The Progress of ATSC 3.0 Rollout from the Broadcaster and Consumer Electronics Perspective

WBA 2021 Broadcasters Clinic Conference

September 10, 2021

© 2021 Pearl TV, LLC. All rights reserved.

Pearl TV and the Pearl Network Consortia

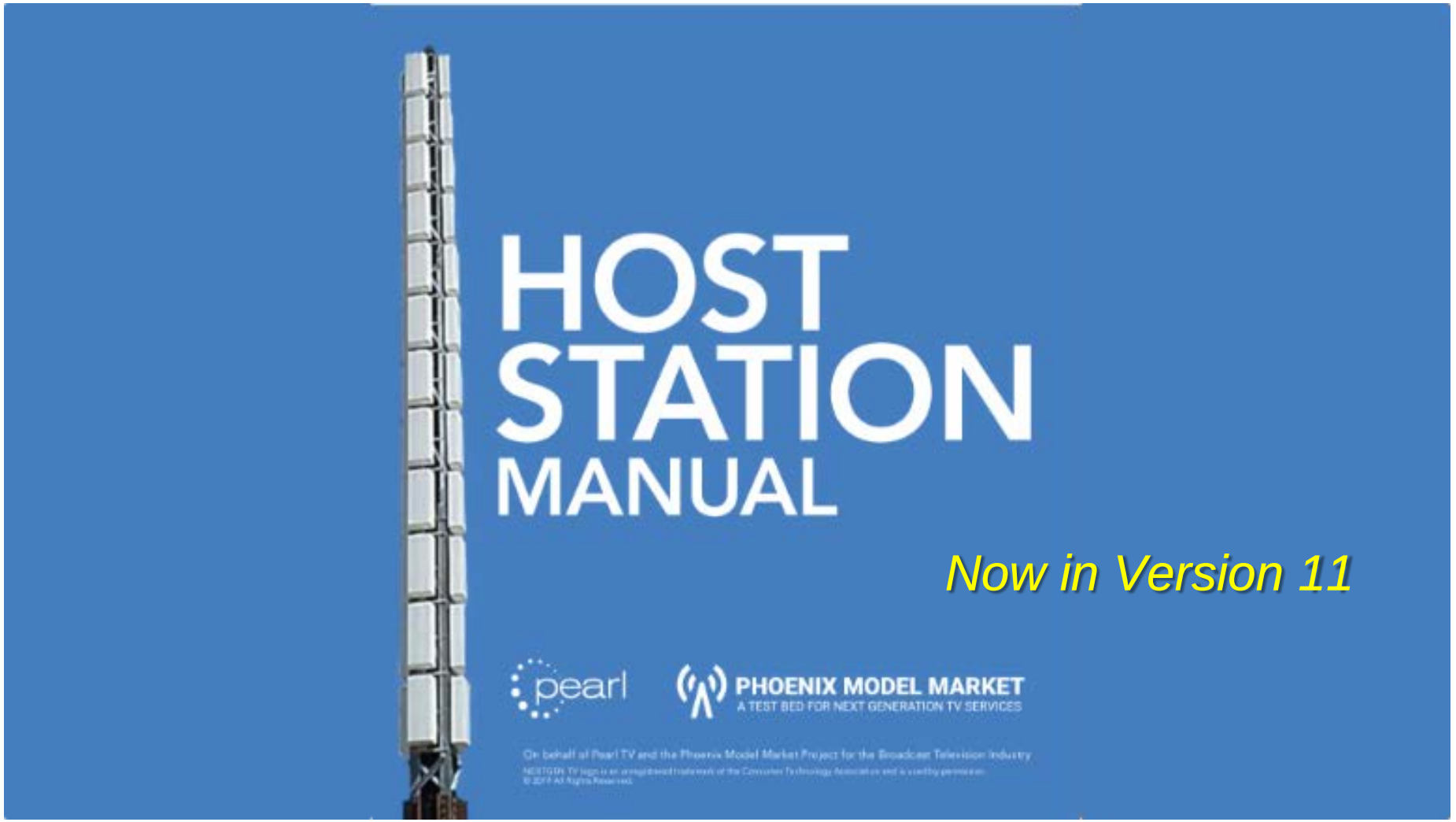
Pearl TV is a business organization of U.S. broadcast companies with a shared interest in exploring forward-looking broadcasting opportunities, including innovative ways of promoting local broadcast TV content and developing digital media. Pearl's membership is comprised of more than 750 TV stations, owned by nine of the largest US broadcast companies.

The Pearl Network Consortia (PNC)* is a collaborative effort of broadcast organizations is by Pearl TV consists of the 4 major networks as well as the stations associated with Pearl TV that are working together to test, develop and advance the capabilities of NextGen TV powered by the ATSC-3 standard.

**PNC formally known as Phoenix Model Market Partnership*

© 2021 Pearl TV, LLC. All rights reserved.

Host Station Manual



© 2021 Pearl TV, LLC. All rights reserved.

What we will discuss today

- Quick Overview of the Standard
- Status of Market Transitions
- Status of Transmission Equipment
- Status of Consumer Receivers and Sales
- Requirements for NextGen TV Security
- Single Frequency Network Testing
- RUN3TV Application Framework
- Broadband Delivery of NextGen TV

© 2021 Pearl TV, LLC. All rights reserved.

Quick Overview of Standard

© 2020 Pearl TV, LLC. All rights reserved.

The ATSC-3 NEXTGEN TV Standard

- Six Noteworthy Features
  - Evolvability
  - OTA/OTT Delivery Capability
  - Enhanced Picture Quality (4K, HDR,WCG)
  - Immersive Audio (Voice+ Controllable Dynamic Range)
  - W3C - HTML-5 Broadcaster Application (Viewer Engagement)
  - Content Security and Service Protection

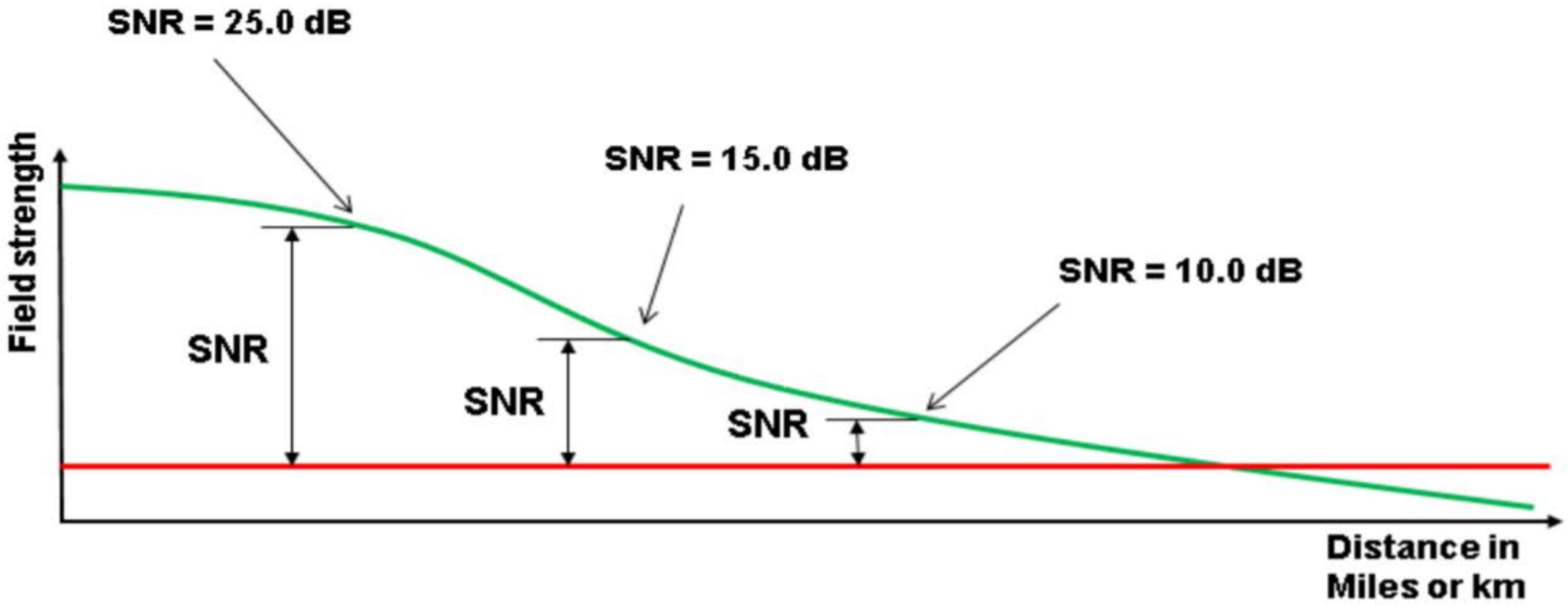
© 2021 Pearl TV, LLC. All rights reserved.

ATSC-3 NEXTGEN TV Standard Underpinnings

- Made up of 22 Individual Standards, 10 recommended Practices, as well as 2 Group Technical Reports
- Well over 1000 pages long and growing
- Based Internet Protocol (IP) and HTML transport
- Uses UDP and Multicast addressing
- Uses COFDM Modulation and LDCP Coding (FEC)
- Requirements for Content and Service Security
- Built in Interactive Capabilities
- Advanced and more efficient video and audio capabilities

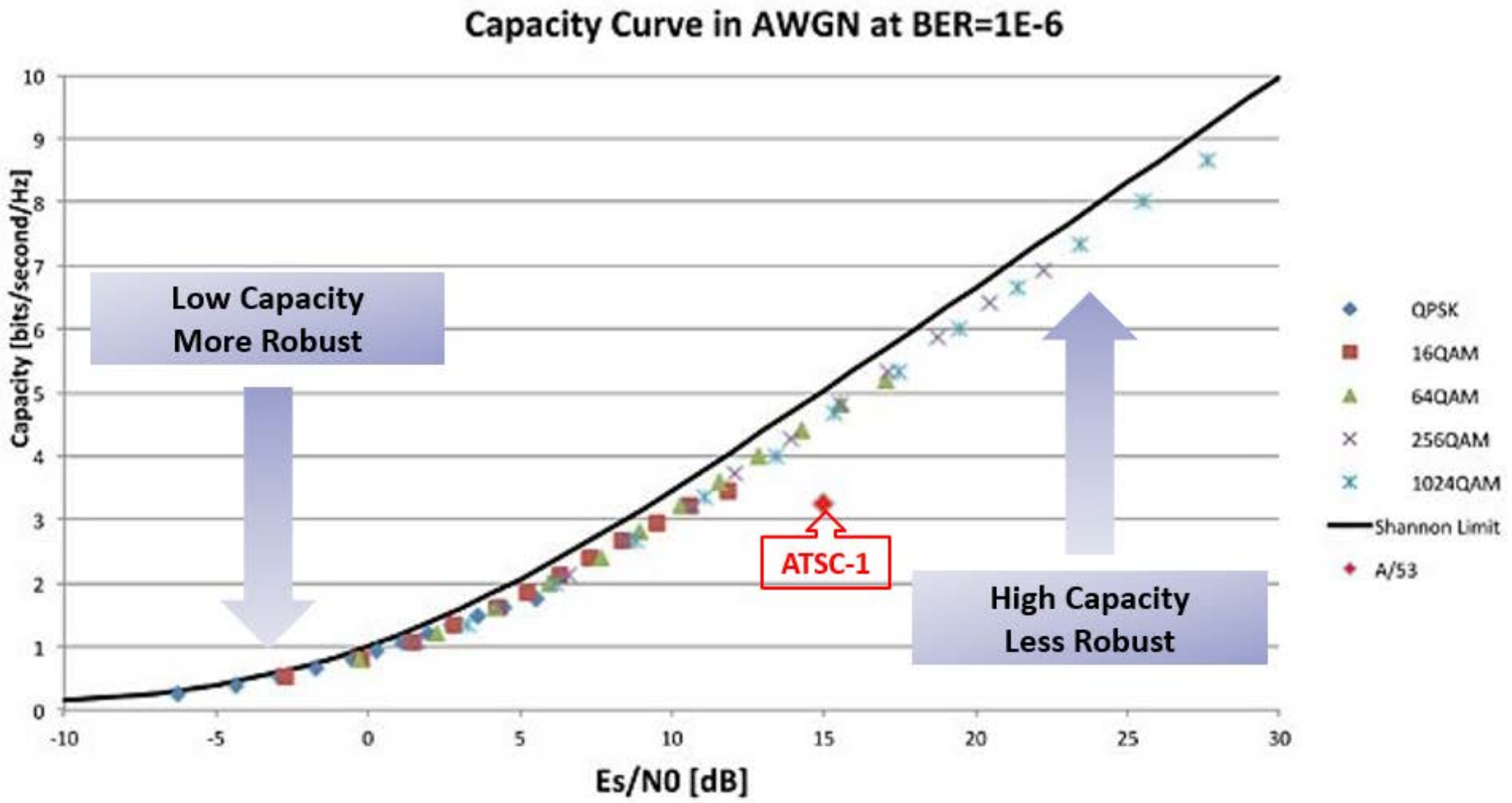
© 2021 Pearl TV, LLC. All rights reserved.

Understanding Noise Threshold



© 2021 Pearl TV, LLC. All rights reserved.

Shannon Limit Channel Capacity Curve

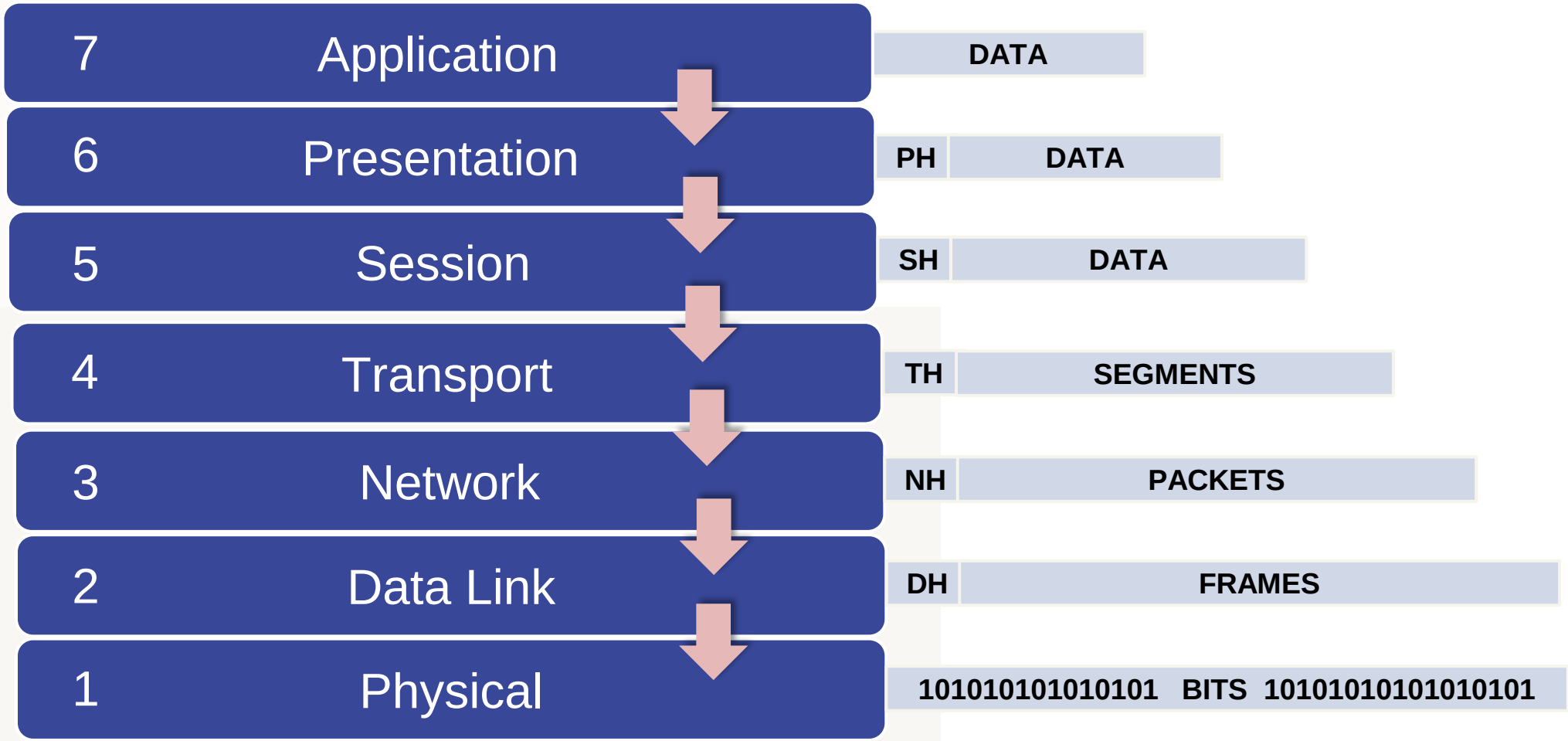


© 2021 Pearl TV, LLC. All rights reserved.

Matryoshka Dolls and NEXTGEN TV

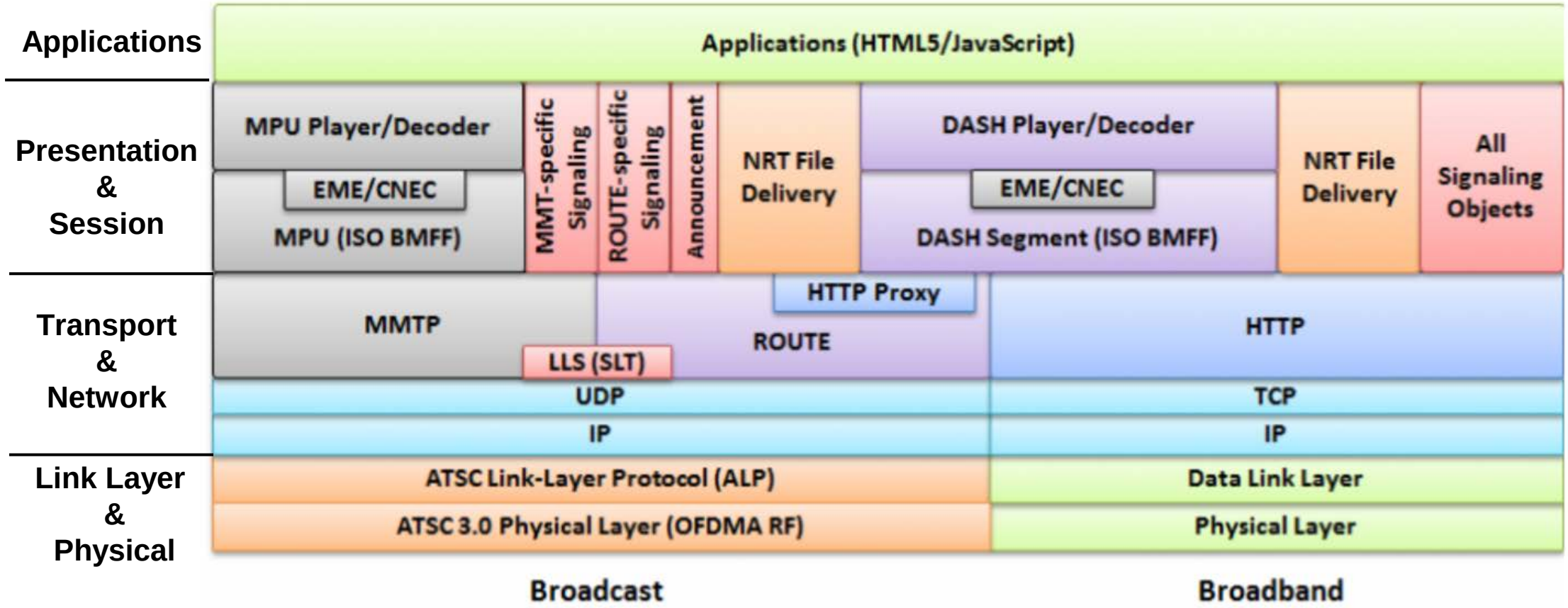
© 2021 Pearl TV, LLC. All rights reserved.

OSI 7 Layer Model



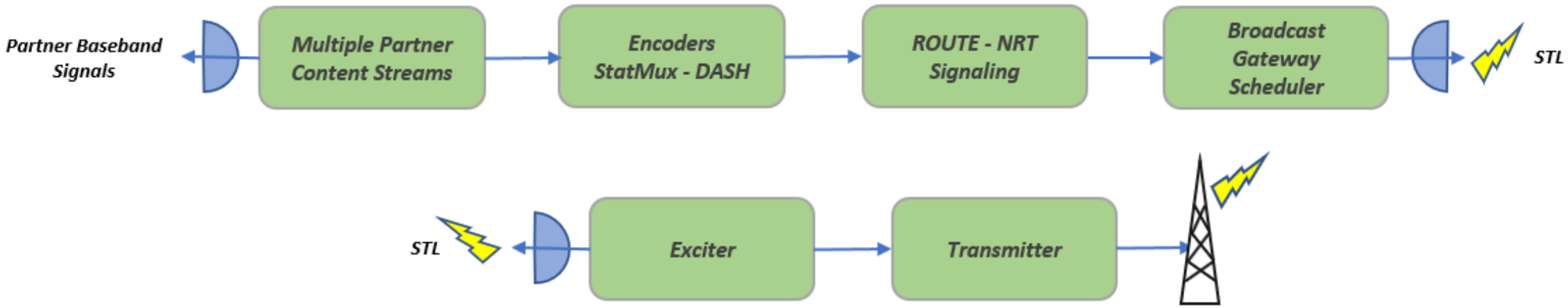
© 2021 Pearl TV, LLC. All rights reserved.

ATSC-3 NextGenTV Stack



© 2021 Pearl TV, LLC. All rights reserved.

OVERVIEW OF STANDARD



Full ATSC-3 Transmission Chain

© 2021 Pearl TV, LLC. All rights reserved.

Status of the Transition

© 2020 Pearl TV, LLC. All rights reserved.

NextGen TV 2021 Transition Market Statistics

NEXTGEN TV Transition Projections *Through 12/31/21*	
Total NEXTGEN TV Markets	51
Total NEXTGEN TV Hosts	64
Markets with Two Hosts	13
VHF Sticks as 3.0 Host	2
Total Services Offered via NGTV*	263
% U.S. HH Reached	59.0%

*Broadcast TV services

© 2021 Pearl TV, LLC. All rights reserved.

Difficult Markets Persist

- Some markets may slip into 1H 2022 based on several factors including: available spectrum, capital availability and personnel bandwidth along with market-specific equipment concerns

Top 40 Markets:

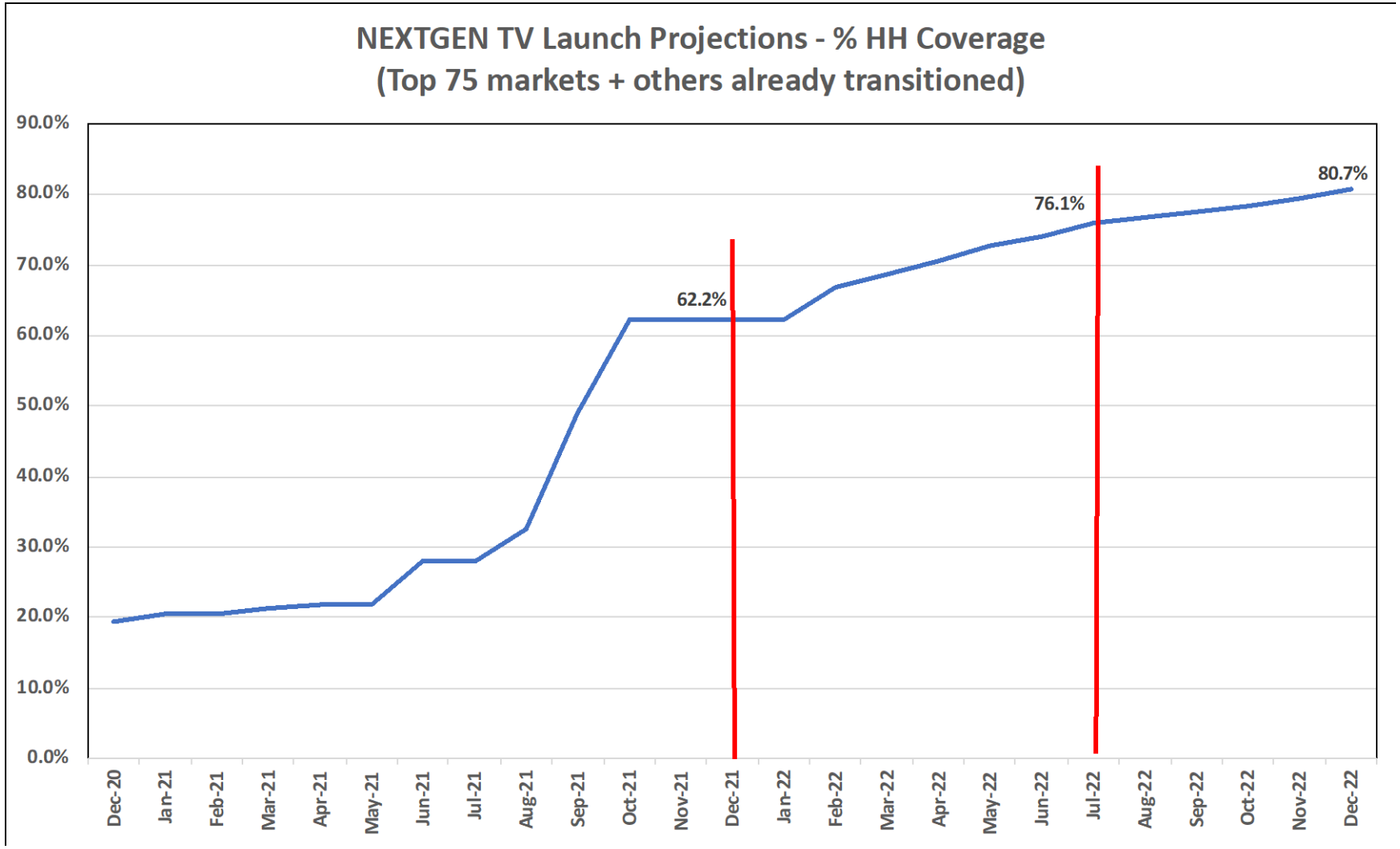
- Chicago (3)
- Minneapolis (14)
- San Diego (27)
- Greenville-Spartanburg (35)
- Milwaukee (37)

Others in Top ~50:

- Jacksonville (43)
- New Orleans (50)
- Memphis (51)

© 2021 Pearl TV, LLC. All rights reserved.

NextGen TV Launch Projections

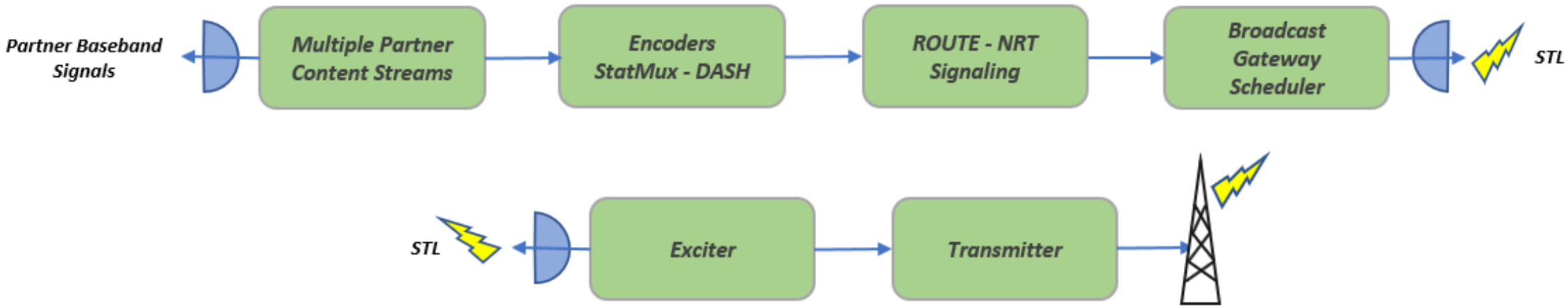


© 2021 Pearl TV, LLC. All rights reserved.

Status of Transmission Equipment

© 2020 Pearl TV, LLC. All rights reserved.

STATUS OF TRANSMISSION EQUIPMENT



Full ATSC-3 Transmission Chain

© 2021 Pearl TV, LLC. All rights reserved.

Increasing Transmission Equipment Vendors

- Top TV manufacturers
- Top technology vendors
- Significant development

© 2021 Pearl TV, LLC. All rights reserved.

Status of Consumer Receivers

© 2020 Pearl TV, LLC. All rights reserved.

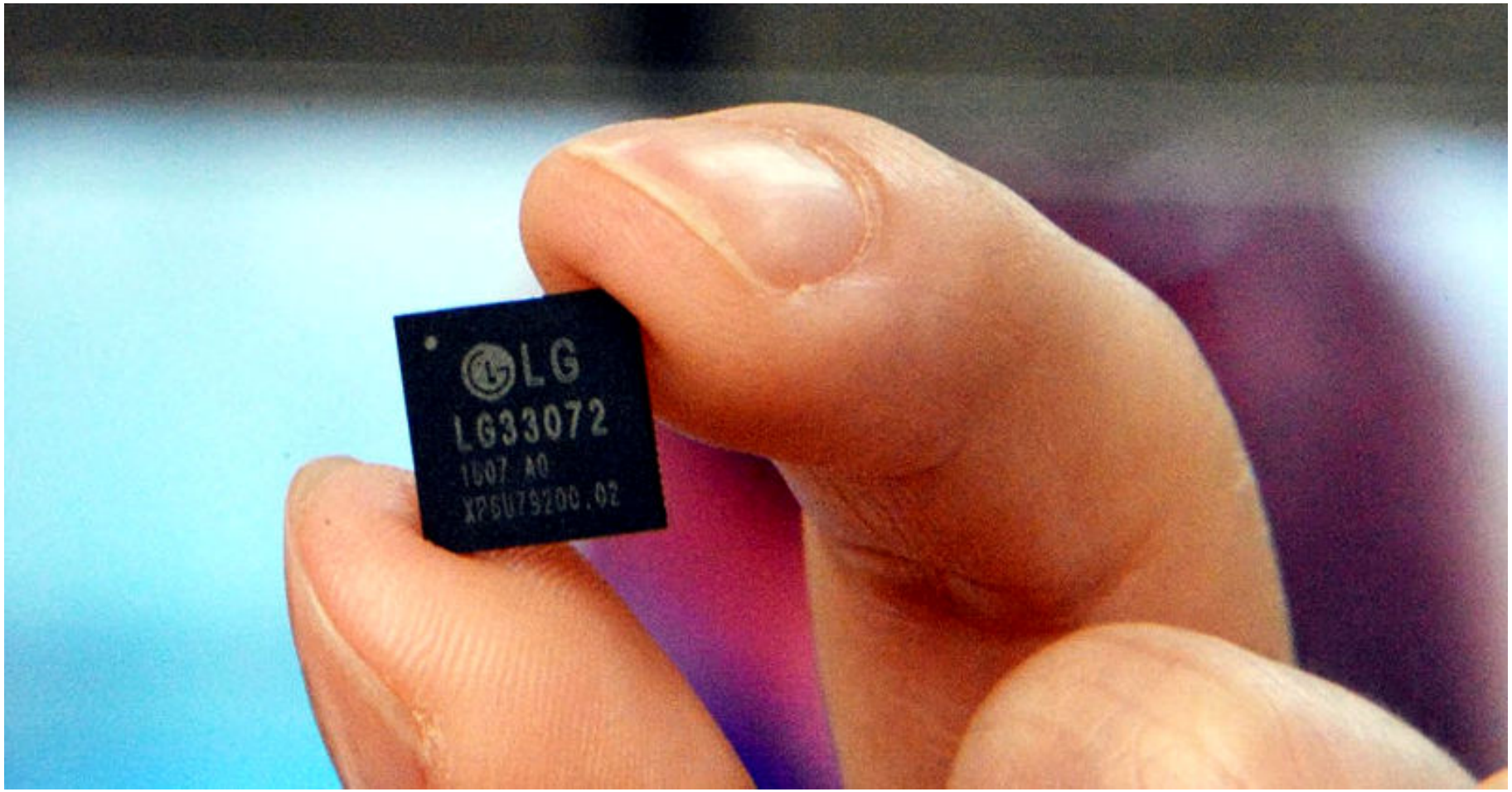
Chip Development Fuels NEXTGEN TV Receivers

CXD2878ER

CXD6801GL

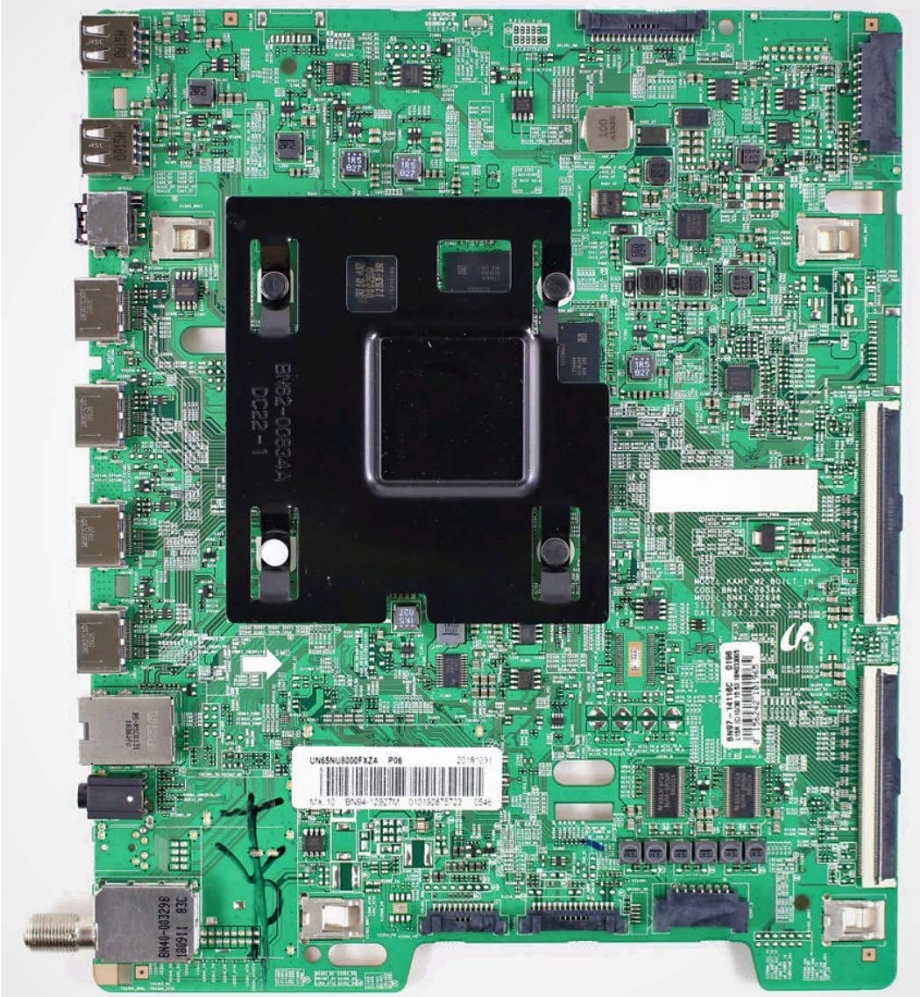
© 2021 Pearl TV, LLC. All rights reserved.

Chip Development Fuels NEXTGEN TV Receivers



© 2021 Pearl TV, LLC. All rights reserved.

Chip Development Fuels NEXTGEN TV Receivers



© 2021 Pearl TV, LLC. All rights reserved.

2021 NEXTGEN TVs: ~70 models for 2021

Manufacturer	Series	Resolution	Panel	Dimensions	Price
SONY	X90J/X90CJ	4K	LCD	50”, 55” (2), 65” (2), 75” (2)	Starting at $1100
SONY	X95J	4K	LCD	65”, 77”, 85”	Starting at $3000
SONY	A80J/A80CJ	4K	OLED	55”, 65” (2), 77” (2)	Starting at $1700
SONY	A90J	4K	OLED	55”, 65”, 83”	Stating at $2800
SONY	Z9J	8K	LCD	75”, 85”	Starting at $8000
SONY	X92	4K	LCD	100”	Starting at $20,000
SONY	X80J	4K	LCD	43”, 50”, 55” (2), 65” (2), 75” (2)	Starting at $599
SONY	X90CH	4K	LCD	85”	

© 2021 Pearl TV, LLC. All rights reserved.

2021 NEXTGEN TVs: ~70 models for 2021, con't

Manufacturer	Series	Resolution	Panel	Dimensions	Price
SONY	X85J/X85CJ	4K	LCD	43", 50", 55", 65" (2), 75" (2), 85" (2)	Starting at $1000
SONY	X91CJ	4K	LCD OLED	85" (2)	Starting at $3000
SONY	XBR-X900H	4K	LCD	55", 65", 75", 85"	Starting at $1000
LG	G1	4K	OLED	48", 55", 65", 77"	Starting at $2000
LG	WX	4K	OLED	65"	Starting at $4000
LG	ZX	4K	OLED	77", 88"	Starting at $20,000
SAMSUNG	QN900A	8K	QLED	65", 75", 85"	Starting at $4800
SAMSUNG	QN800A	8K	QLED	65", 75", 85"	Starting at $3000
SAMSUNG	QN90A	4K	QLED	50", 55", 65", 75", 85"	Starting at $1400

© 2021 Pearl TV, LLC. All rights reserved.

2021 Devices & 2022 Projections

Samsung 2021 QN90

- LG, Samsung, and Sony will have about 70 models available this year. Lowest list price currently $599.
- 1 STBs available currently, about 2500 in market. Additional delay due to chip set shortage

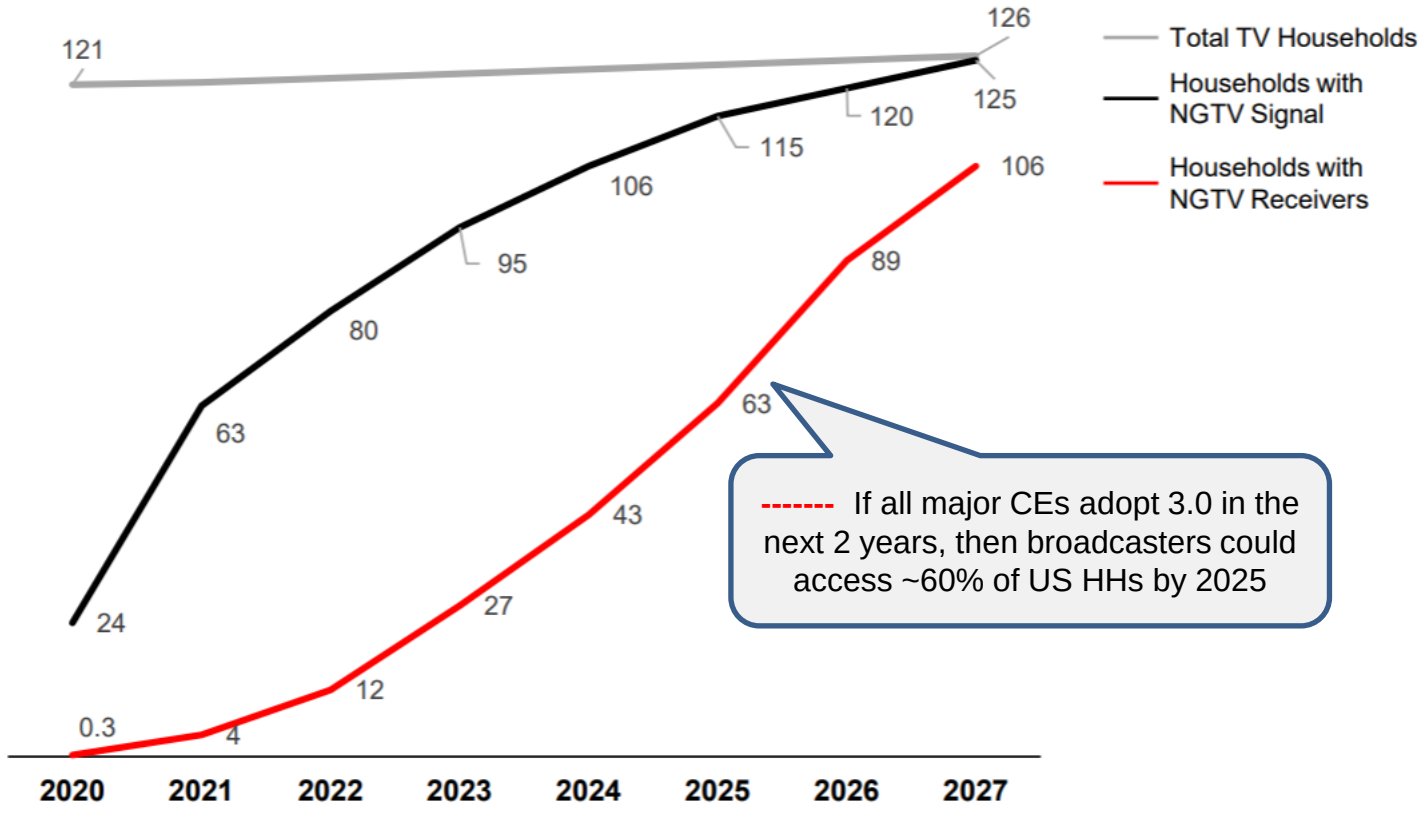
SiliconDust HDHomeRun Connect
$199

- With the addition of at least 1 new TV OEM, we anticipate 100+ TV models or more for 2022.
- In 2022, we estimate additional low-cost accessory devices ranging from $60-$150 that can enable the conversion of existing devices purchased in the last 7 years.

© 2021 Pearl TV, LLC. All rights reserved.

Connected NGTVs Household Penetration

- Sales of 3 MM NEXTGEN TV receivers by end of 2021
- Significant growth of NextGen TV receivers installed base and HH penetration – NGTV receivers are expected to penetrate 100M+ HH by 2027



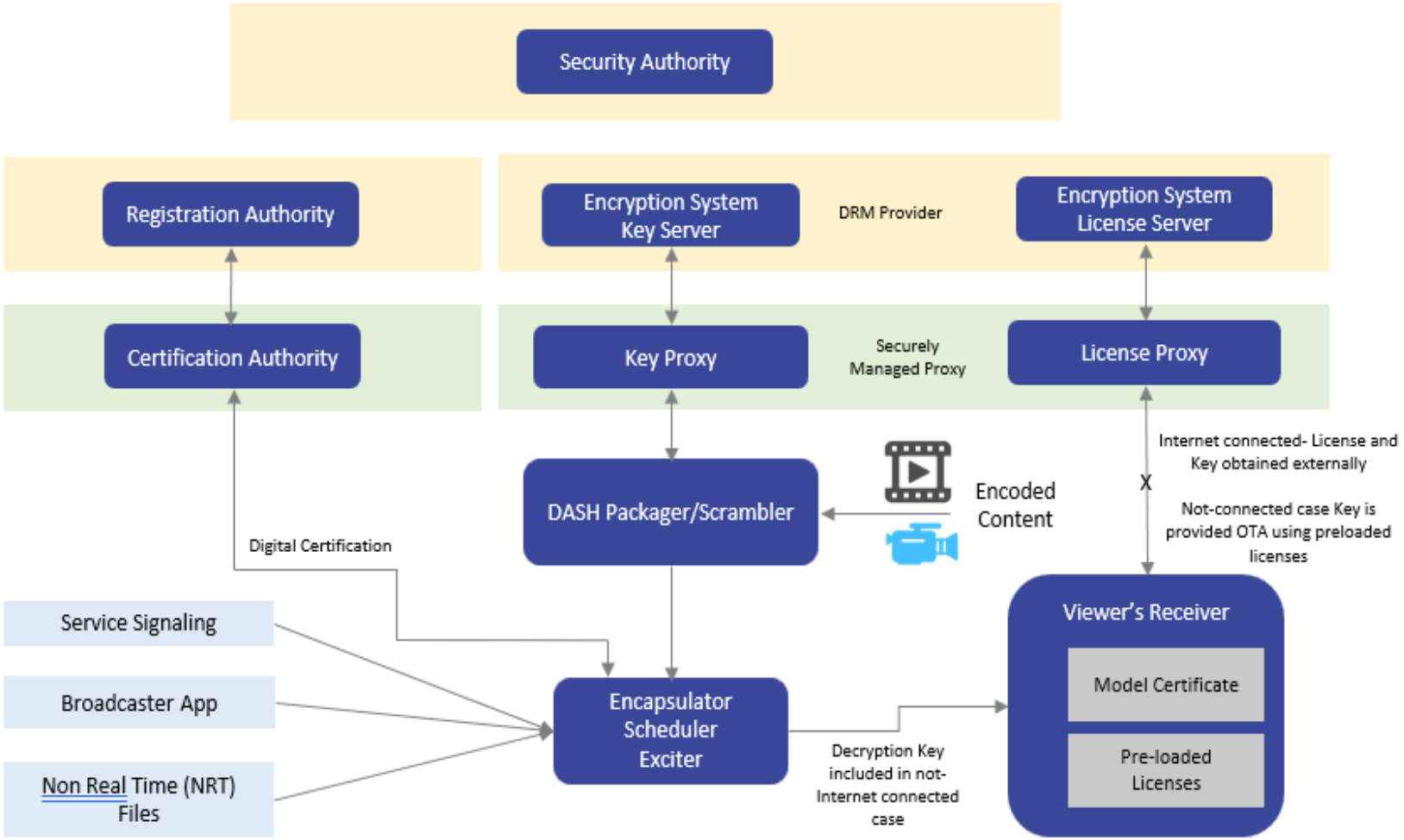
Source(s): Red Chalk Group Analysis; CTA; Nielsen; US Census; Company Financials and Reports; Research and Markets

© 2021 Pearl TV, LLC. All rights reserved.

Status NextGen TV Security

© 2020 Pearl TV, LLC. All rights reserved.

Content Security and Service Protection

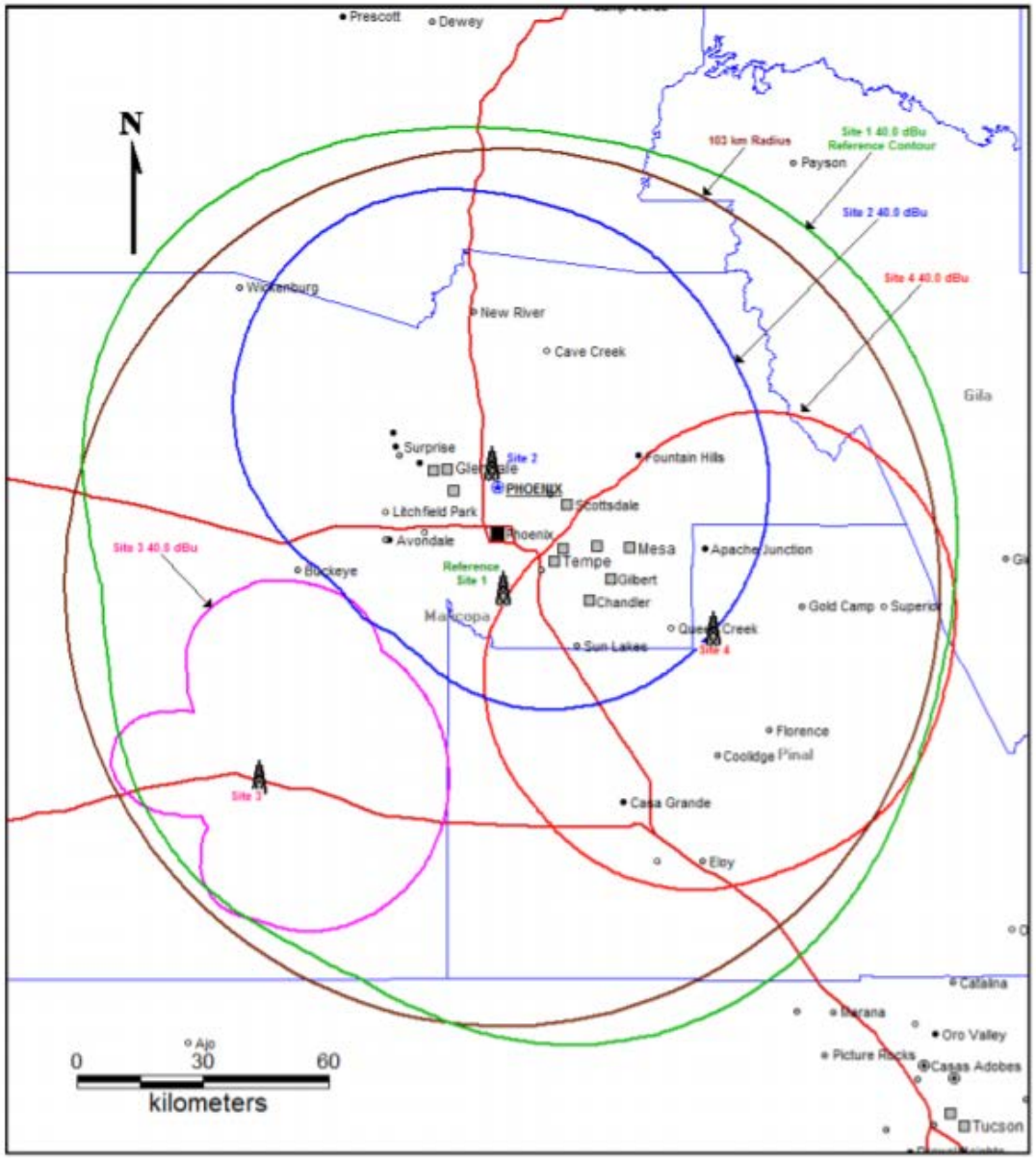


© 2021 Pearl TV, LLC. All rights reserved.

Single Frequency Network Testing

© 2020 Pearl TV, LLC. All rights reserved.

SINGLE FREQUENCY NETWORK TESTING



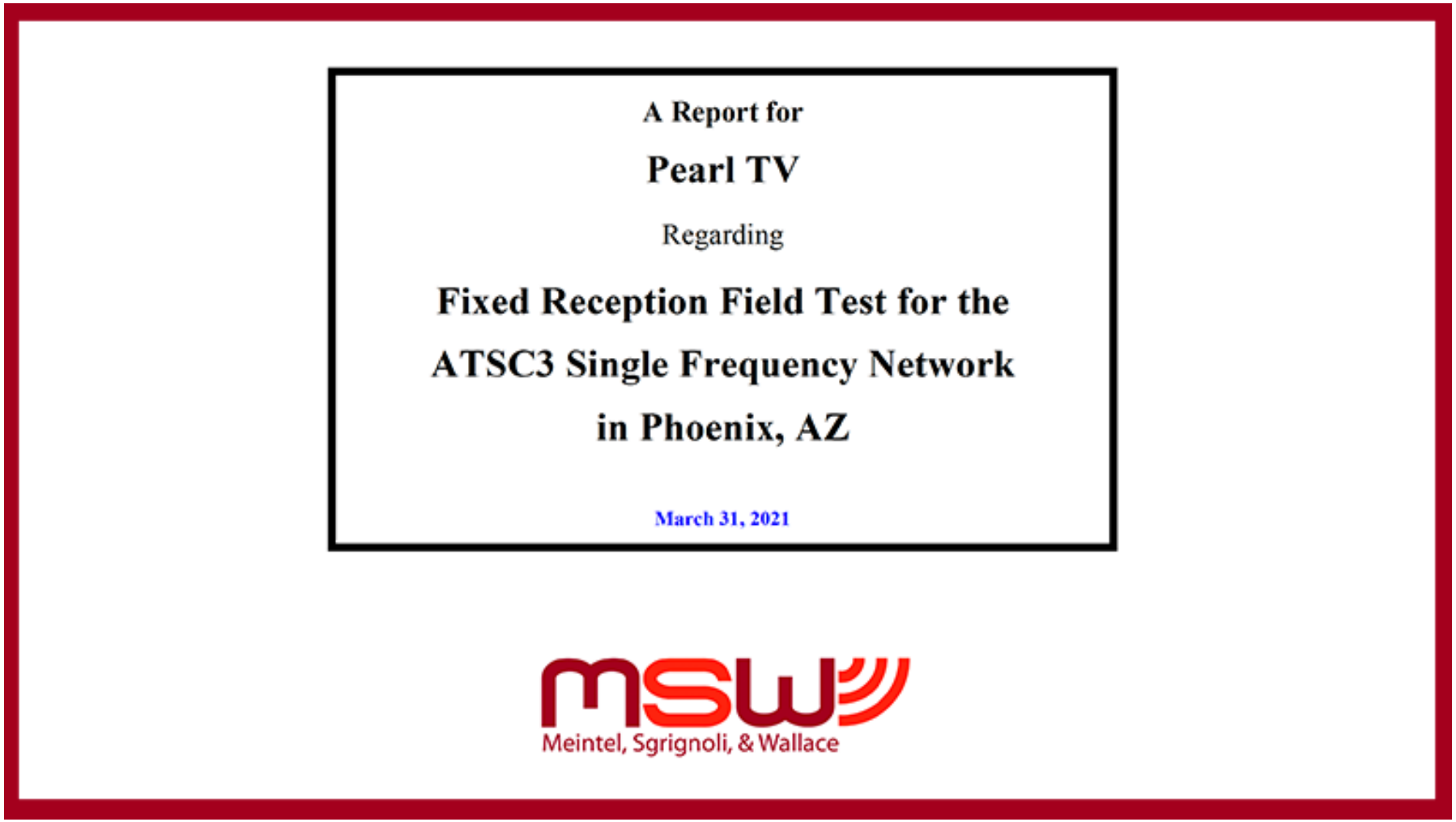
© 2021 Pearl TV, LLC. All rights reserved.

Pearl TV- Network Consortia Phoenix SFN Test

- Test of PNC/Pearl sponsored SFN In late February and early March of 2021
- KASW on South Mountain (KASW-1) on physical channel 27 at 445kW ERP (110kW Vpol) is eight miles south Phoenix. The SFN has second node located on Shaw Butte (KASW-2) that transmits at an 18.5 kW ERP (4KW Vpol) 18 mile north of downtown Phoenix.
- A single PLP used at a high data rate (24.04 Mbps) and AWGN threshold (16.5 dB) was utilized for this test, providing a relatively sensitive type of reception test
- Absolute error-free reception at 80% (32 out of 40 total sites) 35% of the sites (i.e., 14 out of 40 total sites) had no reception without second node on.
- The median Service Margin for the 40 test sites increased (improved) by about 6 dB from the SFN on versus off at 30 feet and about 10 dB (improved) at 12 feet
- Service Availability (completely error free reception) for the 40 test sites increased (improved) with the SFN on by about 22% for 30 feet and 15% at the 12 feet

© 2021 Pearl TV, LLC. All rights reserved.

Pearl TV- Network Consortia Phoenix SFN Test



A Report for

Pearl TV

Regarding

Fixed Reception Field Test for the

ATSC3 Single Frequency Network

in Phoenix, AZ

March 31, 2021

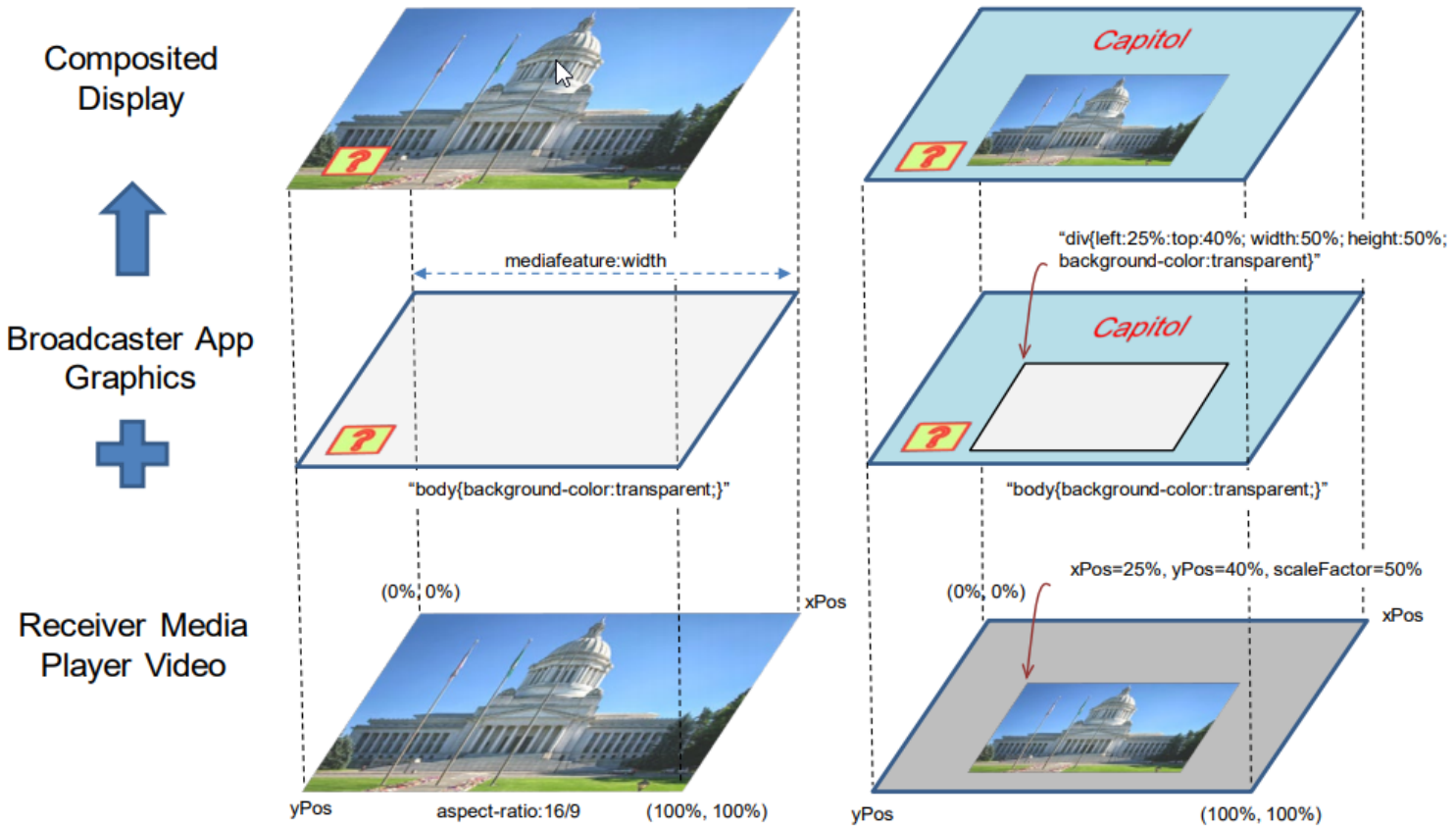
Meintel, Sgrignoli, & Wallace

© 2021 Pearl TV, LLC. All rights reserved.

RUN3TV Application Framework

© 2020 Pearl TV, LLC. All rights reserved.

Common Application Framework

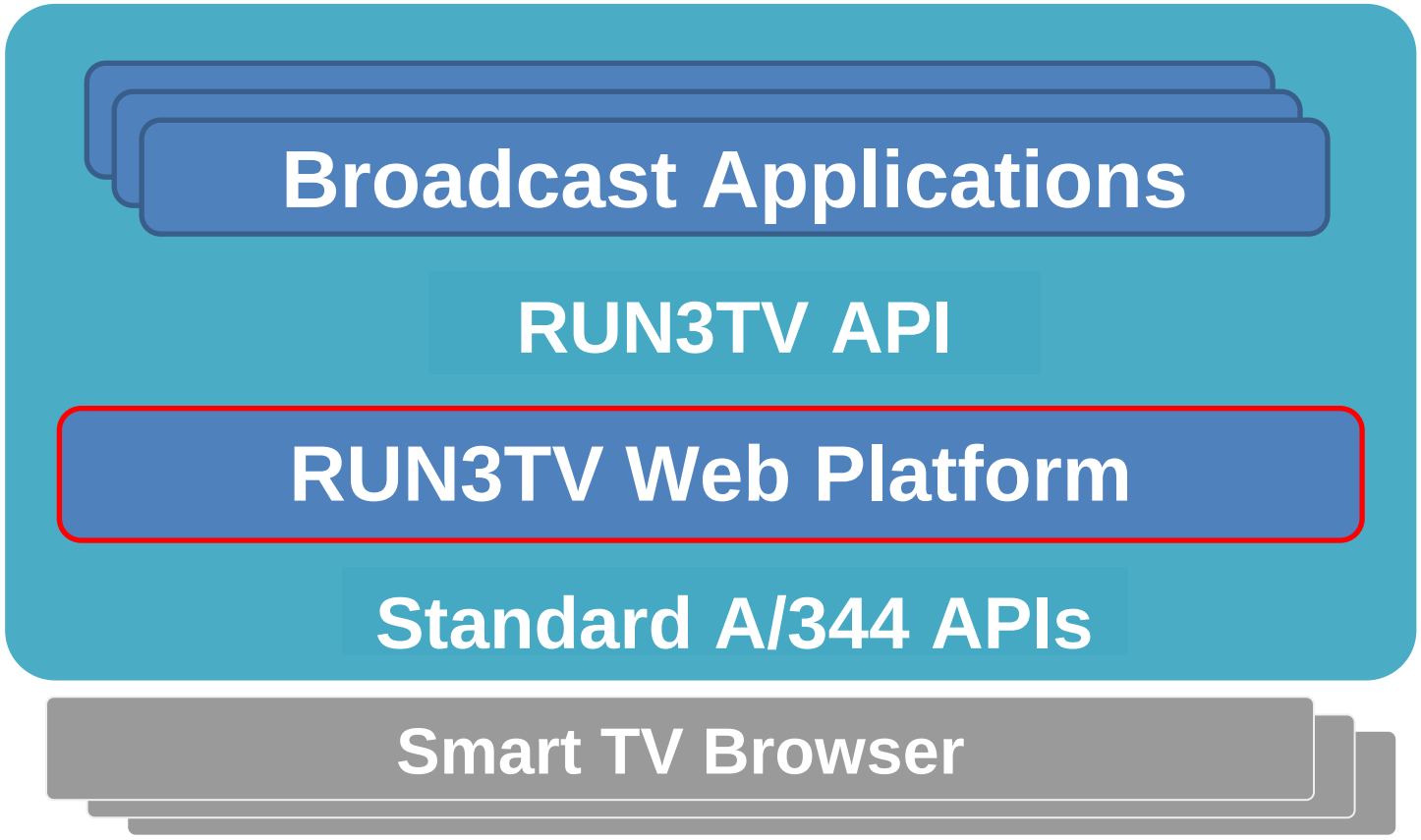


From A/344, “ATSC 3.0 Interactive Content"

© 2021 Pearl TV, LLC. All rights reserved.

Common Application Framework

- RUN3 irons out the differences between the TVs OS
- RUN3 makes application development simple with common web skills
- RUN3 manages the receiver marketplace conformance and sets service requirements
- RUN3 provides onboarding, basic monitoring and support



RUN3TV
The NextGen TV Platform

© 2021 Pearl TV, LLC. All rights reserved.

NBC
40°
The NBC App
DVR
Explore
Guide
Alerts 1
Weather
ON NOW
Nightly News with Lester Holt
START OVER
WHAT YOU MISSED
Law & Order True Crime Season Finale
WATCH ON
hulu
TONIGHT
Superstore
RECORD
Account
Layer a new interactive web experience on top of live content
NBC NEWS NOW
-7.82%
-1,660.63
DJI
19,576.75
LIVE
FROM CORONAVIRUS TASK FORCE
TO NBCNEWS.COM/CORONAVIRUS
NBC NEWS
ILLUSTRATIVE

KOIN 6

6 October 2020

KOIN-HD

06-1

- Live
- Coming Up
- Wildfires !!
- Covid 19
- News
- Weather
- Special Reports
- Sports
- Community
- Settings

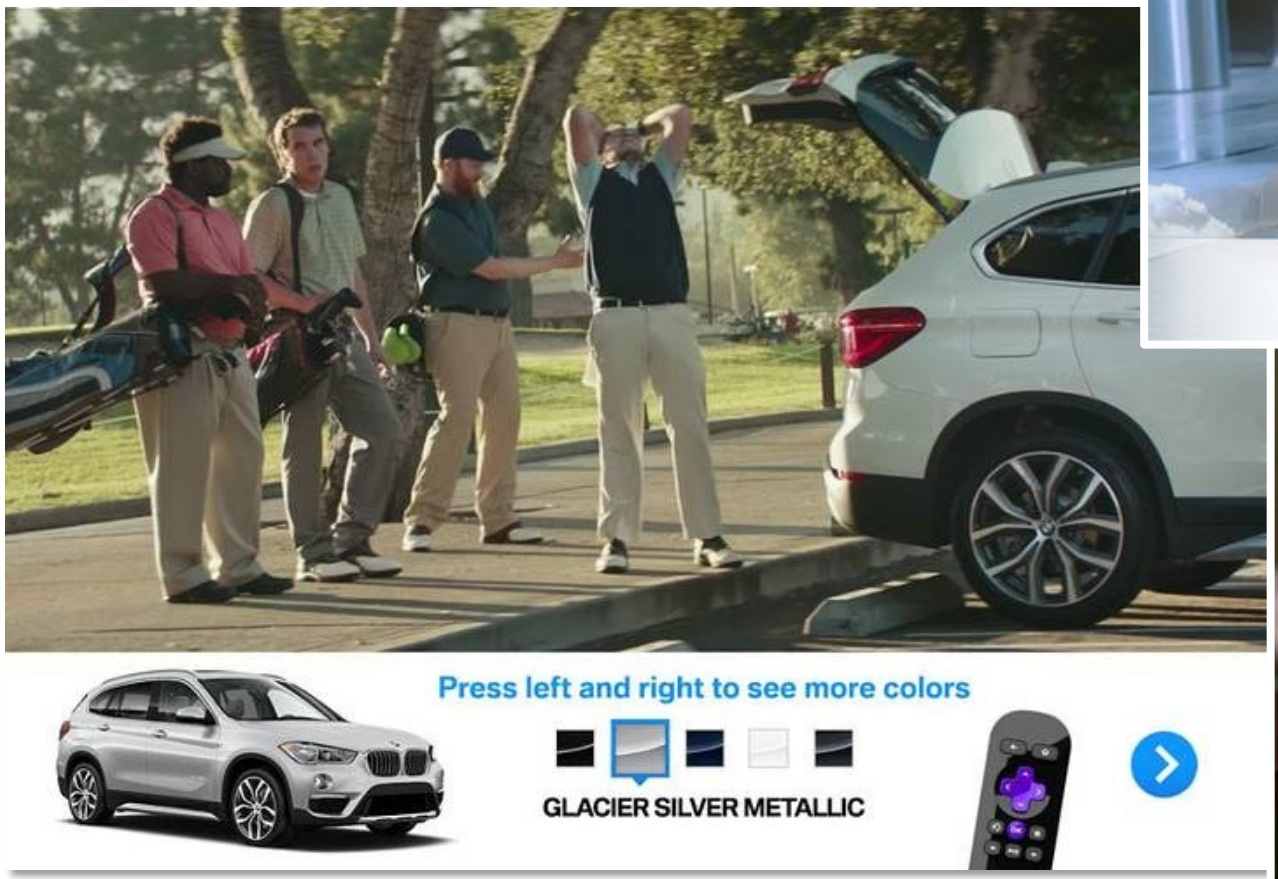
Community

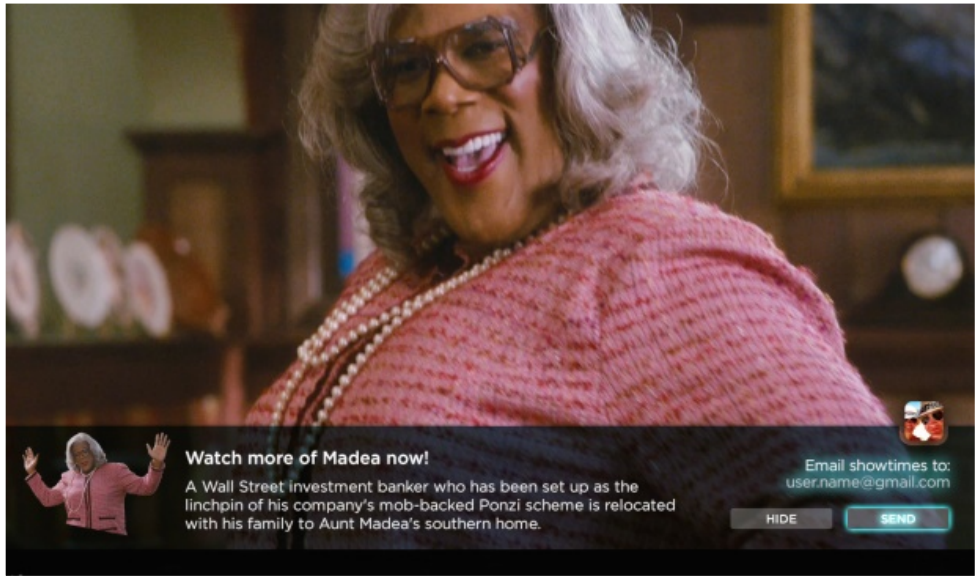
More Than Pink Walk goes virtual

Rabbi spreads message of hope with Sukkot celebration

BIPOC artists, students unite for Beaverton mural installation

Trigger Lead-Gen interactive overlays in ads and programming



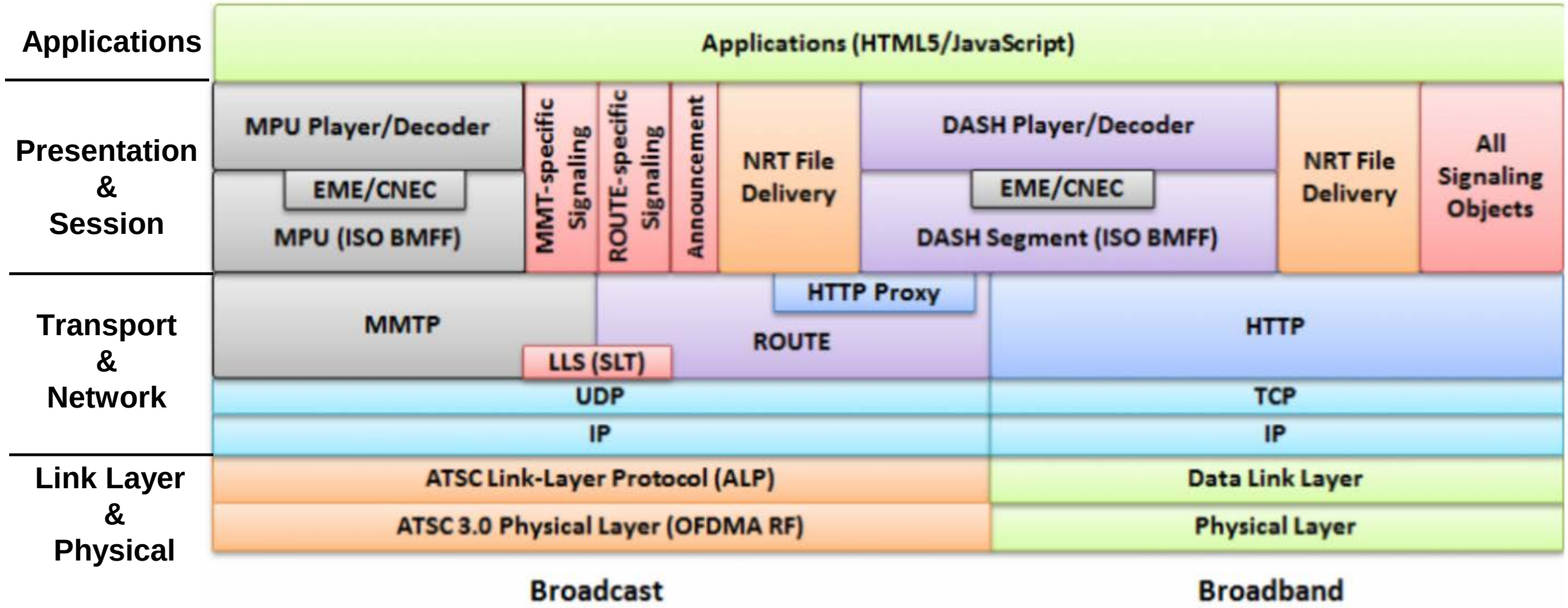


ILLUSTRATIVE

Broadband Delivery of NextGen TV

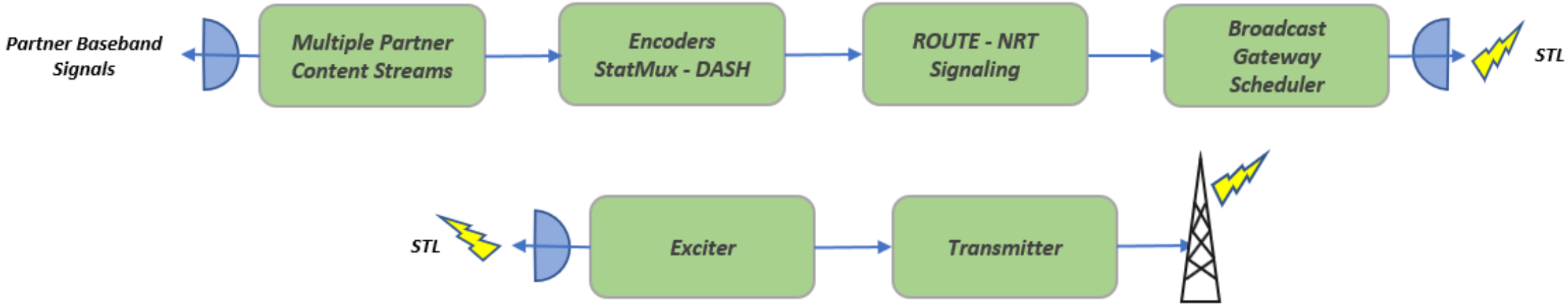
© 2020 Pearl TV, LLC. All rights reserved.

ATSC-3 NextGenTV Stack



© 2021 Pearl TV, LLC. All rights reserved.

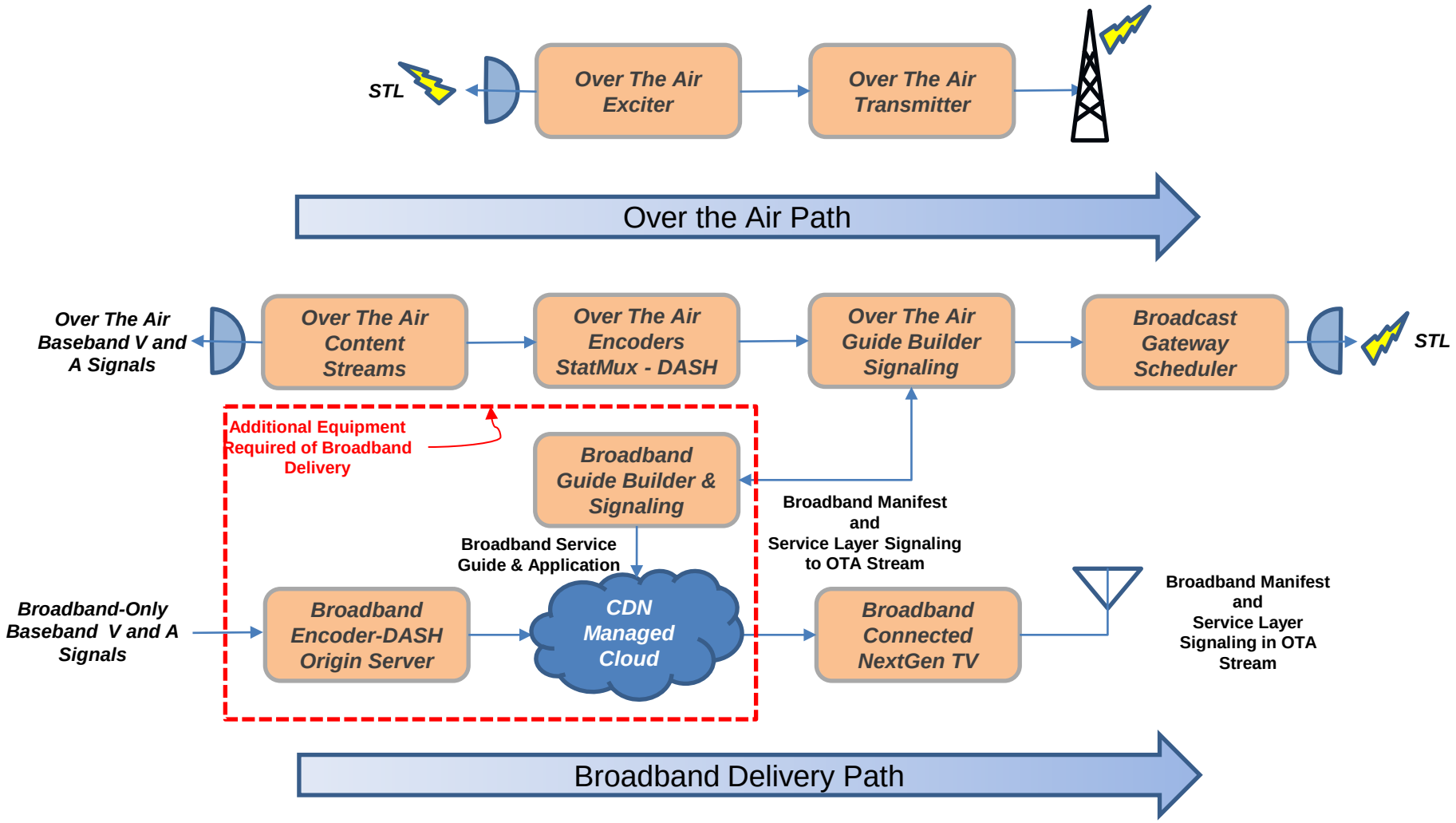
Normal Transmission System in NEXTGEN TV



Full ATSC-3 Transmission Chain

© 2021 Pearl TV, LLC. All rights reserved.

Over the Air with Broadband Delivery



© 2021 Pearl TV, LLC. All rights reserved.

QUESTIONS

© 2021 Pearl TV, LLC. All rights reserved.