



FirstNet After Action Report

June 27, 2017





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1 EXECUTIVE SUMMARY

Super Bowl LI (SBLI) held in Houston, Texas on February 5, 2017 was the first large-scale special event to incorporate the use of mobile apps to support public safety communications from the very beginning of the planning process as key operational tools. The use of mobile data and applications became a core element of the communications during the event and proved incredibly valuable in augmenting land-mobile radio for improved situational awareness and multi-agency information sharing.

Nearly 1,000 public safety personnel across ten local, state and federal agencies were trained on the apps with daily active users ranging from 250 – 400. Messaging, picture/video sharing, and field reporting were the primary uses. Law enforcement users included undercover, security supervisors, Special Events and specialized units such as SWAT, Bomb, K-9 and Special Response Group (SRG). Fire/EMS users included medics, hazmat and Special Events.

In the absence of a prescribed planning process in the Incident Command System (ICS) framework, the team developed an ad hoc process which included 1) creating a Concept of Operation (ConOp) to guide product selection and device distribution 2) developing an information architecture to support the organizational structure and operations plans, and 3) writing Standard Operating Procedures (SOP) to guide who produced/received content, how information was distributed, naming conventions and other operational and technical elements to facilitate efficient and secure information sharing.

1.1 GOALS/OBJECTIVES

One of Harris County's Key Learning Conditions (KLC) from FirstNet is special events, so one of the objectives of the deployment of the Harris County LTE (HCLTE) system was to develop lessons learned for FirstNet to incorporate into the nationwide rollout for how Public Safety LTE (PSLTE) could be used operationally during large special events.

The participating public safety stakeholders did not know exactly how the technology could be used, but believed communications could be improved through PSLTE and were willing to participate in the planning process to identify communications gaps and find ways to solve them using the HCLTE system.

1.2 CONCLUSIONS/LESSONS LEARNED

SBLI would not have been nearly as successful if it had not been for the cooperation and collaboration across agencies from the beginning of the planning process through the entire operation. From the executive command staff to the boots on the ground, all agencies worked together to develop plans and make decisions to host an event in which our community and our visitors were safe and able to enjoy the festivities of this prestigious experience. The unprecedented multi-agency collaboration and visionary leadership was able to deliver one of the most successful Super Bowls the NFL has ever hosted and be the first region in the country to experience the paradigm shift in public safety communications that industry leaders have been working towards for decades.

Under the Unified Command structure, HPD was established to be the lead organization for public safety operations. The other agencies respected that leadership position and took direction from HPD. HPD and other City of Houston agencies did an outstanding job of including county, state, federal and industry





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partners at every stage of the planning process so that all entities were able to participate in meaningful and cooperative ways. The successful use of mobile data which provided tangible results for the safety and security of numerous Super Bowl activities would not have been possible without that leadership and collaboration from all parties.

Since this had never been done before and there were no templates or guidelines to follow, we had to work together to figure it out. Decisions had to be made regarding who owned the data and how long it would be retained, what products to use, who would use them and how. HPD leadership recognized Harris County PSTS as the experts in LTE and looked for guidance from us to facilitate the process while they provided the necessary participation of key staff to develop and execute a plan that would successfully support the overall Incident Action Plan (IAP).

The deployment was incredibly successful. In addition to numerous success stories of arrests, re-unified children, medical responses and property seizures, the use of the HCLTE system and mobile apps provided a variety of operational benefits – some planned and others unanticipated:

- 1) Significantly reduced radio traffic
- 2) Reduced dispatch time through real-time location services
- 3) Provided a secured mechanism for sharing sensitive information not broadcast on the radio
- 4) Provided improved information sharing across agencies and different units within those agencies
- 5) Group messaging allowed for the immediate redistribution of information
- 6) Redistribution of original content and sharing of pictures and videos reduced the amount of misinformation that happens automatically as information is passed to numerous individuals
- 7) Incident Commander (IC) could monitor events in real-time from any location
- 8) Reduced the noise and chaos in the Forward Command Post

While the deployment was a success and exceeded expectations, there were a number of lessons learned during the planning process as well as the operational period worth noting for future deployments.

- 1) **Training** - Training and end-user proficiency are critical to the adoption of new technology. It is also important to select products that are intuitive and easy to use so the learning curve is not steep.
- 2) **Coverage** – It is important to provide ubiquitous coverage throughout an operational area so that end users have access to the tools regardless of location.
- 3) **Additional Device** – Although carrying an additional device is a large objection, most of Public Safety recognized personal cell phones don't work well in large crowd environments. Fire and EMS had fewer objections to the additional device due to familiarity with lots of equipment and carrying backpacks.
- 4) **Notifications** –In most cases, the environment was too loud to hear the notifications in a pocket or on their belt. Vibrations often could not be felt on the belt or in pockets. The notifications seemed to be less of an issue for fire and EMS personnel who typically were able to carry the device in their hand more of the time and some wore smart watches where they received the notifications.
- 5) **Device Assignments/Use Cases** –While the use of the mobile data provided significant value for all user groups, the value was much higher for the undercover teams who carry only backup radios and did not have to worry about being distracted in a uniform.
- 6) **Communications etiquette** – Public safety is trained in most circumstances to acknowledge receipt of information over the radio. With the messaging app, those acknowledgments created distracting and unnecessary notifications for everyone else in the chatgroup.





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- 7) **Buy-In** – Utilization and buy-in was directly related to the functions and what communications challenges we were able to solve and/or operational improvements we were able to deliver. There also was a noticeable difference in the attitude of on-duty versus extra job officers during all testing events as well as during Super Bowl operations.
- 8) **Operations Drive Technology** – It is important to understand their operations and provide tools that solve real challenges versus handing them tools to figure out how to utilize within their operations.
- 9) **Coordinated Strategy for Interoperability & Information Sharing** – The success of the mobile apps was directly related to the collaboration and cooperation of all public safety agencies, functions and disciplines. Without coordinated strategies and common platforms, interoperability challenges in the data world could far exceed the challenges faced with LMR interoperability.
- 10) **Identity Credentialing & Access Management (ICAM)** – Most app vendors leverage proprietary username/password databases which are difficult to manage and not scalable.
- 11) **Shared Device Model** – It is likely that agencies will begin to adopt mobile data by purchasing a cache of devices to share for various deployments. Some things such as app installation can be automated through a Mobile Device Manager, but there is still a lot of manual configuration required.
- 12) **Mobile Device Manager (MDM)** – The use of the MDM helped expedite device configuration by automating the app installation process; however, they are limited in how much time they save.
- 13) **“Killer Apps”** - pictures and videos were clearly understood to provide improved situational awareness between the field and command posts, but we had to determine how they would be deployed and incorporated operationally so as to not create an officer safety situation.
- 14) **No NIMS/ICS Framework for Broadband** – the templates and procedures for communications outlined in the NIMS/ICS Framework support voice-only communications and should be updated to incorporate the utilization of mobile apps and other advanced technologies in standard operating procedures.

2 INTRODUCTION

SBLI brought nearly 150,000 out-of-town visitors to Houston. In addition to the game, SBLI operations included Super Bowl Live, a free event for nine days leading up to Game Day which took place at Discovery Green and surrounding areas. Discovery Green is a park in front of the George R. Brown Convention Center (GRBCC) in downtown Houston. The Super Bowl Live footprint was a seven by five block area. NFL Experience is a paid event which coincided with Super Bowl Live for eight of the nine days and was hosted inside the GRBCC. The busiest night of SB Live was attended by over 125,000 people on the eve of the Super Bowl. In addition to these marquee events, there were various other NFL sanctioned as well as non-sanctioned events throughout Houston from January 28 – February 5, 2017.

The map below depicts the primary operational areas including the Galleria and Memorial City which hosted the team hotels. In addition to these operational areas, public safety was responsible for transporting the teams and other VIPs throughout the city including to/from the airport, daily practices as well as parties and other activities. There were a total of 27 sanctioned event facilities and 21 Command Posts stood up during the 10-day operational period.





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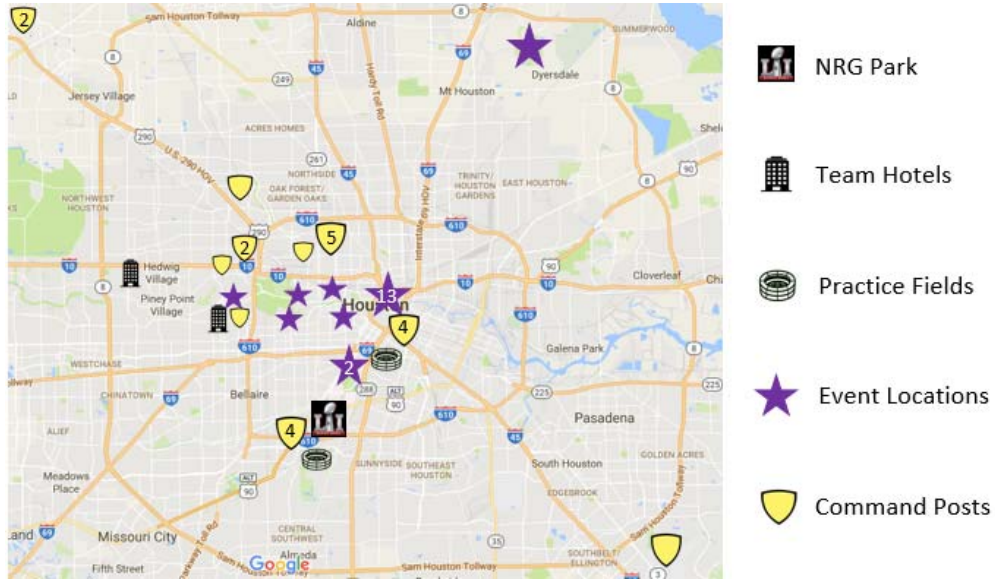


Figure 1 - Operations Footprint

Given the high profile nature of Super Bowl and similar nationally visible events, special procedures were implemented for ensuring the safety of the participants as well as the local community. City, county, state and federal public safety agencies collaborated on the planning and support of Super Bowl LI.

Super Bowl LI had the security designation of a SEAR 1 (Special Event Assessment Rating). In accordance with the National Incident Management System (NIMS) ICS framework, a Unified Command (UC) structure was implemented to provide the command and control framework necessary to facilitate multi-agency cooperation. Within this framework, Resource Working Groups (RWG) were organized to facilitate multi-agency planning across the various public safety functions.

The organizational chart below shows the RWGs and associated Chairpersons established to support SBLI.

The Communications RWG was chaired by Tom Sorley, Deputy CIO/Deputy Director City of Houston – IT Public Safety. Tom also Chairs the FirstNet Public Safety Advisory Council (PSAC) and is integrally involved in nationwide efforts for adopting the use of mobile data to support public safety communications.





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SUPER BOWL LI Resource Working Groups

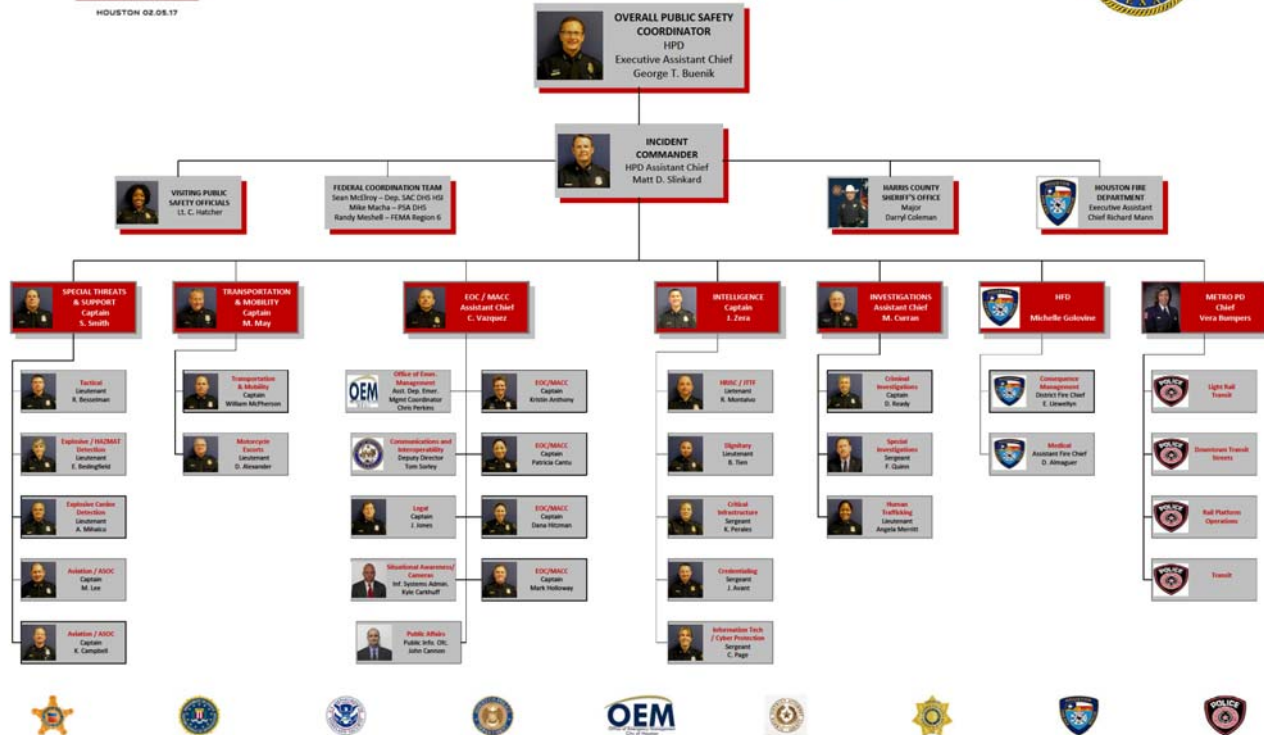


Figure 2 - Resource Working Groups

In March 2016, Harris County was invited by the SB LI Incident Commander, Houston Police Department (HPD) Assistant Chief Matt Slinkard, to participate on the Communications RWG in hopes of leveraging the HCLTE system during SB LI operations. Over the course of the next 10 months, Harris County Public Safety Technology Services (PSTS) worked closely with local, state and federal public safety agencies to develop a plan for the use of the HCLTE system. These planning efforts included the following high-level activities:





Figure 3 - Mobile Data Planning Process

The use of mobile apps far exceeded expectations. The original plans were to support approximately 100-150 users across HPD, Houston Fire Department (HFD) and Harris County Sheriff’s Office (HCSO). Throughout the planning process, additional agencies were incorporated for operational purposes expanding the list to ten city, county, state and federal agencies. Nearly 1,000 PS personnel were trained. Daily use of the apps ranged from 250 – 400 active users across ten agencies during the 10-day operational period.

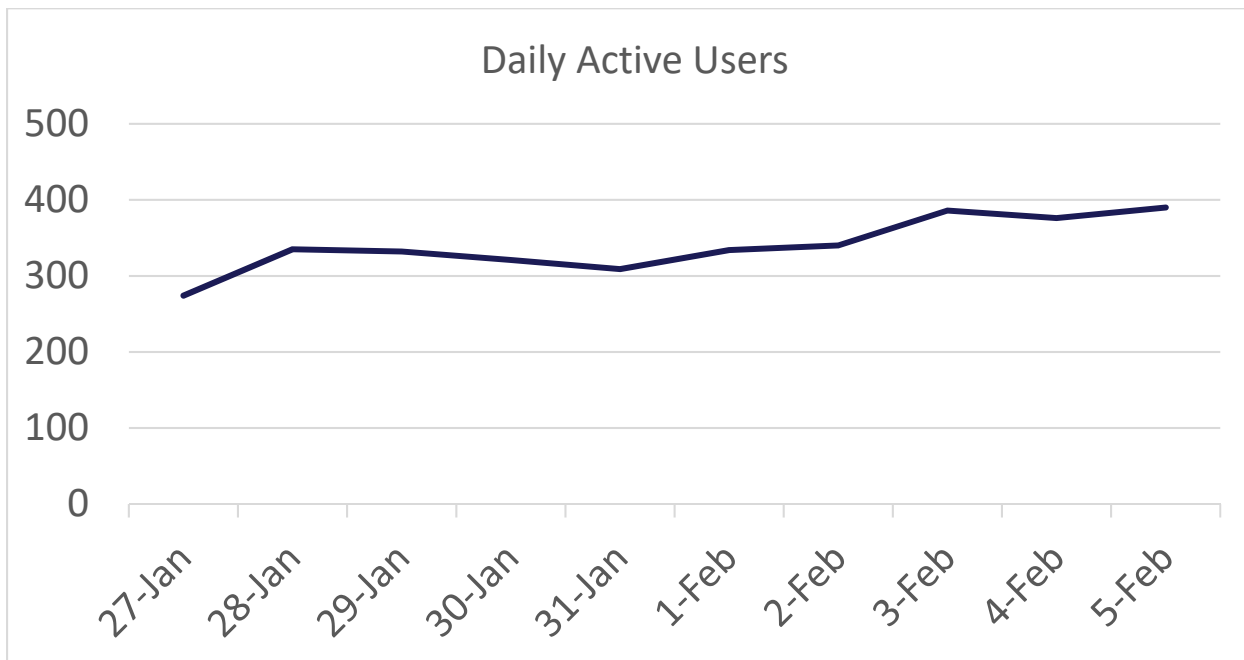


Figure 4 – Daily Active Moxtra Users



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Agencies included:

- 1) Houston Police Department (HPD)
- 2) Houston Fire Department (HFD)
- 3) Harris County Sheriff's Office (HCSO)
- 4) Harris County Emergency Corps (HCEC)
- 5) Homeland Security Investigations (HSI)
- 6) Texas Department of Public Safety (DPS)
- 7) Alcohol Tobacco and Firearms (ATF)
- 8) Harris County Constable Precinct 1 (Pct 1)
- 9) Harris County Fire Marshal's Office (HCFMO)
- 10) Metro Police Department (Metro PD)



Two-hundred devices on the HCLTE system were issued to public safety personnel from various agencies. In addition to the 100 purchased by Harris County and 50 loaned from the manufacturers, the United States Department of Homeland Security (DHS) Science and Technology Directorate (S&T) purchased 50 additional devices which they loaned us for the operation. This brought the total number of devices deployed to approximately 200. Due to budget limitations and the overwhelmingly positive response by participating PS agencies, the county was still not able to provide enough devices for all of the end-users wanting access to the mobile apps. Federal and state agency participants leveraged commercial devices to participate in the information sharing. The commercial carriers brought in temporary infrastructure to significantly augment existing capacity to support SBLI operations. While the HCLTE system typically outperformed the commercial networks in the primary event locations, the temporary infrastructure allowed PS personnel to reliably use the mobile apps on commercial networks despite the sizable crowds.

DEVICES

Sonim Technologies, Motorola and Bittium each manufacture Band 14 Public Safety LTE (PSLTE) devices compatible on the HCLTE network. A combination of all three manufacturers were used. Devices were issued to specialized teams including: Field Intelligence Teams (FIT), Major Offenders, SWAT, Bomb, Special Response Group (SRG), K-9, Hazmat, Medics, Security Supervisors and other Command Staff. The mobile apps provided location services, video and picture sharing, unified communications, field reporting, and Push-To-Talk (PTT). The Sonim XP7 was issued to uniformed personnel due to the rugged nature and superior battery life. The Motorola LEX10 and Bittium Tough Mobile were issued to undercover officers and support personnel due to their commercial-looking form factor.

APPLICATIONS



Moxtra was the unified communications and collaboration app which provided VoIP calling (in app only), video and picture sharing, group messaging and collaboration tools with a common directory for users from multiple agencies to communicate and collaborate as-necessary.

Outdoor location services were provided through a situational awareness app called Sting for location tracking and allows for users to be color-coded and labeled by function. Sting migrated to the Google location service just prior to SBLI which enhanced the accuracy of indoor location services.





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Indoor location services were provided at NRG Stadium for FIT and Medic teams through Neon Personnel Tracker by TRX Systems. Personnel wore a tracking device with Bluetooth connection to the PSLTE device. Neon uses a combination of Wi-Fi fingerprinting, Bluetooth beacons and computations such as altitude and personal movement to calculate indoor location. The command view uses 3D visualization to show personnel on different levels of the building.

ESChat was used by the Special Response Group (SRG) for PTT.



Mobile Indicator, the mobile app for Digital Sandbox, was used for field reporting.

GoCoder was the app used by SpectraRep, LLC to send real-time video to their IncidentOne dashboard. The dashboard was controlled by HFD and could broadcast feeds to other users via Datacasting (TV Antenna & WorldWideWeb).



Personnel in the Command Posts and the EOC predominantly used the desktop and/or web versions of the apps to communicate with the field teams; however, some CP personnel also carried a mobile device in order to continue to support the teams while not stationed at their desk.

3 ACTION SUMMARY

The planning process for SBLI began shortly after the Houston Livestock Show and Rodeo (HLSR). Harris County deployed the HCLTE system at HLSR which proved to be an incredibly valuable learning experience. We came out of that realizing that the technology was not ready for the front-line boots on the ground. So we started SBLI planning by asking the end users their communications challenges and built a plan from the ground up based on the stakeholder requirements and what we had learned about the current state of the technology.

It is important to note that PSTS relied very heavily on relationships with the public safety research community throughout the entire process to identify products, troubleshoot technical issues and develop a successful device and application configuration. Both Public Safety Communications Research (PSCR) under the National Institute of Standards and Technology (NIST) as well as Texas A&M Internet 2 Technology Evaluation Center (ITEC) were instrumental to our efforts.

The Communications RWG kicked off on April 28, 2016 in which the key stakeholders came together to begin SBLI communications planning. It was unclear of the role that PSLTE would play. Harris County PSTS was invited to participate in the Operations Group Commander meeting a few weeks later with executives from HPD, HFD and HCSO. We offered the use of the HCLTE network as a new communications asset to be leveraged. They agreed that they would like to explore ways to leverage the network, but were unsure of who should use it and how.





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Leaders from each of these agencies assigned representatives to participate in a series of requirements gathering workshops where we identified potential users, developed a ConOp, selected products and developed a test plan.

Initially, the group consisted of representatives from the following agencies/units:

- HPD – Special Operations: Special Events and Catastrophic Planning Unit
- HPD – Criminal Intelligence Division
- HCSO – Bomb Squad
- HCSO – High Risk Operations Unit
- HCSO – Special Response Group
- HFD – Special Events
- HFD – Special Operations

In mid-June, we developed a project plan to ensure that we were able to finalize a configuration, acquire the necessary products, test, train the end users and configure the devices in advance of the operational period.

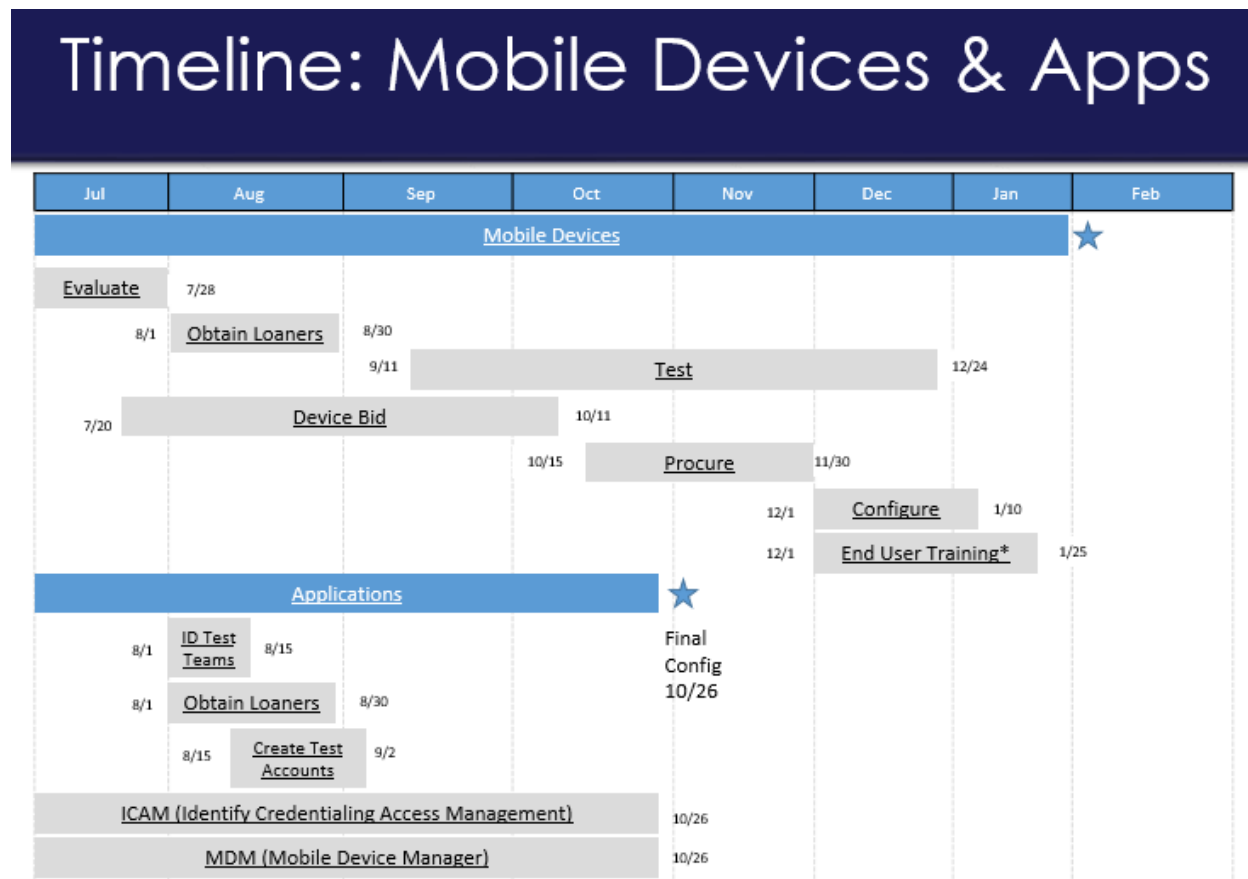


Figure 5 – Mobile Data Project Plan





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Step 1: Identify Users

Users were initially identified as supervisors, undercover teams, gates and special operations units. While that is ultimately the groups that utilized the devices, the composition changed throughout the planning and testing stages. In most cases, one device was assigned per team rather than every individual member. There was also a shift towards more undercover than uniformed personnel.

Step 2: Develop Functional Requirements

The following requirements were identified by the stakeholders as a wish list for mobile data.

Function	Use Case
Information Sharing	Multi-agency calling, messaging, photo/video sharing
Global Directory	Users from all participating agencies to be in a single directory, similar to the Global Address List (GAL) in Microsoft Exchange but across multiple agencies/jurisdictions and only for personnel supporting Super Bowl operations
Location Services	Ability for Command staff to see a real-time map with the location of personnel, key locations and other assets Ability for field personnel to quickly find other field resources and navigate to key locations
Non-P25 Voice	Ability for field personnel to communicate with each other and command staff individually or in small groups. This is particularly important for personnel not carrying a radio and for communicating sensitive information
Field Reporting	Ability for field personnel to provide information, images and geo-location of incidents to commanders for improved situational awareness
Video sharing	Ability for field personnel to stream video from the field directly to the Command Post Ability for Command Post to stream video from relevant sources such as fixed cameras, helicopters, and skywatches to field personnel dispatched to an incident
Security Ops Data Repository	Ability to distribute information such as intel reports, briefings, schedule changes, updated maps, POI alerts, bulletins, etc to all relevant LE agencies and key personnel
Fully integrated map	Ability to add various map layers to a single map for commanders to view assets, personnel, cameras, event locations, FirstAid stations, and any other relevant map/location data
Ad hoc/ temp video	Video for key locations with no fixed cameras in place

Figure 6 – Functional Requirements Table

Step 3: Test Products

The Communications RWG made a conscious decision at the beginning of the process to leverage tools that the city or county already owned rather than going out to look for a best-of-breed solution that would meet all end user requirements. Due to lack of appropriations and limited time for procurement, we determined that it would be in our best interest to utilize existing products and augment them on a case-





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by-case basis for any requirements we could not meet. Our over-arching goals in developing the configuration were:

- 1) Keep it as simple as possible
- 2) Minimize the number of apps end users would have to toggle between

Devices – The Sonim XP7 was selected for all uniformed personnel including special operations teams and supervisors due to the superior battery. The Motorola Lex 10 and Bittium Tough Mobile were selected for the undercover personnel due to the commercial appearance of the devices.

Apps – The initial list of apps considered is outlined below:

Function/Purpose	Application
Location Services	Sting
Group messaging	Sting
Non-P25 Voice	ESChat (PTT)
Field Reporting	Digital Sandbox WebEOC
Video Streaming	GoCoder Mutualink
Security Ops Data Repository	HSIN
Fully integrated map	Digital Sandbox
Ad hoc / temporary video	Edge 360

Figure 7 – Initial Available Apps List

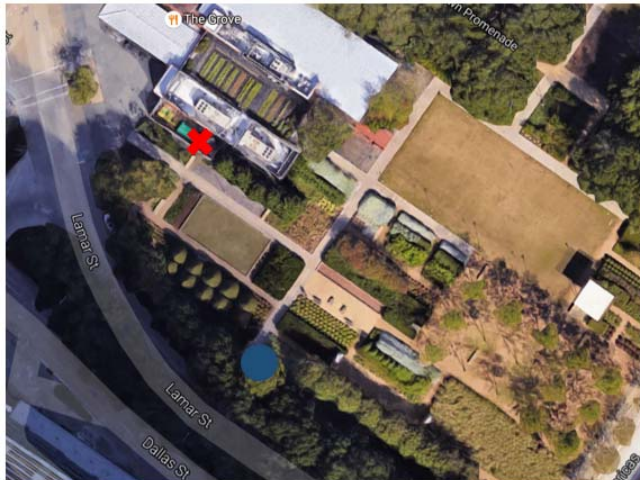
Unfortunately, we could not meet the primary requirements of unified communications (voice calling, group messaging, two-way video sharing and global directory) with the apps available. Through a partnership with Texas A&M, we were able to acquire the Moxtra app for unified communications and collaboration.

We also found during testing that the location service within Sting was inaccurate inside NRG stadium. Sting introduced us to TRX Systems who provided the Neon Personnel Tracker app for FIT teams and roving medic teams inside the stadium. (Sting updated their location service just prior to the operational period which significantly improved the indoor location accuracy). Neon also provided a 3-D visualization which was necessary to determine vertical position for the multi-level facility.

Step 4: Develop Concept of Operations

Once we had identified users and products, we developed an example use case as a baseline for the ConOp.





- Report of a suspicious incident inside Super Bowl Live (marked by X)
- Fusion Center finds nearest FIT Team on Sting Command Map (marked by blue circle)
- Fusion Center shares map location of suspicious incident
- Fusion Center calls FIT Team to help navigate to location and share information



- Fusion Center finds nearest City of Houston camera at intersection
- Fusion Center streams video feed from City of Houston street camera to FIT Team
- FIT Team arrives and streams phone video to Fusion Center
- Fusion Center pulls in GRBCC CP
- GRBCC CP pulls in SRG & Bomb into the group to view the FIT Team video and join group voice call

Figure 8 – Mobile Apps Use Case

Step 5: Test Config

During this phase, we conducted an extensive process of testing hardware and software configurations as well as operational use cases. We developed a test schedule in which we would deploy the technology at home Texans games and other planned events such as races and parades.

In Houston, security at private events is typically provided by off-duty officers in what is termed an “extra job”. Extra jobs are overseen by the law enforcement agency, but officers are paid directly by the private entity rather than the department being reimbursed for overtime. Many extra jobs pay less than on-duty wages and the command structure is unique to each event.

The testing at Texans games proved less valuable for uniformed law enforcement than initially anticipated since the officers were all working in an extra job capacity; however, it was incredibly valuable for the medic and FIT teams. Testing at the home games focused predominantly on technical configurations and network coverage at NRG Park for uniformed law enforcement personnel, while medic and FIT teams built end-user proficiency and developed operational procedures.



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During this time, we were also refining the list of users who would ultimately be leveraging the system. We began conducting classroom-style training sessions for on-duty personnel. Once the majority of teams built basic proficiency with the apps, we scheduled an exercise to test the functionality across teams in an incident-based scenario.

The exercise was structured so that the mobile apps were just one more set of tools in the communications tool chest to augment radio, in-person communications, telephone, public safety video network and other web-based tools. The first two attempts at running the scenario proved unsuccessful as uniformed officers apprehended the suspect as soon as the announcement went out over the radio, so there was not enough time to even create the conversation in the app. At that point, leadership decided to eliminate the radio from the exercise so that we could test the application functionality.

We then successfully ran the exercise two more times in which we developed valuable lessons learned which influenced the operational procedures for utilizing the technology. The exercise plan can be found in [Appendix A](#).

During the testing process, we refined the configuration as well as the device assignments. Product recommendations were provided to the vendors. Product modifications were categorized as 1) must-have 2) really-nice-to-have and 3) nice-to-have. We worked very closely with the vendors throughout the development process to make sure that the changes were consistent with the end-user feedback.

Step 6: Train End Users

This process blended in with the product testing phase as end users needed to develop proficiency in order to provide feedback on what worked and what didn't. We had a combination of end-user trainings on-site during Texans home games and other events as well as classroom trainings for each individual unit. All personnel were trained in advance of the operational period except the security supervisors inside the GRBCC and the gate supervisors at Discovery Green who were trained during roll call.

Step 7: Develop Standard Operating Procedures (SOP)

Once we knew who would be using the HCLTE system and which apps they would be using, we then developed SOPs to guide the use of the apps. Developing SOPs that fit into the overall IAP without being overly prescriptive to it was difficult and required very close coordination with the users.

Components of the SOPs included the following:

- Outline end users
- Define color scheme and function icons for situational awareness map (Sting)
- Determine distribution of dual-band SIMs





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TEAM	DEVICE COUNT	DUAL BAND	COLOR / ICON
Bomb	12	X	
Command Posts (hotspot)	8		
Commanders	8		
EJ Supervisors	23		
FIT Teams	20		
HFD	21		
Hotel Supervisors	12	X	
K-9	12	X	
K-9 (HCSO)	15		
Major Offenders / Precinct 1	7		
Special Events	3		
SRG	24	X	
Super Bowl Live Gates	7		
Support / Runners	10		
SWAT / HNT	18	X*	
Total	200		

*6 SWAT devices will be dual band

Figure 9 – SOP: Assignments, Colors & Icons

- Develop naming convention for Call Signs – in some cases it was important to identify the individual user. For others, it did not matter who the actual person was but rather the function they were providing. Command Post and EOC positions, gates, hotel supervisors, bike teams, medic teams and hazmat teams used generic ID's. All others used individual names.

ROLE	NAMING CONVENTION
Bomb CP	BOMB.CP
Bomb Techs	NAME
Commanders	NAME
EOC	EOC
EJ Supervisors	NAME
Fusion Center	FUSION
FIT Teams	NAME
GRB Command Post	GRB.CP GRB.Sup GRB.WebEOC GRB.Video DiscoveryGreen.CP GRB.CP.Inside
HFD	ROLE (Bike, Medic, Hazmat)
Hotel Supervisors	HotelName.Rank
K-9	NAME
K-9 (HCSO)	NAME
Major Offenders / Precinct 1	NAME
Special Events	NAME
SRG	NAME





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Super Bowl Live Gates	GATE.#
SWAT / HNT	NAME

Figure 10 – SOP: Naming Conventions

- Define expected uses by user group
 - Who produced content?
 - Who received content and how?
 - How was content distributed?

In general, undercover, hazmat and medic teams were the primary producers of field content. Undercovers were also recipients of content. Uniformed law enforcement personnel were designated as content recipients and only expected to generate when possible. Supervisors and command post personnel were both recipients and producers of content. K-9 teams were designated to only use the devices for location services as it would be too difficult to try and operate the apps while handling the dog in crowded venues.

Moxtra was the primary app utilized by law enforcement. An information architecture was developed based on lessons learned during testing and training which in many ways mirrored the information flow of traditional radio and in-person communications. Each team had a chatgroup with only members of their unit. The function determined if the members of the group were from a single agency or across multiple agencies. Specialized groups such as SWAT, Bomb Squad and FIT teams, which operated under a Strike Team or Task Force model utilizing resources from multiple agencies, had personnel from each of the different agencies in their chatgroups. Other groups like HPD Special Events, Metro PD, and HCSO with specific responsibilities had their own group. These chatgroups were structured like the LMR talkgroups.

Each function had a representative in the forward command post, so there was a CP conversation setup in which the CP personnel from each unit were also members. It was the responsibility of the CP personnel to monitor the information coming in from the field that they wanted to share with the other teams as well as monitor the information coming into the CP chatgroup that they thought relevant to share with their field teams. This architecture minimized the amount of unnecessary information and notifications for field personnel while also providing a very fast and efficient mechanism for sharing accurate information across multiple units and agencies. The “Copy To” feature allowed CP personnel to instantly re-broadcast messages, pictures and videos from one chatgroup to the other without any modification. They could then add additional information as they felt appropriate.



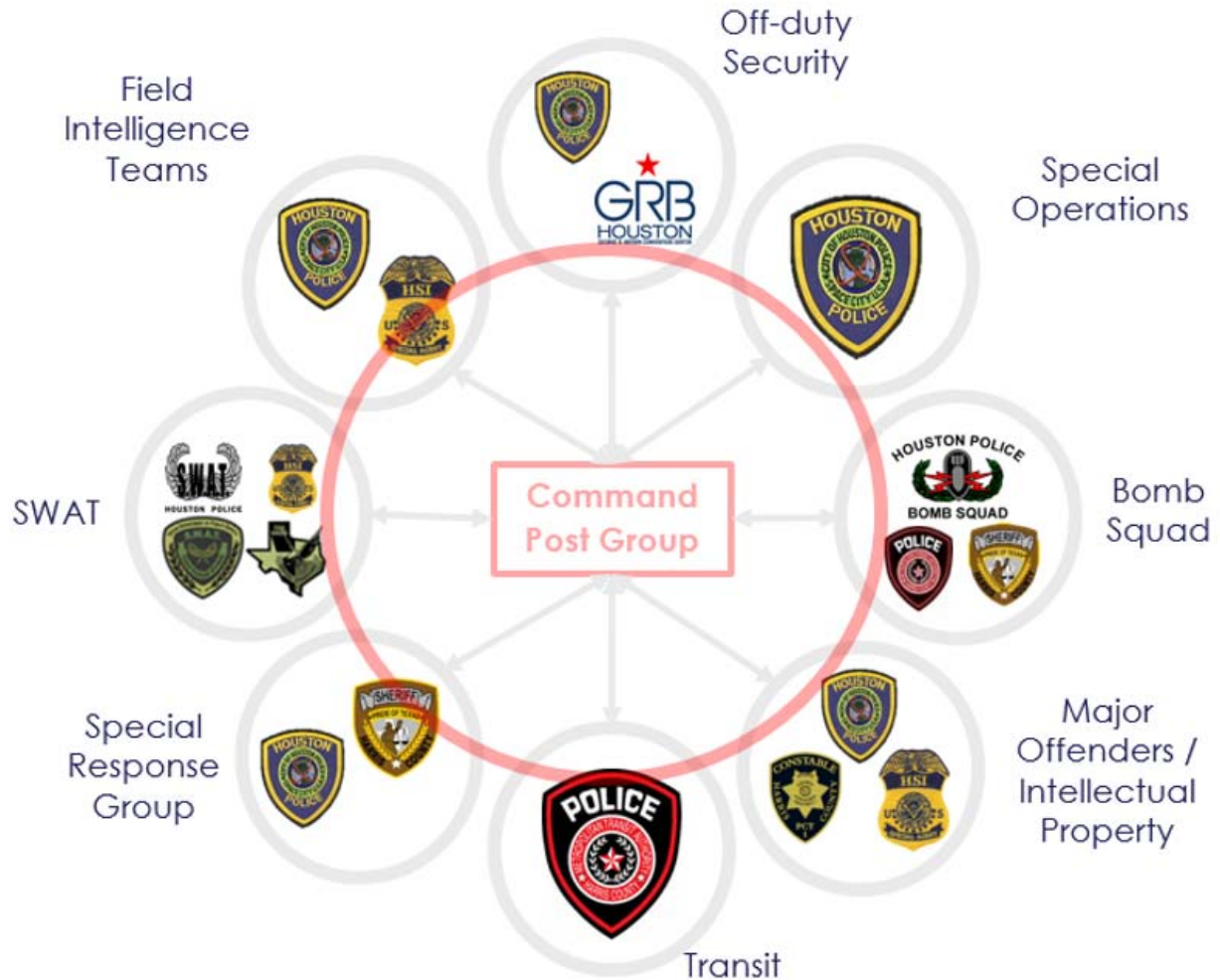


Figure 11 – Moxtra Information Architecture

4 ACTION RESULTS

The use of mobile apps to augment radio communications significantly improved situational awareness and multi-agency information sharing. It also improved the overall efficiency of the public safety personnel and reduced traffic on the radio.

Fire and EMS agencies were able to utilize Sting and Neon Personnel Tracker apps to dispatch the teams closest to an incident which not only reduced response times but significantly cut down on radio traffic for determining which team was closest.

HFD also utilized GoCoder to stream real-time video from the field during protests. Since this video was captured from the field units, it provided an “on-the-ground” perspective not possible from the city’s fixed camera system mounted on light poles and buildings as well as in areas of limited visibility by the city’s



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system. This enhanced situational awareness for both HFD and HPD command staff monitoring the protests.

HCSO used the HCLTE system to stream video from two “Skywatch” units to provide ad hoc video surveillance in and around the event areas to augment existing fixed camera infrastructure.

HFD also utilized the Mobile Indicator app to have field personnel perform Personnel Accountability Reports (PAR) which historically were performed over the radio. This significantly reduced non-emergency radio traffic and allowed command staff to better monitor the status of field teams.

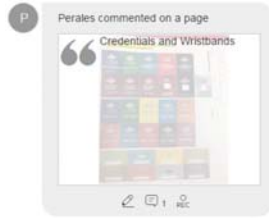
HCEC leveraged Moxtra for similar functionality in which field teams reported their status, requested relief, and communicated all other non-emergency information. HCEC found that many individuals who are sometimes reluctant to communicate over the radio felt very comfortable texting in the chatgroup. This not only improved the overall communications of the team, it eliminated all non-critical radio traffic leaving the radio open for essential patient-related information. HCEC leaders estimated that the mobile apps reduced approximately 80-90% of radio traffic. They also indicated that it had the unanticipated effect of causing everyone to pay more attention to the radio since they knew that it was limited to incident-related information. Finally, HCEC managed 90 medics and 13 transport units with one person operating in the CP. They reported that this would not have been possible without the mobile apps.

Law enforcement agencies leveraged Moxtra for multi-agency communications. The group messaging allowed for the immediate redistribution of information which reduced the misinformation which naturally occurs when relaying information verbally whether on the radio, over the phone or in-person. Moxtra allowed each team to maintain independent, private communications but also to quickly and easily share pertinent information with other teams. The information architecture allowed the discretion to remain at the individual unit level for what information got shared in/out.

Moxtra also provided a secured platform to allow the transmission of sensitive information that they did not want to put on the radio, even on the encrypted channels.

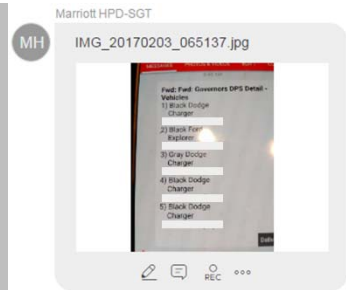
The use of pictures proved to be one of the most significant benefits of the group messaging functionality. Not only were officers able to share images of suspects and protestors for security purposes, they were also able to share pictures that aided in the logistical elements of the operations.





Pictures were distributed daily showing the official credentials and wristbands

Lists of VIP vehicles authorized to park in No Parking zones were distributed with descriptions and license plate numbers



Marriott HPD-SGT
MH The listed vehicles will be parked on adla adjacent to the Marriott Marquis hotel. The vehicles belong to the governor's DPS detail. Any questions call Lt Lopez or Sgt Ruiz.

February 1, 2017 11:34 AM

GRB CP
GC 20170201_112656.jpg

GRB CP
GC Be advised these technicians are subcontractors with the HPD Public Safety Video Network system. They are [redacted] and [redacted] with [redacted]. They will be going to the roof of the George R. Brown to check radio communication antennas. They will be going towards the northwest corner of the Roof. They will be escorted.

GRB CP
GC They are here to try and fix our video camera connection issue.

RR Received; will pass on to roof

Images of technicians needing to perform work on the rooftop were shared with rooftop observation teams

Figure 12 – Picture sharing

5 ACTION SUCCESSES

We successfully demonstrated the impact that mobile data can have operationally on situational awareness and information sharing during large-scale events. Moxtra was viewed 58,253 times during the operational period with 6,897 messages sent and 1,202 multi-media files created. There were 2,476 field reports submitted through Mobile Indicator.



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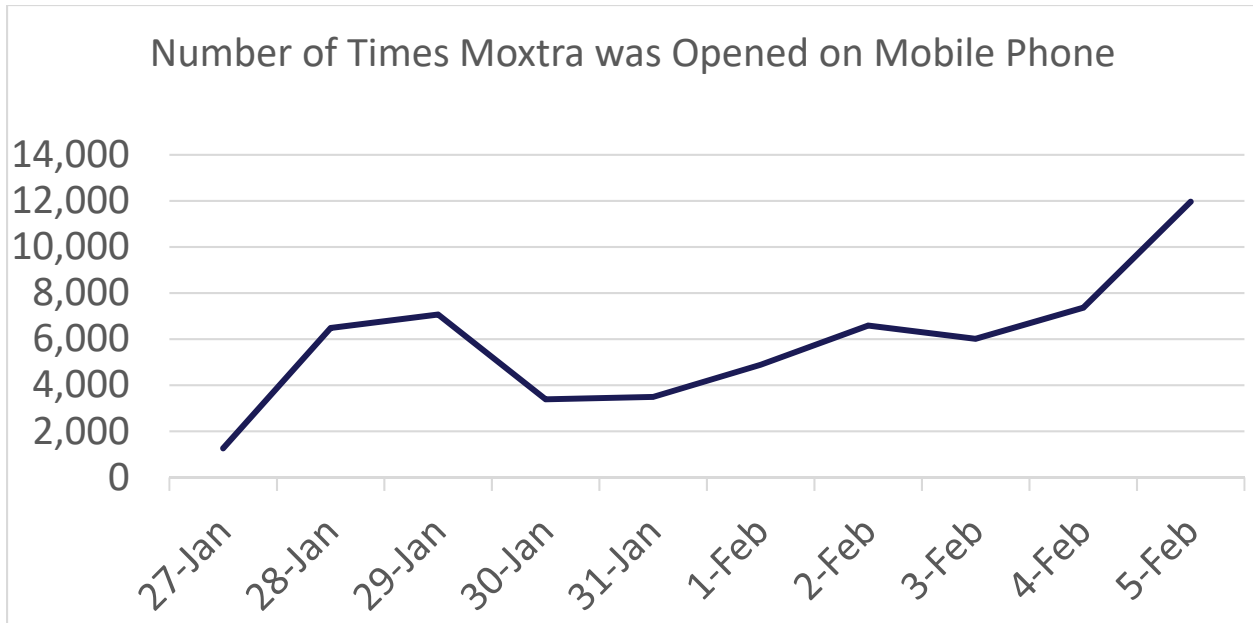


Figure 13 – Moxtra Views

As demonstrated in the graph above, the use of the group messaging steadily increased over the operational period and daily activity coincided with the event duration and crowd size. As expected, weekend traffic was greater than weekday due to larger crowds and longer hours of operation.

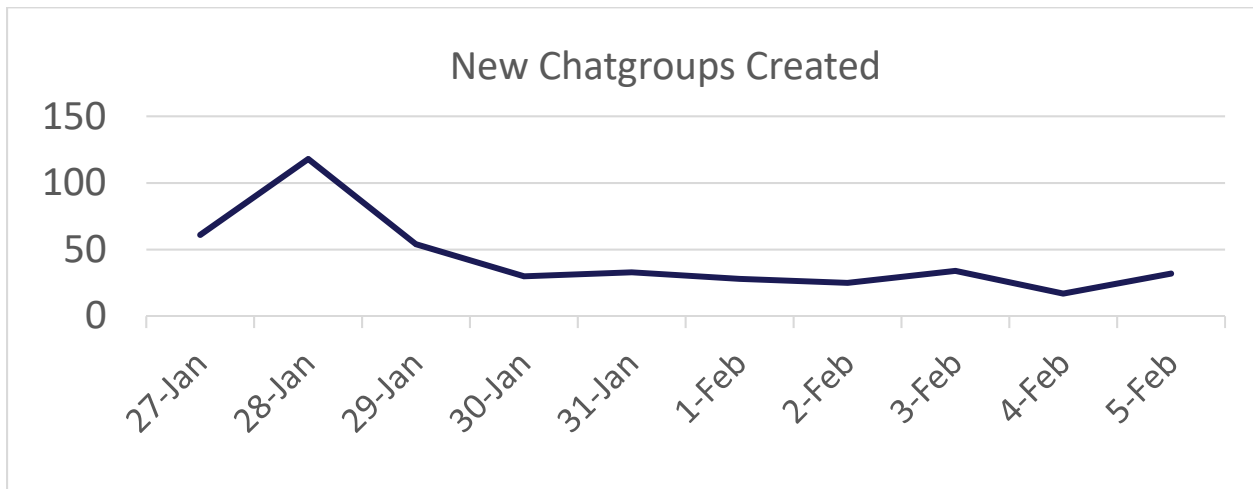


Figure 14 – New Moxtra Chatgroups Created By Date

Once the majority of chatgroups were established in the beginning of the operational period, the number of new groups created dropped to just the new daily chatgroups established as the “official” groups for each operational unit. Most groups wanted to start each day with a clean thread to reduce time when searching for specific images and messages. Some teams preferred to keep a running thread for the entire operational period to go back and reference images of suspects, persons issued trespass warnings, and Officer Safety Alerts from previous days.





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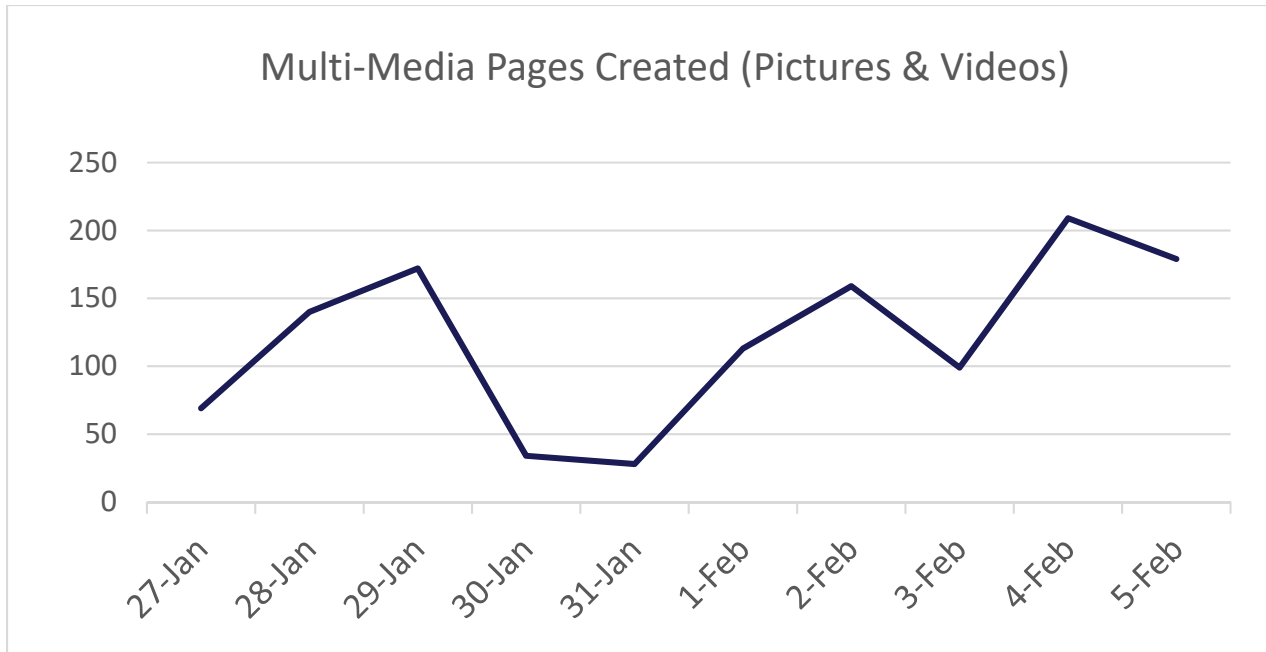


Figure 15 – Moxtra Multi-Media Pages Created By Date

The creation of multi-media content was consistent with the daily crowd size and event duration with the peaks being on the weekends and the lowest volume being on January 30-31 when the event opened later and closed earlier than every other day.

Successful utilization of the HCLTE system included general operational benefits as well as specific use cases.

Benefit #1 – The use of the mobile apps significantly reduced radio traffic which was an unanticipated benefit. By the 3rd day of the operation, senior law enforcement executives were commenting about the noticeable reduction of traffic.

Fire and EMS personnel performed Personnel Accountability Reports (PAR) and In-Service Status Checks through the apps rather than over the radio. Historically this was done in a roll-call fashion over the radio and tied up the channel with significant non-emergency traffic.

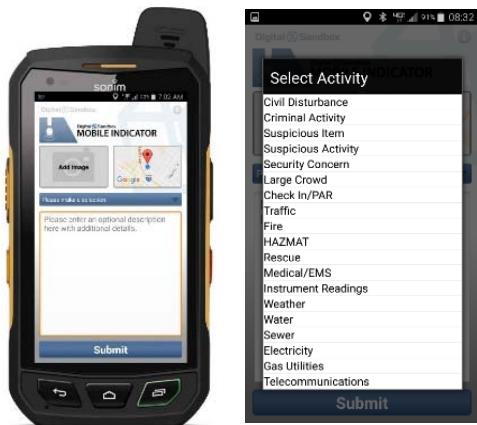




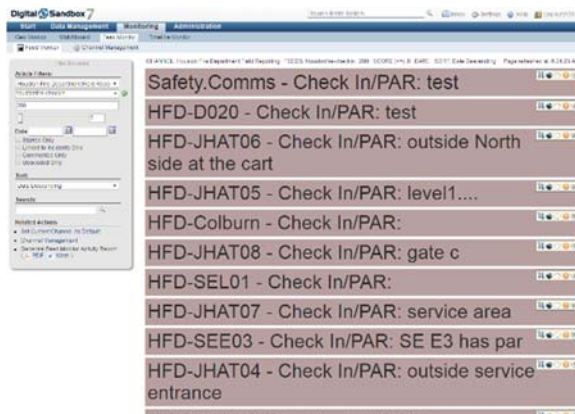
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MOBILE VIEW



COMMAND VIEW



INSTRUCTIONS FOR NON-CRITICAL COMMS

PM

GREETINGS! to all the HCEC medics and support personnel as well as to the doctors who will be assisting with patient care here at Superbowl 51.

We will use Moxtra for non-critical communication, including status updates, times for reports, supply requests, etc.

I will be sharing various reference materials including stadium maps, etc. that you may find useful.

On Saturday Feb 4 and Sunday Feb 5 (game day), Command Post will be in operation and dispatch will be on TX-WARN15.

IN-SERVICE STATUS UPDATES

COMMAND NRG

1100 Muster update IN SERVICE

Command Post - Pulk
 Room 500 - Douglas
 9934 - Northern
 RP1 - North Dock
 RP7 - Maroon lot
 RP8 - Yellow lot
 RP9 - Perimeter staging Gulf Coast
 RP10 - Perimeter staging Gulf Coast
 RP11 - Perimeter staging Gulf Coast
 RP12 - Perimeter staging Gulf Coast
 MD1 - Dr. Decker
 Arena First Aid
 Center First Aid
 Rehab Yellow Lot
 Orange Golf Cart Roaming Team
 North Golf Cart Roaming Team
 Blue Golf Cart Roaming Team
 West Golf Cart Roaming Team
 NE Club FA (missing doctor)
 Club E roamers
 Upper East Roamers

*** IF YOU ARE IN SERVICE AND NOT ON THIS LIST, PLEASE NOTIFY COMMAND ***



Benefit #2 – Dispatch time was significantly reduced by being able to identify on the map the resources nearest the incident. Fire and EMS used this feature much more heavily than Law Enforcement who had a more dense presence and many fixed positions. This also served to reduce radio traffic as the Command Post would automatically dispatch a particular unit rather than spending time finding out locations over the radio to determine who was closest.

Benefit #3 – The apps provided a secured mechanism for sharing sensitive information that they did not want to put on the radio. Even units with encrypted channels were reluctant to share certain information on the radio.

Benefit #4 – The apps and the associated information architecture allowed for improved information sharing not only across agencies, but also across different units within those agencies. Personnel in the Command Post who didn't meet until midway through the operations were sharing information from the very beginning without any verbal communication. Various arrests were made because of the collaboration and information sharing.





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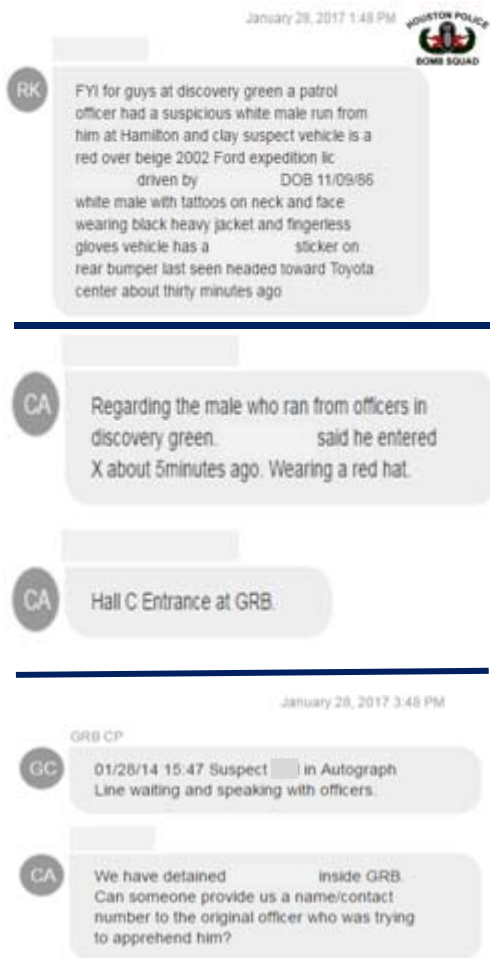
Benefit #5 – The group messaging allowed for the immediate redistribution of information. Command Post personnel who deemed that something should be shared with their field teams or with the other units could simply right click the message/image/video and select “Copy To” and choose the relevant chatgroup. This significantly cut down on the noise, chaos and movement around the CP. The instant nature of the redistribution also reduced the time it took to relay information.

Benefit #6 – The redistribution of original content and the sharing of pictures and videos reduced the amount of misinformation that happens automatically as information is passed to numerous individuals. The sharing of pictures and videos also reduced the misinformation from voice-only communications by allowing personnel to see the situation themselves rather than relying on a verbal description.

Benefit #7 – The Incident Commander (IC) could monitor what was happening in real-time with all teams regardless of his physical location. By being a part of the CP chatgroup, the IC’s Sergeant could keep him updated without being limited to one or two radio channels.

Example Use Cases

Use Case #1 – Felony Arrest



A patrol officer observed a suspicious male. He ran the license plate and found that he had a felony warrant. The patrol officer did not have the app but shared the information with a bomb tech who did. The bomb tech put the information into the Bomb Squad chatgroup. The Bomb Squad CP rep then shared the message into the CP chatgroup. The DPS analyst from Austin who did not know many of the local folks saw the message and ran the Driver’s License photo which she shared with the CP chatgroup. Each unit distributed the original message and the photo to their field teams.

The supervisors inside the GRBCC showed the picture to their officers at the doors. One of the officers recognized him.





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January 28, 2017 4:54 PM

Officers located him and made the arrest.

CA: Officer Gomez, FYI, I spoke with him. There was no evading case. Officer Gomez ran the plate on the vehicle was driving and determined he had a felony warrant. [redacted] drove off before Gomez could approach him.

RH: Was he arrested?

CA: Yes. Arrested for a felony warrant by officers inside GRB.

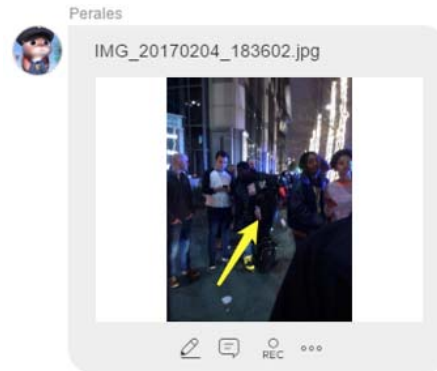
This arrest had the coordination and collaboration of HPD, HCSO, DPS and HSI including Patrol, Event Security, SWAT, Bomb and the Criminal Intelligence Division (CID). The arrest happened less than 3 hours from the time the patrol officer ran the plate at an event with over 100,000 attendees.

Use Case #2 – Multi-Unit Coordination

FIT teams who were responsible for anti-terrorism were noticing lots of scammers and people selling counterfeit merchandise. Ordinarily that activity would not have been dealt with because their phones have such limited bandwidth that even text messages would hardly go through with the large crowds congesting the commercial networks. Plus, CID wouldn't know which Major Offenders officers were working much less have their cell phone numbers. So through the apps, the FIT teams would take pictures of criminal behavior that was not under their area of responsibility and the CP person would then pass it along to Major Offenders. In this case, the FIT team got the guy's phone number and said he would be back with cash and then sent that information to Major Offenders to handle.

Another feature the end users found very valuable was the real-time collaboration tools which allowed them to draw arrows or place boxes or circles around the suspect.

February 4, 2017 6:44 PM



Perales: His phone number is [redacted]. He is selling Superbowl t-shirts 2 for \$30.00. Officer told him he would call later after he got cash. He will meet. Currently at McKinney and Austin

6 ACTION FAILURES

The two biggest complaints from end-users were around coverage and lack of training. There were a total of 27 event venues throughout the city.

Below is an illustration of some of the primary facilities. Locations designated with the red X are facilities we did not have coverage. As our current network is outdoor only, we had to make special





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accommodations to provide indoor coverage in the main event venues at NRG Park and GRBCC. The Westin Memorial City is on the edge of our coverage footprint, and we currently have known coverage gaps in Midtown and Rice University areas. Coverage in the operational footprint was a key element of the planning process, particularly for device assignments.



Figure 16 – Event Venues

The original plan was to deploy devices only to personnel at NRG Park and GRBCC/Discovery Green as those were the locations with the largest crowds and we could ensure coverage. As the planning process evolved, device deployment moved away from uniformed security personnel at those facilities and steered towards specialized teams such as SWAT, Bomb, SRG and K-9 who supported citywide operations. FIT teams were also dispatched to unanticipated areas where they were unable to access the apps due to lack of indoor coverage.

Uniformed security personnel working large events need to be heads up focusing on the crowds. Testing during the Texans home games and other events revealed that carrying the device was distracting, and it was often difficult for them to hear or feel the app notifications. That is when we shifted the deployment strategy to incorporate more undercover personnel and specialized/tactical teams whose job responsibilities were more conducive of utilizing the devices and receiving the notifications. The challenge was that these groups were not all designated to a single location and many of them roamed the city or moved to different facilities to perform sweeps and secure the venues.

In order to support these teams who would be operating outside of our coverage area, we were able to obtain 50 dual-band AT&T SIMs to provide failover capability onto the AT&T network when users were outside the HCLTE footprint. While the SIMs worked, it required a manual process by the user to switch networks. The app was not terribly intuitive and many users forgot or never knew they had the capability.





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In addition to the device assignments, we had to carefully consider the distribution of the dual-band SIMs as demonstrated in Figure 9 above.

This change of deployment plans also contributed to the lack of training. Below is the detailed test plan.

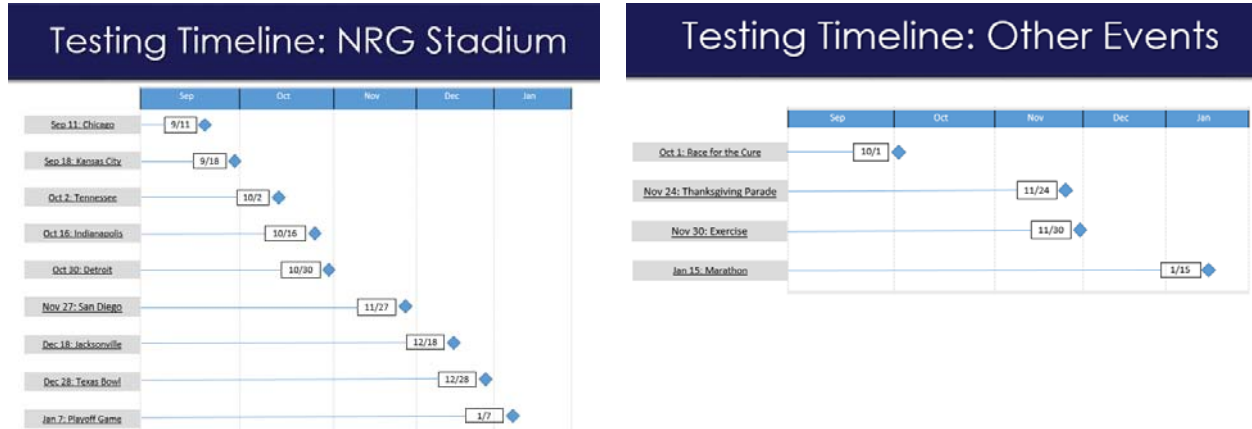


Figure 17 – Testing Timeline

We very quickly discovered at the first home game that utilizing the apps a few hours every two weeks would not be adequate for users to gain proficiency. At the time, we had less than 50 manufacturer loaners for testing at the games. We were in the process of purchasing devices and simultaneously completing network deployment. We did not have devices to loan users on a daily basis; however, we recognized the need for users to utilize them for daily operations in order to develop enough proficiency for us to 1) identify any bugs or required product enhancements and 2) develop SOPs for how they would be deployed and utilized. This led to the first pivot in the plan in which we loaded the apps on city and county issued cell phones to give users the ability to practice using them daily. This worked for some groups; however, many personnel do not have an agency-issued device. As an interim solution, we worked out an arrangement with AT&T to purchase the 50 Sonim phones from them with 6 months of airtime instead of directly from Sonim. This would allow us to loan them to end users prior to the completion of our network deployment by utilizing the commercial cellular network. We temporarily issued those phones to various teams for 1-2 week periods so that they could practice using the apps.

We received the AT&T phones and began distributing them in late October. As demonstrated in the graph below showing the number of user accounts created each month, we had a steady increase in account creation between October and January (*Note that the majority of account creations in February were new accounts for the 2017 Houston Livestock Show and Rodeo).





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Figure 18 – New Moxtra Registered Users By Month

One other contributing factor to the lack of sufficient end-user training was that PSTS was not provided the Incident Action Plan (IAP) or included in many of the operational meetings. Each agency identified different potential end-users in the early planning phases, and these end user groups did not coincide across law enforcement agencies. For example, HSCO included their High Risk Operations Unit (HROU) – the equivalent of a SWAT unit – along with the Bomb Squad. HPD did not initially include SWAT or Bomb. As the IAP evolved, many of the tactical teams ended up working in a Strike Team capacity with personnel from multiple agencies sharing shifts under a single command structure. It was originally communicated to us that different agencies would have responsibility for different venues under Event Operations Groups rather than working together to support numerous events. This created a challenge for device deployment when HCSO HROU and Bomb had been testing and training with the apps, but the equivalent HPD personnel had not. When communications became aware of the staffing plans, we were able to engage those personnel to get them trained and account for them in the device deployment plans. This was also a significant factor in expanding the number of participating agencies.

Since the use of mobile data had never been done before, we all approached the process from the perspective that we saw potential value in the use of the HCLTE system but it would need to be tested and vetted before full commitment to use operationally. So while there was buy-in from the beginning to invest the time and resources into the planning process, the commitment to use the system was not made until around December and we were still ironing out SOPs until shortly before the operations began.

The IAP was under development during the app testing and training period, so the efforts were going on simultaneously. Since PSTS did not participate in the majority of operational planning meetings, operations and HCLTE planning were largely happening in parallel rather than as a tightly integrated function in support of operations plans. Because of this, we were unable to identify the discrepancy between identified end-user personnel from different agencies and get the correct teams trained earlier in the process.





7 LESSONS LEARNED AND RECOMMENDATIONS

- 1) **Training** - Public safety is trained to use muscle memory when responding to incidents, so many are inherently resistant to change due to the high risk nature of their jobs. Training and end-user proficiency are critical to the adoption of new technology. It is very important to provide as much training time as possible so they can become familiar with the tools in advance of a special event. It is also important to select products that are intuitive and easy to use so the learning curve is not steep.
- 2) **Coverage** – It is important to provide ubiquitous coverage throughout an operational area so that end users have access to the tools regardless of location.
- 3) **Additional Device** – One of the biggest objections in every deployment we have done has been the requirement to carry yet another device. Command staff typically at-a-minimum carry their personal cell phone, agency cell phone, and radio. Even for officers who do not have an agency phone, there was pushback about having to carry a second phone. While there was some resistance, most of them recognized that their cell phones don't work well in the large crowds and reluctantly carried the additional device. Fire and EMS had less objections to the additional device since they are pretty accustomed to carrying a lot of equipment and usually have backpacks so everything is not having to be carried on a belt or in a pocket.
- 4) **Notifications** – Notifications were a pretty significant challenge. Uniformed law enforcement officers (LEOs) often found them difficult to hear or feel in large crowds. Most of them do not have space to carry the device on their belt, so they had to carry it in the inside pocket of their shirt in which case the body armor reduced their ability to feel the vibration. Others used the side pocket of their cargo pants which was also not an ideal place to feel the vibration. In most cases, the environment was too loud to hear the notifications in either pocket or for the ones who did opt to wear it on their belt. Users decided if they wanted to have sound or vibration as Moxtra did not support both simultaneously.

As part of the SOPs, the CP would broadcast on the radio “check your app” when they were sending critical information that they wanted to ensure receipt. Most officers would check the app periodically, so they would only put out the radio alert if the information was critical and time sensitive.

The notifications seemed to be less of an issue for fire and EMS personnel who typically were able to carry the device in their hand more of the time. Some EMS personnel connected their smart watch to the device in order to get notifications through the watch which they explained significantly helped with getting messages while not having to carry the device in their hand or constantly pull it out to read messages.

- 5) **Device Assignments** – We learned during the 2016 Houston Rodeo that the technology was not ready for front-line boots on the ground officers who needed to be heads-up and hands-free in a large crowd environment. This was further validated during testing. We held an exercise with HPD, HFD and HCSO. Bomb, SWAT, K-9, SRG and FIT teams all participated along with a suspicious person and several other stand-ins. Command staff in the EOC and CP observed the exercise on the City of Houston Public Safety





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Video network and saw that everyone was looking down on their phones. So while the pictures and videos were clearly understood to provide improved situational awareness between the field and command posts, we had to determine how they would be deployed and incorporated operationally so as to not create an officer safety situation.



After the exercise, the FIT teams cut their device count in half and changed the operational plans from each person having a device to one per team. One team member was tasked with intelligence gathering and crowd observation while their partner was the communications person relaying information to/from the fusion center and the other teams.

All assignments to uniformed personnel were limited to supervisors and specialized teams including SWAT, Bomb, SRG, and K-9 rovers. This exercise was when we determined that the SOPs needed to also include the use case by function to determine if they were expected to produce and/or receive content or merely carry the device for location services for dispatching purposes (K-9).

We also determined that we should incorporate the participation of more undercover teams who could perform a field communications function in the event that the command post needed pictures or videos of an incident without tying up the FIT teams. That is when we engaged Major Offenders who had plain clothes squads working counterfeit merchandise and other related intellectual property crimes. Although they were originally engaged to provide as-needed field information for situational awareness, they ended up becoming one of the heaviest users of the apps which they used to seize hundreds of thousands of dollars in counterfeit merchandise as well as numerous arrests of scalpers, scammers and counterfeit merchants.

While the use of the mobile data provided significant value for all user groups, the value was much higher for the undercover teams who carry only backup radios and did not have to worry about being distracted in a uniform.



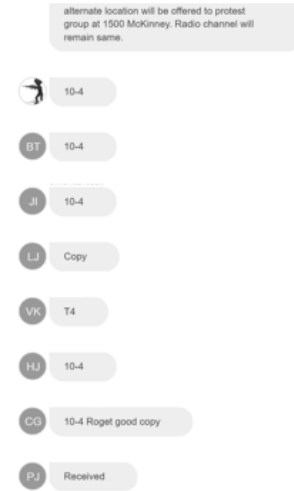


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- 6) **Communications etiquette** – Public safety is trained in most circumstances to acknowledge receipt of information over the radio. With the messaging app, those acknowledgments created distracting and unnecessary notifications for everyone else in the chatgroup.

In the example to the right, there was one message of importance followed by eight acknowledgements which created eight unnecessary and distracting notifications for the other users. Command staff notified their teams that they did not have to acknowledge receipt if it was information-only. If action was required, then they would specifically request acknowledgement through the app or over the radio.



- 7) **Buy-In** – As with anything, adoption is directly related to the level of executive buy-in. Luckily for SBLI, we had strong buy-in from senior leadership across all agencies. Each agency committed significant resources during the planning process. In general, there was more resistance at the lower ranks from law enforcement than fire or EMS. Even within the various law enforcement agencies and units, there was a noticeable difference in the attitude of users and the utilization of the tools by each team based on the buy-in at the different levels of command. The teams with buy-in at the Captain, Lieutenant and/or Sergeant level had consistently better attitudes, greater utilization and reported much higher value.

Utilization and buy-in was also directly related to the functions and what communications challenges we were able to solve and/or operational improvements we were able to deliver.

Finally, there was a noticeable difference in the attitude of on-duty versus extra job officers during all testing events as well as during Super Bowl operations. Extra job officers are typically paid less than the overtime personnel, so there is less incentive to do something new. They are also reporting to different command staff than their daily job within the department, so there seems to be less willingness to participate. Extra job commanders also seemed to be less willing to mandate use, likely for similar reasons. To further validate the conclusion that it is the on/off duty capacity versus the individual personnel, some of the heaviest users and biggest proponents of the tools during Super Bowl were reluctant to use the exact same devices and apps during 2017 Rodeo when they were working in an extra job capacity.

- 8) **Operations Drive Technology** – It is very important to understand their operations and provide tools that solve operational challenges versus handing them tools to figure out how to utilize within their operations. There is no one-size-fits-all for public safety. What works well for undercover officers is not necessarily what will work for other law enforcement functions. And some of the tools that are important to law enforcement are not necessarily relevant to fire and EMS. While messaging, picture/video sharing and field reporting were the primary features utilized by all teams, the use cases





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varied across functions and agencies. So even the same apps may need to be configured and utilized differently based on the job responsibilities and preferences of individual units.

- 9) **Coordinated Strategy for Interoperability & Information Sharing** – The success of the mobile apps during SBLI was directly related to the collaboration and cooperation of all public safety agencies from command staff to the boots on the ground across all participating functions and disciplines. They provided the resources to work with Harris County PSTS to develop a plan. They all participated and worked together on developing the ConOps, selecting products, extensive testing, getting users trained and defining SOPs that everyone agreed to. By utilizing common platforms, we could develop the information architecture which allowed agencies and units to share pertinent information quickly and easily which was the root of why it had such a positive impact on the operations.

The use of mobile data and other advanced technologies has the ability to create a paradigm shift in the way public safety communicates by expanding multi-agency collaboration and information sharing capabilities beyond voice-only communications, and SBLI was the first large-scale operation to experience this shift. On the flip side without coordinated strategies and common platforms, the potential interoperability challenges in the data world could potentially far exceed the challenges faced with LMR interoperability. If every agency chooses their own platforms for various functions such as mapping and messaging, then they are at the mercy of app vendors to integrate with their competitors' products if the agencies want to share information. This is a common challenge with integrating existing platforms such as CAD and video systems which require a significant amount of government time and resources. Even when the integrations are successful, they often don't provide the usability and functionality desired. If that happens, public safety will not be able to realize the full potential for information sharing and interoperability, particularly during incident response where you don't have the benefit of a year to plan.

- 10) **Identity Credentialing & Access Management (ICAM)** – Since no standards have been published yet for Authentication and Directory Services, most app vendors leverage proprietary username/password databases. This is difficult to manage and not scalable. We explored the use of a Single Sign-On (SSO) solution; however, none of the apps supported the necessary authentication protocols. Only one of the apps had Active Directory integration. Even if all of the apps supported AD integration, that was still not a viable solution since we were supporting 10 different agencies and did not have the time to work with each agency IT department to try and integrate with their ADs.
- 11) **Shared Device Model** – We did not have enough devices for all users to have a dedicated device. Most city and county law enforcement agencies in our area provide cell phones to about 10-15% of their personnel. That number is even lower in the fire industry. It is not probable that most agencies will begin providing cell phones to the majority of personnel, so it is likely that agencies will begin to adopt mobile data by purchasing a cache of devices to share for various deployments. This model is limited due to the manual configuration requirements of current devices and the lack of a viable and affordable ICAM solution. Unlike PCs that can be imaged and radios that can be programmed with a template, smartphones require a significant amount of manual configuration for things like Android or Apple account creation/login, location settings, sleep/lock screen, Wi-Fi, etc. Some things such as app installation can be automated through a Mobile Device Manager, but there is still a lot of manual





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configuration required. The number of cached devices an agency can manage and support will be limited until the administration of devices and apps becomes more automated.

12) **Mobile Device Manager (MDM)** – Public safety regulations for sensitive data such as CJIS and HIPPA require that mobile devices accessing this information have an MDM to 1) manage access and 2) lock down or wipe the information from a device that has been lost or compromised. The use of the MDM helped expedite the device configuration process by automating the app installation process; however, they are limited in how much time they save. Android devices still require the following manual steps:

- Install Gmail account to download MDM from Google Play Store
- Download MDM and Login
- Manually install apps in which you don't have the apk to automate through the MDM (ie NFL Super Bowl app)
- Configure device settings: sleep/lock screen timers, display brightness, location service, Wi-Fi, etc

We ran into problems on select devices in which the location service on the MDM interfered with the location service in Sting. This bug produced inaccurate positions and stale connections on certain devices. We were not able to identify and troubleshoot the root cause of the problem until after the event, so additional work needs to be done to figure out how to successfully leverage MDM on these devices.

13) **Shared Google Account** – All Android devices require a Gmail account to be loaded to activate Android and download apps from the Google Play Store. We used one generic Gmail account for all devices. During the testing, we found malware on some of the devices and began troubleshooting. When we looked into the app download history for the account, there were a number of non-operational apps installed ranging from gas pricing apps, fitness trackers and games to dating apps and social media such as Facebook and Pinterest. We also then looked at the Inbox which we had not ever monitored because we were only using the account for Android activation and Play Store downloads. We noticed that there were email notifications with inappropriate content from dating websites and a Pinterest feed.

In the interest of not discouraging adoption, we did not raise the issue to agency command staff. So to avoid this going forward, we would remove the Gmail account from the device prior to test deployments, trainings and loaner periods. This added an additional step in the device configuration process, especially when we had to add the account back to download something from the Play Store such as the NFL Super Bowl app and then remove it again before distribution.

Each Band 14 device manufacturer is at least one release behind the most current version of Android. At the beginning of testing, many of our devices were on Android 4.4.4. Android at Work may be a way to solve some of this going forward; however, we did not have the time or budget to pursue it in time for Super Bowl and it is only available on Android 5.0 and later. We also had the option of leaving the Gmail account on the devices and using the MDM to block any downloads from the Play Store; however, we weren't sure if there would be additional apps we would want to provide the end users





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and did not want to create additional burden on the IT Security administrator who managed the MDM for us.

14) **Enterprise App Administration** – Many apps are built for individual commercial users, so many of them have limited enterprise administration tools. Even purpose-built public safety apps are in their relative infancy and lack robust administration tools.

- Some of the apps require an active email address for account activation. Since we were centrally managing the accounts and credentials, it was not feasible to expect every individual user to activate their accounts and setup passwords. By not having access to the individual user credentials (and no ICAM solution), we would not have been able to re-configure the shared devices for each test event and training session. For the Rodeo last year we created individual Gmail accounts; however, this was not feasible for SBLLI due to the number of end users. Harris County IT agreed to create temporary county email addresses for the end users from the various agencies. Users did not have access to the actual inboxes, but they were provided an app username of first.last@cts.hctx.net. The email addresses were forwarded to an Outlook Inbox shared by the HCLTE app administrators to activate accounts, change passwords, etc. This was a very manual and time consuming process.
- Centrally managing user credentials in lieu of an ICAM solution required the use of shared passwords and a common PIN for all devices.
- Not all of the apps had bulk import capability for account setup, so many of the accounts had to be manually created inside the admin portals.
- Moving and setting up teams had to be done at the individual user level in each of the apps. Having a bulk move capability so that an entire unit could be added to a chatgroup, team or PTT talkgroup would have greatly simplified the administration. The manual process also left room for errors and omissions where occasionally not all the right people were initially added to the groups.

15) **Network agnostic** – End users do not care about the network. They just want the tools to work when and where they need them. It doesn't matter if they are on LTE, Wi-Fi or some other type of network. Ubiquitous LTE coverage in all locations is very difficult for any network operator to achieve, so having devices that can intelligently "roam" onto the best connection – whether it be Wi-Fi or LTE – will help with end-user adoption in this industry.

16) **Role of the Communications Unit (COMU)** – Historically the COMU has focused on programming radios and setting up talkgroups. With the introduction of mobile data to augment voice communications, the COMU must become much more intimately involved with the operational aspects of the end users. The COMU must be able to bring forward solutions that are practical for the different functions of public safety and work closely with the IT Department to provide app administration, support and IT Security.

During SBLLI, communications personnel from the city and county worked closely together under the Communications RWG. While operating somewhat independently but keeping each other abreast of activities and sharing information, communications personnel in radio and LTE became much more embedded operationally in event planning than in prior events. This had a tremendous impact on the success of the overall planning and operations.





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- 17) **Level of Effort** - Harris County PSTS began working on the Communications RWG in April and started logging SBLI time in August. The team logged 4,155 hours from August to February. This included only time related to Super Bowl planning and operations and did not include standard network deployment activities. This time also did not account for the significant level of effort contributed by the various agencies throughout the planning process. The majority of time was spent conducting end user trainings, device configuration and supporting numerous test deployments. It is anticipated that the level of effort will go down as agencies begin to operationalize the use of these tools, have end user accounts setup and develop repeatable procedures; however, early deployments will require significant planning and support to ensure that the technologies are successfully adopted.
- 18) **Troubleshooting** – it is often difficult to troubleshoot issues to isolate whether the problem was related to the network, the device or the app(s). Some issues were not long enough or consistent enough to be able to determine the cause. In many situations, it required coordination between the network, app and device engineers to identify and resolve problems. Having good vendor support is essential to successful deployments. By the nature of public safety communications, the tools we put in their hands must work. And when they don't, we need to be able to resolve the issue as quickly as possible.

8 CONCLUSION

Harris County, the City of Houston and the various local, state and federal agencies who participated in the mobile app deployment for SBLI are honored to have executed the first large-scale special event to operationalize the use of Public Safety LTE from the very beginning of the planning process and formalized its use in the IAP. We are proud to have successfully demonstrated the operational impact these technologies can have for improving multi-agency collaboration, information sharing and situational awareness during such a major special event. But the technology is just one piece of the success. It would not have been possible without the leadership and hard work of all participants.

By being one of the first major deployments of PSLTE and the very first to have a formal role in the communications planning process, SBLI provided a unique opportunity to demonstrate the impact PSLTE can have without many of the traditional obstacles and challenges of interoperability and information sharing. There were minimal rules to abide by, and most issues were resolved through a phone call or a hand shake. Few agencies had existing investments in competing products drawing political battle lines. And as the Band 14 network operator, Harris County had the opportunity to be the objective solution provider for all SBLI public safety stakeholders. We recognize the uniqueness of this event and hope that the lessons learned will provide public safety leaders the motivation to proactively develop regional strategies for adopting mobile data. From product selection, to data ownership and retention, to SOPs – regional partners must come together to develop and execute plans for operationalizing these technologies in order to be able to realize the benefits demonstrated during SBLI at other planned events and unplanned disasters as well as avoid the kinds of costly interoperability challenges experienced with land-mobile radio.





APPENDIX A - PRE-ACTION PLANS

MOBILE APPS EXERCISE PLAN

Public Safety LTE
Mobile Apps Exercise Plan



November 30, 2016





MOBILE DATA COMMS PLAN

Public Safety LTE
Mobile Data Comms Plan



December 29, 2016





MOBILE DATA COMMS PLAN ADD-ON

Public Safety LTE
Mobile Data Comms Plan
Add-On



January 17, 2017

