# Shifting to Digital TV and ATSC 3

## Why and Why Now?

***Skip Pizzi***

*Owner/Principal*
*Skip Pizzi Media Consultant LLC*

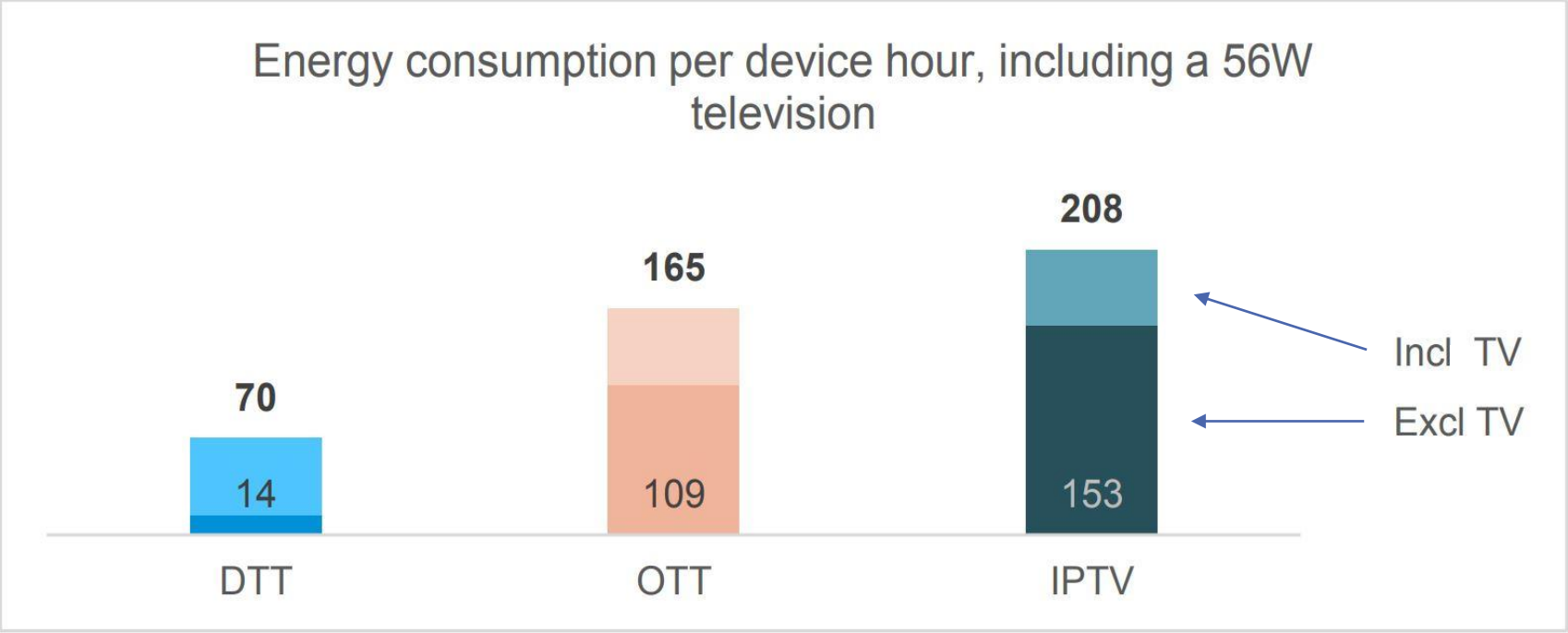
*ATSC TG3 Vice Chair*

CARIBBEAN SPECTRUM MANAGEMENT TASK FORCE MEETING
MONTEGO BAY, JAMAICA
FEBRUARY 7, 2023

# Why Digital Terrestrial TV?

- Modernization: The rest of the world is converting
- Efficiency: In bandwidth, spectrum usage and power usage
- Coverage control: Pattern control and interference mitigation
- Robustness: Fixed & mobile reception on a variety of devices
- Flexibility: Allows a wide range of optimized uses
- Extensibility: Evolution for future-proofing
- Localism: Provides unique public service

"…(T)he energy consumption and associated emissions of DTT (Digital Terrestrial TV) are an order of magnitude lower than estimates for OTT and managed IPTV."




*--Quantitative Study of the GHG Emissions of Delivering TV Content*
Carnstone/The LoCAT Project
Final Report, v1.1, September 2021

# Why Now?

- Second-generation digital broadcast systems are emerging
- These systems improve efficiency, robustness and flexibility
- Their extensibility will make future conversions easier
- Optimum conversion requires new spectrum allocation
- That spectrum is only going to get harder to obtain over time

# Why ATSC 3.0?

- The only all IP-based broadcast system: Bridges digital divide
- Combines advantages of over-the-air with online streaming
- State-of-the-art spectrum efficiency and robustness
- Immense flexibility in transmission
- Minimum co-channel interference
- High extensibility and backward-compatible evolution
- Expanded accessibility and emergency alerting capabilities
- Interactivity options allow personalization and increased user engagement
- Strong security options
- Numerous countries now adopting: Economies of scale

# ATSC 3.0 Technical Details

A QUICK OVERVIEW

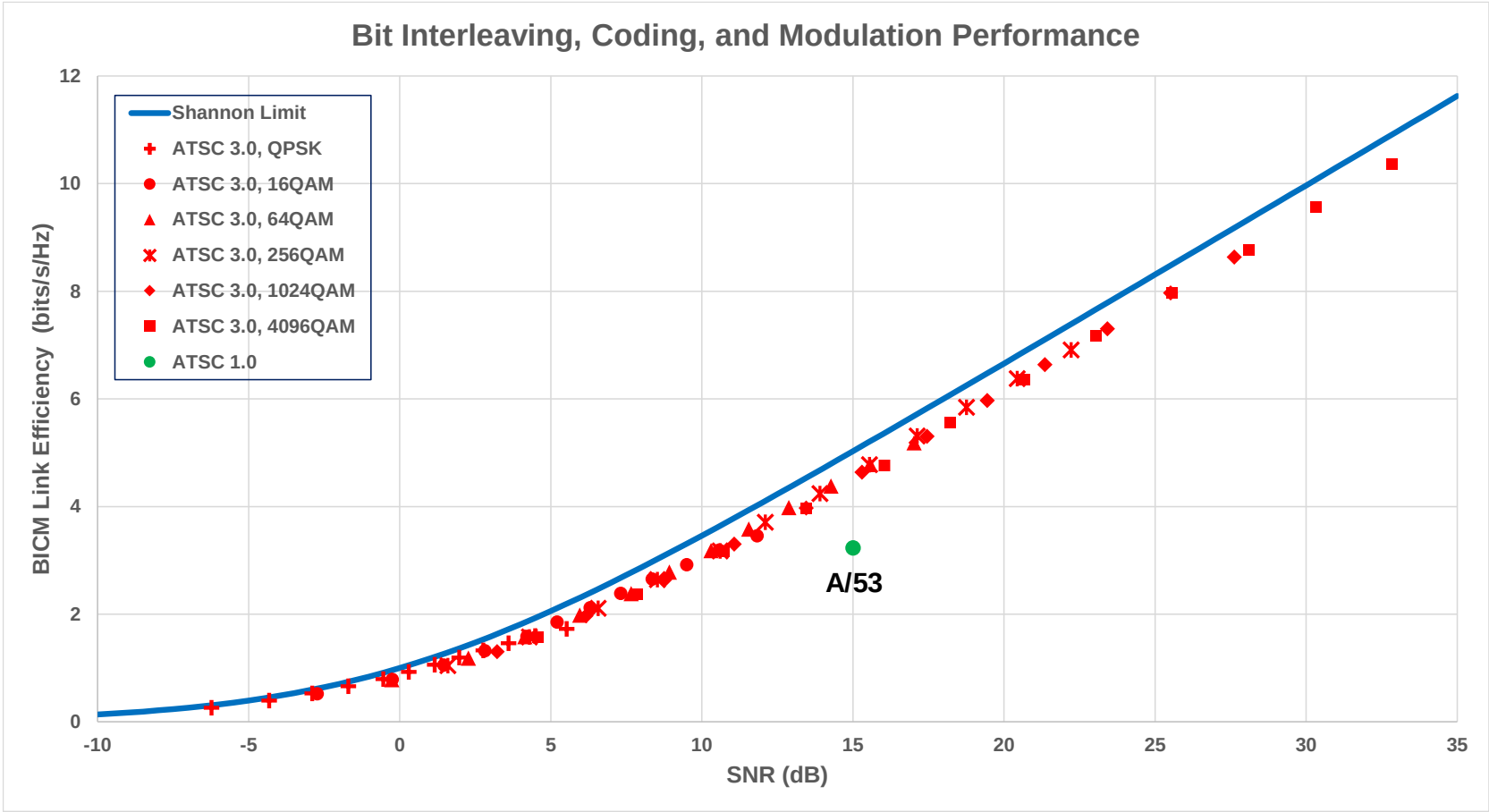
# ATSC 3.0 Physical Layer

- Uses a sophisticated form of COFDM
- RF Channel Capacity Increase of ~30% (19 Mbps → ~25Mbps)
- State-of-the-Art Error Correction (LDPC) and Interleaving
- Wide Range of FFT Sizes and Modulation/Coding Settings
- TDM or LDM
- "Bootstrap" concept for Flexibility/Extensibility
- SFNs, MIMO & Channel Bonding Options

# ATSC 3.0 Physical Layer Performance

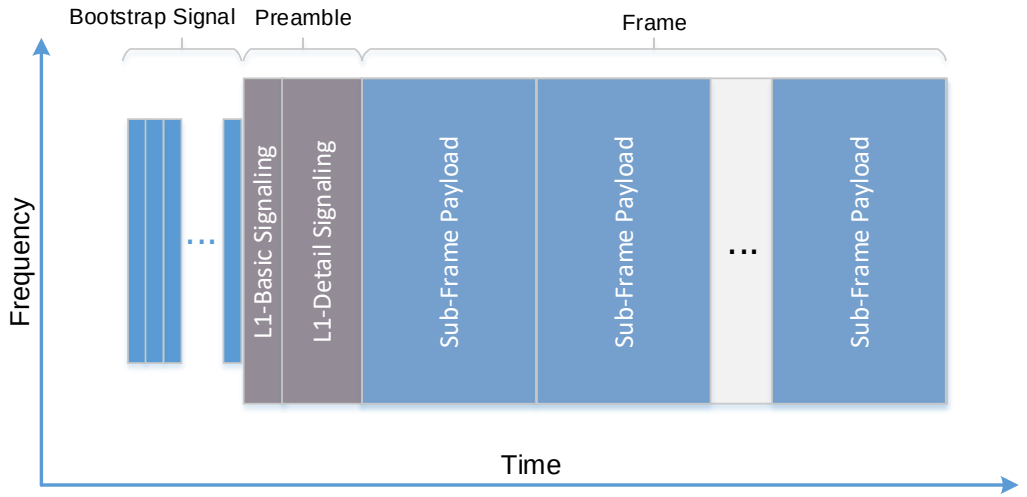
ATSC 3.0 has considerable flexibility in operating points:

- Low capacity, high robustness
- High capacity, low robustness
- Multiple **Physical Layer Pipes** (PLPs) at different operating points simultaneously on a single TV channel



# Bootstrap (A/321)

- **Extensibility / Flexibility**
  - Possible to evolve system/physical layer
    - Announces technology used in each frame
  - Layers signal technologies to layer above
  - Allows graceful evolution over time




- Bootstrap emission is the starting point for ATSC 3.0
  - Robust synchronization
    - Service discovery
    - Coarse time, frequency acquisition
    - 5 MHz bandwidth
    - Receivable at <–6 dB SNR (with FER = 1E-2)
  - 24 signaling bits
    - Sampling frequency
    - Channel bandwidth
    - EAS wake-up
    - Preamble selection

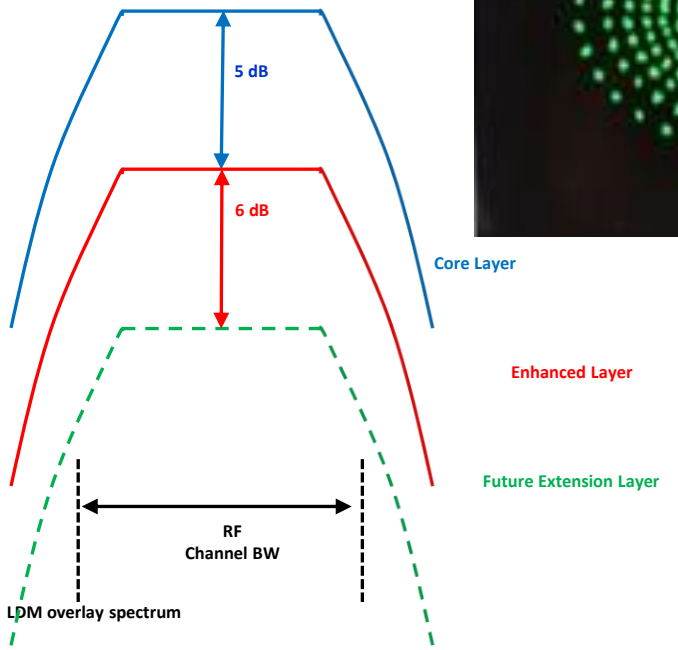
# Bootstrap Allows Flexibility, Longevity and Public Service

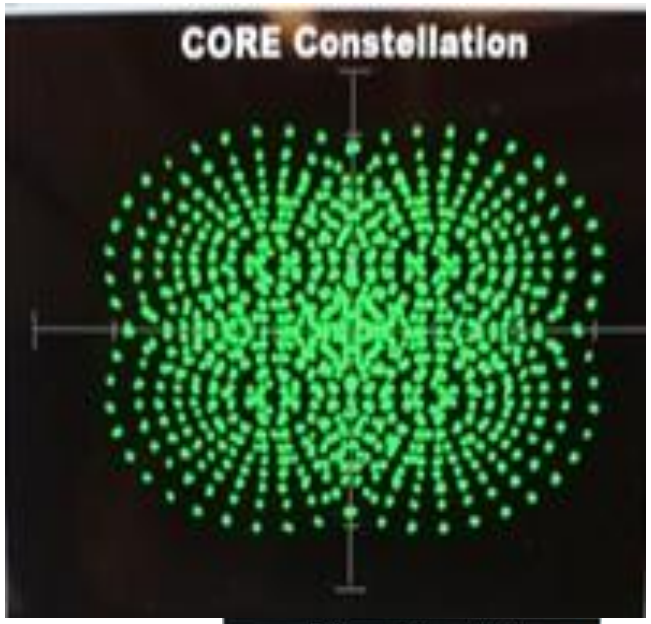
- Bootstrap allows mixture of different PHY formats in a single broadcast
- Extensibility via versioning and mixture of PHYs
  - Can support a mixture of today's PHY tech along with tomorrow's in a way that allows a receiver to utilize what it understands
- Wake-up of receiving devices in standby mode in case of emergency
  - Mechanisms to reduce annoyance factor and battery conservation (for mobile devices)

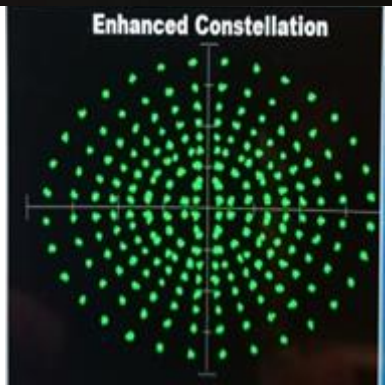
# Layered Division Multiplexing

LDM is a new transmission scheme that uses spectrum overlay technology to superimpose multiple physical layer data streams with different power levels, error correction codes, and modulations for different services and reception environments.

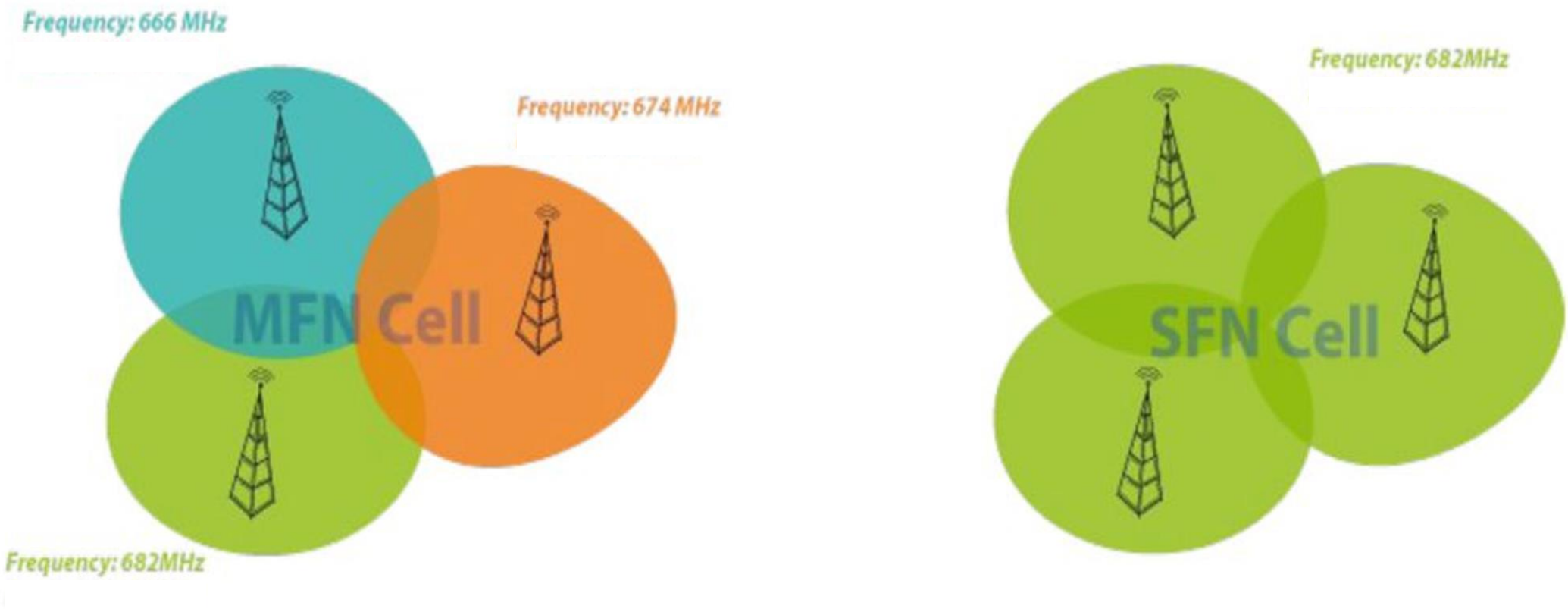
For each LDM layer, 100% of the RF bandwidth and 100% of the time are used to transmit the multi-layered signals for spectrum efficiency and flexible use of the spectrum.



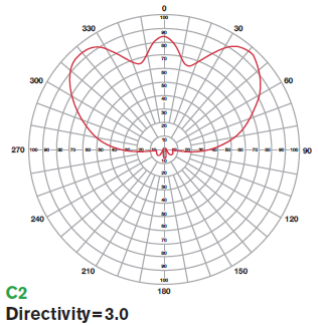



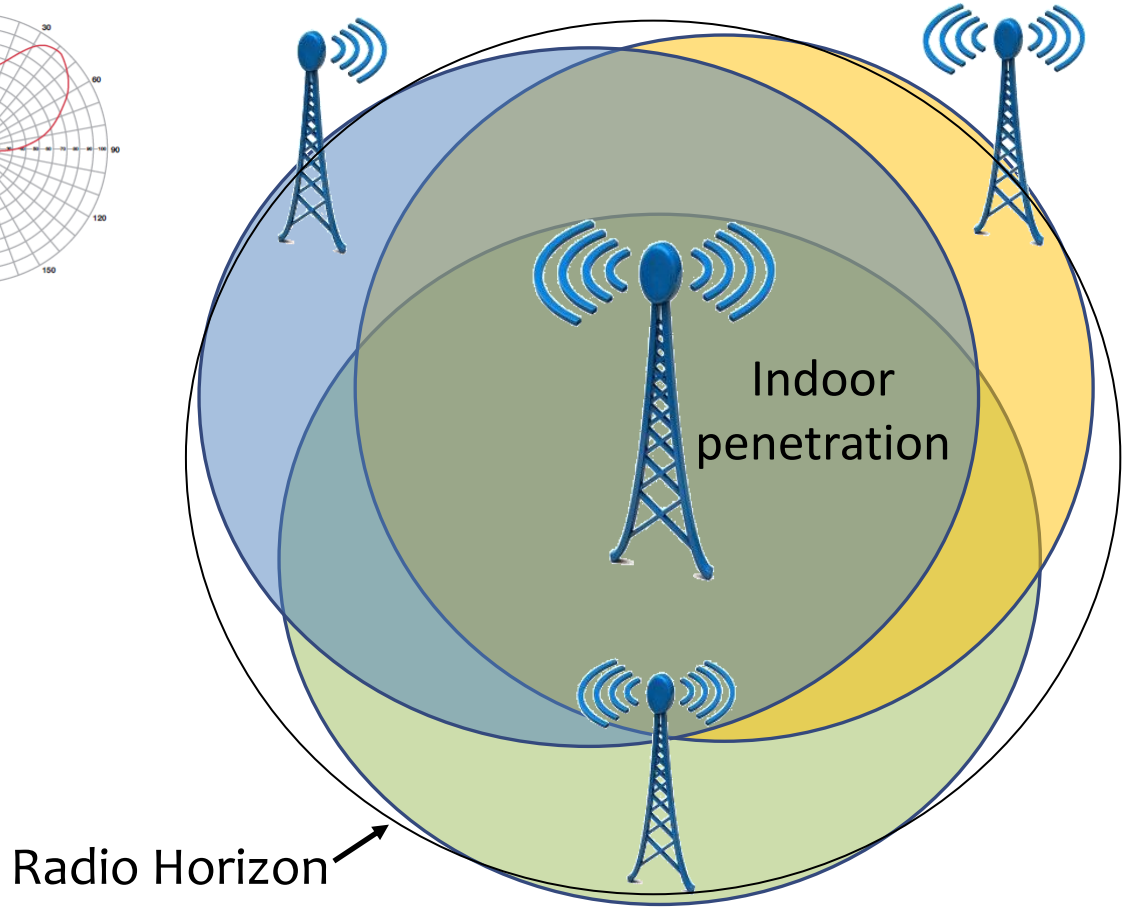



# Single-frequency Networking (SFN)



# SFNs Provide Better Coverage and Deep Indoor Penetration



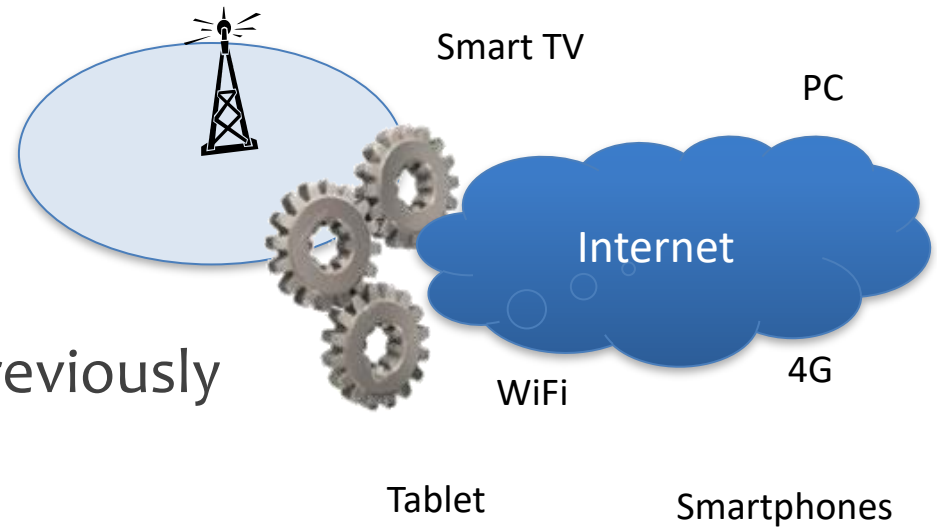




Multiple transmitters in a SFN can be used to extend coverage and add capacity by raising the SNR.

OFDM guard interval alleviates potential inter-symbol interference arising from multiple transmitters.

# Bringing Broadcast to Parity with Other Digital Delivery Systems

- Broadcasting no longer an independent silo
  - Use of IP allows taking advantage of evolution speed of the Internet
- Broadcast and broadband as peer delivery mechanisms
  - Enables new types of hybrid services
  - Ability to seamlessly incorporate niche content
- Enable new business models
  - Localized insertion of ads or other content
  - New revenue model for broadcasters that has previously been available to only cable or IPTV operators
  - Addressable advertising



# Key Accessibility Features

- Deliver video description audio service emergency alert crawl audio tracks
  - While also sending additional alternative audio tracks
  - Alternate audio tracks can share the immersive music & effects track that the main audio listeners enjoy
  - Multiple languages are possible
- Deliver multiple closed caption tracks
- Multiple languages are possible
- Improved Dialog Intelligibility control

# Advanced Emergency Information

- Leverages the power of ATSC 3.0 to supplement existing EAS alerts
- On-screen icons/prompts/summaries
- Detailed and targeted info
- Rich media content (video, evacuation maps, etc.)
- User selection of preferences (e.g., language)
- Possibility to wake up devices for urgent alerts

# Possible Uses of Additional ATSC 3.0 Capacity

## Additional TV services

- News, Entertainment, Educational

## Spectrum Sharing

- Multiple local stations can share a single TV channel

## Datacasting

- Data services to non-broadband homes/students and incarcerated populations
- Content delivery to Digital Signage/Kiosks
- Advanced Emergency Information
- Precision Location Services
- Automotive Software Updates
- Internet of Things

## Interactivity

- Application development (including program enhancements and new advertising techniques)

# References

ATSC
- https://www.atsc.org/nextgen-tv/

Pearl TV
- https://pearltv.com/station-resources/
  - Host Station Manual

NAB PILOT
- BEIT Conference Proceedings
  - https://nabpilot.org/beitc-proceedings/

Public Media Ventures Group (PMVG)
- Public TV Station NextGen Advice and Training
  - https://www.publicmediaventure.com/
  - **Public Media Technology Summit: April 13-14, 2023**

# Questions?

skip@skippizzi.com
www.atsc.org