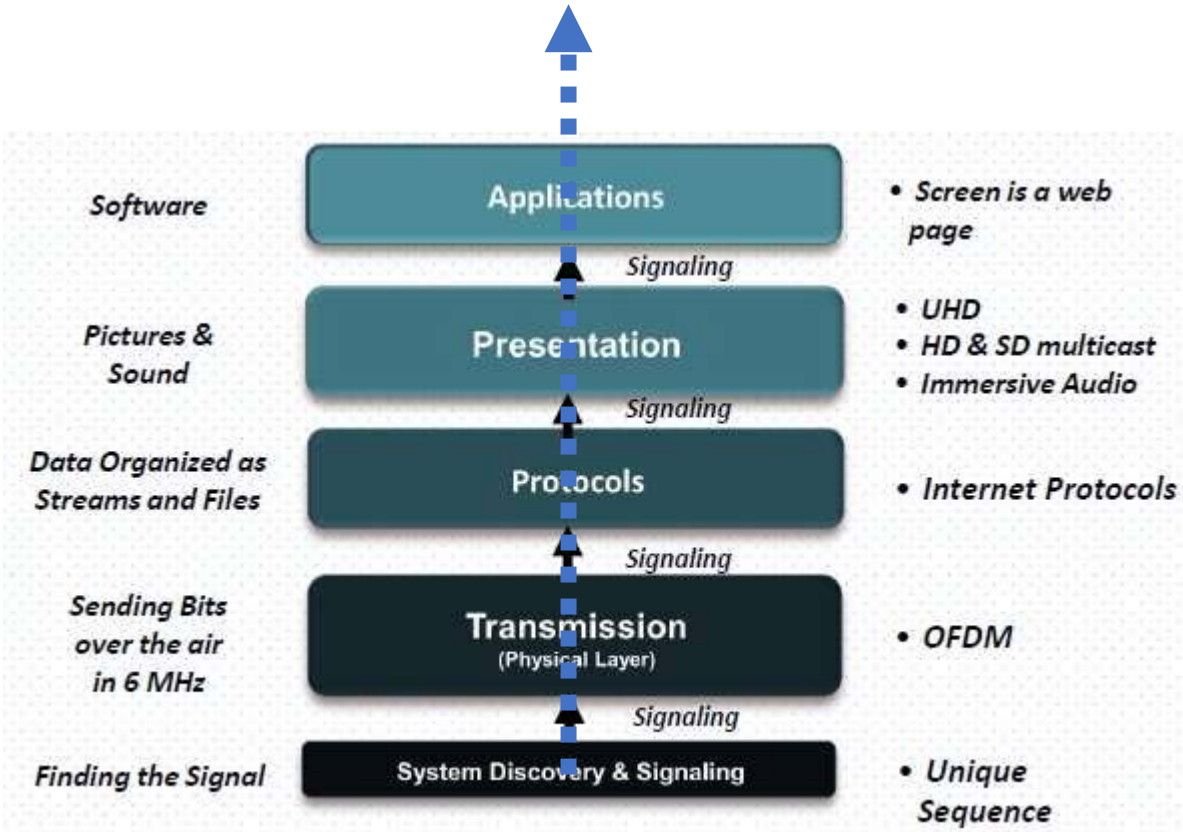

1.0/1.2 Protocol Stack



# Improved TV


Applications (HTML5/JavaScript)
MPU Player/Decoder
EME/CNEC
MPU (ISO BMFF)
MMT-specific Signaling
ROUTE-specific Signaling
Announcement
NRT File Delivery
DASH Player/Decoder
EME/CNEC
DASH Segment (ISO BMFF)
NRT File Delivery
All Signaling Objects
MMTP
LLS (SLT)
HTTP Proxy
ROUTE
HTTP
UDP
TCP
IP
IP
ATSC Link-Layer Protocol (ALP)
Data Link Layer
ATSC 3.0 Physical Layer (OFDMA RF)
Physical Layer
Broadcast
Broadband


Software
Applications
Signaling
Pictures & Sound
Presentation
Signaling
Data Organized as Streams and Files
Protocols
Signaling
Sending Bits over the air in 6 MHz
Transmission
(Physical Layer)
Signaling
Finding the Signal
System Discovery & Signaling
• Screen is a web page
• UHD
• HD & SD multicast
• Immersive Audio
• Internet Protocols
• OFDM
• Unique Sequence

# IP Off Ramp


Applications (HTML5/JavaScript)
MPU Player/Decoder
EME/CNEC
MPU (ISO BMFF)
MMT-specific Signaling
ROUTE-specific Signaling
Announcement
NRT File Delivery
DASH Player/Decoder
EME/CNEC
DASH Segment (ISO BMFF)
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All Signaling Objects
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ATSC 3.0 Physical Layer (OFDMA RF)
Physical Layer
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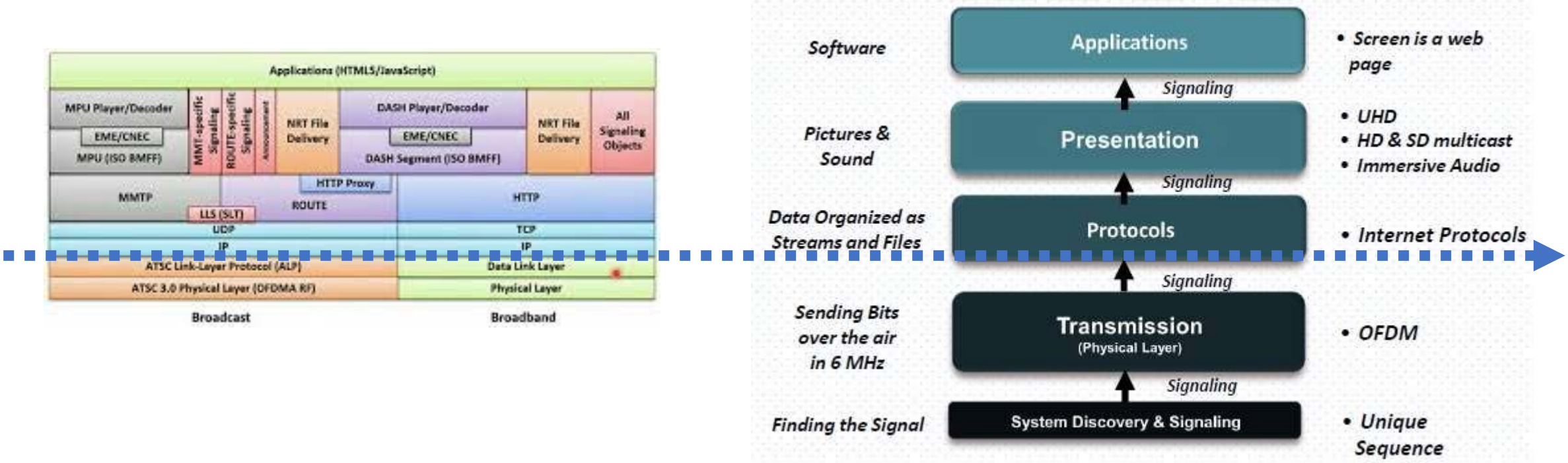
Broadband


Software
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Screen is a web page
Signaling
Pictures & Sound
Presentation
UHD
HD & SD multicast
Immersive Audio
Signaling
Data Organized as Streams and Files
Protocols
Internet Protocols
Signaling
Sending Bits over the air in 6 MHz
Transmission
(Physical Layer)
OFDM
Signaling
Finding the Signal
System Discovery & Signaling
Unique Sequence

# Boomers Boosters & DAS

- Boomer 1 MW – 1000 ft +

- Boosters – Any size
  - Sparse – 100 kW 300 Feet

- Dense

# DAS


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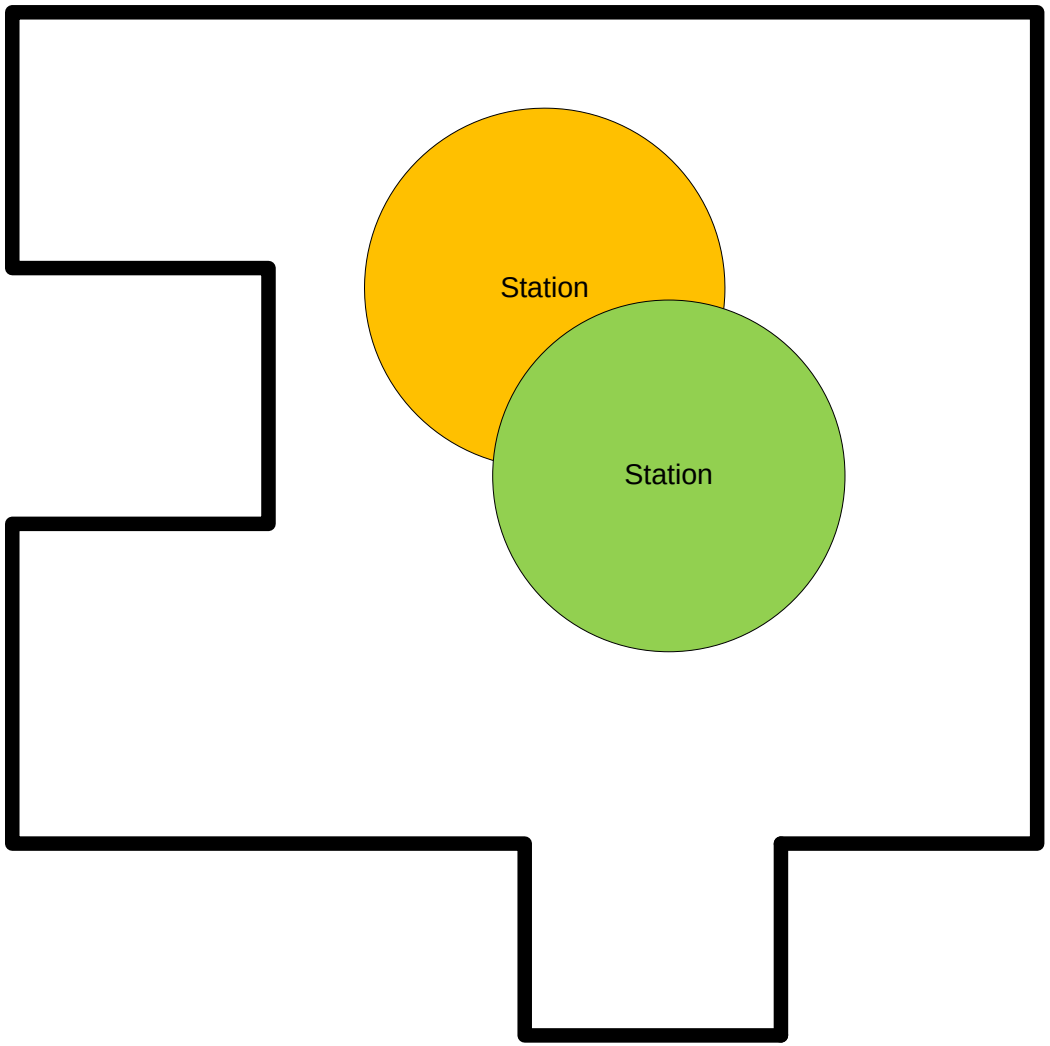
# OTA Coverage is Round DMAs are Not

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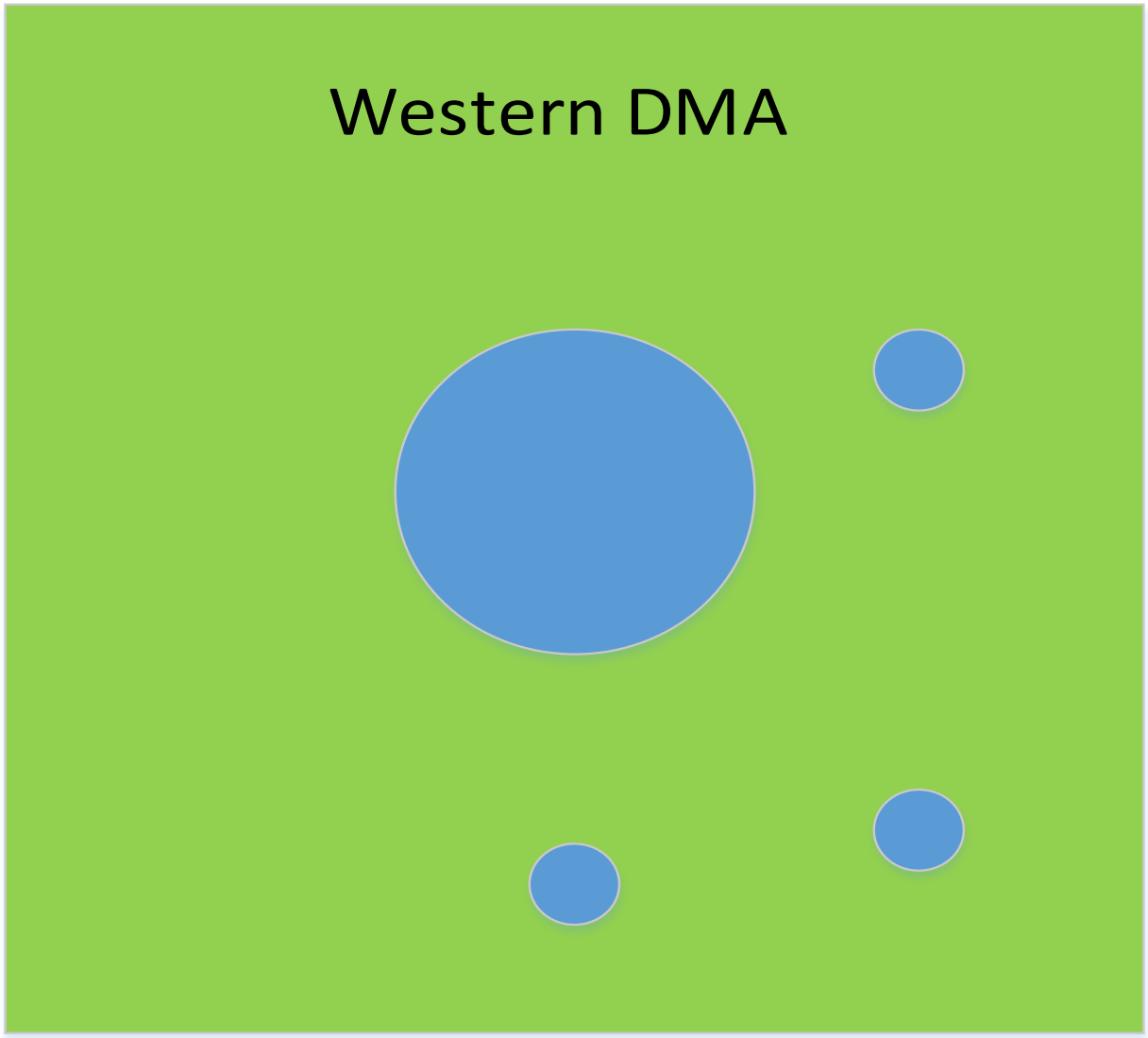
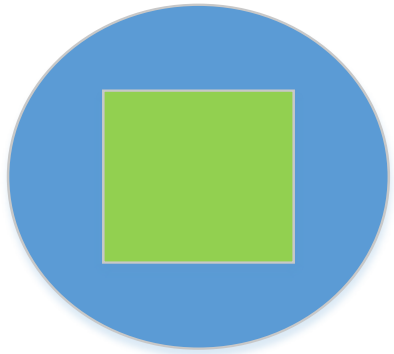
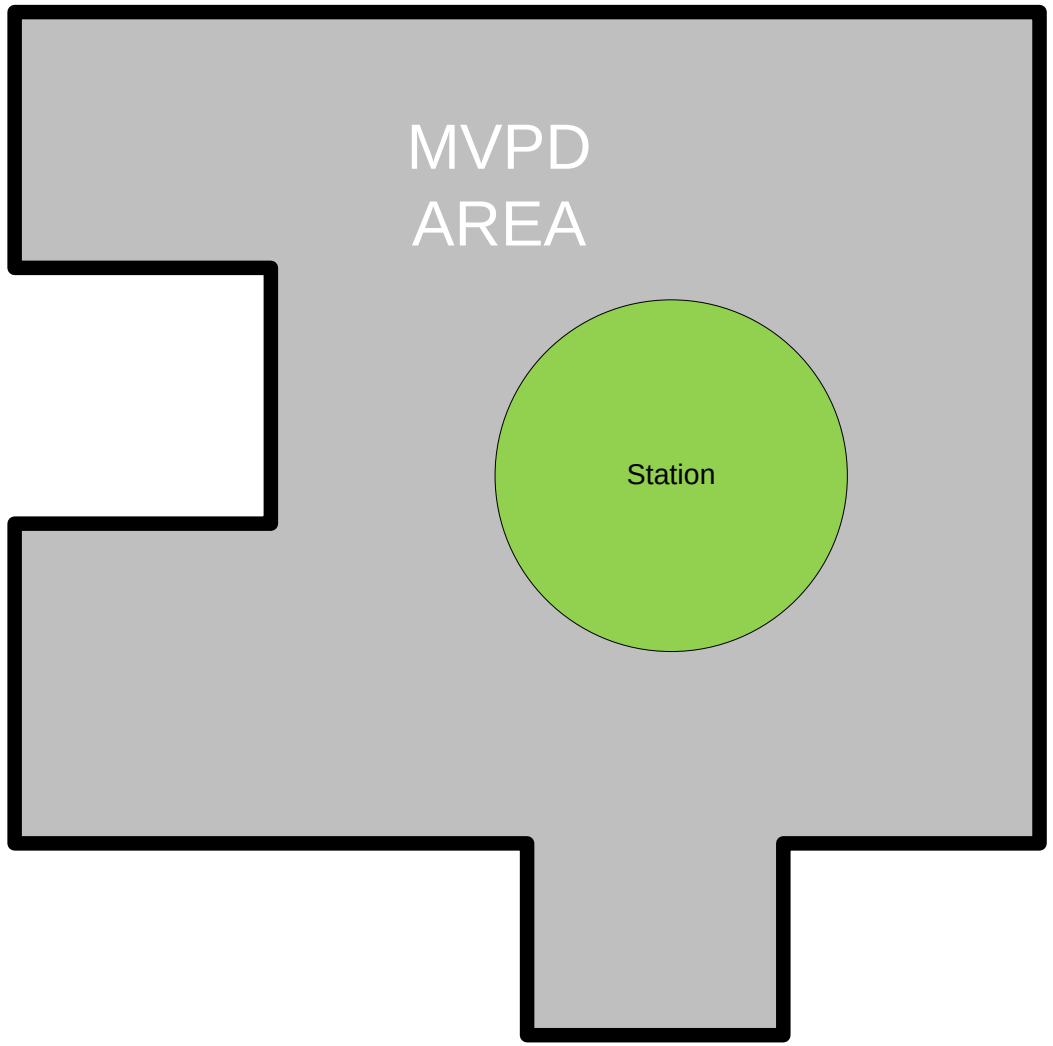

Western DMA


Eastern DMA

# OTA Coverage is Round DMAs are Not

MVPD's role is major in ATSC 1.0

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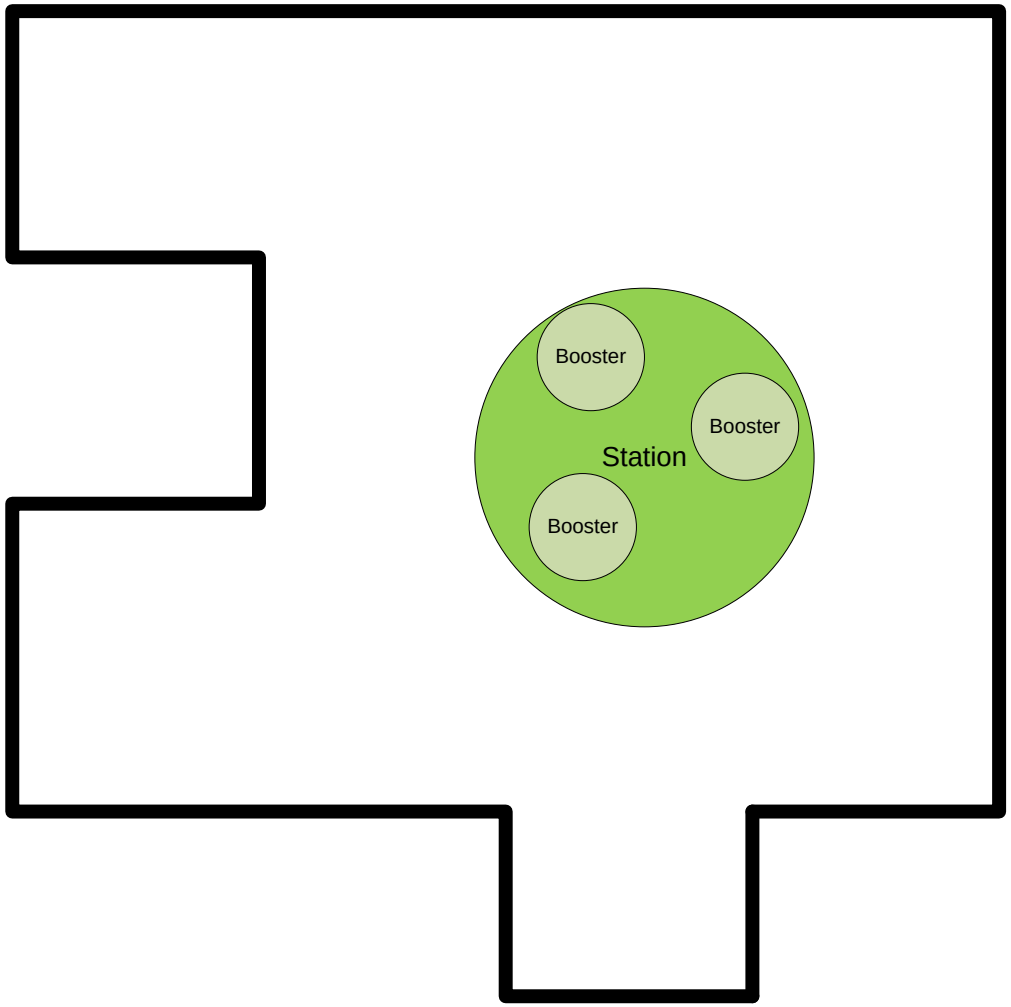
# Add SFN Support

Good for pumping up intensity

Doesn’t help with extending coverage

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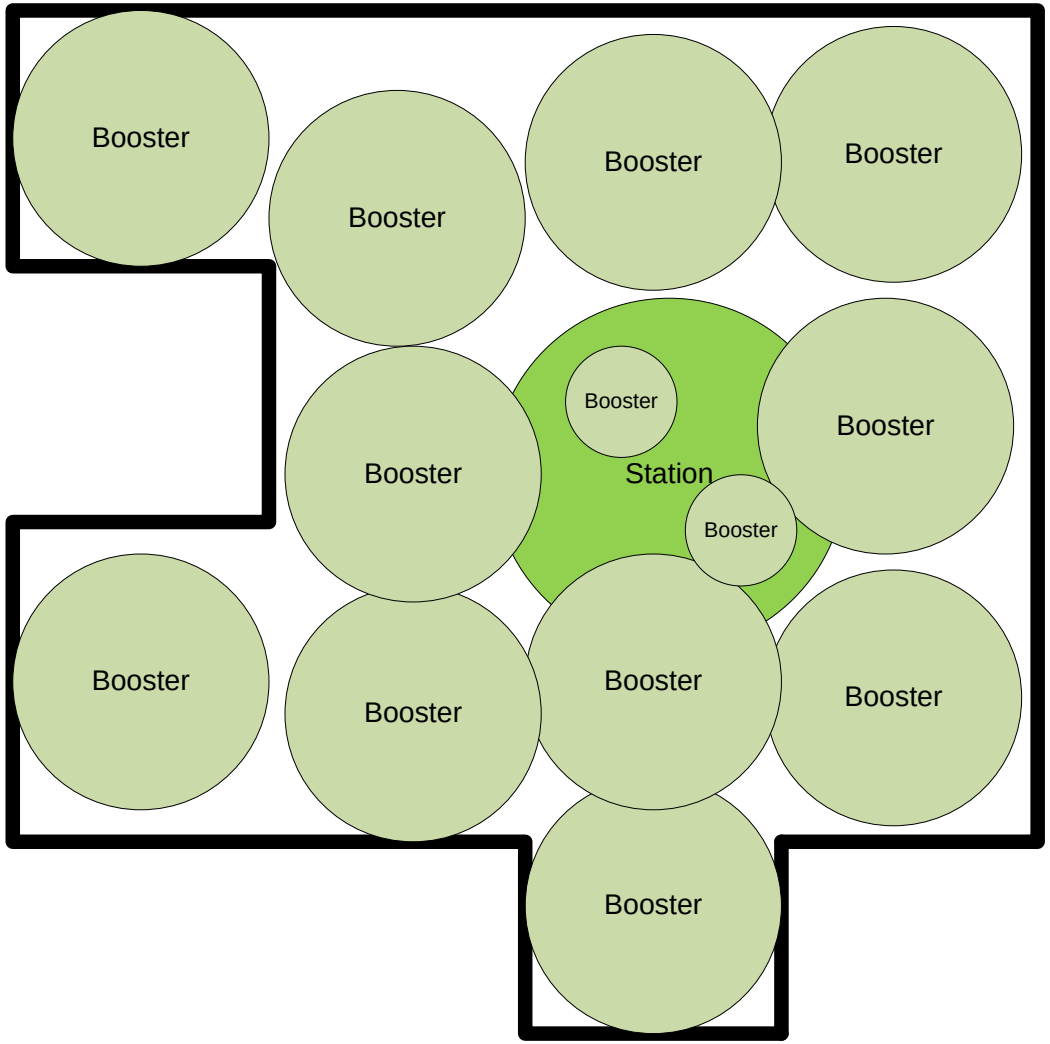
# If the rules were updated…
# SFN to Cover DMA

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# *NextGen TV*

- I.  Sinclair – ONEMedia
- II. Spectrum
- III. Standard
- IV. Transmission
- V. **Platform (s)**
- VI. Business
- VII. Media
- VIII. Significant and Useful Tangents

- OTT/OTA
- Home Gateway
- UX/UI
- Ecosystem



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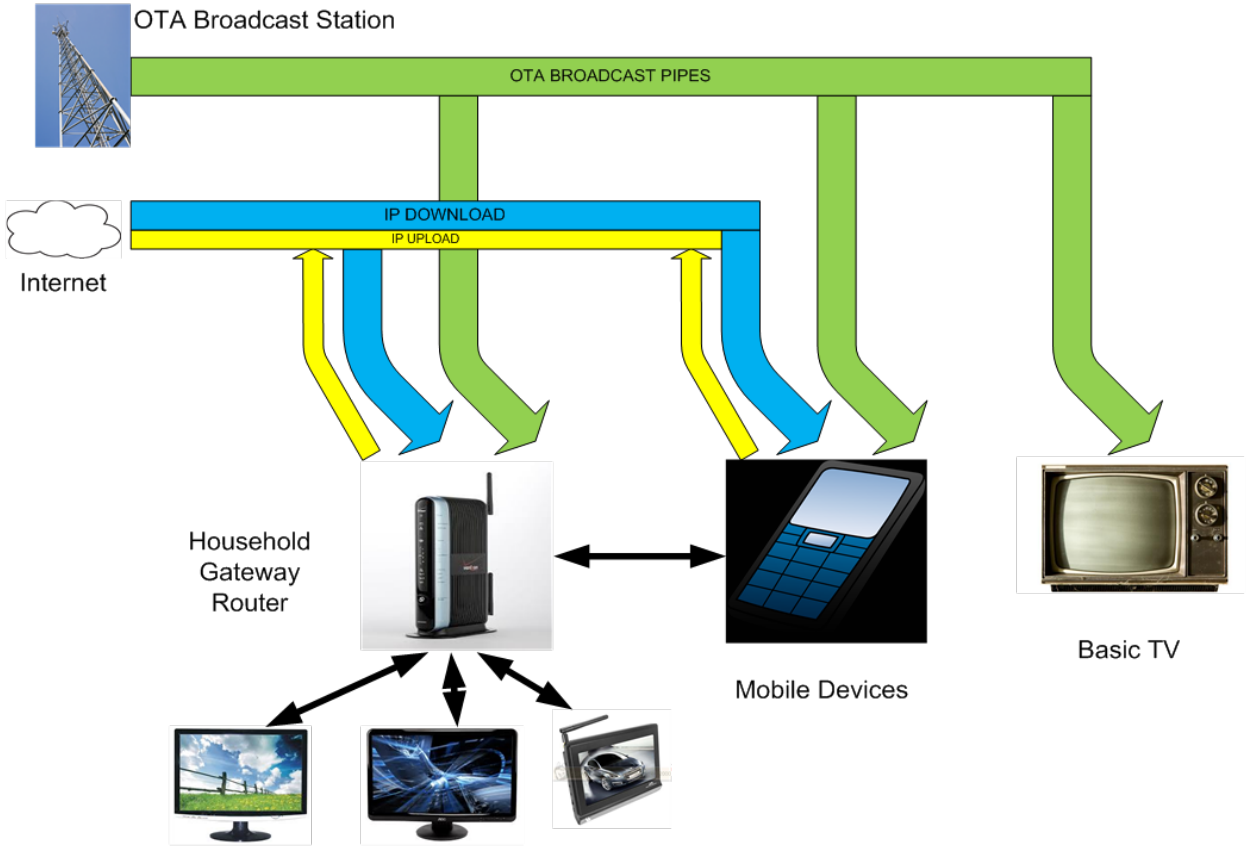
# Big Things

- Not Backward Compatible
- Feeds a Router, not a TV
  - Or a Device
  - Or a “Granny TV” Dongle

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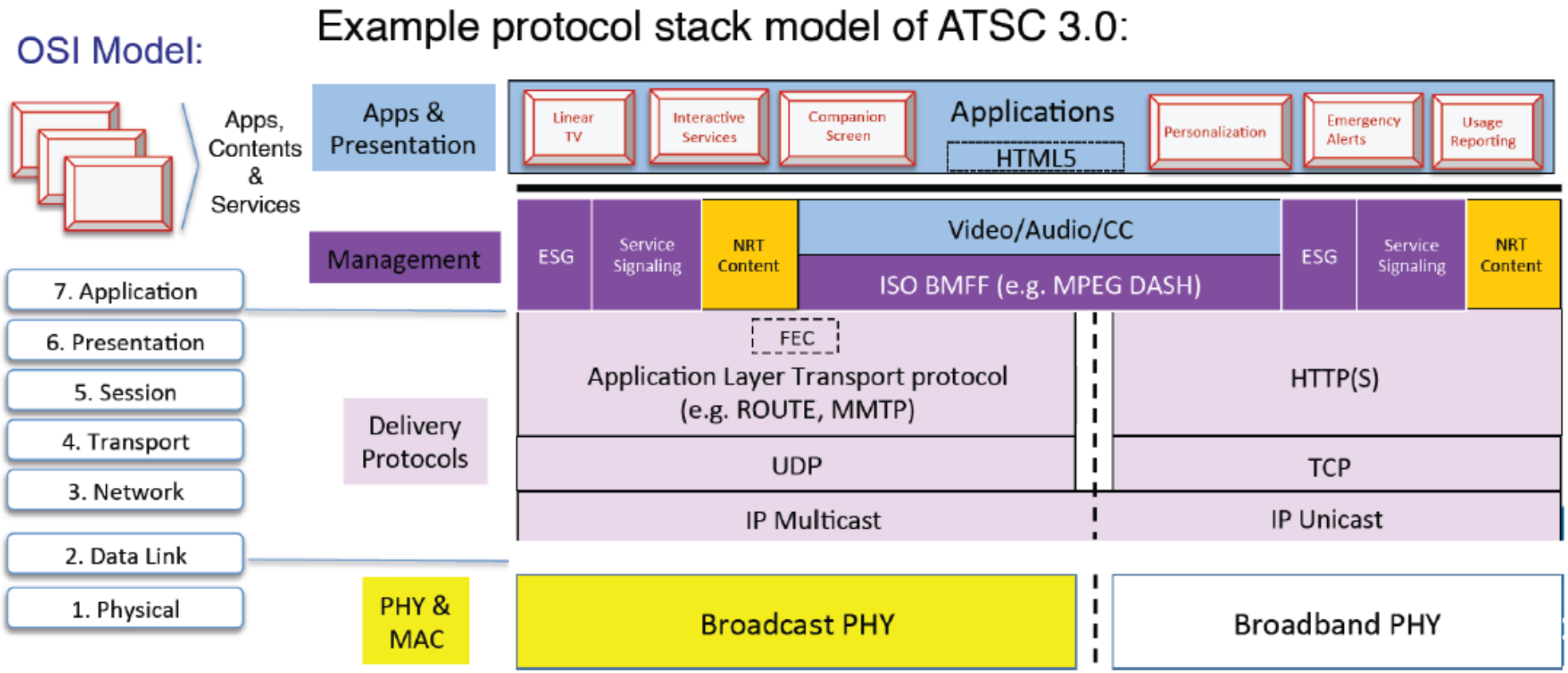
# IP Payload is *Multimedia* Capable

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# Multimedia Experience

## Applications

Internet Experience
Personalized & Dynamic

### ATSC 1.0


- Pictures, Graphics and Sound are “burned in”
- Same experience for entire audience

### ATSC 3.0

HTML

HbbTV


- HTML5/Internet overlay graphics
- Hybrid delivery - merge broadcast & internet
- Dynamic Ad Insertion
- Personalized Graphics
- Interactivity
- Synchronized second-screen applications
- Immersive Audio - user control of tracks and mix
- Audience Measurement capabilities

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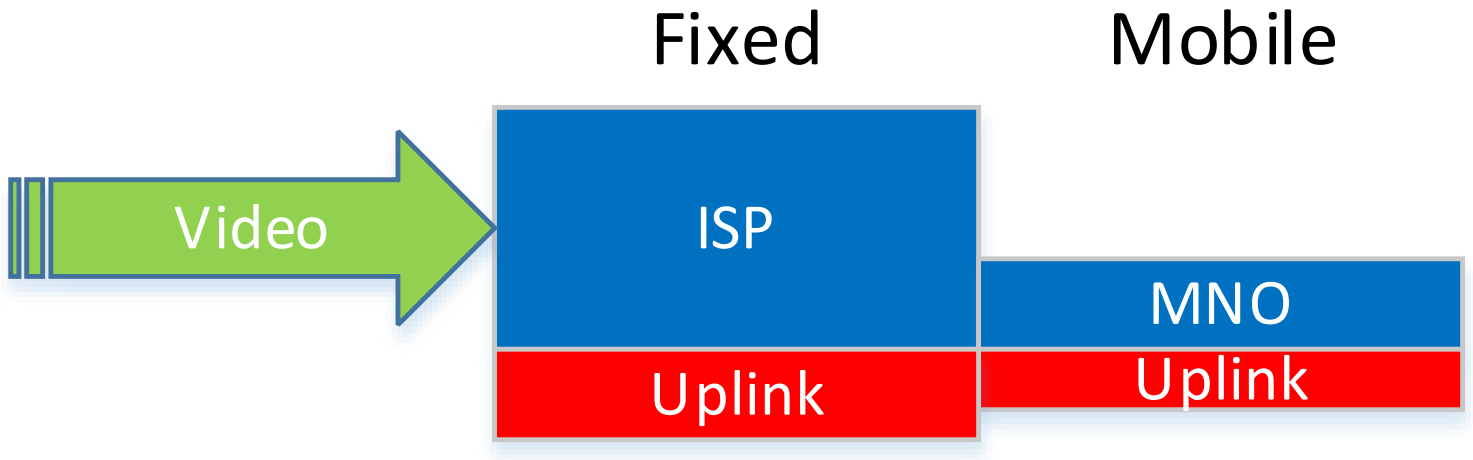
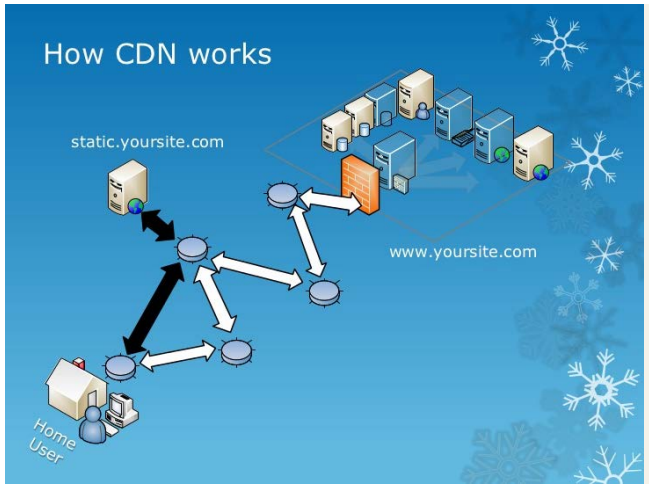
# Platform

- One Facet – New Product – New *Platform*
- *Platforms are inclusive, transactional, and highly integrated*
  - Example – Number of viewers drives programming and bit allocation
  - Example – The ad you need is played for you
  - Example -- Recommendations
- *We own less of the Ecosystem than others*

# Ecosystem – OTT

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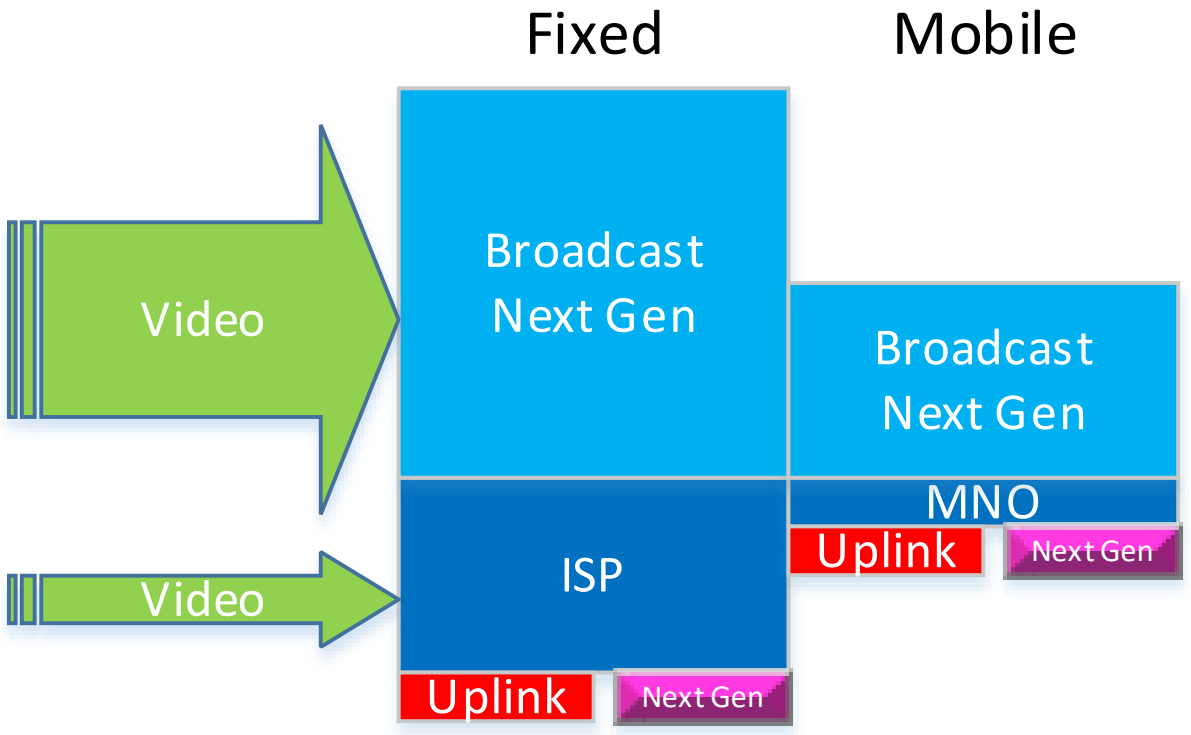
# Ecosystem – “Hybrid” OTT-OTA

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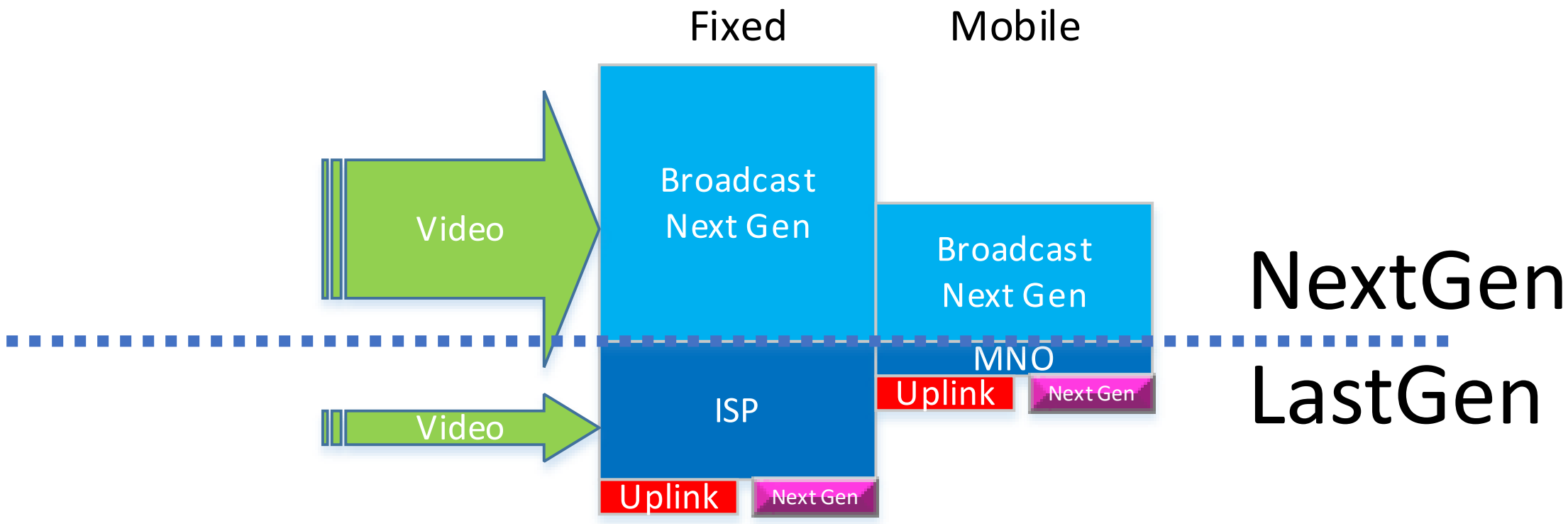
# Ecosystem – “Hybrid” OTT-OTA

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# One Facet

- We produce OTT like products which are distributed via the Internet AND OTA.
- Viewers can receive Either or BOTH.
  - “Hybrid”
    - SHEVC
    - Server Side DAI
  - Fills holes in coverage
  - Launch business models as we build SFNs
- Incentives for 3.0 receivers/gateways

# 3.0 versus Internet Reach

## Broadband

- Wireless – 68%
  - Expensive
  - Delicate
  - 5G rolling out
- Wired – 75%
  - Expensive
  - Delicate
  - Work in Progress

## Broadcast

- Once 98%, eroding to 96%

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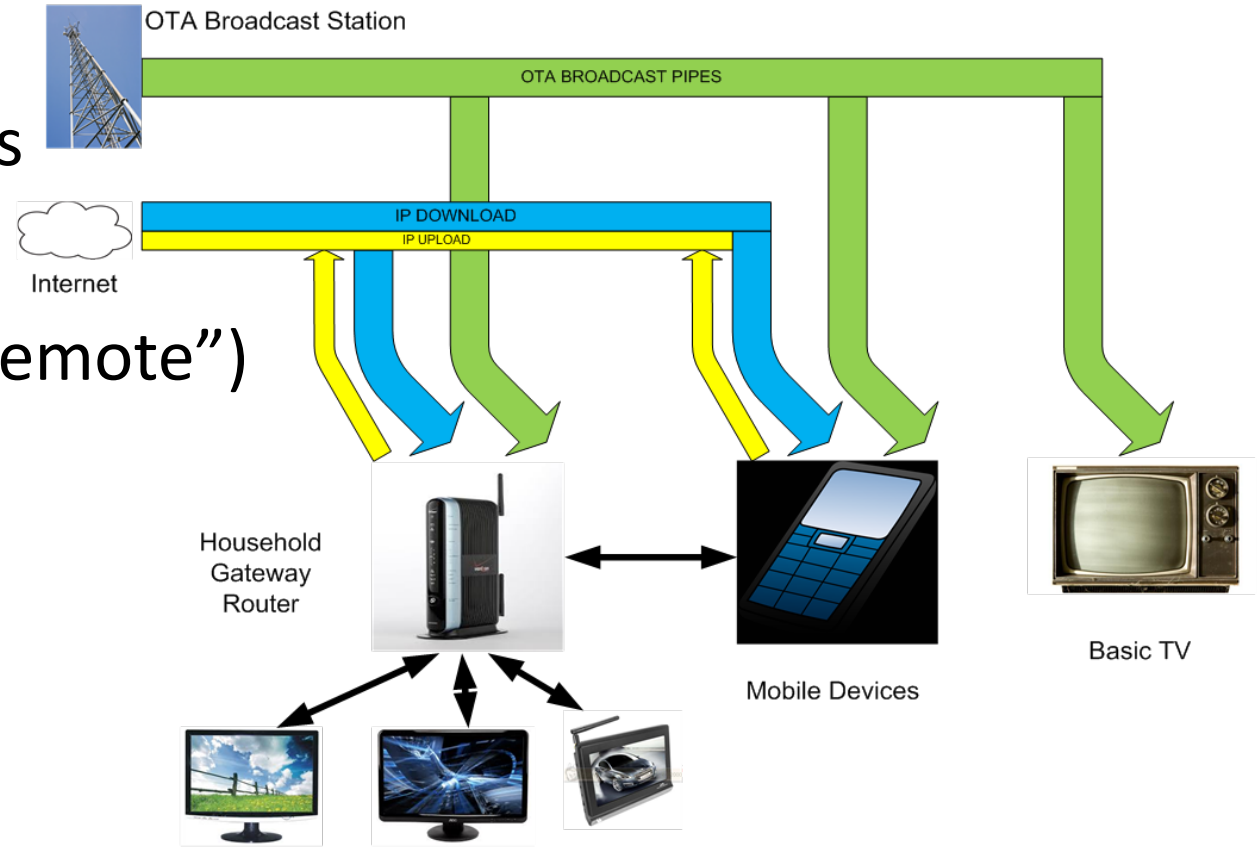
# “Home” Gateway

- 3.0 Receivers (lots of them)
- ISP – WAN/LAN Router Functions
- DVR
- 2nd Screen (handheld the new “remote”)
- Video/CAS/AEA/etc.
- “Universal Translator”
- Remotely upgradable

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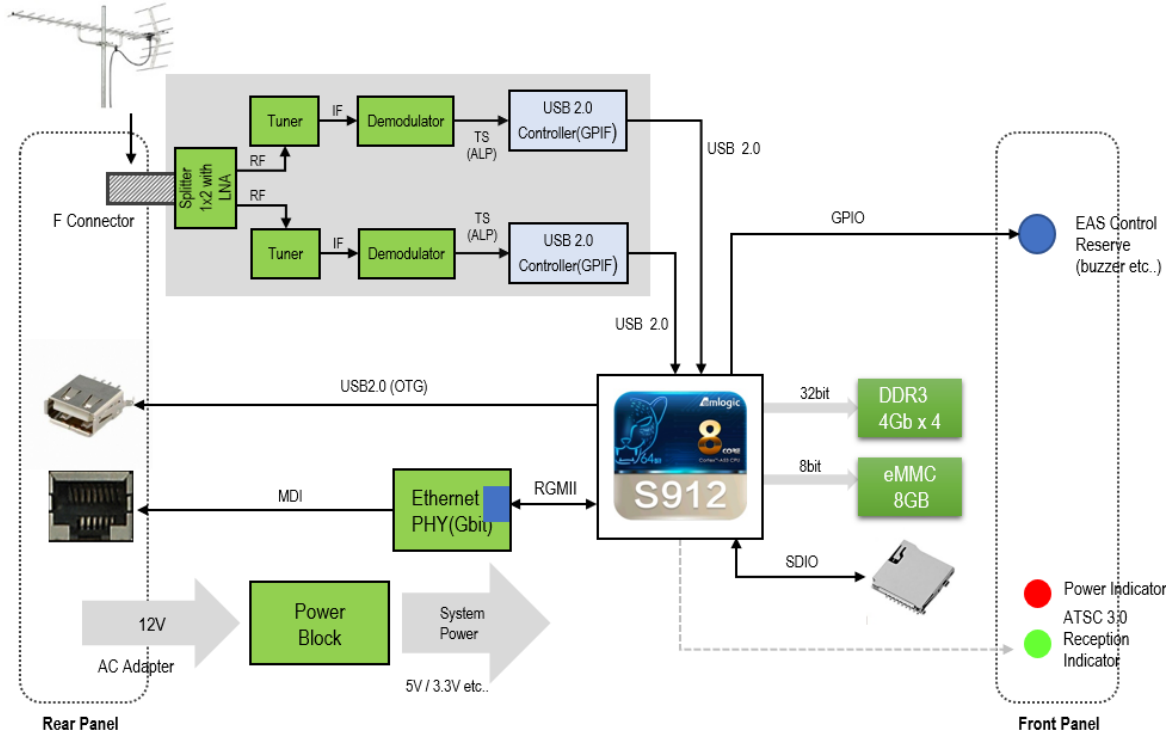
## ATSC 3.0 HG Pre Production Grade Model Overview

- Enables existing devices on the home network
- Middleware to support seamless UX
- Dual ATSC 3.0 Demodulators
- Unicast session to each client device in the home
  - Prevents Wifi saturation
  - Reduces processing load of clients
- NRT (Non Real Time) Edge Cache / Local CDN
  - Pre-placed alternate/personalized Advertisements

## ATSC 3.0 HG Pre Production Grade Model Overview



# Virtualized?

- Closer the Edge Server, the better… Physical Gateway is closest
- Purchase price vs. Continuing payments
- Bring back Internet Issues?
  - Our advantage is we bypass the Internet
    - Peak capacity issues
    - Throttle -- ABR Quality
    - Walled Gardens
- Differing Business Models for Virtualized Home Gateway

# 1.0 Home Gateways


**AirTV Player Bundle**

Fire TV Recast, Over-the-air DVR, 500 GB, 75 hours

$229.99 prime

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# Everything is a Subset of “Home Gateway”

**Mobile**

- In Home
  - Extension of Gateway
  - Becomes the Remote Control
- Out of Home
  - OTA direct
  - Internet to Gateway at Home

**Granny TV**

# User Interface (UX)

- How many?
- Who does it?
- Who owns it?


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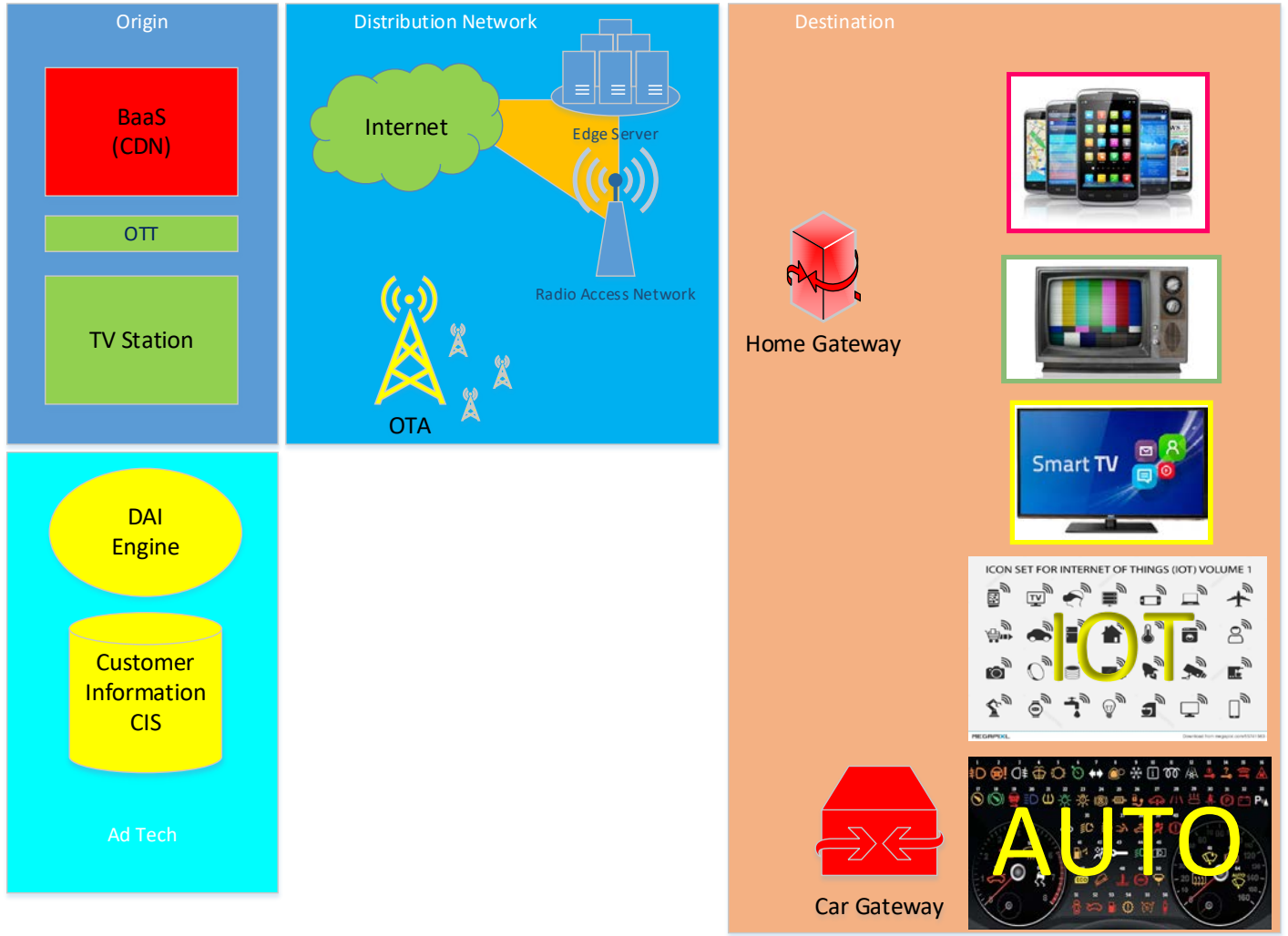
# Ecosystem

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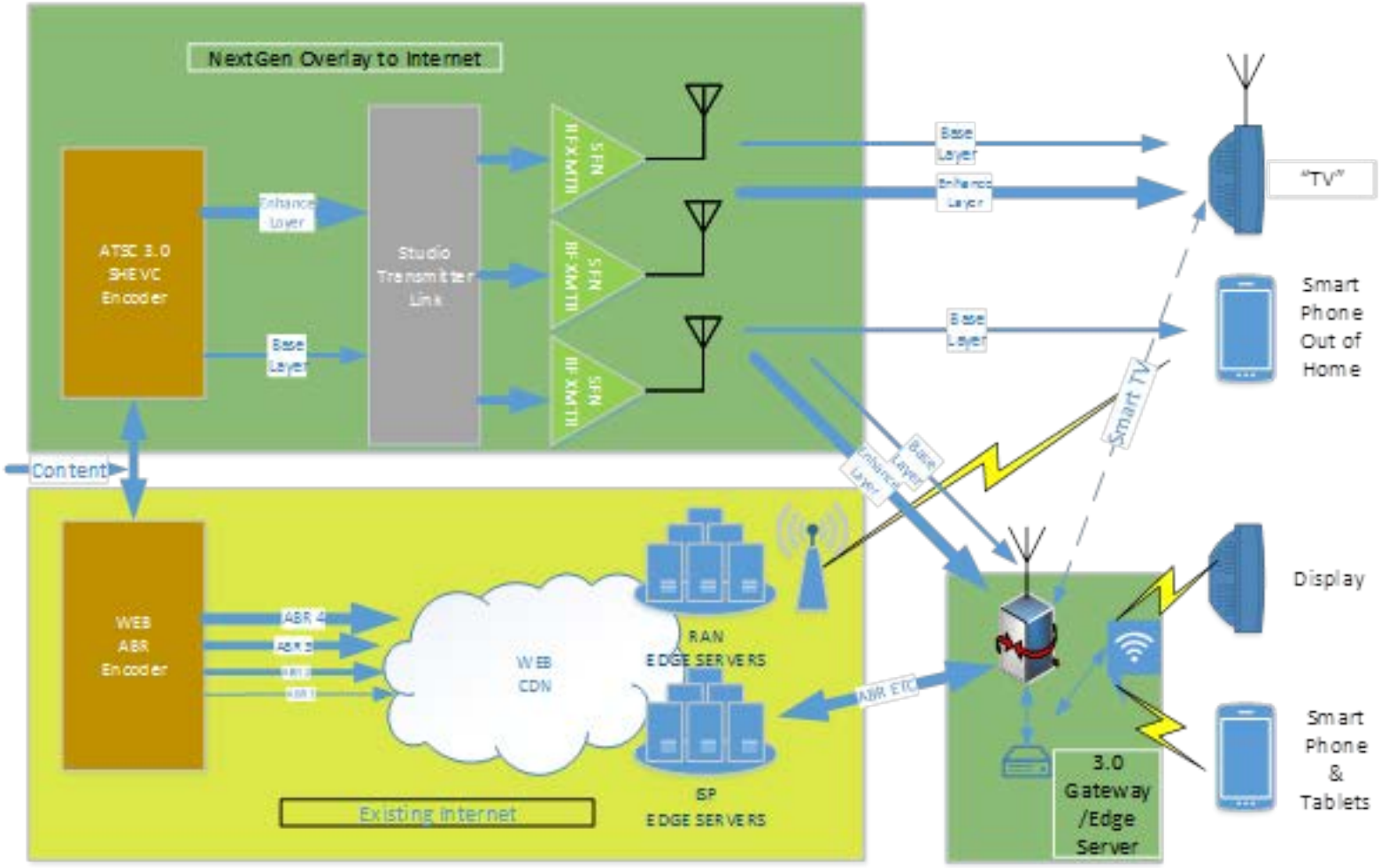
# Possible NextGen TV Station

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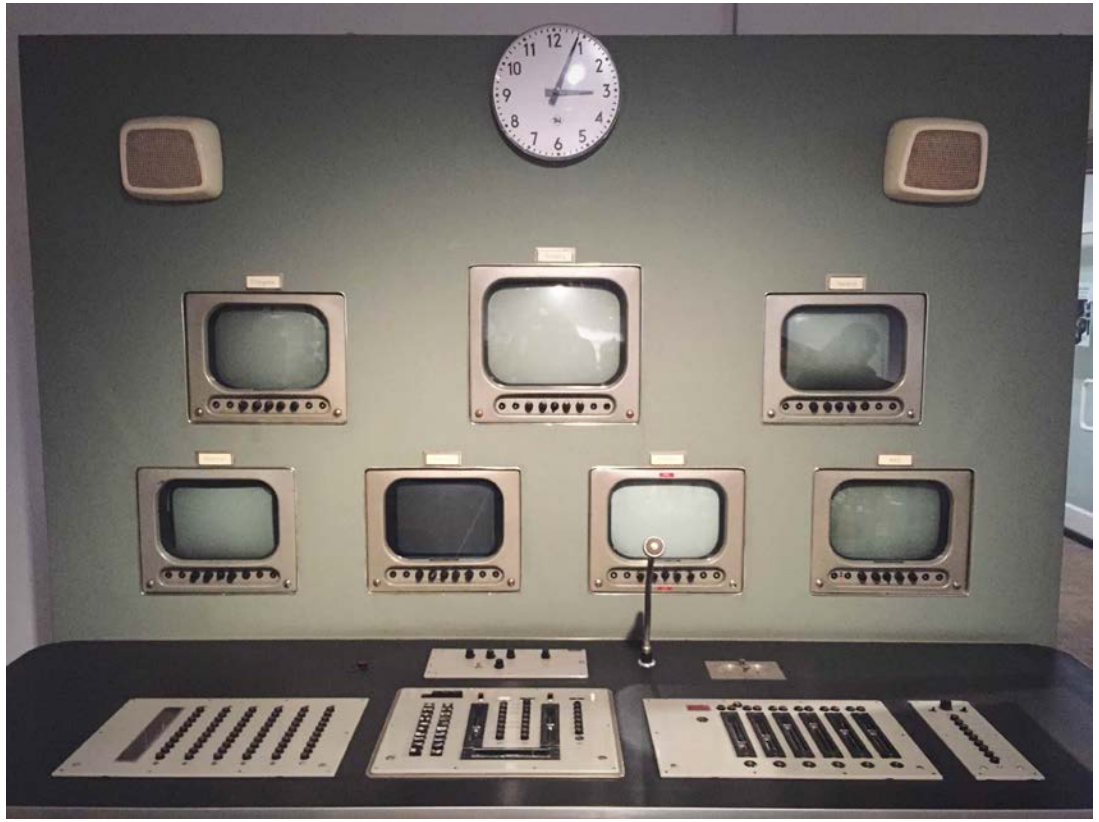
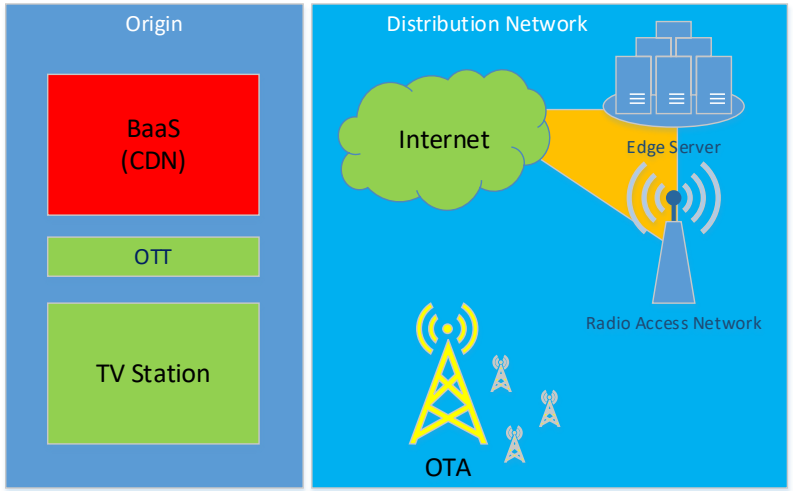
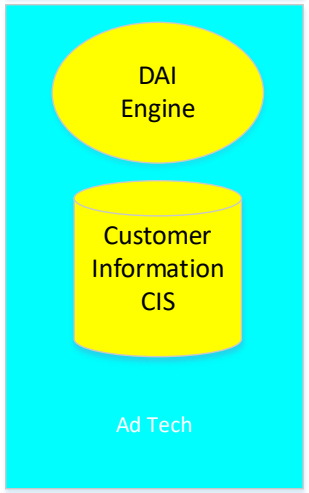
# Changes to Our Stations?

- More OTT like
- Triggers
- More HTML 5.0 like production
- Super Sales Department
- Bigger “Digital” presence
- Less “Video” presence



# Ecosystem




In satellite and cable - they own most of the ecosystem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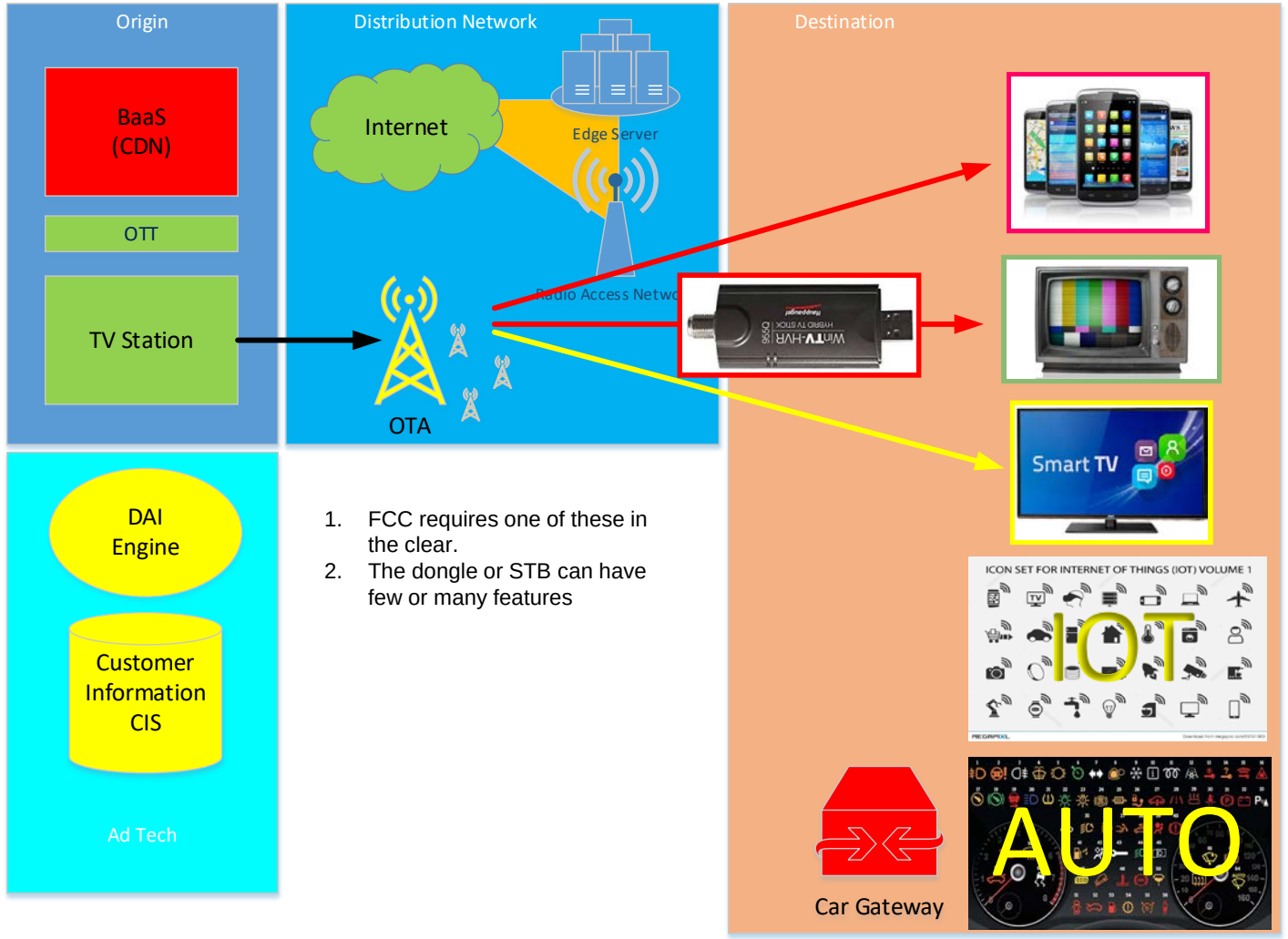
# Ecosystem – “TV”




1. FCC requires one of these in the clear.
2. The dongle or STB can have few or many features

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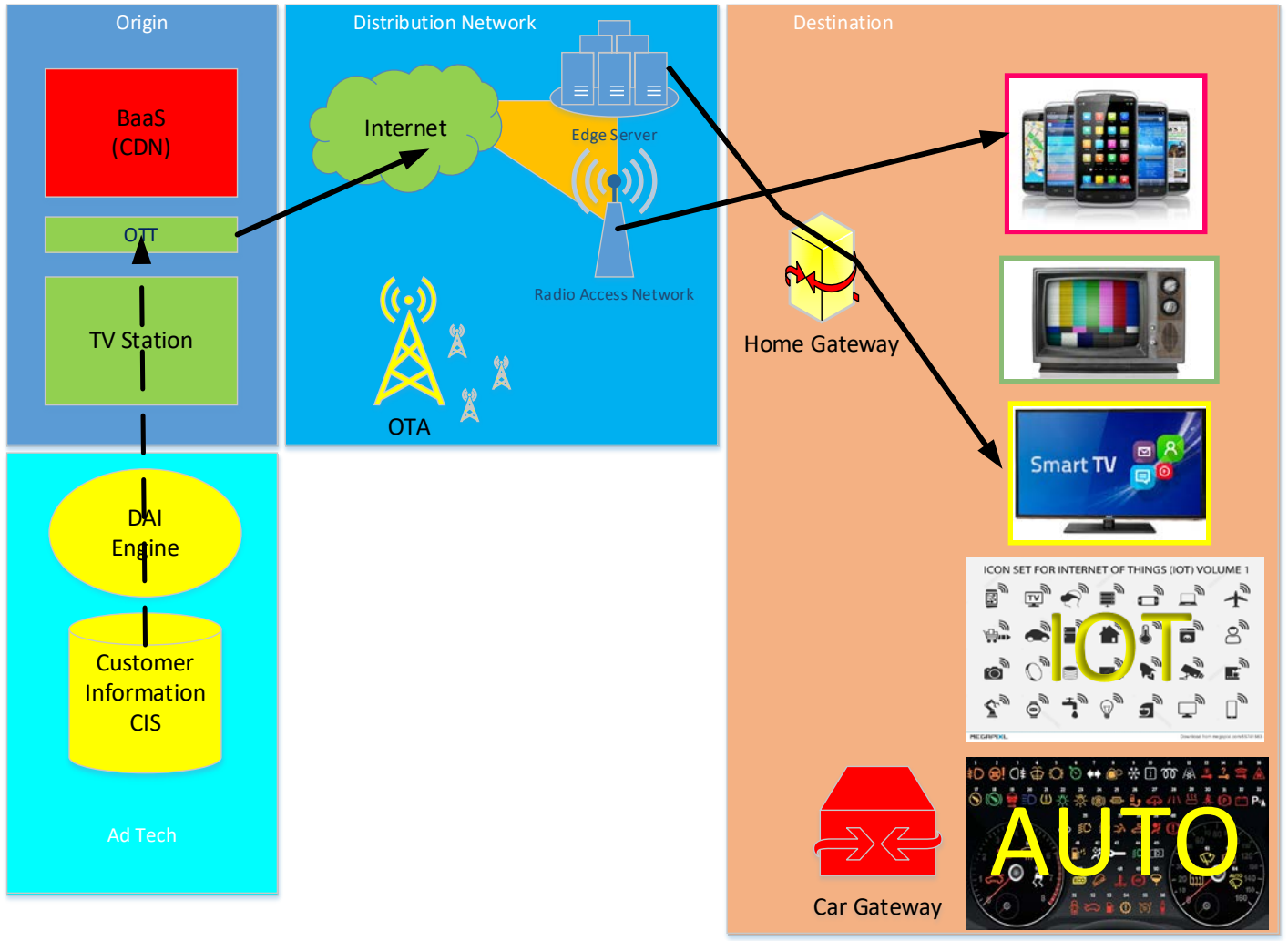
# Ecosystem -- OTT

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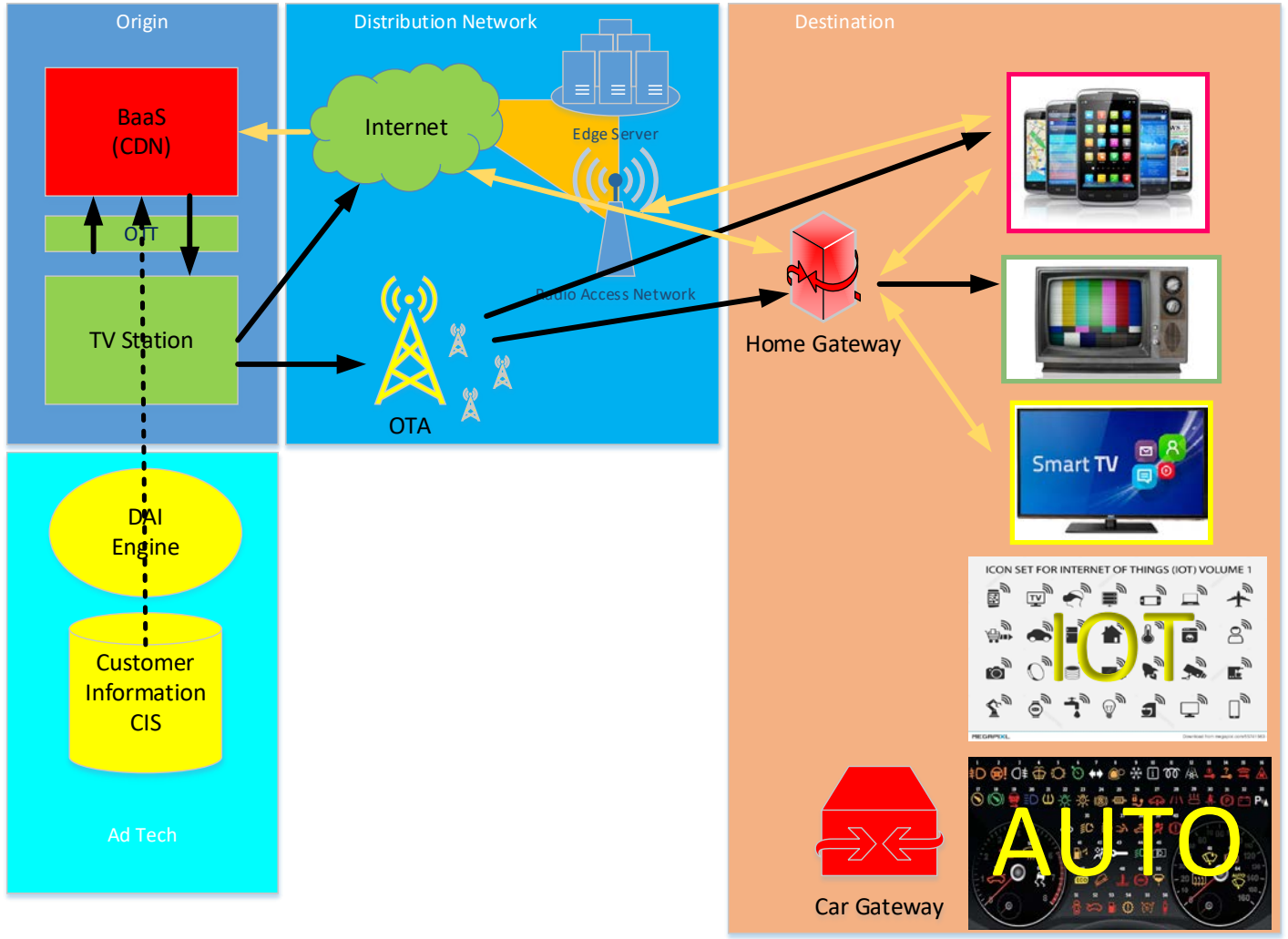


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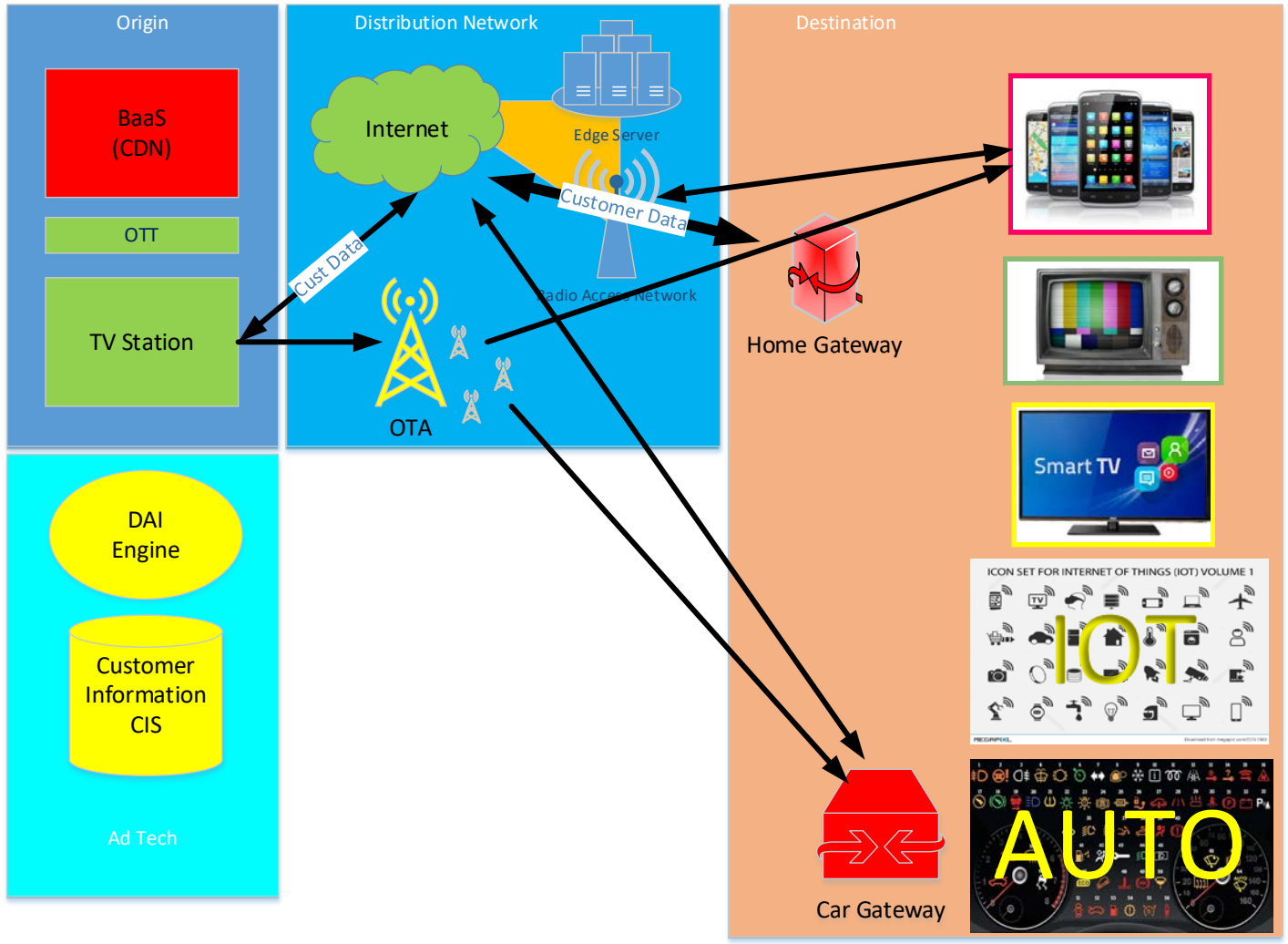
# Ecosystem – Mobile OoH

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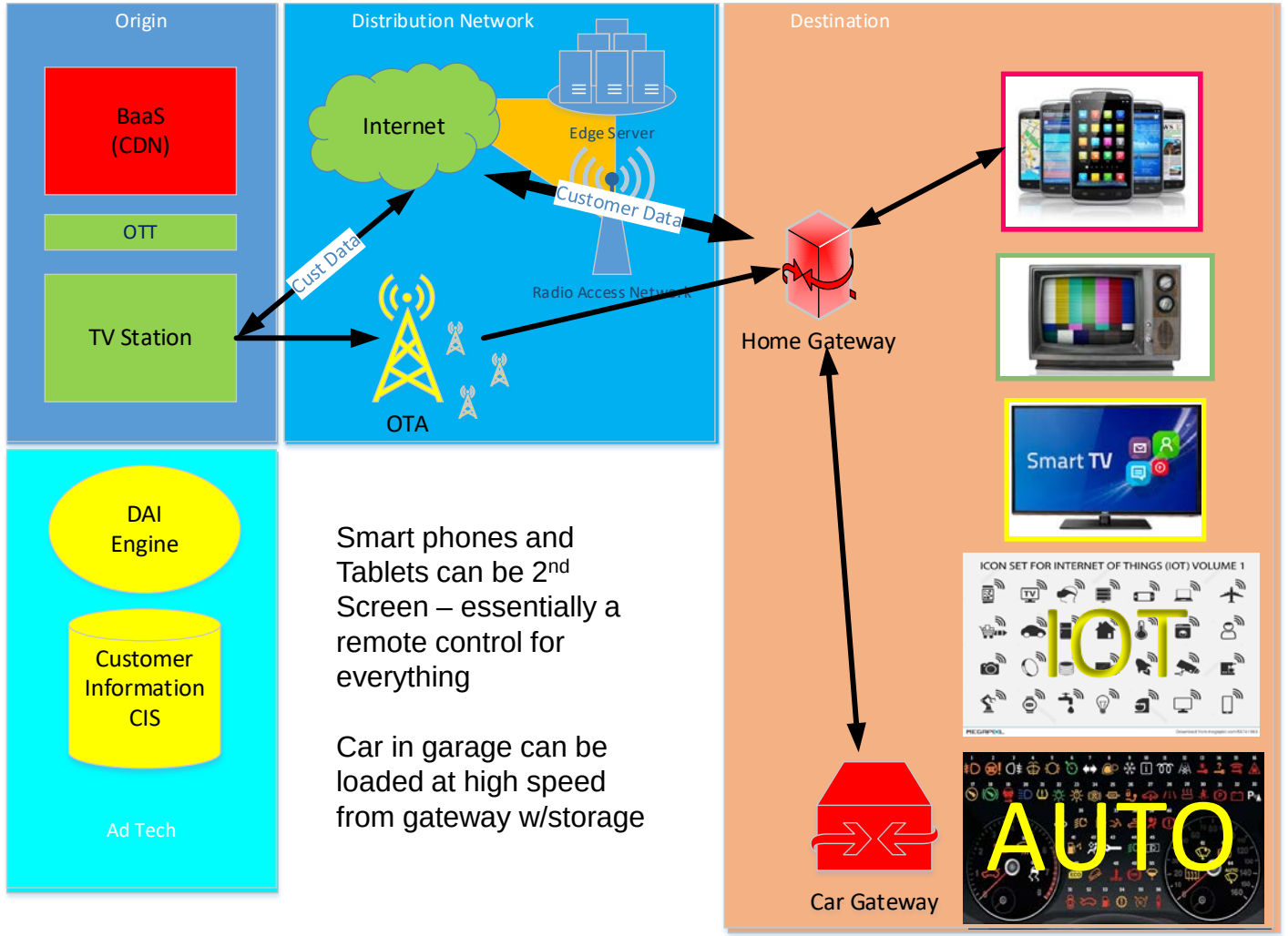
# Ecosystem – Mobile in Home




Smart phones and Tablets can be 2nd Screen – essentially a remote control for everything

Car in garage can be loaded at high speed from gateway w/storage

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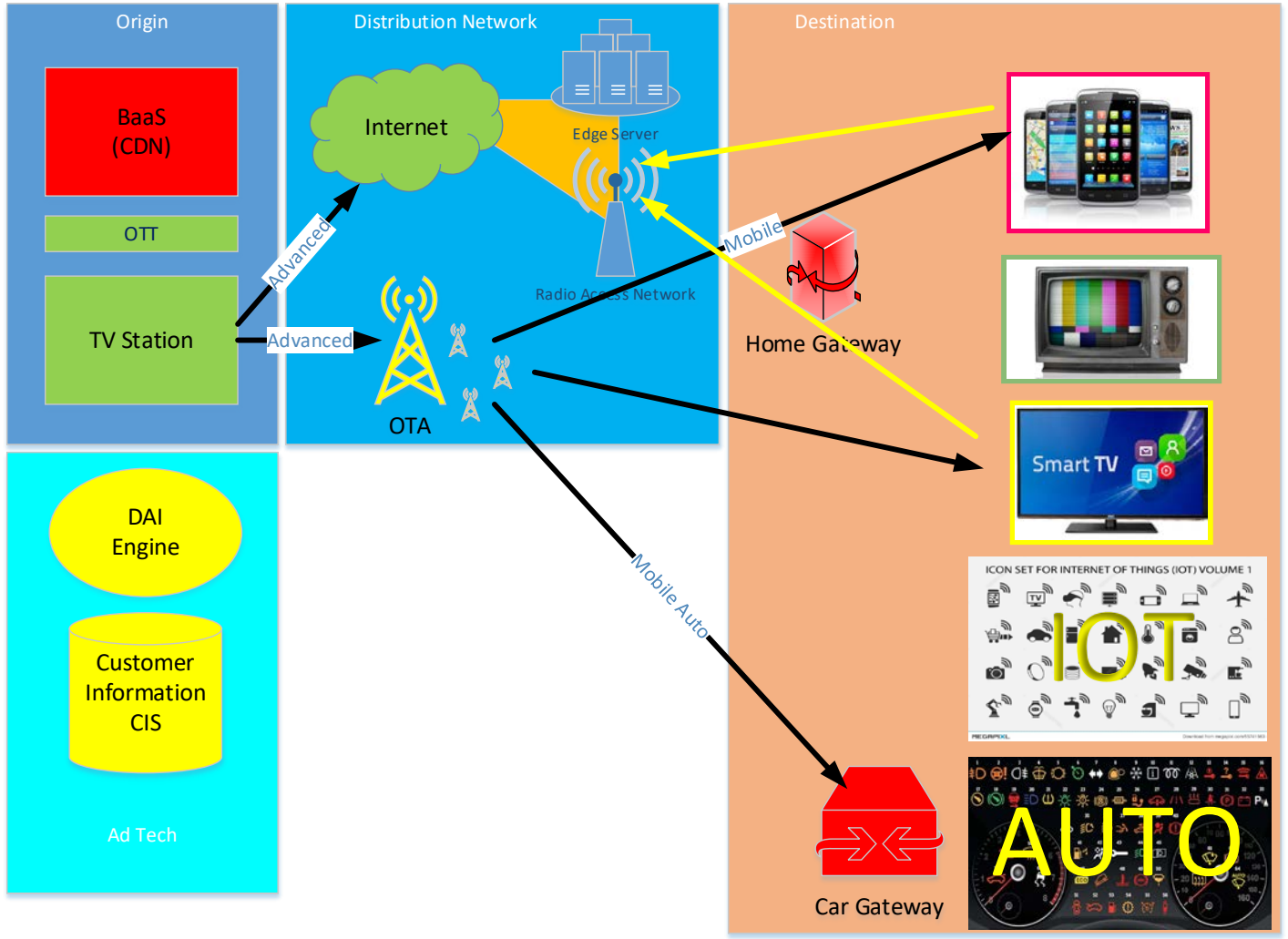
# Ecosystem – NextGen TV w/o Gateway

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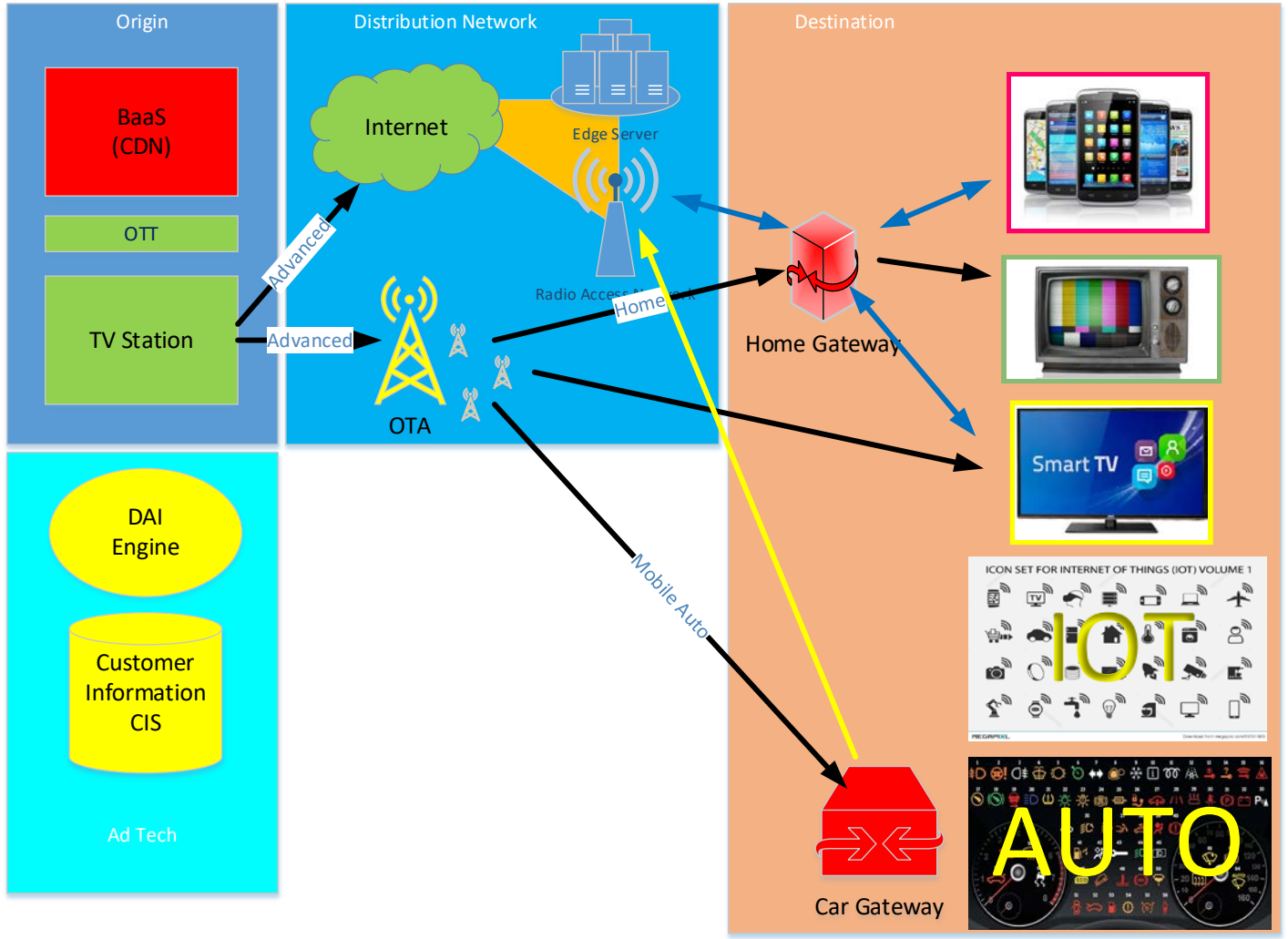
# Ecosystem – NextGen TV w/Gateway

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# *NextGen TV*

- I.  Sinclair – ONEMedia
- II. Spectrum
- III. Standard
- IV. Transmission
- V. Platform (s)
- VI. **Business**
- VII. Media
- VIII. Significant and Useful Tangents

- Big Three
  - DAI
  - Mobile
  - CDN
- Questionable Business Plan
  - IOT
  - Digital Signage
  - Etc.



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# Business Case Views

**Broadcast**

- Better Quality
  - Immersive Sound
  - High Dynamic Range
  - More Pixels More Frames
- Public Service
  - More information (AEA)
  - Bullet Proof Delivery

**Internet Overlay**

- Business that benefit from universally available, fatter, cheaper “fast lane”
  - Big Distribution
  - Live OTT
  - Computer Based Learning
  - Ya Da Ya Da Ya….

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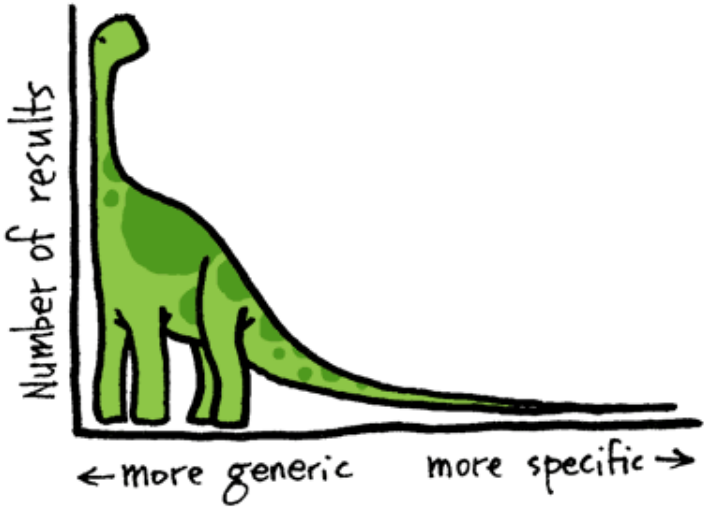
# The “Long Tail” AKA; Not the “Grazing Zone”

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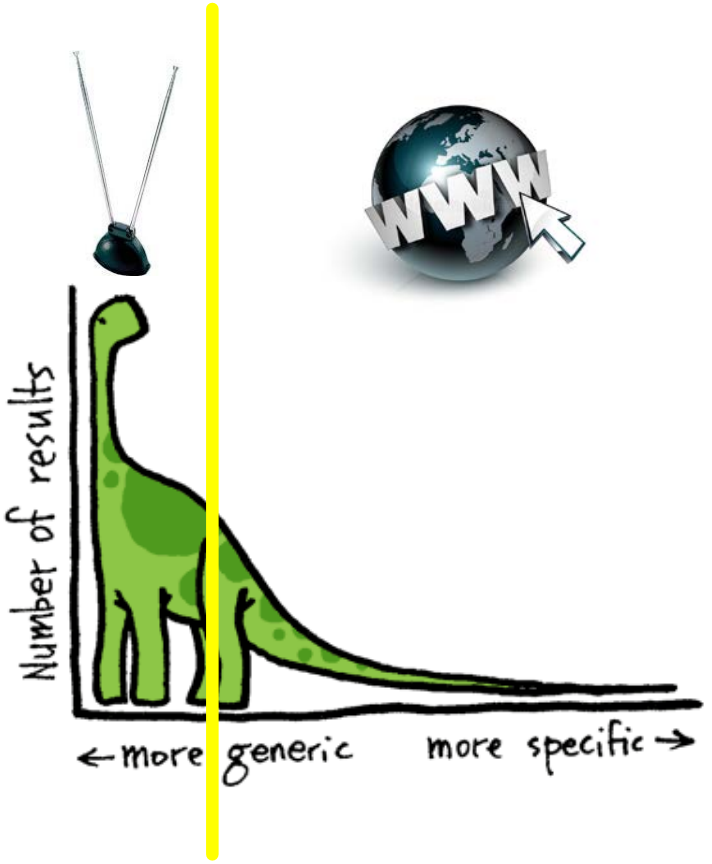


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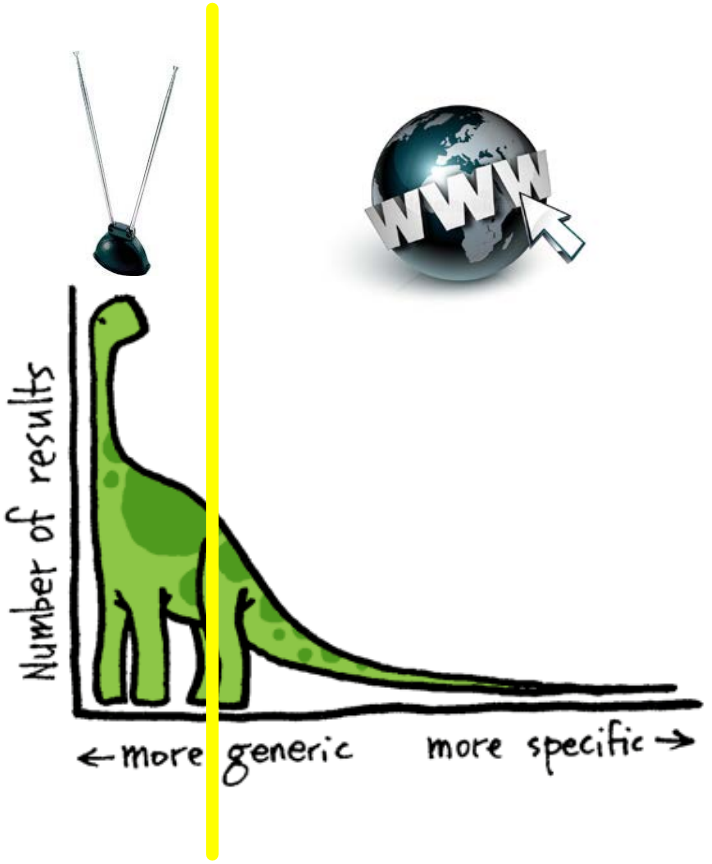
# The “Long Tail” AKA; Not the “Grazing Zone”

Live
Mass Distribution

Mobile Enabled
Fixed Home Gateway
NextGen “TV” receivers

*Selling More of More*




Non Real Time
Individualized
Specialized

*Selling More of Less*

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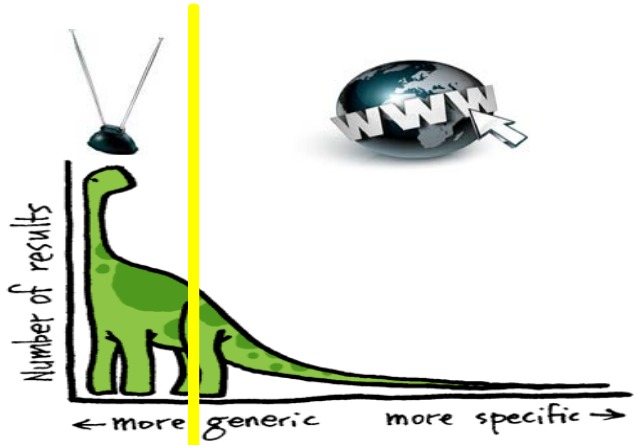
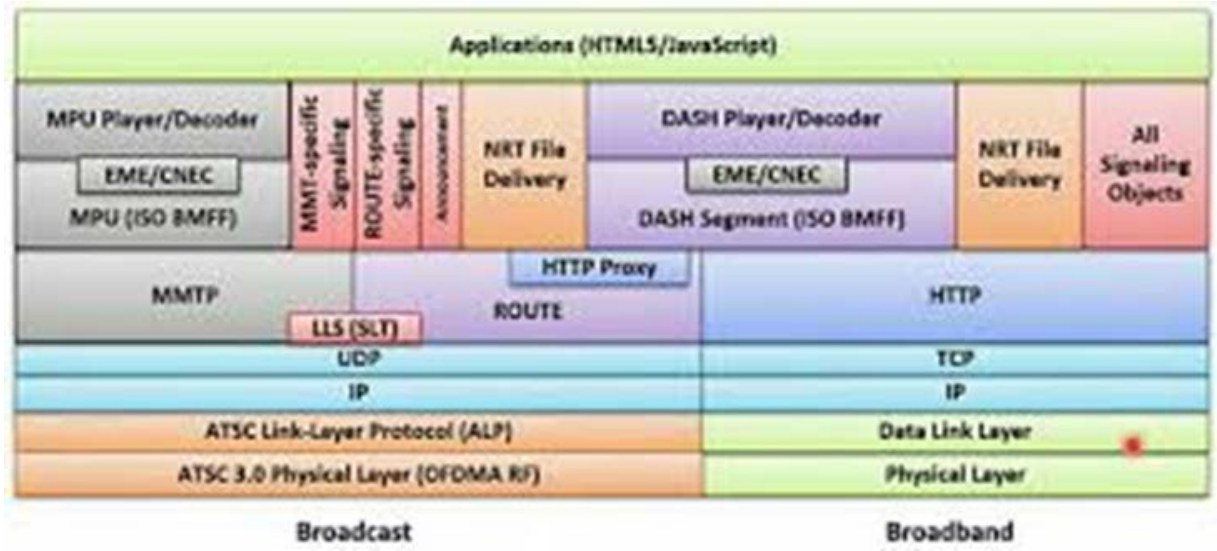
# The “Long Tail” AKA; Not the “Grazing Zone”

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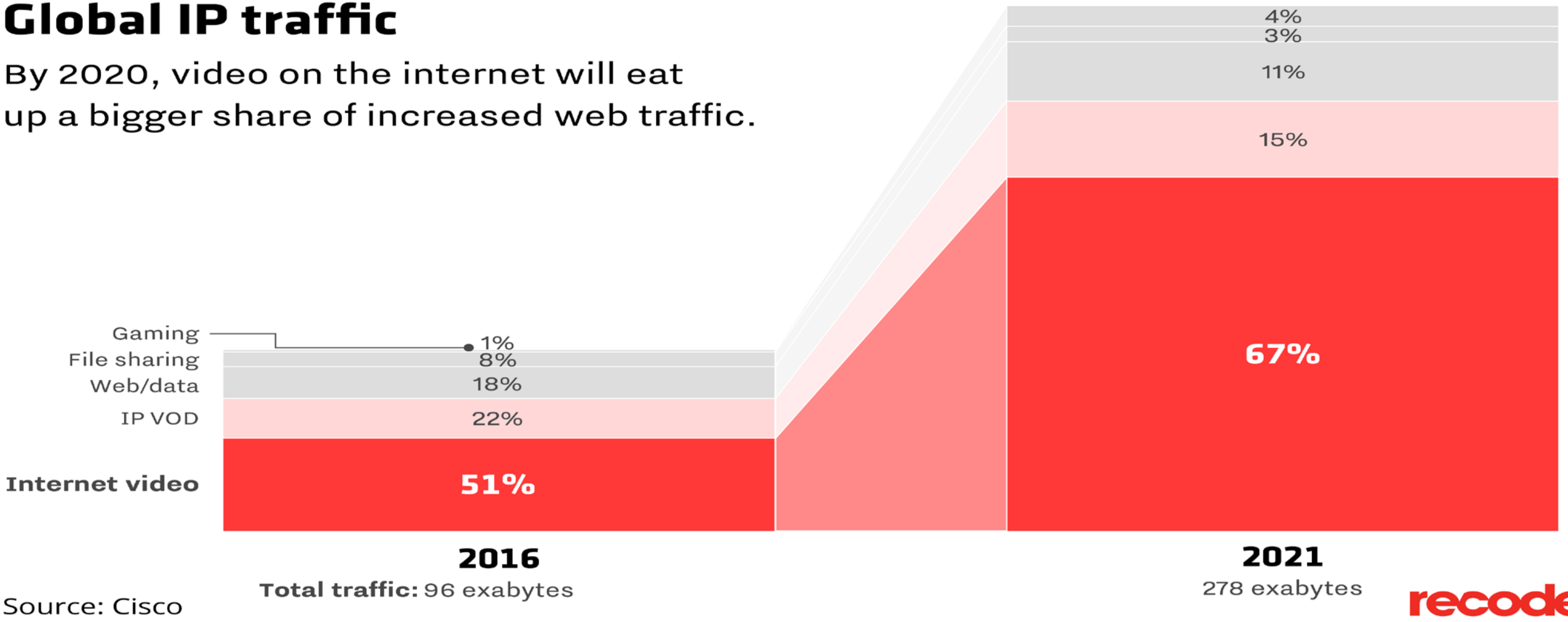
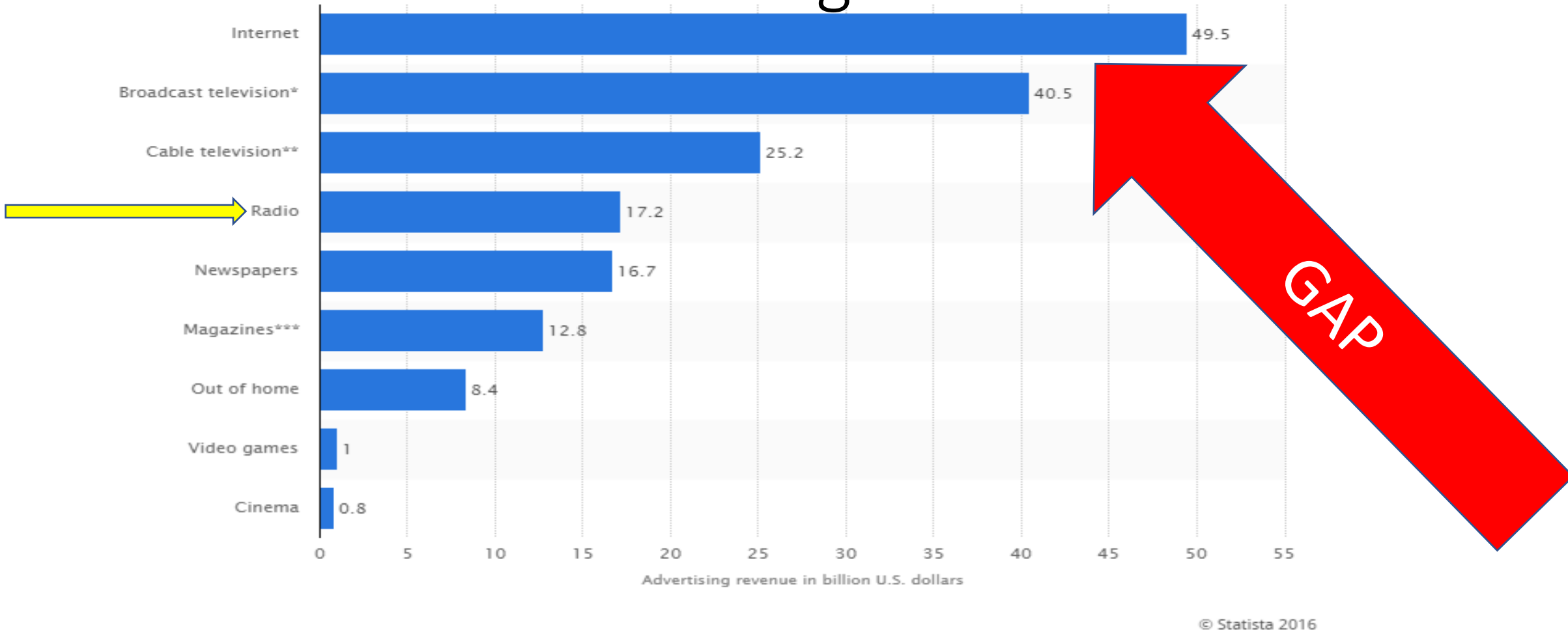
# By 2019, 80% of the World's Internet Traffic Will Be Video [Cisco Study]



# Where Advertising Dollars Go

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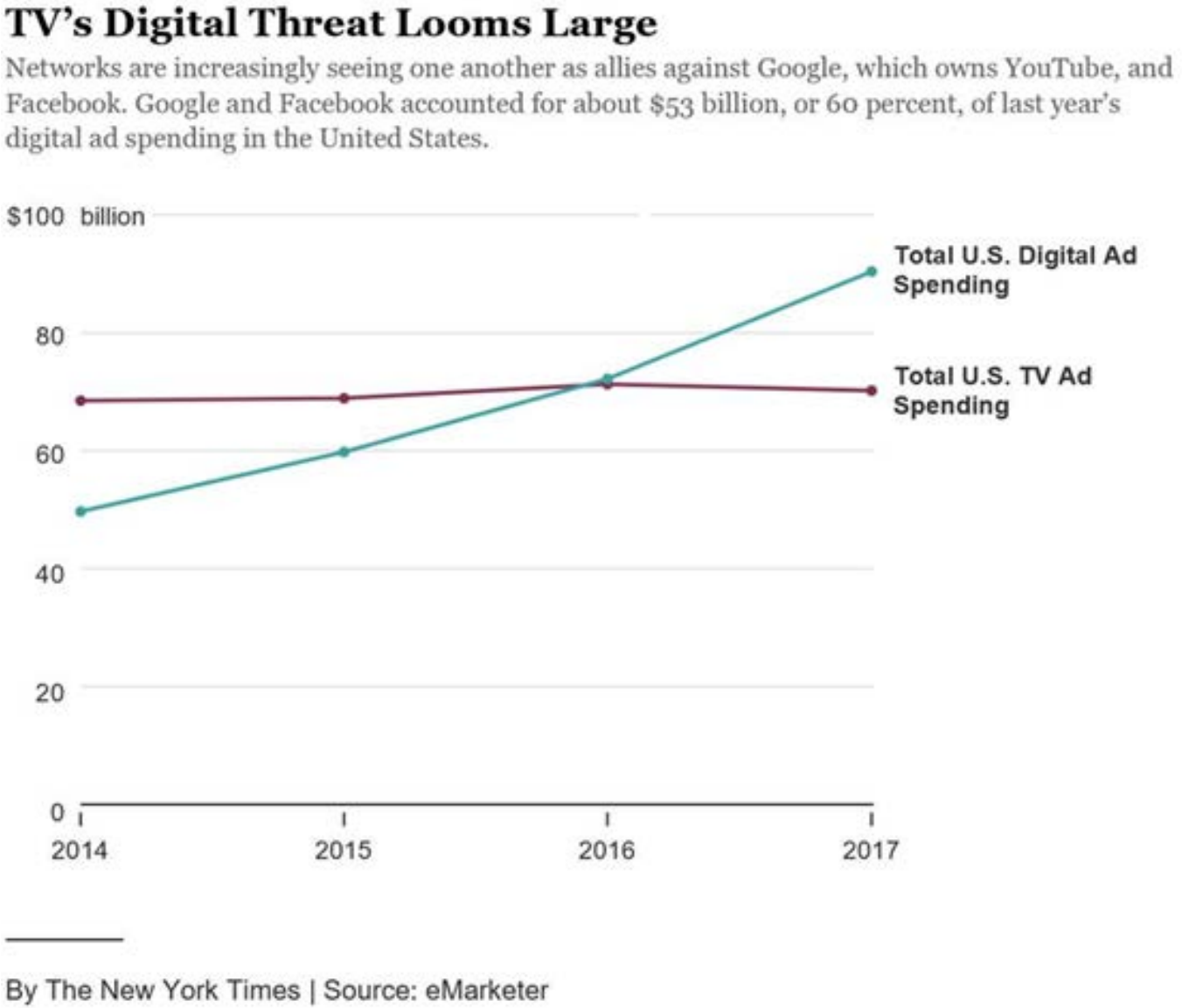
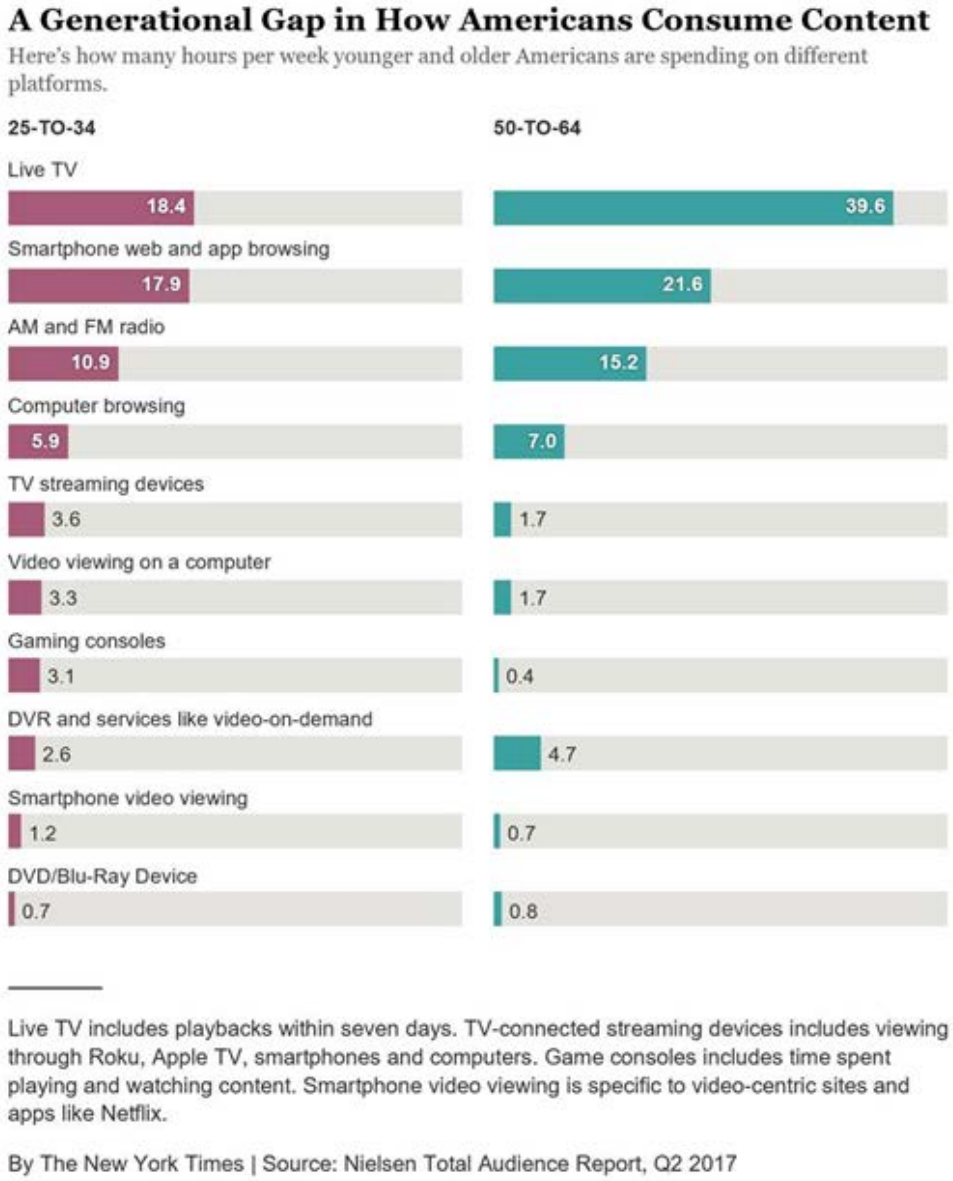
# The Pie Over Time



# Generation Gap

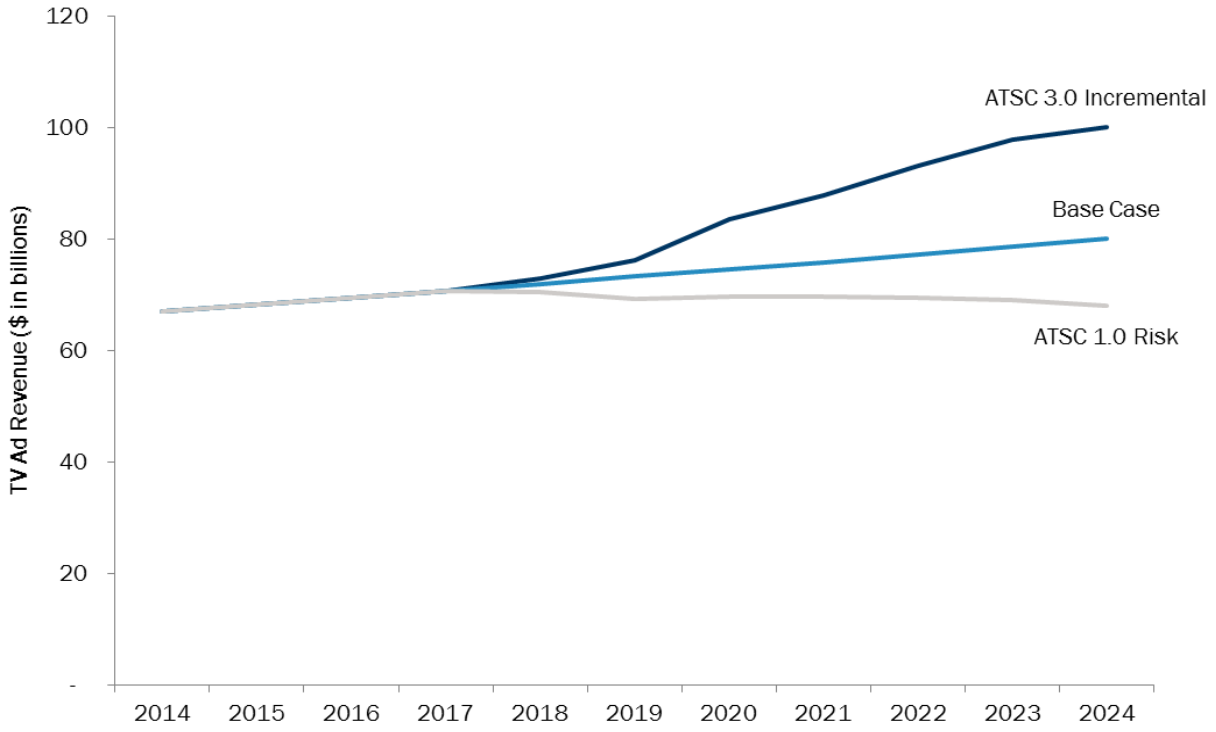
Older folks average 40 hours of live TV and 21 Hours on line each week?
-- Per Nielsen



# ATSC 3.0 enables potential revenue upside from advanced advertising, data casting, new services and core upgrades

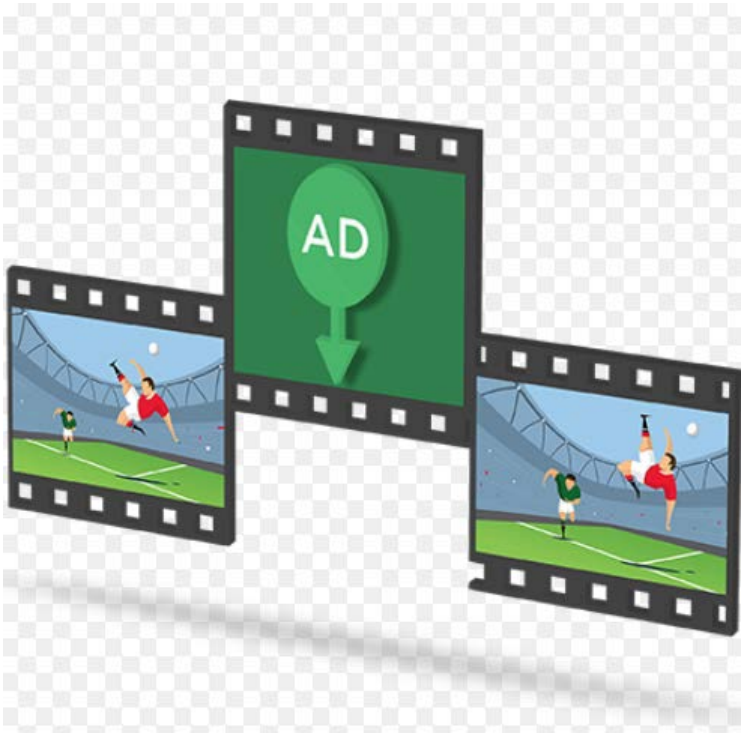
ATSC 3.0 could provide incremental revenue of up to $20 billion…

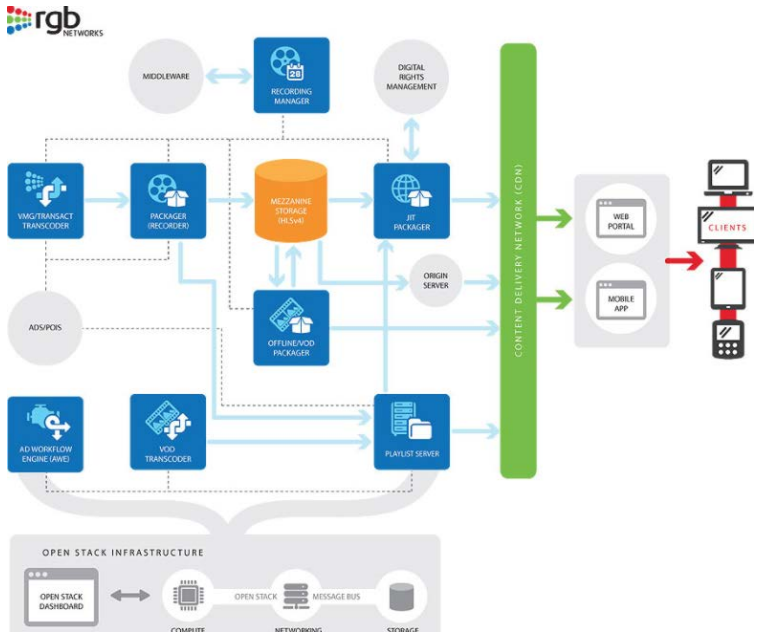
… where as staying at ATSC 1.0 could pose a revenue loss risk of up to $12 billion (1)




(1) Revenue forecast based on FTI ATSC 3.0 Revenue Study, June 2015

# Digital Ad Insertion

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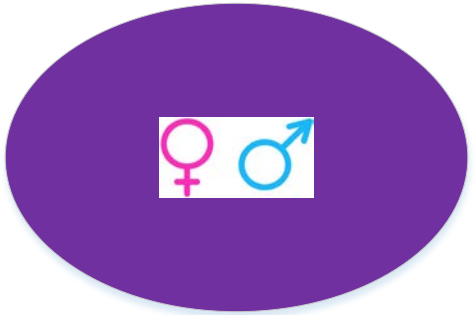
Simple Boy-Girl Ad Split

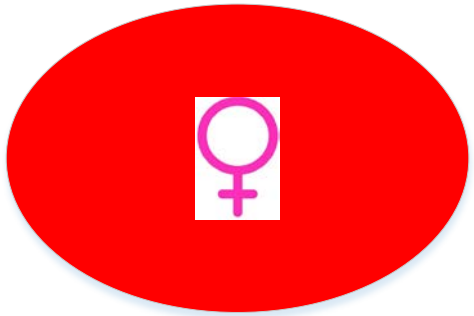
# 1.5 X

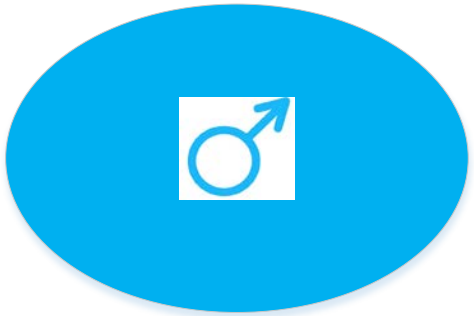
$100 Spot



OR

$75 Spots

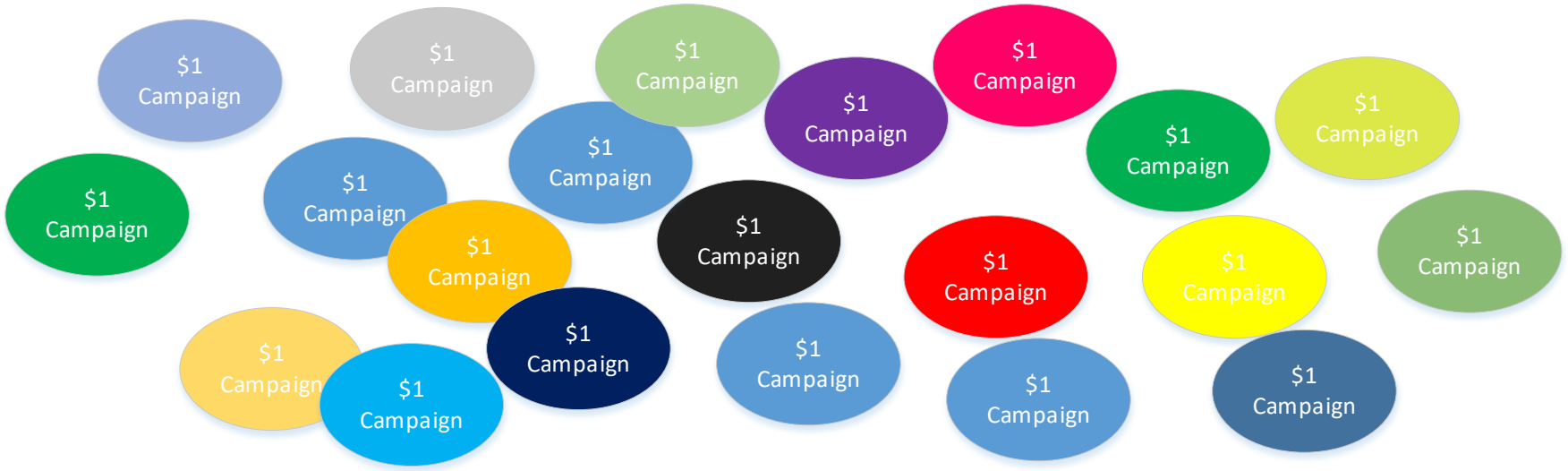


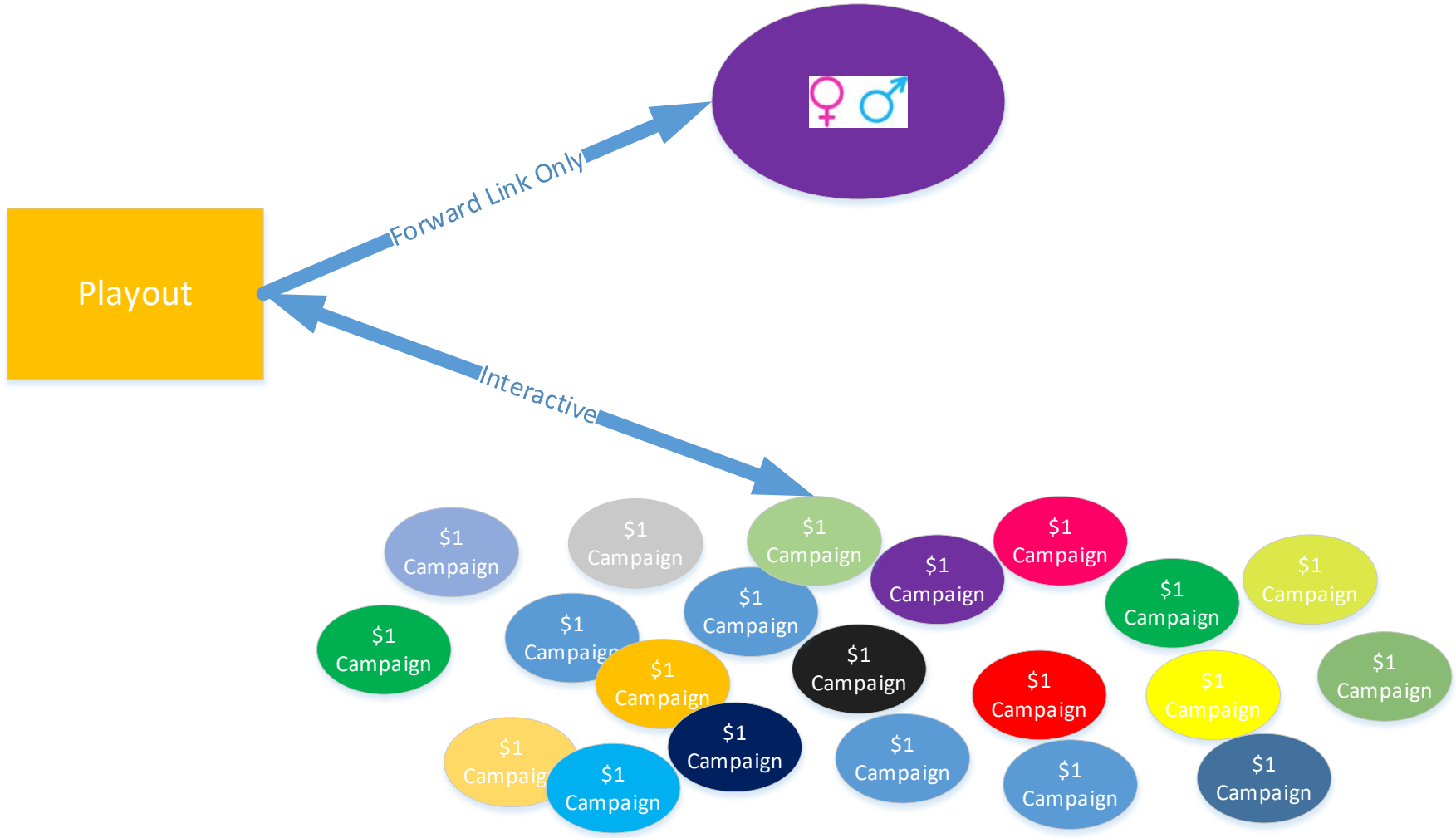


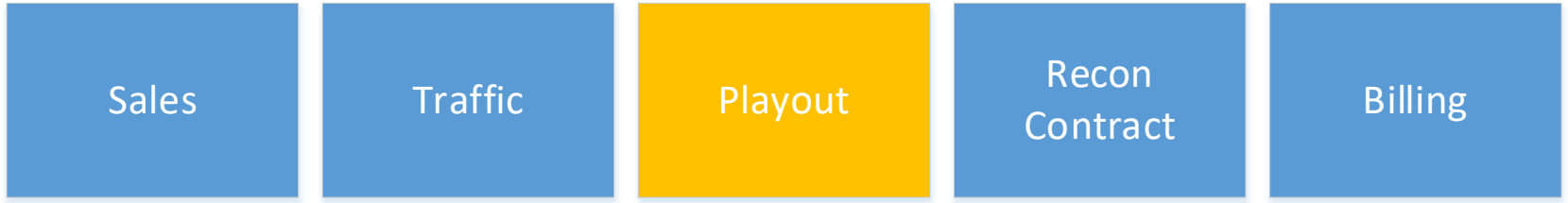
$150 Revenue

Advanced Advertising Campaign

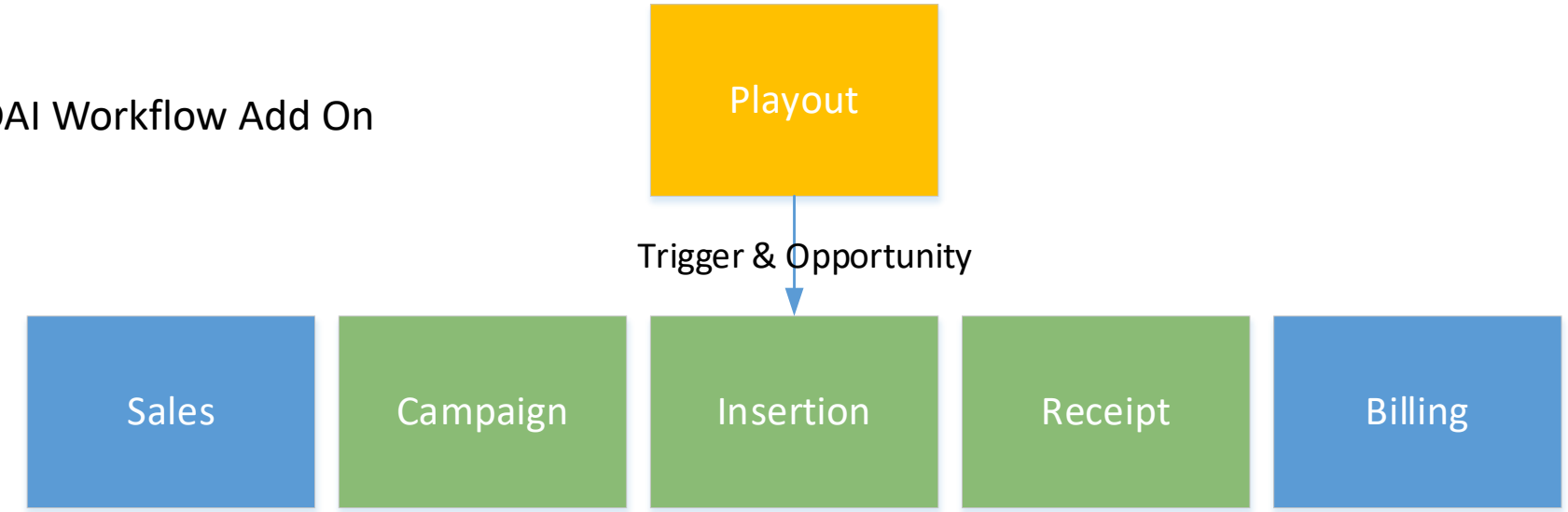
# 2-10X?




Playout
Forward Link Only
Interactive
$1 Campaign




DAI Workflow Add On



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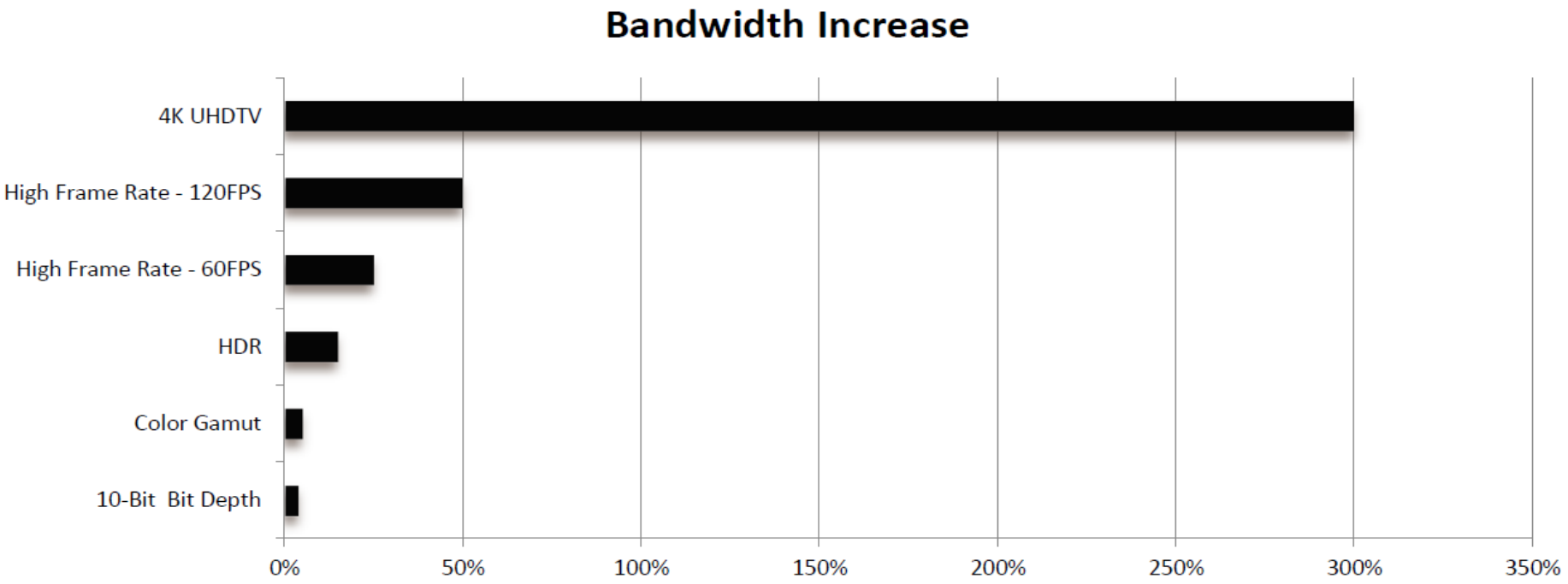
- VIII. Significant and Useful Tangents

- Audio
- Video
- HTML-5ish
- Trends – Move to OTT

# Video
# Relative Bandwidth Demands Of 4K, HDR, WCG, HFR

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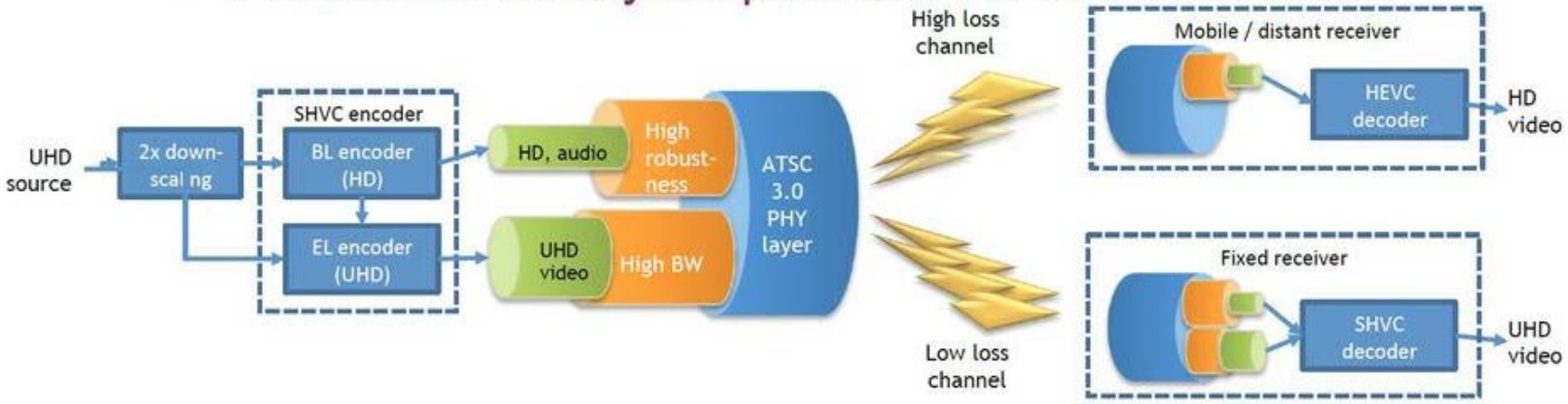
# Scalable High Efficiency Video Coding

## SHVC: Spatial Scalability

- Limited to 2 spatial layers
- Base layer optimized for mobile reception
- Enhancement layer optimized for UHD resolution




A diagram explaining how ATSC plans to have both a robust signal for mobile and distant receivers, and a high-bandwidth signal for Ultra HD resolutions.

CNET/ATSC

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# ATSC 3.0 Audio Attributes (1)

- Immersive (“3D Audio”) Capabilities
  - 7.1+4 support mandatory
  - 22.2 and HOA (high order Ambisonics) support optional
  - Channels only and Channels + Objects mandatory
  - Enables flexible rendering (including headphones)
- Personalization Capabilities
  - Dialog Enhancement
  - Using static objects for Dialog Replacement
  - Mix/sync of audio content received OTA and online

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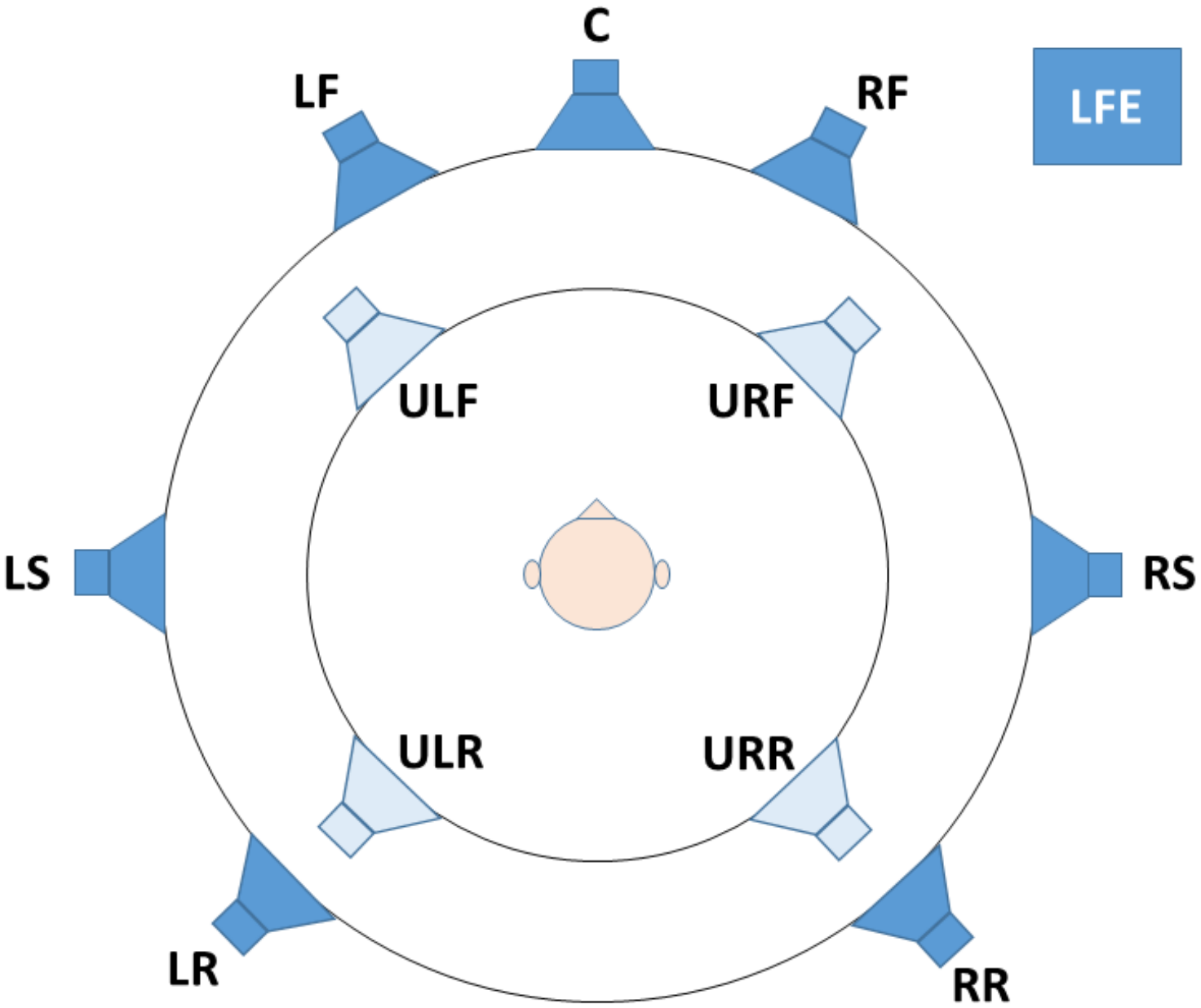


# ATSC 3.0 Minimum Immersive Configuration

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# ATSC 3.0 Audio Attributes (2)

- Provides state-of-the-art efficiency
- Provides extremely high audio quality
- Maintains support for Stereo and 5.1 surround
- Maintains or improves ATSC 1.0 loudness control
- Maintains or improves ATSC 1.0 accessibility features
- Low latency, excellent lip-sync performance
- Provides framework for system extensibility

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| | Per MPEG N13411 / ITU-R BS.2051 | | | | | Layout | | | |
|---|---|---|---|---|---|---|---|---|---|
| No. | Position Label | Az.° | Az. Tol. | El.° | El. Tol. | 2.0 | 5.1 | 7.1+4 | 22.2 |
| 1 | M+000 | 0 | ±2 | 0 | ±2 | | C | C | X |
| 2 | M+030 | 30 | ±2 | 0 | ±2 | L | LF | LF | X |
| 3 | M-030 | -30 | ±2 | 0 | ±2 | R | RF | RF | X |
| 4 | M+060 | 60 | ±2 | 0 | ±2 | | | | X |
| 5 | M-060 | -60 | ±2 | 0 | ±2 | | | | X |
| 6 | M+090 | 90 | ±5 | 0 | ±2 | | | LS | X |
| 7 | M-090 | -90 | ±5 | 0 | ±2 | | | RS | X |
| 8 | M+110 | 110 | ±5 | 0 | ±2 | | LSur | | |
| 9 | M-110 | -110 | ±5 | 0 | ±2 | | RSur | | |
| 10 | M+135 | 135 | ±5 | 0 | ±2 | | | LR | X |
| 11 | M-135 | -135 | ±5 | 0 | ±2 | | | RR | X |
| 12 | M+180 | 180 | ±5 | 0 | ±2 | | | | X |
| 13 | U+000 | 0 | ±2 | 35 | ±10 | | | | X |
| 14 | U+045 | 45 | ±5 | 35 | ±10 | | | ULF | X |
| 15 | U-045 | -45 | ±5 | 35 | ±10 | | | URF | X |
| 16 | U+030 | 30 | ±5 | 35 | ±10 | | | | |
| 17 | U-030 | -30 | ±5 | 35 | ±10 | | | | |
| 18 | U+090 | 90 | ±5 | 35 | ±10 | | | | X |
| 19 | U-090 | -90 | ±5 | 35 | ±10 | | | | X |
| 20 | U+110 | 110 | ±5 | 35 | ±10 | | | | |
| 21 | U-110 | -110 | ±5 | 35 | ±10 | | | | |
| 22 | U+135 | 135 | ±5 | 35 | ±10 | | | ULR | X |
| 23 | U-135 | -135 | ±5 | 35 | ±10 | | | URR | X |
| 24 | U+180 | 180 | ±5 | 35 | ±10 | | | | X |
| 25 | T+000 | 0 | ±2 | 90 | ±10 | | | | X |
| 26 | L+000 | 0 | ±2 | -15 | +5, -25 | | | | X |
| 27 | L+045 | 45 | ±5 | -15 | +5, -25 | | | | X |
| 28 | L-045 | -45 | ±5 | -15 | +5, -25 | | | | X |
| 29 | LFE1 | 45 | ±15 | -15 | ±15 | | LFE | LFE | X |
| 30 | LFE2 | -45 | ±15 | -15 | ±15 | | | | X |

# 30-channel Canonical Speaker Positioning Table

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# 30-ch Listening Lab at McGill University

ONEMedia
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BROADCAST GROUP

# ATSC 3.0 Formats/Bit Rates Tested

| TEST | MODE | MANDATORY / OPTIONAL | CODED BIT RATES | REFERENCE | COMMENT |
|---|---|---|---|---|---|
| **Codec Performance** | Stereo | Mandatory | **32, 64, 96 kbps** | Original Stereo | Channels only |
| | 5.1 | Mandatory | **80, 144, 208 kbps** | Original 5.1 | Channels only |
| | 7.1+4 | Mandatory | **144, 256, 384 kbps** | Original 7.1+4 | Channels only |
| | 22.2 | Optional | **288, 512, 768 kbps** | Original 22.2 | C only or C+O |
| | HOA+LFE [ch=$(N+1)^2$] | Optional | **10, 20, 30 kbps/ch, +4, 8, 16 kbps/LFE** | Original HOA rendered to 22.2 | All HOA Orders @ 22.2 playback (N=HOA Order) |
| **Immersive Headphone** | 7.1+4 | Mandatory | **256 kbps** | Orig. content convolved through BRIR of BS.1116-compliant room | BRIR provided to proponents with source content (N=HOA Order) |
| | 22.2 | Optional | **512 kbps** | | |
| | HOA | Optional | **$20(N+1)^2$ + 8 kbps** | | |

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# *NextGen TV*

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- VII. Media
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- **Historical**
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  - Shannon
- OFDM
  - GI
- LDM
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- Antenna
- AEA
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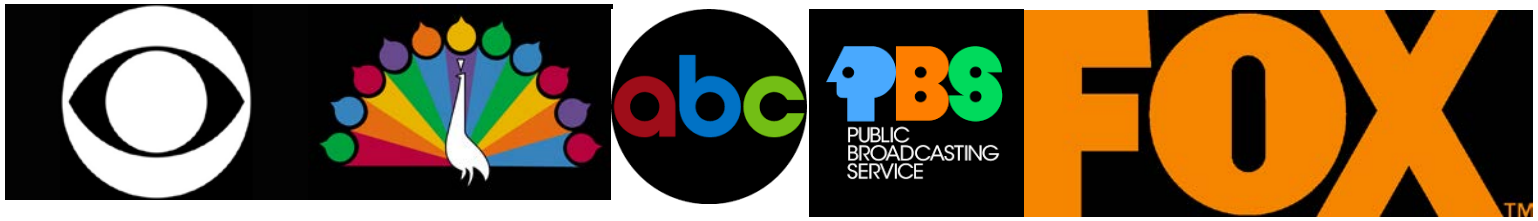
# *Unlike* the DTV Transition, many broadcasters are on-board for ATSC 3.0

- Networks / O&Os




- Major Owners – 11 of them in Pearl

HEARST television inc
SCHURZ COMMUNICATIONS INC.
meredith
GRAHAM MEDIA GROUP
RAYCOM Media
SCRIPPS
TEGNA
Media General
COXMEDIA GROUP

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**ATSC 2.0: What's Next?**

**ATSC Bootcamp**

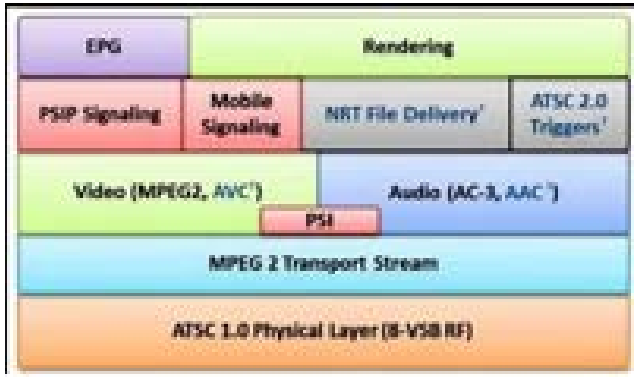
**Rich Chernock**

triveni

ATSC
THE FUTURE OF TV

So… we skipped over ATSC 2.0…
and hundreds of people…
Mostly manufacturers and IPR holders…
Started all over…


OMVC
OPEN MOBILE VIDEO COALITION



$3,000,000,000.00
RIP


QUALCOMM MediaFLO

## MediaFLO Technology Highlights

Higher Efficiency with Optimum Capacity & User Experience Simultaneously

- **OFDM-based broadcast technology**
  - Spectral efficiency of 1-2 bit per second per Hz
  - 4096 (4k) subcarriers
- **Various modulation techniques**
  - QPSK/16-QAM, various code rates
  - Layered modulation for extended coverage
- **Virtual and dynamic channelization**
  - Quality of Service – video quality can be adapted for media types
  - Increased capacity gain – statistical multiplexing
- **Superior mobility**
  - Robust operation at low and vehicular speeds > 200 kph
- **National and local area services**
  - Delivered in one RF channel
- **Lower power consumption**
  - 4+ hours of battery time on a standard battery
- **Fast acquisition (channel change)**
  - ~ 2 seconds channel switching time

P.32


DVB T2

# 1st Mobile TV

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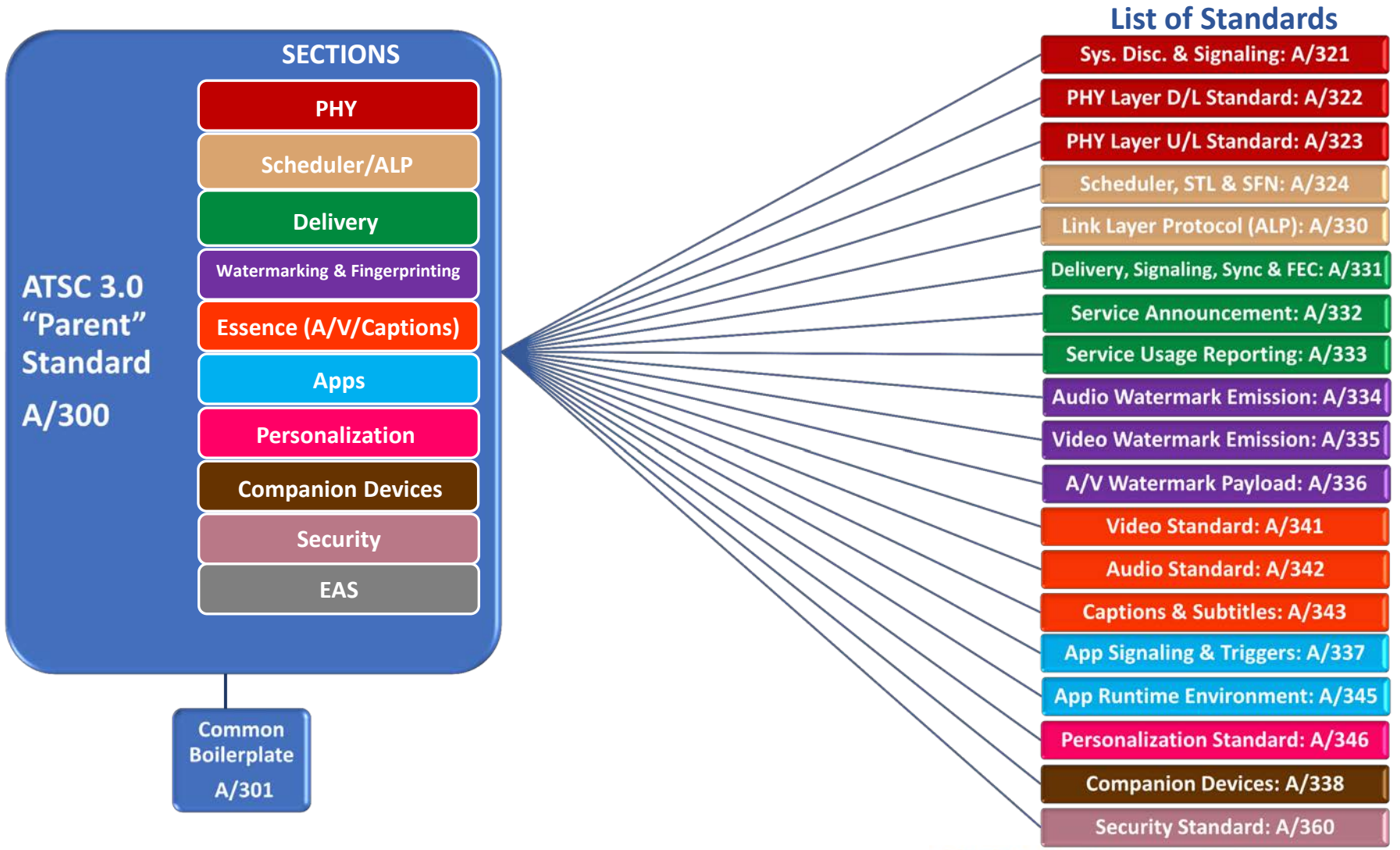
# ATSC 3.0 Document Structure

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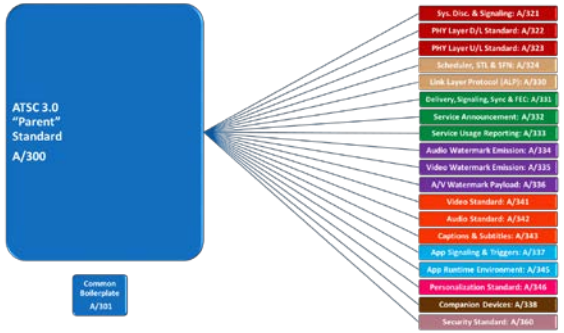
# State of NextGen

**Foundation**

- Regulation – FCC Approval
- Standards – Last Mile
- Irritants – Need FCC forms (OMB)




**Trials**

- Phoenix – Pearl
- Cleveland – NAB
- WRAL
- Baltimore – ONEMedia
  - SFN
  - Lab
- Dallas
  - Production SFN
  - Spectrum Clearing

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# 3/5/2018 we have FCC Rules

**21 Standards**

# Bootstrap A321

- System Discovery and Signaling
- Describes the modulation waveform
- Everything else can be changed
- -15 dB below noise is OK
- Emergency warnings go here

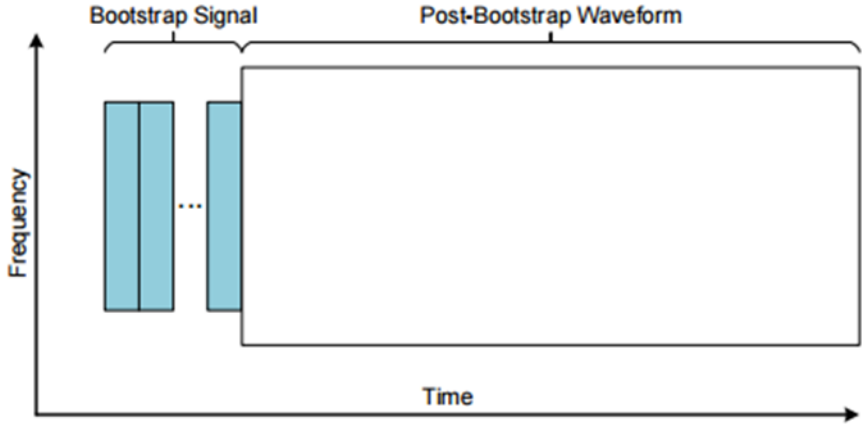


**Figure 4.1** General physical layer frame and bootstrap structure.

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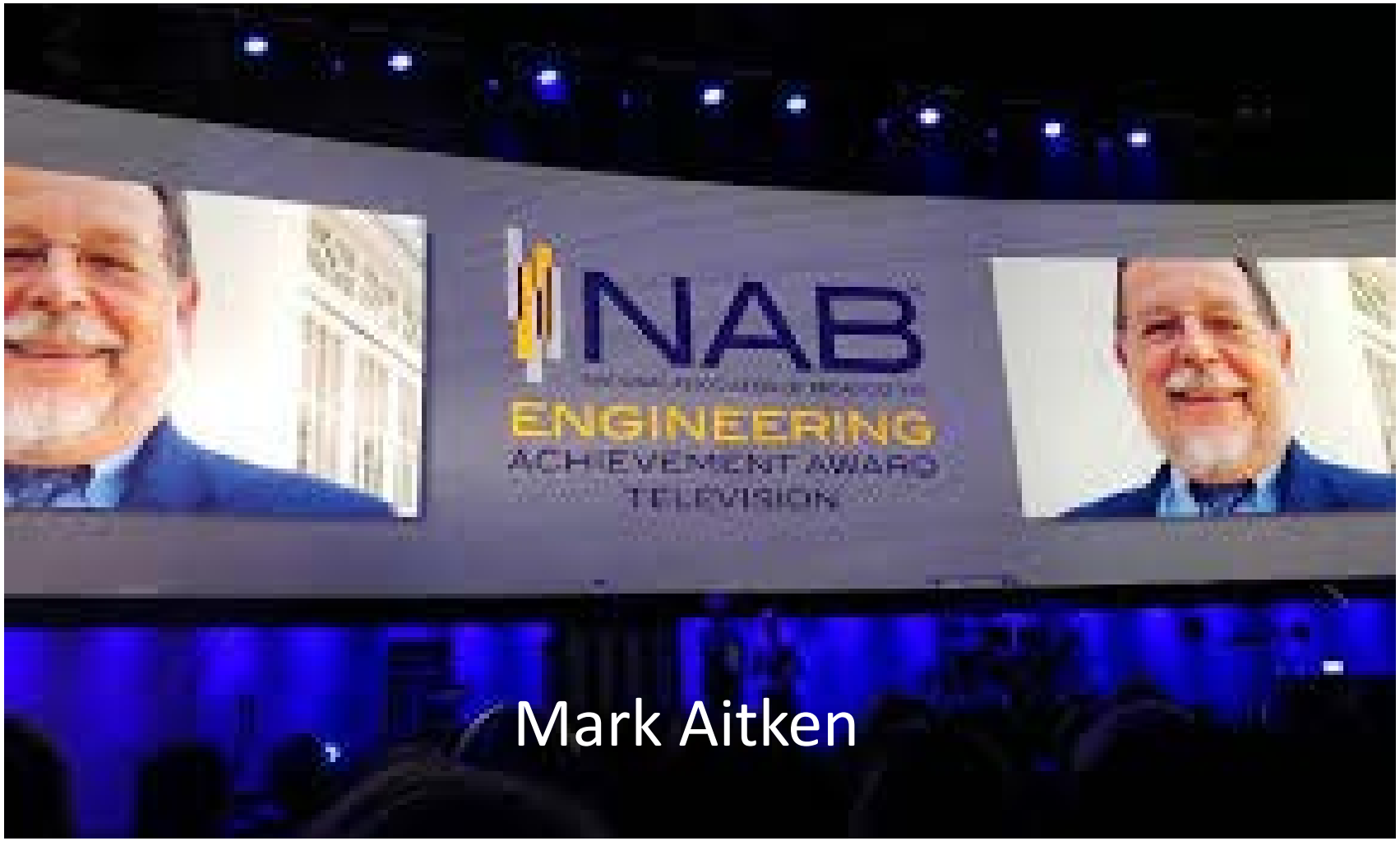


Mark Aitken

# Extensible

Dictionary

extensible

ex·ten·si·ble

/ikˈstensəb(ə)l/

*adjective*

able to be extended; extendable.
"an extensible architecture designed to accommodate changes"

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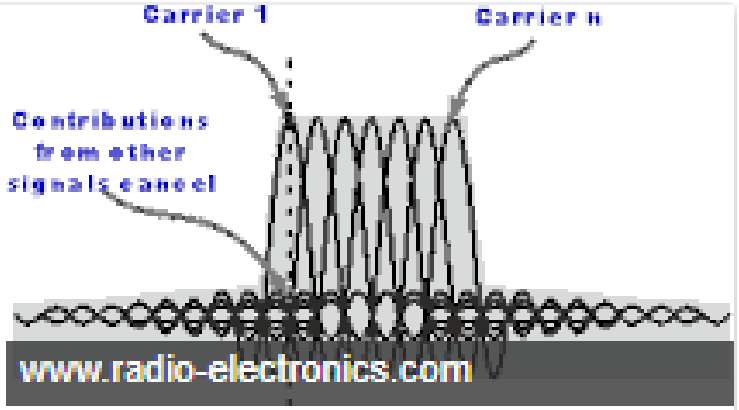
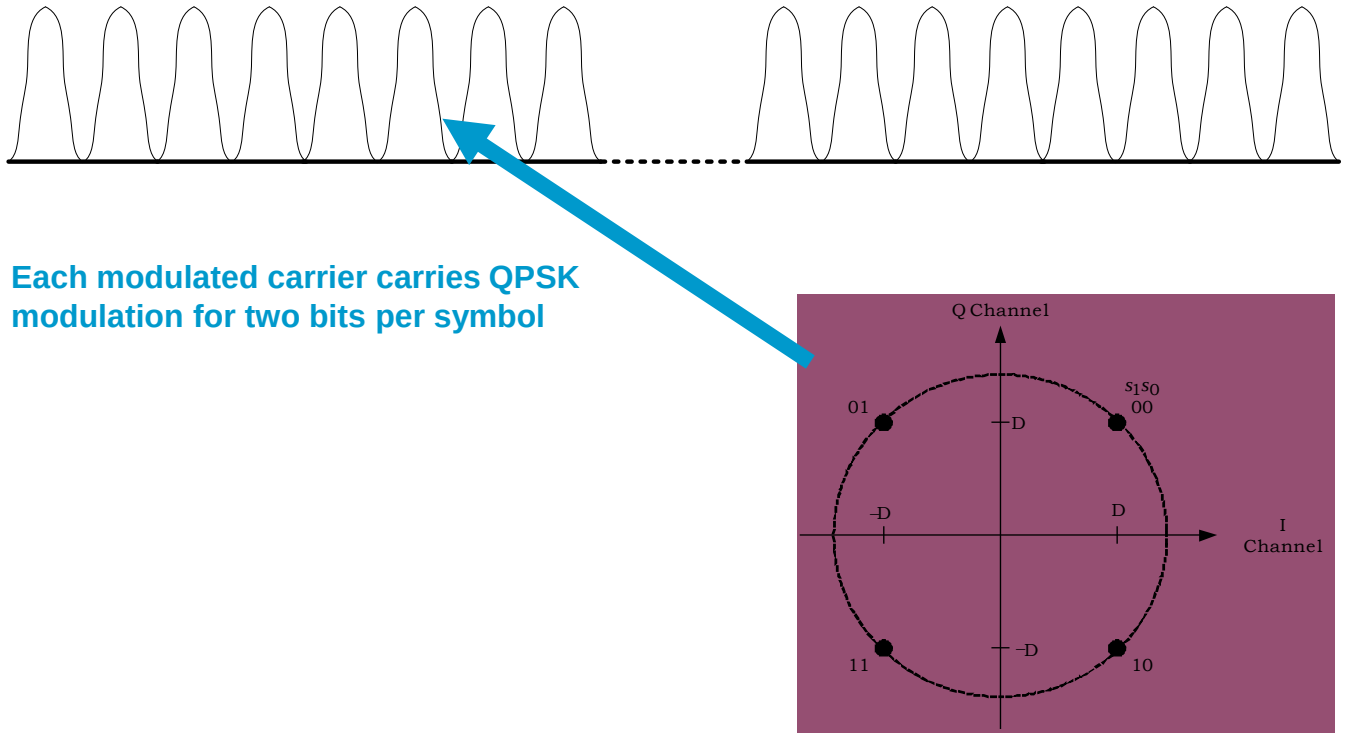
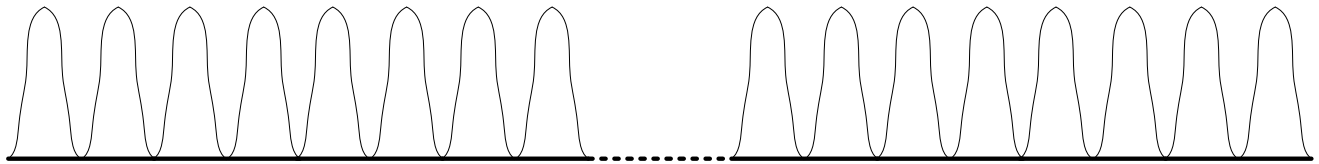
# OFDM

Orthogonal frequency-division multiplexing (**OFDM**) is a method of digital signal modulation in which a single data stream is split across several separate narrowband channels at different frequencies to reduce interference and crosstalk. Sep 7, 2016

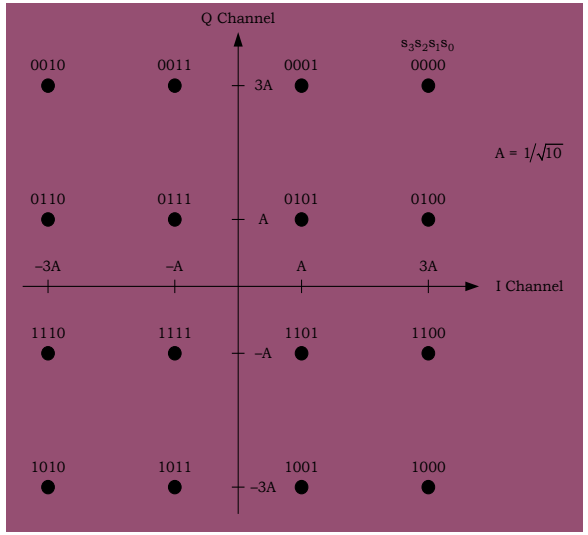



What is orthogonal frequency-division multiplexing (OFDM ...
https://searchnetworking.techtarget.com/.../orthogonal-frequency-division-multiplexing


Each modulated carrier carries QPSK modulation for two bits per symbol
Q Channel
I Channel
01
00
11
10
D
–D
D
–D
$s_1s_0$



Or it could be 16-QAM for 4 Bits/Symbol

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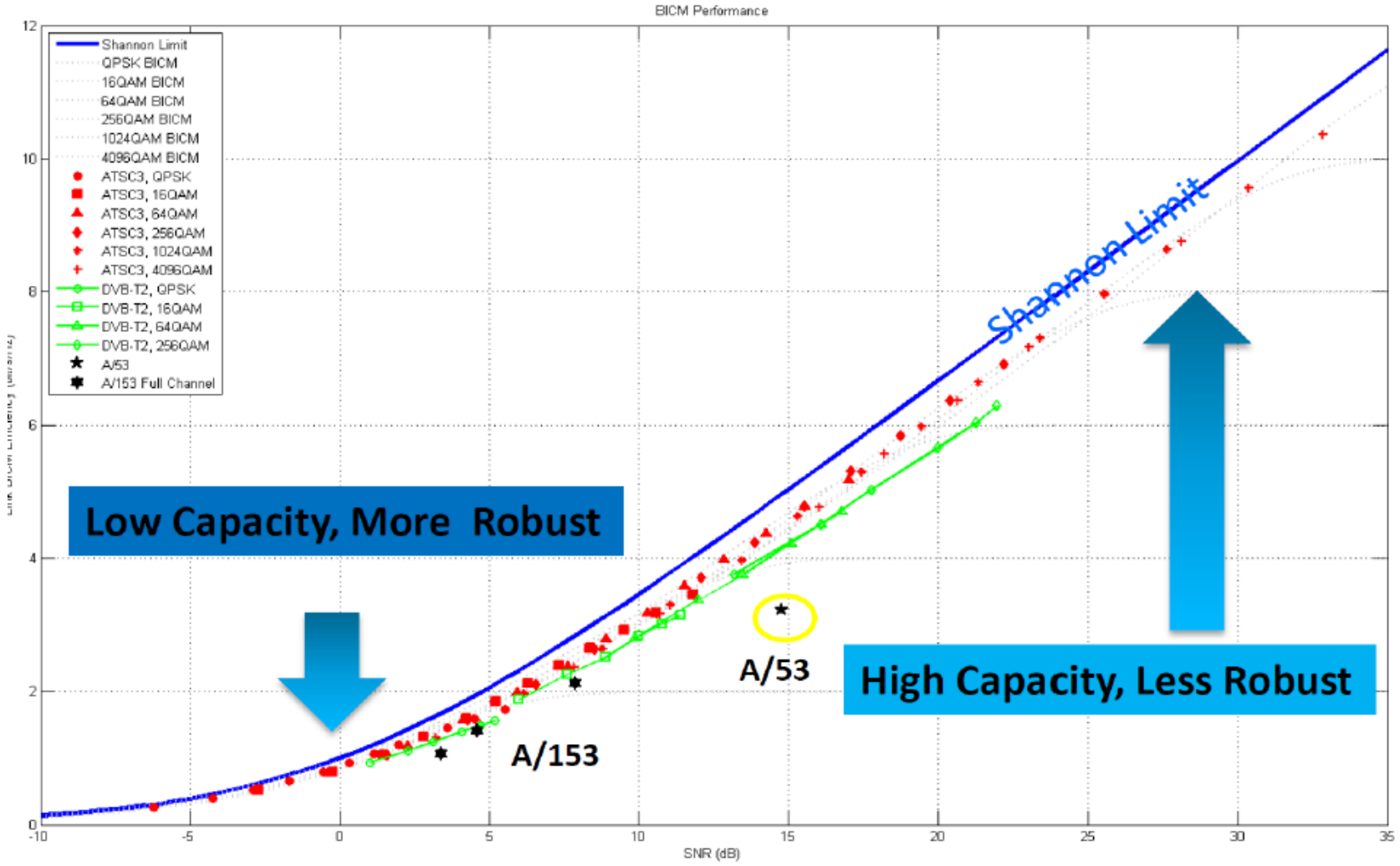
# Shannon

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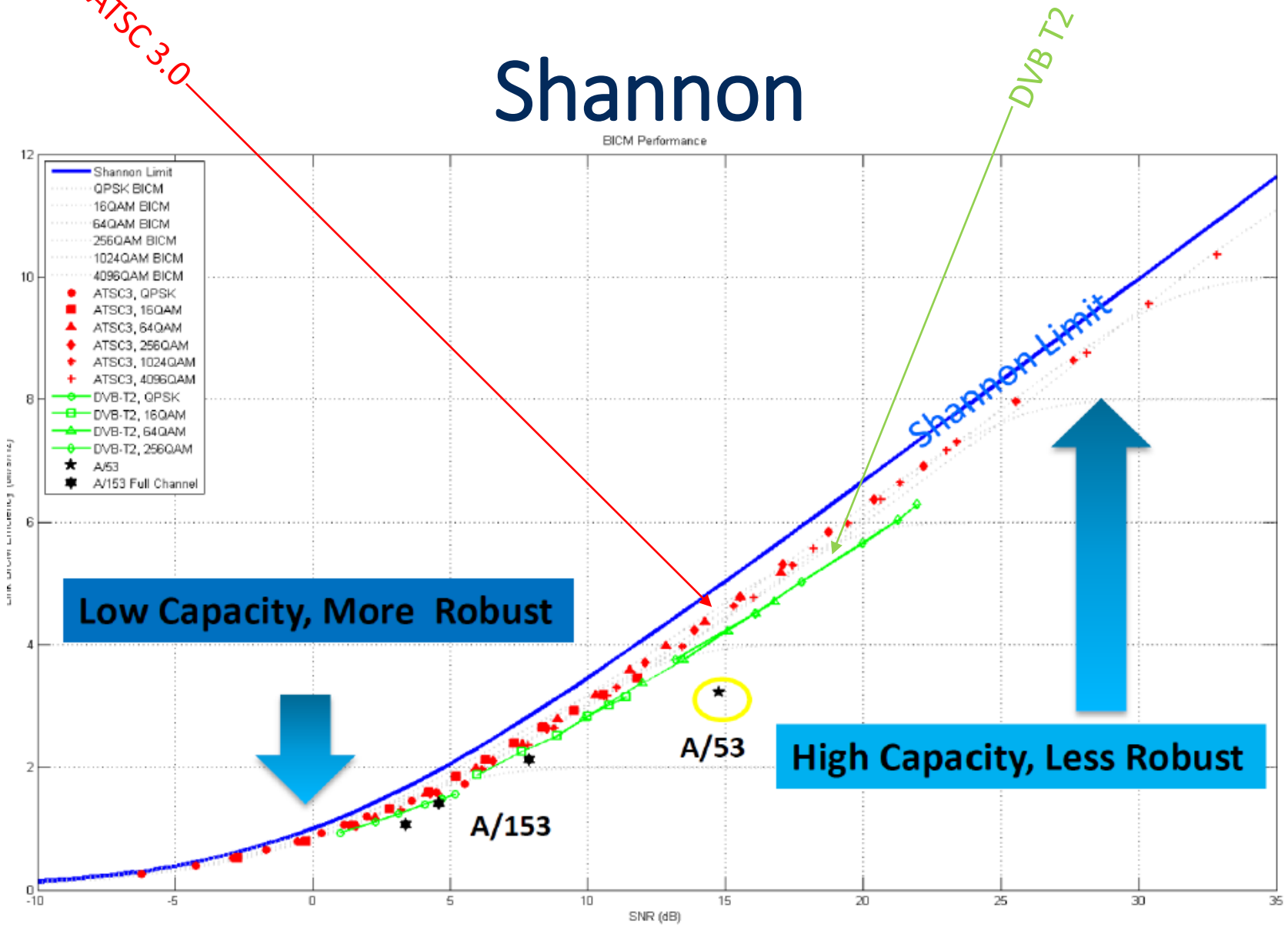
# Shannon

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# Mobile = Single Frequency Networks


- Current 8-VSB is poor at mobile
  - Burns up spectrum
  - Doesn't penetrate
- New ATSC 3.0
  - Really good at mobile
  - VERY different distribution network
    - Boomers
    - Boosters
    - DAS

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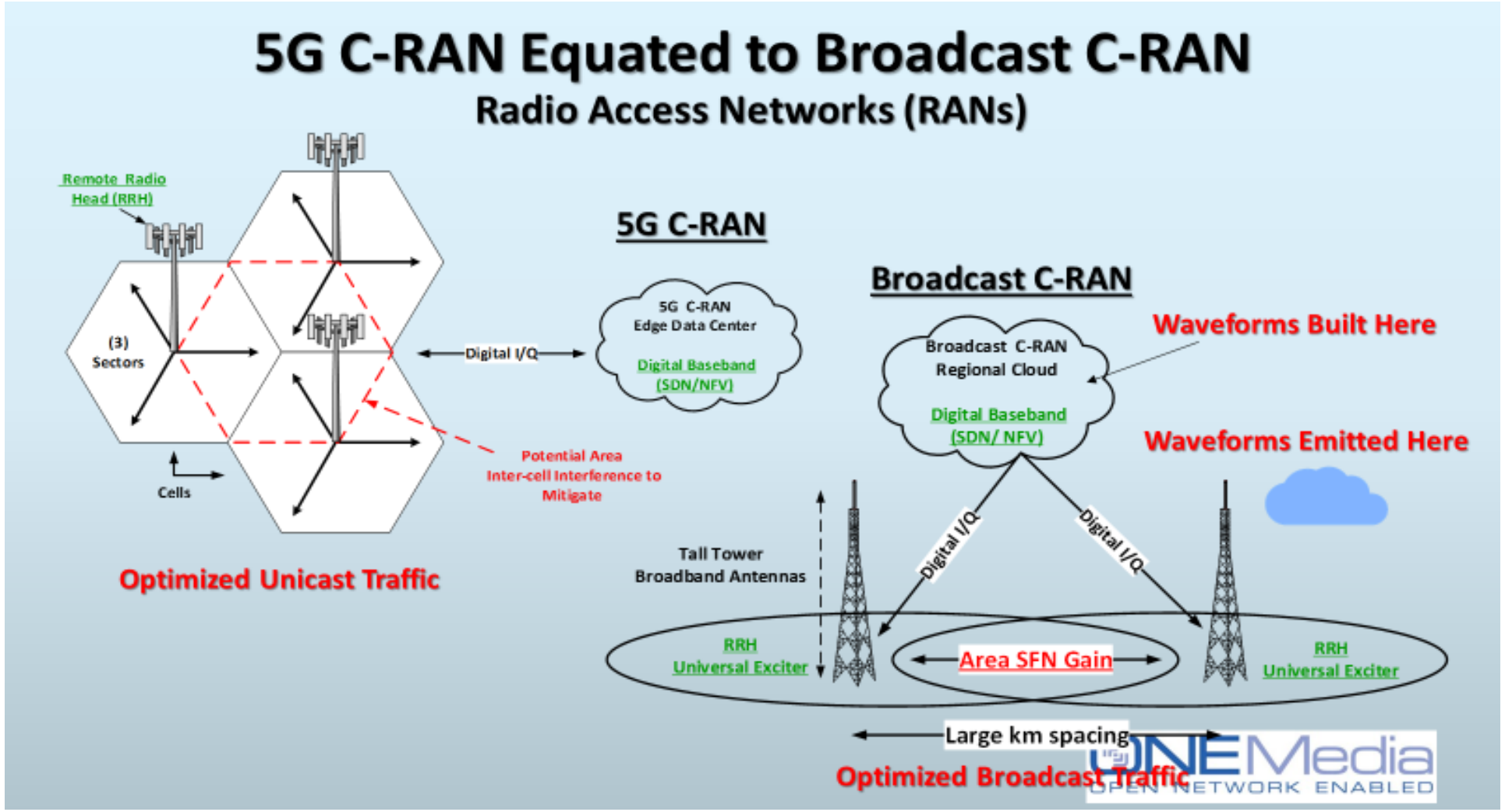
# RF Distribution Design

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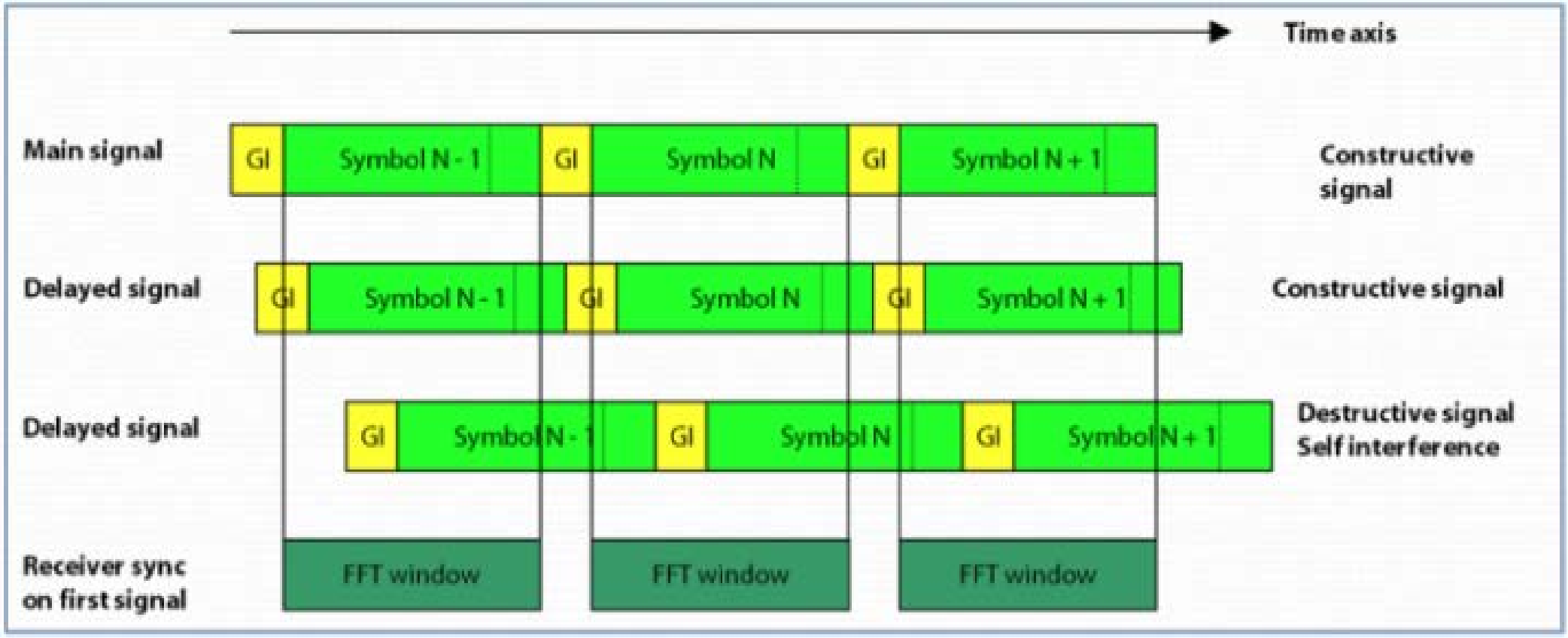
# Guard Interval

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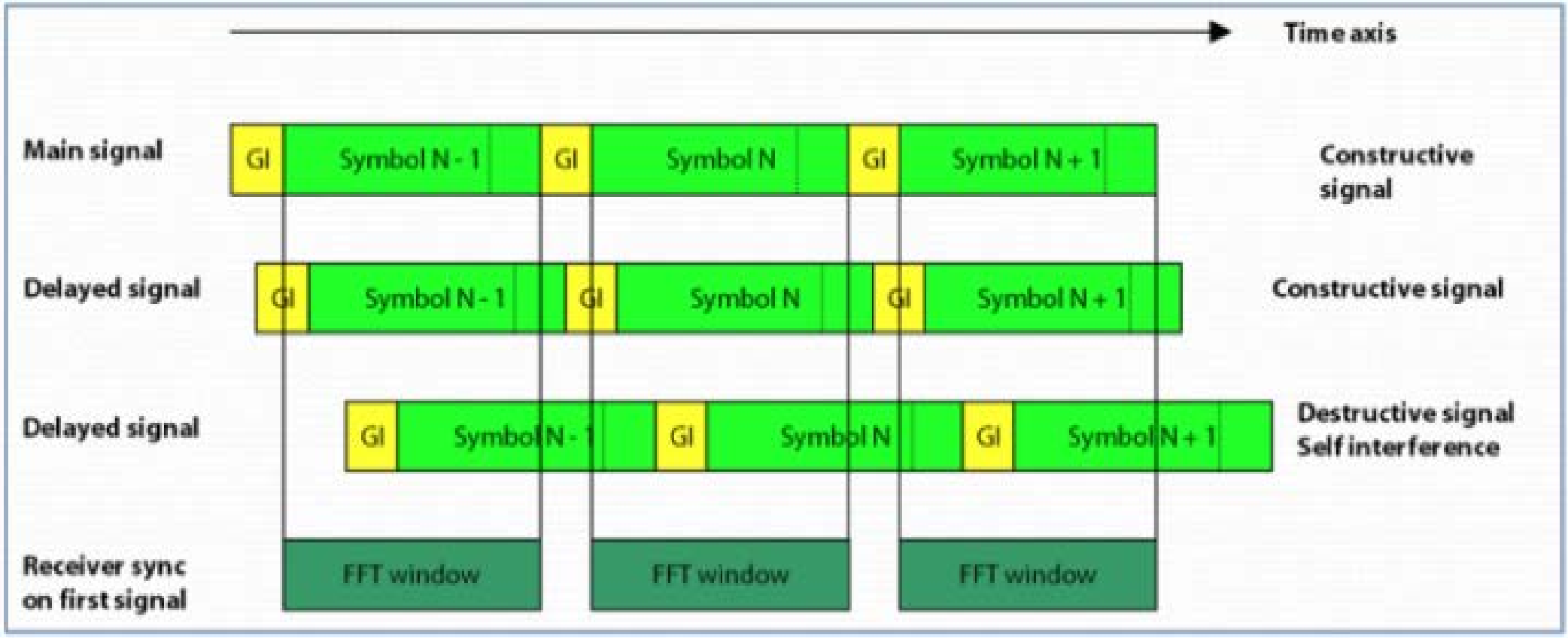
# Guard Interval

Good

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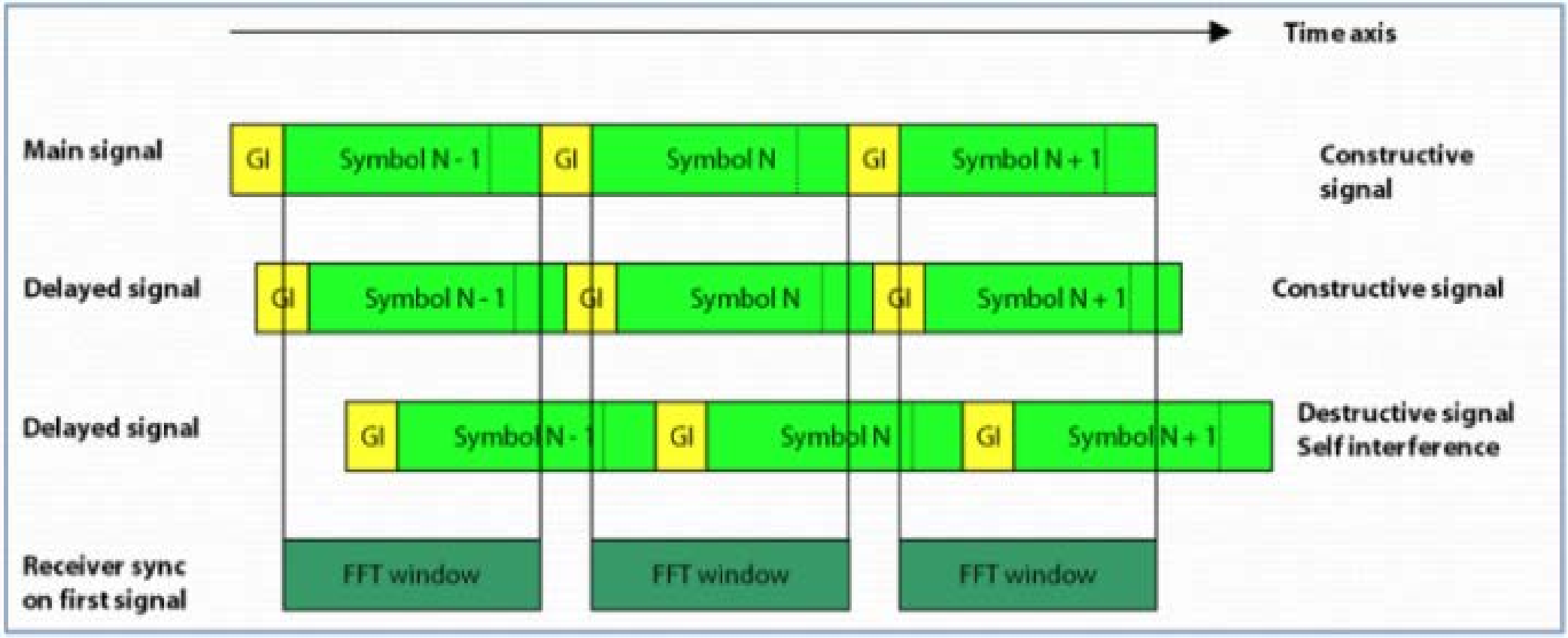
# Guard Interval

Good

Bad

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# OFDM Loves Multipath

- Power and More Transmitters Fixes Everything
- Classes of Transmitters
  - Boomers
  - Boosters
  - Distributed Antenna Systems

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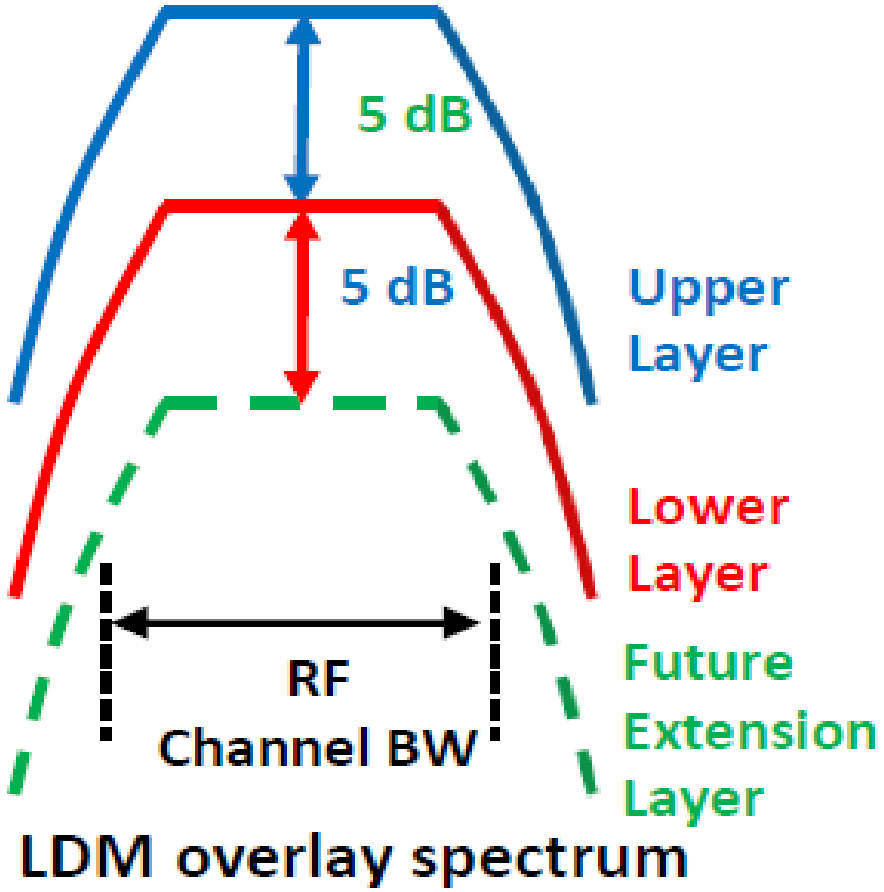
# Layered Division Multiplexing

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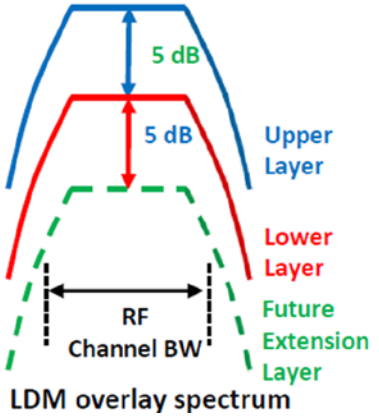
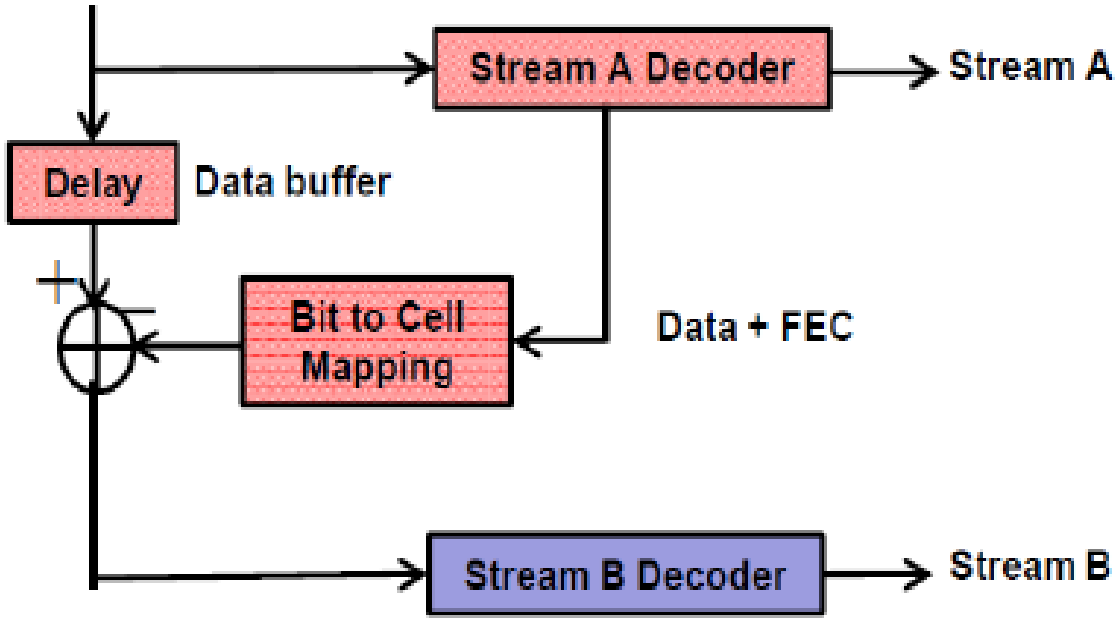
# LDM Decoding




Upper Layer BICM

Lower Layer BICM

Common Modules

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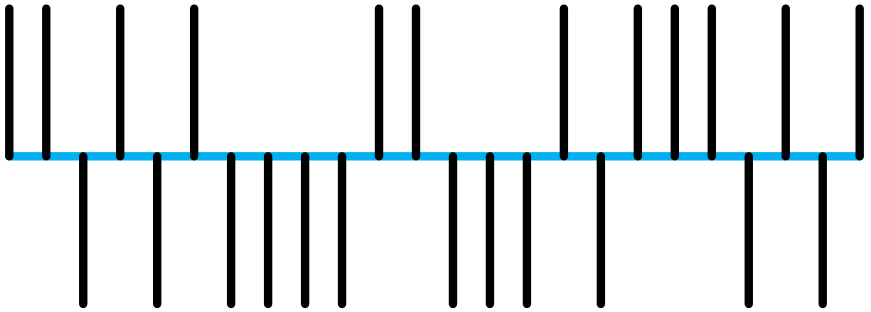
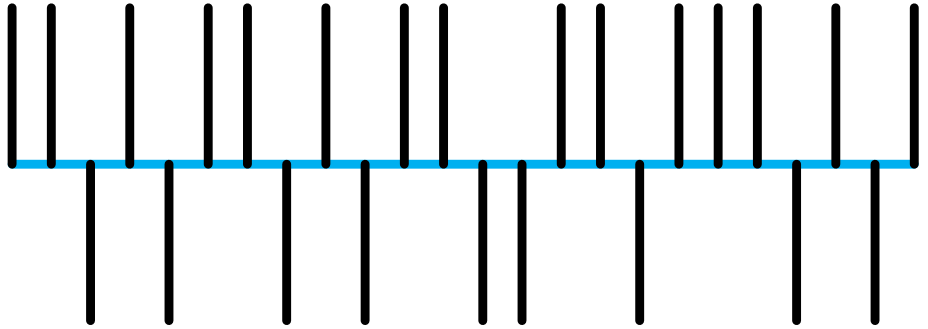
# Crest Factor / Peak to Average Power Ratio (Comparative CF)



CF=1



CF=1.5

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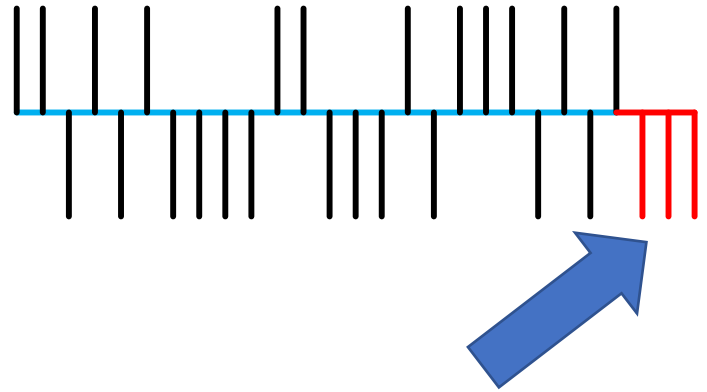
# Crest Factor / Peak to Average Power Ratio

- 8 VSB is 6.5 – 8.1 dB
- OFDM is ~ 12 dB
  - 1 or 2 dB headroom needed
  - Doherty Amplification for Efficiency

- PAPR Reduction
  - Clipping
  - Processing
    - Partial Transmit Sequence
    - Selective Mapping
  - Tone Reservation



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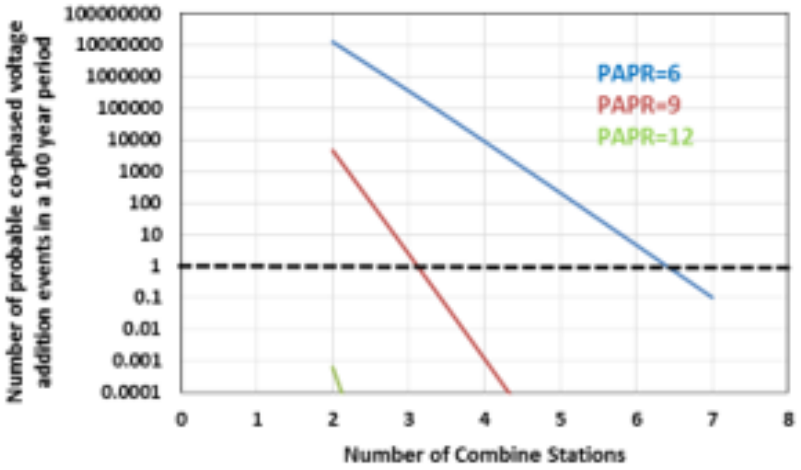
# Single Frequency Network SFN BOM Bill of Materials

# Sweet Spot = 6 X 100 kW ERP

- 6 x 5 kW 3.0 Transmitters
- Combiner
- Wide Band Antenna
- Adequate STL
- Monitoring
- Networking – KVM – Console

# Crest Factor



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# Performance Parameters

- Proof of Performance
  - Work in Progress
  - Can always do a 1.0 proof
  - Usual
    - Power
    - Out of band emission
  - Does linear correction matter?
- Fidelity
  - Phase Noise
  - MER – Modulation Error Ratio
    - Appears as SNR
    - Same as:
      - EVM = error vector magnitude
      - RCE = relative constellation error

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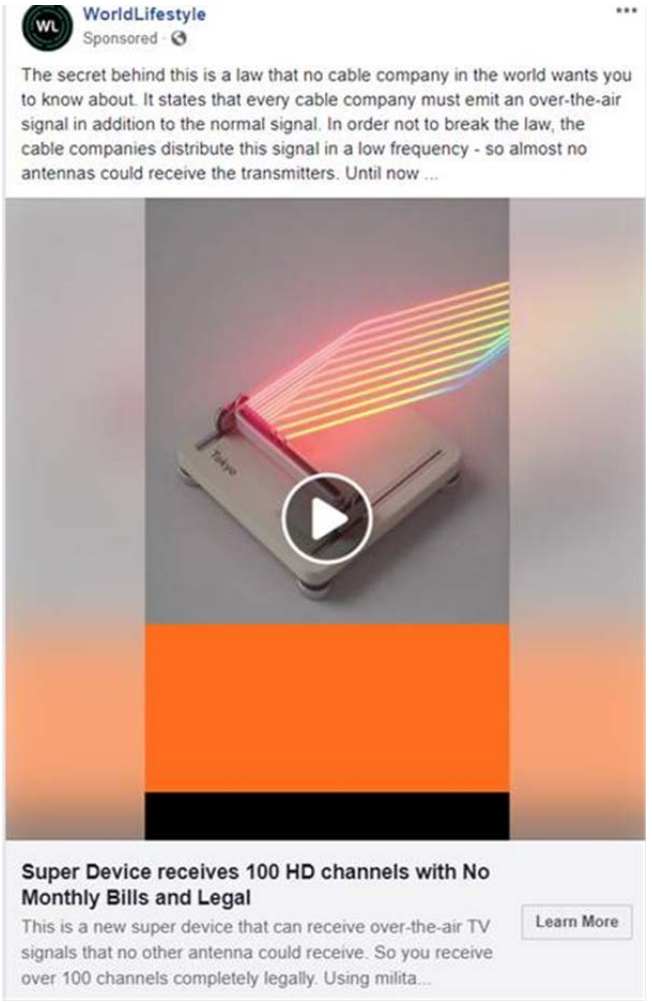
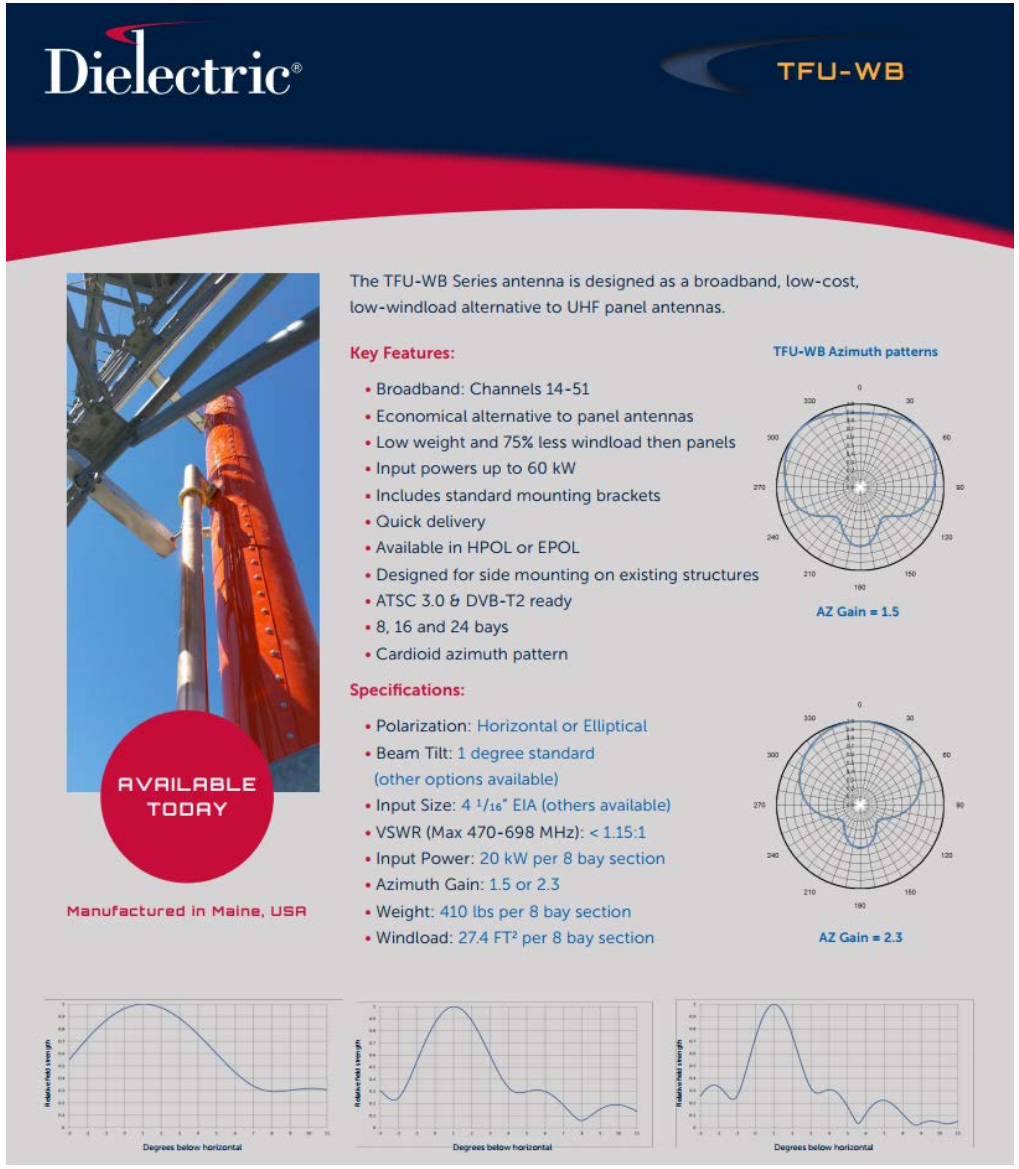
# Home Gateway Antennas



- 6-inch line
- Wide Band Antenna
- Reasonably Omni Cardioid
- Side mount can “fit” more towers



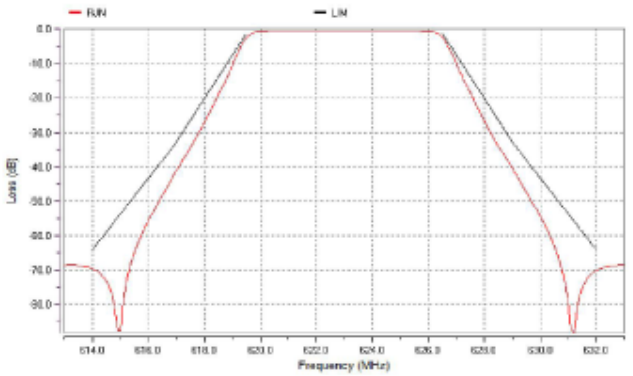
# UHF 6 pole CIF combiner

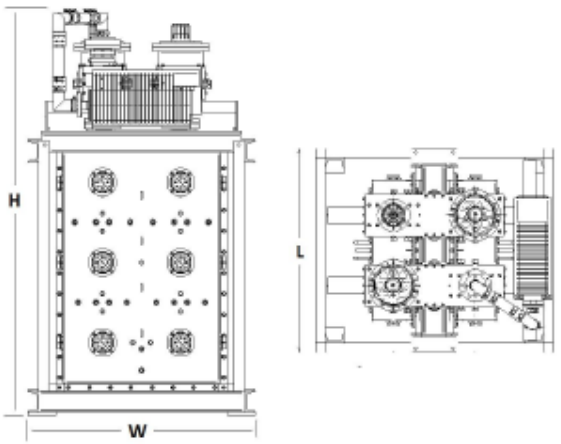
## CIF-UT6D11F-20K- 3x6 - ATSC

| PARAMETER | SPEC |
|---|---|
| Port Size (NB,WB, Output) | 3 1/8", 6 1/8", 6 1/8" EIA |
| Maximum NB Input Power | 20kW average |
| Maximum Combined Power | 40 kW average |
| Tuning Frequency Range | 470 MHz –698MHz |
| Standard | ATSC, DVB-T, ISDB-T |
| Narrowband loss (fo) | 0.32 dB max |
| Narrowband loss (fo±2.69) | .42 dB max |
| Narrowband Rejection | (ATSC) |
| fo +/- 3.5 MHz | 2 dB min |
| fo +/-4.5 MHz | 12 dB min |
| fo +/- 6.0 MHz | 32 dB min |
| fo +/- 9.0 MHz | 64 dB min |
| Broadband loss (fc) | 0.1 dB max |
| Narrowband group delay | 200 ns max |
| Broadband group delay | 20 ns max |
| Input return loss (NB / BB) | 28 dB min / 26 dB min |
| NB to BB isolation | 30 dB min |
| Weight | 640 lbs (272 kg) |
| Length x width x height | 33 in x 38in x 56 in<br>(84 cm x 97 cm x 142 cm) |
| Ambient Temp Range | 0°C to 40°C |
| Cooling | Free convection cooled |
| Model Number (3-50 BB hybrid) | CIF-UT6D11F-20K-3x3 |

All specifications are preliminary and subject to change
Broadband loss and delay based on semi-adjacent channel operation, wider channel spacing will have less loss / delay.

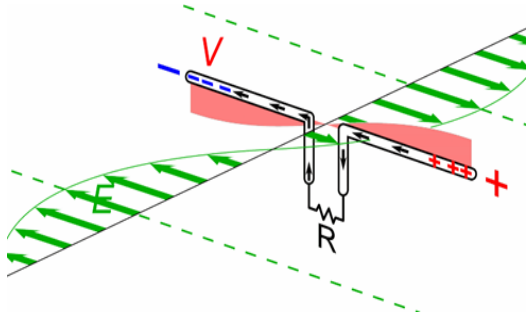
Dielectric. LLC
22 Tower Road
Raymond, ME 04071
1-800-341-9678

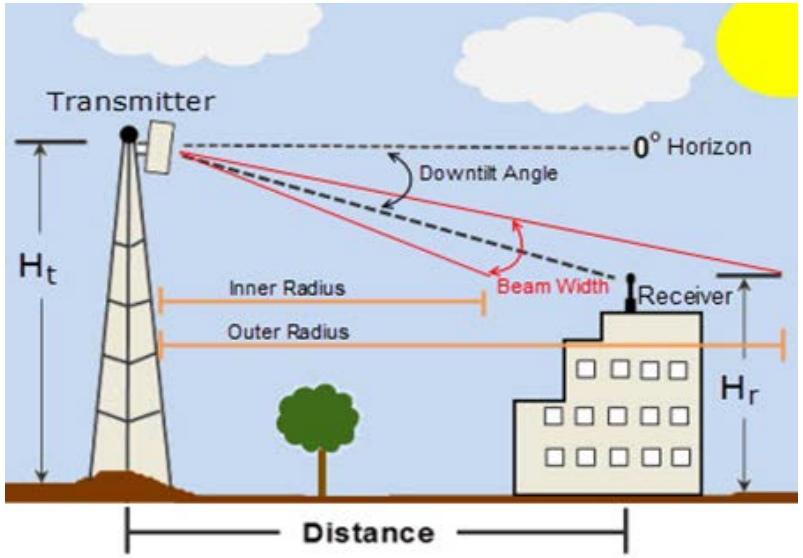


# Boomer-Booster Antennas

- 25% V-pol
- Null Fill




- Almost always for SFN Boosters
  - Unless highly directional
- When Tower is *in* Town
- Not when in the Mountains
- Not when Rim Shot

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- OFDM
  - GI
- LDM
- Crest Factor
- Antenna
- **AEA**
- Radio on NextGen
- NextGen TV Station
- What's Available to Receive 3.0?
- Adoption
- Dallas Test SFN

# AEA – Per Dr. Chernock & ATSC

**What is Advanced Emergency Alerting?**

**AEA is a facility in ATSC 3.0 to send urgent information**

- A new way to present alerts and other critical public info
- Supplements, enhances, but doesn't necessarily replace EAS
- Possibility of geo-targeting to narrow areas, or even specific receivers
  - For receivers that "know where they are"
- Possibility of targeting (and encrypting) messaging for groups (first responders, gov't, business…)

2017 NEXTGENTV CONFERENCE POWERED BY ATSC 3.0

**What is Advanced Emergency Alerting?**

**Direct interaction between the TV station and the TV receiver**

- On-screen icons/prompts/summaries
- Detailed and targeted info
- Accompanying multimedia and live media
- User selection of preferences (language, types of alerts to display …)
- Possibility of TV receiver wake up for the most urgent alerts

2017 NEXTGENTV CONFERENCE POWERED BY ATSC 3.0

# Advanced Emergency Alerting

Tune In to the Future

- Next step in robust delivery of emergency information to the public
- Developed from work by the Mobile-EAS coalition and the ATSC M-EAS Implementation Team as demonstrated in numerous public venues
- An application using the robust capabilities that are part of ATSC 3.0….next generation DTV now in development

AWARN
Advanced Warning and Response Network

# Opportunity for Broadcasters


- Provide a more robust and reliable public warning and safety information communications system…. ….independent of cellular network congestion
- Leverage broadcaster's major role as public information provider with disaster-resistant facilities
- Offload data and video traffic during times of emergency to preserve LTE for what is does best… point-to-point voice communications

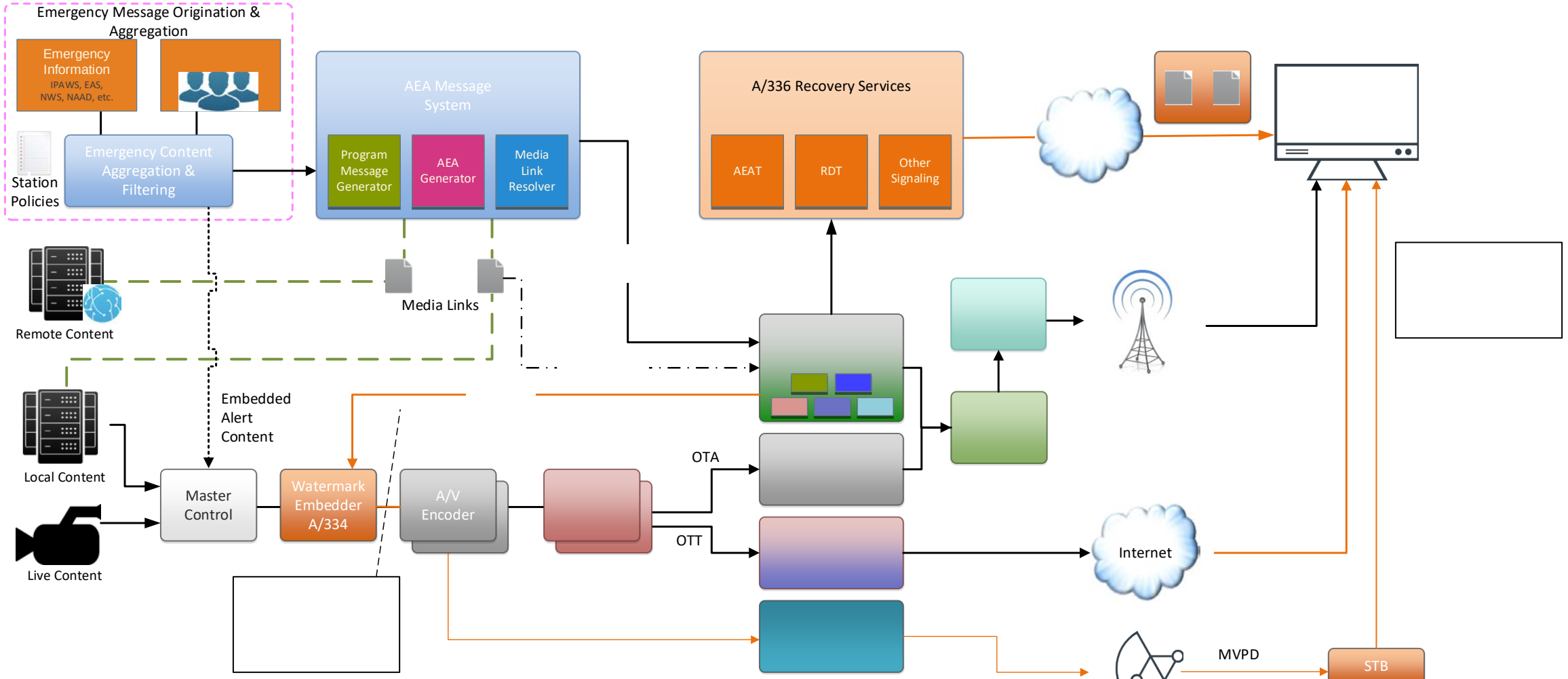
AWARN
Advanced Warning and Response Network

# AEA High Points

- AWARN
- ATSC AEA I-team
- NAB – Pilot
- Alert is different than Informing
- Vendors – Monroe, Triveni…
- Points
  - Targeting
  - Auto Turn On
- Rich Content
- WEA

# ATSC 3.0 AEA Messaging Delivery Architecture

## *Including HDMI Access to Rich Services*



# *NextGen TV*

- I. Sinclair – ONEMedia
- II. Spectrum
- III. Standard
- IV. Transmission
- V. Platform (s)
- VI. Business
- VII. Media
- VIII. **Significant and Useful Tangents**

- Historical
- Standard
  - Shannon
- OFDM
  - GI
- LDM
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# ATSC 3.0 is *Multimedia*

…and That Means Radio Too



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# TV Without Pictures

- TV Radio
  - **(TV radio** or **TV band radio** or **TV audio Radio)**
  - Last known is Sony Analog
  - Most VHF only
  - Few Car Versions
  - No DTV Version
    - 8 VSB has mobile issues
    - Displays are cheap


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# “Radio” Bands

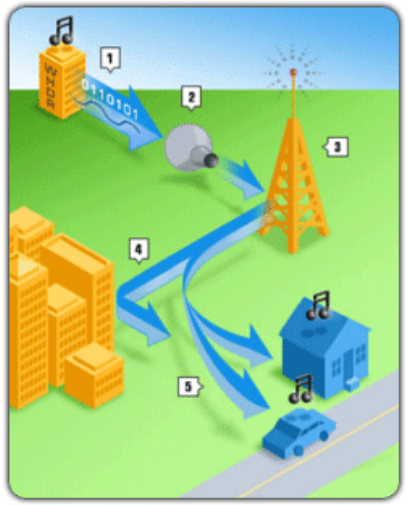
- MW (aka AM)
  - Great for 1925
  - Lots of Radios out there
  - Most of them don’t work well
    - Electronic cars have too much EMI
  - Link Budget
    - Awesome Power Density
      - 50 kW in 10 kHz = 5 W/Hz
    - Terrible Receive Antenna Efficiency
      - Usually way less than 1%


- VHF (FM)
  - Link Budget
    - Huge Power Density
      - 100 kW in 200 kHz = .5 W/Hz
        - 316 kW in 6 MHz = .052 W/Hz
        - 1MW in 6 MHz = .16 W/Hz
    - Antennas are as big as a man
  - Phones
    - Needs the earbud wire for antenna
    - Multipath kills FM
    - RANs and 3.0 kicks OTA FM

# Radio With Pictures

## Video On HD Radio

- Clear Channel's -- Artist Experience in (June 2010)
- iBiquity's -- *Advanced Application Services over HD Radio* (1999)

# Radio is already going to IP

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# Smart Speakers

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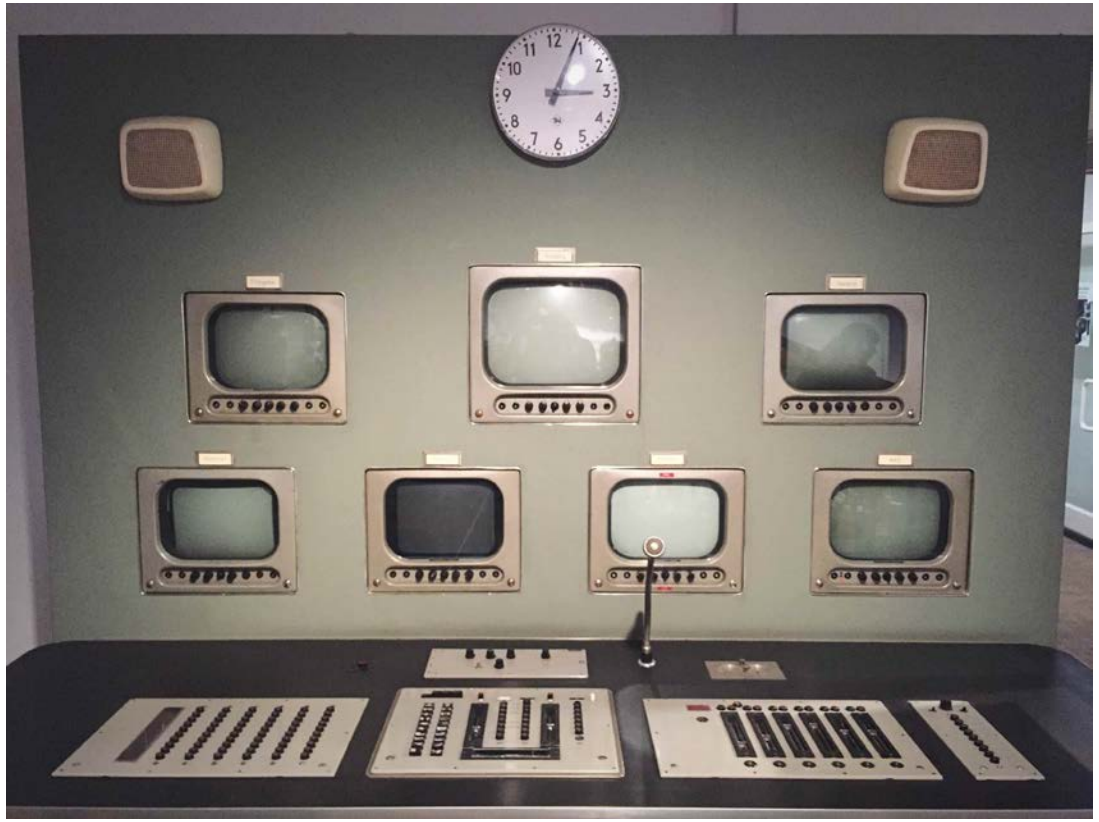
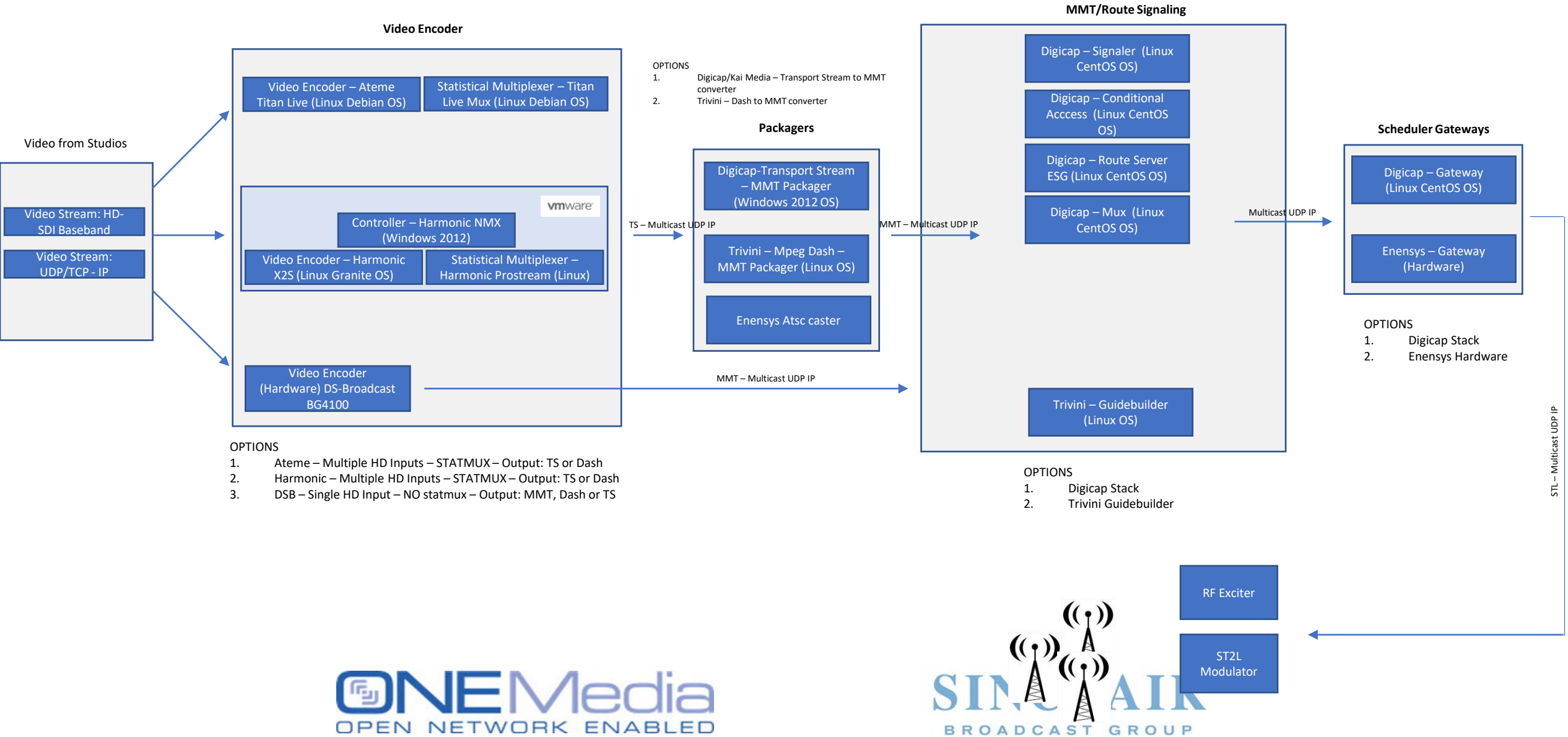
# Changes to Our Stations?

- More OTT like
- Triggers
- More HTML 5.0 like production
- Super Sales Department
- Bigger “Digital” presence
- Less “Video” presence



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# *NextGen TV*

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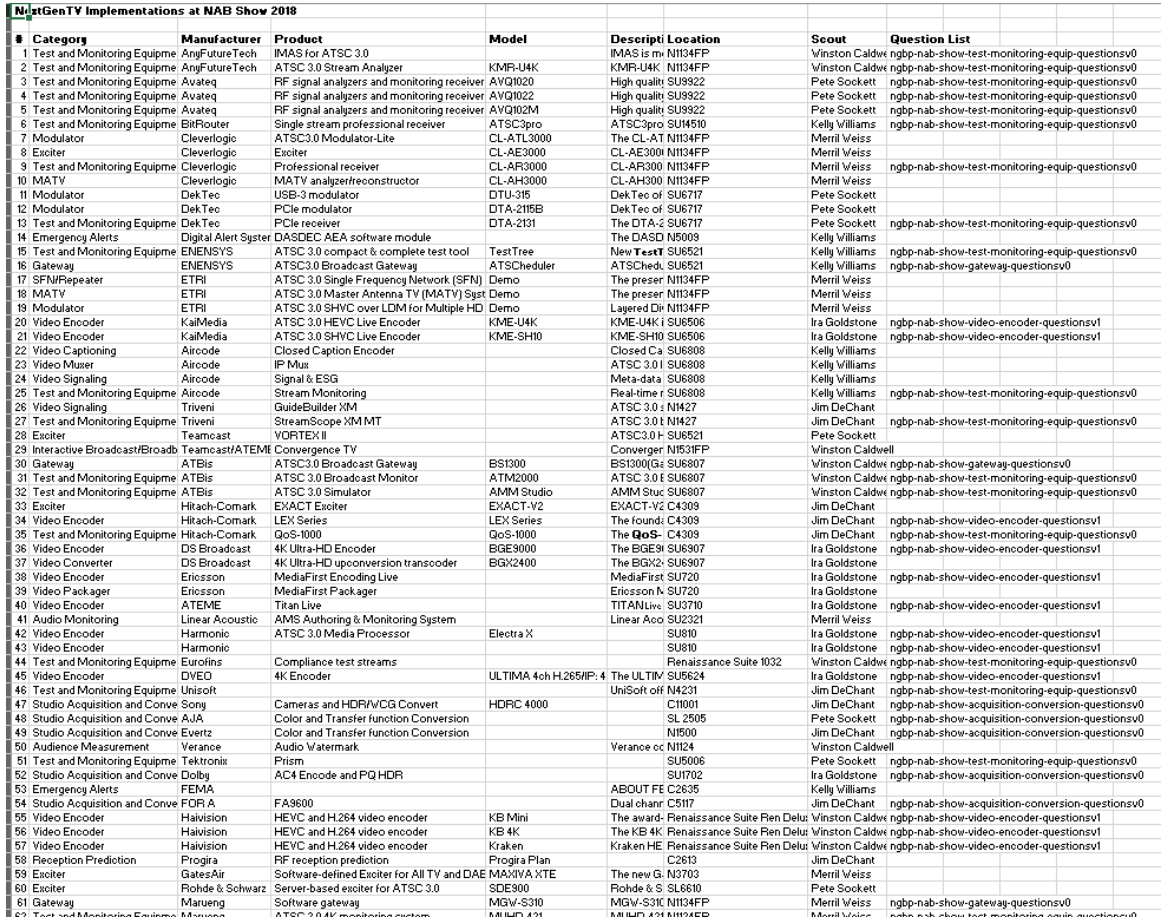
# Where Do I Buy A 3.0 Receiver?

- **Chips**
- Dongles
- Receivers
- Mobile
- Home Gateway



NextGenTV Implementations at NAB Show 2018

| # | Category | Manufacturer | Product | Model | Descripti | Location | Scout | Question List |
|---|---|---|---|---|---|---|---|---|
| 1 | Test and Monitoring Equipme | AnyFutureTech | IMAS for ATSC 3.0 | | IMAS is m | N1134FP | Winston Caldwe | ngbp-nab-show-test-monitoring-equip-questionsv0 |
| 2 | Test and Monitoring Equipme | AnyFutureTech | ATSC 3.0 Stream Analyzer | KMR-U4K | KMR-U4K | N1134FP | Winston Caldwe | ngbp-nab-show-test-monitoring-equip-questionsv0 |
| 3 | Test and Monitoring Equipme | Avateq | RF signal analyzers and monitoring receiver | AVQ1020 | High quality | SU9922 | Pete Sockett | ngbp-nab-show-test-monitoring-equip-questionsv0 |
| 4 | Test and Monitoring Equipme | Avateq | RF signal analyzers and monitoring receiver | AVQ1022 | High quality | SU9922 | Pete Sockett | ngbp-nab-show-test-monitoring-equip-questionsv0 |
| 5 | Test and Monitoring Equipme | Avateq | RF signal analyzers and monitoring receiver | AVQ102M | High quality | SU9922 | Pete Sockett | ngbp-nab-show-test-monitoring-equip-questionsv0 |
| 6 | Test and Monitoring Equipme | BitRouter | Single stream professional receiver | ATSC3pro | ATSC3pro | SU14510 | Kelly Williams | ngbp-nab-show-test-monitoring-equip-questionsv0 |
| 7 | Modulator | Cleverlogic | ATSC3.0 Modulator-Lite | CL-ATL3000 | The CL-AT | N1134FP | Merril Weiss | |
| 8 | Exciter | Cleverlogic | Exciter | CL-AE3000 | CL-AE300 | N1134FP | Merril Weiss | |
| 9 | Test and Monitoring Equipme | Cleverlogic | Professional receiver | CL-AR3000 | CL-AR300 | N1134FP | Merril Weiss | ngbp-nab-show-test-monitoring-equip-questionsv0 |
| 10 | MATV | Cleverlogic | MATV analyzer/reconstructor | CL-AH3000 | CL-AH300 | N1134FP | Merril Weiss | |
| 11 | Modulator | DekTec | USB-3 modulator | DTU-315 | DekTec of | SU6717 | Pete Sockett | |
| 12 | Modulator | DekTec | PCIe modulator | DTA-2115B | DekTec of | SU6717 | Pete Sockett | |
| 13 | Test and Monitoring Equipme | DekTec | PCIe receiver | DTA-2131 | The DTA-2 | SU6717 | Pete Sockett | ngbp-nab-show-test-monitoring-equip-questionsv0 |
| 14 | Emergency Alerts | Digital Alert Syster | DASDEC AEA software module | | The DASD | N5009 | Kelly Williams | |
| 15 | Test and Monitoring Equipme | ENENSYS | ATSC 3.0 compact & complete test tool | TestTree | New TestT | SU6521 | Kelly Williams | ngbp-nab-show-test-monitoring-equip-questionsv0 |
| 16 | Gateway | ENENSYS | ATSC3.0 Broadcast Gateway | ATSCheduler | ATSCheduler | SU6521 | Kelly Williams | ngbp-nab-show-gateway-questionsv0 |
| 17 | SFN/Repeater | ETRI | ATSC 3.0 Single Frequency Network (SFN) | Demo | The preser | N1134FP | Merril Weiss | |
| 18 | MATV | ETRI | ATSC 3.0 Master Antenna TV (MATV) Syst | Demo | The preser | N1134FP | Merril Weiss | |
| 19 | Modulator | ETRI | ATSC 3.0 SHVC over LDM for Multiple HD | Demo | Layered Di | N1134FP | Merril Weiss | |
| 20 | Video Encoder | KaiMedia | ATSC 3.0 HEVC Live Encoder | KME-U4K | KME-U4K i | SU6506 | Ira Goldstone | ngbp-nab-show-video-encoder-questionsv1 |
| 21 | Video Encoder | KaiMedia | ATSC 3.0 SHVC Live Encoder | KME-SH10 | KME-SH10 | SU6506 | Ira Goldstone | ngbp-nab-show-video-encoder-questionsv1 |
| 22 | Video Captioning | Aircode | Closed Caption Encoder | | Closed Ca | SU6808 | Kelly Williams | |
| 23 | Video Muxer | Aircode | IP Mux | | ATSC 3.0 I | SU6808 | Kelly Williams | |
| 24 | Video Signaling | Aircode | Signal & ESG | | Meta-data | SU6808 | Kelly Williams | |
| 25 | Test and Monitoring Equipme | Aircode | Stream Monitoring | | Real-time r | SU6808 | Kelly Williams | ngbp-nab-show-test-monitoring-equip-questionsv0 |
| 26 | Video Signaling | Triveni | GuideBuilder XM | | ATSC 3.0 s | N1427 | Jim DeChant | |
| 27 | Test and Monitoring Equipme | Triveni | StreamScope XM MT | | ATSC 3.0 t | N1427 | Jim DeChant | ngbp-nab-show-test-monitoring-equip-questionsv0 |
| 28 | Exciter | Teamcast | VORTEX II | | ATSC3.0 H | SU6521 | Pete Sockett | |
| 29 | Interactive Broadcast/Broadb | Teamcast/ATEME | Convergence TV | | Converger | N1531FP | Winston Caldwell | |
| 30 | Gateway | ATBis | ATSC3.0 Broadcast Gateway | BS1300 | BS1300(Ga | SU6807 | Winston Caldwe | ngbp-nab-show-gateway-questionsv0 |
| 31 | Test and Monitoring Equipme | ATBis | ATSC 3.0 Broadcast Monitor | ATM2000 | ATSC 3.0 E | SU6807 | Winston Caldwe | ngbp-nab-show-test-monitoring-equip-questionsv0 |
| 32 | Test and Monitoring Equipme | ATBis | ATSC 3.0 Simulator | AMM Studio | AMM Stuc | SU6807 | Winston Caldwe | ngbp-nab-show-test-monitoring-equip-questionsv0 |
| 33 | Exciter | Hitach-Comark | EXACT Exciter | EXACT-V2 | EXACT-V2 | C4309 | Jim DeChant | |
| 34 | Video Encoder | Hitach-Comark | LEX Series | LEX Series | The founda | C4309 | Jim DeChant | ngbp-nab-show-video-encoder-questionsv1 |
| 35 | Test and Monitoring Equipme | Hitach-Comark | QoS-1000 | QoS-1000 | The QoS- | C4309 | Jim DeChant | ngbp-nab-show-test-monitoring-equip-questionsv0 |
| 36 | Video Encoder | DS Broadcast | 4K Ultra-HD Encoder | BGE9000 | The BGE9 | SU6907 | Ira Goldstone | ngbp-nab-show-video-encoder-questionsv1 |
| 37 | Video Converter | DS Broadcast | 4K Ultra-HD upconversion transcoder | BGX2400 | The BGX2 | SU6907 | Ira Goldstone | |
| 38 | Video Encoder | Ericsson | MediaFirst Encoding Live | | MediaFirst | SU720 | Ira Goldstone | ngbp-nab-show-video-encoder-questionsv1 |
| 39 | Video Packager | Ericsson | MediaFirst Packager | | Ericsson M | SU720 | Ira Goldstone | |
| 40 | Video Encoder | ATEME | Titan Live | | TITAN Live | SU3710 | Ira Goldstone | ngbp-nab-show-video-encoder-questionsv1 |
| 41 | Audio Monitoring | Linear Acoustic | AMS Authoring & Monitoring System | | Linear Aco | SU2321 | Merril Weiss | |
| 42 | Video Encoder | Harmonic | ATSC 3.0 Media Processor | Electra X | | SU810 | Ira Goldstone | ngbp-nab-show-video-encoder-questionsv1 |
| 43 | Video Encoder | Harmonic | | | | SU810 | Ira Goldstone | ngbp-nab-show-video-encoder-questionsv1 |
| 44 | Test and Monitoring Equipme | Eurofins | Compliance test streams | | | Renaissance Suite 1032 | Winston Caldwe | ngbp-nab-show-test-monitoring-equip-questionsv0 |
| 45 | Video Encoder | DVEO | 4K Encoder | ULTIMA 4ch H.265/IP; 4 | The ULTIM | SU5624 | Ira Goldstone | ngbp-nab-show-video-encoder-questionsv1 |
| 46 | Test and Monitoring Equipme | Unisoft | | | UniSoft off | N4231 | Jim DeChant | ngbp-nab-show-test-monitoring-equip-questionsv0 |
| 47 | Studio Acquisition and Conve | Sony | Cameras and HDR/WCG Convert | HDRC 4000 | | C11001 | Jim DeChant | ngbp-nab-show-acquisition-conversion-questionsv0 |
| 48 | Studio Acquisition and Conve | AJA | Color and Transfer function Conversion | | | SL 2505 | Pete Sockett | ngbp-nab-show-acquisition-conversion-questionsv0 |
| 49 | Studio Acquisition and Conve | Evertz | Color and Transfer function Conversion | | | N1500 | Jim DeChant | ngbp-nab-show-acquisition-conversion-questionsv0 |
| 50 | Audience Measurement | Verance | Audio Watermark | | Verance oc | N1124 | Winston Caldwell | |
| 51 | Test and Monitoring Equipme | Tektronix | Prism | | | SU5006 | Pete Sockett | ngbp-nab-show-test-monitoring-equip-questionsv0 |
| 52 | Studio Acquisition and Conve | Dolby | AC4 Encode and PQ HDR | | | SU1702 | Ira Goldstone | ngbp-nab-show-acquisition-conversion-questionsv0 |
| 53 | Emergency Alerts | FEMA | | | ABOUT FE | C2635 | Kelly Williams | |
| 54 | Studio Acquisition and Conve | FOR A | FA9600 | | Dual chanr | C5117 | Jim DeChant | ngbp-nab-show-acquisition-conversion-questionsv0 |
| 55 | Video Encoder | Haivision | HEVC and H.264 video encoder | KB Mini | The award- | Renaissance Suite Ren Delu | Winston Caldwe | ngbp-nab-show-video-encoder-questionsv1 |
| 56 | Video Encoder | Haivision | HEVC and H.264 video encoder | KB 4K | The KB 4K | Renaissance Suite Ren Delu | Winston Caldwe | ngbp-nab-show-video-encoder-questionsv1 |
| 57 | Video Encoder | Haivision | HEVC and H.264 video encoder | Kraken | Kraken HE | Renaissance Suite Ren Delu | Winston Caldwe | ngbp-nab-show-video-encoder-questionsv1 |
| 58 | Reception Prediction | Progira | RF reception prediction | Progira Plan | | C2613 | Jim DeChant | |
| 59 | Exciter | GatesAir | Software-defined Exciter for All TV and DAE | MAXIVA XTE | The new G | N3703 | Merril Weiss | |
| 60 | Exciter | Rohde & Schwarz | Server-based exciter for ATSC 3.0 | SDE900 | Rohde & S | SL6610 | Pete Sockett | |
| 61 | Gateway | Maraeng | Software gateway | MGW-S310 | MGW-S310 | N1134FP | Merril Weiss | ngbp-nab-show-gateway-questionsv0 |

# ONEMedia Chip

- Seed the transisiton
- One for Mobile – One for STBs, TVs…
- First users… India…
  - Unlocked Phones to the US?
- 1,000,000 to give away to anyone that will roll a 3.0 product in the US.

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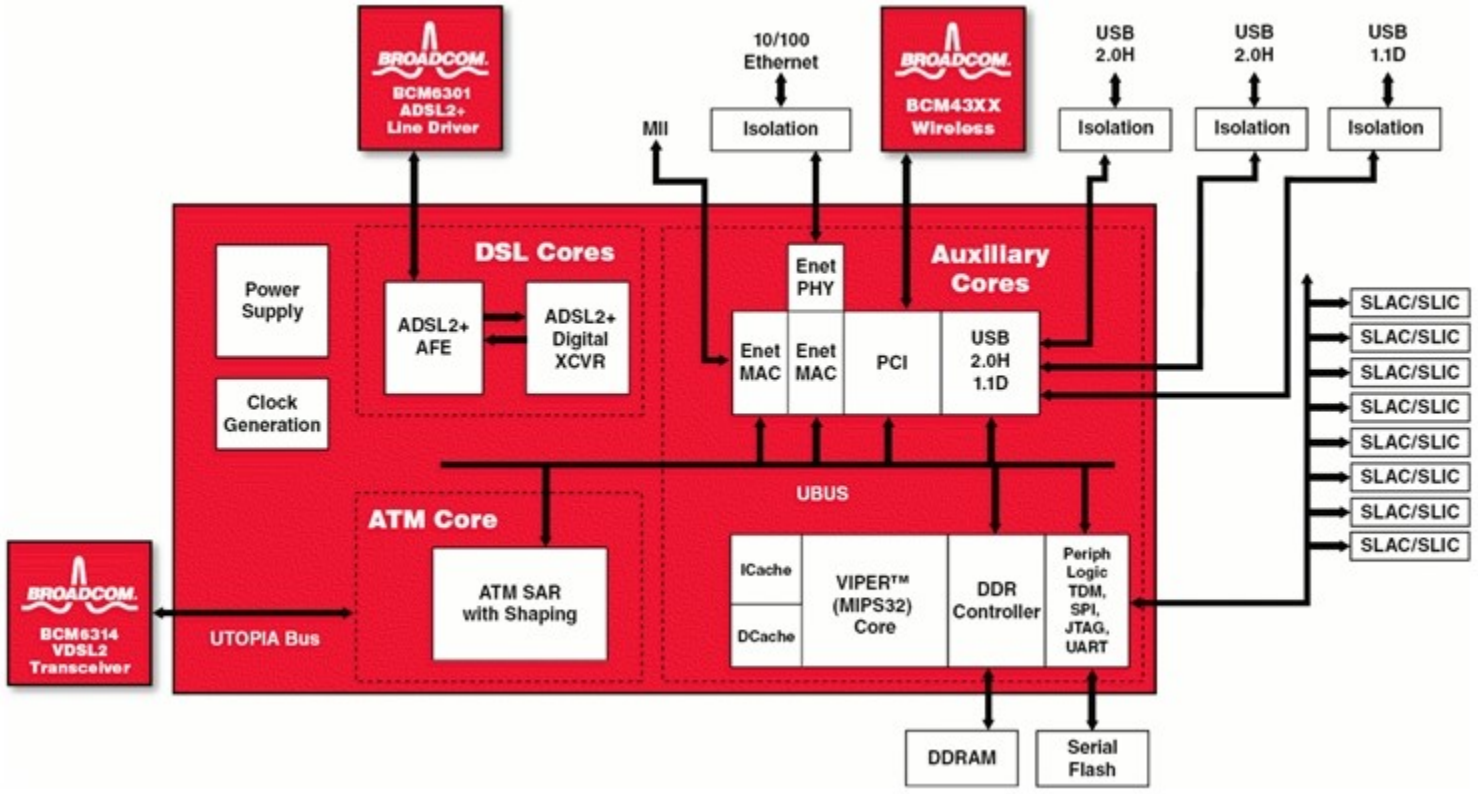
# Chip

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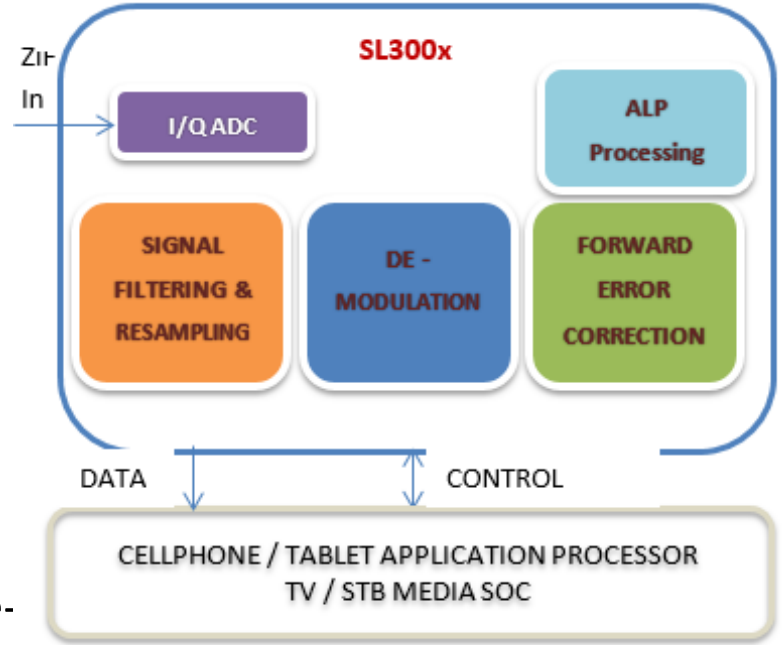
# Chip

- SL300X
  - Samples in December
  - Advanced DTV Demodulator
    - Full feature set takes space and power
  - SDR
  - SOC
    - Tuner – DTV Demod – FEC decode – Memory de-

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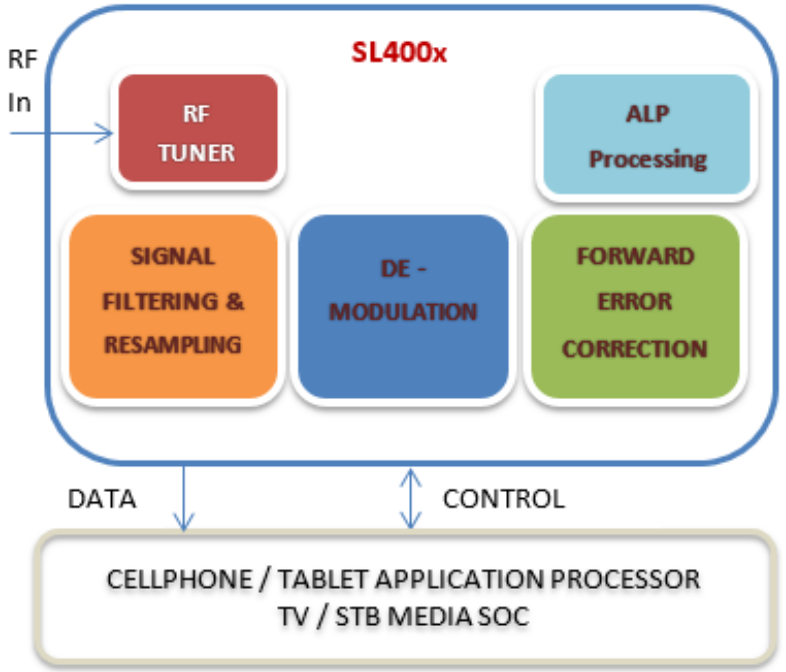
# Chip

- SL400X
  - Samples in December
  - Highly Integrated Mobile DTV Receiver
    - Power Saving
  - SOC
  - SDR

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# Dongle

- A $49 dongle is a game changer
  - Easier to give away dongles than set up 1.0 Hosts (light houses).
- Chips are hard to come by
  - Sinclair – 2 Years
  - 1,000,000 free to each product developer
  - IPR (*Intellectual Property Rights*) TBD


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# Two Dongles Available

Korean and Airwavz
$800.00/ea
Neither has a SOC – Need software stack

# Big TVs



# Pro Receivers

TELEVIEW

## ATSC 3.0 UHD Decoder
## TLV500

### Overview

ATSC 3.0 + 1.0 4K UHD/HD decoder takes RF and IP input, supply 12G/Quad 3G and 1.5G SDI video output with embedded audio. HDMI 2,0 video output is available to BNC(AES-EBU). Up to four TLV510 decoder module in 1RU frame is available.

### TLV500 Features

- SDI output in 12G/12G/1.5G/1.5G with embedded audio (SMPTE-2082, SMPTE-292M, SMPTE-299M)
- SDI output in Quad-3G 2SI with embedded audio
- SDI output in Quad-3G Square division with embedded audio
- HDMI 2.0 4K/60P output with embedded audio
- Each TLV510 module has 1 BNC connector which can be DVB-ASI input, SMPTE-310M input, DVB-ASI output, and AES-EBU output
- MPEG-2(HD/SD), MPEG-4/H.264 and HEVC video decoder
- Dolby digital AC-3, HE-AAC (MPEG2 AAC-LC(13818-7), MPEG4 HE-AAC v1(14496-3. 2003) ), MPEG-1/2 and MPEG-H audio decoder
- Firmware upgradeable via internet
- Genlock input available (Factory option. Replace BNC, SDI-3, 4 or RF input)
- Remote control using ModulatorConsole™ software available for Windows® 7/8/10 32bit / 64bit and Ubuntu 32bit / 64bit

### TLV500 ATSC 3.0 Features

- ATSC 3.0 RF tuner, STL IP ethernet and ALP IP ethernet input
- ROUTE and MMTP support

### TLV500 ATSC 1.0 Features

- ATSC 1.0 RF tuner, UDP/RTP IP ethernet input, DVB-ASI and SMPTE-310M BNC input
- UDP/RTP IP ethernet output and DVB-ASI output
- MPEG-2 TS support

# Mobile

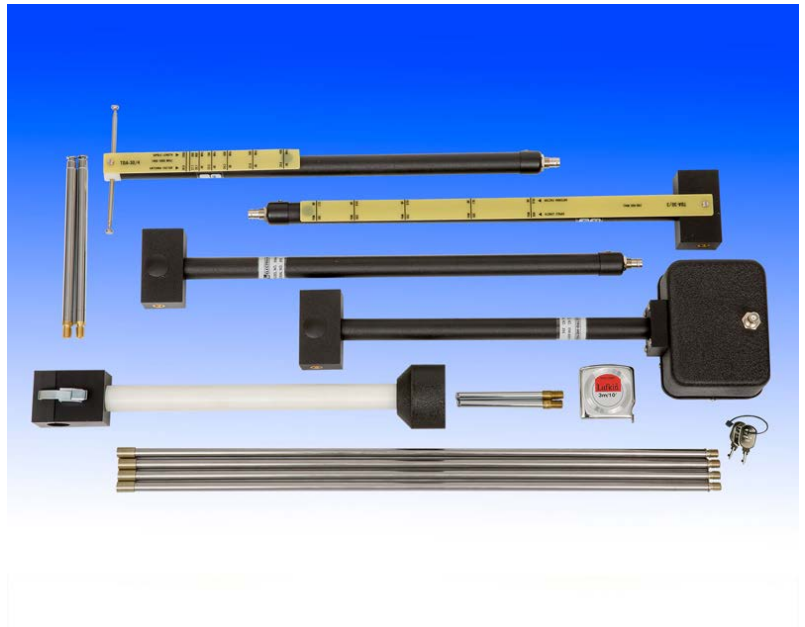
- Handheld Devices – 2yrs?
  - Korea
  - India
- Unlocked Imports
- Automotive
  - Add on to Console

# Measurement Equipment

- Patch Bay
  - Amplifier
  - Gain Set
  - Channel Filters (14-36,46,48…)
  - “Off Air” Receivers

# Measurement Equipment

- Antennas
  - FCC Calibrated Reference Dipoles (V&H) on mast
  - Rooftop Omni

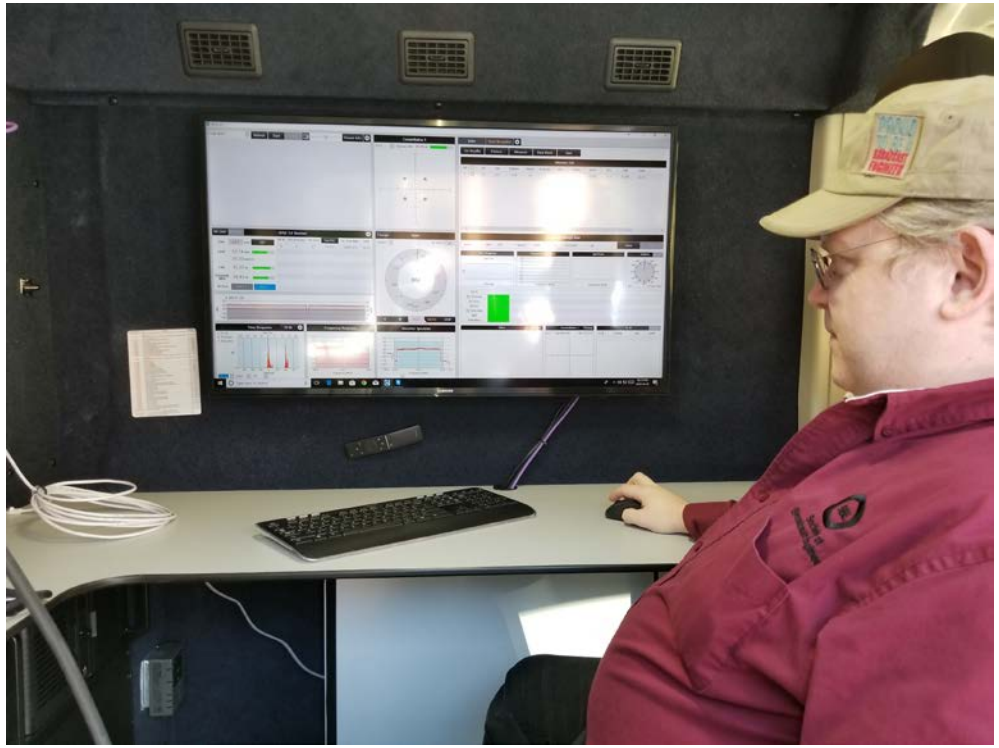


# Measurement Equipment

- Vehicle
  - Comfortable, Agile, Flexible
  - 2016 Ram ProMaster 1500 modified by Accelerated Media Technologies -- Auburn, MA
  - Generator, Heat, Air, Seats two
  - All the safety gear required/desired
    - Mast alarms
    - Fall Protection
    - Equipment Restraints
    - Lojack
    - Lighting

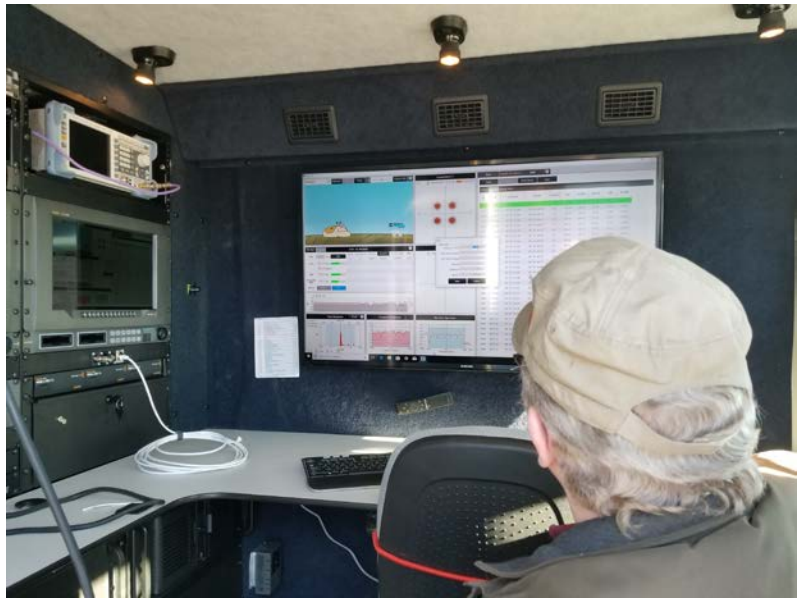
# Measurement Equipment

- TV Monitors
- Video Recorders
- Stream Recorders
- I/Q Recorders

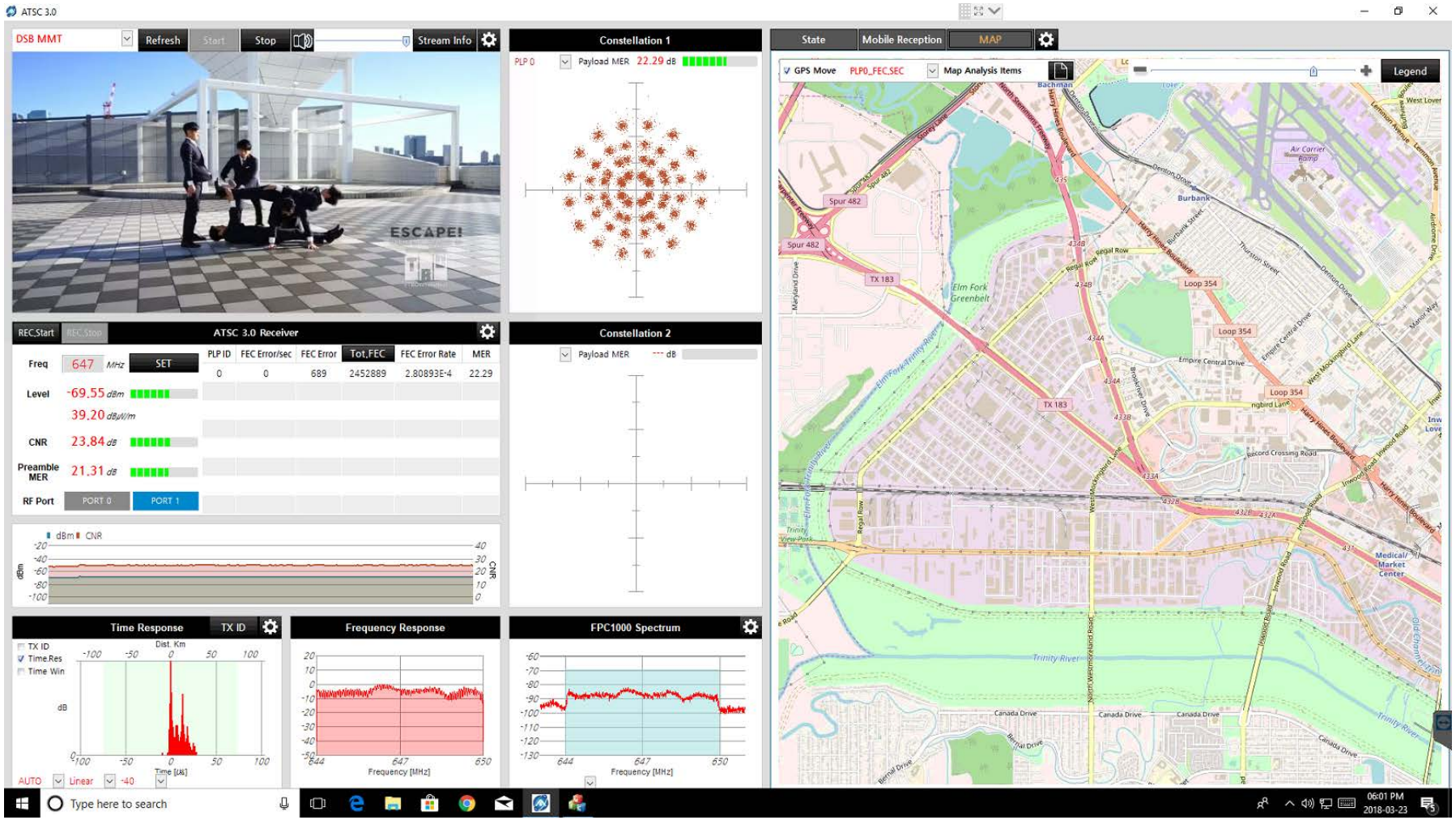


# Measurement Equipment

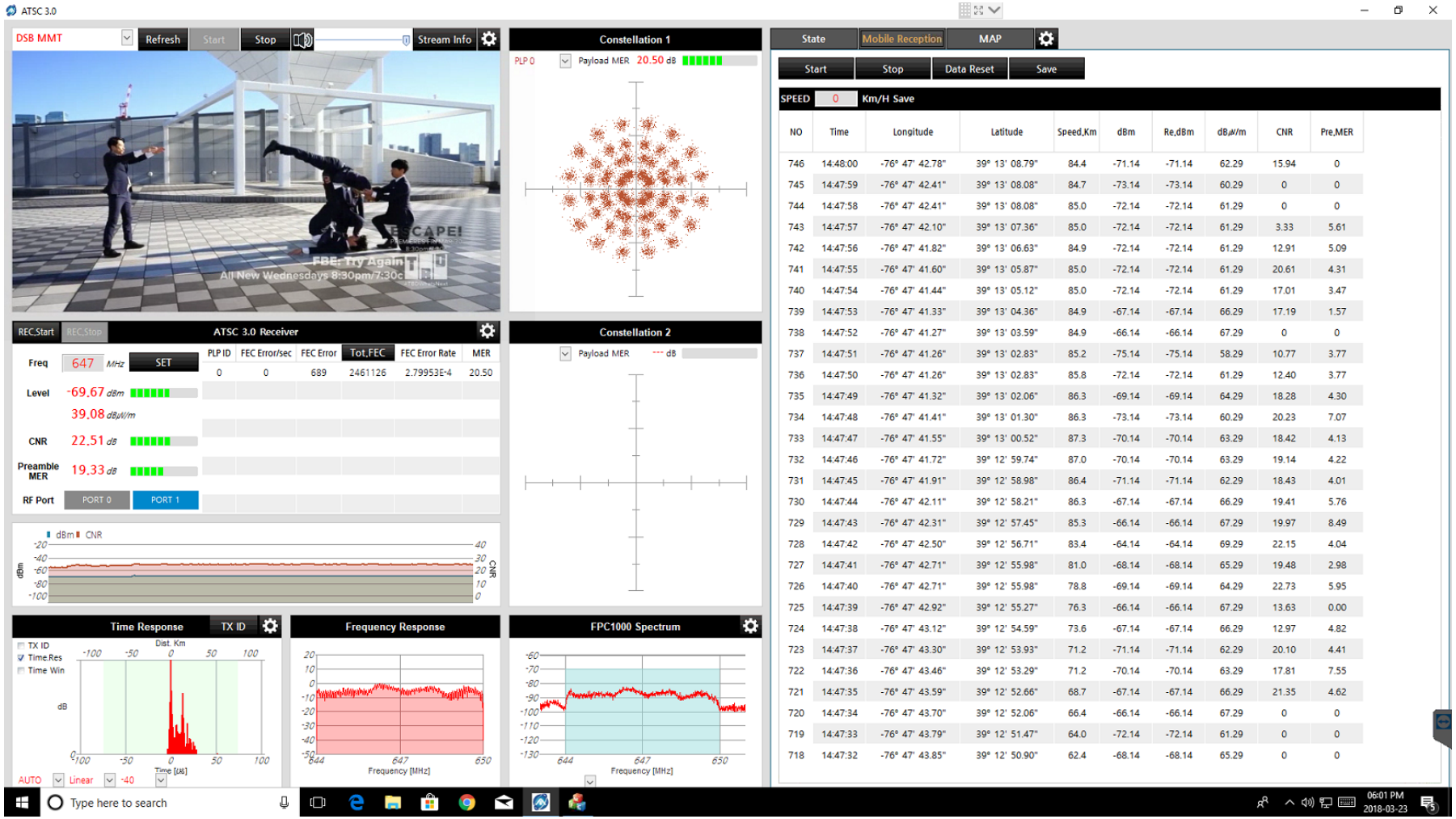
- Receiver
  - Clever Logic (2)
  - Spectrum Analyzer
  - DekTec
  - Various “dongles”
- IMAS software Suite
  - GPS location
- Enensys Lab Module



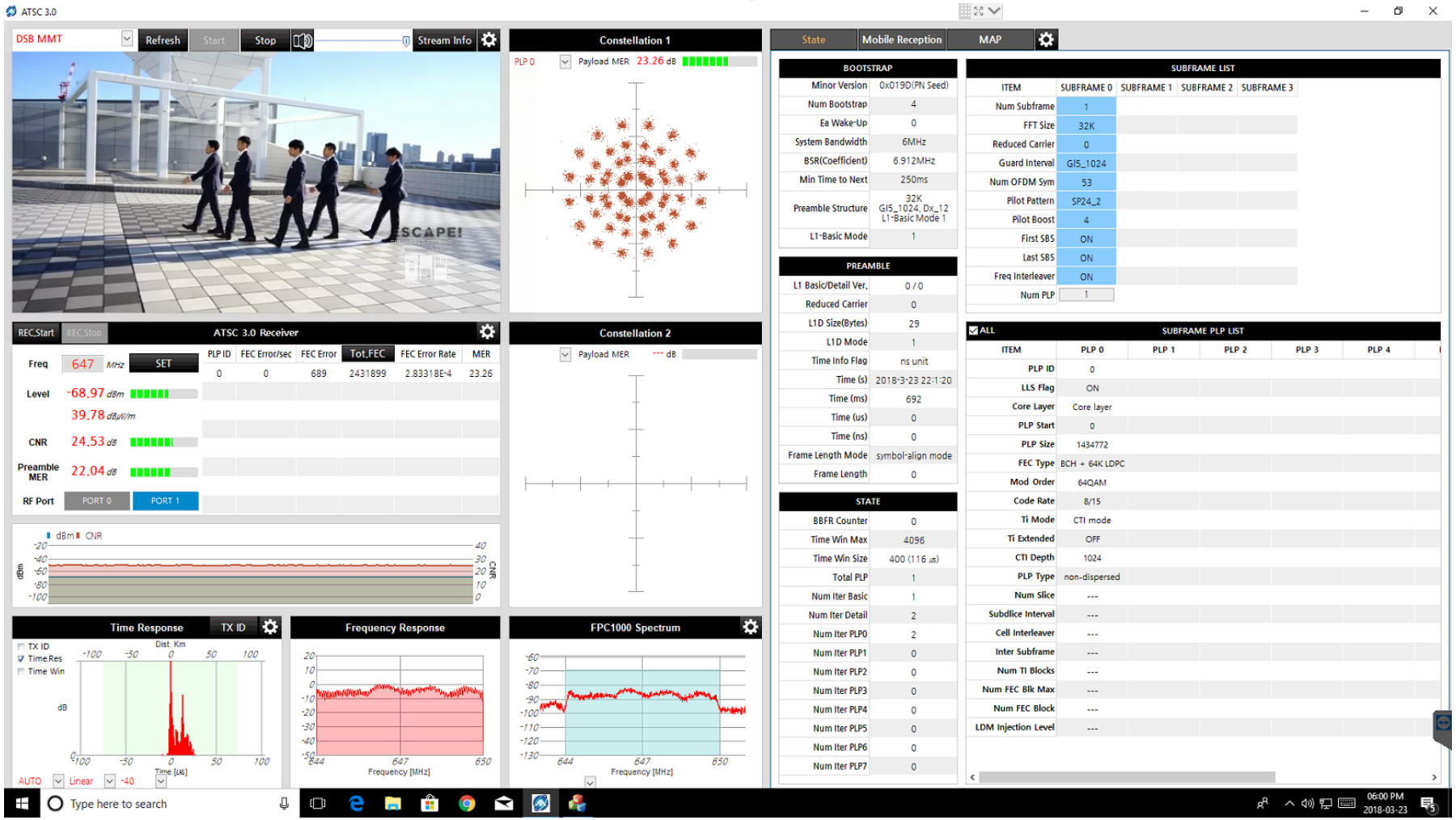
# IMAS

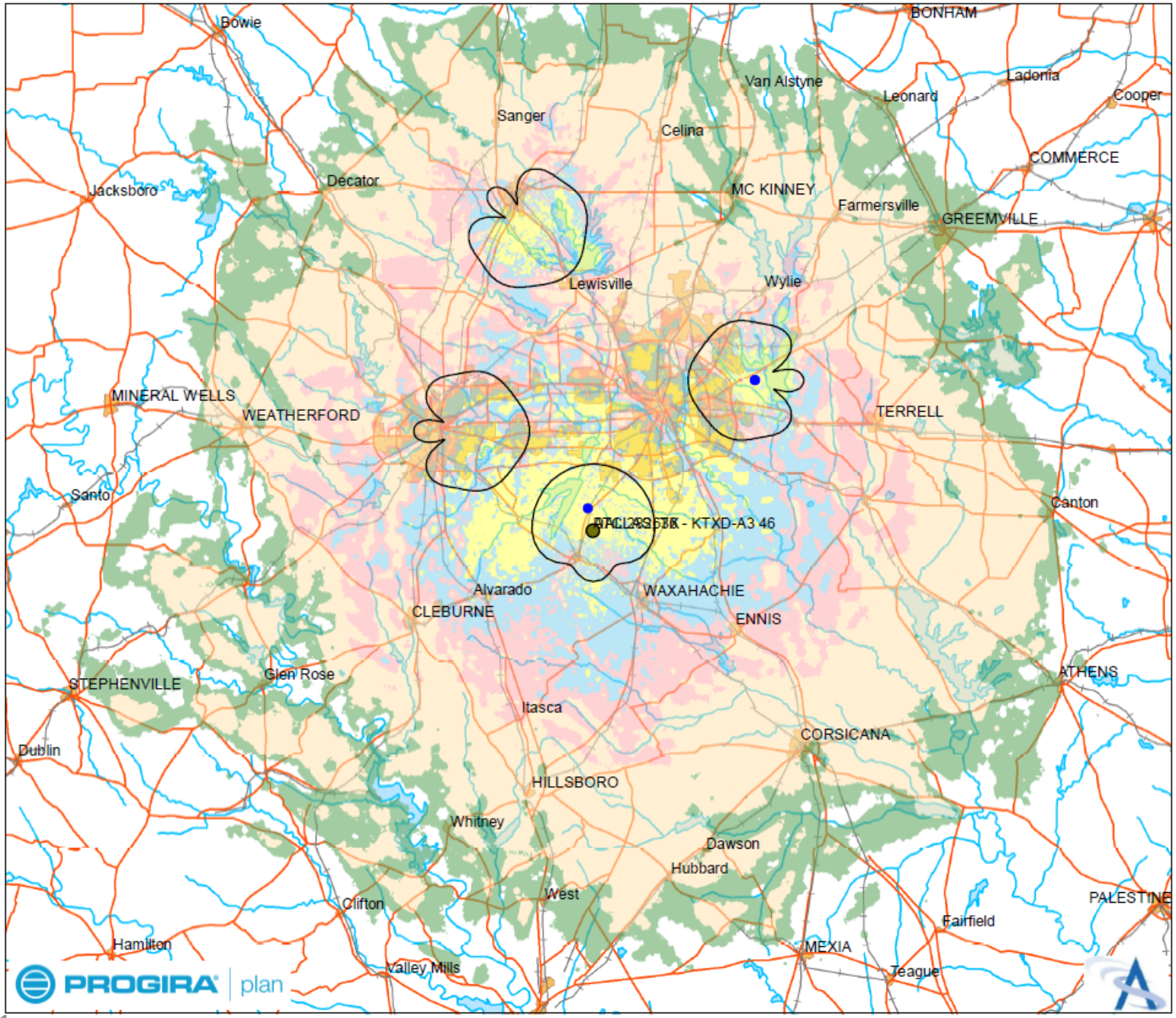

ATSC 3.0
DSB MMT
Refresh
Start
Stop
Stream Info
Constellation 1
PLP 0
Payload MER 22.29 dB
ESCAPE!
REC.Start
REC.Stop
ATSC 3.0 Receiver
Freq 647 MHz SET
Level -69.55 dBm
39.20 dBµV/m
CNR 23.84 dB
Preamble MER 21.31 dB
RF Port PORT 0 PORT 1
PLP ID FEC Error/sec FEC Error Tot.FEC FEC Error Rate MER
0 0 689 2452889 2.80893E-4 22.29
Constellation 2
Payload MER --- dB
dBm CNR
Time Response
TX ID
Time Res
Time Win
Dist. Km
Time [µs]
Frequency Response
Frequency [MHz]
FPC1000 Spectrum
Frequency [MHz]
AUTO Linear -40
State
Mobile Reception
MAP
GPS Move
PLP0_FEC.SEC
Map Analysis Items
Legend
Type here to search
06:01 PM
2018-03-23

# IMAS

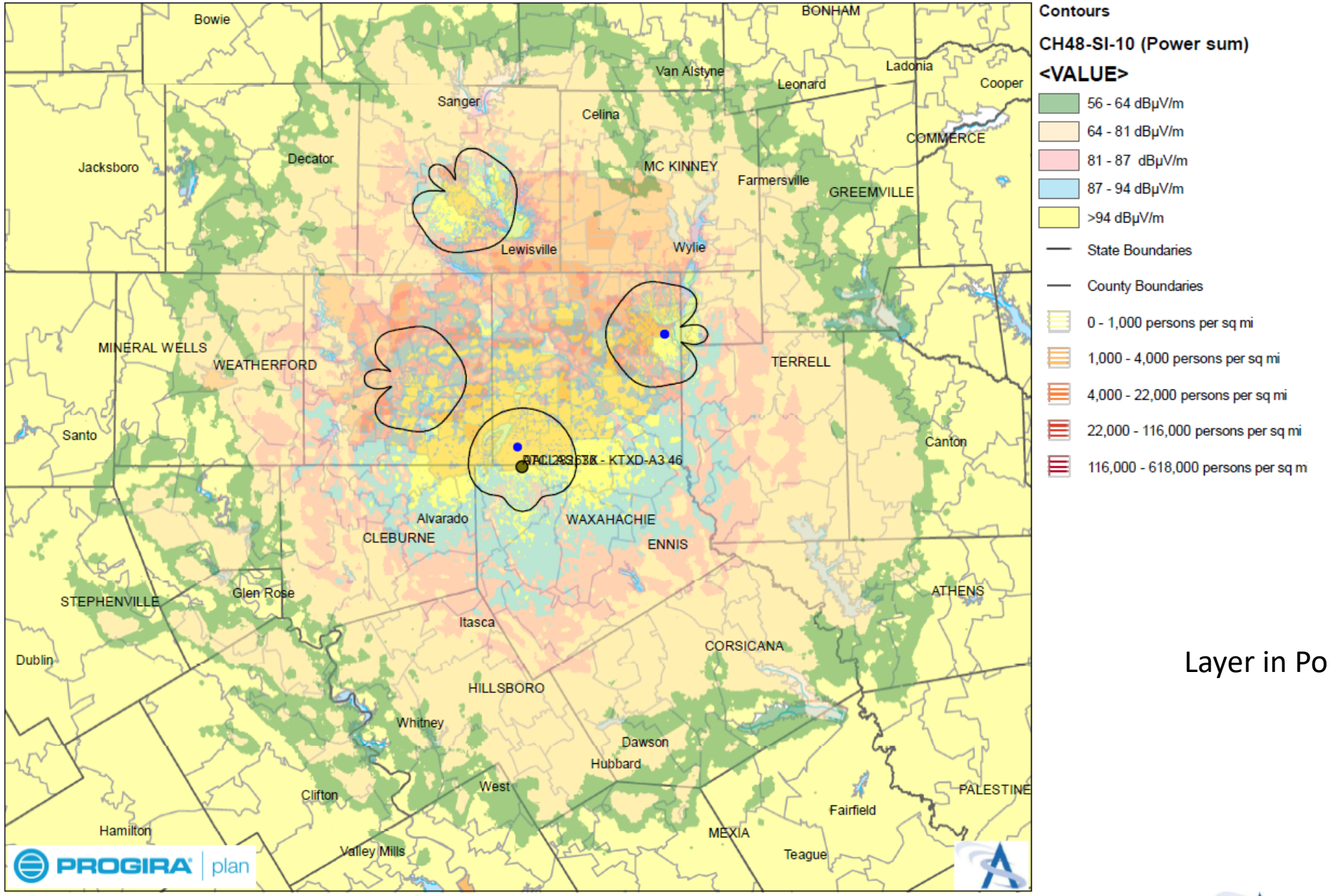

ATSC 3.0
DSB MMT
Refresh
Start
Stop
Stream Info
Constellation 1
PLP 0
Payload MER 20.50 dB
State
Mobile Reception
MAP
Start
Stop
Data Reset
Save
SPEED 0 Km/H Save
NO Time Longitude Latitude Speed,Km dBm Re,dBm dBμV/m CNR Pre,MER
746 14:48:00 -76° 47' 42.78" 39° 13' 08.79" 84.4 -71.14 -71.14 62.29 15.94 0
745 14:47:59 -76° 47' 42.41" 39° 13' 08.08" 84.7 -73.14 -73.14 60.29 0 0
744 14:47:58 -76° 47' 42.41" 39° 13' 08.08" 85.0 -72.14 -72.14 61.29 0 0
743 14:47:57 -76° 47' 42.10" 39° 13' 07.36" 85.0 -72.14 -72.14 61.29 3.33 5.61
742 14:47:56 -76° 47' 41.82" 39° 13' 06.63" 84.9 -72.14 -72.14 61.29 12.91 5.09
741 14:47:55 -76° 47' 41.60" 39° 13' 05.87" 85.0 -72.14 -72.14 61.29 20.61 4.31
740 14:47:54 -76° 47' 41.44" 39° 13' 05.12" 85.0 -72.14 -72.14 61.29 17.01 3.47
739 14:47:53 -76° 47' 41.33" 39° 13' 04.36" 84.9 -67.14 -67.14 66.29 17.19 1.57
738 14:47:52 -76° 47' 41.27" 39° 13' 03.59" 84.9 -66.14 -66.14 67.29 0 0
737 14:47:51 -76° 47' 41.26" 39° 13' 02.83" 85.2 -75.14 -75.14 58.29 10.77 3.77
736 14:47:50 -76° 47' 41.26" 39° 13' 02.83" 85.8 -72.14 -72.14 61.29 12.40 3.77
735 14:47:49 -76° 47' 41.32" 39° 13' 02.06" 86.3 -69.14 -69.14 64.29 18.28 4.30
734 14:47:48 -76° 47' 41.41" 39° 13' 01.30" 86.3 -73.14 -73.14 60.29 20.23 7.07
733 14:47:47 -76° 47' 41.55" 39° 13' 00.52" 87.3 -70.14 -70.14 63.29 18.42 4.13
732 14:47:46 -76° 47' 41.72" 39° 12' 59.74" 87.0 -70.14 -70.14 63.29 19.14 4.22
731 14:47:45 -76° 47' 41.91" 39° 12' 58.98" 86.4 -71.14 -71.14 62.29 18.43 4.01
730 14:47:44 -76° 47' 42.11" 39° 12' 58.21" 86.3 -67.14 -67.14 66.29 19.41 5.76
729 14:47:43 -76° 47' 42.31" 39° 12' 57.45" 85.3 -66.14 -66.14 67.29 19.97 8.49
728 14:47:42 -76° 47' 42.50" 39° 12' 56.71" 83.4 -64.14 -64.14 69.29 22.15 4.04
727 14:47:41 -76° 47' 42.71" 39° 12' 55.98" 81.0 -68.14 -68.14 65.29 19.48 2.98
726 14:47:40 -76° 47' 42.71" 39° 12' 55.98" 78.8 -69.14 -69.14 64.29 22.73 5.95
725 14:47:39 -76° 47' 42.92" 39° 12' 55.27" 76.3 -66.14 -66.14 67.29 13.63 0.00
724 14:47:38 -76° 47' 43.12" 39° 12' 54.59" 73.6 -67.14 -67.14 66.29 12.97 4.82
723 14:47:37 -76° 47' 43.30" 39° 12' 53.93" 71.2 -71.14 -71.14 62.29 20.10 4.41
722 14:47:36 -76° 47' 43.46" 39° 12' 53.29" 71.2 -70.14 -70.14 63.29 17.81 7.55
721 14:47:35 -76° 47' 43.59" 39° 12' 52.66" 68.7 -67.14 -67.14 66.29 21.35 4.62
720 14:47:34 -76° 47' 43.70" 39° 12' 52.06" 66.4 -66.14 -66.14 67.29 0 0
719 14:47:33 -76° 47' 43.79" 39° 12' 51.47" 64.0 -72.14 -72.14 61.29 0 0
718 14:47:32 -76° 47' 43.85" 39° 12' 50.90" 62.4 -68.14 -68.14 65.29 0 0
REC.Start
REC.Stop
ATSC 3.0 Receiver
Freq 647 MHz SET
Level -69.67 dBm
39.08 dBμV/m
CNR 22.51 dB
Preamble MER 19.33 dB
RF Port PORT 0 PORT 1
PLP ID FEC Error/sec FEC Error Tot.FEC FEC Error Rate MER
0 0 689 2461126 2.79953E-4 20.50
Constellation 2
Payload MER --- dB
dBm CNR
Time Response
TX ID
Time.Res
Time Win
Dist. Km
Time [μs]
Frequency Response
Frequency [MHz]
FPC1000 Spectrum
Frequency [MHz]
AUTO
Linear
-40
Type here to search
06:01 PM
2018-03-23

# IMAS

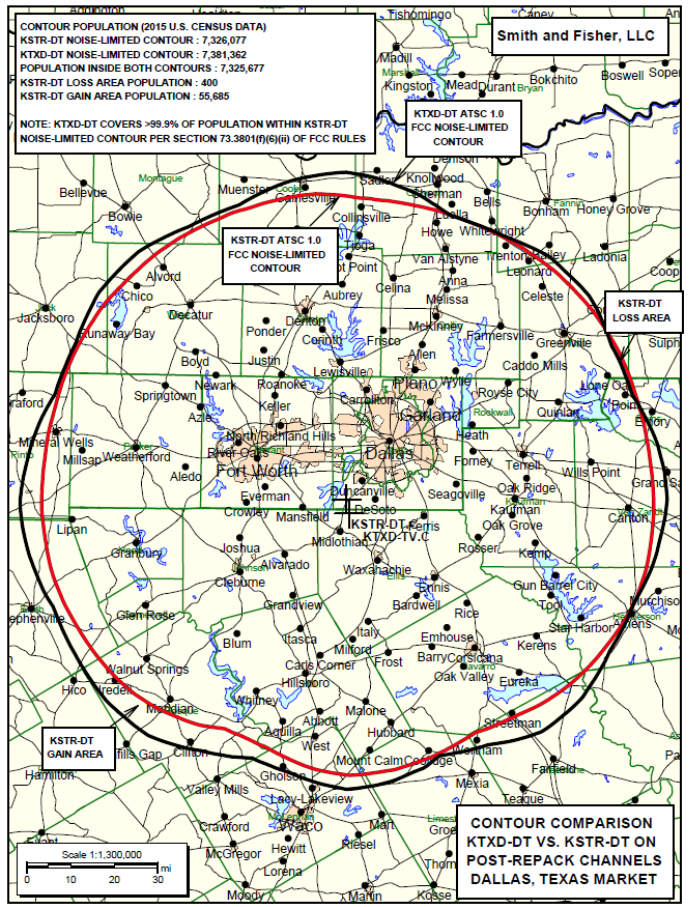

ATSC 3.0
DSB MMT
Refresh
Start
Stop
Stream Info
Constellation 1
PLP 0
Payload MER 23.26 dB
State
Mobile Reception
MAP
BOOTSTRAP
Minor Version 0x019D(PN Seed)
Num Bootstrap 4
Ea Wake-Up 0
System Bandwidth 6MHz
BSR(Coefficient) 6.912MHz
Min Time to Next 250ms
Preamble Structure 32K GI5_1024, Dx_12 L1-Basic Mode 1
L1-Basic Mode 1
SUBFRAME LIST
ITEM SUBFRAME 0 SUBFRAME 1 SUBFRAME 2 SUBFRAME 3
Num Subframe 1
FFT Size 32K
Reduced Carrier 0
Guard Interval GI5_1024
Num OFDM Sym 53
Pilot Pattern SP24_2
Pilot Boost 4
First SBS ON
Last SBS ON
Freq Interleaver ON
Num PLP 1
REC.Start
REC.Stop
ATSC 3.0 Receiver
Freq 647 MHz SET
Level -68.97 dBm
39.78 dBμV/m
CNR 24.53 dB
Preamble MER 22.04 dB
RF Port PORT 0 PORT 1
PLP ID FEC Error/sec FEC Error Tot.FEC FEC Error Rate MER
0 0 689 2431899 2.83318E-4 23.26
Constellation 2
Payload MER --- dB
PREAMBLE
L1 Basic/Detail Ver. 0 / 0
Reduced Carrier 0
L1D Size(Bytes) 29
L1D Mode 1
Time Info Flag ns unit
Time (s) 2018-3-23 22:1:20
Time (ms) 692
Time (us) 0
Time (ns) 0
Frame Length Mode symbol-align mode
Frame Length 0
ALL
SUBFRAME PLP LIST
ITEM PLP 0 PLP 1 PLP 2 PLP 3 PLP 4
PLP ID 0
LLS Flag ON
Core Layer Core layer
PLP Start 0
PLP Size 1434772
FEC Type BCH + 64K LDPC
Mod Order 64QAM
Code Rate 8/15
Ti Mode CTI mode
Ti Extended OFF
CTI Depth 1024
PLP Type non-dispersed
Num Slice ---
Subdlice Interval ---
Cell Interleaver ---
Inter Subframe ---
Num TI Blocks ---
Num FEC Blk Max ---
Num FEC Block ---
LDM Injection Level ---
STATE
BBFR Counter 0
Time Win Max 4096
Time Win Size 400 (116 μs)
Total PLP 1
Num Iter Basic 1
Num Iter Detail 2
Num Iter PLP0 2
Num Iter PLP1 0
Num Iter PLP2 0
Num Iter PLP3 0
Num Iter PLP4 0
Num Iter PLP5 0
Num Iter PLP6 0
Num Iter PLP7 0
dBm CNR
Time Response
TX ID
Time.Res
Time Win
Dist. Km
Time [μs]
AUTO Linear -40
Frequency Response
Frequency [MHz]
FPC1000 Spectrum
Frequency [MHz]
Type here to search
06:00 PM
2018-03-23

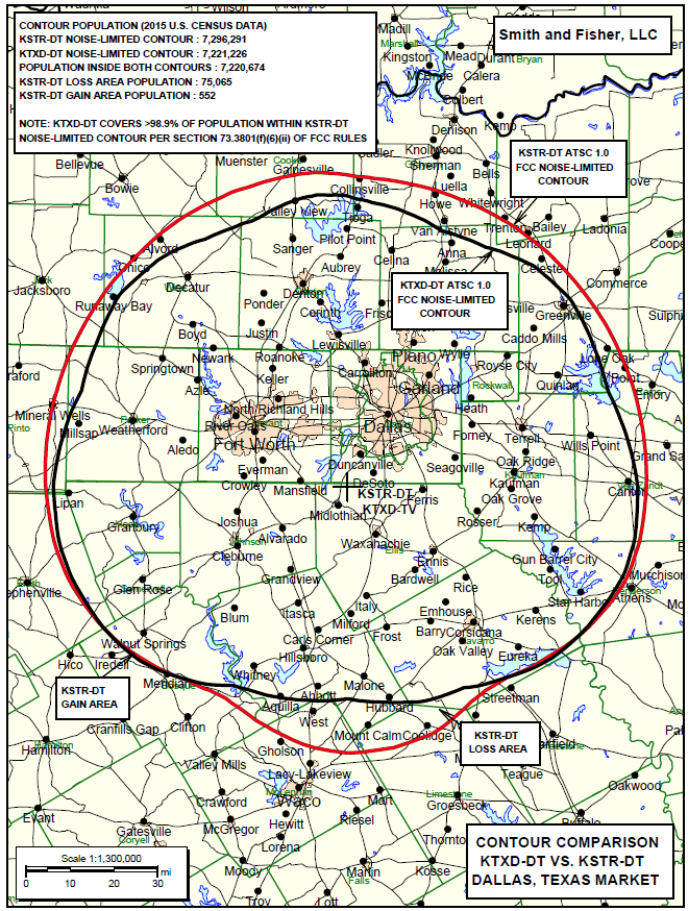


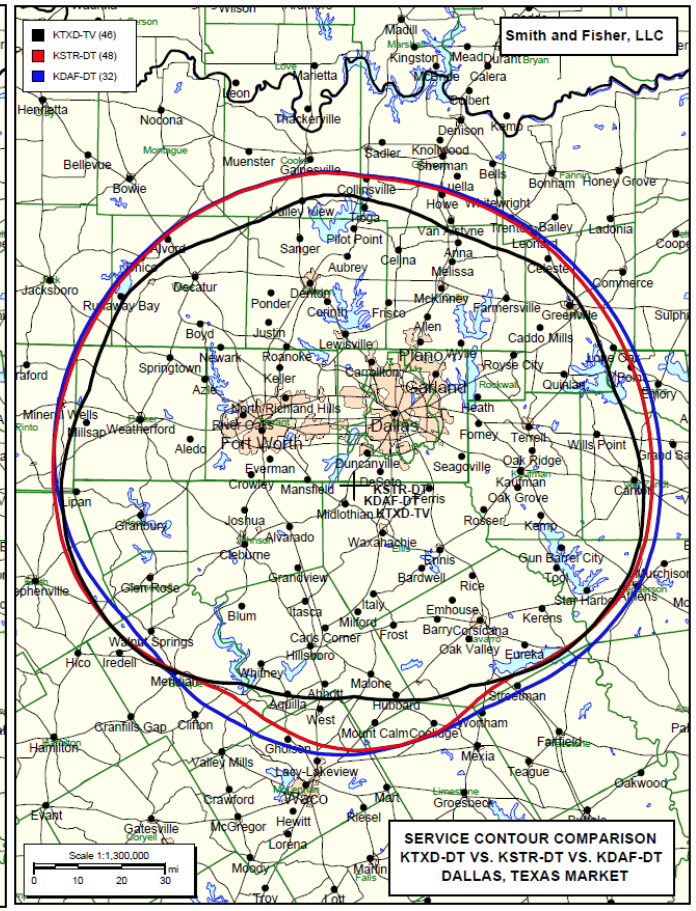

Sum of all Power




Layer in Population


CONTOUR POPULATION (2015 U.S. CENSUS DATA)
KSTR-DT NOISE-LIMITED CONTOUR : 7,326,077
KTXD-DT NOISE-LIMITED CONTOUR : 7,381,362
POPULATION INSIDE BOTH CONTOURS : 7,325,677
KSTR-DT LOSS AREA POPULATION : 400
KSTR-DT GAIN AREA POPULATION : 55,685
NOTE: KTXD-DT COVERS >99.9% OF POPULATION WITHIN KSTR-DT NOISE-LIMITED CONTOUR PER SECTION 73.3801(f)(6)(ii) OF FCC RULES
Smith and Fisher, LLC
KTXD-DT ATSC 1.0 FCC NOISE-LIMITED CONTOUR
KSTR-DT ATSC 1.0 FCC NOISE-LIMITED CONTOUR
KSTR-DT LOSS AREA
KSTR-DT GAIN AREA
KSTR-DT
KTXD-TV.C
CONTOUR COMPARISON KTXD-DT VS. KSTR-DT ON POST-REPACK CHANNELS DALLAS, TEXAS MARKET


CONTOUR POPULATION (2015 U.S. CENSUS DATA)
KSTR-DT NOISE-LIMITED CONTOUR : 7,296,291
KTXD-DT NOISE-LIMITED CONTOUR : 7,221,226
POPULATION INSIDE BOTH CONTOURS : 7,220,674
KSTR-DT LOSS AREA POPULATION : 75,065
KSTR-DT GAIN AREA POPULATION : 552
NOTE: KTXD-DT COVERS >98.9% OF POPULATION WITHIN KSTR-DT NOISE-LIMITED CONTOUR PER SECTION 73.3801(f)(6)(ii) OF FCC RULES
Smith and Fisher, LLC
KTXD-DT ATSC 1.0 FCC NOISE-LIMITED CONTOUR
KSTR-DT ATSC 1.0 FCC NOISE-LIMITED CONTOUR
KSTR-DT GAIN AREA
KSTR-DT LOSS AREA
KSTR-DT
KTXD-TV
CONTOUR COMPARISON KTXD-DT VS. KSTR-DT DALLAS, TEXAS MARKET


KTXD-TV (46)
KSTR-DT (48)
KDAF-DT (32)
Smith and Fisher, LLC
KSTR-DT
KDAF-DT
KTXD-TV
SERVICE CONTOUR COMPARISON KTXD-DT VS. KSTR-DT VS. KDAF-DT DALLAS, TEXAS MARKET

# *NextGen TV*

- I. Sinclair – ONEMedia
- II. Spectrum
- III. Standard
- IV. Transmission
- V. Platform (s)
- VI. Business
- VII. Media
- VIII. **Significant and Useful Tangents**

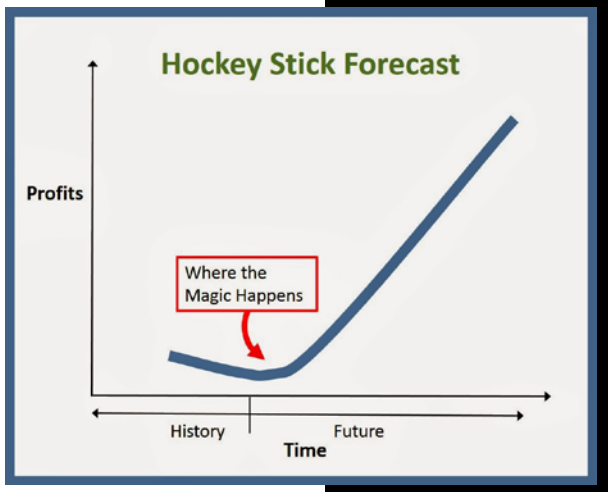
- Historical
- Standard
  - Shannon
- OFDM
  - GI
- LDM
- Crest Factor
- Antenna
- AEA
- Radio on NextGen
- NextGen TV Station
- What's Available to Receive 3.0?
- **Adoption**
- Dallas Test SFN

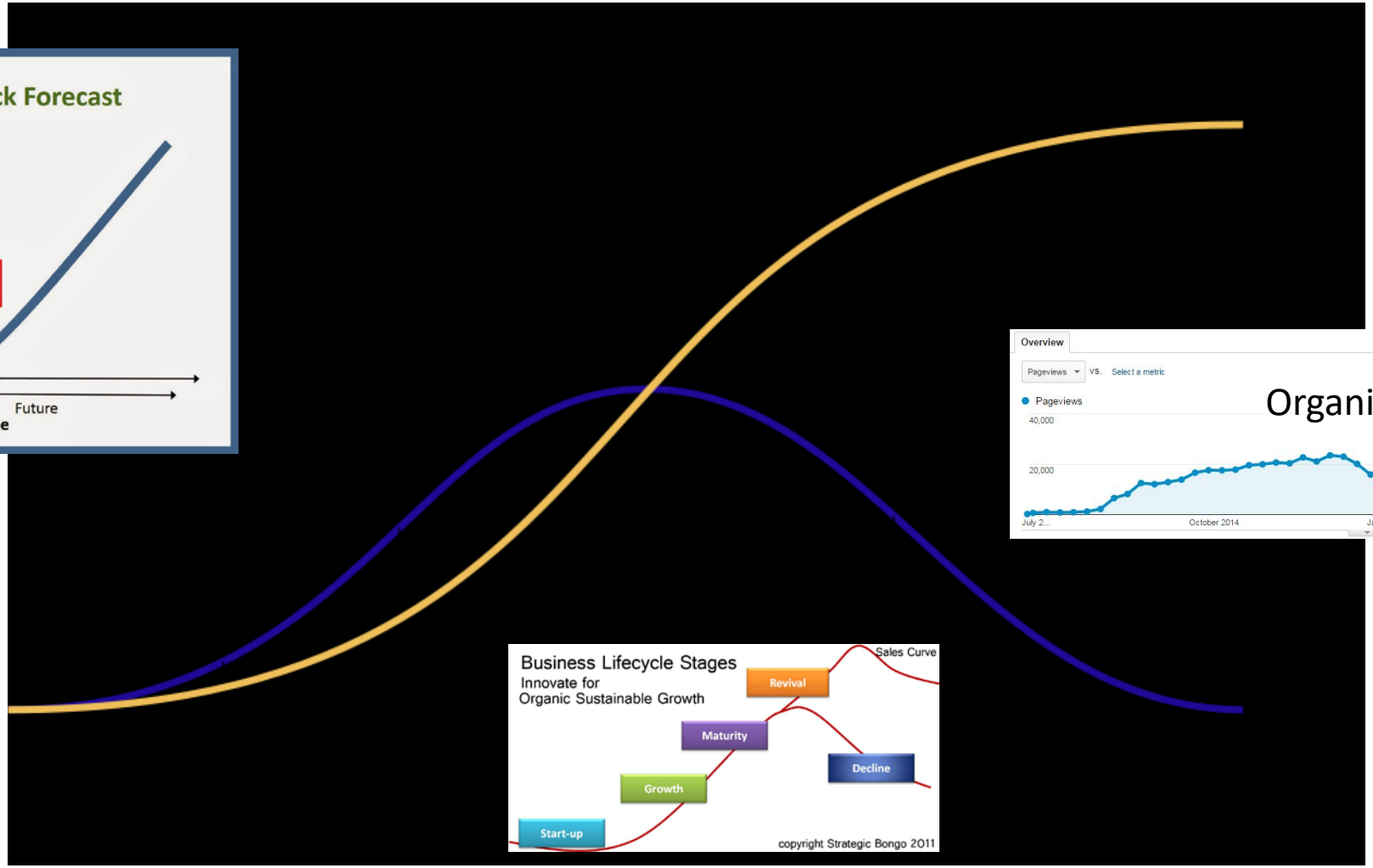


ONEMedia
OPEN NETWORK ENABLED

SINCLAIR
BROADCAST GROUP

# Incentivization



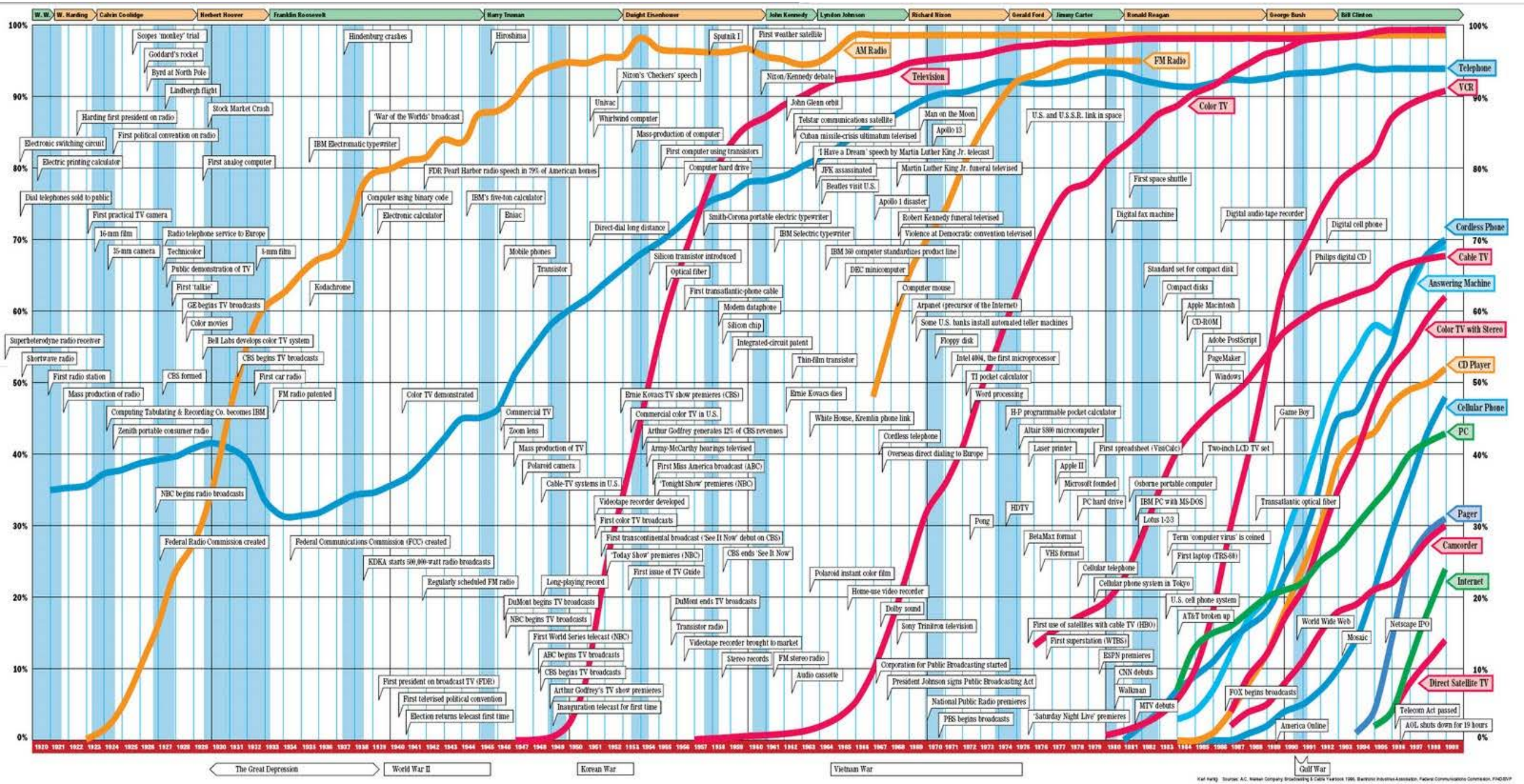

Organic Growth

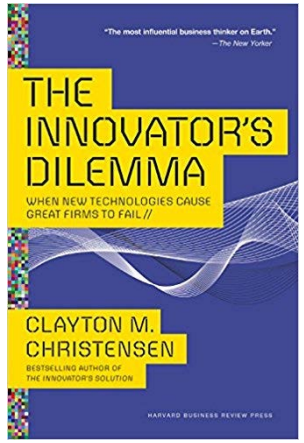





ONEMedia
OPEN NETWORK ENABLED

SINCLAIR
BROADCAST GROUP


W.W.
W. Harding
Calvin Coolidge
Herbert Hoover
Franklin Roosevelt
Harry Truman
Dwight Eisenhower
John Kennedy
Lyndon Johnson
Richard Nixon
Gerald Ford
Jimmy Carter
Ronald Reagan
George Bush
Bill Clinton
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Scopes 'monkey' trial
Goddard's rocket
Byrd at North Pole
Lindbergh flight
Stock Market Crash
Harding first president on radio
First political convention on radio
Electronic switching circuit
Electric printing calculator
First analog computer
Dial telephones sold to public
First practical TV camera
16-mm film
35-mm camera
Radio telephone service to Europe
Technicolor
8-mm film
Public demonstration of TV
First 'talkie'
GE begins TV broadcasts
Color movies
Bell Labs develops color TV system
CBS begins TV broadcasts
First car radio
Superheterodyne radio receiver
Shortwave radio
First radio station
CBS formed
Mass production of radio
FM radio patented
Computing Tabulating & Recording Co. becomes IBM
Zenith portable consumer radio
NBC begins radio broadcasts
Federal Radio Commission created
Federal Communications Commission (FCC) created
KDKA starts 500,000-watt radio broadcasts
Regularly scheduled FM radio
First president on broadcast TV (FDR)
First televised political convention
Election returns telecast first time
Hindenburg crashes
'War of the Worlds' broadcast
IBM Electromatic typewriter
FDR Pearl Harbor radio speech in 79% of American homes
Computer using binary code
Electronic calculator
Kodachrome
Color TV demonstrated
Hiroshima
IBM's five-ton calculator
Eniac
Mobile phones
Transistor
Commercial TV
Zoom lens
Mass production of TV
Polaroid camera
Cable-TV systems in U.S.
Videotape recorder developed
First color TV broadcasts
First transcontinental broadcast ('See It Now' debut on CBS)
'Today Show' premieres (NBC)
First issue of TV Guide
Long-playing record
DuMont begins TV broadcasts
NBC begins TV broadcasts
First World Series telecast (NBC)
ABC begins TV broadcasts
CBS begins TV broadcasts
Arthur Godfrey's TV show premieres
Inauguration telecast for first time
Sputnik I
First weather satellite
Nixon's 'Checkers' speech
Univac
Whirlwind computer
Mass-production of computer
First computer using transistors
Computer hard drive
Direct-dial long distance
Smith-Corona portable electric typewriter
Silicon transistor introduced
Optical fiber
First transatlantic-phone cable
Modem dataphone
Silicon chip
Integrated-circuit patent
Thin-film transistor
Ernie Kovacs TV show premieres (CBS)
Commercial color TV in U.S.
Arthur Godfrey generates 12% of CBS revenues
Army-McCarthy hearings televised
First Miss America broadcast (ABC)
'Tonight Show' premieres (NBC)
CBS ends 'See It Now'
DuMont ends TV broadcasts
Transistor radio
Videotape recorder brought to market
Stereo records
FM stereo radio
Audio cassette
Ernie Kovacs dies
White House, Kremlin phone link
Cordless telephone
Overseas direct dialing to Europe
Polaroid instant color film
Home-use video recorder
Dolby sound
Sony Trinitron television
Corporation for Public Broadcasting started
President Johnson signs Public Broadcasting Act
National Public Radio premieres
PBS begins broadcasts
AM Radio
Nixon/Kennedy debate
John Glenn orbit
Telstar communications satellite
Cuban missile-crisis ultimatum televised
'I Have a Dream' speech by Martin Luther King Jr. telecast
JFK assassinated
Beatles visit U.S.
Martin Luther King Jr. funeral televised
Apollo 1 disaster
Robert Kennedy funeral televised
Violence at Democratic convention televised
IBM Selectric typewriter
IBM 360 computer standardizes product line
DEC minicomputer
Computer mouse
Arpanet (precursor of the Internet)
Some U.S. banks install automated teller machines
Floppy disk
Intel 4004, the first microprocessor
TI pocket calculator
Word processing
H-P programmable pocket calculator
Altair 8800 microcomputer
Laser printer
Apple II
Microsoft founded
PC hard drive
Pong
HDTV
BetaMax format
VHS format
Cellular telephone
Cellular phone system in Tokyo
First use of satellites with cable TV (HBO)
First superstation (WTBS)
ESPN premieres
CNN debuts
Walkman
MTV debuts
'Saturday Night Live' premieres
Television
FM Radio
Telephone
VCR
Color TV
U.S. and U.S.S.R. link in space
Man on the Moon
Apollo 13
First space shuttle
Digital fax machine
Digital audio tape recorder
Digital cell phone
Cordless Phone
Philips digital CD
Cable TV
Standard set for compact disk
Compact disks
Apple Macintosh
CD-ROM
Adobe PostScript
PageMaker
Windows
Answering Machine
Color TV with Stereo
CD Player
Cellular Phone
PC
Game Boy
Two-inch LCD TV set
First spreadsheet (VisiCalc)
Osborne portable computer
IBM PC with MS-DOS
Lotus 1-2-3
Transatlantic optical fiber
Term 'computer virus' is coined
First laptop (TRS-80)
U.S. cell phone system
AT&T broken up
Pager
Camcorder
Internet
World Wide Web
Mosaic
Netscape IPO
FOX begins broadcasts
America Online
Direct Satellite TV
Telecom Act passed
AOL shuts down for 19 hours
Gulf War
1920 1921 1922 1923 1924 1925 1926 1927 1928 1929 1930 1931 1932 1933 1934 1935 1936 1937 1938 1939 1940 1941 1942 1943 1944 1945 1946 1947 1948 1949 1950 1951 1952 1953 1954 1955 1956 1957 1958 1959 1960 1961 1962 1963 1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999
The Great Depression
World War II
Korean War
Vietnam War

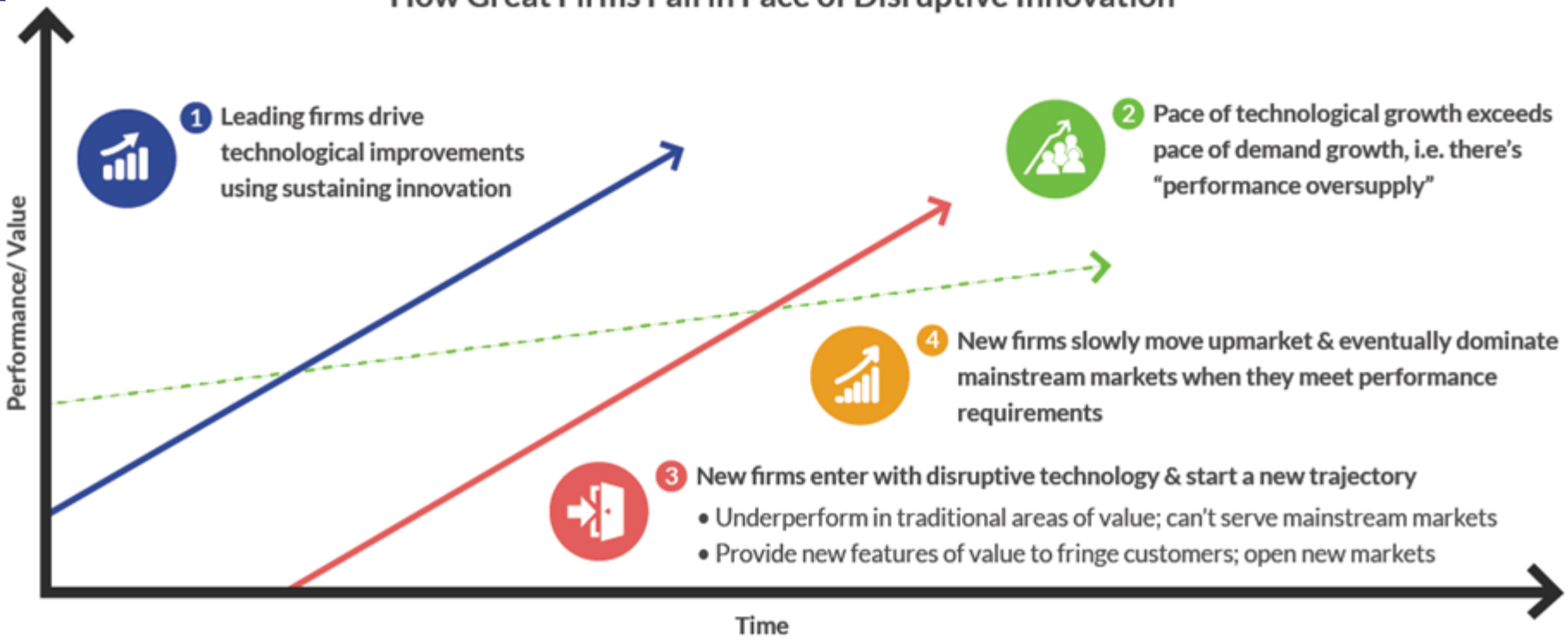



## THE INNOVATOR'S DILEMMA

READINGRAPHICS
ACTIONABLE INSIGHTS IN ONE PAGE

Because established firms consciously (a) listen to the needs of their best customers and (b) focus their investments on innovations with the highest returns, they tend not to commit to disruptive technologies until it is too late.

### How Great Firms Fail in Face of Disruptive Innovation



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- NextGen TV Station
- What's Available to Receive 3.0?
- Adoption
- **Dallas Test SFN**



ONEMedia
OPEN NETWORK ENABLED

SINCLAIR
BROADCAST GROUP

# Why Dallas First?

AMERICAN TOWER

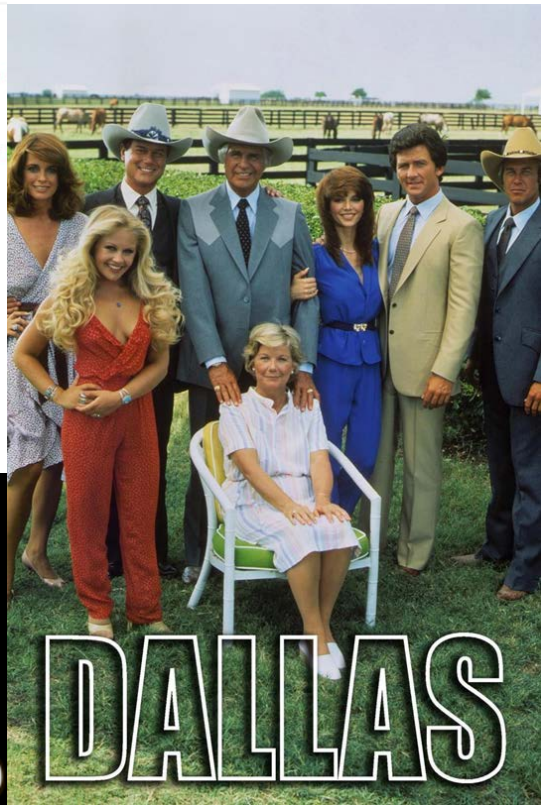
- Relatively Flat
- ATC is Here
- More UHF Slots
- Major Market
- High Tech
- Corridor to Austin
- Social Factors -- BBQ

According to dallasfilmcommission.com

KDFW KXAS-TV WFAA KTVT KERA KTXA

**LOCAL TELEVISION STATIONS**

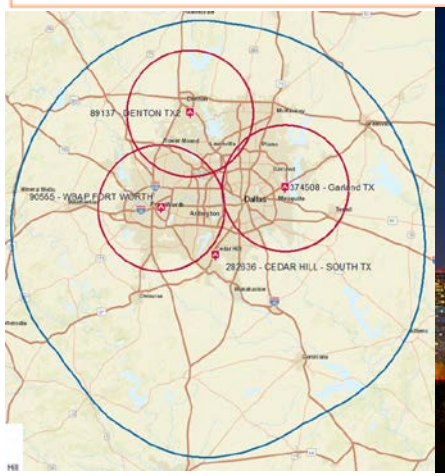
- KDFW – Channel 4. FOX.
- KXAS – Channel 5. NBC.
- WFAA – Channel 8. ABC.
- KTVT – Channel 11. CBS.
- KERA – Channel 13. PBS.
- KTXA – Channel 21. TXA.
- KDAF – Channel 33. CW.
- KUVN – Channel 23. Univision.

# Dallas

- Potential Partners
  - American Tower
  - Univision
  - Tribune
  - Cunningham Broadcast

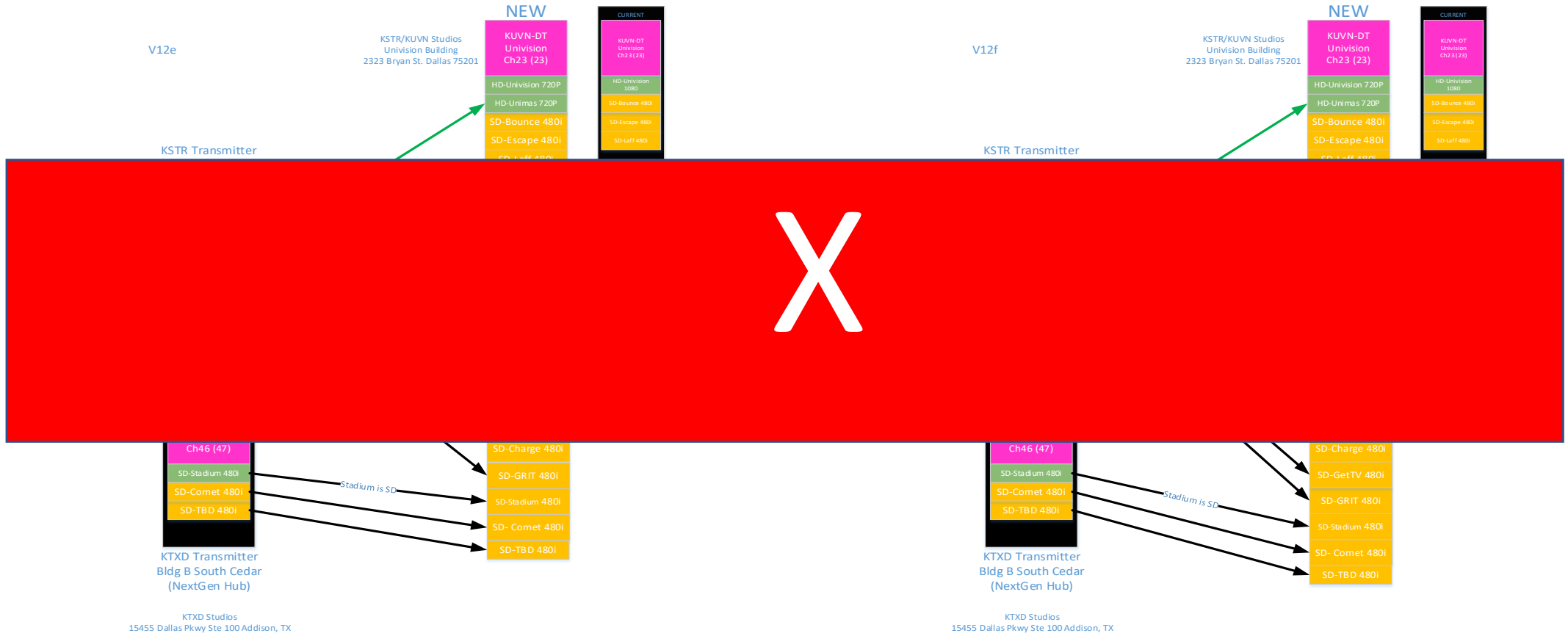
| Dallas | |
|---|---|
| DMA Rank: | #5 |
| Total TV HH: | 2,648,290 |
| % of US TV HH: | 2.36% |
| Fortune 500 HQ: | 21 |




ONEMedia OPEN NETWORK ENABLED

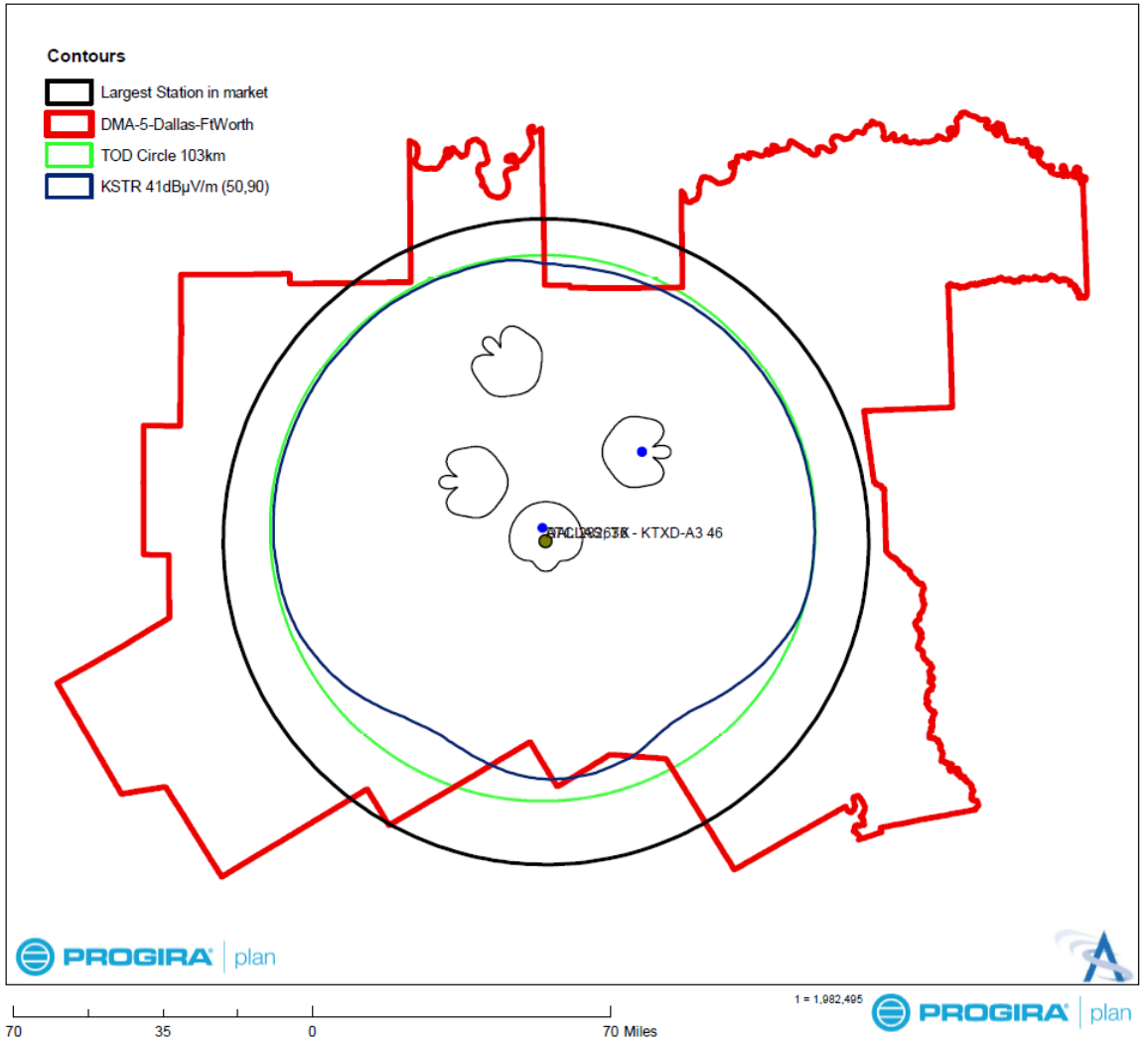
SINCLAIR BROADCAST GROUP

# 1.0 Host -- 12e and 12f



# Spectrum

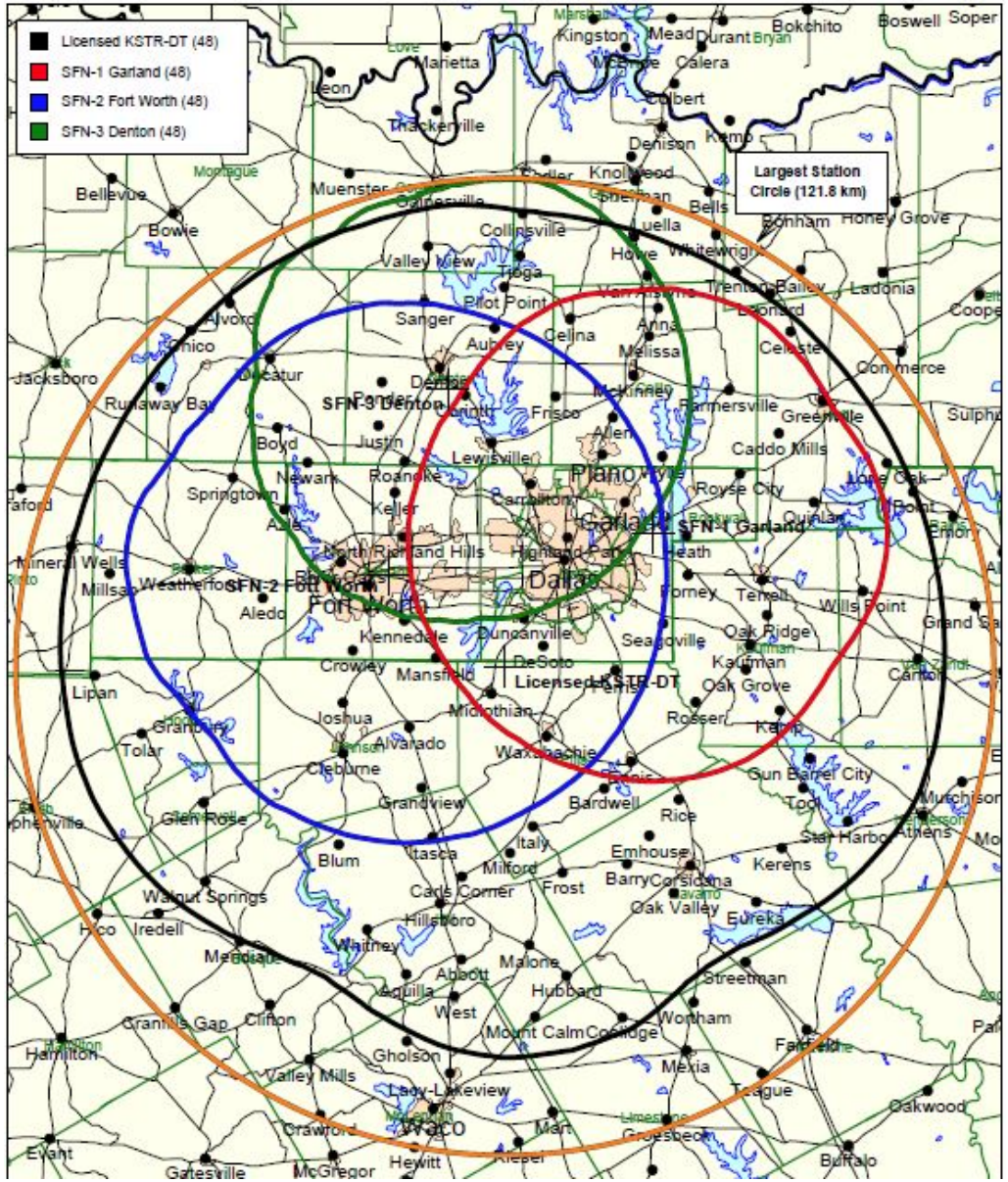
- 3.0 SFN Limits
  - Existing Station's 41 dBuV/M (50,90)
  - Table of Distances (TOD)
  - Largest Station in Market






ONEMedia OPEN NETWORK ENABLED

SINCLAIR BROADCAST GROUP


Licensed KSTR-DT (48)
SFN-1 Garland (48)
SFN-2 Fort Worth (48)
SFN-3 Denton (48)
Largest Station Circle (121.8 km)
SFN-3 Denton
SFN-1 Garland
SFN-2 Fort Worth
Licensed KSTR-DT
Dallas
Fort Worth
Plano
Garland
Waco
Kingston
Mead
Durant
Bokchito
Boswell
Soper
Marietta
Leon
Thackerville
Denison
Colbert
Bellevue
Muenster
Gainesville
Bowie
Collinsville
Valley View
Tioga
Pilot Point
Sanger
Aubrey
Celina
Melissa
Anna
Bonham
Honey Grove
Ladonia
Jacksboro
Runaway Bay
Decatur
Boyd
Justin
Roanoke
Newark
Springtown
Keller
Frisco
McKinney
Farmersville
Greenville
Caddo Mills
Royse City
Lewisville
Carrollton
Weatherford
Millsap
Aledo
Kennedale
Duncanville
Seagoville
Terrell
Wills Point
Oak Ridge
Kaufman
Oak Grove
Crowley
Mansfield
DeSoto
Lipan
Joshua
Alvarado
Cleburne
Midlothian
Waxahachie
Rosser
Tolar
Glen Rose
Grandview
Bardwell
Rice
Italy
Itasca
Milford
Blum
Carls Corner
Frost
Emhouse
Kerens
Oak Valley
Eureka
Walnut Springs
Hillsboro
Whitney
Malone
Abbott
Aquilla
Hubbard
Streetman
West
Mount Calm
Wortham
Granite Gap
Clifton
Hamilton
Gholson
Valley Mills
Mexia
Lake Waco
Crawford
Evant
Hewitt
McGregor
Gatesville
Buffalo
Oakwood
Gun Barrel City
Star Harbor
Athens
Murchison

# SFN Sites

Garland

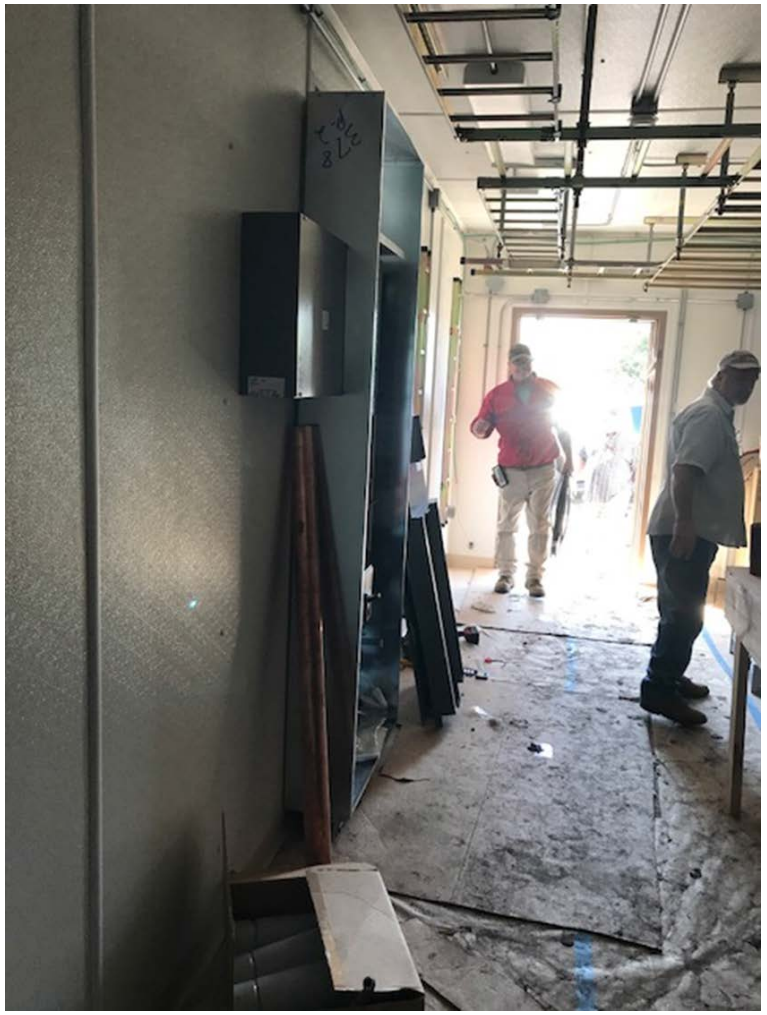
Denton

Fort Worth

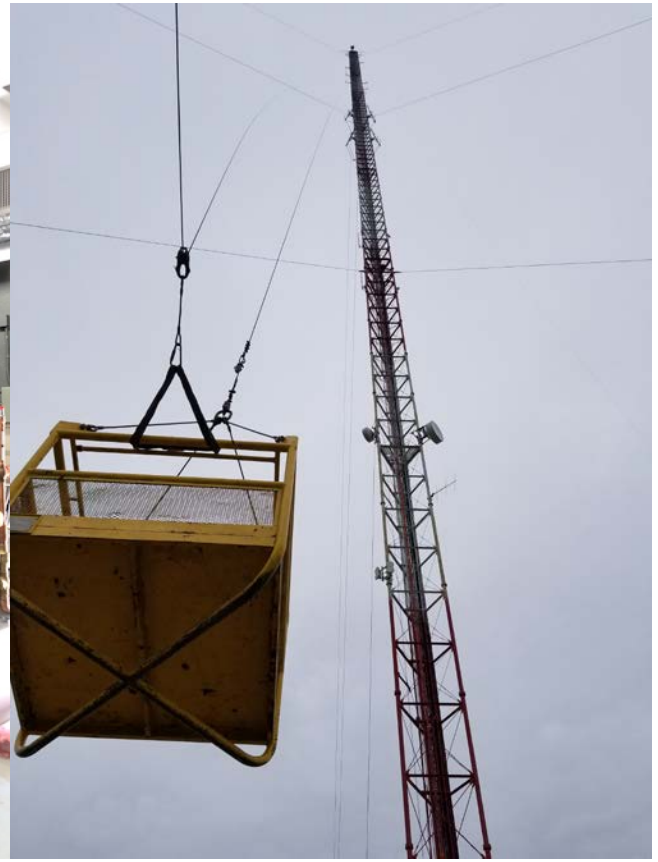
# Garland


AMERICAN TOWER
CORPORATION
SITE NAME: GARLAND TX
SITE NUMBER:
FCC REGISTRATION NUMBER:
877-282-7483
877-ATC-SITE
877-518-6937
877-51-TOWER
NO TRESPASSING
NOTICE
GUIDELINES FOR WORKING IN RADIOFREQUENCY ENVIRONMENTS


Bobcat



# WBAP – Fort Worth



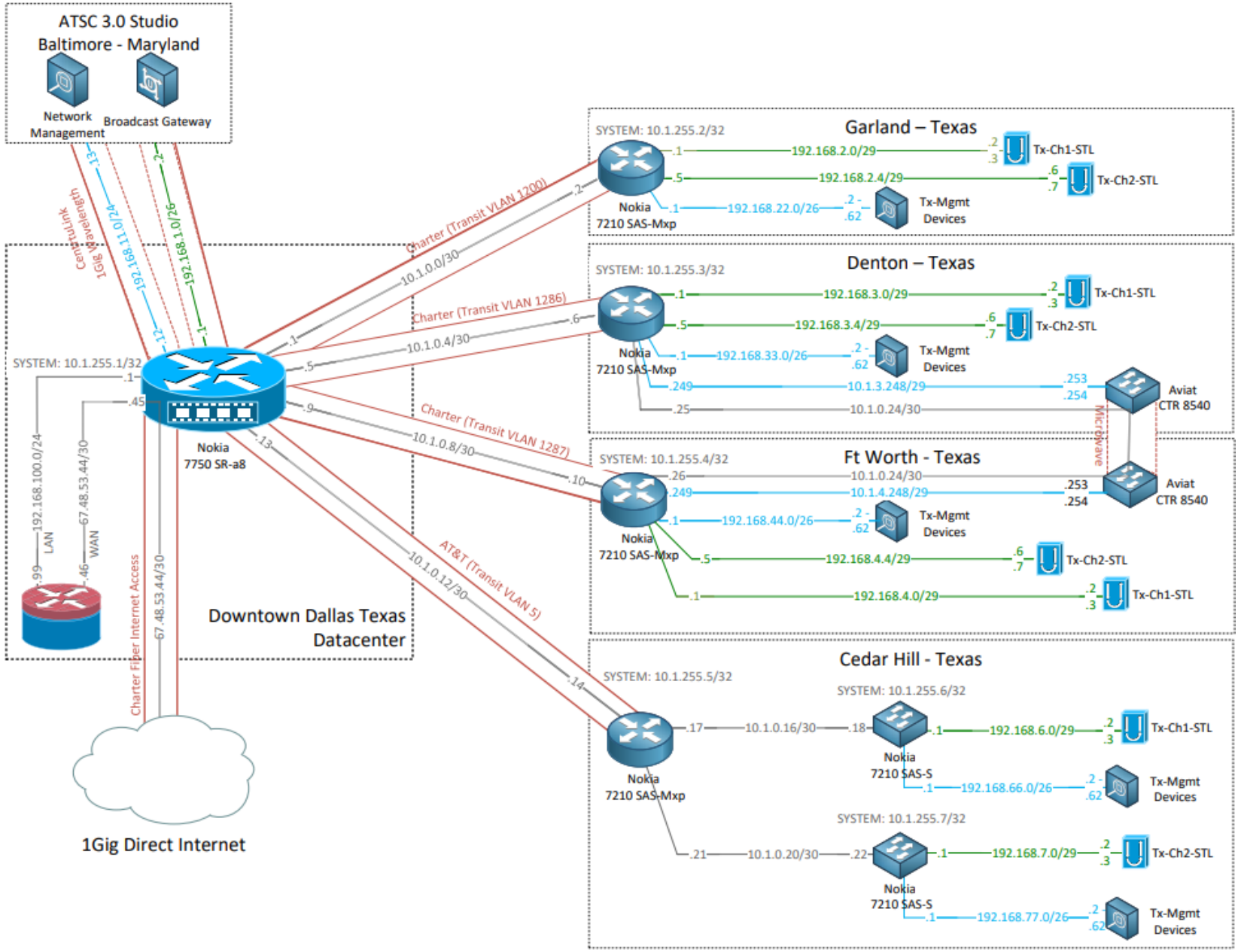

WBAP – Fort Worth

# Denton

# Comark Parallax UHF GTD Rev P2
## Dielectric UWB & Combiners

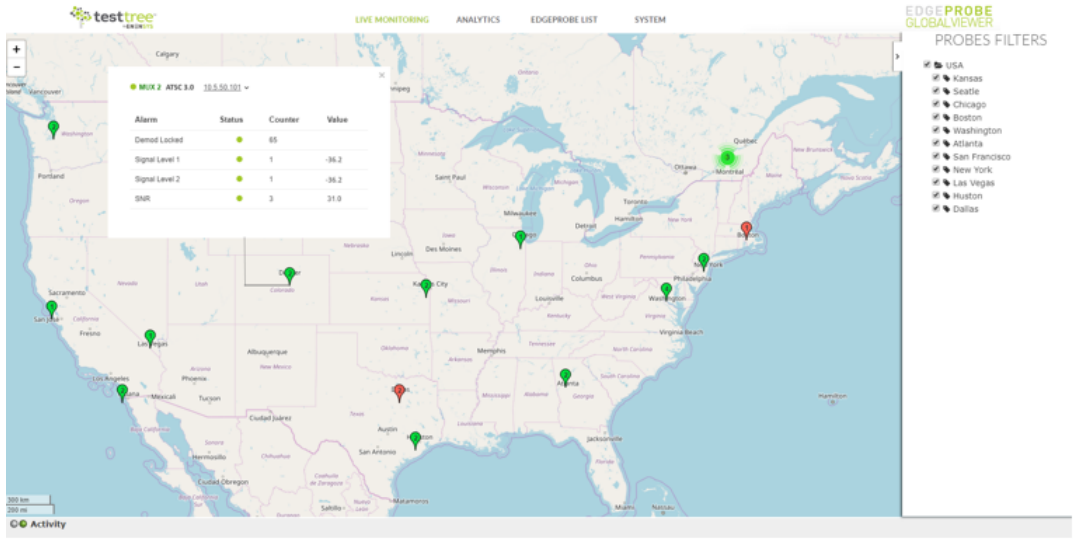
# STL

- Adequate bandwidth
  - ~ 25 Mb/s for 3.0 STL
    - Modulators & Exciters at Transmitter
  - ~ 150 Mb/s for ST2L (I/Q)
    - Exciters at Transmitter, Modulator at hub
- Protocol
  - IP Multicast
- Room for Internet & M&C


ATSC 3.0 Studio
Baltimore - Maryland
Network Management
Broadcast Gateway
CenturyLink 1Gig Wavelength
192.168.11.0/24
192.168.1.0/26
Charter (Transit VLAN 1200)
10.1.0.0/30
Charter (Transit VLAN 1286)
10.1.0.4/30
Charter (Transit VLAN 1287)
10.1.0.8/30
AT&T (Transit VLAN 5)
10.1.0.12/30
SYSTEM: 10.1.255.1/32
Nokia
7750 SR-a8
192.168.100.0/24
LAN
67.48.53.44/30
WAN
Charter Fiber Internet Access
67.48.53.44/30
Downtown Dallas Texas
Datacenter
1Gig Direct Internet
Garland – Texas
SYSTEM: 10.1.255.2/32
Nokia
7210 SAS-Mxp
192.168.2.0/29
Tx-Ch1-STL
192.168.2.4/29
Tx-Ch2-STL
192.168.22.0/26
Tx-Mgmt
Devices
Denton – Texas
SYSTEM: 10.1.255.3/32
Nokia
7210 SAS-Mxp
192.168.3.0/29
Tx-Ch1-STL
192.168.3.4/29
Tx-Ch2-STL
192.168.33.0/26
Tx-Mgmt
Devices
10.1.3.248/29
10.1.0.24/30
Aviat
CTR 8540
Microwave
Ft Worth - Texas
SYSTEM: 10.1.255.4/32
Nokia
7210 SAS-Mxp
10.1.0.24/30
10.1.4.248/29
Aviat
CTR 8540
192.168.44.0/26
Tx-Mgmt
Devices
192.168.4.4/29
Tx-Ch2-STL
192.168.4.0/29
Tx-Ch1-STL
Cedar Hill - Texas
SYSTEM: 10.1.255.5/32
Nokia
7210 SAS-Mxp
10.1.0.16/30
SYSTEM: 10.1.255.6/32
Nokia
7210 SAS-S
192.168.6.0/29
Tx-Ch1-STL
192.168.66.0/26
Tx-Mgmt
Devices
SYSTEM: 10.1.255.7/32
10.1.0.20/30
Nokia
7210 SAS-S
192.168.7.0/29
Tx-Ch2-STL
192.168.77.0/26
Tx-Mgmt
Devices

# 24/7 monitoring ATSC 3.0

## Unified & complete solution under a Global QoS Viewer

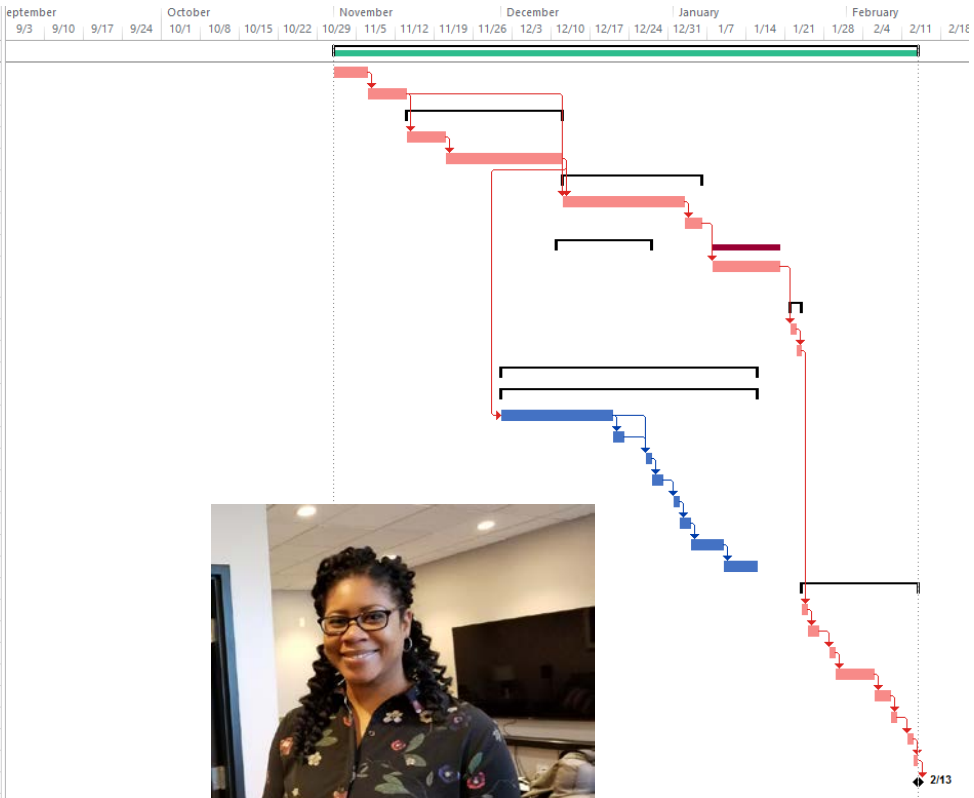




- **Transmission monitoring**
  - RF signal quality
  - SFN synchronization
- **Distribution network monitoring**
  - STL-TP integrity, Network Delay
- **Contribution input monitoring**

# Planning

| | Task Name | Duration | Start | Finish |
|---|---|---|---|---|
| 1 | **ATSC 3.0 - 89137 Denton** | **72 days** | **Wed 11/1/17** | **Tue 2/13/18** |
| 2 | Project Setup | 4 days | Wed 11/1/17 | Mon 11/6/17 |
| 3 | Structural Analysis | 5 days | Tue 11/7/17 | Mon 11/13/17 |
| 4 | A/E Permit Package | **19 days** | **Tue 11/14/17** | **Mon 12/11/17** |
| 5 | Submittal to Jurisdictions | 5 days | Tue 11/14/17 | Mon 11/20/17 |
| 6 | Receive Permits | 14 days | Tue 11/21/17 | Mon 12/11/17 |
| 7 | Material | **17 days** | **Tue 12/12/17** | **Fri 1/5/18** |
| 8 | Fabrication | 14 days | Tue 12/12/17 | Tue 1/2/18 |
| 9 | Shipping | 3 days | Wed 1/3/18 | Fri 1/5/18 |
| 10 | Tower Modifications | **11 days** | **Mon 12/11/17** | **Wed 12/27/17** |
| 11 | With the loading conditions the tower is expected to fail, which will require the replacement of structural members, added sub-bracing and/or guy wire upgrades. | 10 days | Mon 1/8/18 | Fri 1/19/18 |
| 12 | Transmission line bridge | **2 days** | **Mon 1/22/18** | **Tue 1/23/18** |
| 13 | Installation of Bridge | 1 day | Mon 1/22/18 | Mon 1/22/18 |
| 14 | Installation of Horizontal hangers | 1 day | Tue 1/23/18 | Tue 1/23/18 |
| 15 | Building | **30 days** | **Fri 12/1/17** | **Mon 1/15/18** |
| 16 | Electrical | **30 days** | **Fri 12/1/17** | **Mon 1/15/18** |
| 17 | Installation of 3 phase power 40v – 150 KVA | 14 days | Fri 12/1/17 | Wed 12/20/17 |
| 18 | Installation of 3" conduit | 2 days | Thu 12/21/17 | Fri 12/22/17 |
| 19 | Setting transformer | 1 day | Wed 12/27/17 | Wed 12/27/17 |
| 20 | Wiring from transformer to Switch gear | 2 days | Thu 12/28/17 | Fri 12/29/17 |
| 21 | Installation of Switch gear | 1 day | Mon 1/1/18 | Mon 1/1/18 |
| 22 | Installation of backup generator | 2 days | Tue 1/2/18 | Wed 1/3/18 |
| 23 | Installation of electrical sub panels | 4 days | Thu 1/4/18 | Tue 1/9/18 |
| 24 | Installation of HVAC | 4 days | Wed 1/10/18 | Mon 1/15/18 |
| 25 | RF | **15 days** | **Wed 1/24/18** | **Tue 2/13/18** |
| 26 | Installation of Transmission line | 1 day | Wed 1/24/18 | Wed 1/24/18 |
| 27 | Installation of Antenna | 2 days | Thu 1/25/18 | Fri 1/26/18 |
| 28 | Test and Tune | 1 day | Mon 1/29/18 | Mon 1/29/18 |
| 29 | Transmitters install | 5 days | Tue 1/30/18 | Mon 2/5/18 |
| 30 | Transmitter supportive equipment | 3 days | Tue 2/6/18 | Thu 2/8/18 |
| 31 | Test and tune | 1 day | Fri 2/9/18 | Fri 2/9/18 |
| 32 | Combiner installation | 1 day | Mon 2/12/18 | Mon 2/12/18 |
| 33 | Test and tune | 1 day | Tue 2/13/18 | Tue 2/13/18 |
| 34 | Final testing and signal strength tests | 0 days | Tue 2/13/18 | Tue 2/13/18 |




# Permits

- Structural Analysis
- Building
- Electrical
- Site
- FAA

AMERICAN TOWER®
CORPORATION

**Structural Analysis Report**

| | | |
|---|---|---|
| Structure | : | 400 ft Guyed Tower |
| ATC Site Name | : | Garland TX, TX |
| ATC Site Number | : | 374508 |
| Engineering Number | : | 12181185 |
| Proposed Carrier | : | American Tower |
| Carrier Site Name | : | N/A |
| Carrier Site Number | : | N/A |
| Site Location | : | 4450 Blue Creek Drive<br>Garland, TX<br>32.843500,-96.563700 |
| County | : | Dallas |
| Date | : | January 3, 2018 |
| Max Usage | : | 93% |
| Result | : | Pass |

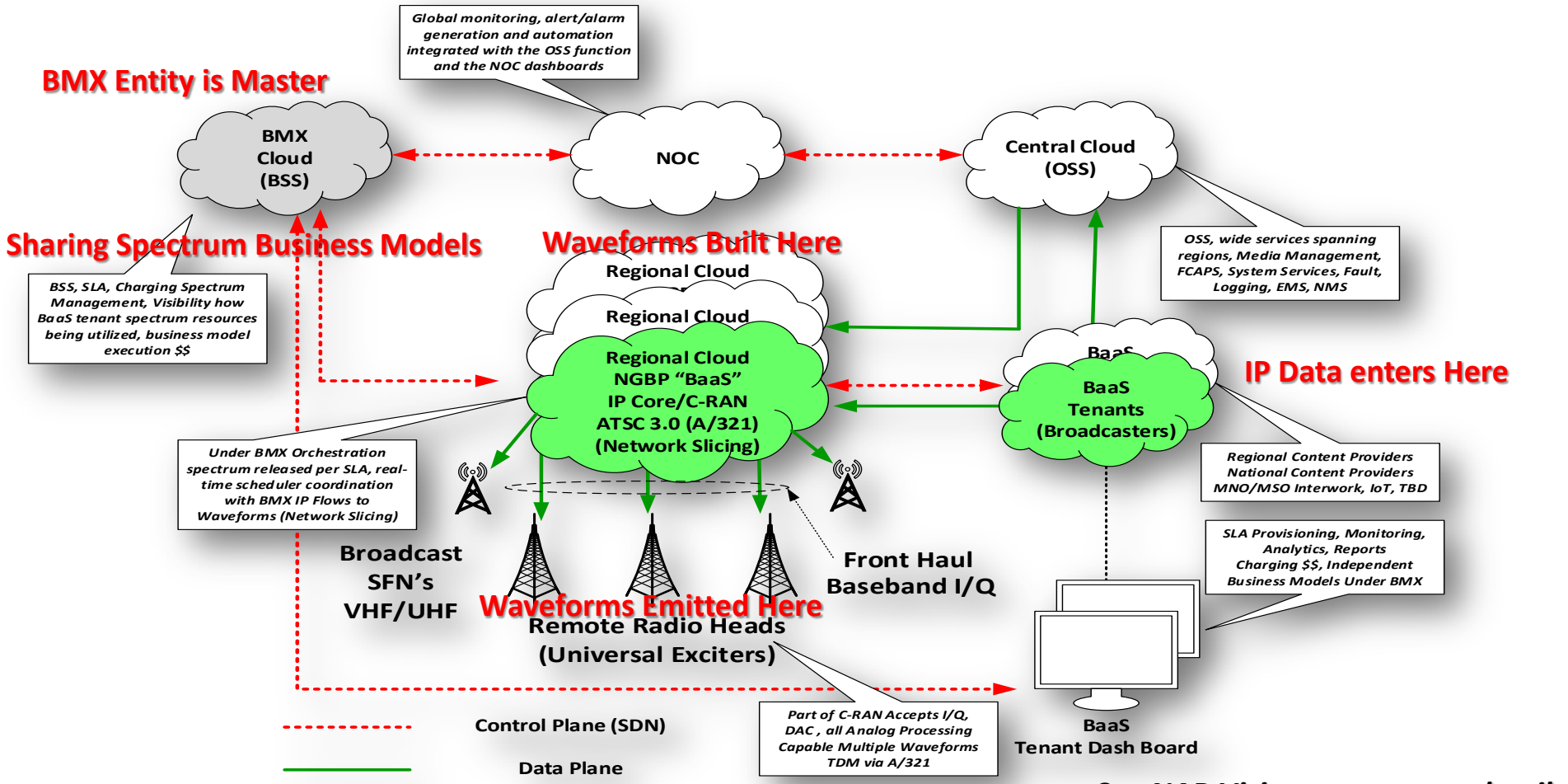
Prepared By:
Sarah W. Frye, E.I.
Engineering Supervisor

Reviewed By:

STATE OF TEXAS
SANTHOSHA SHANBHOGUE
125230
LICENSED
PROFESSIONAL ENGINEER

Jan 4 2018 4:39 PM cosign

# Nationwide Community Cloud Architecture using “BaaS”




*See NAB Vision paper more details*

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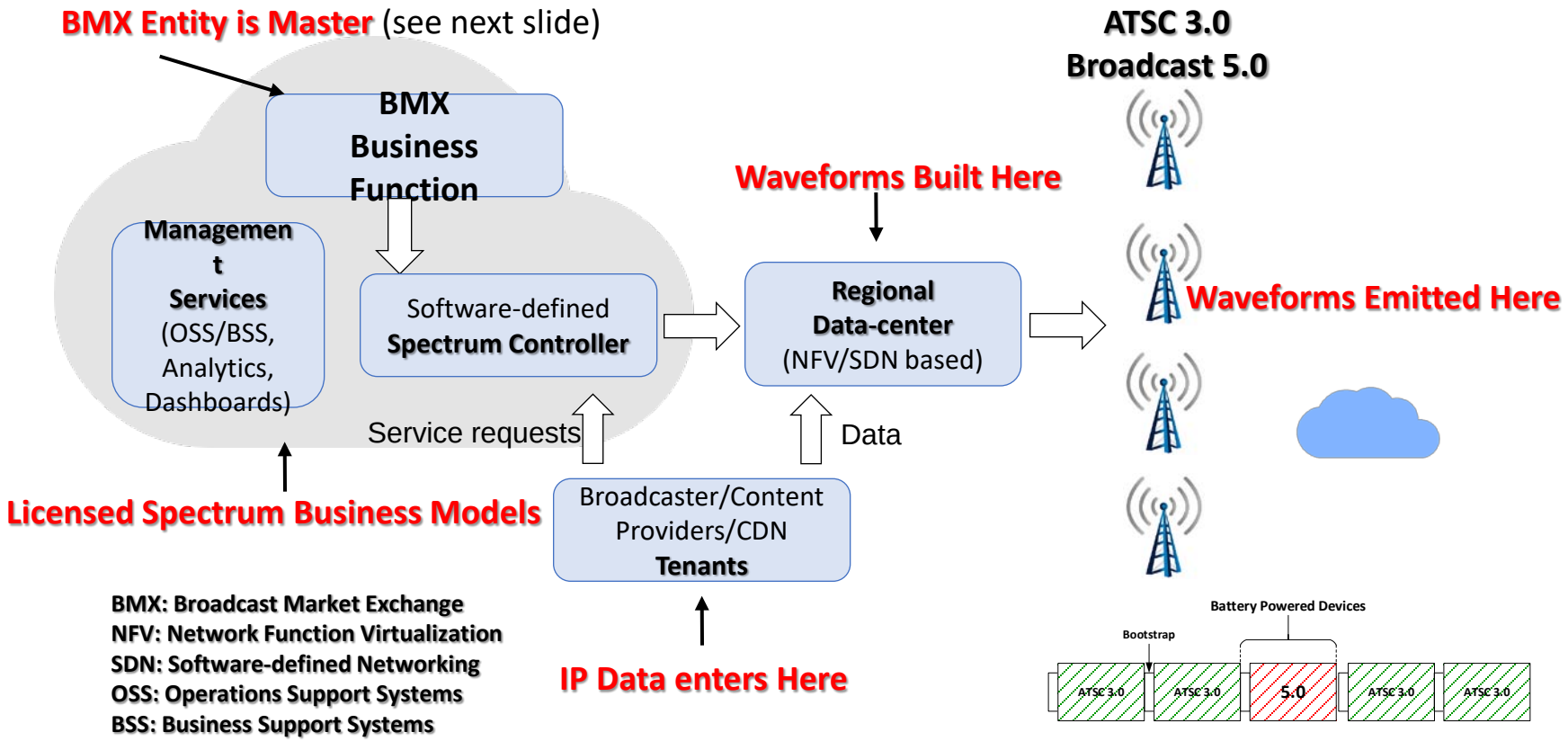
BROADCAST GROUP

# New Broadcast Community Cloud System Architecture (SDN/NFV)
# Channels (2-36) USA




***See NAB Vision paper more details***

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SINCLAIR
BROADCAST GROUP

Fred Baumgartner
ONEMedia
fmb@ONEMediaLLC.com


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BROADCAST GROUP

# FAQ
# (Last Slide)

- How long do we get access to Broadcast Spectrum?
  - As long as it is a good use
- What happens to Big Sticks?
  - They stay… until EOL or maybe Refresh
- Do I need a new TV?
  - No, you need a new (gateway) router or smart phone
  - Or a converter box/dongle
- What about IPR costs?
  - No party with key IPR seems motivated to hold-up adoption
- How much signal is enough?
  - 62-73 dB µV/m??
- What about VHF?
  - 1.0 Hosts, wireless mics, STLs


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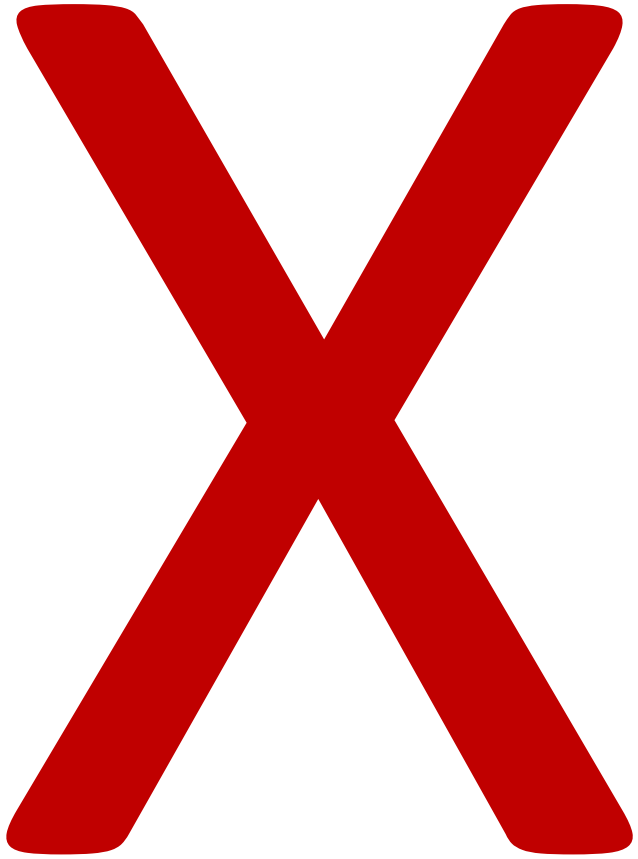


# Some 3.0

Mohu Leaf 50 Flat 50-Mile Indoor HDTV **Antenna**

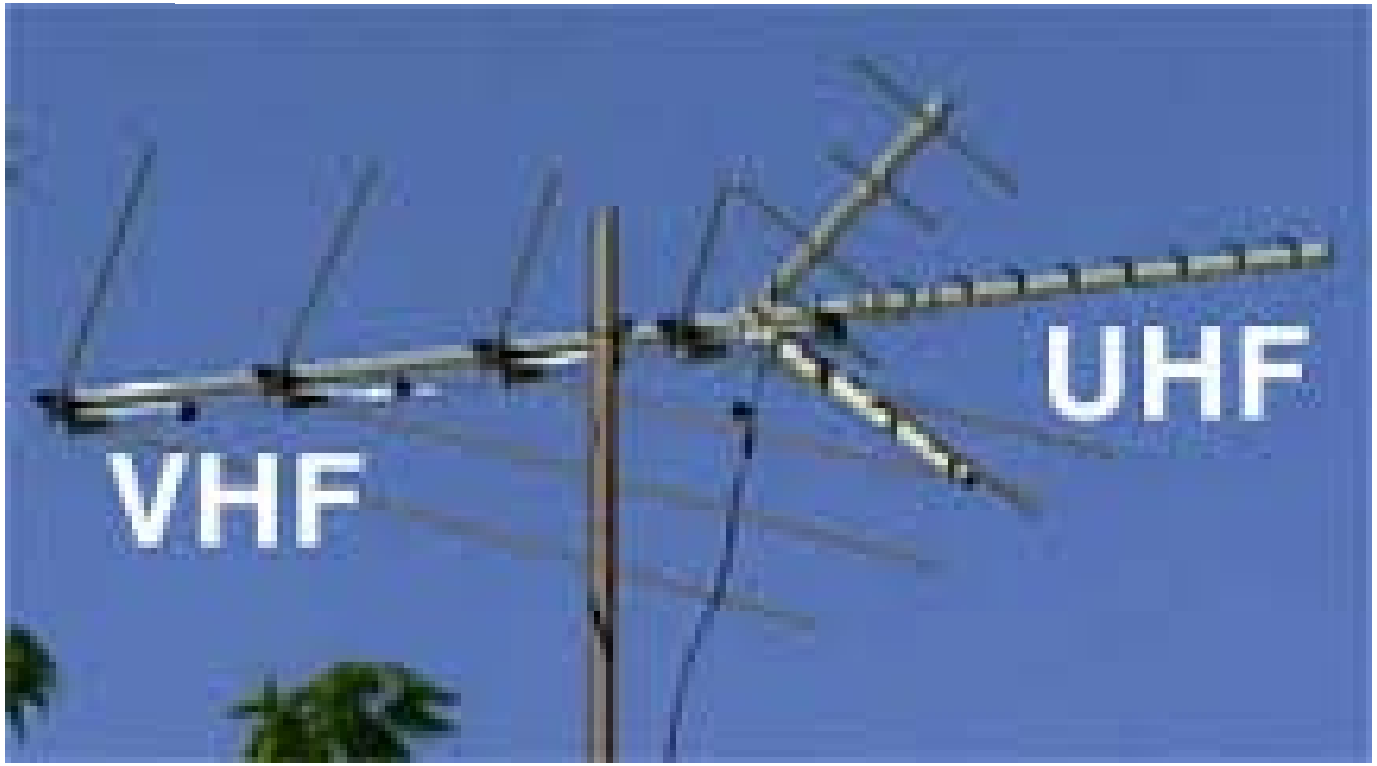
★★★☆☆ (207)

**$46.99** ~~$69.95~~

Show only Mohu items

Walmart

- VHF is not UHF
  - Low V antennas are BIG
  - UHF does Mobile
  - VHF does rural homes

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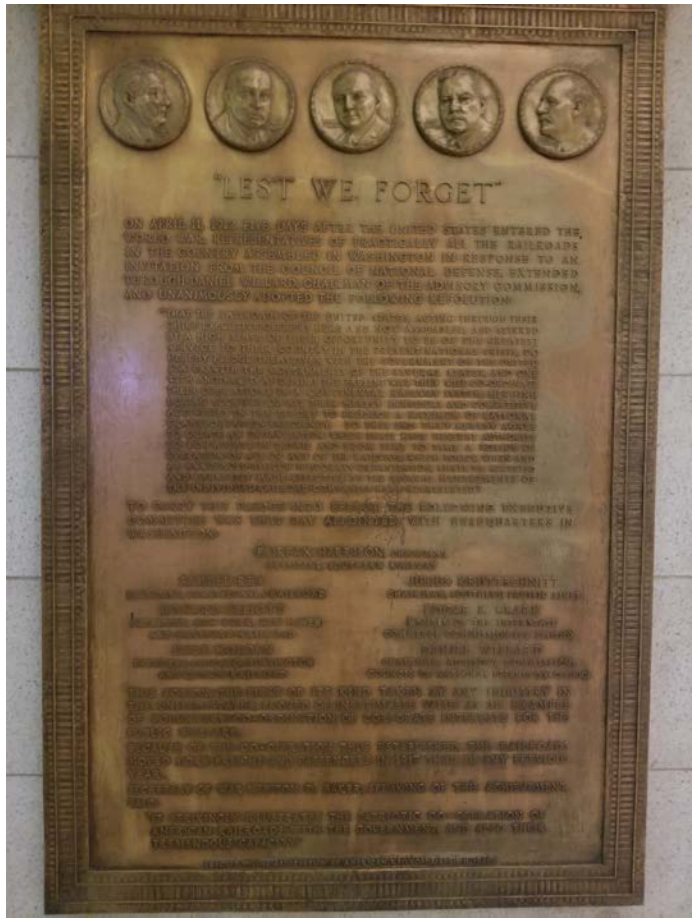
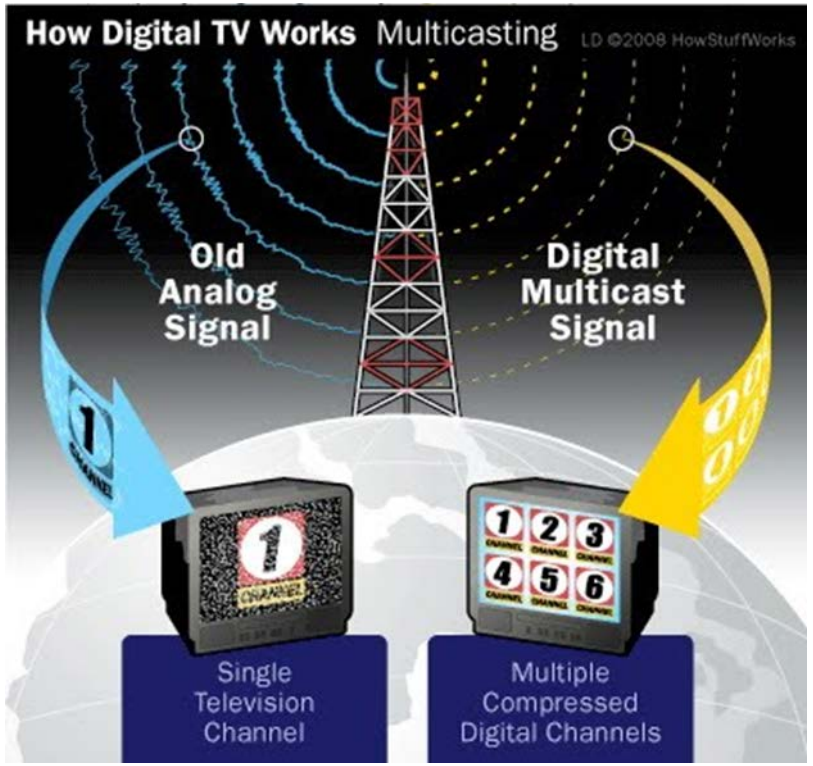
# 11 April 1917 – Railroads work together




NEW
Freid Chicken Scent
Wireless
Internet Signal
Air Path
Conditioner
Directioins: Just spray around the room
where you are getting slow speeds
and wait for the
impeding air molecules
to dissipate.
works for both upload and download
Could take up to 30 days to see
Warning : Do not use if you are
or undergoing mental health
if you experience dizziness or
You should take something for that.


How Digital TV Works Multicasting
LD ©2008 HowStuffWorks
Old Analog Signal
Digital Multicast Signal
Single Television Channel
Multiple Compressed Digital Channels