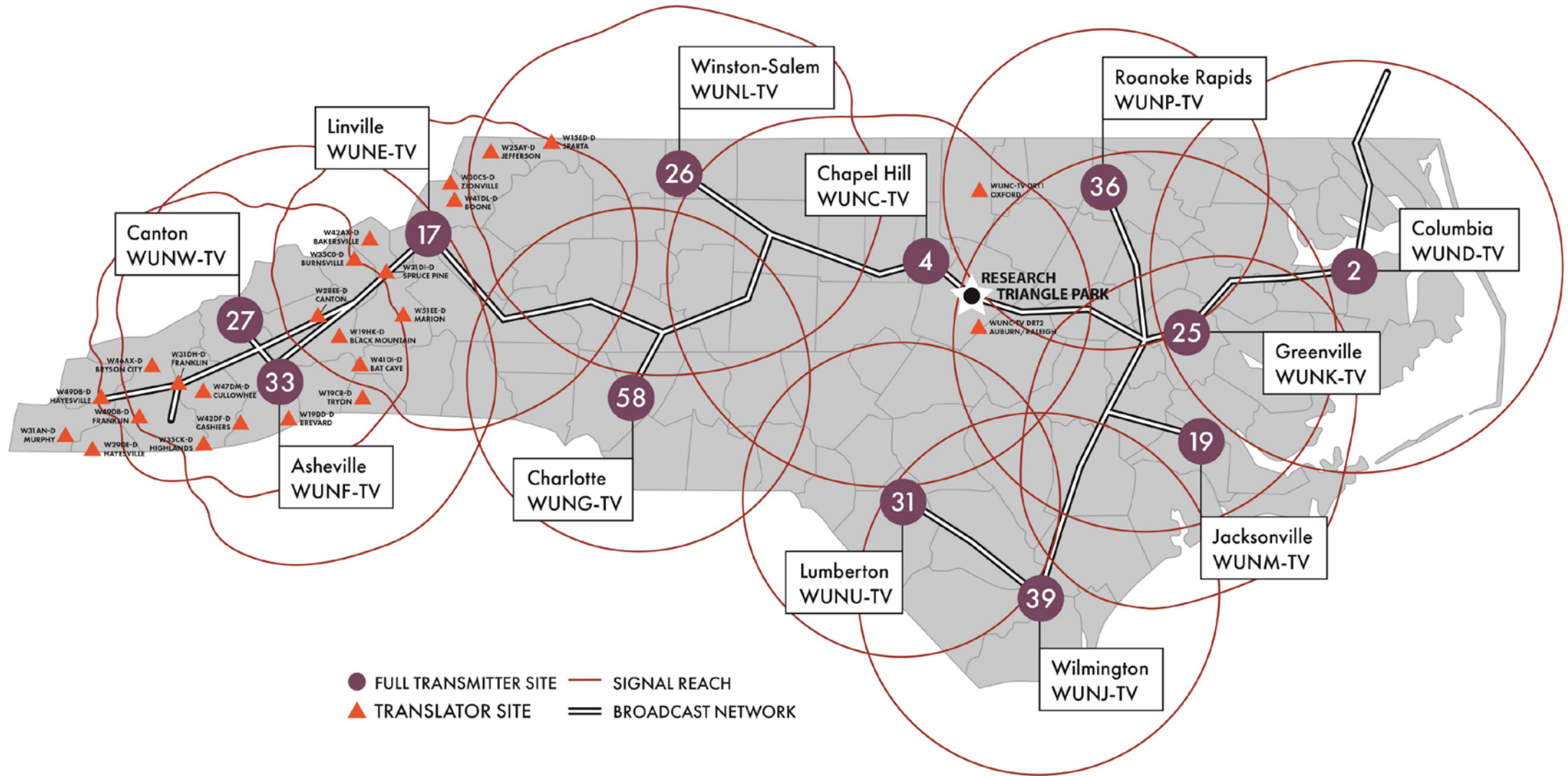# ATSC 3.0/NextGenTV Public Safety and Datacasting

Fred Engel CPBE

Chief Technology Officer

PBS North Carolina

Canton
WUNW-TV

Linville
WUNE-TV

Winston-Salem
WUNL-TV

Roanoke Rapids
WUNP-TV

Chapel Hill
WUNC-TV

Columbia
WUND-TV

Greenville
WUNK-TV

Jacksonville
WUNM-TV

Asheville
WUNF-TV

Charlotte
WUNG-TV

Lumberton
WUNU-TV

Wilmington
WUNJ-TV

RESEARCH
TRIANGLE PARK

W15ED-D SPARTA
W25AY-D JEFFERSON
W30CS-D ZIONVILLE
W41DL-D BOONE
W42AX-D BAKERSVILLE
W35CO-D BURNSVILLE
W31DI-D SPRUCE PINE
W28EE-D CANTON
W51EE-D MARION
W19HK-D BLACK MOUNTAIN
W41DI-D BAT CAVE
W31OH-D FRANKLIN
W46AX-D BRYSON CITY
W47DM-D CULLOWHEE
W19CR-D TRYON
W49DB-D HAYESVILLE
W49DB-D FRANKLIN
W42DF-D CASHIERS
W19DD-D BREVARD
W31AN-D MURPHY
W35CK-D HIGHLANDS
W29DE-D HAYESVILLE
WUNC-TV DRT1 OXFORD
WUNC-TV DRT2 AUBURN / RALEIGH

● FULL TRANSMITTER SITE   —— SIGNAL REACH
▲ TRANSLATOR SITE   ═══ BROADCAST NETWORK

PBS NORTH CAROLINA
POWERED BY THE UNC SYSTEM

Public Media Perception

Public Media Perception

Public media organizations have always been focused on enriching lives.

+

Now, they will also help save them.

PBS NORTH CAROLINA
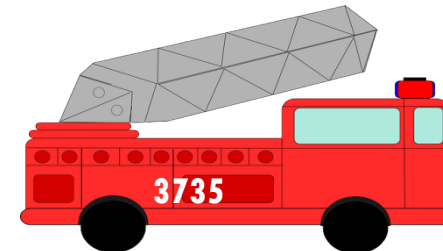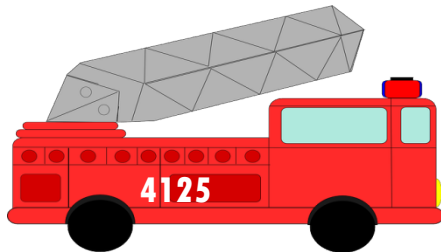POWERED BY THE UNC SYSTEM

Kitchen Fire Dispatch: Current

- 5 tones to 9 units – 26 secs
- Voice announcement <u>only</u> <u>after</u> all pager tones
- 11 secs to read unit numbers
- Location announced 42 secs after alert initiated
- Full alert = ~67 secs

Tone alerting and today's analog pages

- Technology from 50+ years ago
- 70% of firefights are volunteers
- Volunteers might not be located at the fire station
- Tone & Voice Pager
- Extremely reliable & durable
- Most have no display, voice only

PBS **NORTH CAROLINA**
POWERED BY THE UNC SYSTEM

Coverage designed for the response area

- County level is common
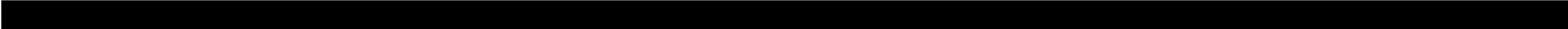- Every county is a different shape and size
- Each system is separate

PBS NORTH CAROLINA
POWERED BY THE UNC SYSTEM
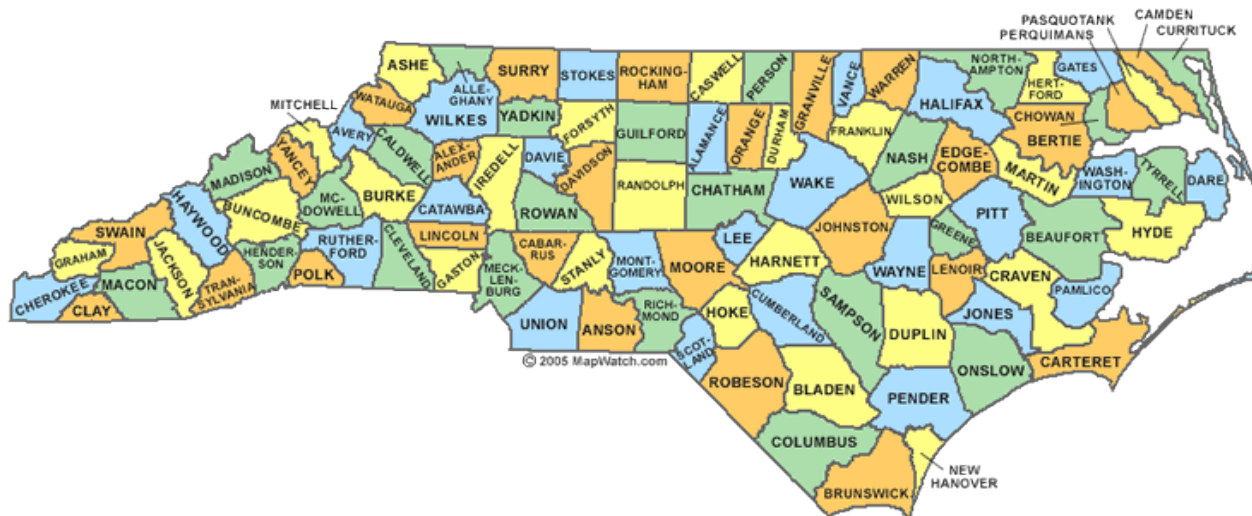
What is Datacasting?

- Unused bandwidth for other needs
- Sending one-way data using the existing TV transmission
- Data can include text, video, audio, files, etc.

Government Document

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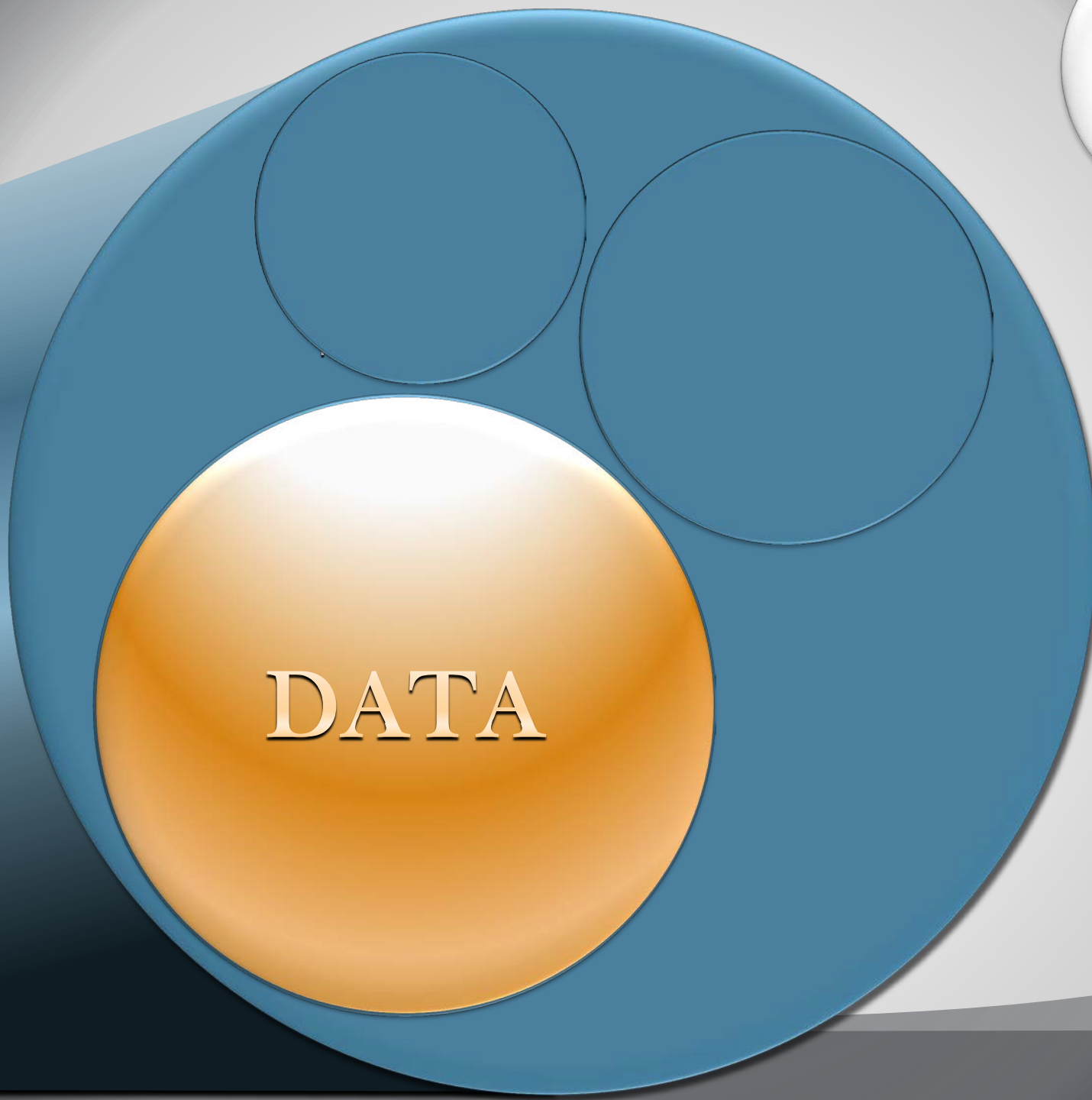
Kitchen Fire Dispatch: NextGenTV

Full alert ≈ 1 second

4034, 4024, 4125, 4114, 3735, 3720, 4027, 4002, 4102, Respond to a first alarm, Florrisant, kitchen, 450 Naomi Ave. cross street of Bobbinray, respond on tac 10

Florissant

Hazelwood

67

4034

4102

4125

4002

4024

4114   4027

3735

3720
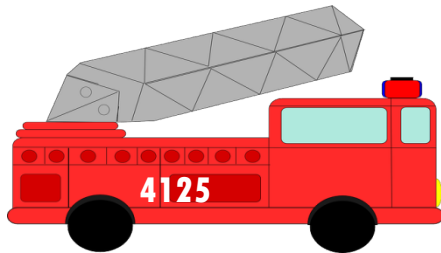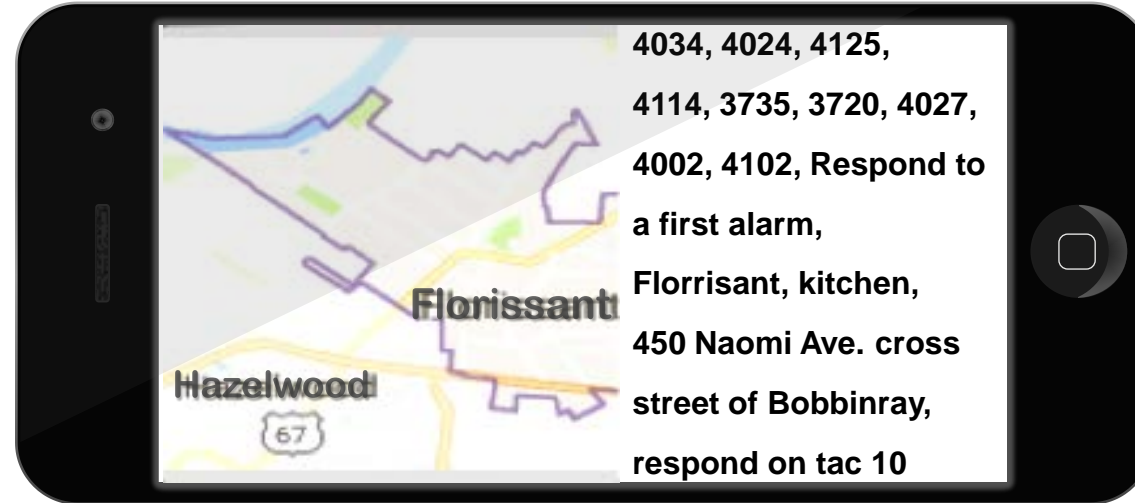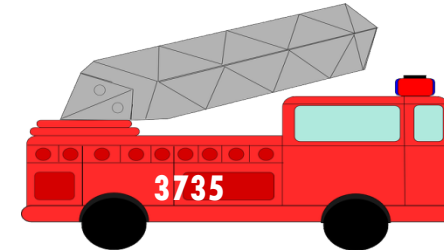
INTRODUCTION

Fire and EMS services across the United States still rely on paging technology to communicate emergency incident information. The infrastructure for these paging systems is typically owned, operated, and maintained by the local government or agency to ensure coverage includes as close to 100% of the jurisdiction as possible. This paper proposes the use of datacasting technology to serve the paging needs of public safety and uses North Carolina as a test case. This concept could lead to cost-sharing, greater collaboration across jurisdictions, and reduced response times for mutual aid requests. The public deserve the best possible response from the public safety sector and therefore, public safety deserves the best technology available in order to achieve their mission. Note that certain topics, such as automated voice systems, smartphone apps, alphanumeric pagers, fire station alerting, and CAD-to-CAD interfaces are not discussed here for the sake of focus and clarity.

THE STATE OF PUBLIC SAFETY PAGING

Currently, paging is still widely used in the Fire and EMS disciplines for emergency call alerting. This can be true for both volunteer and staffed/career agencies. In these instances, paging is generally only a one-way page sent from fixed infrastructure to a device worn by a member of that agency. Call alerting can occur for agency members while they are at a station, at home, or even as they go about their daily jobs. A Public Safety Answering Point (PSAP), or 911 center, send the page to a voice pager with information about the location and type of emergency. This type of pager allows the responder to hear the dispatch. These devices are also known as a Tone & Voice Pager, Fire Pager, Voice Pager, and/or by the common vendor models such as the Motorola Minitor Pager, Unication G4/G5 Voice Pager, SwissPhone Voice Pager, or Apollo Voice Pager, just to name a few.

This voice pager has a speaker listening to a specific radio channel with a 'selective' call setting that will keep the speaker silent until a trigger (such as a specific set of tones) is heard on that channel. When a trigger is heard, the pager will then alert the user, either with a special beep and/or vibration, and unmute the speaker so that the dispatcher can be heard. There are a number of manufacturers of these voice pagers, each with a number of different features such as audio recording (stored voice), a display screen, customized audio alerts, etc.

Analog Paging, Time for a Change? ATSC 3.0 as a Use Case for Public Safety Communications

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Adam Woodlief
Chief Technology Officer
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Atlanta, GA
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Abstract – *Fire and EMS services across the United States still rely on paging technology to communicate emergency incident information. The infrastructure for these paging systems is typically owned, operated, and maintained by the local government or agency to ensure coverage includes as close to 100% of the jurisdiction as possible. This paper proposes the use of datacasting technology to serve the paging needs of public safety and uses North Carolina as a test case. This concept could lead to cost-sharing, greater collaboration across jurisdictions, and reduced response times for mutual aid requests. The public deserve the best possible response from the public safety sector and therefore, public safety deserves the best technology available in order to achieve their mission.*

THE STATE OF PUBLIC SAFETY PAGING

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The selective call feature allows responders to be alerted only for emergency incidents or for other 911 Center information that is targeted for a specific group. The group

Homeland Security

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Science and Technology

Research | Collaboration | Work with S&T | News & Events | About S&T

News Release: DHS Awards $981K to N. Carolina Small Business for Digital Paging Technology

Release Date: August 17, 2021

FOR IMMEDIATE RELEASE
S&T Public Affairs, 202-254-2385

WASHINGTON – The Department of Homeland Security (DHS) Small Business Innovation Research (SBIR) Program recently awarded $981,657.52 to Hillsborough, North Carolina-based Device Solutions, Inc. to develop a secure, standards-based, public safety one-way digital paging system. Currently, many emergency medical services (EMS) agencies rely on analog voice pager infrastructure to communicate during emergency incidents. The new capabilities will use the Advanced Television Systems Committee 3.0 (ATSC 3.0) standard, providing responders with improved pager coverage capacity, quicker dispatching, and overall improved situational awareness.

"It is vital that we develop and implement the most advanced interoperable communications technologies so our emergency responders can to do their jobs effectively, protect the public, and remain safe themselves," said Kathryn Coulter Mitchell, DHS Senior Official Performing the Duties of the Under Secretary for Science and Technology. "We must continue to leverage technology advancements, and by using the ATSC 3.0 standard to develop a more robust digital paging system, we can address the substantial challenges of slow speed, limited coverage, and capacity found with existing analog voice paging systems."

eDPPT Background, Project Overview

- Existing emergency paging systems present multiple challenges:
  - Expensive 2-way radio equipment can limit number of radios that can be purchased and utilized by emergency workers
  - Contributing factors to decreased situational awareness:
    - Lack of secure data path prevents transmission of sensitive data
    - Paging coverage area limitations
    - Lack of / unreliable redundant data paths
      - Cellular coverage not ubiquitous
      - NFPA / ISO does not currently recognize Cellular as a delivery network
      - Paging latency / delayed delivery issues
  - CAD / PSAPs are largely not standardized, unique
    for each installation / vendor
    - Makes interoperability difficult
    - Normalizing data is a challenge
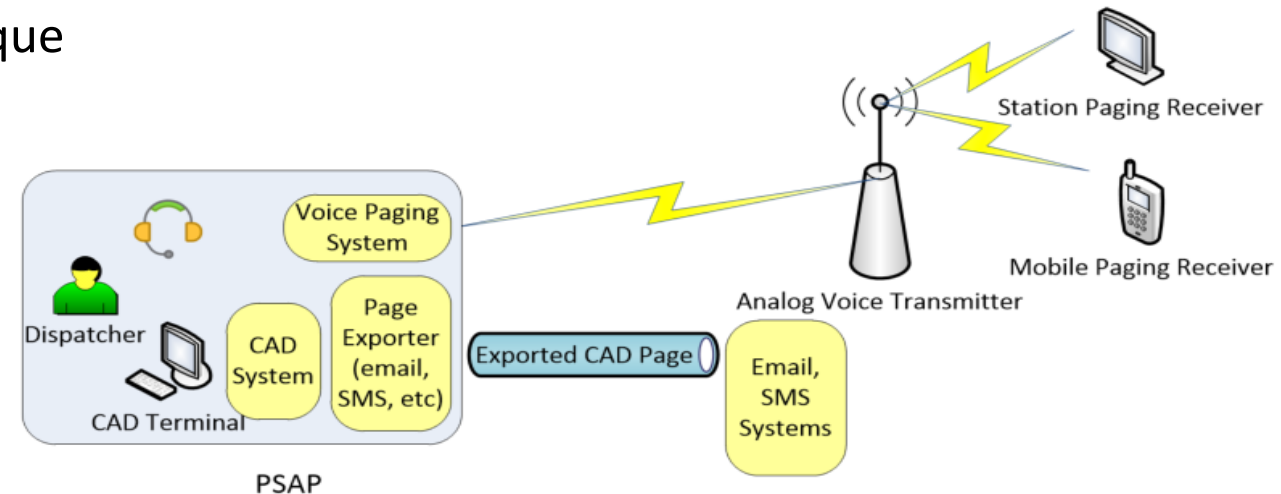
eDPPT Phase I Project and Results
Completed Q3 2020

- Goals:
  - Provide responders and incident commanders with improved pager coverage and capacity, quicker dispatching, and messaging details for improved situational awareness
  - Develop a Proof Of Concept (POC) digital paging system and receiver for emergency responders using public television ATSC 3.0

- Can PSAP-customized CAD dispatches, from multiple PSAPs be captured, normalized, and exported?
  - *Yes. We developed a proof-of-concept paging server to normalize CAD / PSAP data and inject into the ATSC 3.0 broadcast stream*

- Can the common protocol message be sent to an ATSC 3.0 system for datacast and receipt by a receiver?
  - *Yes. We developed a proof-of-concept paging receiver*

- How do Key Performance Indicators such as dispatch delivery time, transmission reliability and clarity, multi-PSAP capability, and data channel capacity, compare between traditional voice and tone dispatch systems and an eDPPT system?
  - *Can be as good and much better*

- Can a cost effective, wearable, receiver with sufficient battery life be developed with technology available within the next year?
  - *Phase II!*
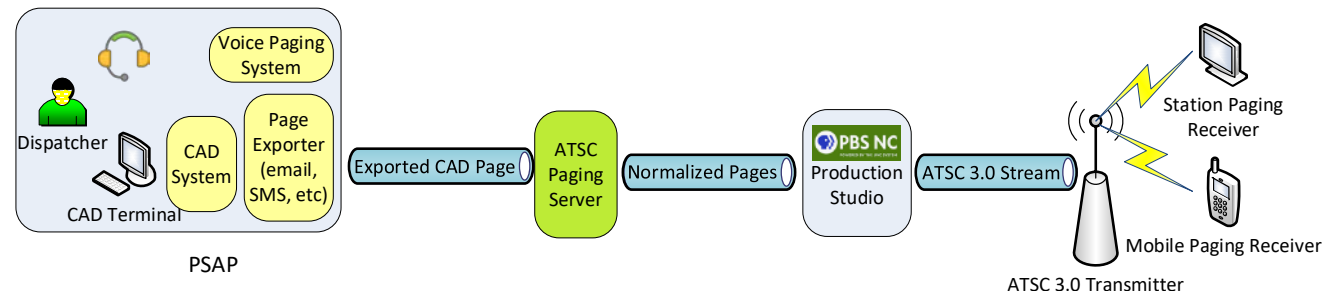
eDPPT Phase II Project
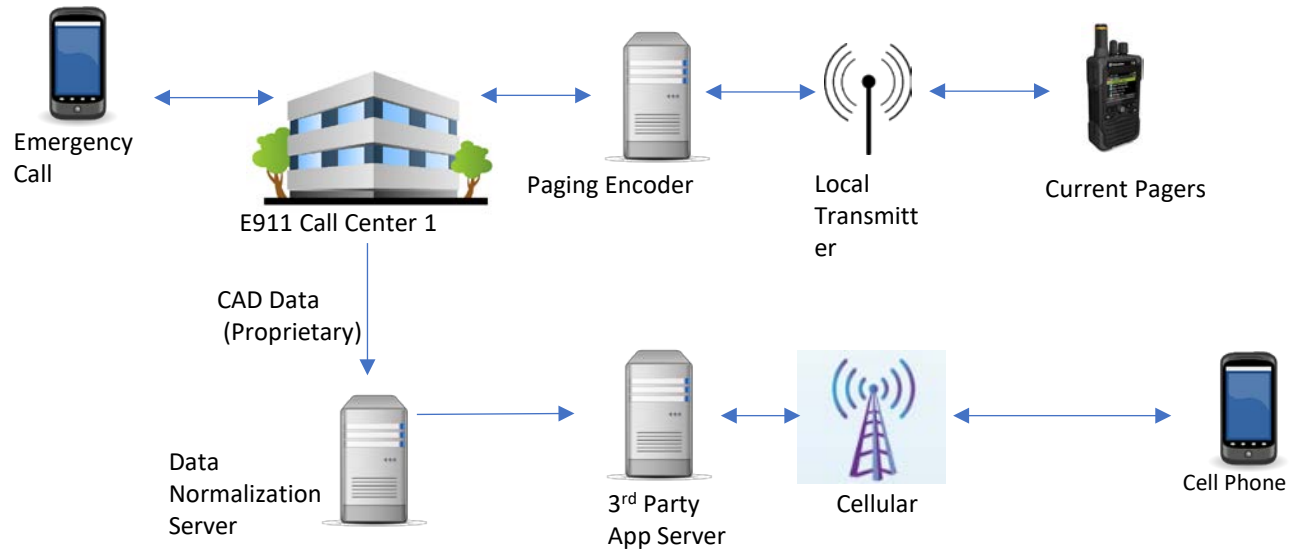
- *DHS SBIR Phase II Contract awarded April 2021!*

- Goals:
  - Develop a prototype ATSC 3.0 paging receiver which displays / forwards the CAD information sent from the normalization server to the ATSC 3.0 transmitter
  - Optimize ATSC 3.0 delivery chain for delivery of emergency pages
  - Deliver results from performance modeling and testing of ATSC 3.0 receptibility in a controlled environment for anticipated paging receiver design (for example, body worn small device on a belt)
  - *Prototype two different paging receiver designs, one based on a stand-alone model and the other based on a smartphone integration with the ATSC 3.0 information passed along to a smartphone application*
  - Provide a practical demonstration of the capability with at least 10 receivers located with different first responder organizations from different jurisdictions within a state. The organizations should represent different types of jurisdictions from urban to rural, career to volunteer, mountainous to coastal

We are designing an affordable, long battery life, receiver reference design to improve situational awareness. By utilizing Digital TV ATSC3 technology deployed by TV broadcasters, we can help firefighters, first responders, and EMTs with increased coverage area and penetration, reduce latency, and provide a secure, reliable, means for transmitting emergency pages.
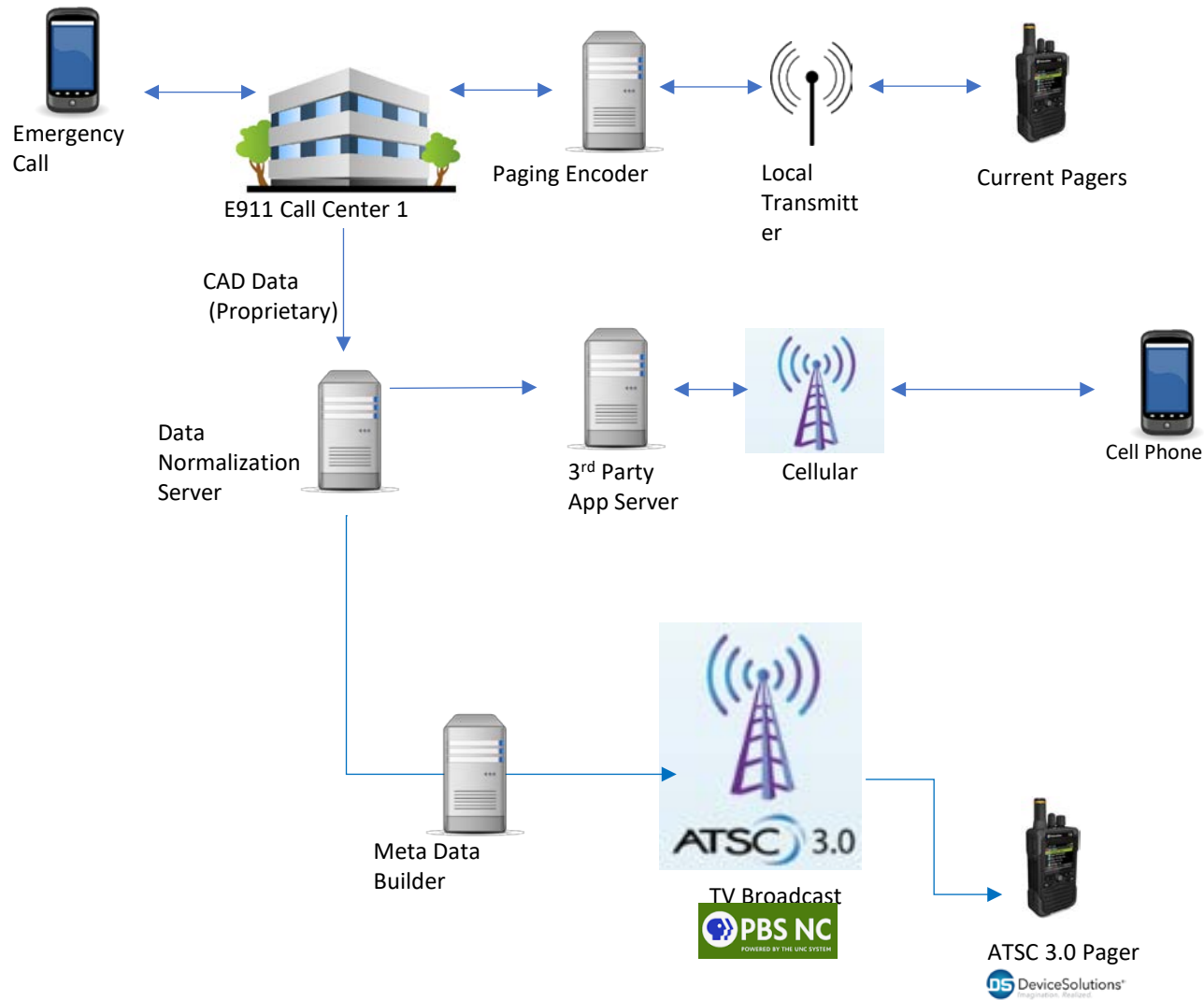
Existing Emergency Paging Eco-System

Emergency Call

E911 Call Center 1

Paging Encoder

Local Transmitter

Current Pagers

CAD Data (Proprietary)

Data Normalization Server

3rd Party App Server

Cellular

Cell Phone

End Users:
- EMT
- First Responders
- Firefighters

ATSC 3.0 Standalone Paging Eco-System
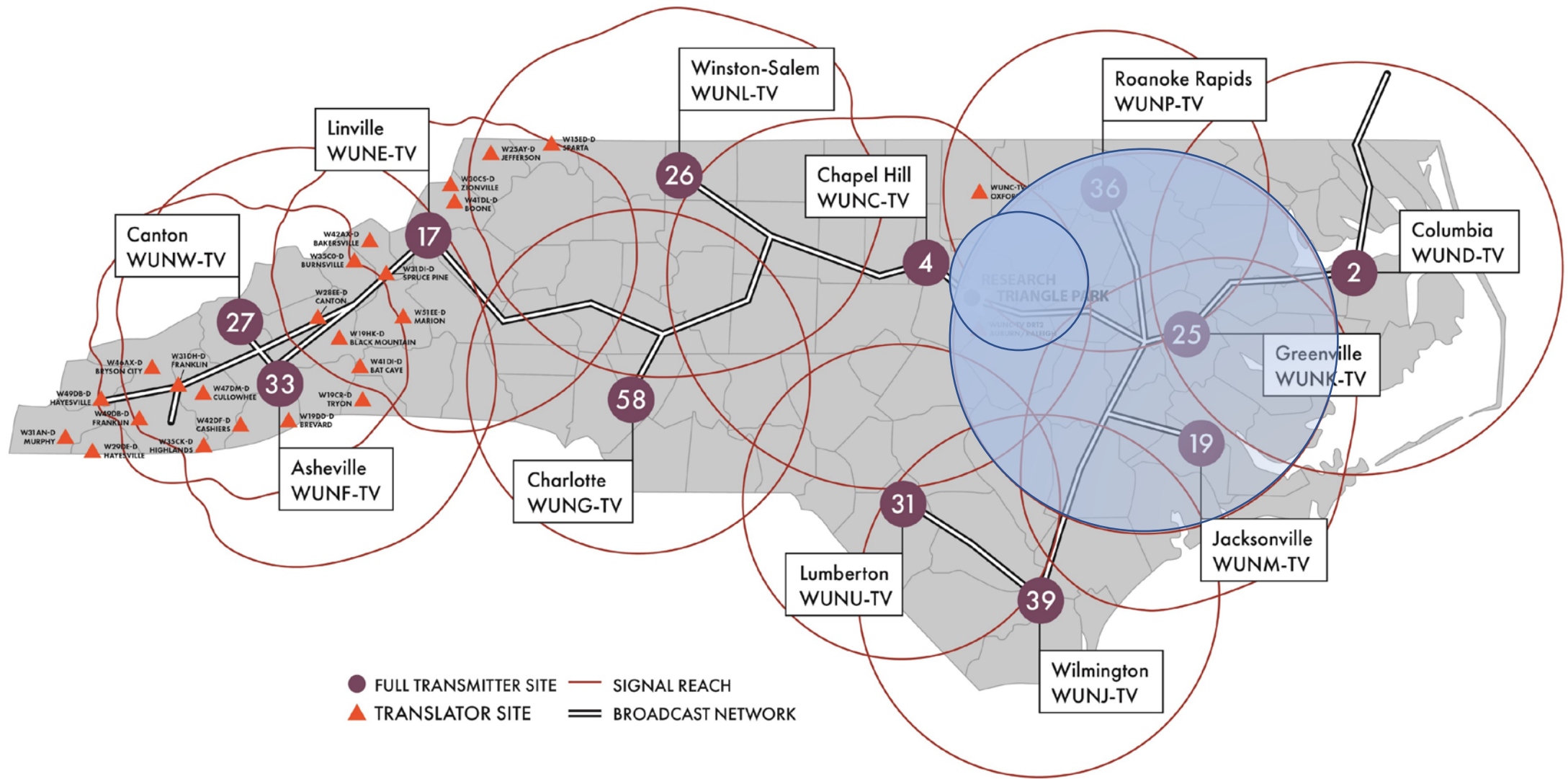
ATSC 3.0 Companion Device Paging Eco-System
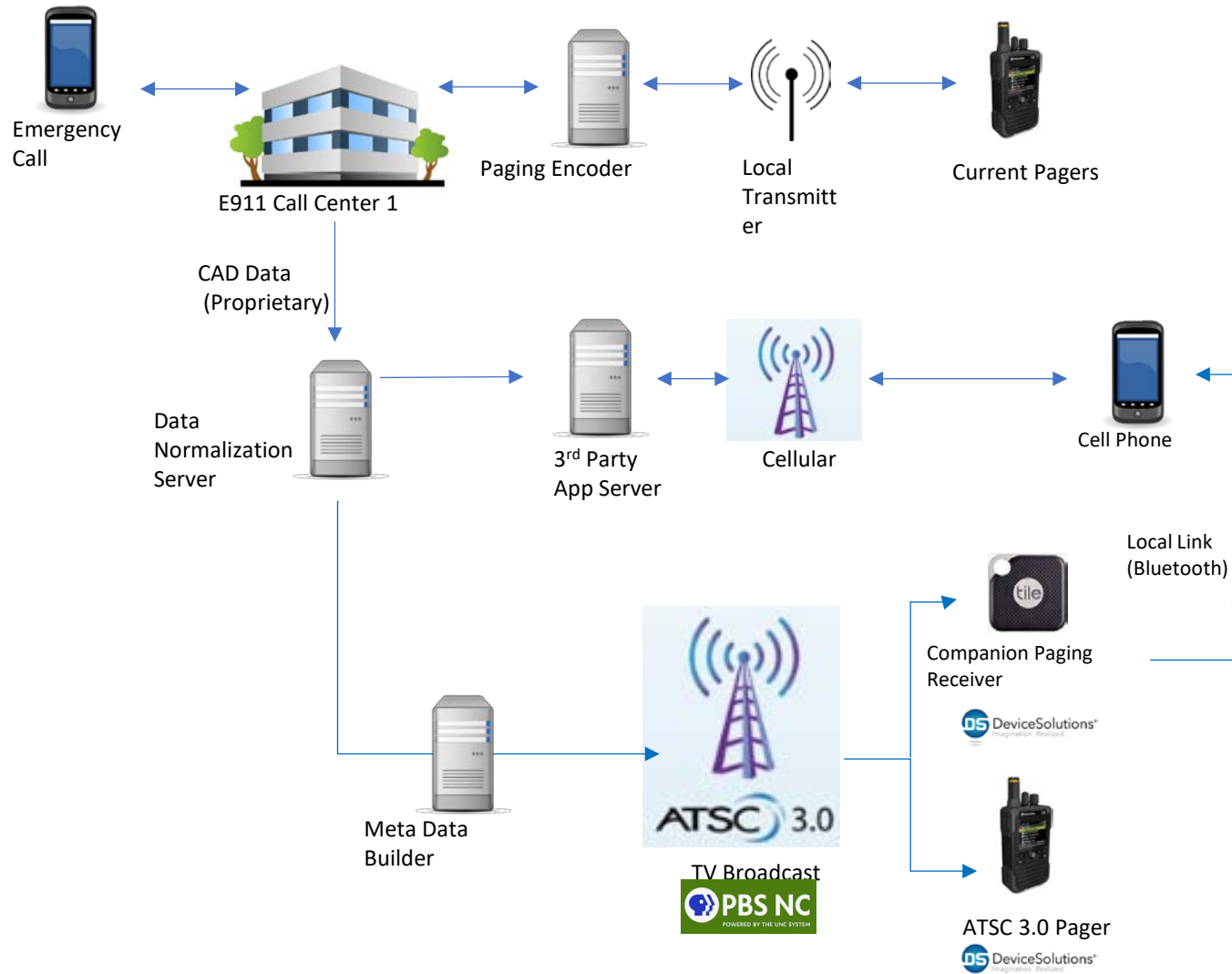
End Users:
- EMT
- First Responders
- Firefighters

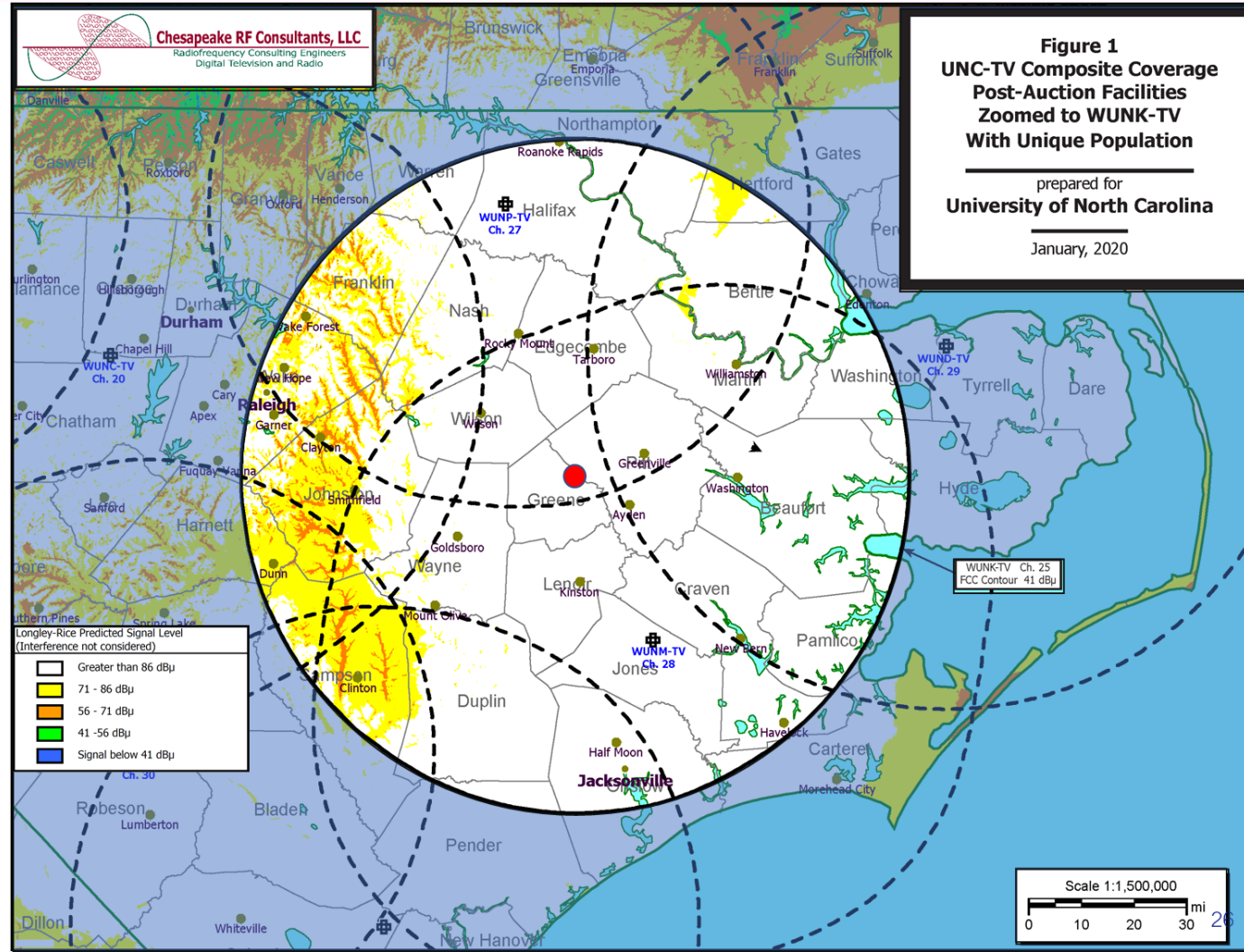# Digital Paging of Public Television Benefits

- High Tower & High Power
- Infrastructure already exists
- Instantaneous
- Encrypted
- Scalable bandwidth
- Simultaneous dispatches
- Maps, preplans, ICS forms, audio, video

Winston-Salem
WUNL-TV

Linville
WUNE-TV

Roanoke Rapids
WUNP-TV

Chapel Hill
WUNC-TV

Columbia
WUND-TV

Canton
WUNW-TV

RESEARCH
TRIANGLE PARK

Greenville
WUNK-TV

Asheville
WUNF-TV

Charlotte
WUNG-TV

Jacksonville
WUNM-TV

Lumberton
WUNU-TV

Wilmington
WUNJ-TV

26   4   2   36   25   19   27   33   17   58   31   39

W25AY-D
JEFFERSON

W15ED-D
SPARTA

W30CS-D
ZIONVILLE

W41DL-D
BOONE

WUNC-TV
OXFORD

W42AX-D
BAKERSVILLE

W35CO-D
BURNSVILLE

W31DI-D
SPRUCE PINE

W28EE-D
CANTON

W51EE-D
MARION

W19HK-D
BLACK MOUNTAIN

W41DI-D
BAT CAVE

W46AX-D
BRYSON CITY

W31DH-D
FRANKLIN

W49DB-D
HAYESVILLE

W47DM-D
CULLOWHEE

W19CR-D
TRYON

W49DB-D
FRANKLIN

W42DF-D
BREVARD

W19DD-D
BREVARD

W31AN-D
MURPHY

W35CK-D
HIGHLANDS

W29DE-D
HAYESVILLE

● FULL TRANSMITTER SITE   — SIGNAL REACH

▲ TRANSLATOR SITE   ═ BROADCAST NETWORK

PBS NORTH CAROLINA
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WUNK-TV/Greenville NC

Figure 1
UNC-TV Composite Coverage
Post-Auction Facilities
Zoomed to WUNK-TV
With Unique Population

prepared for
University of North Carolina

January, 2020

WUNK handheld coverage

17/8/2020 12:50:36

Assumptions
Portable / Handheld Rx
1.5m height
-9 dB antenna gain
52 dBu minimum signal strength
in accordance with ETSI
DVB T2 handheld profile
16 NUQAM, 6 dB C/N threshold

31 mi

51 dBuV/m	-88 dBm
58 dBuV/m	-81 dBm
65 dBuV/m	-74 dBm
72 dBuV/m	-67 dBm
79 dBuV/m	-60 dBm
86 dBuV/m	-53 dBm
93 dBuV/m	-46 dBm
100 dBuV/m	-39 dBm
107 dBuV/m	-32 dBm
114 dBuV/m	-25 dBm
121 dBuV/m	-18 dBm
128 dBuV/m	-11 dBm

GATESAIR

PBS NORTH CAROLINA
POWERED BY THE UNC SYSTEM
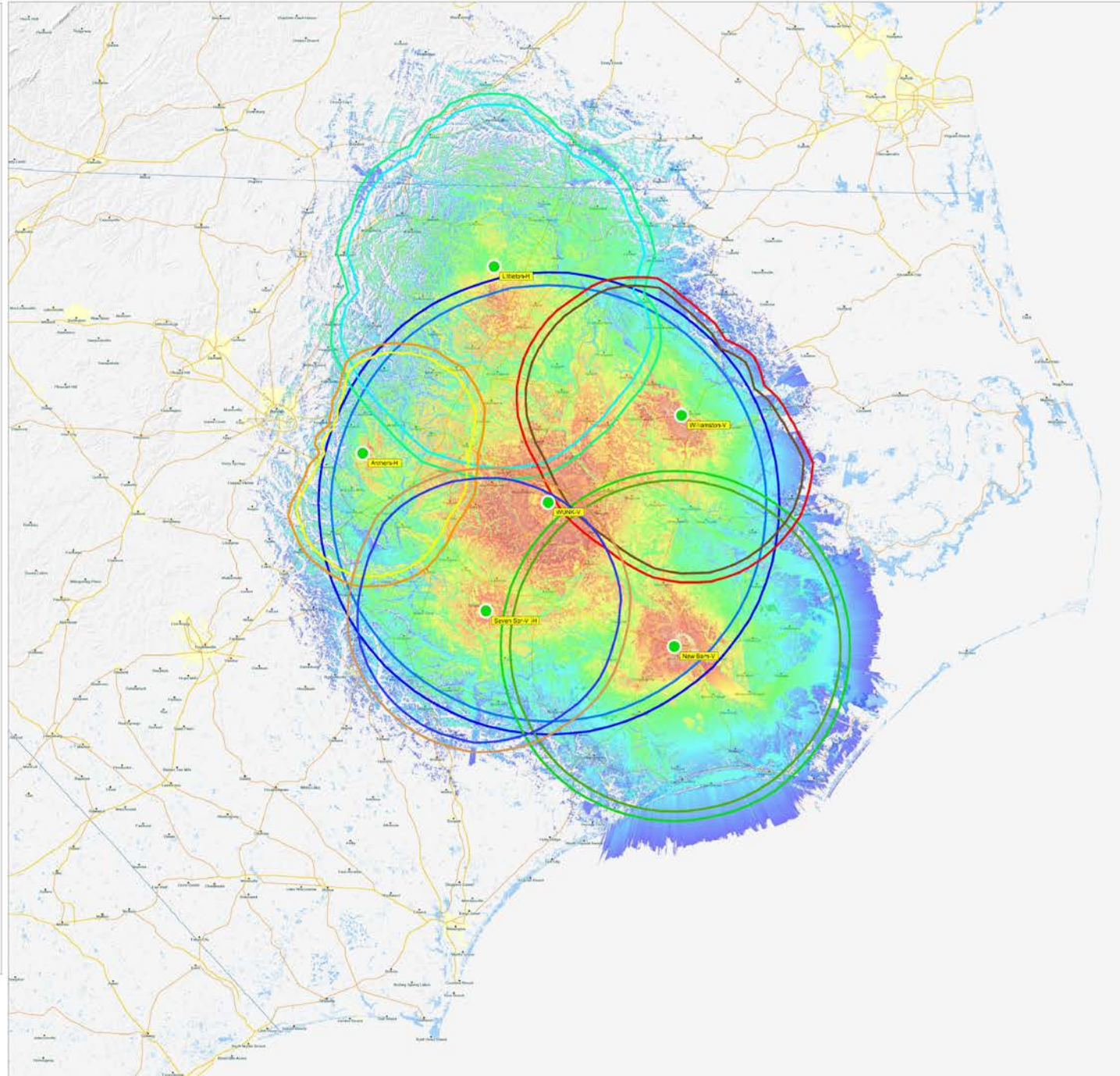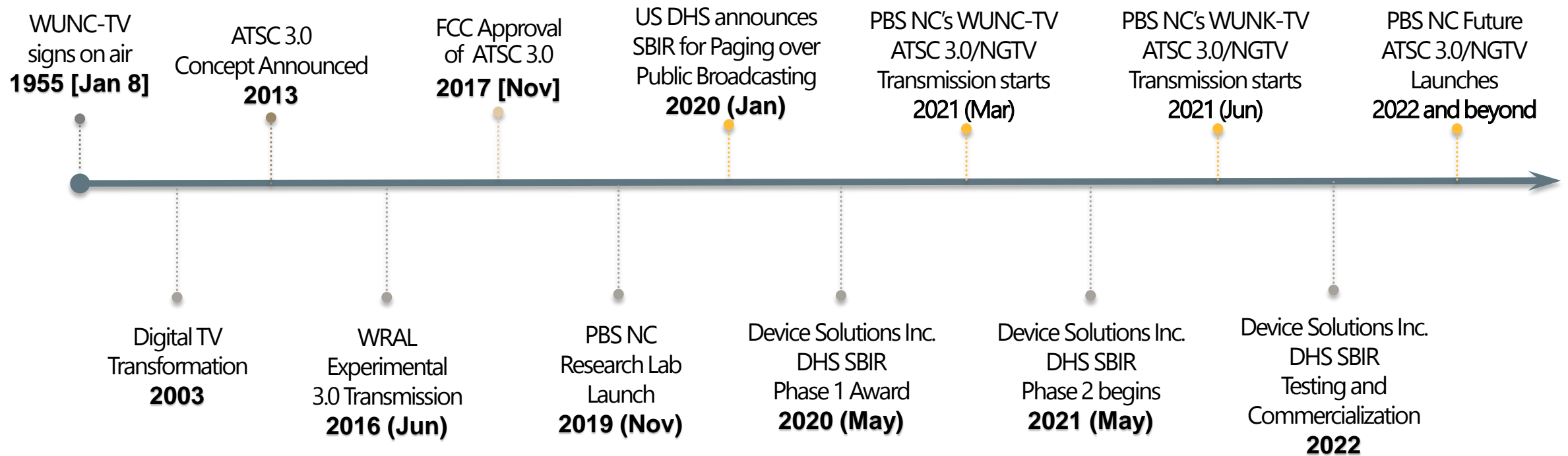
Government Document

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The Educational Broadband Gap:
A White Paper on Utilizing
ATSC 3.0/NextGenTV to Address Remote Learning Needs

Fred Engel CPBE
Chief Technology Officer
PBS North Carolina

INTRODUCTION

Significant gaps in Internet (broadband) access remain in the United States. Never has this problem been more evident than in its effect on K-12 education during the COVID-19 pandemic. Inequities in internet availability and costs have disrupted the education process.

K-12 educational institutions and governmental partners scrambled to address the need for internet connectivity with the mass purchase and deployment of cellular hotspots. Some Public Television networks stepped in to provide limited data delivery over a 20-year-old broadcast television technology that soon will become obsolete. These efforts are to be commended, but will not provide a long-term solution.

This paper explores a sustainable solution to the national broadband concern as it relates to education, utilizing emerging broadcast television transmission technology to address access, security and user experience. It will focus on utilizing the software teachers and students currently use, adapted for this new broadcast technology, providing disconnected students with an "internet-like" experience to vastly improve their remote learning environment, and heighten their chances for success.

PMEP Project Partners

The Digital Divide

30% of K-12 students lack adequate connectivity and/or technology

PMEP: Public Media Education Platform™

- Helping to close the digital divide where broadband is not an option

- Delivering teacher-assigned data files, like lessons, videos and worksheets, via a television broadcast signal

- Providing on-demand access to a library of rich, digital content

- Offering expert tech support for educators and families

- Creating equitable learning environments

America's Largest Classroom

PBS and its member public television stations have a 50+ year history of serving our neighbors with educational media designed to engage, enlighten and spark curiosity.

- PBS LearningMedia

- Learning at Home

- Free Educator Professional Development Workshops

- Original Video Productions that Align with K-12 standards
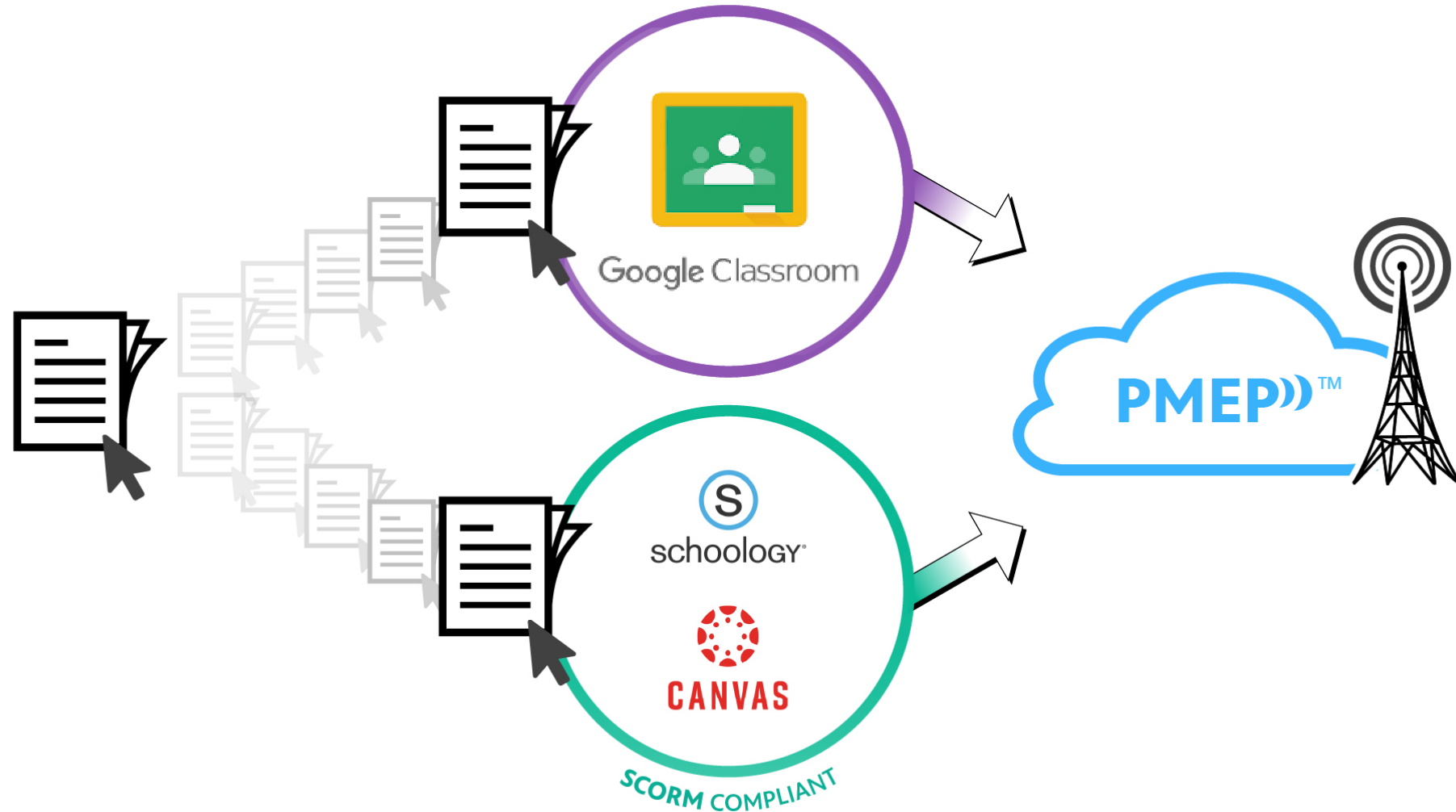
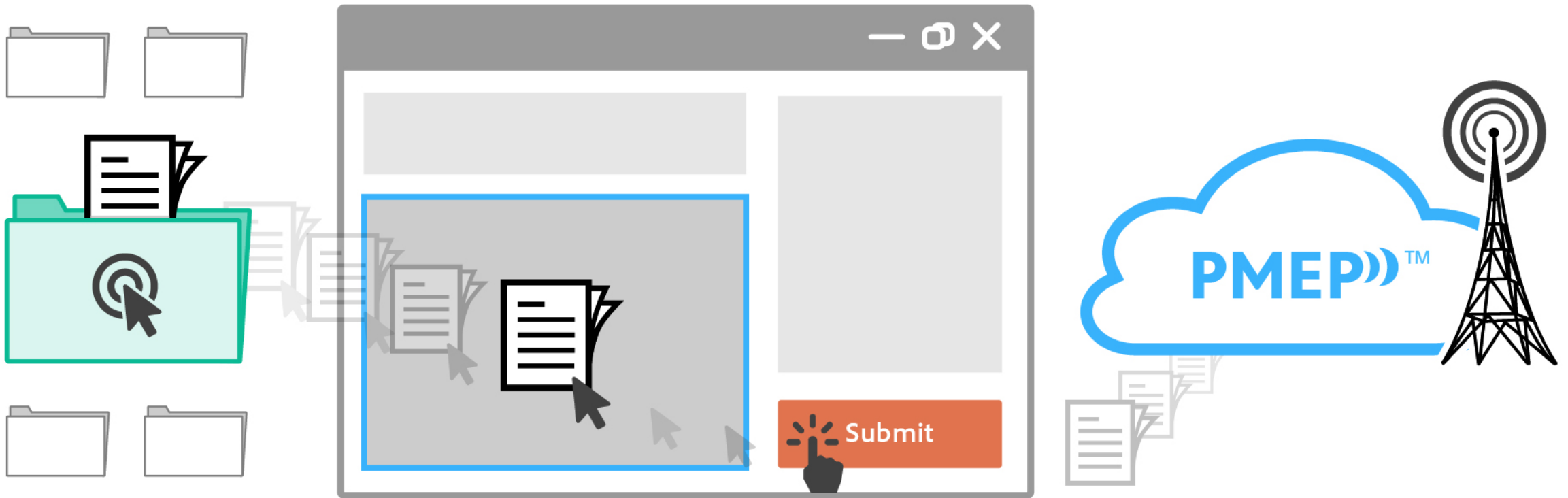- Engaging Events & Demonstrations

PBS

Platform Content
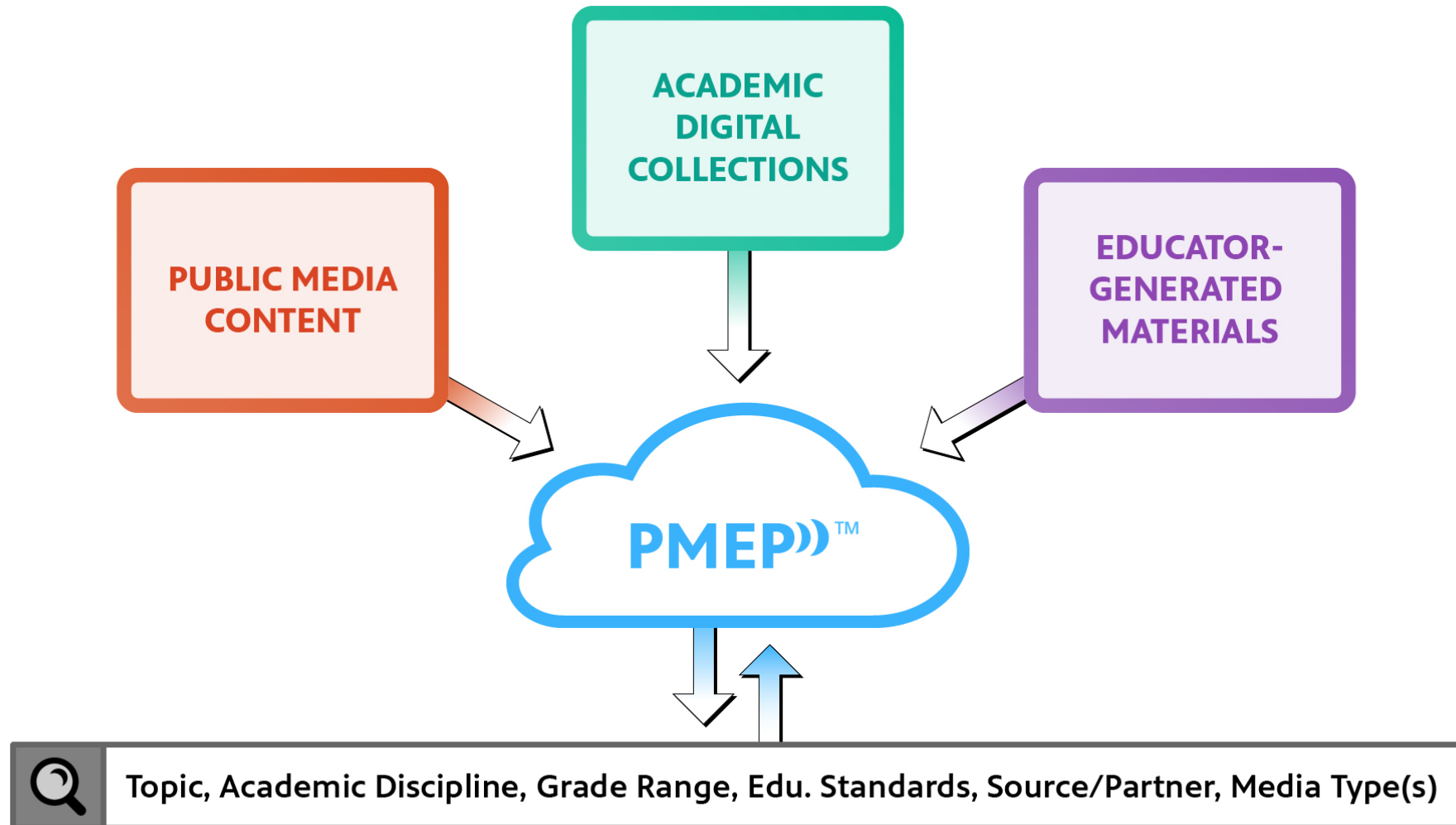
Learning Management System Integrations

Educator Dashboard

Designed for simplicity, featuring easy drag-and-drop workflows.

LEARNER EXPERIENCE

Antenna

Education Device

NextGen TV
On-Demand Content

Student 1
Lesson

Student 2
Lesson

On-Demand Content
• Books
• Games
• Interactive Content
• Lessons

On-Demand Content
• Books
• Games
• Interactive Content
• Lessons

COMPUTER   **TABLET**   **MOBILE**

Students easily access content from the devices they already have.

NextGen TV On-Demand Content

Student 1 Lesson
Student 2 Lesson

On-Demand Content
• Books
• Games
• Interactive Content
• Lessons

On-Demand Content
• Books
• Games
• Interactive Content
• Lessons

And respond with:

Voice/SMS/Email

Internet (when available)

Security & Privacy

MODERN CLOUD ARCHITECTURE
- Highly available and reliable
- Redundancies provide resilience
- 24/7 monitoring and alerts

STUDENT-CENTRIC PRIVACY
- Limited personal data stored or collected
- Role-based security to limit data access
- Aggregated/anonymized usage data

Questions?

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