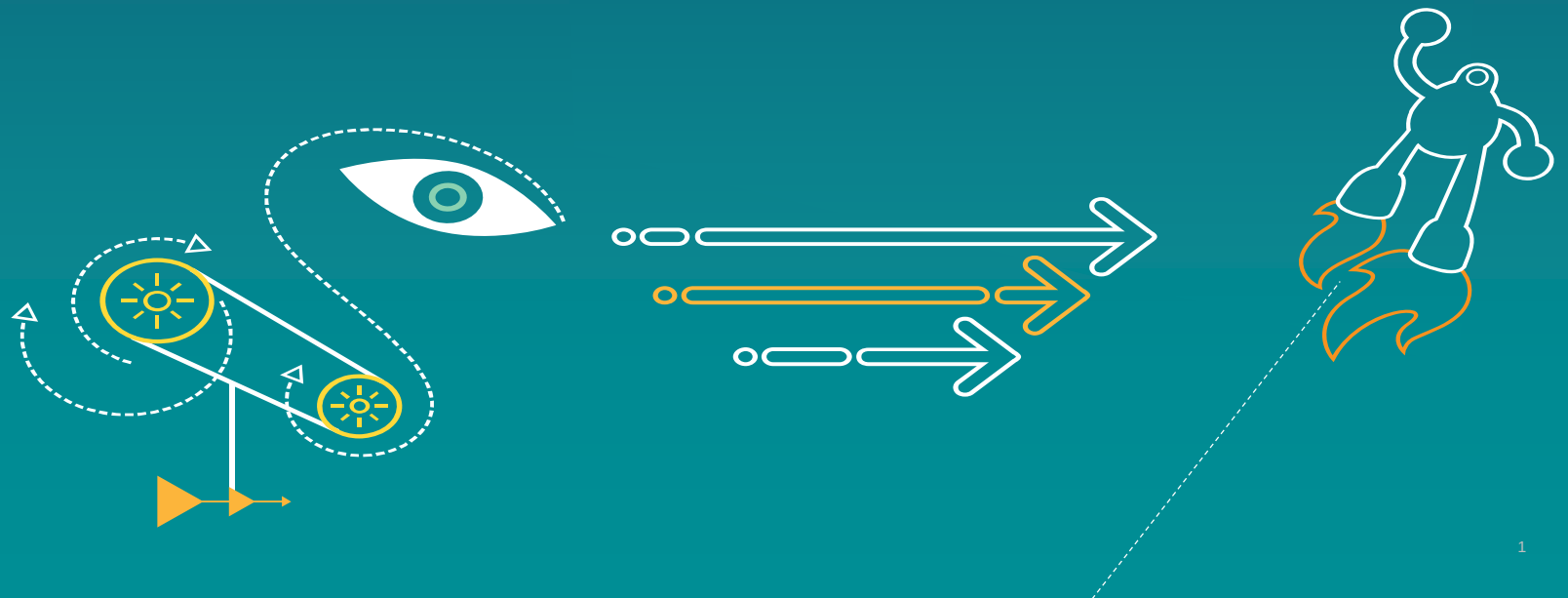
August-2015

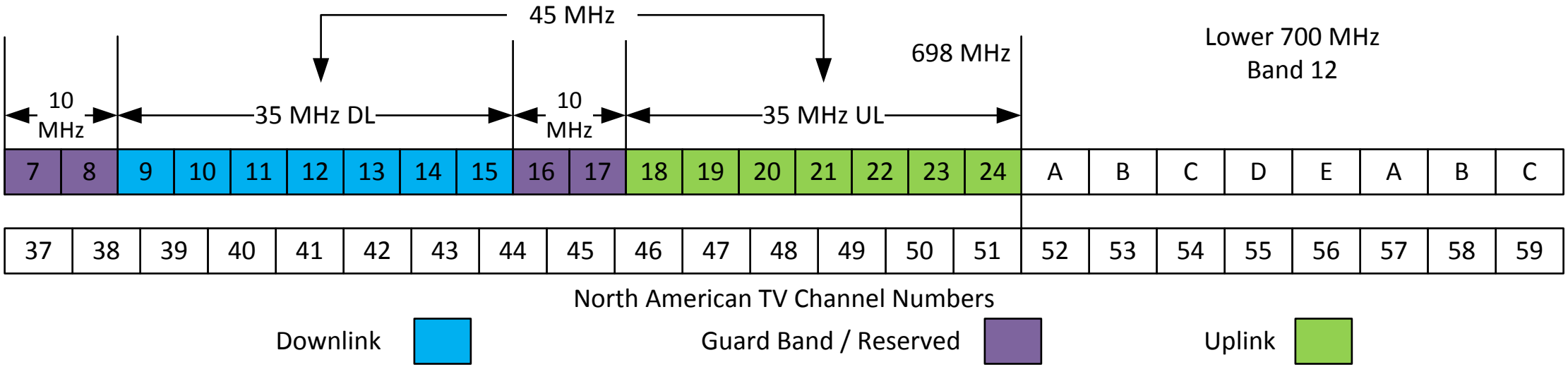
Broadcaster Directions

QUALCOMM®



Why ATSC 3.0 now?

- The FCC has a current proceeding that will result in “reverse auction” of TV spectrum to FCC for ultimate resale to the wireless Multiple Network Operators (MNOs)
- There are many technical issues:
  - Low efficiency of ASTC 1.0
  - Serious spectrum reduction is coming i.e. some broadcasters will sell
  - Unlicensed usage in guardbands
  - Desire for direct access to mobiles by broadcasters
  - 6MHz spectrum allocations vs 5 MHz
  - A transition plan

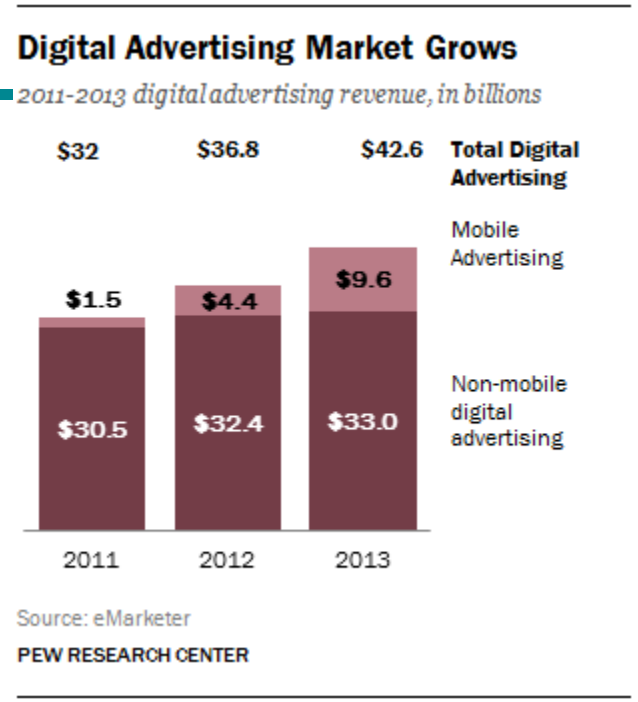


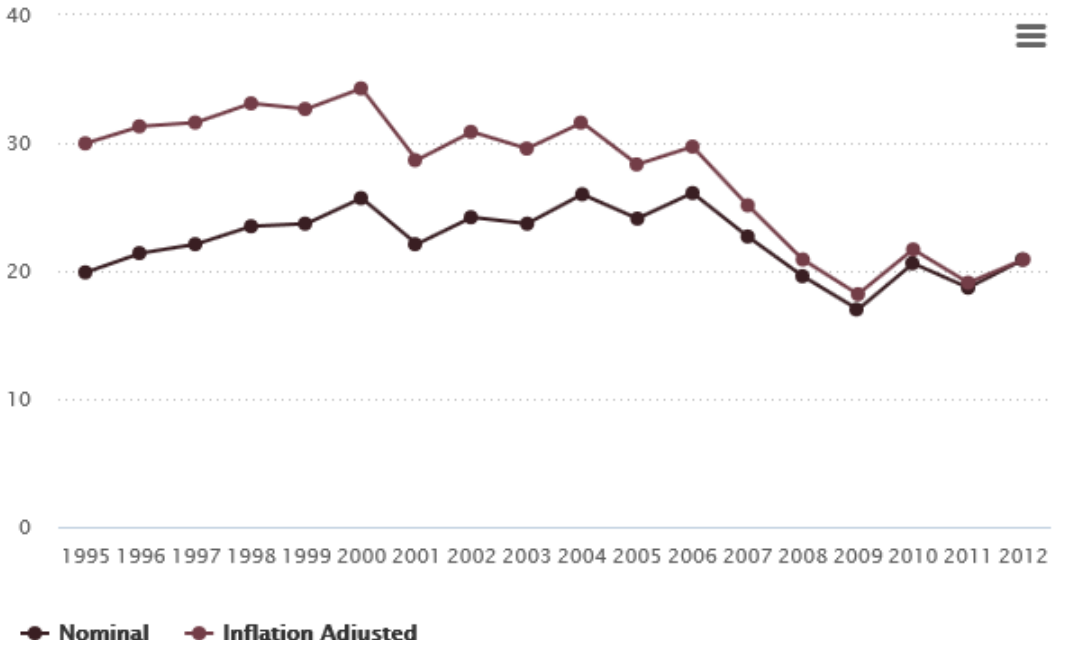
What are the basic ideas?

- Use an OFDM physical layer
  - More suitable to mobile applications
  - Can achieve higher spectral efficiency than ASTC 1.0
  - Can support layering at the physical layer
- Align more closely with the web
  - Use IP protocol and related IETF methods
  - Utilize ISO BMFF file streaming e.g. DASH
  - Create a browser based user interface and application environment
  - Utilize web tools to more effectively, better monetize ads
- Align service layer with 3GPP eMBMS, mobile compatibility is important
- Update the codecs for higher efficiency and enhanced feature set e.g. UHDTV, HDR, WCG, high frame rate, and Immersive Audio
  - Codecs are +20 years old: MPEG-2 Video, Dolby AC3
  - Number of possibilities including HEVC / SHVC, Dolby AC4, and MPEG-H audio

Major Challenges for Broadcasters

- Broadcast television ad revenues are declining
- Audience is increasingly on mobile devices
- Access to mobile devices is problematic
  - Data caps limit the penetration of Over The Top (OTT) services
  - Getting any non-3GPP or Wifi physical layer into cell phone or a tablet is extremely difficult
- Pending enhancements to eMBMS could achieve a physical layer suitable for use in a medium power high tower deployment for mobile are possible
  - Television spectrum allocation is wideband with one or perhaps two stations per 6MHz
  - Fundamental physics of antennas limit the useful bandwidth to perhaps 30 MHz at very top of the band
  - Licensing and operation of 600 MHz band has to change, and there is no current activity

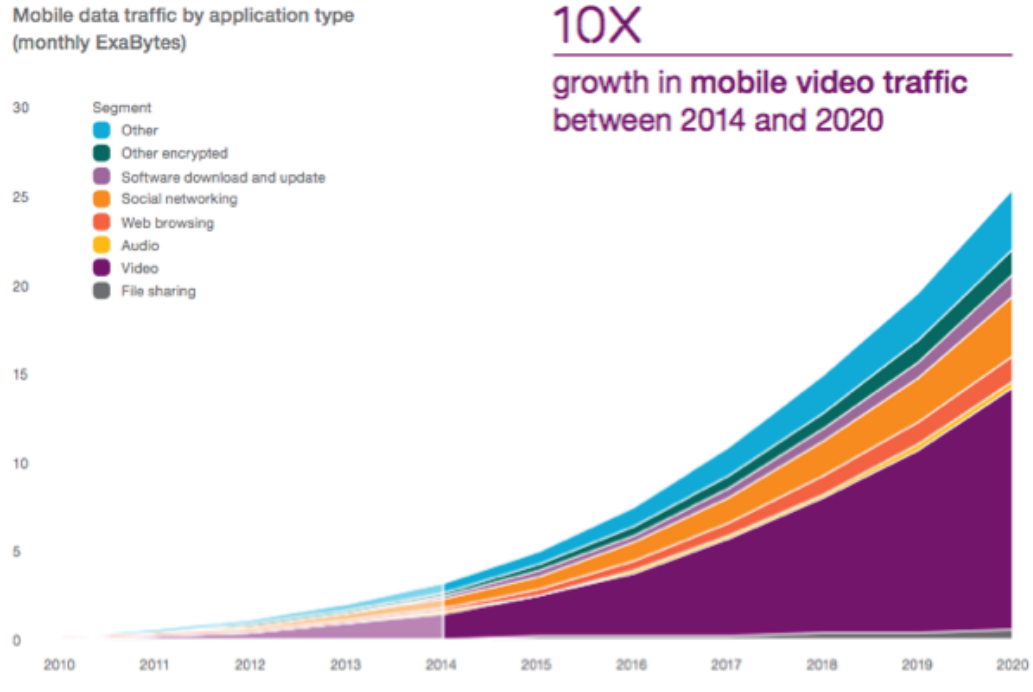




PEW Research Television Station Ad Revenue

Issues and Distractions

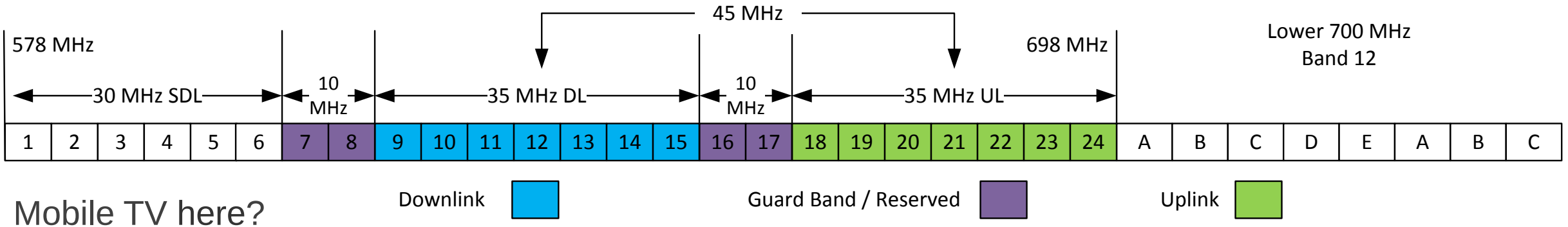
- Primary broadcast TV business is ad supported streaming media
- Current business model is predicated on 6 MHz VHF or UHF spectrum allocations
  - Defines must carry access to Satellite and Cable
  - Operating the spectrum is costly in infrastructure and electrical power
  - Over the Air (OTA) reaches a low percentage of the population 5% to 10 %, depending on accounting method
  - A few cord cutters are going back to OTA
- There is ever increasing demand for more mobile spectrum
- There is some notion of broadcasters selling capacity to MNOs
  - MNOs only want the spectrum
  - The broadcast TV deployment style High Power High Tower (HPHT) is not efficient or effective for support of mobile devices
- Broadcasters see their spectrum as a primary asset
  - This due to spectrum regulatory policy
  - Actual primary assets are consumer brand loyalty (if any) and access to quality content



Ericsson Projection from Web

Summary

- The general concept of ATSC 3.0 addresses many of the key technical issues with respect to ATSC 1.0
- There are core regulatory and business aspects that prevent the broadcasters from achieving all their key business objectives
- Technology cannot by itself resolve all the issues
- Expect to see continued embrace of OTT and hence DASH
- Success of broadcast depends on ubiquity, all mobiles need to support the format
- Regulatory and business approaches have to change significantly in order to achieve any significant direct penetration of broadcast TV into mobile devices



Mobile TV here?