AR/VR

ATSC3.0

DIGITAL STORYTELLING

LIVE SPORTS

LIVE STREAMING

THE
M.E.T
EFFECT™

MEDIA. ENTERTAINMENT. TECHNOLOGY.

Be part of the
BIGGER PICTURE and at the
CENTER OF IT ALL

NABSHOW
Where Content Comes to Life

#NABShow

ATSC 3.0 Today Can be Bridge to "Mobile First" in Future
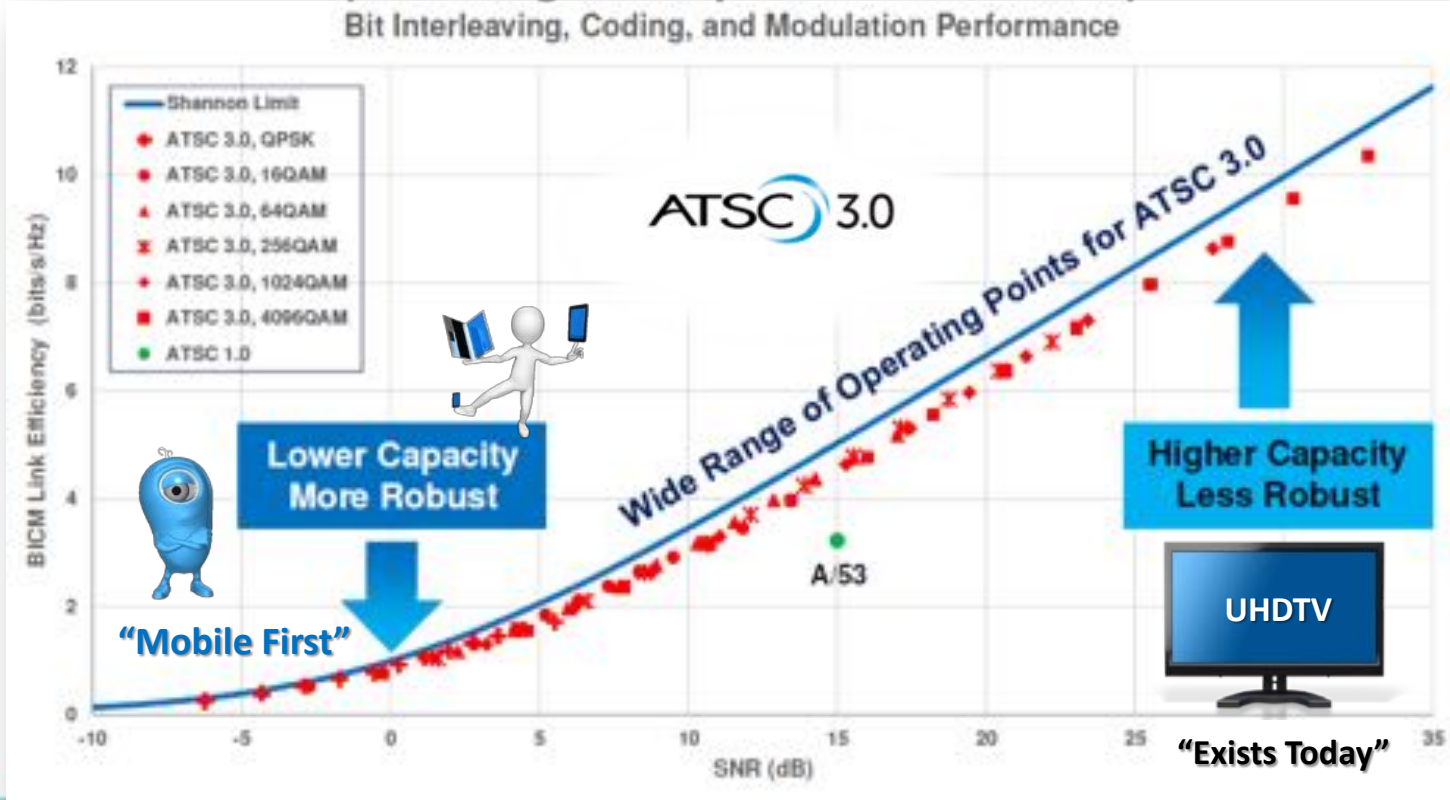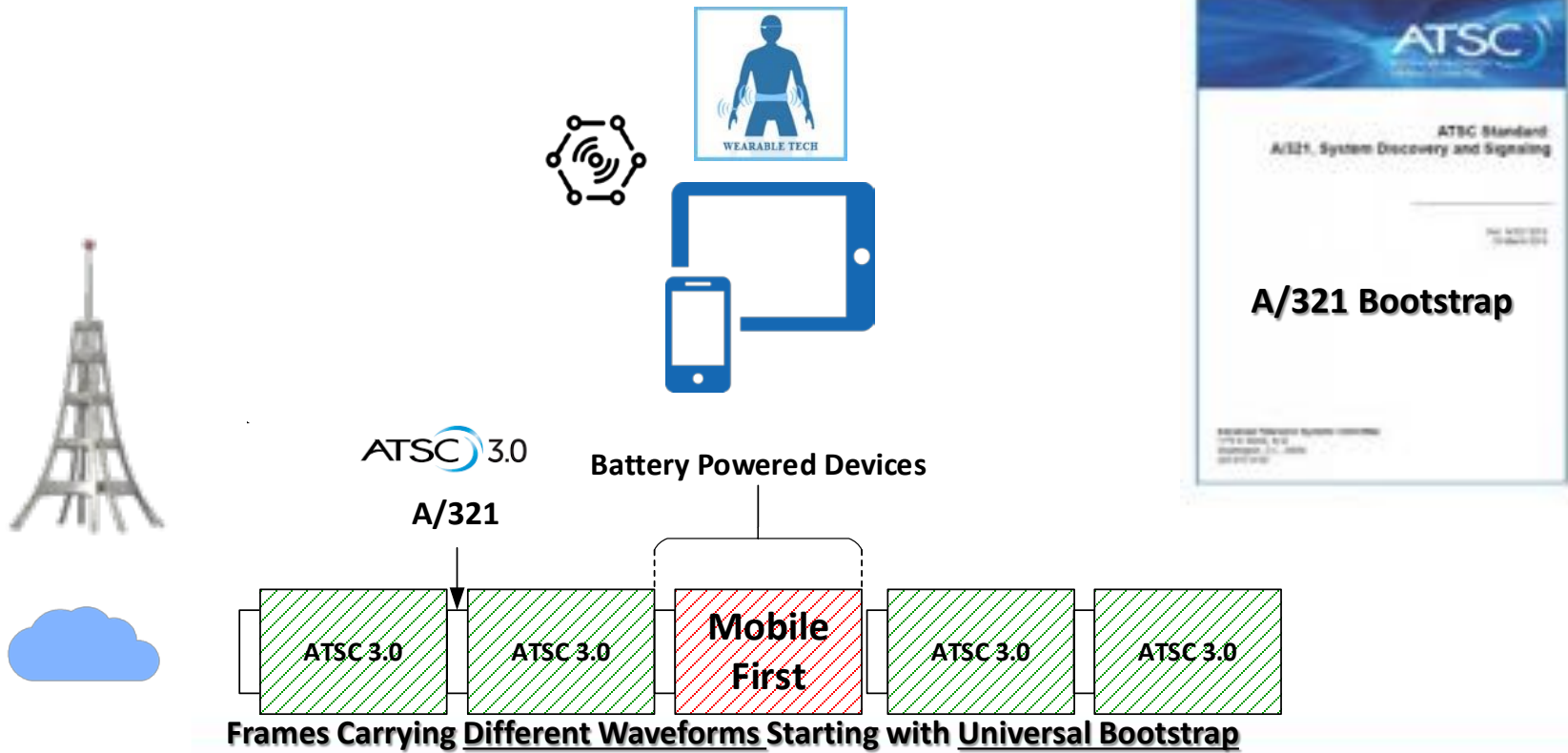
Questions

- Why isn't ATSC 3.0 enough?
- Why now?
- Why should you, your company be involved?
- Why not wait?
- How will this all play out?

"Mobile First" Target is <u>Towards</u> Lower Capacity More Robust
(Including Battery Powered Devices)

"Mobile First" Leverages ATSC A/321 Bootstrap (Extensibility)

WEARABLE TECH

A/321 Bootstrap

ATSC Standard
A/321, System Discovery and Signaling

ATSC 3.0

A/321

Battery Powered Devices

ATSC 3.0	ATSC 3.0	Mobile First	ATSC 3.0	ATSC 3.0

Frames Carrying Different Waveforms Starting with Universal Bootstrap

Sinclair's Vision of "Mobile First" Future

ATSC 3.0   5G

"Sinclair's Vision" will describe the similarities **Mobile First** and **3GPP 5G**

Why IMT- 2020 (5G) ?
"Web-Scale IT": Competitive Survival

- Telecom (5G) realizes **Web-Scale IT players** are real competition and are re-inventing their business towards 5G to have Web-Scale IT Architecture

- 3GPP 5G proposes **New Technology** and **New System Architecture**

- For **Broadcast to be competitive** with the real disrupters in an all IP World , **YES** a new **Broadcast System Architecture** aligned with Internet and towards 5G is needed using a "**Community Cloud Model**" in USA is the Architecture
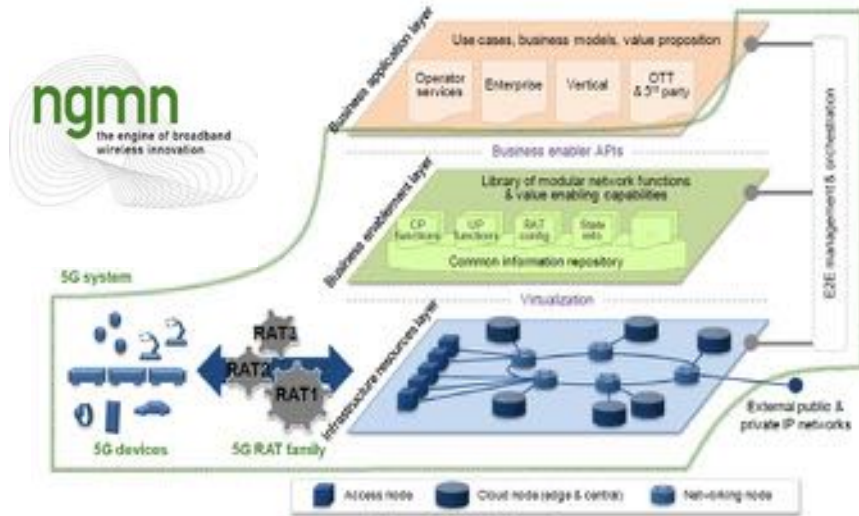

WEB-SCALE IT

Real Competitors

Emerging 5G (New Architecture Re-Think)

Example: NGMN 5G Whitepaper 2015

Figure 8: 5G Architecture

Sinclair's Mobile First Vision 2017:
New 5G Aligned Broadcast Architecture and Technologies

Global Published 5G Visions

- **Leverage IT Infrastructure**
  - Servers, Storage, Network (COTS)

- Abstraction using **Open Source Software**
  - OpenStack, OpenDaylight, ONAP, Others

- **SDN/NFV** Programmatic 5G Platform

- **CLOUD-RAN**
  - Process Waveforms Datacenter

Open Source is now Mainstream Telcom 2017 ONAP Project (SDN/NFV)

AT&T

April 6, 2017 Contributes 8.5 Million Lines of Code into ONAP

"Now is the point in time to be thinking Broadcast Waveforms in Cloud"

THE LINUX FOUNDATION

ONAP
OPEN NETWORK AUTOMATION PLATFORM

AT&T | Bell | 中国电信 CHINA TELECOM | 中国移动 China Mobile

CISCO | HUAWEI | IBM | intel

Jio | NOKIA | SAMSUNG | vmware

ZTE | orange | ERICSSON

60+ Year Old Broadcast System Architecture

- **Studio -> STL -> Transmitter**

- "Digital Conversion" (ATSC 1.0) left the business **UNDERSTANDINGUNCHANGED**

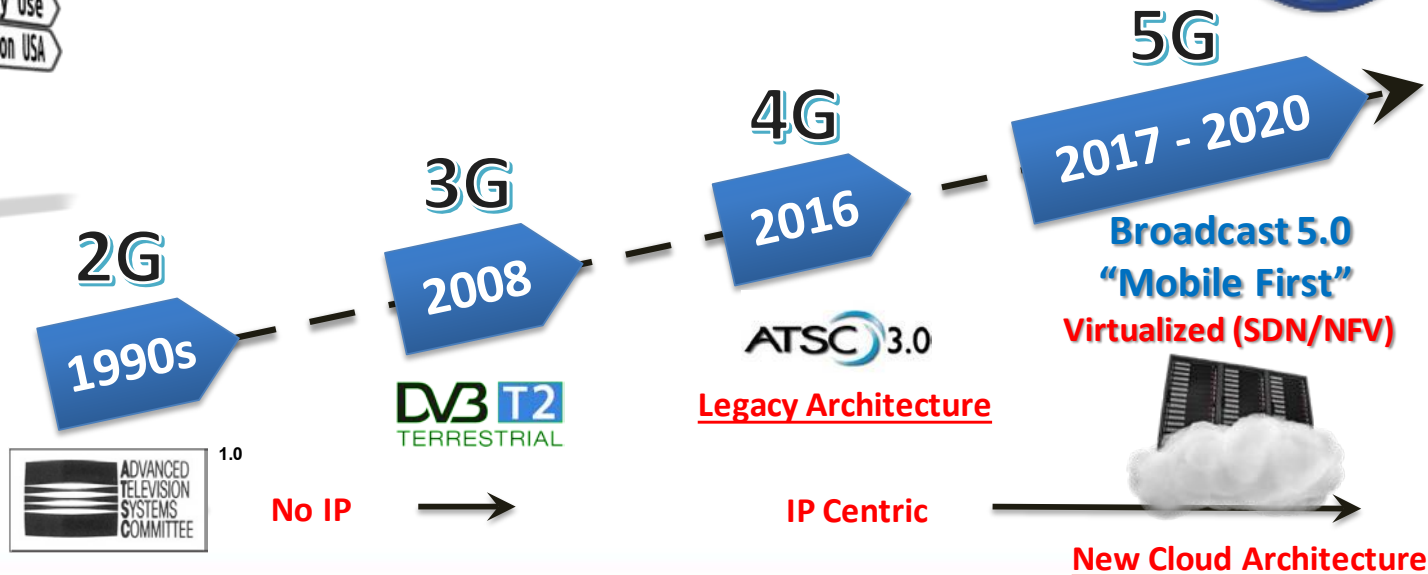**Problem: Today Broadcasters are isolated Islands**
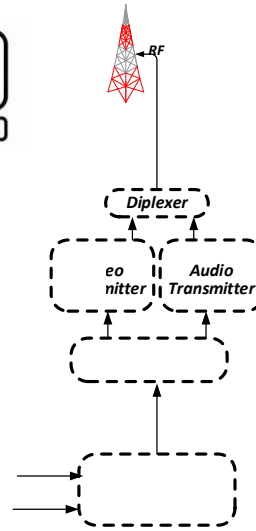
- Emerging ATSC 3.0... what to do?
  - Keep Architecture ?

- **Vision Broadcast 5.0 or "Mobile First"** a new System Architecture aligned with IP and emerging 5G
  - **Can be enabled with ATSC 3.0 and A/321 Bootstrap for Innovation**

NTSC

RF

Diplexer

eo
nitter

Audio
Transmitter

HD
TV

ATSC 3.0

Future ?

log
ge

tal
and
ge
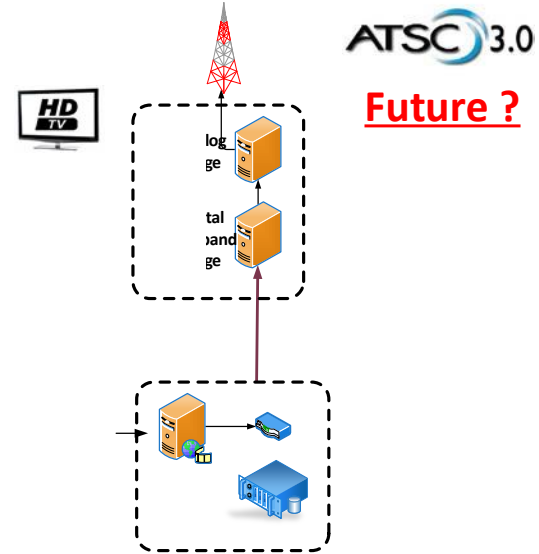
Innovation Wireless and Broadcast Including Sinclair's Vision

Now is Time to Start to Innovate Mobile First USA
"This will be a Journey not an Event"

600 MHz Auction
Repack
39 Months
FCC NPRM
Vountary Use
Innovation USA

Broadcast Innovation USA

5G

4G

2017 - 2020

Broadcast 5.0
"Mobile First"
Virtualized (SDN/NFV)

3G

2016

ATSC 3.0

Legacy Architecture

2G

2008

DVB T2 TERRESTRIAL

1990s

ADVANCED TELEVISION SYSTEMS COMMITTEE 1.0

No IP →

IP Centric

New Cloud Architecture

NABSHOW   #NABShow

"Mobile First"
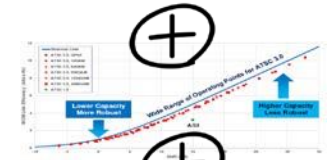
VHF **Broadcast TV Spectrum** UHF

- Channel 2-36 (VHF/UHF) Broadcast USA
- Offer new services… not just linear TV?
- Spectrum Infrastructure Sharing Architecture
- Create robust waveforms that carry IP bits
- Create and manage local, regional and national service areas
- **Voluntary** but must Evolve isolated broadcast entities into a fully virtualized platform
- New **Community Cloud Model** offering **Broadcast as a Service (BaaS)**

Cloud RAN

RAN = Radio Access Network

NABSHOW #NABShow

"Mobile First"

- Mobile devices for all forms of communications

- Applications are moving to the Cloud

- Video is the natural communications medium

- Media is detached from delivery platforms

- Anytime, everywhere open wireless and cloud access

"Mobile First"

- Extending wireless to most objects in our lives (IoT)
- Ubiquitous, high quality, fast wireless access
- Wired & fixed-wireless for high speed last mile
- Extending cloud scale to all aspects of networks
- Open operating systems and standards

"Mobile First"

✓Improve utilization of Broadcast Spectrum

✓Strategy for distribution of video content

✓Lower total cost of ownership (cloud services)

✓Increased automation - operations and management

✓New competitive business models

New Broadcast Cloud-based System Architecture

Community Cloud Model

- Broadcast as a Service (**BaaS**)
- Broadcast Market Exchange (**BMX**)
- Spectrum and Infrastructure **Sharing**
- **Multi-tenancy**
- Rapid elasticity (Scalability and Load-balancing)
- Measured service (pay-per-use model)
- Reduced costs
- Reliability and Availability
- Security
- New Business Models in IP World

Network Function Virtualization

- Separation of **control and data plane**
- **Virtualization of network functions** on COTS HW platforms (flexibility at reduced costs)
- Programmatic control of network and computational resources using orchestration (**PLP Service chaining or Network Slicing**)
- Programmatic control of Standards-based configuration protocols
- Operational efficiency in control, deployment, and business processes
- Automated resource **orchestration** in response to application/function needs

"Concepts like these are well understood by Web-Scale IT Players and Emerging 5G"

Google   amazon   facebook   AT&T   verizon

NABSHOW   #NABShow

Voluntary Opportunity ATSC 3.0:

1st - *Green Field (No backward compatibility)*
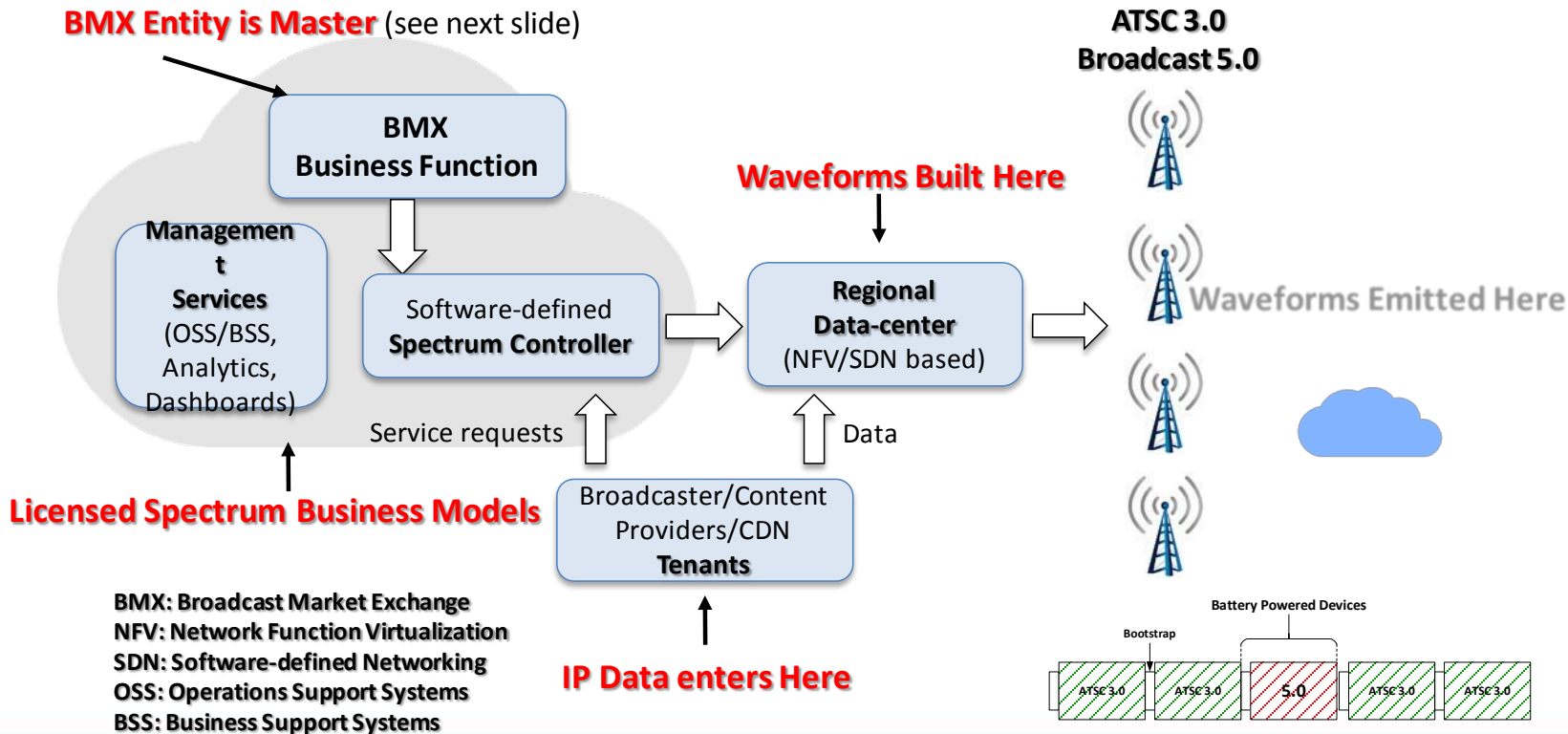2nd - *Broadcast is simpler than 5G*
3rd - *FCC is encouraging Broadcast Innovation*

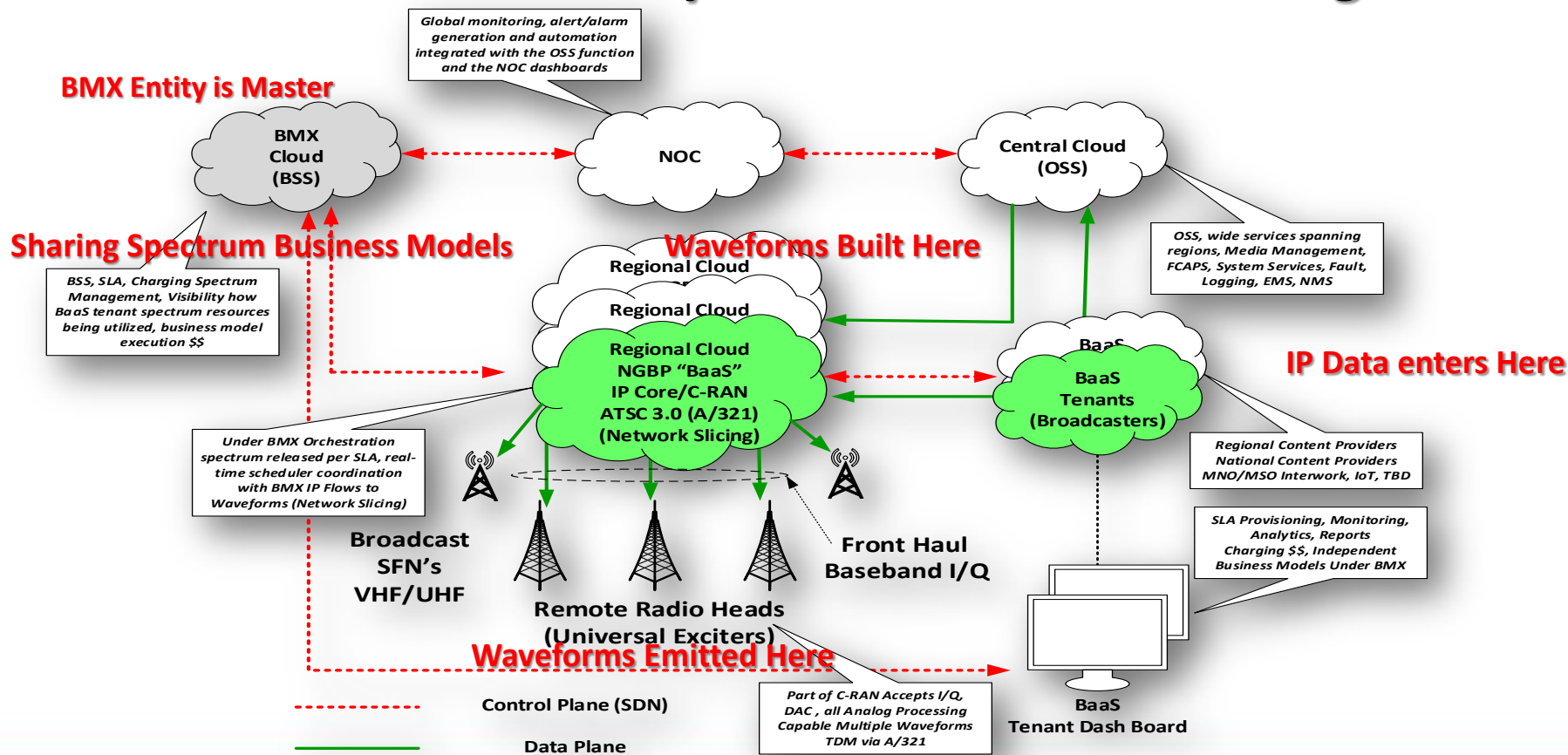*"Only New to Traditional Broadcast?"*

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

BMX Entity is Master (see next slide)

ATSC 3.0
Broadcast 5.0

Waveforms Built Here

**BMX
Business Function**

**Management
Services**
(OSS/BSS,
Analytics,
Dashboards)

Software-defined
Spectrum Controller

**Regional
Data-center**
(NFV/SDN based)

Waveforms Emitted Here

Service requests

Data

Licensed Spectrum Business Models

Broadcaster/Content
Providers/CDN
Tenants

BMX: Broadcast Market Exchange
NFV: Network Function Virtualization
SDN: Software-defined Networking
OSS: Operations Support Systems
BSS: Business Support Systems

IP Data enters Here

Battery Powered Devices

Bootstrap

| ATSC 3.0 | ATSC 3.0 | 5.0 | ATSC 3.0 | ATSC 3.0 |

See NAB Vision paper more details

NABSHOW   #NABShow

Nationwide Community Cloud Architecture using "BaaS"

Global monitoring, alert/alarm generation and automation integrated with the OSS function and the NOC dashboards

BMX Entity is Master

BMX Cloud (BSS)

NOC

Central Cloud (OSS)

Sharing Spectrum Business Models

BSS, SLA, Charging Spectrum Management, Visibility how BaaS tenant spectrum resources being utilized, business model execution $$

Waveforms Built Here

Regional Cloud

Regional Cloud

Regional Cloud NGBP "BaaS" IP Core/C-RAN ATSC 3.0 (A/321) (Network Slicing)

OSS, wide services spanning regions, Media Management, FCAPS, System Services, Fault, Logging, EMS, NMS

BaaS

BaaS Tenants (Broadcasters)

IP Data enters Here

Under BMX Orchestration spectrum released per SLA, real-time scheduler coordination with BMX IP Flows to Waveforms (Network Slicing)

Regional Content Providers National Content Providers MNO/MSO Interwork, IoT, TBD

Broadcast SFN's VHF/UHF

Front Haul Baseband I/Q

SLA Provisioning, Monitoring, Analytics, Reports Charging $$, Independent Business Models Under BMX

Remote Radio Heads (Universal Exciters)

Waveforms Emitted Here

Part of C-RAN Accepts I/Q, DAC , all Analog Processing Capable Multiple Waveforms TDM via A/321

BaaS Tenant Dash Board

- - - - - Control Plane (SDN)

——— Data Plane

See NAB Vision paper more details

NABSHOW   #NABShow

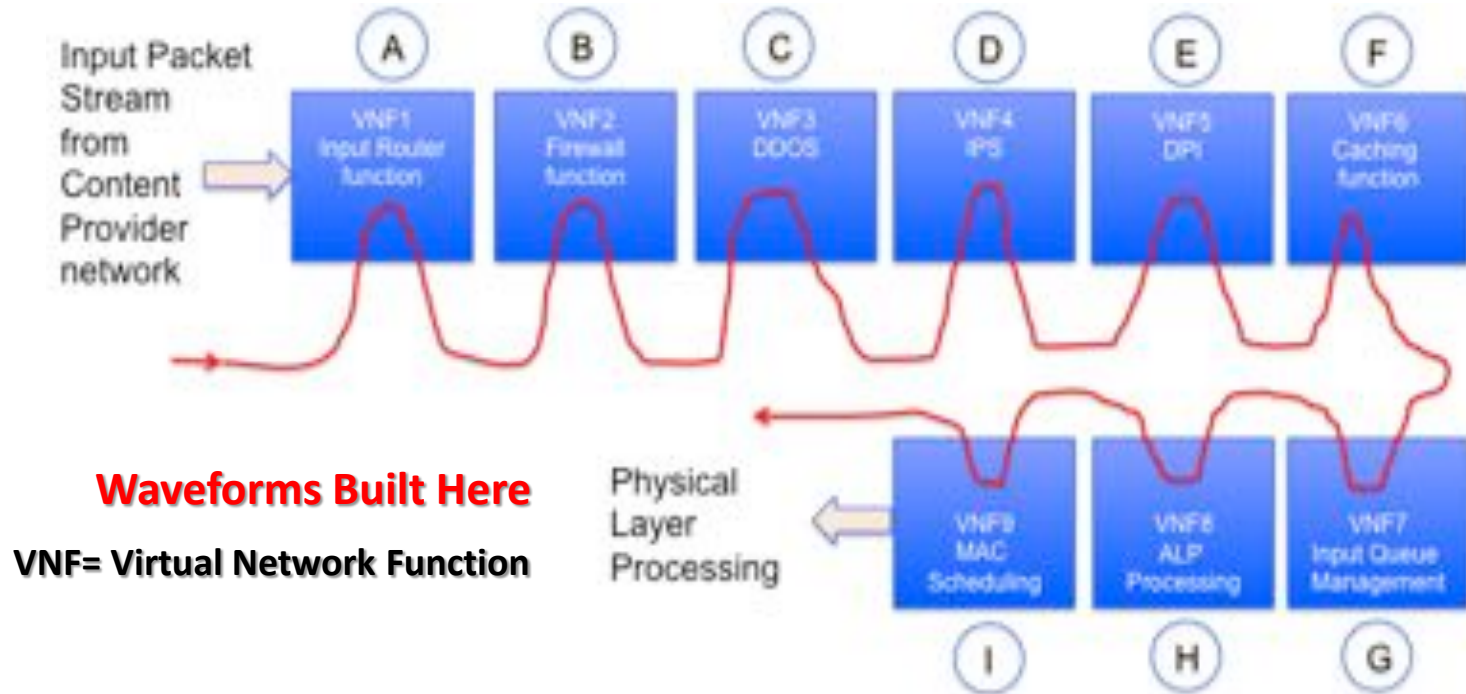# Web-Scale IT Broadcast Regional Data Center

Waveforms Built Here

Common Basic Cloud Computing Architecture

Web-Scale Broadcast Regional Data Center

Chaining of VNF's on a PLP by PLP or Service basis is termed Network Slicing

Waveforms Built Here

VNF= Virtual Network Function

What use to be built as HW boxes such as Gateways / Exciters is now instantiated in Software

PLP Service Chaining or Network Slicing in Cloud
Regional Data Center
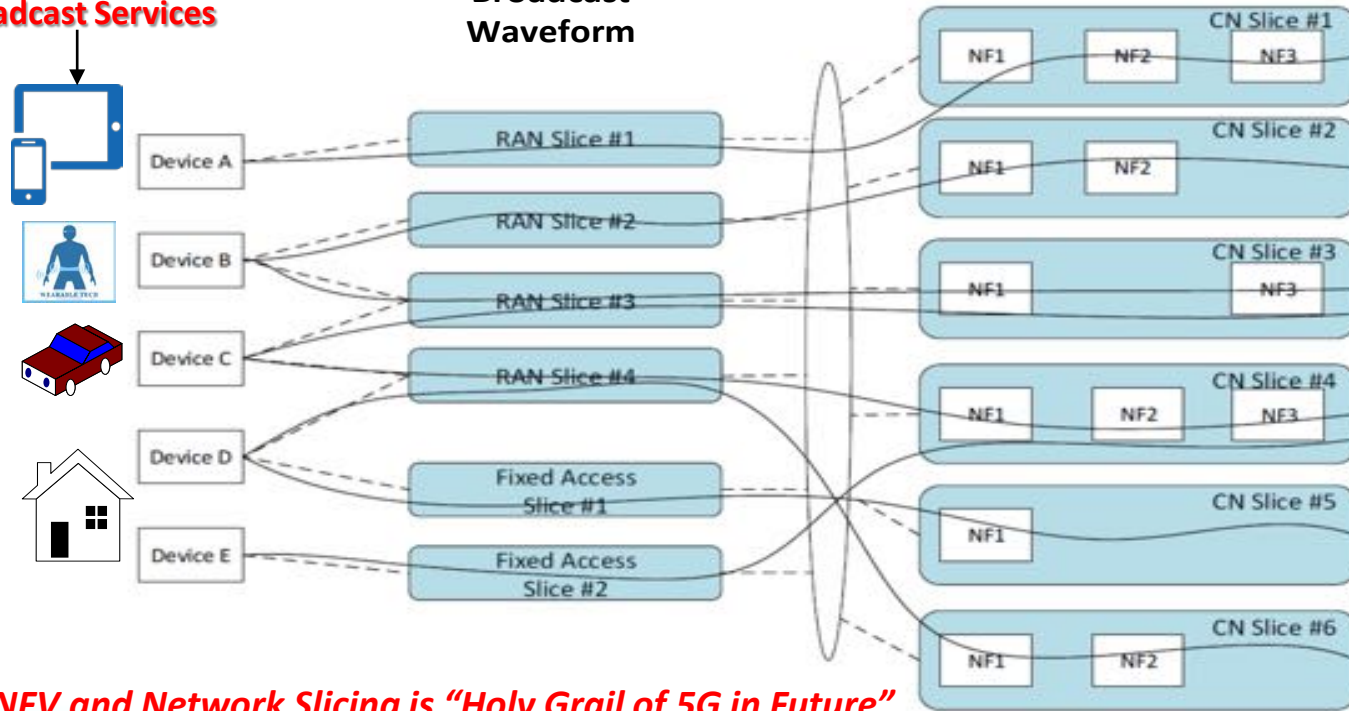
5G C-RAN Equated to Broadcast C-RAN
Radio Access Networks (RANs)

Remote Radio Head (RRH)

(3) Sectors

Cells

Potential Area Inter-cell Interference to Mitigate

5G C-RAN

5G C-RAN Edge Data Center

Digital Baseband (SDN/NFV)

Digital I/Q

Optimized Unicast Traffic

Broadcast C-RAN

Waveforms Built Here

Waveforms Emitted Here

Digital I/Q

Digital I/Q

Optimized Broadcast Traffic
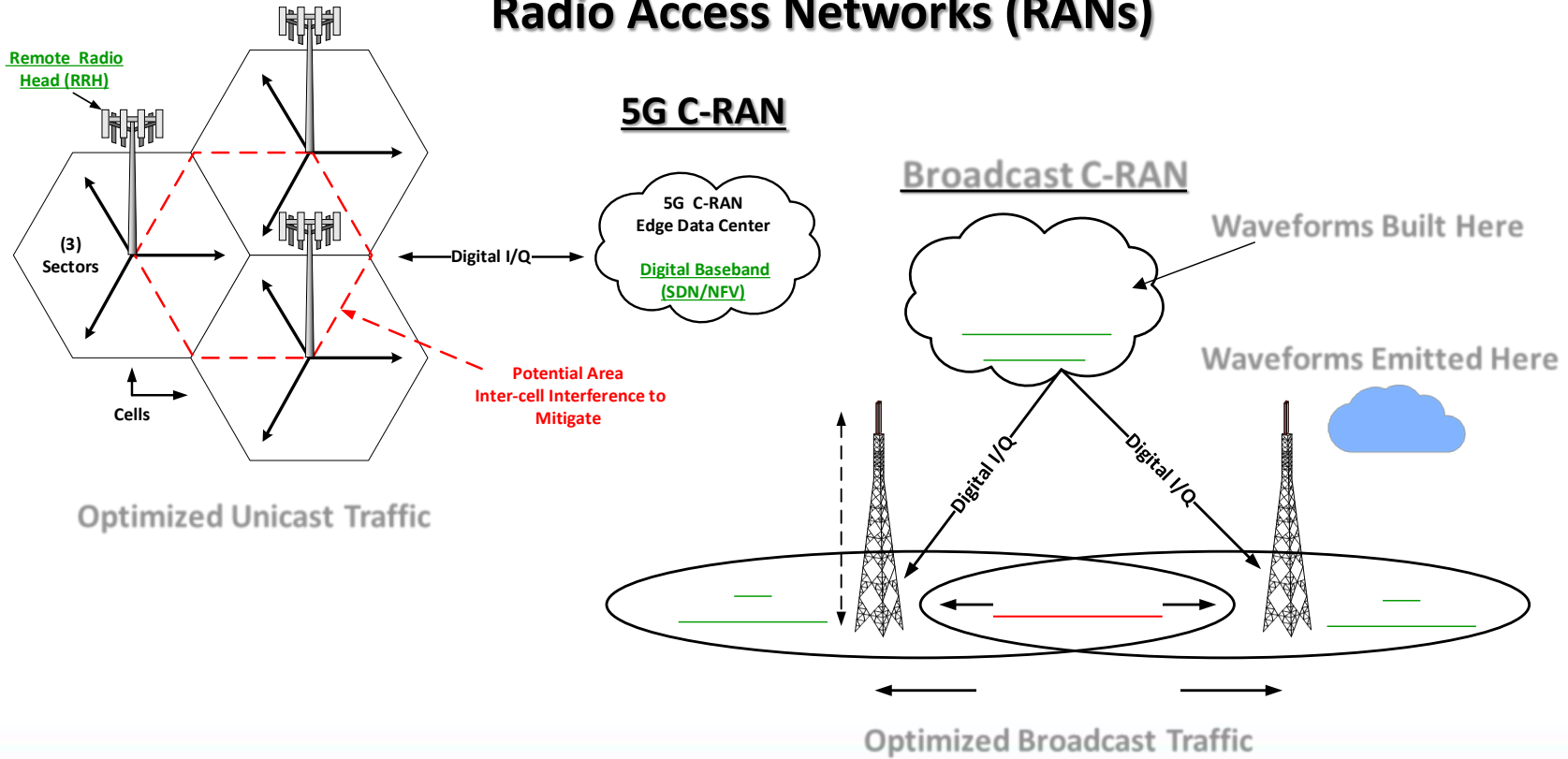
Hybrid Network Slicing and Diverse Services
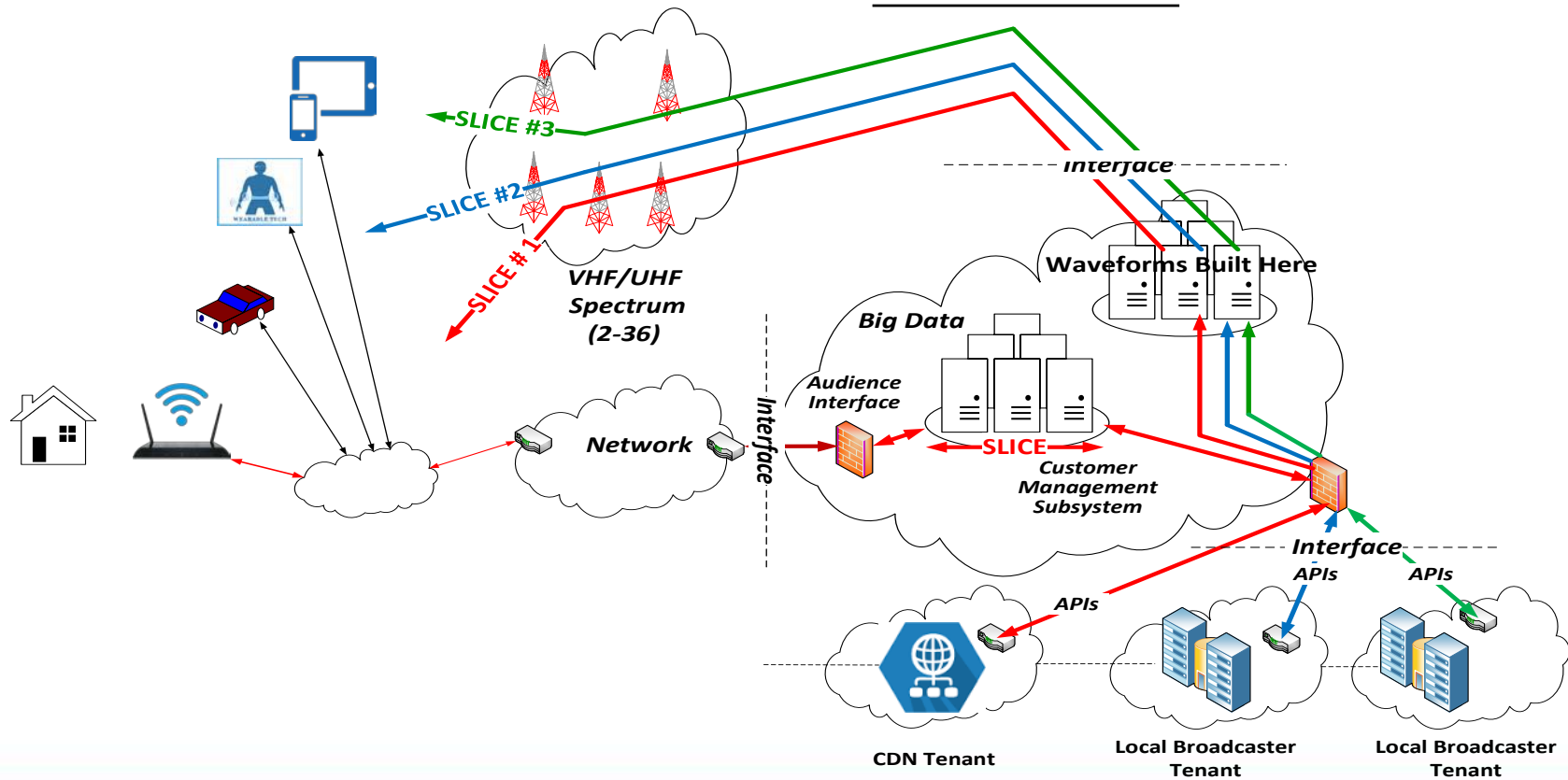
New Broadband Broadcast Business Opportunities Leveraging New Architecture

Sinclair's Vision of "Mobile First" Future

"USA should be at forefront of Innovation in Broadcast Space"
What does that look like? Here's is one Well-timed Vision

"Closing Thought"
Reality based Spectrum, Technology & Policy is Required

TESTIMONY OF FCC COMMISSIONER AJIT PAI BEFORE THE U.S. SENATE COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION Sept 2016

I believe that it is important for the Commission to act with dispatch. Just as the United States is leading the way on 5G in the mobile space, so too should we be at the forefront of innovation in the broadcast space. Other countries aren't standing still. Earlier this year, for example, South Korea adopted the ATSC 3.0 standard, and ATSC 3.0 broadcasters are scheduled to begin there in February 2017. We should get moving, too.

These must all come together in a Free Market
"Sinclair's Vision"

NABSHOW   #NABShow

For a copy of the written paper:
http://sbgi.net/one-media/