M-EAS Implementation

A Report by the ATSC M-EAS I-TEAM

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What is M-EAS?

- M-EAS is a hardened mass-alerting system to reach citizens during emergencies
- M-EAS rides on top of Mobile DTV
- M-EAS only consumes bits when broadcasting alerts
- M-EAS is a next-gen service that adds CAP-based or other formatted emergency messaging to Mobile DTV
What is M-EAS?

- M-EAS is a very low-cost addition to Mobile DTV requiring no new spectrum and minimal new transmission infrastructure
- Regular MDTV programming continues during M-EAS Alerts
- M-EAS has two components:
  - The text-based message from CAP similar to EAS currently on TV
  - Rich media additions (photos, videos, evacuation maps, radar images, predicted storm tracks, HTML, etc.)
- M-EAS includes a device wake-up function
M-EAS Compatibility

• M-EAS is completely CAP compliant
• M-EAS is designed to integrate seamlessly with, and become an extension of IPAWS (Integrated Public Alert and Warning System)
  **Not** a replacement but rather an augmentation
• M-EAS is compatible with existing IPAWS systems, as well as compatible with local alerting capabilities
• M-EAS is an integral part Mobile DTV standard (ATSC A/153)
IPAWS – M-EAS Integration

Alerting Authorities
- Local
- State
- Territorial
- Tribal
- Federal* (includes NOAA)

IPAWS compliant CAP Alert Origination Tools

Alerting Authorities
- Local
- State
- Territorial
- Tribal
- Federal*

* Includes NOAA

Alert Disseminators (public alerting systems)
- CAP messages

Alert Aggregator / Gateway
- IPAWS OPEN

The Message Router (Open platform for Emergency Networks)

Alert Disseminators
- CAP messages

IPAWS – M-EAS Integration

NOAA

Internet Services

Future Technologies

FM RBDS

ETN

Siren

Digital Signage

American People

cell phones

web applications, widgets, web sites, social media

HazCollect

NWS
M-EAS Implementation Team

• In the first part of the M-EAS project:

  The basic system and ATSC standardization process was completed …
  … now it’s time to make it real and put the standard to use

• I-Team Scope: “Provides a venue for industry discussions of issues related to implementation of this addition to the ATSC A/153 MDTV Standard”
Background – M-EAS

- **April 2011**  M-EAS Pilot Project announced
- **January 2012**  First public demonstration (CES 2012)
- **Feb/March 2012**  Trials with participating PBS stations …WGBH…WBIQ…KLVS
- **April 2012**  On Air demonstration at NAB Show
- **September 2012**  Use at first commercial station (WRAL)
- **January 2013**  ATSC Implementation Team (“M-EAS I-Team”) established
- **March 2013**  ATSC Standard adopted for M-EAS
- **April 2013**  Demonstrated at NAB Show
- **October 2013**  I-Team completes workflow plan & Content Manager concept
- **November 2013**  ATSC M-EAS I-Team publishes Implementation Guide
- **February 2014**  ON Air test of M-EAS system using Content Manager
- **April 2014**  Complete M-EAS workflow solution available
M-EAS Content Sources

Types of M-EAS Messages and Content

M-EAS Content Manager at TV Station
- Video Clips
- CAP Messages
- Library Files
- Graphic Files

Mobile EAS Content Server
Note: Resides within Mobile DTV Signaling and Announcement Server

DTV Transmission System
- Mobile Encoders
- ATSC Encoders
- Mobile Mux
- DTV Transmission System
M-EAS Content Sources

**Alerting Authorities**
- Local
- State
- Territorial
- Tribal
- Federal

**CAP Message Feed**
- Alert Aggregator/Gateway
- Video Clips
- CAP Messages
- Library Files
- Graphic Files

**M-EAS Content Manager at TV Station**
- Mobile EAS Content Server
  - Note: Resides within Mobile DTV Signaling and Announcement Server

**DTV Transmission System**
- Mobile Encoders
- ATSC Encoders
- Mobile Mux
- DTV Transmission System

**Networks**
- IPAWS OPEN (Open Platform for Emergency Networks)
- IPAWS Compliant Origination Tools
M-EAS Content Manager at TV Station

M-EAS Content Sources

Video Clips from Various Sources

SNG

ENG

News Copter

Traffic Cameras

Tower Camera

Live Studio

Video Clips

CAP Messages

Library Files

Graphic Files

Mobile EAS Content Server

Note: Resides within Mobile DTV Signaling and Announcement Server

DTV Transmission System

Mobile Encoders

ATSC Encoders

Mobile Mux

DTV Transmission System
M-EAS Content Sources

Graphic Content Files from Local or External Sources

- Video Clips
- CAP Messages
- Library Files
- Graphic Files
- HTML Pages

M-EAS Content Manager at TV Station

- Note: Resides within Mobile DTV Signaling and Announcement Server

DTV Transmission System

- Mobile Encoders
- ATSC Encoders

TV Station Graphic Systems

- Hyperlinks to Internet Content
- Electronic Still Camera

Weather Radar Systems
M-EAS General Signal Flow

Emergency Message Sources (FEMA, Local/State, or Station)

Emergency Message Processing

M-EAS Signal Generation

Rich Media Sources (National/State/Local or Station)

Rich Media Generation

Broadcast station operations

Mobile DTV Receivers
M-EAS: Station Operations

- **Emerg Message Source (CAP) (FEMA)**
- **Emerg Message Source (CAP & Other) (Local/Regional)**
- **Rich Media: Externally Supplied Files**
- **External Source Data for Rich Media (as required)**

**Rich Media Processing & Queue**

- **EAS Receiver / Processor**
- **Emerg Message Reception Prep & Queue**
- **Rich Media Elements**

**Rich Media:**
- **Real-time Locally Generated Files**
- **Pre-generated Files**

**Mobile DTV Encoders**

**MDTV Signaling/Announcement Generator**

**Simple IP Router**

** Content Manager**

- **Emergency Messages**

**Video/Audio Programming**

**To Broadcast Plant**

**Internal Station Systems for Mobile DTV**
Mobile EAS Equipment Overview

- Emergency Operator
- Public Internet
- FEMA IPAWS
- DASEOC Originator
- Television Station
  - DASDEC Receiver (Receive / Generate Alerts)
  - Mobile Content Manager (Tables, ESG, M-EAS NRT)
  - Mobile Mux / Exciter (Encode / Xmit)
EAS Receiver / Content Manager Interface
EAS Receiver / Content Manager Dataflow

M-EAS Data/Message Flow - Originate to Transmit

- Start Here
- Operator creates EAS/CAP message on DASEOC
  - All the rich media, audio, pdfs, jpg's etc are on the originating computer/laptop
- Message with media elements sent to DASDEC receiver
- DASDEC Receiver captures all content on local drive
  - All media is now stored on DAS RX local drive
- FTP for media retrieval
- DASDEC Receiver forwards CAP message to TCM
- TCM processes CAP message, retrieving media from DAS RX via FTP
  - Simple task to get data from DASDEC using FTP
- Information placed in Xmit stream

Bill Robertson 12/12/13 Revision 0.0
Provisioning M-EAS / NRT

- Connect EAS / Content Mgr FTP (station intra-net)
- Provision M-EAS NRT bandwidth
Content Manager CAP Processing

1) CAP XML received via FTP
2) Process CAP
   - Determine expiration
   - Find Rich Media references
   - Remove resource references from CAP
3) Encode
   - EAT w/CAP
   - M-EAS NRT
4) Transmit
   - Tables uploaded to Mux
   - M-EAS NRT streamed (UDP)
M-EAS Ensemble Multicast Datagrams

**Signaling Tables**
- 224.0.23.60:4937
- 239.1.56.1:8000
- 239.1.56.1:8001
- 239.1.56.1:8002
- 239.1.56.1:8003
- 224.0.1.1:123
- 239.1.56.101:10001
- 239.1.56.101:10002
- 239.1.56.102:10003

**RTP Video**
- 239.1.56.1:8000

**RTP Audio**
- 239.1.56.1:8002

**RTCP Sender Reports**
- 239.1.56.1:8001
- 239.1.56.1:8003

**NTPv4 Time of Day**
- 224.0.1.1:123

**FLUTE**
- 239.1.56.101:10001
- 239.1.56.101:10002
- 239.1.56.102:10003

**Service Map Table (SMT)**
- Id: 56-1
  - Name: KNAB
  - Status: Active & Visible
  - Type: TV
  - Id: 56-101
    - Name: Guide
    - Status: Active & Hidden
    - Type: Service Guide
  - Id: 56-102
    - Name: M-EAS
    - Status: Active & Hidden
    - Type: M-EAS NRT

**Emergency Alert Table (EAT)**
- Id: 56-1
  - Name: KNAB
  - Status: Active & Visible
  - Type: TV
- Id: 56-101
  - Name: Guide
  - Status: Active & Hidden
  - Type: Service Guide
- Id: 56-102
  - Name: M-EAS
  - Status: Active & Hidden
  - Type: M-EAS NRT

**CAP Message:**
```
<alert>
  <identifier>20131104225600</identifier>
  <sender>dasdec@192.168.27.4</sender>
  <sent>2013-12-31T12:00:00-05:00</sent>
  <status>Actual</status>
  <msgType>Alert</msgType>
  <source>DASDEC</source>
  <scope>Public</scope>
  <code>IPAWSv1.0</code>
  <info>
    <language>en-US</language>
    <category>Safety</category>
    <event>HURRICANE WARNING</event>
  </info>
</alert>
```

NRT Service Id: 56-102
M-EAS Receiver Example

Pop-up Alert Message
Available Associated Media
View Alert Media
QUESTIONS?
Real-World Examples

Safety and Emergency Information Distribution using Broadcast and Mobile TV

Mark Corl, CTO
Triveni Digital, Inc.
A Brief History

• To date, ‘Datacasting’ has been primarily a Public Television venture

• Two main focus areas:
  – Education
  – Safety
Education Examples

• KLAS – Los Angeles Public School System
• NJN – New Jersey Network
• ECB – Wisconsin Public TV
• KET – Kentucky Educational TV
Safety Examples

• KET – Kentucky Educational TV
• WXXI – ‘ESN’ for Rochester, NY Fire Dept.
• New Hampshire NHPTV ‘PSAMS’
• Maine Public Broadcasting
Emergency Services Network

• Delivered continuous information to first responders supporting multiple activity types:
  – Alerts
  – Training
  – Planning & Coordination
  – Daily Operations
• Files pushed to receiving sites via datacasting, stored, and accessed locally as needed
• No Internet connection required at receiving sites
Detailed Example: New Hampshire

• PSAMS:
  – Public Safety Alternate Messaging System
• Use Public Broadcasting infrastructure as a secure, robust means of communicating to Public Safety officials in the field
• Mobile Handheld (M/H) datacasting system
Key PSAMS Requirements

- Have no impact on the current NHPTV DTV broadcast
- Operate both in trooper stations and in cruisers
- Available across the state of New Hampshire without interruption
- Easy to use in emergency situations
- Messages can contain text, pictures and video
- Completely secure transmission system
• Under 2 Mb/s free bandwidth available in current NHPTV broadcast transport
• Operating in cruisers (aka moving vehicles) would be difficult with standard 8VSB broadcast
• New Hampshire is covered by 5 transmitters
  – Receivers ‘on the move’ would necessarily need to be ‘agile’, tuning to whatever frequency can be locked
• Messages originate at the safety operations center (IPOC) which has strict security constraints
  – Limited options for connecting to NHPTV
… and more Issues

• M/H can be received by cruisers but reduces available bandwidth even more (<500Kb/s)
  – Messages need to be small to be delivered quickly
  – Streaming video or downloading video clips is impractical – 1MB takes over 16 seconds

• Off-the-shelf tools have many options and are not suited for use under emergency conditions
  – Operational features need to be reduced for the specific usage cases
Hybrid Solution

• Application layer on top of general datacasting system
• HTML-based Messages, compressed and encrypted
  – Messages are small and highly compressible
  – Small images can accompany messages
  – Larger images and videos can be associated by reference
• Use fast and reliable broadcast system to send key message content
  – Cellular often too fragile during times of emergency
• Cellular system used for adjunct content included by reference
• Receiver user interface is a browser pointing to a local web site
  – User is unaware how content is obtained
  – Simple interface with almost no training required
1. Encrypted zip file sent via secure ftp to NHPTV
2. Datacasting system picks up zip file
3. System datacasts zip file to M/H transmission system
4. Datacast broadcast on all 5 NH frequencies
5. M/H Transport decoded by M/H Receiver
6. Local multicast to Datacast Receiver
7. Extracted to zip file
8. Zip file picked up, decrypted and content placed in web site
9. Message content included in web page
10. Page updated in local browser automatically
Other Features

• Message Priority
  – Messages have priority: Emergency and warning messages force the receiver browser to front

• Secure
  – Messages are secured using 256-bit encryption by PSAMS Messenger
  – Transferred over secure FTP to NHPTV

• Redundant
  – Messages transmitted on two redundant broadcast chains
  – Messages retransmitted every 5 minutes over the course of an hour

• Automatic Receiver Scanning
  – Receiver automatically scans through each of the 5 NH frequencies until one can be tuned
Summary

• Broadcast offers robust alternative to cellular data transmission
  – The two systems can be leveraged to take advantage of what each does best

• Off-the-shelf tools are available to build nearly any type of distribution system over fixed or M/H broadcast
  – Almost every system will require some application layer development to address task-specific user needs
  – However, the application layer can be relatively simple and straightforward to build
Thank You!

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