SAFECOM NCSWIC
Information Sharing Framework (ISF)

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Developing an Interoperable Information Sharing Framework: Recommendations for Public Safety Answering Points Computer Aided Dispatch and Next Generation 911

Prepared by the Johns Hopkins Applied Physics Laboratory for the

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Emergency Communications Division (ECD)

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Document Revision History

Revision No.	Date	Description
1	November 2022	Initial Draft Developed by ISF Team including Mr. John Contestabile, Mr. Jay Chang, Dr. Arnab Das, and Mr. Jonathan Follmer
1.2	25 February 2023	Technical Review and edits by Ms. Ruth Vogel, Emergency Management Subject Matter Expert, JHU/APL
2.0	27 February 2023	Full team review with edits to add clarity to visuals
3.0	14 March 2023	Finalized Distribution version with APL Quality Updates

EXECUTIVE SUMMARY

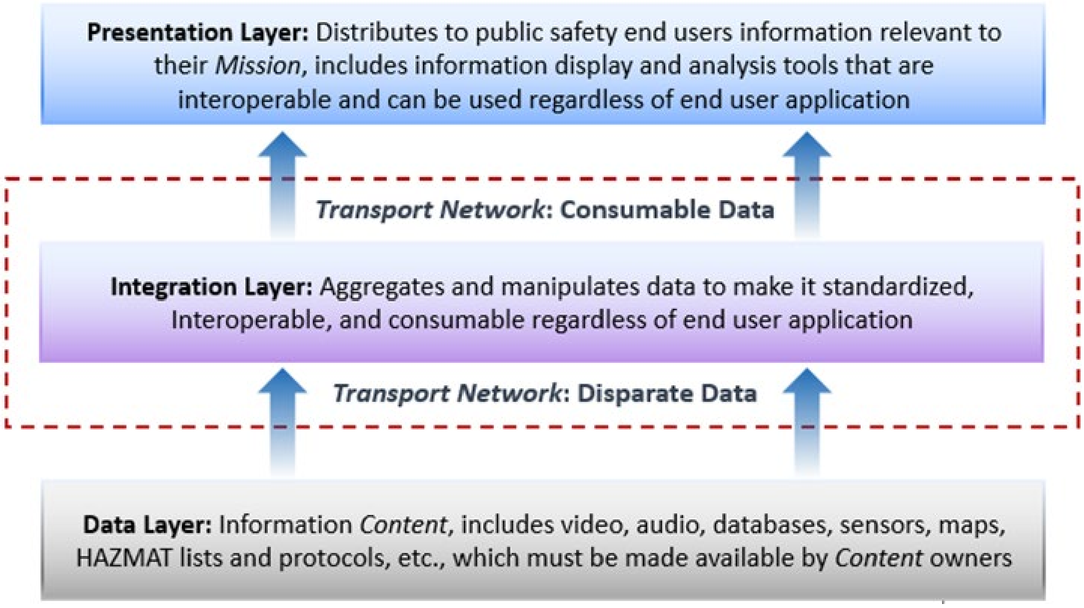
The desire to improve the efficiency and effectiveness of communications and information sharing for our Nation's public safety agencies has led to an ever-growing market of platforms and solutions that do not always address operational needs. As a result, agencies continue to invest in new products and technologies to improve their public safety communications ecosystems. However, many of these new products and technologies force trade-offs among interoperability, flexibility, security and sustainability, which impacts time to value for any agency. The solutions often attempt to position their product as the central predominant technology without due consideration to the long-term impact to the end users' mission environments and their ongoing interoperability requirements. Typically, the public safety agencies must manage a multitude of platforms and systems that don't interoperate and burden the agency with technical complexity and incomplete situational awareness.

Acknowledging the need to support our public safety agencies, SAFECOM and the National Council of Statewide Interoperability Coordinators (NCSWIC) in partnership with the Cybersecurity and Infrastructure Security Agency (CISA) have established the Information Sharing Framework Task Force (ISFTF) comprised of information technology (IT) and public safety communications subject matter experts from public safety agencies across the country.

CISA is engaging with the ISFTF to develop an Information Sharing Framework (ISF) to ensure the effectiveness of new products and technologies as agencies transition to mobile and fully interconnected environments. Making data interoperable and enabling information sharing across platforms is a requirement that spans beyond technical and traditional organizational boundaries. First responders should be able to discover, access, and consume any relevant information on a need-to-know basis, regardless of jurisdiction, affiliation, or location.

The overarching goal of the ISF is to inform and guide the transition of operational capabilities to a common data exchange approach that a public safety entity can adopt and use efficiently. Many public safety organizations experience the same challenges and the intention of ISF is to provide then with a beneficial tool. Therefore, an important component to the effort is the ongoing partnerships with the nation's emergency communications stakeholder communities. To continue to ensure the products and outcomes are useful, the ISF project team worked closely with representatives from the public safety community to implement a Focus Group effort to assess and validate the ISF and to help answer the fundamental question: "Does the ISF work in practice?"

Focus Group participants for this effort included public safety and IT personnel from Des Moines, Iowa and surrounding counties, as well as the Des Moines State Radio organization. Next Generation 911 (NG911) and Computer Aided Dispatch (CAD)-to-CAD interoperability challenges at public safety answering points (PSAPs) were identified and subsequently analyzed based on the ISF Conceptual Data-Information Model (see Figure ES 1 below). This model presumes that, in order to realize CAD-to-CAD information sharing, it would require integration layer functions be facilitated.



ES 1: ISF Conceptual Data-Informational Model

This Report provides information elicited from the Iowa Focus Group via surveys baseline requirements elicitation discussions. This report provides outcomes from the Iowa ISF pilot and serves as supporting documentation and supplemental guidance for CISA's "*Approach for Developing an Interoperable Sharing Framework*."[1]

To help elicit feedback, the ISF project team developed a survey to guide the collection of relevant information to evaluate the CAD-to-CAD and NG911 readiness of stakeholders. Outcomes from this effort will be used to inform information sharing requirements of the future emergency communications ecosystems, and it is recognized that these outcomes represent only one iteration of the ISF methodology and will require additional iterations to reach a final commonly shared approach. Outcomes from this effort will also provide useful input for the future ISF technical proof of concept (TPoC) initiative[s], which will be used to demonstrate the ISF's readiness to be deployed in an operational environment.

The CAD-to-CAD and NG911 readiness survey yielded the following high-level findings:

- General readiness for NG911 functionality is high throughout the Des Moines, Iowa region from a technology perspective to include awareness of the need to include NG911 readiness.
- Statewide efforts to provide a common communications IP architecture [ESInet] and certain shared services has contributed greatly to this readiness.
- Inconsistencies (e.g., policies, technologies, regulations, etc.) between jurisdictions may present interoperability challenges with respect to NG911 capabilities.
- The region is poised to update their PSAP/CAD systems, so piloting the ISF with this group of stakeholders was applicable and timely.

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[1] Cybersecurity & Infrastructure Security Agency. (2021, August). Approach for Developing an Interoperable Information Sharing Framework. Retrieved from https://www.cisa.gov/sites/default/files/publications/21_0929_cisa_approachfordeveloping_isf_v3_508.pdf

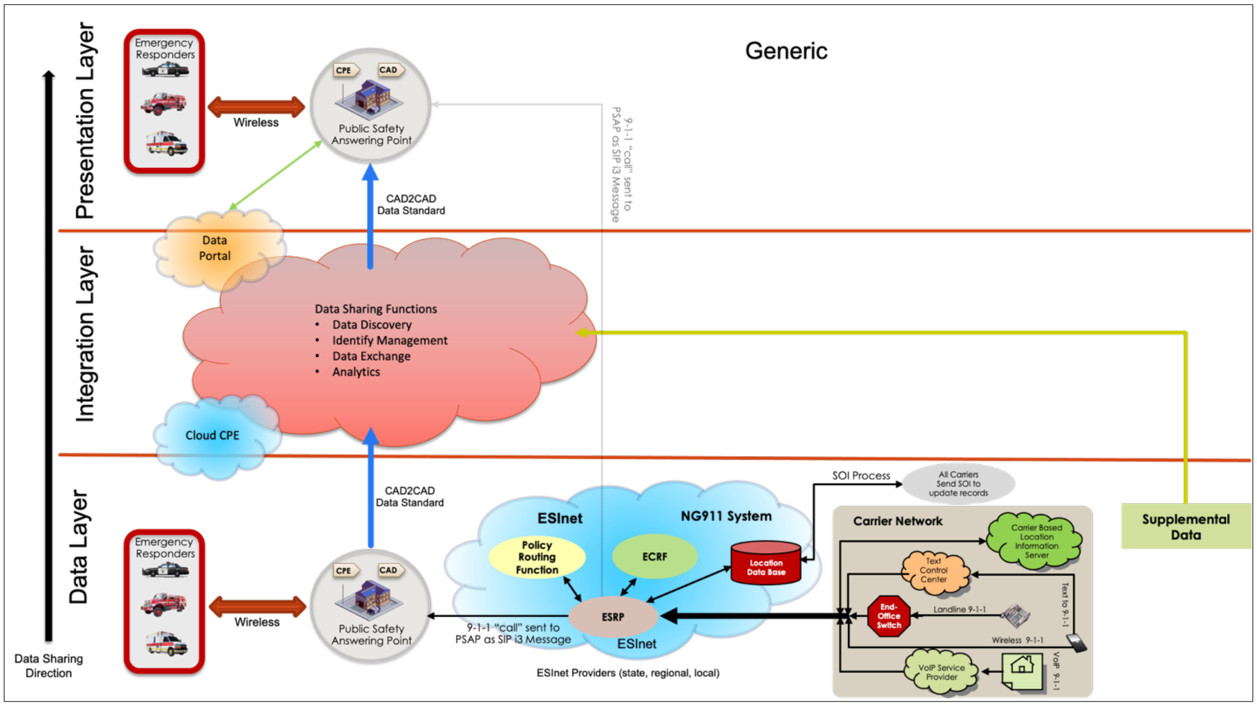
- At present, there is information sharing occurring within a jurisdiction, but limited sharing with adjoining jurisdictions. Information sharing that is occurring between jurisdictions is accomplished via the same CAD system software.

The ISF project team learned of an ongoing CAD-to-CAD interoperability initiative in the Des Moines metro area to include the implementation of CentralSquare Unify (https://www.centralsquare.com/public-safety/cad/cad2cad). It was acknowledged that the ISF methodology will be useful in helping them to assess interoperability and the project team hopes to continue to work with this group.

It was also discovered that a statewide CAD exploratory committee is investigating a CAD solution for the various Iowa emergency communications partners. Currently, the Mobile Architecture for Communication Handling (MACH) CAD module is used by the Iowa State Patrol to dispatch calls for service. The MACH software is supported by the Iowa Department of Transportation and provided at no charge to Iowa public safety agencies as well as many local jurisdictions. The ISF project team was able to brief this group on the ISF methodology and plans to collaborate in identifying requirements as they explore upgrading their CAD system for improved interoperability.

Given the set of stakeholders implementing the CentralSquare Unify solution and the formation of the statewide CAD exploratory committee, the ISF project team conducted further research in exploring options for CAD-to-CAD interoperability. The team met with industry providers as well as other jurisdictions who are exploring, or have already achieved some level, of CAD interoperability. The explored options included: 1) all jurisdictions/entities purchasing the same CAD software, 2) purchasing an interoperability solution from a single vendor, and 3) employing a group of vendors to serve particular pieces of a more open architected system. These approaches are workable and can meet the interoperability need, however, it was determined that some are more scalable, inclusive of varying applications and better positioned the jurisdiction for multimedia data sharing needs such as those that will be needed for NG911.

Based upon this input, the ISF project team proposes a CAD-to-CAD architecture (consistent with the ISF) as shown below in Figure ES 2: This approach consists of several building-block components that represent commonalities among the various implementations that the team has explored during this effort. In addition to the technical commonalities, it is important to note that each region will need a governance structure and a formal process to architect and eventually deploy a data interoperability solution.



ES 2: Notional CAD-to-CAD ISD Architecture

For the recommended approach noted in Figure ES 2 the following must be true:

1. The integration layer needs to provide a capability for data sharing
2. A data portal that is available to the end-user(s), supports call routing, and allows for the inclusion of supplemental data
3. Leverage the ESInet and data standards.

This approach is inclusive of various CAD and presentation layer applications, is scalable and positions the jurisdiction for NG911 multimedia data. It was shared with Iowa stakeholders in a meeting in November of 2022 and it is anticipated this ISF collaboration project with entities in Iowa and Des Moines will continue during the remainder of 2022 and possibly into 2023.

As referenced in the "*Approach for Developing an Interoperable Information Sharing Framework*" (**https://www.cisa.gov/sites/default/files/publications/21_0929_cisa_approachfordeveloping_isf_v3_508.pdf**), it is important to note that the ISF is *not* meant to replace other relevant interoperability guidance such as the National Emergency Communications Plan (NECP), the NG911 Roadmap, the National Interoperability Field Operations Guide, and the SAFECOM Interoperability Continuum. Rather the framework is meant to leverage and help ensure ongoing efforts support other key federal initiatives and partnerships and it is anticipated that adaptions and updates that align with and support public safety needs will be required.

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1 PROJECT BACKGROUND

In support of efforts to develop a framework for information sharing to support public safety telecommunications, SAFECOM and the National Council of Statewide Interoperability Coordinators (NCSWIC) in partnership with the Cybersecurity and Infrastructure Security Agency (CISA) have established the Information Sharing Framework Task Force (ISFTF) comprised of a number of information technology (IT) and public safety communications subject matter experts from agencies across the country. CISA is engaging with the ISFTF to develop an Information Sharing Framework (ISF) to ensure the effectiveness of new products and technologies as agencies transition to mobile and fully interconnected environments.

In 2018, CISA developed an architectural framework to support information sharing within the public safety community under the guidance of the ISFTF. Phase 1 of this effort was completed during the fall of 2018 with the delivery of a report: "*Approach for Developing an Interoperable Information Sharing Framework*" (https://www.cisa.gov/sites/default/files/publications/21_0929_cisa_approachfordeveloping_isf_v3_508.pdf). This report describes the nature of the interoperability problem and provides a high-level concept for visualizing the emerging public safety architecture (See Figure 1 below).

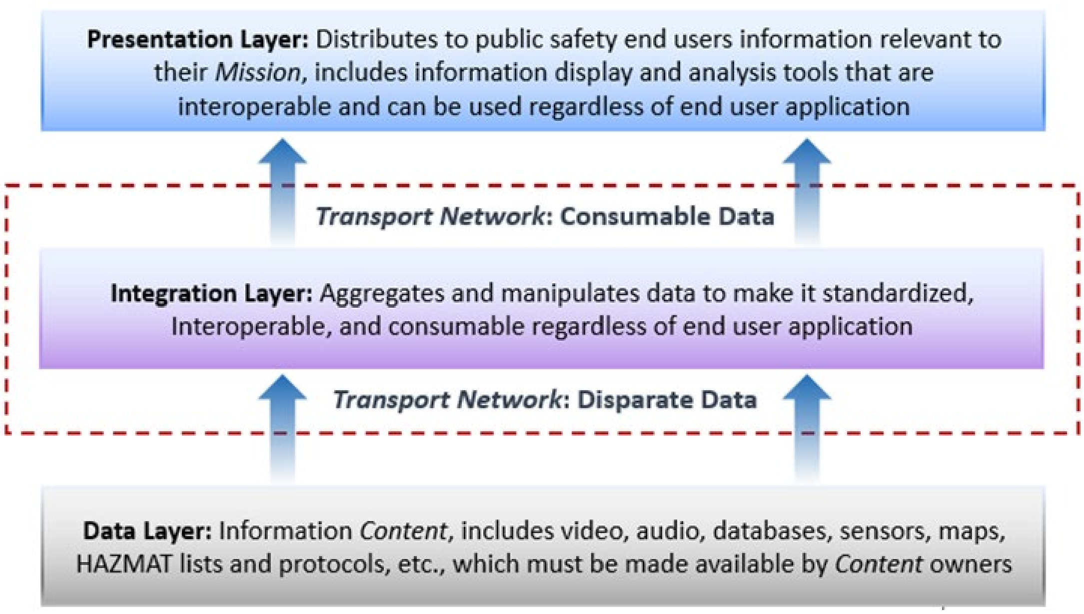

Figure 1: Conceptual Data-In Model

Figure 2 below provides a more detailed view of the logical (or layered) model as the underpinning for ISF. The challenge is to move data from the legacy systems in the data layer to the end user in the presentation layer. This is depicted below through a number of identified important functions: 1) Data Exchange, 2) Identity Management, 3) Discovery, 4) Transport, and 5) Analytics.

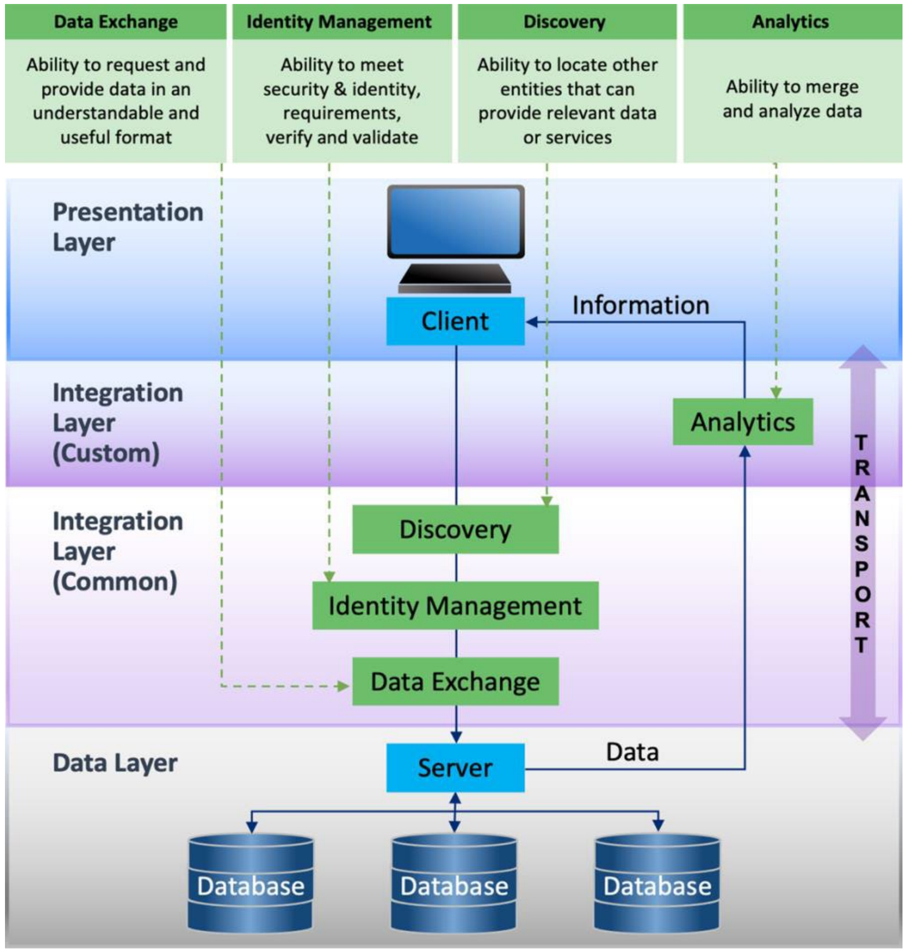

Figure 2: Functional Components of an Information Sharing Framework

Phase 2 to develop more detailed guidance on a systems/enterprise approach began in May 2019. A draft Concept of Operations (CONOPS) document based upon public safety use-cases developed by the National Public Safety Telecommunications Council (NPSTC) delivered to the ISFTF. The goal of Phase 2 is to transition the Phase 1 framework into a more comprehensive and usable multi-dimensional process that can be readily applied by any public safety agency in the United States.

Recognizing that the successful adoption and implementation of the ISF will require collaboration and coordination among the public safety community (to include product vendors, services providers, and IT professional), Phase 2 of this effort began in May 2019, and was focused on developing detailed guidance on a systems/enterprise approach. The overarching goal of Phase 2 is to transition the ISF into a more comprehensive and usable process that can be readily applied by any public safety agency. Figure 3 below, provides the high-level construct for implementing a multi-dimensional process in which various tools and resources can be used to help guide each of the six (6) steps of the ISF Implementation Cycle.

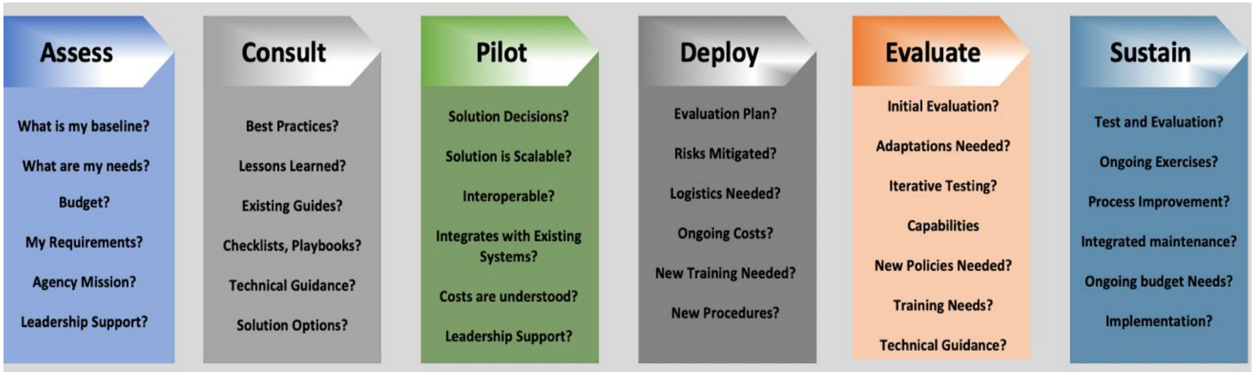

Figure 3: ISF Implementation Cycle

The project team and the ISFTF chose the City of Houston and the Harris County, Texas public safety partners for the initial Focus Group outreach as they provide an accurate representation of the information sharing needs for an urban area response community. Also, census data shows that approximately 82% of Americans live in urban areas and that urban responders have different technology needs and budgets than those in rural areas. In this Houston based effort, the project team hosted a workshop which examined an active assailant incident in a school as the exercise to identify situational awareness needs related to video. The ISF was applied to identify sources of video content, end-user requirements for consuming that data and how that information could be accessed and transported by the end-user.

After successful series of Focus Group efforts implemented in Houston Texas with representatives from the City of Houston and Harris County Texas, the project team recognized the need to elicit feedback from a more rural environment. Therefore, the team worked closely with stakeholders from Des Moines, Iowa and surrounding counties as well as the Des Moines State Radio organization for the next ISF pilot implementation. This more rural location was also chosen based upon its current CAD and Next Generation 911 (NG911) development and desire to be more interoperable.

This report discusses this second ISF Focus Group effort pilot in Iowa and serves as supporting documentation and supplemental guidance for the Cybersecurity and Infrastructure Security Agency's (CISA's) "*Approach for Developing an Interoperable Sharing Framework (ISF)*." Using questions created to guide discussion regarding interoperability need, the project team elicited feedback regarding public safety information sharing needs from participants. The Focus Group objectives were to a) educate the group on the ISF approach, b) engage end-users to discuss information sharing-related needs, c) document feedback to include recommendations, and d) apply methods to validate the overall ISF approach to further refine and advance and the development of the ISF methodology.

To accommodate time and resource constraints of the public safety communities in Iowa, the Focus Group effort was conducted in three parts: 1) A virtual Introductory Session to introduce stakeholders to the ISF methodology, 2) A series of in-person discussions to elicit feedback and recommendations particular to NG911 and CAD interoperability requirements, and 3) A second series of in-person discussions that included state-level working groups, Des Moines area public safety stakeholders, and a presentation of initial CAD and NG911 survey results and insights.

The in-person working discussions were a series of multi-day events with participants from law enforcement, and PSAP leadership. Participant feedback was collected, analyzed and processed which will be used to a) identify and develop the ISF integration layer systems and interfaces between content desired across various data sources and, b) to support end-user applications located in the presentation layer. This mutually beneficial process will enable operational end-users and IT professionals to implement the ISF process when considering various interoperability solution.

2 The Information Sharing Framework

This section further explains the background on the ISF and the technical approach that it takes for an ISF implementation. Section 2.1 discusses the background on the ISF. Section 2.2 presents the methodology and repeatable, generalized process developed through the execution of a series of Focus Group meetings. Next, the details of the Implementation Cycle are provided in Section 2.3

2.1 ISF Background

As previously described, the ISF's overarching goal is to develop a shared view and dialect of data interoperability, and to inform and guide the transition of operational capabilities to a common data exchange approach. The ISF was developed in 2019 to build an approach to reach interoperability between disparate systems founded from legacy systems, proprietary solutions, and general non-interoperable approaches or methods. [2]

The ISF is a model based upon and complements existing interoperability guidance and is meant to be used as a guide for implementation. Existing guidance includes but is not limited to:

- National Emergency Communications Plan (NECP)
- NG911 Roadmap (www.911.gov)
- National Interoperability Field Operations Guidance (https://www.cisa.gov/sites/default/files/publications/NIFOG%20Ver%201.6.1A.pdf)
- SAFECOM Interoperability Continuum

The overarching goal of the ISF is based on the need to recognize the three dimensions of interoperability (people, processes and technologies) and to help align those needs accordingly (Figure 4: Interoperability Components, below).

[2] Cybersecurity and Infrastructure Security Agency. (2021, August). *Approach for Developing an Interoperable Information Sharing Framework.* Retrieved from: https://www.cisa.gov/sites/default/files/publications/21_0929_cisa_approachfordeveloping_isf_v3_508.pdf

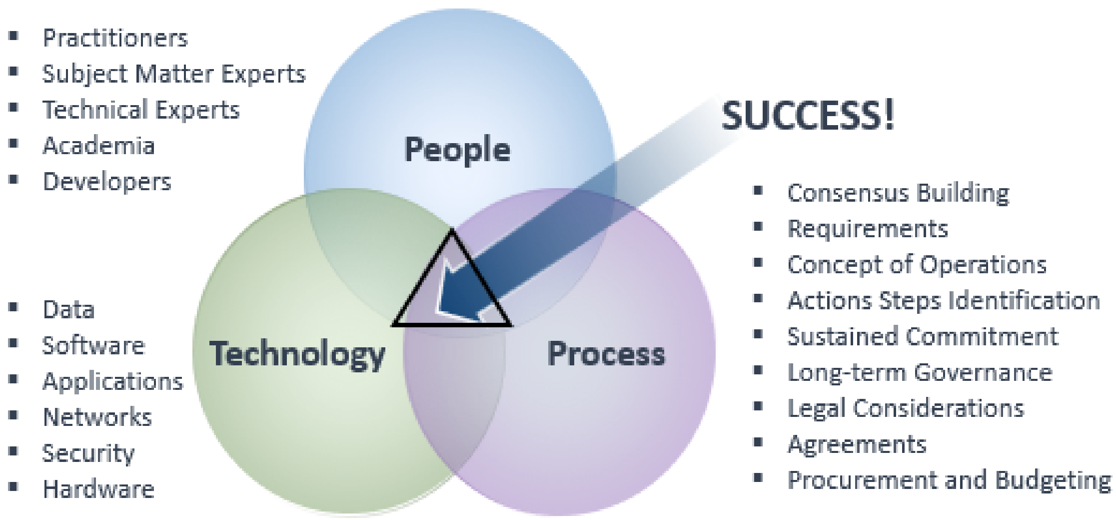

Figure 4: Interoperability Components

The people (e.g., public safety end-users and IT personnel) involved in data sharing must acknowledge the interoperability gaps and come to agreement that they are willing to invest the resources necessary to address the challenge. With an agreement to collaborate, they may utilize the ISF methodology to determine their present and desired level of interoperability as well as the processes and procedures needed to ensure data sharing. Those requirements and relevant procedural components can then be designed into the technology with a focus on achieving the necessary information flows. The conceptual data-information model that comprises the framework is a three-layered model as seen in Figure 5: ISF Conceptual Data-Information Model

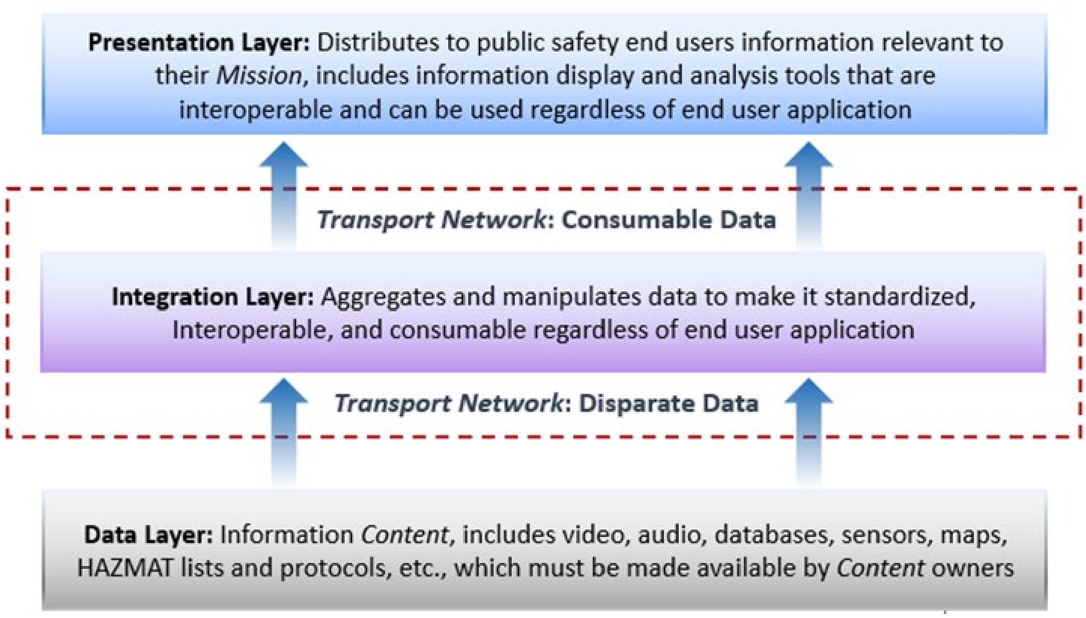

Figure 5: ISF Conceptual Data-Information Model

The model was designed under the presumption that existing legacy systems found in the *data layer* are not necessarily designed for sharing across platforms. Existing systems in enterprise server environments and can include legacy systems that house data content in proprietary formats or developed with outdated code, which are by definition not shareable with other systems. In this model, the end-user will interface with the *presentation layer* applications. These applications increasingly are found on “smart” devices [cellular phone, pads, and mobile data terminals (MDTs)]. The interoperability challenge is getting data from where it is housed in the data layer to the end-user(s) in the presentation layer. Given the challenges in accessing the data, its proprietary format and in transporting the data, functionality within an *integration layer* to facilitate this exchange is needed. The *integration layer* is where data is discovered, accessed, processed, aggregated, manipulated, and analyzed into useful information. The resulting information can then be *transported* (i.e., delivered) in a standardized format to the presentation layer *so that any public safety end-user can consume the desired information in the application of their choice with the goal of improving their situational awareness*. Figure 6 below provides a more detailed view of the logical (or layered) model as the underpinning for the ISF and illustrates the five essential functions of the integration layer.

- *Discovery* (i.e., where can one find the desired data?),
- *Identity Management* (i.e., has one been granted access to that data?),
- *Data Exchange* (i.e., what format or standard is appropriate for the particular content?),
- *Transport* (i.e., what networks need to be used to get the data to where it is needed?), and
- *Analytics* (i.e., how do you parse the data, so it is timely and relevant?).

The *Common* sub-section shown in the integration layer below suggests that certain functions should be standardized and widely applicable across datasets and systems. This would allow for the discovery, access and exchange of public safety data to all those with a need to know. The *Custom* sub-section is where the Analytics function resides and allows for commercial technology differentiation while not negating the key outcomes of interoperability, security, resiliency, and data management. The ISF has demonstrated that the five functions of the integration layer are needed in order to allow for data interoperability regardless of the technology. These five functions can be provided by the appropriate combination of commercially available solutions or more customized code depending upon the IT environment. With the creation of the integration layer, it will facilitate the data flow between legacy systems and the end-user in the presentation layer, thus improving near real time situational awareness.

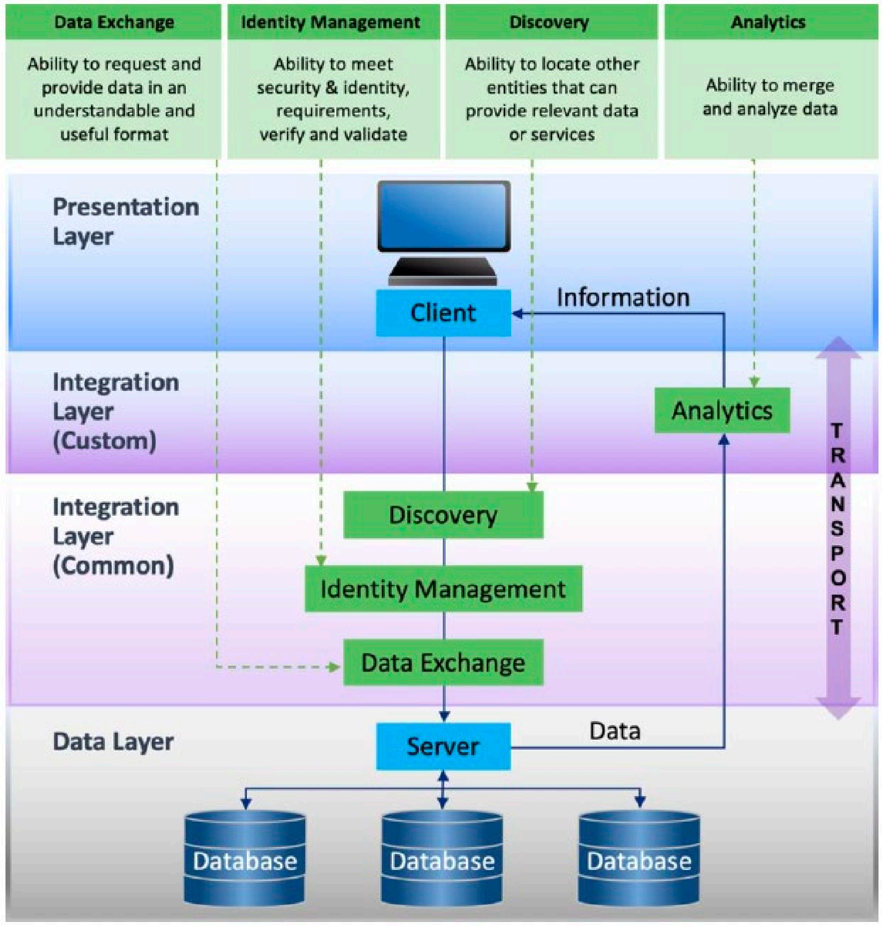

Figure 6: Expanded Conceptual Data-Information Model

It should be noted that this framework does not anticipate the participants having to purchase new data layer or presentation layer systems. In fact, this approach puts the burden of interoperability on the integration layer such that the participants do not have to purchase the same data or presentation layer systems to achieve the ability to share data. Also, the integration layer seeks to leverage existing systems the participants already have in service to provide the needed five functions. (For example, use the existing network transport paths and authentication methods). The ISF is a pragmatic approach to data sharing recognizing that legacy data layer systems are usually not interoperable and typically too costly to adapt or update/revise for interoperability purposes.

2.2 Focus Group Methodology

Outcomes from the Iowa Focus Groups are important to ensure the ISF approach can be implemented and adopted by any public safety entity regardless of size, location, or resources. The Focus Group methodology is best understood within the broader scope of the ISF project. The block diagram depicted below in Figure 7: ISF Project Stages summarizes the ISF project stages for calendar years 2021 and 2022. Note the Focus Groups represent one component of the larger project that culminates in the development and demonstration of a future ISF Technical Proof of Concept.

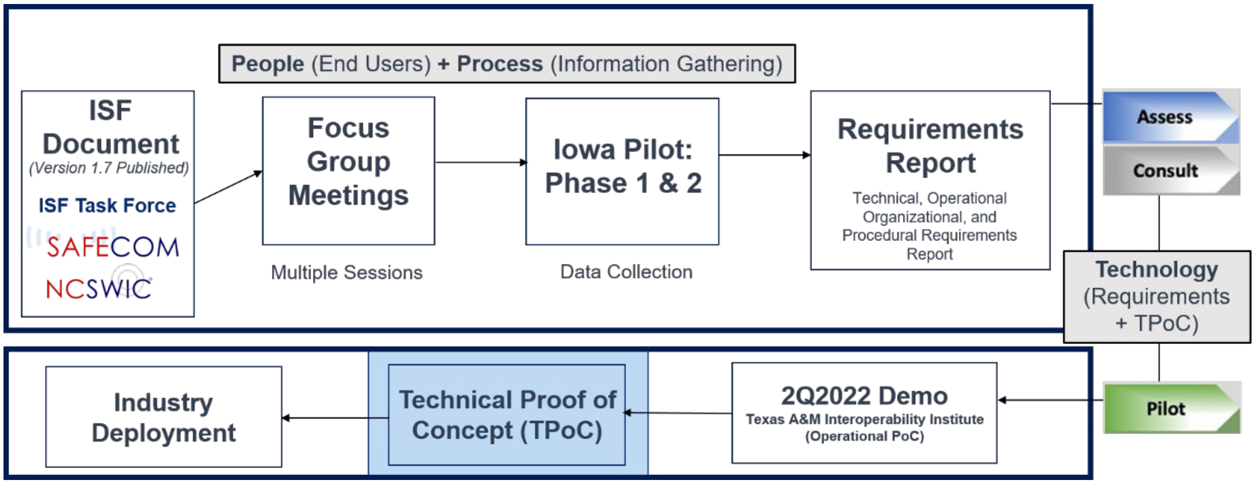

Figure 7: ISF Project Stages

The top half of Figure 7: ISF Project Stages represents the "Assess" and "Consult" phases (see Figure 7 for reference), in which the primary objective is to create an environment where the ISF can be understood and used by public safety practitioners. Therefore, the Focus Group sessions represented the major components of the methodology for practical application. In developing this methodology, the goal was to apply the generalized framework to any public safety jurisdiction and customize it to that unique set of requirements. The end result is the notional architecture seen in Figure ES-2 which will improve data interoperability and information flow such that situational awareness is enhanced.

To accommodate schedules and limited availabilities, the Focus Group implementations are conducted in three parts: 1) A virtual Introductory Session to introduce stakeholders to the ISF methodology, 2) A series of in-person discussions to elicit feedback and recommendations particular to NG911 and CAD interoperability requirements, and 3) A second series of in-person discussions that included state-level working groups, Des Moines area public safety stakeholders, and a presentation of initial CAD and NG911 survey results and insights. This process will often need to be iterated several times in order for the focus group to develop the specifics as to how the integration layer functions will be achieved (I.e., what products and services in the current environment can be leveraged to perform those functions. Or identify new products to fill any identified gaps.).

2.3 Implementation Cycle

Once the Focus Group information is collected and organized, it is analyzed to discover key insights about information sharing in the context of a relevant use case. The ISF Implementation Cycle contains exemplar questions at each stage as depicted below in Figure 8: ISF Implementation Cycle with exemplar question

This effort resided largely within the Assess and Consult steps. The analysis of this collected information represents the area between the Consult/Pilot stages, and some of the early parts of the Pilot stage.

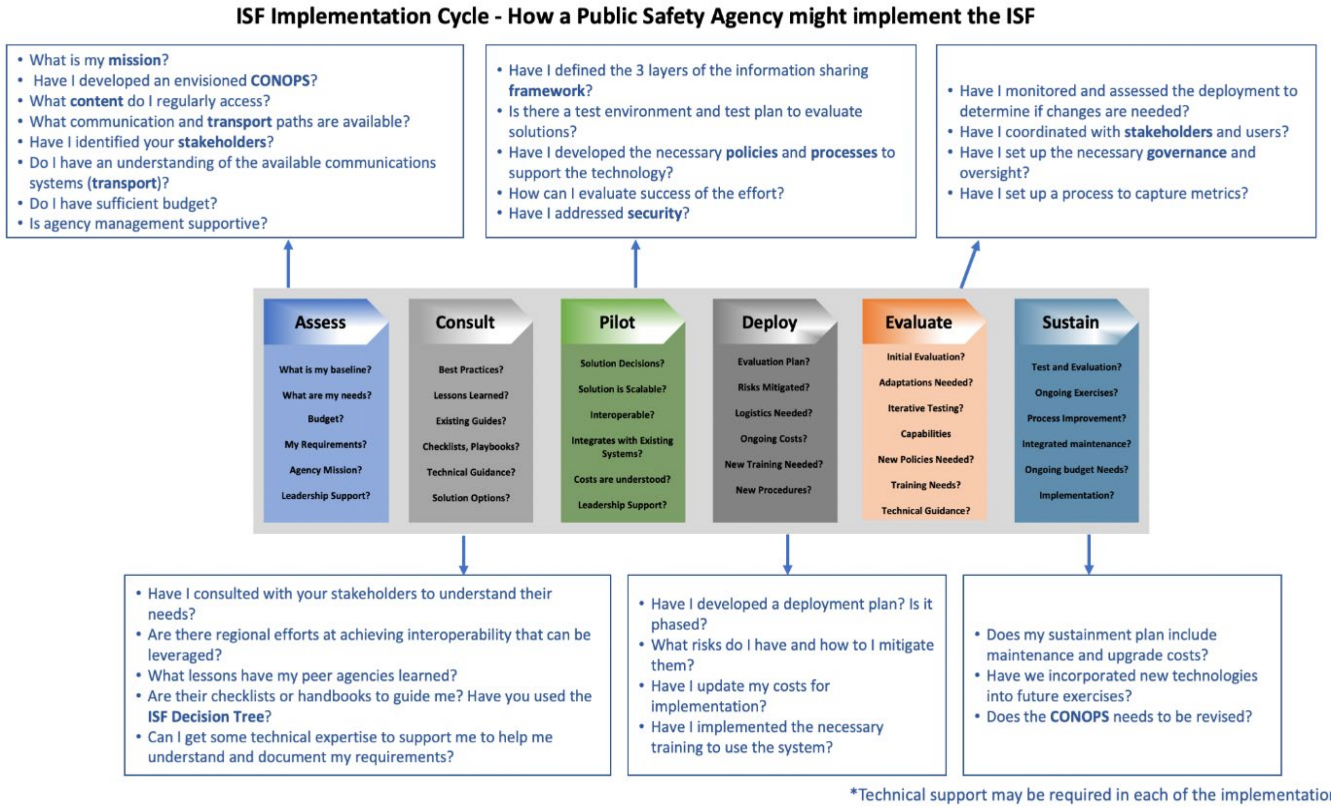

Figure 8: ISF Implementation Cycle with exemplar question

Figure 8 above expands upon the ISF implementation cycle (Figure 3) by adding exemplar questions to guide the implementation process. These questions will help to identify data needed to produce actionable information for each operational mission, as well as inform the technical interface requirements.

The three dimensions of "People, Process, and Technology" represent a cornerstone of the ISF, and provide guidance on how to analyze and understand the collected information. Some recommended questions related to People, Process, and Technology include:

- What kind of data is needed to fulfill the mission need? (I.e., GIS, GPS, Video, text, sensors, etc.)
- What other partners need to be engaged because of the data they own? (I.e., law enforcement, transportation, hospitals, emergency management, fusion center, etc.)
- Who owns the data and are the owner(s) willing and prepared to share their data?
- What procedures are needed to effectively share data? Is an MOU or CONOPS needed?
- How will data security, access and privacy requirements be handled?
- How do we build the necessary connections and satisfy the requirements of the integration layer?
- What kind of transport systems are available and can they be leveraged? (I.e., 5G LTE, Wi-Fi, Bluetooth, LMR, etc.)
- What constraints might exist within the transport systems?

Analysis of this information using the ISF Implementation Cycle provides a methodology that ultimately will inform and guide the transition to a common information exchange approach.

3 SURVEY RESULTS FOR IOWA CAD-TO-CAD AND NG911

This section describes the project team's approach to the Assess and Consult phases of the implementation cycle with Iowa participants related to the need for interoperability between CAD systems. Section 3.1 provides information on Iowa's 911 history and background. Section 3.2 outlines the areas of participation in Iowa. Section 3.3 contains the analysis of CAD-to-CAD (C2C) interoperability readiness. Section 3.4 contains the analysis of NG911 readiness. Finally, Section 3.5 provides key findings.

3.1 IOWA 911 HISTORY AND BACKGROUND

In 1986, the Iowa General Assembly created a 29-member state emergency telephone number commission to study the issue of statewide implementation of 911 service and provide the legislature with a written report with recommendations. The legislative language contained in the report became House File 2400, which was adopted by the General Assembly and signed into law in 1988 by Gov. Terry Branstad. Since the law's passage, several amendments have been passed and recodifies as Iowa Code Chapter 34A.

The wireline 911 system was launched in 1988 and managed by the local 911 service boards. Wireless capability was added at the beginning of 1998. Iowa Public Safety Answering Points (PSAP) currently answer wireline, wireless, and voice over internet protocol (VoIP) emergency calls as well as Text-to-911 calls across the state.

The Iowa Department of Homeland Security and Emergency Management (HSEMD) has responsibility for the statewide administration of the Iowa 911 Program under Iowa Code Chapter 34A. The HSEMD oversees and manages the network delivering 911 calls to the PSAP. As a result, the HSEMD manages contractual relationships with vendors that provide Next Generation core services, network transport, and shared PSAP services.

The shared PSAP services maintained and operated by the HSEMD were implemented in 2018 under authority granted in House of Representatives bill HF2254. With the implementation of the shared services, PSAPs were allowed to remotely access a state-owned host call-handling system for a more cost-effective alternative to a locally owned call-handling system for PSAPs.

A 911 annual report by the HSEMD published in 2020[3] noted that as of 2019, 113 PSAPs served 99 counties in the state of Iowa. HSEMD converted wireless 911 from analog technology to a digital technology supporting Next Generation (NG) 911 through the implementation of an emergency services internet protocol network (ESInet). With a population of 3,190,369 in 2020[4], the upgraded NG911 network processed 978,609 wireless 911 calls and 3,337 text-to-911 calls between October 1, 2019 through September 30, 2020. During the same time period, local jurisdictions also reported processing 256,039

[3] Iowa Department of Homeland Security and Emergency Management. (2020). 2020 911 Annual Report. Retrieved from https://homelandsecurity.iowa.gov/wp-content/uploads/2021/08/FINAL-APPROVED-2020-911-ANNUAL-REPORT.pdf

[4] Bureau, U. (2022). Iowa’ s 2020 Population Neared 3.2 Million in 2020. Census.gov. Retrieved 16 May 2022, from https://www.census.gov/library/stories/state-by-state/iowa-population-change-between-census-decade.html.

wireline calls and 42,576 VoIP calls. Local PSAPs answered and dispatched more than 98% of all wireless 911 calls. The Department of Public Safety (DPS) handled the remainder of the wireless calls.

The upgrades to the legacy 911 system to the NG911 have been accomplished through a phased approach. The 1st phase consisted of converting analog/copper trunks to a local/statewide IP-based Ethernet network. The IP-based backbone was completed in 2012 using the Iowa Communications Network (ICN). The 2nd phase consisted of upgrading local PSAPs with IP-capable call-handling and recording systems. The 3rd phase consists of adding wireline 911 traffic onto the existing NG911 network and the State's virtual consolidation effort, integration of legacy wireline networks to the Next Generation IP-based network, and shared services for call processing equipment at the PSAPs. The 4th and last phase of the 911 system will consist of migration to a fully functioning NG911 capability that includes upgrades to support the delivery of higher accuracy caller location information and multimedia data. It is this last phase for which the ISF approach to data sharing will be most helpful.

The National 911 Program was created in 2004 by Congress as the 911 Implementation and Coordination Office (ICO) within the National Highway Traffic Safety Administration (NTSA) and is a joint program with the National Telecommunication and Information Administration (NTIA) within the Department of Commerce. The National 911 Program works with States, technology providers, public safety, and 911 professionals to ensure a smooth transition of 911 systems that can leverage new communication technologies.

The National 911 Program explains NG911 as,

> "*NG911 is new technology that allows the public to share richer, more detailed data—such as videos, images and texts—with 911 call centers. It also enhances the ability of 911 call centers to communicate with each other and improves system resiliency*."[5]

The desire for NG911 is to allow multimedia support and improved interoperability between 911 centers (PSAPs). The first step in allowing this capability is the transition from an analog based 911 infrastructure to an all IP-based network. This enables PSAPs to be connected through a common data network designed for emergency services referred to as the ESInet.

While the NG911 initiative, together with the ESInet, may allow multimedia data to flow through PSAPs and enable communication and system resiliency, that's only one element of the system. CAD is one of the main tools used by public safety to communicate and share data within a PSAP service area. A key component for improved communication and system resiliency is data interoperability *between* PSAPs across city, county and state boundaries and the relationship between the different CAD systems in use.

3.2 IOWA FOCUS GROUP

BACKGROUND

Out of the 99 counties in Iowa, five (5) counties; Boone, Story, Dallas, Polk and Warren were selected to participate as shown in Figure 9 below.

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[5] 911.gov. (2022). Retrieved 13 May 2022, from https://www.911.gov/about_national_911program.html.

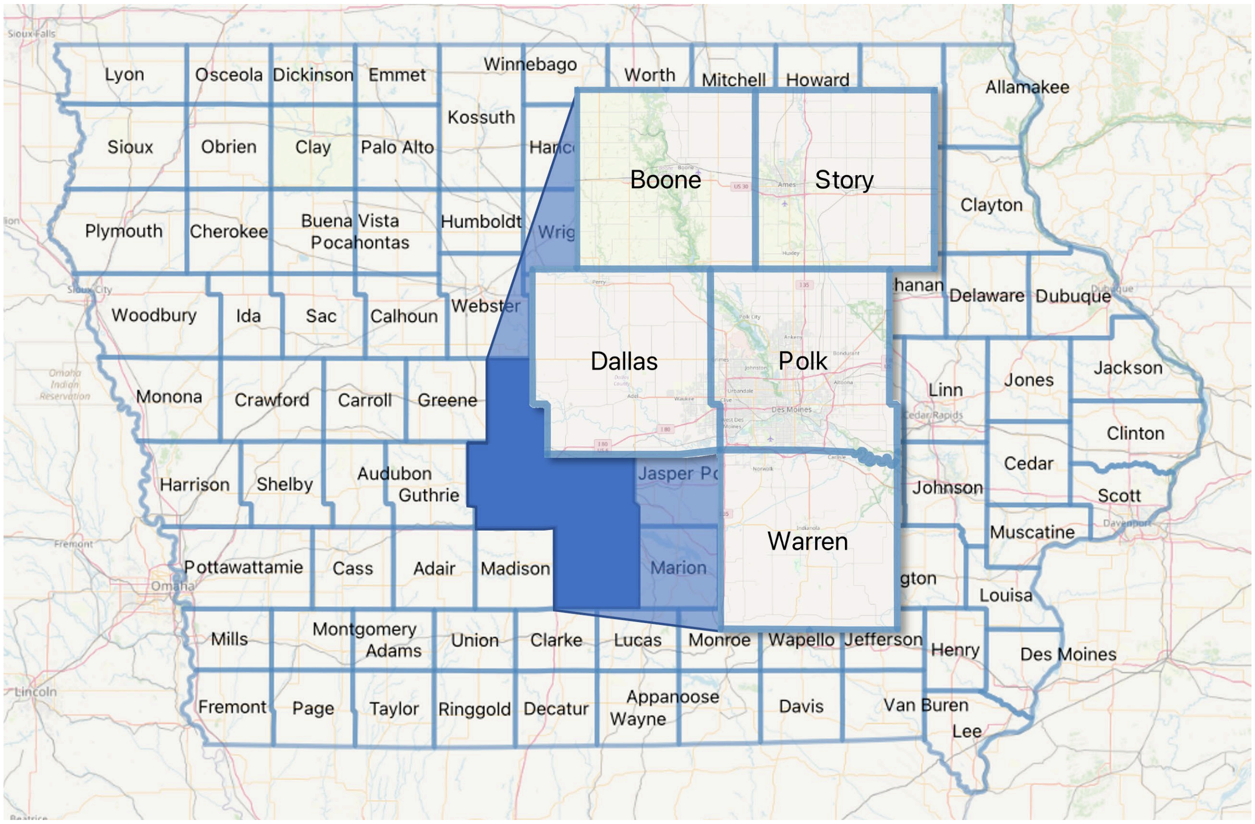

Figure 9: ISF Iowa Focus Group Participants

A questionnaire was developed and distributed to the PSAPs, State Radio, State 911, and State interoperability stakeholders to solicit information regarding their CAD systems and CAD-to-CAD interoperability. The data gathered from the nine (9) PSAPs and Des Moines State Radio were analyzed and shared during focus group meetings held between February 22, 2022 through February 25, 2022 and April 26, 2022, through April 27, 2022.

The first focus group session included representatives from,

1) Des Moines State Radio
2) Iowa State University Police Department
3) Ames Police Department
4) Story County Sheriff’s Office
5) Westcom
6) Des Moines Police Department
7) Polk County Sheriff’s Office
8) Dallas County Sheriff’s Office

The second focus group session included representatives from;

1) CAD Exploratory Committee
2) Boone County Sheriff’s Office

Based on the results of the questionnaire and these face-to-face engagements, the following assessments were completed.

3.3 CAD-TO-CAD OBSERVATIONS AND RESULTS

Data was collected through conference calls and pre-meeting inquiries, followed by a face-to-face meeting with state and local PSAP stakeholders to gain an understanding of their current and future needs for CAD-to-CAD interoperability. The results and key findings are discussed in the following sections.

3.3.1 CAD SYSTEM DEPLOYMENT SUMMARY

In collaboration with the state officials, there were five counties in IOWA identified as part of assessment. Within these counties there were nine PSAPs that participated in by providing information on their currently deployed CAD systems. Table 1: PSAP CAD Vendor Deployment and Capability Summary below is the summary of results. The table is color-coded based on vendor solutions used at the PSAP.

Table 1: PSAP CAD Vendor Deployment and Capability Summary

PSAP	CALL HANDLING (CURRENT)	CAD SYSTEM (CURRENT)	RMS EQUIPMENT (CURRENT)	MAPPING TOOL (CURRENT)	CAD2CAD INTEROP INTERFACE (CURRENT)	CAD UPGRADE (FUTURE)
Des Moines State Radio	Zetron Shared Services	MACH-CAD		MACH		Under Evaluation
ISU PD	Zetron Shared Services	CentralSquare	CentralSquare	CentralSquare	Yes	Yes, 2-4 years
Ames PD	Zetron Shared Services	CentralSquare	CentralSquare	CentralSquare	Yes	Yes
Story Co SO	Zetron Shared Services	CentralSquare	CentralSquare	Local GIS, RapidSOS	Yes	Yes
Westcom	VIPER	CentralSquare	None	CentralSquare	Yes	No
Des Moines PD	VIPER	Hexagon	Hexagon	Hexagon, AWARE, RapidSOS	Yes	Yes, In the next few years
Polk Co SO	VIPER	Hexagon	Hexagon	Hexagon, RapidSOS	Yes	Unknown
Boone Co SO	Zetron Shared Services	Tac 10	Tac 10	Geocomm Geolynx	No	Yes, to Motorola FLEX
Dallas Co SO	VIPER	Tyler	Tyler	Tyler	Yes	No

Call Handling System Analysis

Two call handling systems are used by the PSAPs within this region. The Zetron system (https://www.zetron.co) is offered by the state to all PSAPs as a shared service. Any PSAPs can choose to utilize the Zetron system to reduce overall costs or can choose to purchase a local hosted call handling system. Five out of nine (56%) responding PSAPs currently utilize the state's shared call for service. The remaining four (44%) use Intrado's (https://www.intrado.com) Viper call handling solution.

CAD System Analysis

As shown by the orange color in the Table 1 above, CentralSquare CAD system is used in four out of nine PSAPs (44%) and has the largest number of deployments in the area. It is then followed by Hexagon CAD solution that is used by two out of the nine respondents (22%). Other systems include Tac 10 and Tyler CAD solutions used by one PSAP each.

The Mobile Architecture for Communication Handling (MACH) CAD module is used by the Iowa State Patrol to dispatch 911 and other calls for service. The MACH software is provided and supported by the Iowa Department of Transportation at no charge to Iowa public safety agencies. MACH is designed to help agencies collaborate during daily activities and emergency events, capable of supporting instant messaging, National Crime Information Center (NCIC)/National Law Enforcement Telecommunications System (NLETS) searches and integrated with real-time data mapping.[6] MACH is deployed to the Iowa State Patrol, Iowa DOT Commercial Motor Vehicle Enforcement, Iowa Department of Natural Resources statewide and 356 other local agencies.[7]

CAD-to-CAD Interoperability Interface

Seven out of nine (77%) responding PSAPs had access for CAD-to-CAD data sharing interface, but only some PSAPs have implemented CAD-to-CAD data sharing with a single vendor solution. As Figure 10 indicates, Story and Polk County currently have CAD-to-CAD interoperability through CentralSquare.

CAD System Upgrade

The majority of the respondents stated that they are considering upgrading their CAD system. Out of the nine responding PSAPs, six (66.7%) confirmed that they are considering or planning to upgrade their CAD system. Two out of nine (22.2%) stated that they have no plans to upgrade or have upgraded already. One PSAPs (11.1%) stated they are unsure.

CAD-to-CAD Interoperability Status

CAD-to-CAD Interoperability currently exists between different PSAPs but is limited to PSAPs within the same county boundary using the same CAD vendor solution. For example, as illustrated in Figure 9, CAD-to-CAD data sharing between Story County Sheriff's Office, Ames Police Department, and Iowa State Police Department is achieved through the use of the CentralSquare CAD solution (depicted in gray). CAD-to-CAD interoperability also exists between the Polk County Sheriff's Office and the Des Moines Police

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[6] *Iowa TRACS*. (2022). Retrieved 24 March 2022, from https://iowadot.gov/tracs/about-mach.

[7] National Model - Iowa. Teginc.com. (2022). Retrieved 18 May 2022, from http://www.teginc.com/nationalmodel/nm_about_iowa.html.

department, who both use the Hexagon CAD solution. The benefit of a single vendor solution is the capability to share data without having to translate the data into a compatible format.

It is important to also note that CAD-to-CAD data sharing does not occur across county boundaries. This may be due to the inability to access proprietary data and data structures of a CAD system, cost to implement a data sharing interface, or lack of policies or agreements addressing data sharing between PSAPs.

Unlike other PSAPs, Westcom's service area covers part of Dallas County, Polk County and Warren County. Westcom also uses a single vendor solution (CentralSquare) rather than sharing data between different vendor solutions across jurisdictions.

While the Dallas County Sheriff's office currently does not directly share CAD-to-CAD data with its neighboring PSAPs, they have enabled remote viewing of CAD information through a web-interface. PSAPs that are approved and authorized by Dallas County can access the information. Different CAD solutions used by other PSAPs may also have similar web viewing capabilities, but they did not explicitly state they have enabled this feature.

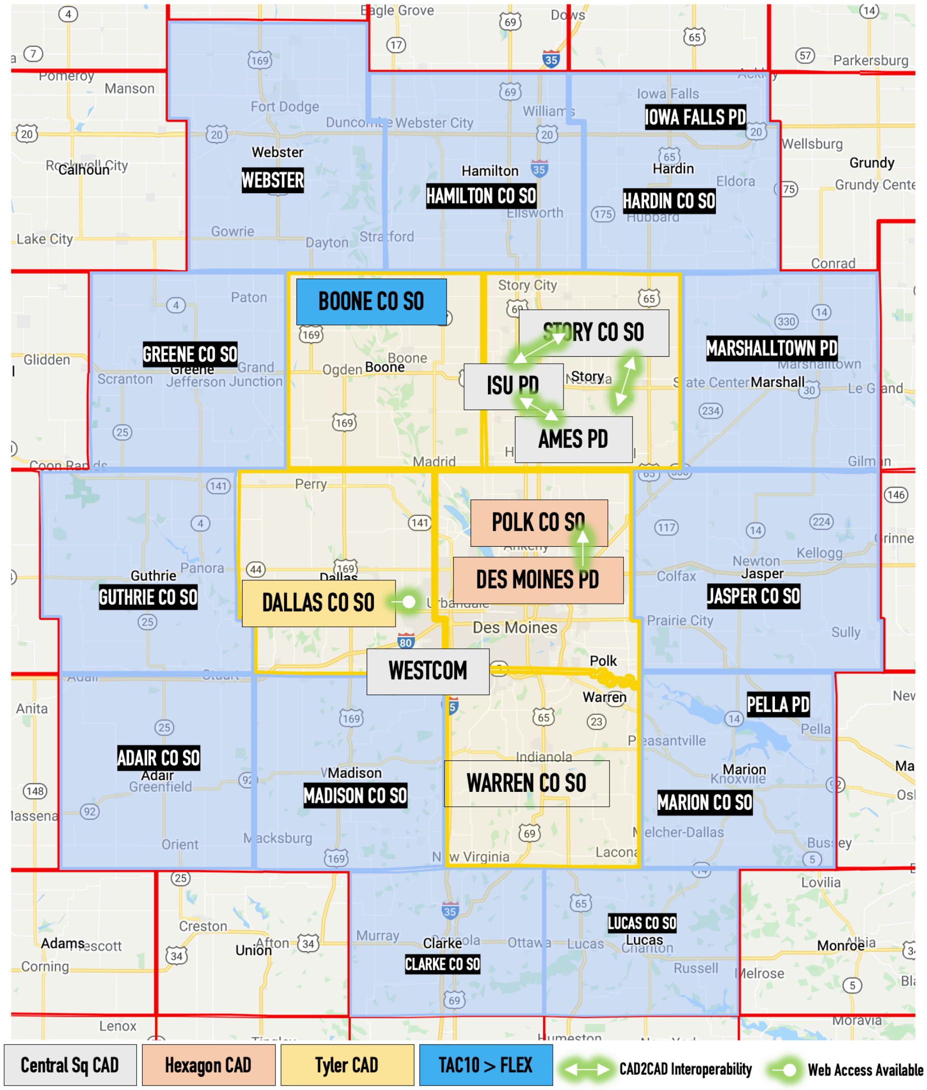

Figure 10: CAD Deployment and Interoperability Map

Des Moines State Radio is not represented in Figure 10, since it is a regional secondary PSAP that handles calls for service transferred from the local PSAPs who dispatch Iowa State Police resources and default-routed calls. MACH-CAD is used to dispatch Iowa State Police resources. MACH has many useful capabilities, such as hosting 99.2% of crash data from state and local law enforcement agencies; traffic accident report details, connection to the judicial database and geographic location of state assets, but does not currently have all the features that most other CAD systems provide, e.g., ANI/ALI data and calls for service details are not transferred. As a result, information must be entered manually by copying and pasting information into the appropriate fields within MACH-CAD.

The need for CAD-to-CAD data sharing is most pressing along the borders of PSAP service areas. In many cases, these service areas are drawn along county boundaries. The need for CAD-to-CAD interoperability is more critical in these areas since wireless 911 calls for service can originate from an adjacent county along the border of a PSAP service area. This could result in the call being routed to the wrong PSAP, which may not have the ability to dispatch the closest resources due to a lack of CAD-to-CAD interoperability and therefore could delay response.

In the above map (Figure 10), the counties that are highlighted in blue are adjacent counties to the ones participating in this pilot. As a result, PSAPs within these bordering counties may be potential CAD-to-CAD data sharing partners. Figure 11 illustrates this graphically. As the figure shows, several participating PSAPs could potentially have up to 11 PSAP interoperability partners as a result of the county/PSAP service area boundaries.

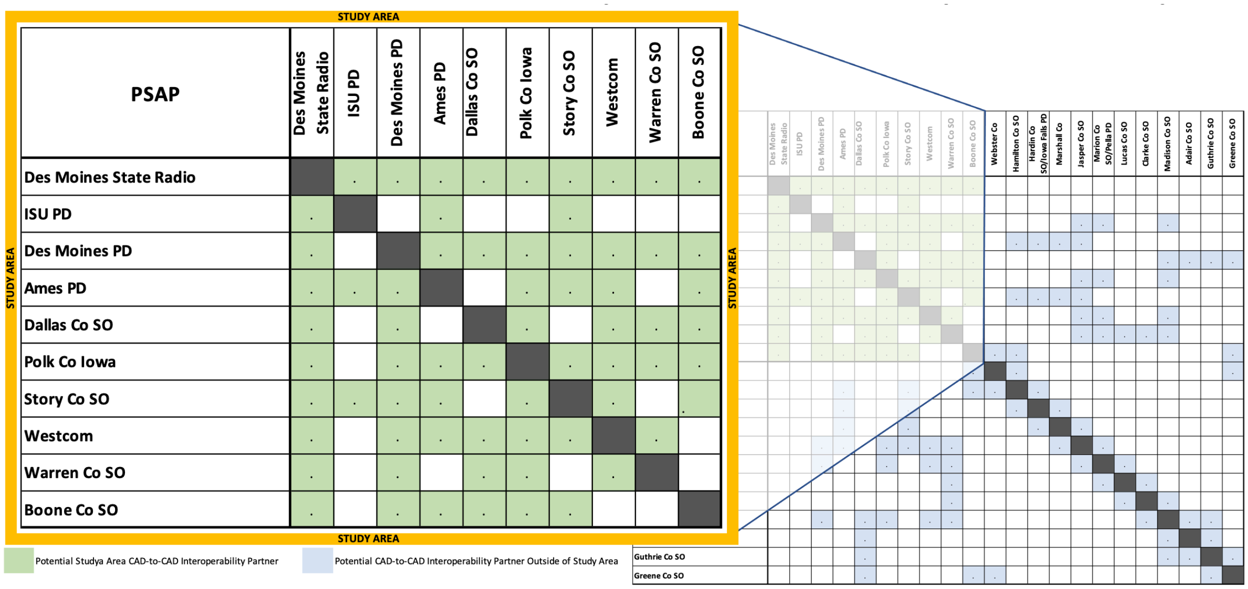

Figure 11: Potential Interoperability Partners for Iowa Pilot Stakeholders

Not all adjacent PSAP partners identified in the figure above may be actual partners in practice. Instead, it was developed to illustrate the number of potential partners based on service area *adjacency* alone. In addition to service area adjacency, each PSAP should identify CAD-to-CAD interoperability and data sharing needs based on their own unique requirements.

For example, the need for CAD-to-CAD interoperability does not necessarily apply to those counties or PSAP service areas bordering each other. A law enforcement officer may desire the capability to access the local criminal database of the driver during a traffic stop but can't because data sharing and interoperability have not been implemented between two different agencies.

Having CAD-to-CAD interoperability and data sharing will not only help improve first responder safety but should also increase response time and efficiency.

3.3.2 Data Sharing Findings

There are various levels of data sharing between PSAPs within the area. PSAPs without CAD-to-CAD interoperability may rely on a telephone system; however, PSAPs with full CAD-to-CAD interoperability may share data directly through CAD, including ANI/ALI information, call for service (CFS) details, full mapping of CFS location, and available resources with dispatching capabilities.

From the perspective of real-time interoperable data, the participants provided feedback on whether or not they share real-time data between partnering agencies and jurisdictions.

One of the critical elements of PSAP operations is the monitoring and dispatching of resources closest to the call for service. As shown in Table 2, the majority of the participants (67%) responded that they had real-time access to resource locations of partnering agencies and jurisdictions. This information may be provided through a mapping product integrated with their CAD system (e.g., CentralSquare, Hexagon Tyler). It could also be provided through an external Geographic Information Systems (GIS) system, such as MACH, RapidSOS, Geolynx or other GIS solutions.

Table 2: Real Time Data Summary

Real-time Access to Location Data of Resources		Real-time CAD-to-CAD Data Sharing	
Responses	**Percentage**	**Responses**	**Percentage**
Yes	67%	Yes	44%
No	33%	No (No connectivity)	33%
		Not Answered	23%
Data represents nine (9) participating PSAPs			

Real-time CAD data sharing between PSAPs imply CAD-to-CAD capability and data sharing is enabled. PSAPs that have deployed this capability between their partner jurisdictions may have access to the full suite of data (depending on their policies). This capability potentially improves response time through direct access to CAD data, regardless of original call for service routing, and dispatching the closest resources. CAD-to-CAD interoperability may also allow participating PSAPs to act as a backup or secondary PSAP in the event of an external attack, outage, staffing shortages, or schedules. As depicted in Table 2, 44% of the survey respondents indicated they have real-time CAD-to-CAD interoperability. Thirty-three percent stated they do not because they have no direct connectivity to other PSAPs.

PSAPs that do not have CAD-to-CAD interoperability use more conventional manner (e.g., phones, radios).

Table 3 provides a summary of other forms of communications used by the participating PSAPs. As expected, the two systems most widely used to communicate between PSAPs are phones (67%) and the radios (LMR) (67%).

Table 3: Non-CAD Based forms of Communication

Most Common Used Systems	Response Percentage
Phone	67%
Radio (LMR)	67%
Automatic Vehicle Location Information	11%
Video	11%
Data	11%
Internet	11%
Note: Percent totals do not equal 100% because some PSAP use multiple systems	

Data represents nine (9) participating PSAPs.

Data Sharing Needs

An important aspect of CAD-to-CAD interoperability is the type of data desired through the CAD. Through the ISF process, a set of baseline needs for data sharing among PSAPs were identified and represented in Figure 12. The PSAPs currently handle calls for service through voice, TTY, and text message. As NG911 capabilities are deployed, other forms of multimedia data will likely be processed through the PSAPs. The following captures some of the feedback regarding multimedia data.

Figure 12: Desirable CAD Data Types and Capabilities Identified by Responding PSAPs

The requirement listed above does not account for the data sharing needs of every PSAP in the area. It is only intended to provide the reader with a high-level awareness of the types of data that the PSAPs collectively have identified as desirable between partnering PSAPs.

While there are many technical and financial challenges to deploying a CAD-to-CAD interoperability solution, the participants have also identified other barriers to achieving data sharing. These include the fact that a formalized agreement for sharing data has not been implemented, agencies have not made the request to share data, or federal, state, or local laws and regulations may prevent the sharing of data.

Further development and refinement of data sharing needs for each PSAP should use the ISF process to define requirements for to identify and deploy an appropriate interoperability solution.

3.3.3 Multimedia Data Sharing Findings

Table 4 below depicts that all participating PSAPs confirmed that they currently support text-to-911 CFS. Sixty-seven percent of responding PSAPs stated they have access to video from various external sources, including school, county, and Department of Transportation cameras. Thirty-eight percent of the PSAPs also received alarms or other notifications within the PSAP.

Table 4: Multimedia Data Available at the PSAP

Current Multimedia Data Supported by PSAP	Response Percentage
Text-to-911	100%
Video (CCT: School, County, DOT)	67%
Alarm/Other Notification	38%
Note: Percent totals do not equal 100% because some PSAP use multiple systems Data represents nine (9) participating PSAPs.	

As far as the types of multimedia data that may be important in the future, 100% of the responding PSAPs indicated that video (with audio) was the most critical multimedia data. As an example, new multimedia data could arrive at the PSAP through Multimedia Messaging Service (MMS) based picture or video CFS. The other data types that the respondents identified were voice (67%), text (33%), and pictures (17%). The responses also suggest that video (specifically video with audio) may supplement or replace the traditional voice-only CFS in the future.

Table 5: Future Multimedia Priority

Most Critical Multimedia in the Future	Response Percentage
Video/Video with Audio	100%
Voice	67%
Text	33%
Picture	17%
Note: Percent totals do not equal 100% because some PSAP use multiple systems Data represents nine (9) participating PSAPs.	

Note that the tables above are only a summary of what was reported by respondents. As a result, it may identify only a small subset of all available data or future needs. In addition to identifying various sets of multimedia data, the respondents also noted that artificial intelligence (AI) may be needed to help prioritize and process the data in the future.

3.4 NG911 Observations and Results

This section focuses on the NG911 data collection process and results. As mentioned previously, the purpose of this data collection effort was to obtain a high-level understanding of information exchange needs as they relate to Next-Generation 9-1-1 (NG911) and the region's NG911 readiness.

3.4.1 Approach

The data collection approach consisted of disseminating a survey that included 14 questions. These questions were extracted from the SAFECOM's NG911 Self-Assessment Tool (https://911.gov/project/ng911-self-assessment-tool/), which provides a detailed, easy-to-use NG911 readiness checklist to help evaluate a system's NG911 maturity state and understand the next steps necessary to continue NG911 deployment. The survey included the following 14 questions which were adapted from the Self-Assessment Tool:

#	Survey Questions
1	Are there ongoing efforts to encourage collaboration among NG911 and other public safety governance bodies (e.g., broadband, other jurisdictions) to promote interoperability? If "YES", identify collaborators or governance.
2	Have you executed strategic plans for NG911 system requirements (e.g., NIEM, standards) adopted and implemented? If "YES", explain.
3	Have you executed strategic plans for system interoperability (e.g., GIS, CAD) been adopted and implemented? If "YES", describe systems.
4	Has joint 911/NG911 MOU for multi-jurisdictional cooperation been adopted and implemented? If "YES", list jurisdictions.
5	Has a governance body been aligned with the Statewide Communications Interoperability Plan (SCIP)?
6	Are you actively coordinating with other (adjoining) ECCs/PSAPs to address challenges associated with the evolving emergency communications landscape? If "YES", with which ECCs/PSAPs?
7	Have you promoted economies of scale (to reduce overall cost) and interoperability by instituting cooperative purchasing agreements or offering master purchasing agreements for the acquisition of NG911 capabilities? If "YES", with which ECCs/PSAPs/State Agencies or others?
8	Have logging capabilities for Next Generation Services been fully implemented and maintained (recording of incoming call data)
9	Are you using a singularly connected interoperable multimedia call handling system? If "NO", describe if your call handling system is IP based or planned to be IP based.
10	Does your system route multimedia information?
11	Does mapping occur directly in CAD?
12	Has logging and recording of NG911 multimedia data been implemented?
13	Is computer-aided dispatch (CAD) being used? If "YES", describe how it is being used.
14	Is a broadband field network being used and which carrier (e.g., AT&T, FirstNet, Verizon, etc.)? If "YES", identify which carrier.

For participants from the State, the questions were organized by the following four topics:

1) Routing & Location,
2) Geographic Information System (GIS) Data,
3) Next Generation Core Service (NGCS) Elements, and
4) Network (OSP & ESInet).

For PSAP participants, questions were organized according to the following categories:

1) Local Governance and Planning,
2) Next Generation Core Service (NGCS) Elements,
3) ECC/PSAP Call Handling System and Applications, and
4) Optional Interfaces.

Each question requested Yes/No responses and had the option for N/A and Unknown as well.

3.4.2 NG911 KEY FINDINGS

State Level Findings

The state level responses were either marked "Yes" or will be "Yes" in 2-12 months for all topics. Some potential areas to explore include clarification of the data responsibilities between the 911 Council and the Office of the Statewide Interoperability Coordinator (SWIC) and if there are any opportunities for statewide CAD-to-CAD interoperability coordination.

PSAP Level Findings

From the PSAP perspective, approximately two-thirds of questions had general consistency in responses across PSAPs. For the remaining one-third of questions, the responses were answered with "Unknown" or the responses varied widely among the PSAPs.

For Local Governance and Planning (Category 1 above), collaboration among governance bodies and coordination with adjoining ECCs/PSAPs are being pursued at most PSAPs, however, strategic plans for NG911 system requirements are not being executed by most PSAPs. Furthermore, questions remain on whether joint 911/NG911 MOUs for multi-jurisdictional cooperation are being widely adopted among the PSAPs.

For NGCS Elements (Category 2), logging capabilities for Next Generation Services have been fully implemented and maintained for a slight majority of the surveyed PSAPs (5 of 9 PSAPs), while there are inconsistent answers (No, Unknown, No Answer) for the remaining PSAPs.

Related to the ECC/PSAP Call Handling perspective (Category 3), multimedia call handling and CAD mapping capabilities are largely being implemented across the PSAPs. Questions remain on items like PSAP routing of multimedia information, and the consistency across individual PSAPs in the logging and recording of NG911 multimedia data.

Lastly, from an Optional Interfaces perspective (Category 4), CAD is being used among the majority of PSAPs, with Verizon and/or FirstNet (First Responder Network Authority) are used as the field broadband capabilities in the majority of PSAPs.

Detailed Results

Figure 13: Summary of Aggregate PSAP NG911 Survey Data below presents the NG911 survey aggregated set of data across all surveyed PSAPs (see Appendix C for detailed responses by PSAP). In addition to the questions categorized in the original NG911 survey format, each question was also labeled as a People, Process, and/or Technology related question to align with the ISF principles. This provided another perspective to help assess the NG911 readiness of the region. Note some questions related to more than just one of the three ISF categories, so some labels include more than one category (e.g., People and Process).

Per the legend, green shading represents that the majority of PSAPs answered "Yes" to that question. Yellow shading represents no majority answer or that the majority of answers were "Unknown," "N/A," or "No Answer." Red shading represents the majority of PSAPs answered "No." Survey results indicate that the areas to address for NG911 readiness are related more to the People and Process topics rather than Technology.

Legend: Majority Yes; Majority N/A or Unknown; Majority No	NG911 Readiness Survey: Summary of Aggregate Results Based on the SAFECOM Self Assessment	ISF Components
Local Governance and Planning	Are there ongoing efforts to encourage collaboration among NG911 and other public safety governance bodies (e.g., broadband, other jurisdictions) to promote interoperability? If "YES", identify collaborators or governance bodies.	People Process
	Have you executed strategic plans for NG911 system requirements (e.g., NIEM, standards) adopted and implemented? If "YES", explain.	Process
	Have you executed strategic plans for system interoperability (e.g., GIS, CAD) been adopted and implemented? If "YES", describe systems.	Process
	Has joint 911/NG911 MOU for multi-jurisdictional cooperation been adopted and implemented? If "YES", list jurisdictions.	People Process
	Has a governance body been aligned with the Statewide Communications Interoperability Plan (SCIP)?	People Process
	Are you actively coordinating with other (adjoining) ECCs/PSAPs to address challenges associated with the evolving emergency communications landscape? If "YES", with which ECCs/PSAPs?	People, Process
	Have you promoted economies of scale (to reduce overall cost) and interoperability by instituting cooperative purchasing agreements or offering master purchasing agreements for the acquisition of NG911 capabilities? If "YES", with which ECCs/PSAPs/State Agencies or others?	Process
Next Generation Core Service (NGCS) Elements	Have logging capabilities for Next Generation Services been fully implemented and maintained (recording of incoming call data)?	Technology
ECC/PSAP Call Handling System & Applications	Are you using a singularly connected interoperable multimedia call handling system? If "NO", describe if your call handling system is IP based or planned to be IP based.	Technology
	Does mapping occur directly in CAD?	Technology
	Does your system route multimedia information?	Technology
	Has logging and recording of NG911 multimedia data been implemented?	Technology
Optional Interfaces	Is computer-aided dispatch (CAD) being used? If "YES", describe how it is being used.	Technology
	Is a broadband field network being used and which carrier (e.g., AT&T, FirstNet, Verizon, etc.)? If "YES", identify which carrier.	Process Technology

Figure 13: Summary of Aggregate PSAP NG911 Survey Data

Figure 14 below presents a summary of results from the NG911 survey questions based on each individual PSAP response. In summary, results indicate varying degrees of NG911 readiness and indicates that no single PSAP is prepared across all NG911 categories and no single PSAP is unprepared across all categories. This presents an opportunity for enhanced NG911 collaboration in the region.

Legend	
PSAP Response	Aggregate Assessment
Yes	Majority Yes
Unknown, N/A, No answer	Majority No, Unknown, N/A, No answer
No	Majority No

	NG911 PSAP Readiness Survey: Based on the SAFECOM Self-Assessment	ISU	DMPD	AMES	DALLS	DSM	POLK	STORY	WESTCOM	BOONE	Aggregate Assessment	ISF Components
Local Governance and Planning	Are there ongoing efforts to encourage collaboration among NG911 and other public safety governance bodies (e.g., broadband, other jurisdictions) to promote interoperability? If "YES", identify collaborators or governance bodies.	Unknown	Yes		Yes	Yes	Yes	Yes	Unknown			People Process
	Have you executed strategic plans for NG911 system requirements (e.g., NIEM, standards) adopted and implemented? If "YES", explain.	Unknown	No	No	Yes	No	No	No	No			Process
	Have you executed strategic plans for system interoperability (e.g., GIS, CAD) been adopted and implemented? If "YES", describe systems.	Unknown	Yes	Yes	Yes	No	No	Yes	Yes			Process
	Has joint 911/NG911 MOU for multi-jurisdictional cooperation been adopted and implemented? If "YES", list jurisdictions.	Unknown	Unknown	Yes	Unknown	No	Unknown	Unknown	No			People Process
	Has a governance body been aligned with the Statewide Communications Interoperability Plan (SCIP)?	Unknown	Unknown		Yes	Yes	Unknown	Unknown	No			People Process
	Are you actively coordinating with other (adjoining) PSAPs to address challenges associated with the evolving emergency communications landscape? If "YES", with which ECCs/PSAPs?	Yes	Yes		Yes	Yes	Yes	Yes	Yes			People Process
	Have you promoted economies of scale (to reduce overall cost) and interoperability by instituting cooperative purchasing agreements or offering master purchasing agreements for the acquisition of NG911 capabilities? If "YES", with which PSAPs, agencies or others?	Yes	Yes		N/A	Unknown	No	Yes	No			Process
Next Generation Core Service (NGCS) Elements	Have logging capabilities for Next Generation Services been fully implemented and maintained (recording of incoming call data)?	Unknown	Yes	Unknown	Yes	Yes	Yes	No	Yes			Technology
ECC/PSAP Call Handling System & Applications	Are you using a singularly connected interoperable multimedia call handling system? If "NO", describe if your call handling system is IP based or planned to be IP based.	Unknown	Yes		Yes	Yes	Yes	No	No	Yes		Technology
	Does mapping occur directly in CAD?	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No		Technology
	Does your system route multimedia information?	No	Unknown	Yes		Unknown	Unknown	Unknown	Unknown	No		Technology
	Has logging and recording of NG911 multimedia data been implemented?	No	Yes	Unknown	Yes	Yes	Unknown	No	No	Yes		Technology
Optional Interfaces	Is computer-aided dispatch (CAD) being used? If "YES", describe how it is being used.	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes		Technology
	Is a broadband field network being used and which carrier (e.g., AT&T, FirstNet, Verizon, etc.)? If "YES", identify which carrier.	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No		Process Technology

Figure 14: Detailed PSAP NG911 Survey Data

<u>NG911 Readiness by PSAP</u>

The next assessment of the NG911 collected data involved NG911 readiness by PSAPs i.e., examining the specific responses from each PSAP. The goal of this process was to assess the readiness level at each individual PSAP along NG911 categories and ISF categories.

In addition, this process enabled the determination of the opportunity for interoperability by comparing readiness levels among geographically adjacent PSAPs. The following figures depicts the PSAPs surveyed, each colored according to their responses along NG911 and ISF categories. For each PSAP, Green means the PSAP answered a majority or half of the questions “Yes”, Yellow means no majority in the PSAP’s answers or the majority was “Unknown,” “N/A,” or “No answer.” Lastly, Red means that the PSAP answered “No” for the majority of questions in that category. For each figure, some observations are provided.

Aggregate: All 14 NG911 Questions

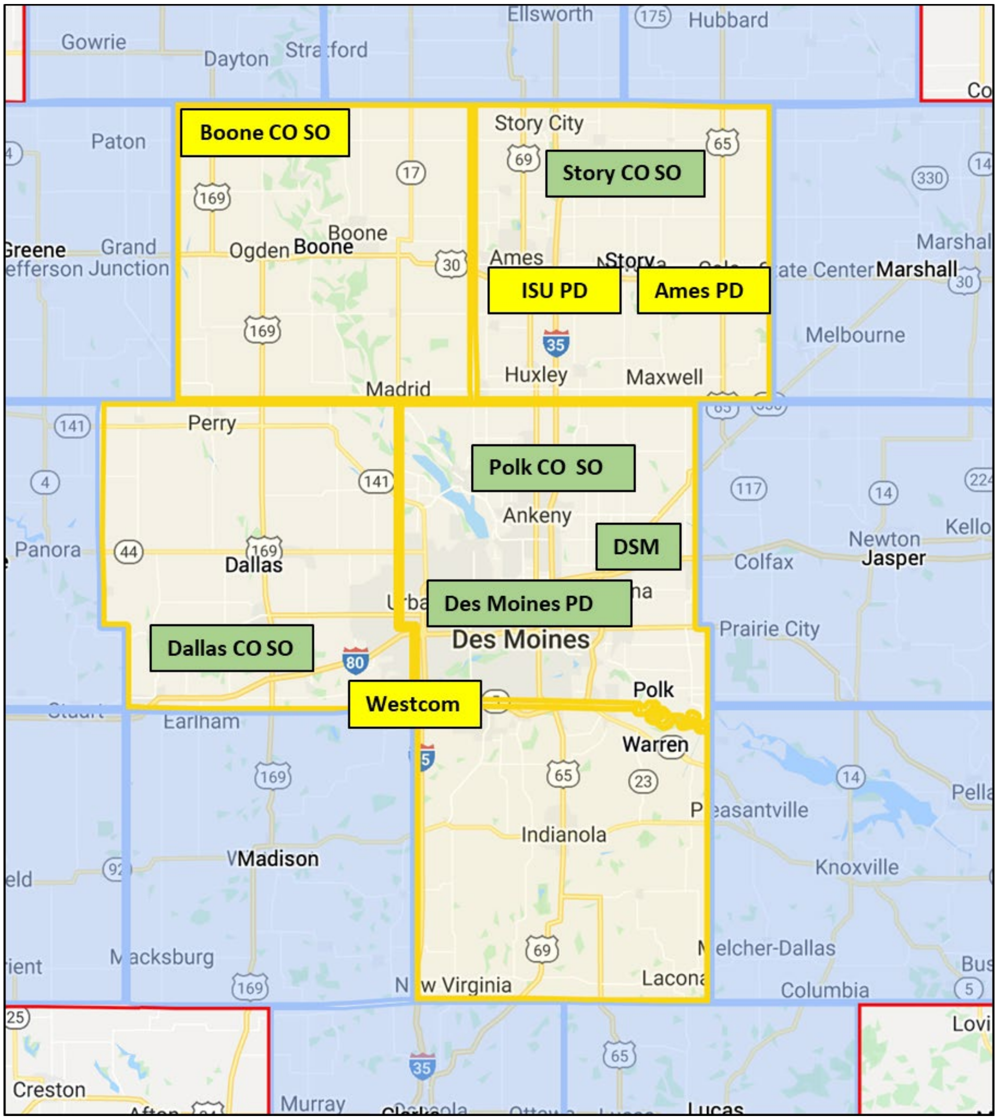

Figure 15: PSAP Readiness Assessment - Aggregate

Observations

- Similar readiness levels grouped together geographically
- Des Moines area entities have high level of overall readiness

Local Governance and Planning

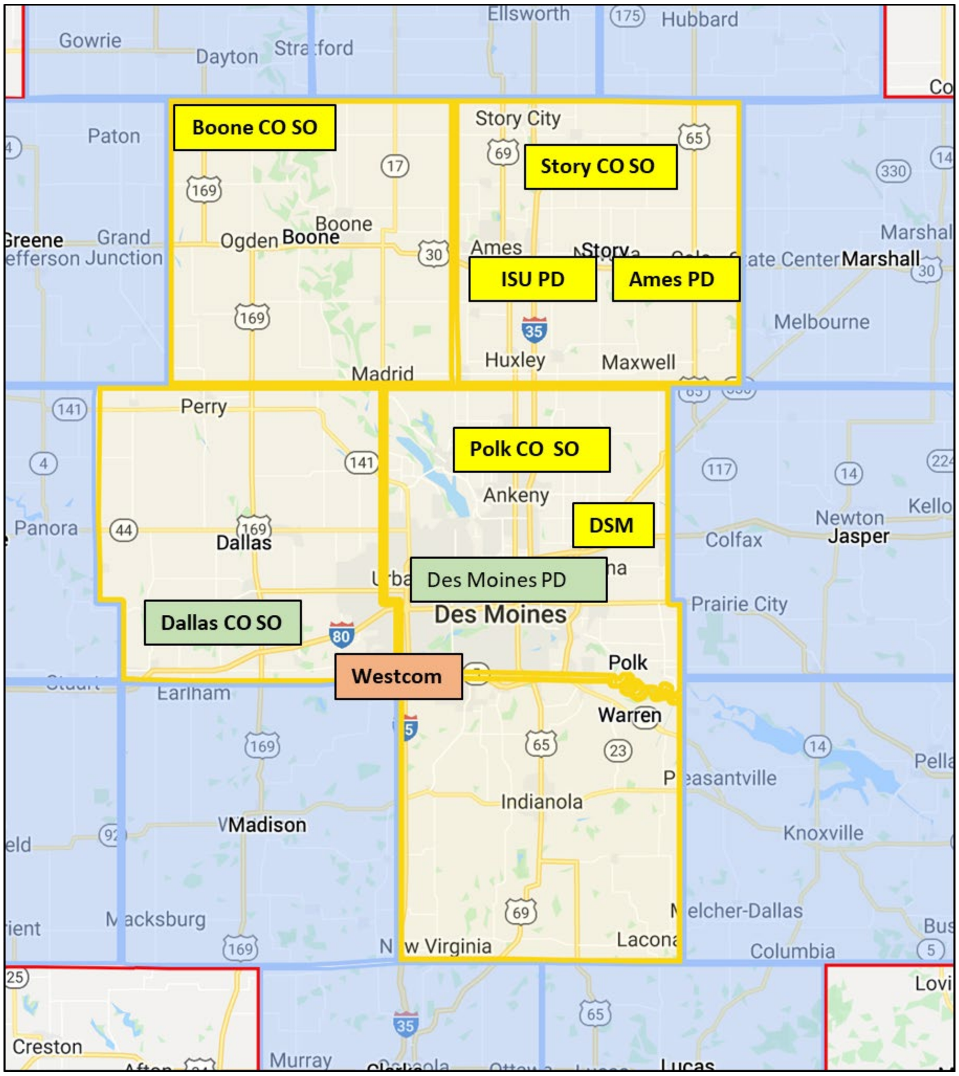

Figure 16: PSAP Readiness Assessment – Local Governance and Planning

Observation

- Mostly medium level of readiness in the region

NGCS Elements

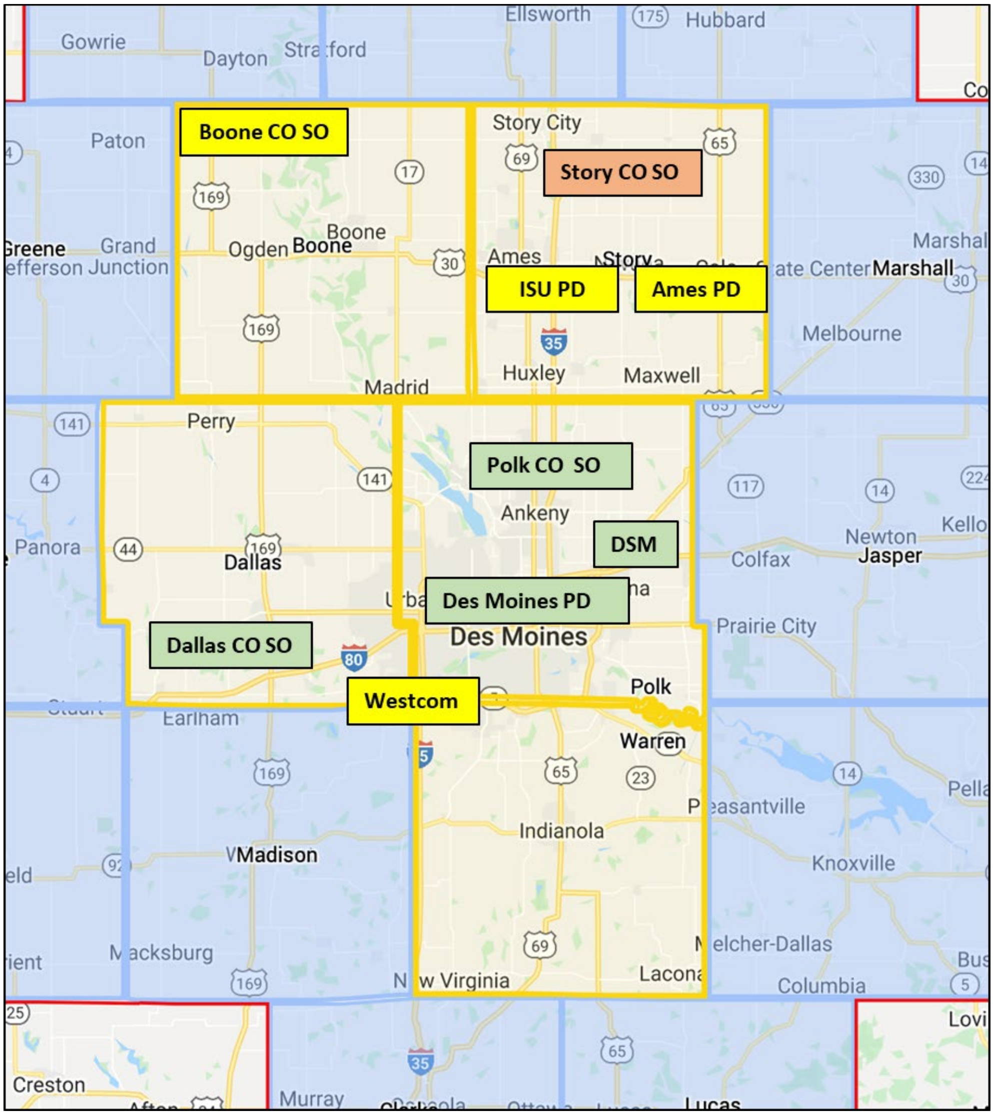

Figure 17: PSAP Readiness Assessment – Next Generation CAD System Elements

Observations

- Readiness not very fragmented
- Des Moines area entities have high level of overall readiness

ECC/PSAP Call Handling System and Applications

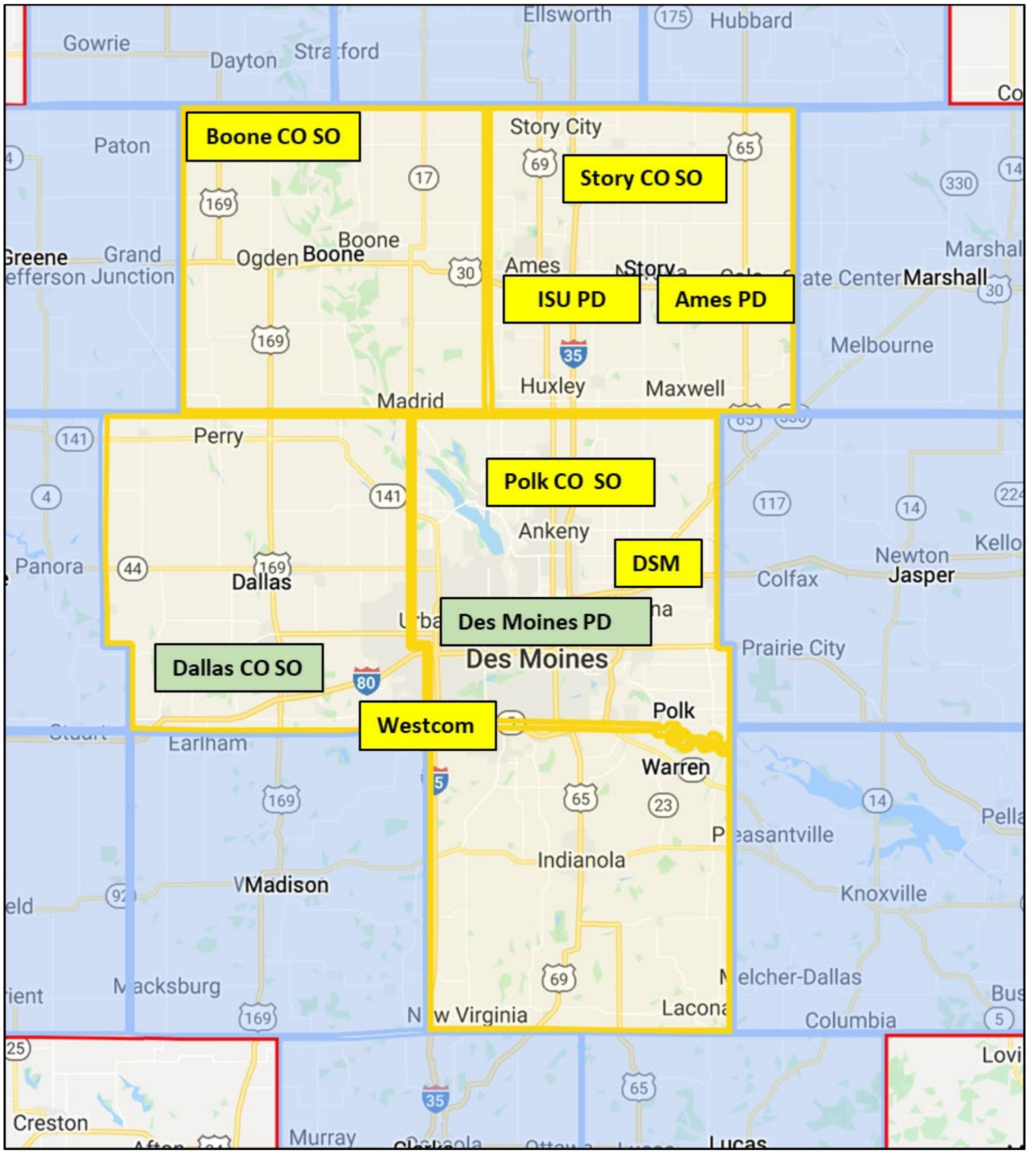

Figure 18: PSAP Readiness Assessment – ECC/PSAP Call Handling System and Applications

Observations

- Mostly medium level of readiness region with a few agencies with high level of readiness

Optional Interfaces

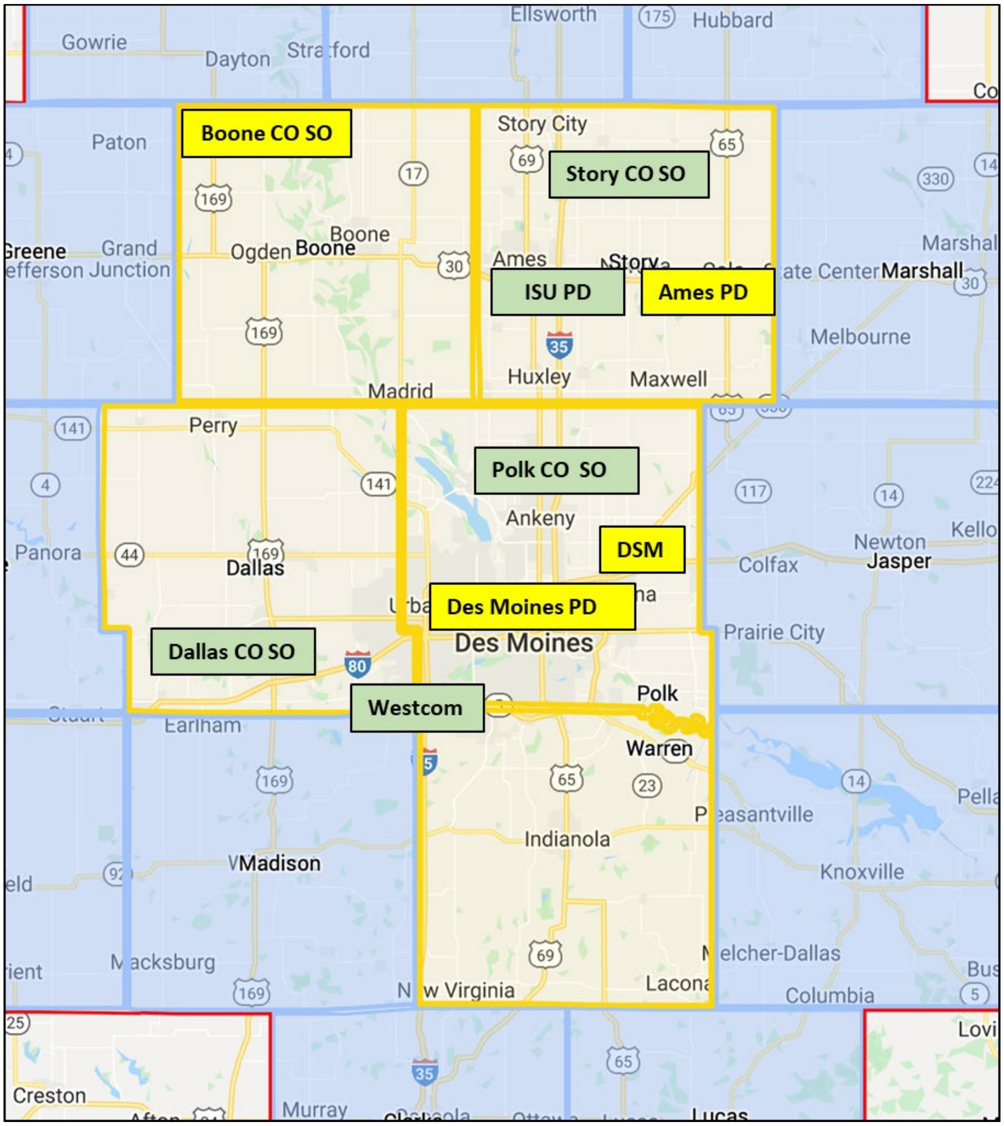

Figure 19: PSAP Readiness Assessment – Optional Interfaces

Observations

- Readiness not very consistent among adjacent agencies, which could present interoperability challenges

People and Process

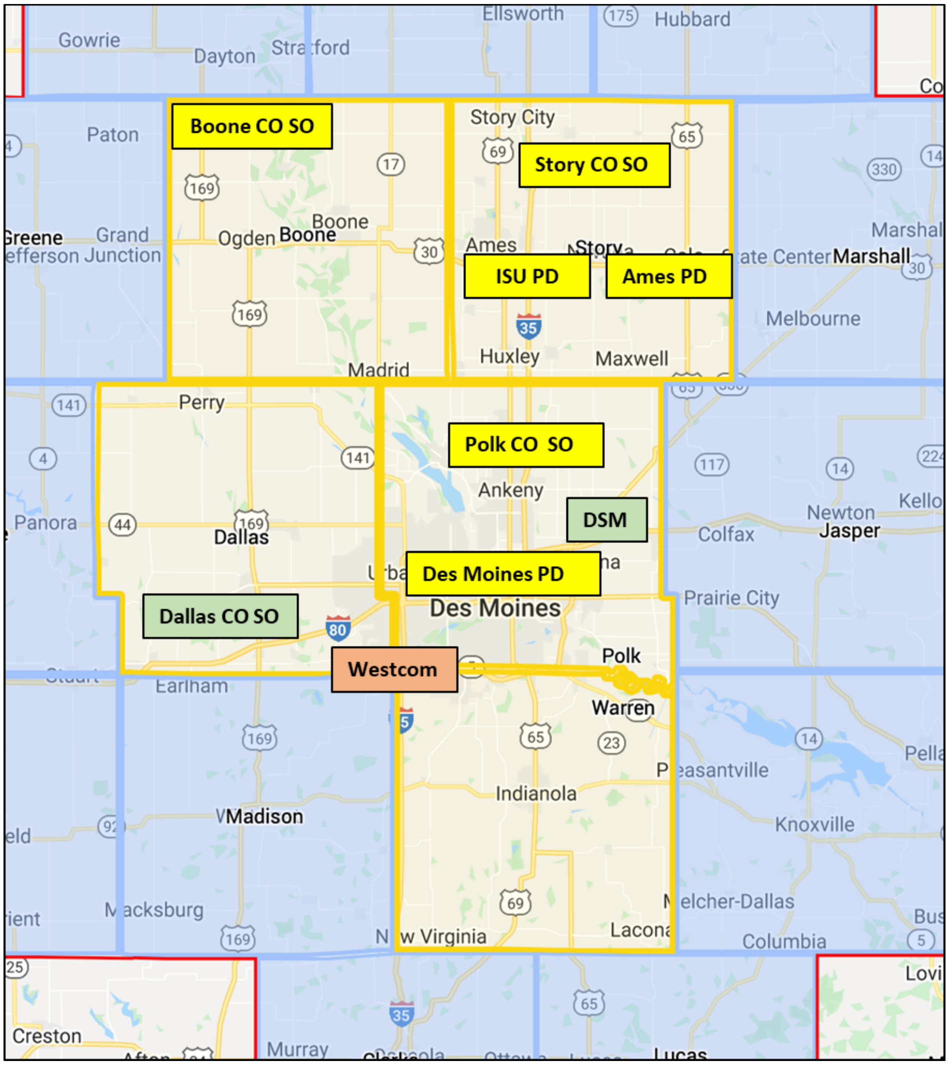

Figure 20: PSAP Readiness Assessment – People and Process

Observations

- Medium level of readiness throughout region
- Isolated locations of high to low level of readiness

__Process__

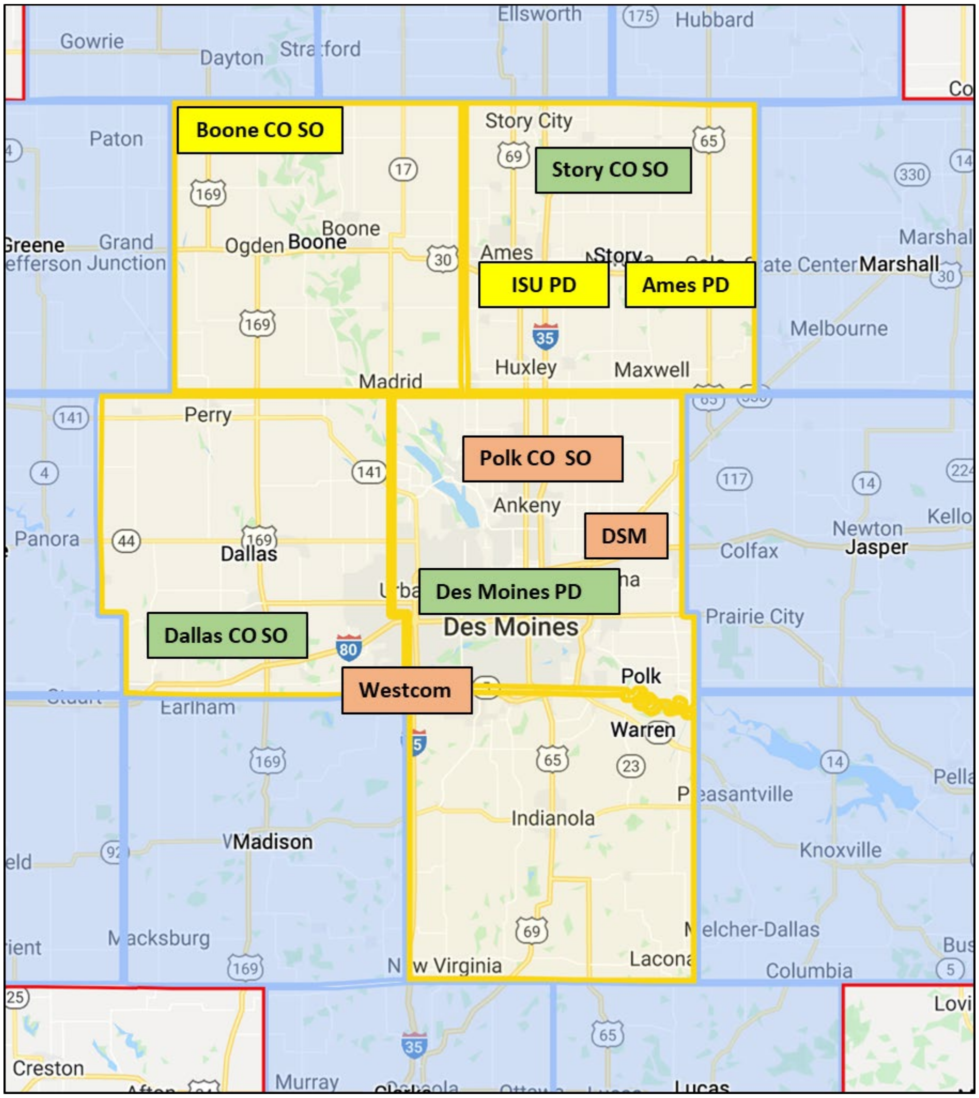

__Figure 21: PSAP Readiness Assessment – Process__

Observations

- Inconsistent readiness throughout region, which may present interoperability challenges
- Process component could be an area to address

Technology

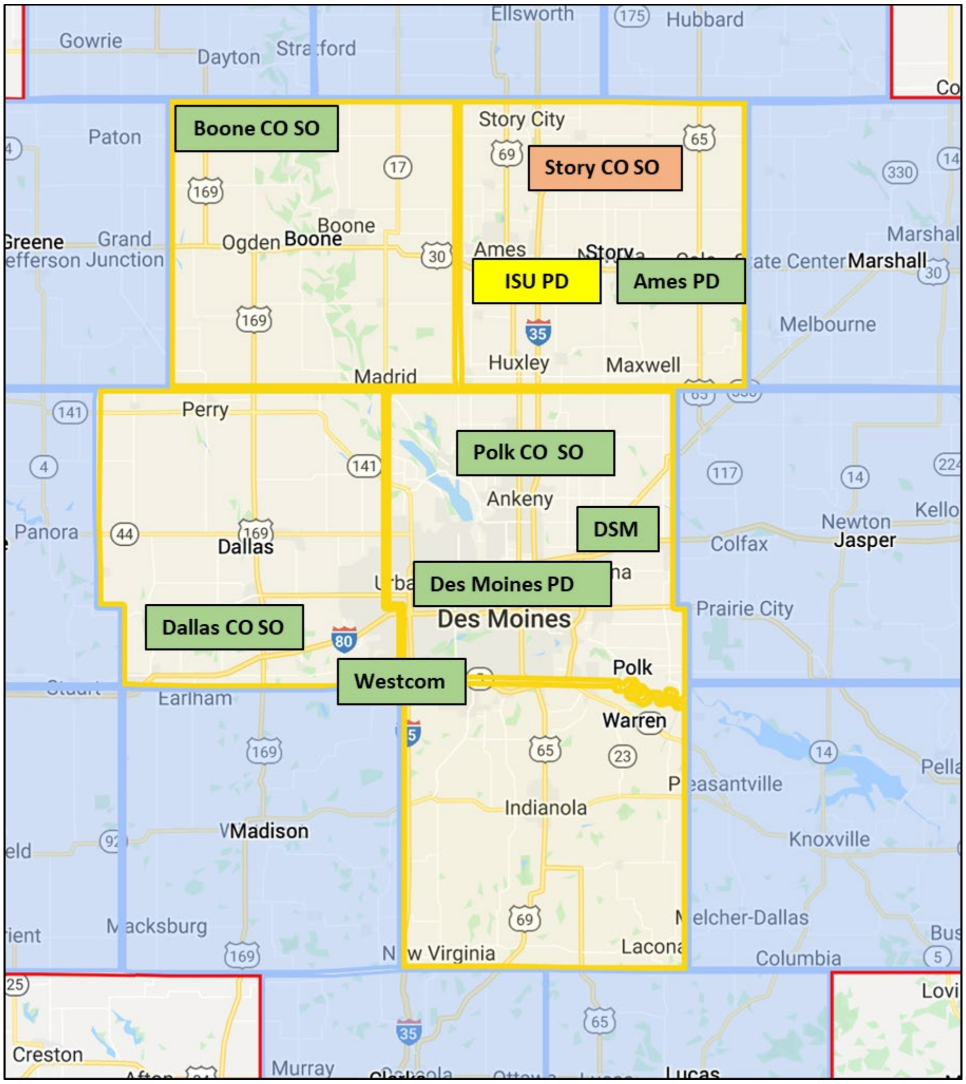

Figure 22: PSAP Readiness Assessment – Technology

Observations

- Mostly high level of readiness throughout region
- Consistently high in Des Moines area, which is favorable for interoperability
- Inconsistent readiness within Story County, which could present interoperability challenges

Technology and Process

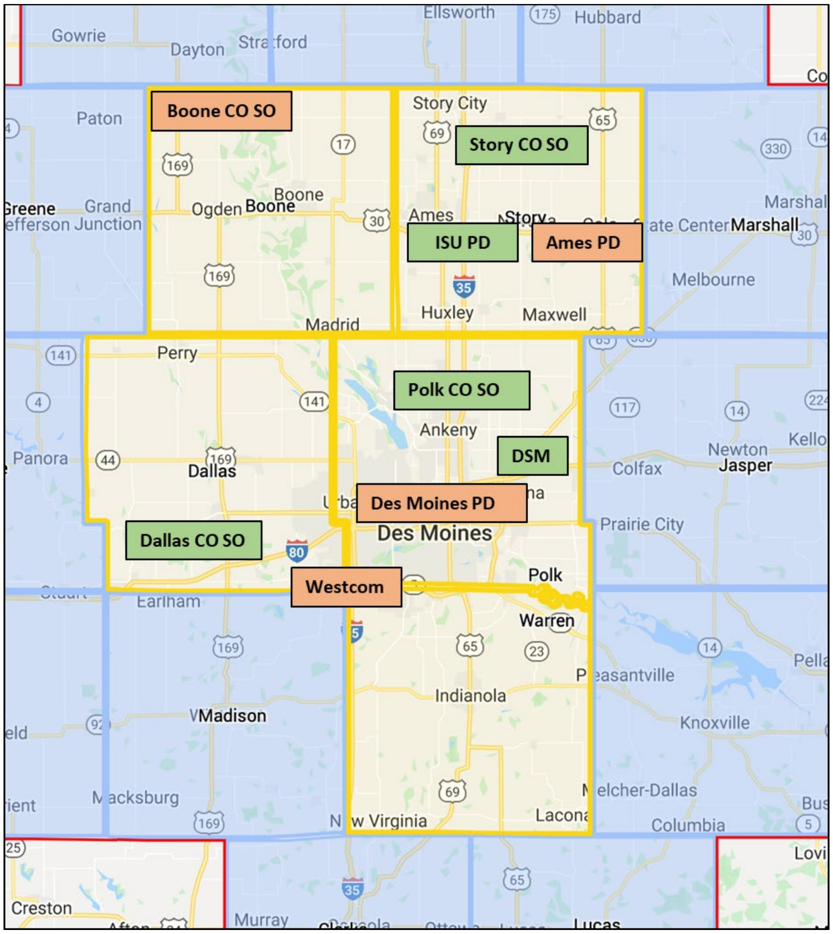

Figure 23: PSAP Readiness Assessment – Technology and Process

Observations (1 question)

- Readiness is at two extremes throughout region, which could present broader interoperability challenges

Table 6 below provides a summary of the PSAP NG911 readiness observations and are presented according to a) aggregate data - considering all questions collectively, b) NG911 survey categories, and c) ISF alignment based on the interoperability components of people, process, and technology. Note that the same 14 set of questions are considered in each category, but the observations were made from different perspectives to help analyze the responses as thoroughly as possible.

Table 6: Summary of PSAP NG911 Readiness Observations

Category	Category Type	Number of Questions	Observations
Aggregate (All 14 NG911 Questions)	N/A	14	• Similar readiness levels grouped together geographically • Des Moines area entities have high level of overall readiness
Local Governance and Planning	NG911 Readiness	7	• Mostly medium level of readiness in the region
NGCS Elements	NG911 Readiness	1	• Readiness not very fragmented • Des Moines area entities have high level of overall readiness
ECC/PSAP Call Handling System and Applications	NG911 Readiness	4	• Mostly medium level of readiness region with a few agencies with high level of readiness
Optional Interfaces	NG911 Readiness	2	• Readiness not very consistent among adjacent agencies, which could present interoperability challenges
People and Process	ISF Alignment	4	• Medium level of readiness throughout region • Isolated locations of high to low level of readiness
Process	ISF Alignment	3	• Inconsistent readiness throughout region, which may present interoperability challenges • Process component could be an area to address
Technology	ISF Alignment	6	• Mostly high level of readiness throughout region • Consistently high in Des Moines area, which is favorable for interoperability • Inconsistent readiness within Story County, which could present interoperability challenges
Technology and Process	ISF Alignment	1	• Readiness is at two extremes throughout region, which could present broader interoperability challenges

3.4.3 Additional Observations

The information below provides a summary of some additional observations from the PSAPs' responses to the NG911 questions. These are provided as further detail to supplement the statistical analysis from the previous subsections.

- Local Governance and Planning
  - Some venues for collaboration include Iowa State 911 Council, Iowa Statewide Interoperable Communications System (ISICS), Metro Interoperability Committee, and the FirstNet Authority
- NGCS Elements
  - Eventide was mentioned as an application that addresses NGCS

- ECC/PSAP Call Handling Systems and Applications
    - VIPER mentioned as a call handling system and Eventide IP recoding for logging and recording of NG911 multimedia data
- Optional Interfaces
    - Combination of using Verizon and AT&T/FirstNet for broadband field network

3.5 Focus Group Key Findings

3.5.1 CAD-to-CAD

Existing CAD-to-CAD Interoperability Characteristics

CAD-to-CAD interoperability and data sharing currently exist to some extent between PSAPs. There are two attributes which are common enabling this capability:

- PSAPs with CAD-to-CAD interoperability and data sharing all use a CAD solution from the same vendor
- PSAPs that share data with other agencies are all located within the same county

Lack of CAD-to-CAD Interoperability Characteristics

It was found that there are currently no PSAPs that share CAD data across county boundaries with respect to the participants. The majority of the respondents stated the desire to have CAD-to-CAD interoperability and data sharing across jurisdictional/county boundaries, however there are multiple reasons they currently do not have this capability. These include, but are not limited to, the following,

- Capability to share data through CAD has not been built
- Difficulty in implementing CAD-to-CAD interoperability between different CAD solutions
- There are no policies or agreements in place for data sharing
- No one has requested CAD-to-CAD data sharing
- Federal, State, Local laws or regulations prevent sharing certain data

Opportunities to Enable CAD Data Sharing Across Boundaries.

Of all the responding PSAPs, 67% reported that they are considering CAD upgrades in the future. Many of those PSAPs are located in counties that border other counties that currently lack CAD-to-CAD interoperability. This provides a unique opportunity for those considering upgrades to their CAD system to not only address their technical and operational needs, but also to factor in CAD-to-CAD interoperability between adjacent counties during the procurement process. As with the shared telecom system availability from the state, the PSAPs could potentially share and leverage each other's upgrade plans to take the necessary steps to ensure CAD-to-CAD interoperability and data sharing capacity are built into their plans.

3.5.2 NG911

The NG911 readiness across the individual PSAPs varied based on responses to the questions from an ISF category perspective. More than half of the Technology question responses were answered “Yes.” The People and Process question responses were mostly inconclusive. Lastly, the Process questions have the most “No” responses. The current NG911 readiness assessment in this region indicates that the region is most prepared in Technology, questions remain with respect to the People components, and further exploration of the Process components would likely prove beneficial. The level of readiness is medium to high throughout the region, but there are inconsistencies among some NG911 and ISF categories, which could present interoperability challenges.

Existing NG911 Interoperability Characteristics

As mentioned previously, the majority of the responses to the Technology question were “Yes” which indicates that most of the agencies surveyed likely have deployed similar levels of technology for NG911 capabilities. Agencies in the Des Moines region have a consistent level of high readiness from a Technology perspective.

Lack of NG911 Interoperability Characteristics

Both the readiness level and the consistency of readiness throughout the region from a Process standpoint are low. In addition, in aspects that are both People and Process-related, there is high variability and uncertainty in readiness, both within counties and between adjacent counties.

Opportunities to enable NG911 Interoperability across county boundaries.

Overall, if the People and Process aspects of NG911 are addressed and executed consistently throughout the region, the Technology in place should be ready to be set up and configured to promote region-wide NG911 interoperability.

4 APPROACH FOR CAD-TO-CAD

The following sections will describe additional follow up research completed by the ISF project team about the direction the industry is taking to provide greater interoperability. The research conducted in this section was motivated by the project team learning of a statewide CAD exploratory committee that is investigating a CAD solution for the various state of Iowa agencies.

At present the Mobile Architecture for Communication Handling (MACH) CAD module is used by the Iowa State Patrol to dispatch 911 and other calls for service. The MACH software is supported by the Iowa Department of Transportation and provided at no charge to Iowa public safety agencies as well as many local jurisdictions. The team was able to brief this group on the ISF methodology and technical approach and plans to work with this group in defining its requirements as they explore upgrading their CAD options and improving interoperability.

4.1 THE ASSOCIATIONS APPROACH TO INTEROPERABILITY

There are numerous organizations and associations that support the public safety community with training, advocacy, professional development, technology development, and implementation. Among these associations, the National Emergency Numbers Association (NENA) and the Association of Public-Safety Communication Officials (APCO) are key organizations that focus on the standardization efforts of potential technical solutions in support of the public safety community.

4.1.1 EMERGENCY INCIDENT DATA OBJECT (EIDO) DATA STANDARD

The NENA empowers its members and the greater 9-1-1 community to provide the best possible emergency response through standard development, training, thought leadership, outreach, and advocacy. NENA's Vision and Mission are to "Empowers its members and the greater 9-1-1 community to provide the best possible emergency response through standards development, training, thought leadership, outreach, and advocacy. Our vision is a public made safer by 9-1-1 services delivered by highly-trained emergency-communications professionals and powered by the latest technologies."[8]

The NENA Standard for *Emergency Incident Data Object (EIDO)* NENA-STA-021.1-2021[9], was first developed in October 19, 2021 and updated on April 19, 2022. The EIDO standard uses the JavaScript Object Notation (JSON) data format to store and exchange electronic data.

JSON is a lightweight, human-readable data exchange format that is easy to parse and generate. Its data structure consists of an object and an array. The object is a collection of name and value pairs. The array is an ordered list of values. JSON has different object types for different sets of data, and data is exchanged between systems using this structure in a simple and concise fashion. This mapping makes the data structure easier to understand. This has been cited as the main advantage over Extensible Markup Language (XML). While structured data interchange and the simple nature of JSON make it faster than

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[8] https://www.nena.org/page/mission2017

[9] https://cdn.ymaws.com/www.nena.org/resource/resmgr/standards/nena-sta-021.1a_eido_json_20.pdf

XML for data exchange, which can be used for many use cases, XML can be more powerful depending on the data sharing requirements.

For CAD-to-CAD interoperability, EIDO was developed to standardize the exchange of emergency incident information using an industry-neutral format between one or more public safety agencies that are using systems from various manufacturers. The adherence to standardized data formats to exchange information between systems ensures that one or more safety agencies can share information and interoperate with other incident stakeholders.

Within the ISF, standardizing on the EIDO data exchange format will enable the integration layer function to more easily ingest and share data between different PSAP systems to enable CAD-to-CAD interoperability.

4.1.2 Emergency Incident Data Document (EIDD) Data Standard

The Association of Public-Safety Communications Officials (APCO) provides public safety communications expertise, professional development, technical assistance, advocacy, and outreach to benefit its members and the public internationally. APCO's mission is "In a rapidly evolving global context and a time of transformational change, APCO strives to add value to our clients' enterprises and benefit society. We enable clients to achieve their objectives through insightful counsel, compelling narratives and creative solutions."[10]

The *Emergency Incident Data Document - EIDD* standard originated with a joint NENA/APCO NG9-1-1 Public Safety Answering Power (PSAP) Working Group (WG), with the first meeting of the EIDO WG occurring on January 11, 2010. EIDO was renamed to EIDD and became a separate WG within NENA's Agency Systems Committee and then under APCO's Standards Development Committee (SDC). The latest update to the EIDD is the APCO NENA 2.105.1-2017[11] NG9-1-1 Emergency Incident Data Document. The EIDD standards use the Extensible Markup Language (XLM) to exchange data between applications.

XML is both a language and a file format for storing, sharing, and reconstituting data in plain text format. XML acts as a data wrapper designed to carry information with tags that describe the data content. The tags are not pre-defined but user-defined and are extensible as new data is added or removed. Additionally, metadata can be put into tags as attributes. XML doesn't define objects as types but simply as strings. Since XML is also a language, it supports more powerful features that can be used to accommodate complex data exchange requirements rather than a simple object-array data structure. While the capabilities of the XML language and format may meet advanced data sharing requirements, it generally requires more system resources and is slower and harder to understand its data structure when compared to JSON.

EIDD was initially designed to replace the interface between Customer Premise Equipment (CPE) and CAD in PSAPs but has now evolved to support data exchanges of emergency incident data within a public safety communication center and between communications centers that conform to i3 specifications using an industry-neutral, vendor-agnostic data sharing format. The interface was originally designed to support

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[10] https://apcoworldwide.com/about/mission-values/

[11] https://www.apcointl.org/~documents/standard/21051-2017-eidd/?layout=default

CAD-to-CAD, CAD-to-RMS, and CAD-to-mobile data interoperability. Similar to the EIDO standard, selecting the EIDD standard for data interoperability will also allow the integration layer function within the ISF to more easily ingest and share data between different CAD vendor systems to enable CAD-to-CAD interoperability.

4.1.3 Data Format Summary

There are two prevailing emergency incident data sharing formats designed to be vendor neutral and, when in conformance with the standard, will support data interoperability within and between PSAPs across federal, state, and local jurisdictions.

Both the EIDO (JSON) and EIDD (XML) emergency information data sharing formats have advantages and disadvantages. Choosing the appropriate interoperability format as the basis of data sharing within and across PSAP jurisdictions will be dependent on the current and future system architecture and the specific data sharing requirements between relevant jurisdictions, among other factors. If the data sharing requirements can be met through a solution that leverages JSON's simple data structure, then a solution that utilizes the XML format may not be needed. However, if the data sharing requirements cannot be accommodated by a JSON formatted solution, a solution based on XML may be an alternative choice. Since a universal interoperable data format standard has not been widely adopted, each entity that has the responsibility for interoperability within and between PSAPs may choose one data sharing standard or the other. From an ISF perspective, it would be desirable for one or the other standard to be adopted (or specified in a procurement) in order to facilitate data exchange.

Even though a PSAP may ensure that their system conforms to a particular standard, the lack of a singular standard could inherently cause interoperability issues since JSON and XML are not directly interchangeable. For example, as shown in Figure 24: Potential EIDO and EIDD Interoperability Issues, jurisdictions "A" and "B" chooses a system that supports the EIDO standard as the most suitable for their sharing requirements. The neighboring jurisdictions "C" and "D" selects a different system that supports the EIDD standard because it best meets their requirements.

While both EIDO and EIDD are designed to share interoperable data between PSAPs, and both could be used in the integration layer function of the ISF, if both neighboring PSAPs do not choose the same standard, data sharing across jurisdictions may not be guaranteed. In order for EIDO and EIDD to interoperate, additional translation may be required within the Integration Layer. For example, as shown in Figure 24: Potential EIDO and EIDD Interoperability Issues, PSAPs "A" and "B" and PSAPs "C" and "D" can directly share CAD data because they implemented compatible data standards, but PSAPs "A" and "C" cannot share data without additional translation because PSAP "A" uses an EIDO-based interoperability solution and PSAP "C" uses an EIDD-based solution.

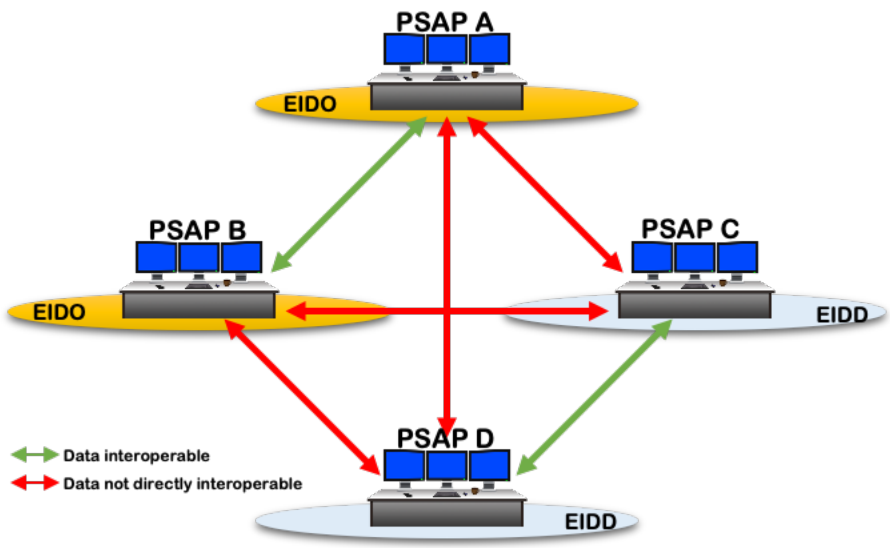

Figure 24: Potential EIDO and EIDD Interoperability Issues

The people and process step in the ISF is equally an important feature, as that can help to determine expectation and establish data sharing policies and procedures. In order to implement a CAD-to-CAD interoperability solution, the stakeholders must be purposeful when defining their requirements during the acquisition phase of a new system or an upgrade to an existing system. They must develop a CAD-to-CAD data sharing strategy and agreements, ideally prior to any procurement process, and ensure that requirement is built into the solution provider's design that implements a holistic solution approach based on a common set of vendor-agnostic data standards. This ensures that interoperability is built into a CAD system that not only supports the disciplines within and between PSAPs.

Until a universal data format is adopted and implemented for CAD-to-CAD interoperability, the procured or upgraded CAD solution should conform to the NG911 i3 standard for NG911 and natively accommodate CAD-to-CAD interoperability, supporting both EIDO and EIDD standards.

4.2 Industry Solutions for CAD-to-CAD

4.2.1 County 1, Virginia

The ISF project team engaged in discussions with Northern Virginia public safety personnel as part of its follow-up effort. The project team was aware that CAD-to-CAD capabilities were being implemented in the National Capital Region (NCR). Therefore, the team engaged with County 1's personnel to learn more about their implementation of their CAD-to-CAD capability. The virtual meeting occurred on August 26th, 2022 with an in-person meeting on October 27th, 2022. Representatives from County 1 included the operations manager, assistant director of support services, CAD system administrator, information systems manager, CAD officer, and other emergency communications personnel. The following summary notes are provided below based the ISF interoperability components of People, Process, and Technology and then along the layers of the ISF conceptual model.

4.2.1.1 INTEROPERABILITY COMPONENTS: PEOPLE, PROCESS, AND TECHNOLOGY

When implementing the ISF, it is essential to initially identify the People, Process, and Technology components. This sub-section presents details on the technical discussion with County 1 based on these interoperability components.

People

County 1 is part of the "National Capital Region" (NCR). The NCR was created pursuant to the National Capital Planning Act of 1952 (40 U.S.C. § 71). The Act defined the NCR as the District of Columbia; Montgomery and Prince George's Counties of Maryland; Arlington, Fairfax, Loudoun, and Prince William Counties of Virginia; and all cities now or hereafter existing in Maryland or Virginia within the geographic area bounded by the outer boundaries of the combined area of said counties (https://www.directives.doe.gov/terms_definitions/national-capital-region-ncr).

The NCR is highly interconnected with interstate highways/arterials and transit which calls for a high degree of coordination during emergency type events. It is understood in the region that an incident in one jurisdiction can shortly become an issue in an adjoining jurisdiction. In addition, due to the proximity to the nation's capital, planned special events (marches, protests, inauguration, etc.) requires the region's public safety personnel to work together on a regular basis. This ongoing dialogue and coordination creates an environment of public safety professionals who are highly receptive to initiatives striving to achieve greater interoperability across PSAP's.

Process

In the NCR, the Washington Council of Governments is the regional Metropolitan Planning Organization (MPO) and is also the "State Administrative Agent" (SAA) for Department of Homeland Security (DHS) grant funds. As such, the WashCOG has created a number of working groups focused on interoperability, public safety. These working groups provide a platform and process for regular meetings to discuss data interoperability needs. From an ISF perspective, this kind of structure and support is needed to create and sustain ongoing forums to further data sharing discussions.

The initial impetus for CAD-to-CAD connectivity in the NCR was based upon the length of time it took to handoff a fire service call requesting mutual aid from an adjoining jurisdiction. The ongoing discussions in the Washington Coalition for Open Government (WashCOG) working groups, and supported by DHS grant funds, led to an effort to facilitate CAD-to-CAD connectivity. The original effort was initiated around 2010 and the first version of the solution was implemented in 2015.

An example of the need for interoperability of processes, was noted that during the design phase of the project it was learned that jurisdictions in the NCR do not all use the same event type names or have the same number of event types. In fact, there may be an order of magnitude difference in the number of event types between jurisdictions, thereby causing interoperability challenges. This was one of the main issues resolved through mutually agreed to changes by the NCR partners.

Technology

County 1 took the lead in developing the CAD-to-CAD regional solution for mutual aid fire calls and procured a consultant in 2010 to develop the requirements and a solution. The initial design provided for limited data sharing between CAD systems based upon the "need to know." The "home" agency (i. e., the jurisdiction in which the event originates) retains control of its assets and has to approve the utilization of those assets. The home agency has full visibility into the call, including location and unit dispatch information, whereas the other jurisdictions will have limited information. The home jurisdiction has access to the history of calls at that location, whereas the other jurisdiction will not. The initial interoperability solution was custom designed and implemented in 2010 as the Data Exchange Hub (DEH) and upgraded to version 2 in 2015.

An Active Directory approach is used between each county and the DEH. If a public safety staff member is logged into the CAD system at their agency, they have access to CAD data from the neighboring agency via the DEH and a read-only system administration page showing activity in the DEH. The DEH provide system logs and status reports, however, analytics as defined in the ISF model have not been implemented. GIS coordination among jurisdictions across the region may require some consideration to ensure accurate and precise addressing and routing proxy functionality for CAD capabilities.

4.2.1.2 ISF Layer perspectives

After developing an understanding of the desired information-sharing along the lines of people, process, and technology, the next step in the ISF process for successful implementation is to decompose the use case along the lines of the individual ISF layers.

Data Layer

From a data layer perspective, the County 1 PSAPs have a variety of datasets available to them. This includes full blueprints and access to emergency response plans available to a dispatcher, e.g., for an active assailant incident. There is access to law enforcement data, but this data is generally not populated on displays at PSAPs. In addition, PSAP maps do have Virginia Department of Transportation (VDOT) cameras that appear as icons on the maps, but the PSAP personnel do not have PTZ control of camera video. In general, there are concerns about information overload for public safety personnel.

Presentation Layer

From a presentation layer perspective, there are 900 fire units located in County 1. 700 of these are on the Mutual Aid platform. There are an additional 300 police units, but police often do not publish their real-time locations. Additionally, a concern was expressed about dispatchers viewing live video that may be graphic.

Integration Layer

There was considerable discussion around this layer, as it is an essential component of sharing data. The County 1 PSAP personnel characterized their CAD systems as “Connected” from an interoperability standpoint. Upon further discussion, this means the CAD systems are independent but can be interfaced with one another.

County 1 maintains partnerships with the other Virginia jurisdictions that are part of the NCR. The original focus for CAD-to-CAD interoperability was for fire dispatching. Their interoperability hub (DEH) synchronizes all eight CAD systems in the region. Partners are aware when incidents take place outside their jurisdiction, but do not see details unless they must be involved in the emergency response. Data transport is accomplished across a regional fiber network called NCRnet which connects each of the jurisdictions in the NCR. The "home" system controls the dispatched unit and the implementation is such that data (such as history and locations of interest) are not shared unless required.

The next CAD-to-CAD system upgrade is forthcoming and will shift to the NG-CAD-X[12] platform. One of the new features that will be available is for call taker/dispatcher capabilities to become more regional rather than limited to one jurisdiction. This software will also enable users to transfer event data between jurisdictions as required. For example, non-county partnering PSAP personnel can handle County 1 calls and then potentially assign non-county first responders to address the incident should it be most efficient logistically. From a data interoperability standpoint, this upgrade will allow the system to be more JSON compatible, whereas the current approach uses an XML-based approach.

4.2.1.3 County 1 Implementation

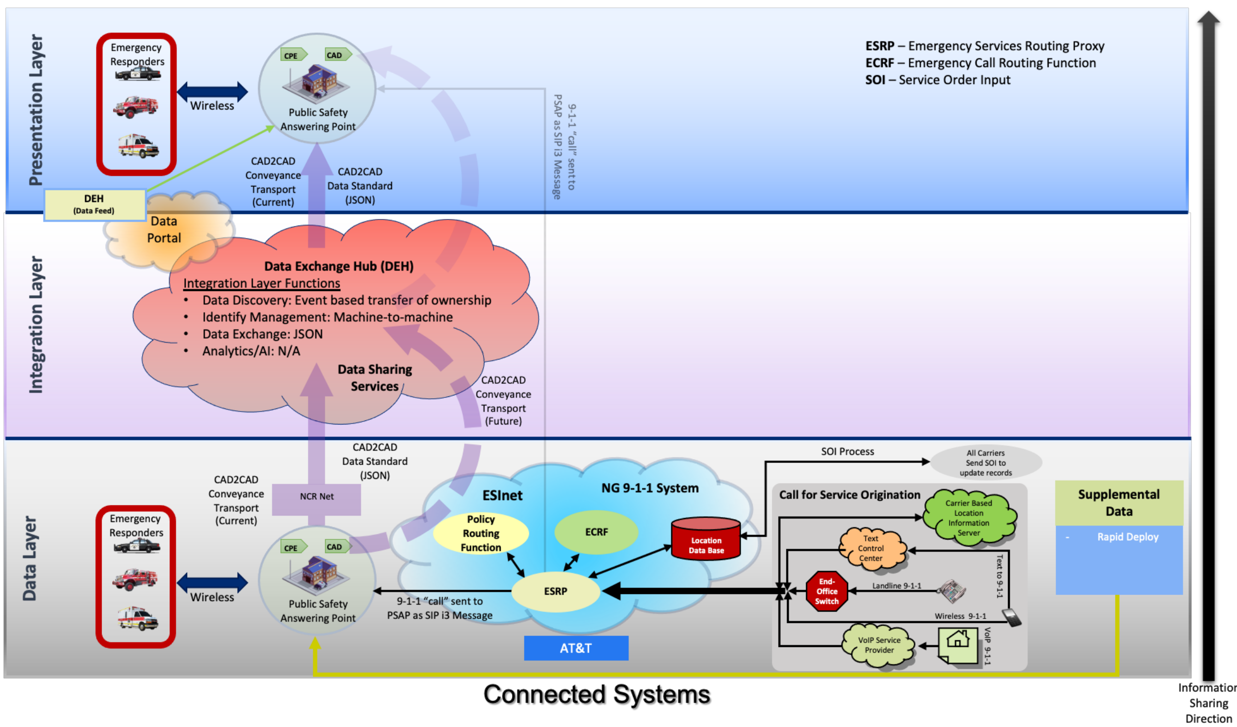

Figure 25: County 1 C2C Implementation along ISF Layers

Figure 25 illustrates the County 1's CAD-to-CAD implementation along ISF layers. Information from the data layer PSAP arrives at the DEH through the NCR net. Supplemental data such as RapidDeploy originates from the data layer as well. The integration layer functions are described in the red cloud, which enables multi-jurisdiction compatibility. Data discovery consists of event-based transfer ownership, as previously discussed, while identity management is machine-to-machine using the Active Directory approach. Data exchange is through JSON and analytics are not implemented in the strictest sense of the

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[12] https://www.ngcadx.com

definition, but the DEH does generate usage and status reports. Between the integration layer and the presentation layer, while there does not exist a universal data portal, there is a data feed out of the DEH to which PSAPs can subscribe.

4.2.2 California Office of Emergency Services (Cal OES)

The ISF project team visited the Cal OES on September 12, 2022. This technical exchange meeting was to share information about ISF principles and for the ISF team to learn how California's statewide ESInet and CAD-to-CAD interoperability systems are implemented.

The ISF and Cal OES personnel participating in the meeting included the California 911 administrator and Statewide Interoperability Coordinator along with additional Cal OES personnel.

The discussion during this technical exchange meeting is also organized along the lines of People, Process, and Technology and the ISF layers.

4.2.2.1 People, Process, and Technology Perspectives

The People, Process, and Technology discussions with Cal OES were highly informative as well.

People

There are 438 PSAPs and 600 public safety entities in California. Information-sharing can be challenging given the scale/scope of the state. Additionally, prior interoperability efforts have tended to be Land Mobile Radio (LMR) and voice-centric in their communications focus. As NG911 unfolds, there will need to be a greater emphasis on data interoperability and sharing information across jurisdictions and agencies. There was discussion of engaging with regional entities within the state on these ISF concepts to help advance the ideas and principles.

Process

Cal OES's perspective as a state-level entity is that it needs to create the proper environment to support change. That is, it needs to provide/promote structures and solutions that will invite the market to engage in a mutually beneficial way. This includes requiring standards-based solutions such as EIDO. Additionally, statewide contracts that can be accessed by local jurisdictions have been made available to local jurisdictions to streamline procurement and promote greater interoperability. In addition to making the procurement process easier, this should provide the same level of capabilities to smaller jurisdictions as it does to large ones and promote a level of standardization. The ISF discussion illustrated that the California implementation experience to date was largely consistent with the ISF concept and it can provide useful lessons learned for state and local jurisdictions to prepare for full NG911 implementation.

Technology

Data interoperability in California is feasible because of the deployment of its ESInet. Transitions plans for the ESInet's deployment began back in 2017 and included development of a statewide ESInet architecture that included any existing ESInets in the state, local telecommunications provider coordination, monitoring and management capabilities, and support for any legacy 9-1-1 services.[13] By 2019, California's ESInet deployment could offer NG911 services for PSAPs throughout the state based on the PSAP's individual network performance needs e.g., network capacity.[14]

Upon establishing its ESInet foundation, Cal OES was able to incrementally build towards NG911 solutions by adding vendors/capabilities. The main public safety cloud vendors used in the state are Amazon Web Services (AWS) and Azure. All other organizations function more as data centers. Experimentation with emerging radio technologies is common in CA such as with Starlink satellite communications technologies or cellular speed tests in rural counties. However, based on coverage and heterogeneous terrain characteristics, LMR technology is still a priority among public safety practitioners. Legacy and emerging technologies can coexist within the ESInet-based architecture California has established.

4.2.2.2 ISF Layers

Data Layer

During the Cal OES discussions, it was mentioned that there could be as many as 50 different vendors being used in the data layer. Therefore, the need for implementation of an ISF-like approach is compelling and necessary in a large state such as California. In California, wildfire camera/drone video footage is an example of common data layer sources. Furthermore, it was noted that key infrastructure partners like water treatment facilities and systems have elaborate camera systems. For example, San Diego gets it water from Los Angeles or the Colorado River and water treatment involves chemicals, which necessitates an extensive security system.

Presentation Layer

One of the common presentation layer tools used among California public safety personnel is RapidDeploy. It is a standalone application along with a web client that has a convenient User Interface (UI). This capability was procured by Cal OES for statewide use and represents an interface between the presentation and integration layers. Cal OES stated that the public often needs more help in receiving incident information than public safety entities do and therefore presentation layer tools directed at the public should also be considered an essential need.

Integration Layer

The technical interchange meeting with Cal OES included several discussion points pertaining to the integration layer. The state has instituted PSAP cloud services which allow for redundancy and duplication to deploy services to the 438 PSAPs found in the state. Joint dispatch centers could have the same CAD system or there could be different CADs in a multi-agency system. Regarding, specific integration layer technology solutions, the state procured RapidDeploy as an over-the-top Geographic Information System solution made available to all PSAPs in California. It also supports supplemental data in its browser, which includes NG-911 information, Uber, etc. The state also procured Rave as a mass notification tool used in

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[13] https://www.caloes.ca.gov/wp-content/uploads/PSC/Documents/0001-NextGeneration9-1-1TransitionPlans.pdf

[14] https://statetechmagazine.com/article/2019/09/esinets-help-public-safety-agencies-move-ng911-perfcon

conjunction with RapidDeploy, and represents another integration layer tool and capability that has been made available to all PSAPs. RapidDeploy, Rave, and RapidSOS coupled with AWS represents a statewide cloud solution. Also discussed was Inteliquent (https://www.inteliquent.com), a company that provides a number of services and solutions to help address disparate data integration.

From a data transport perspective, there were discussions on how 5G networking slicing would be involved in integration layer solutions, but that cellular carriers would not be the only transport entities. Wi-Fi technology, satellite, and other wireless protocols could be present in the integration layer.

Lastly, there were conceptual discussions on the integration layer such as the need to abstract out the integration layer to understand how its presence reduces complexity as data is moved toward the presentation layer. These discussions where insightful as they provided an understanding of the need to determine where the specific integration functions reside (i.e., on premise or in the cloud or a hybrid), which is highly region and jurisdiction-dependent.

4.2.2.3 ISF Implementation of CAD-to-CAD Architecture in CA OES

In addition to the technical interchange meeting discussions, Cal OES also provided architecture diagrams and slides for its CAD-to-CAD implementation. Figure 26 below depicts the ISF project team's adaptation of this implementation to demonstrate alignment with the ISF.

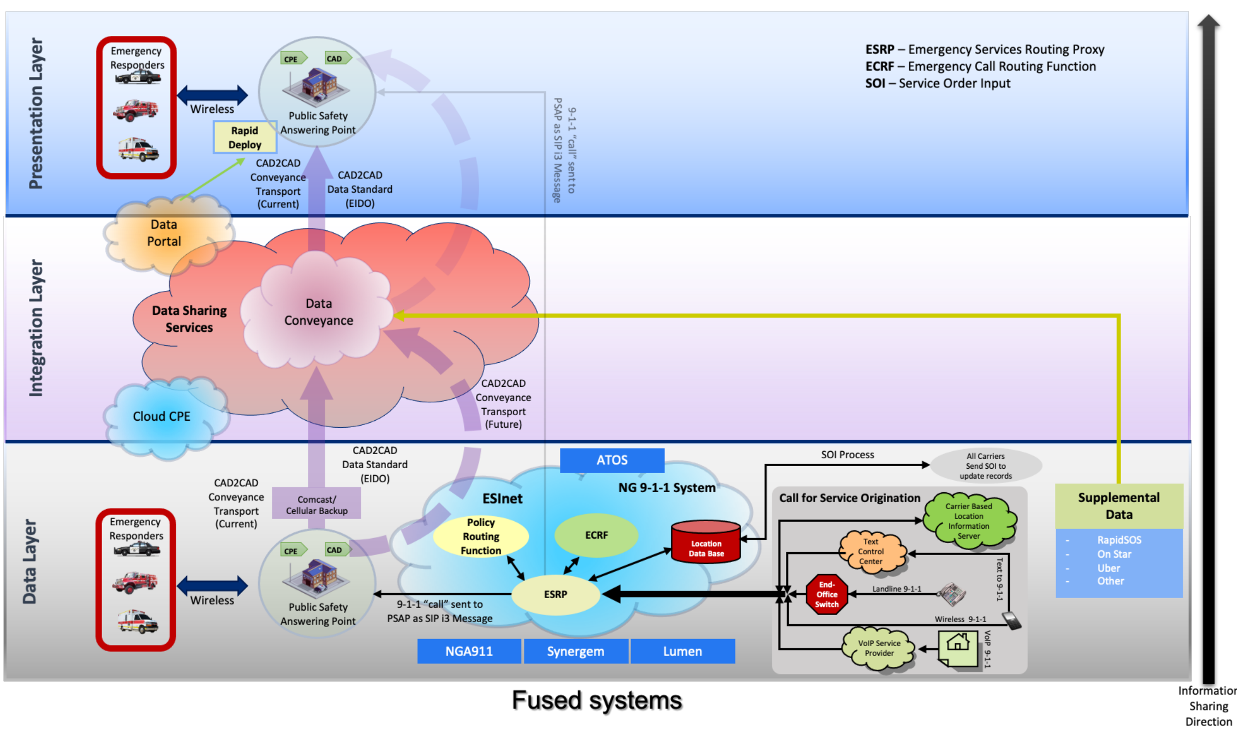


Figure 26: Cal OES C2C Implementation along ISF Layers

In this figure, the lower right of the graphic depicts when a call comes in from the public and how it is processed. Cal OES has procured ESInet providers for each region of the state (shown in blue) such that the call is processed and provided to the PSAP as a Session Initiation Protocol (SIP) i3 message. As the call is input into the initial CAD system, supplemental data may be added in the integration layer via the other partners Cal OES has procured and ultimately published via a data portal to the recipients in the presentation layer. The integration layer provides cloud-based CPE, and data conveyance and sharing capability that could be leveraged in the future for CAD-to-CAD exchange. Transport to the presentation layer is accomplished by whatever provider the PSAP has retained under contract.

From an ISF perspective, Cal OES has required compliance with the EIDO standard in their procurements, selected entities to provide the necessary ESInet service and established a cloud environment for data processing. These actions provide the data discovery, access, exchange and transport functions needed for data interoperability. Still to be addressed is the processing of video and other multimedia as well as any analytic tools to refine the data.

4.2.3 CentralSquare Unify Approach

In addition to engaging with public safety professionals, the ISF project team also had the opportunity to engage with representatives from the vendor, CentralSquare (https://www.centralsquare.com/solutions), a public sector software development company, to discuss their CAD-to-CAD interoperability technology, CentralSquare Unify (CSU). CentralSquare Unify (https://www.centralsquare.com/solutions/public-safety-software/unify-cad-to-cad) is an example of a commercial integration solution for CAD-to-CAD interoperability, which bundles Application Programming Interfaces (APIs) and leverages a JavaScript Object Notation (JSON) approach for open data exchange. The program's objective is to enable CAD information sharing between PSAPs from adjacent jurisdictions that may use different CAD programs. CentralSquare Unify technically collaborates with new vendors entering the emergency communications ecosystem through non-disclosure agreements (NDAs) and service-level agreements (SLAs) and provides testing procedures to ensure the vendor's system interfaces properly with their system. At time this discussion occurred, the data exchanged through CSU consisted of approximately 40 data elements, and certain policies or "business rules" dictated which elements an adjacent PSAP may access.

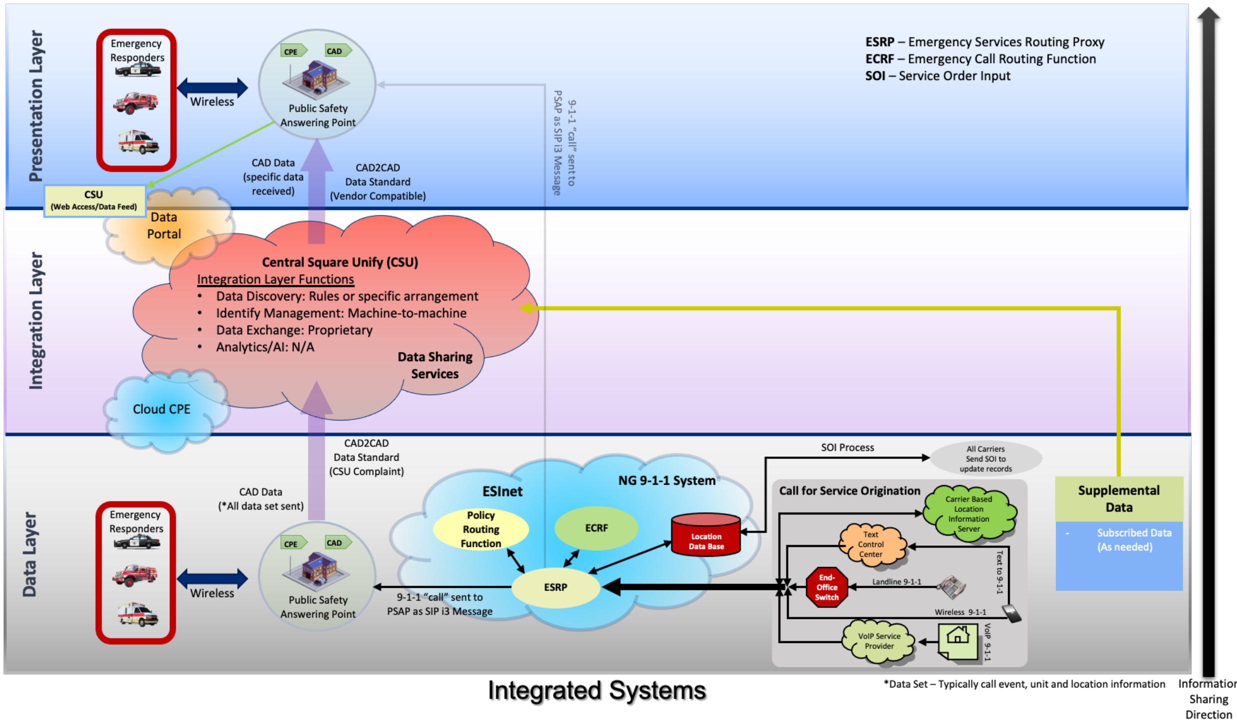


Figure 27: CentralSquare Unify C2C approach across ISF layers

Figure 27 illustrates a CSU-based approach to CAD-to-CAD interoperability, where the CSU program's functionality resides predominantly in the integration layer. The approach to the integration layer functions are listed in the red cloud. At this time detailed analytics are not being generated. Supplemental data from the data layer are used as needed but it is ingested into the integration layer making it available to the presentation layer. Data layer PSAPs are connect to CSU through an encrypted tunnel or fiber to the Hub instance. Data is not sent through the ESInet. The key in achieving interoperability among various CAD commercial solutions is that data are pushed into CSU in the correct format. This is illustrated in 26 by the purple arrow between the PSAP in the data layer into the integration layer and the purple arrow from the integration layer to the PSAP in the presentation layer.

4.2.4 Generalized CAD-to-CAD ISF Implementation

The ISF project team engaged in discussions with numerous stakeholders and analyzed a variety of CAD-to-CAD implementations in jurisdictions such as NCR, California, and Iowa. These efforts led to adaptation and development of several instantiations of CAD-to-CAD architectures along the ISF layers. These diagrams have been presented in previous subsections. The approaches to implementing a CAD-to-CAD interoperability solution can be standards-based using EIDO/EIDD, County 1's approach with its custom integration layer solution, or California's approach, where an open architecture can accommodate an incremental developmental process incorporating solutions across many vendors.

While these approaches are very different from each other, all are valid as they are based on a determination by an individual region or jurisdiction on what its needs are for CAD-to-CAD interoperability. The people and process aspects of the ISF approach play a significant role in ultimately deciding what type of technology approach would be best for a region. The engagements and discussions on these variety of approaches have provided validation of the ISF model as a framework that aligns with real-world implementation of CAD-to-CAD interoperability capabilities.

Figure 27 depicts a generalized CAD-to-CAD implementation along ISF layers adapted from the examples from the various jurisdictions. This generalized implementation consists of several building-block components that represent commonalities among the various implementations that the ISF project team has researched during this effort. In addition to the technical commonalities shown in the figure, each region will need a governance structure and a formal process by which to architect and eventually deploy a data interoperability solution such as CAD-to-CAD.

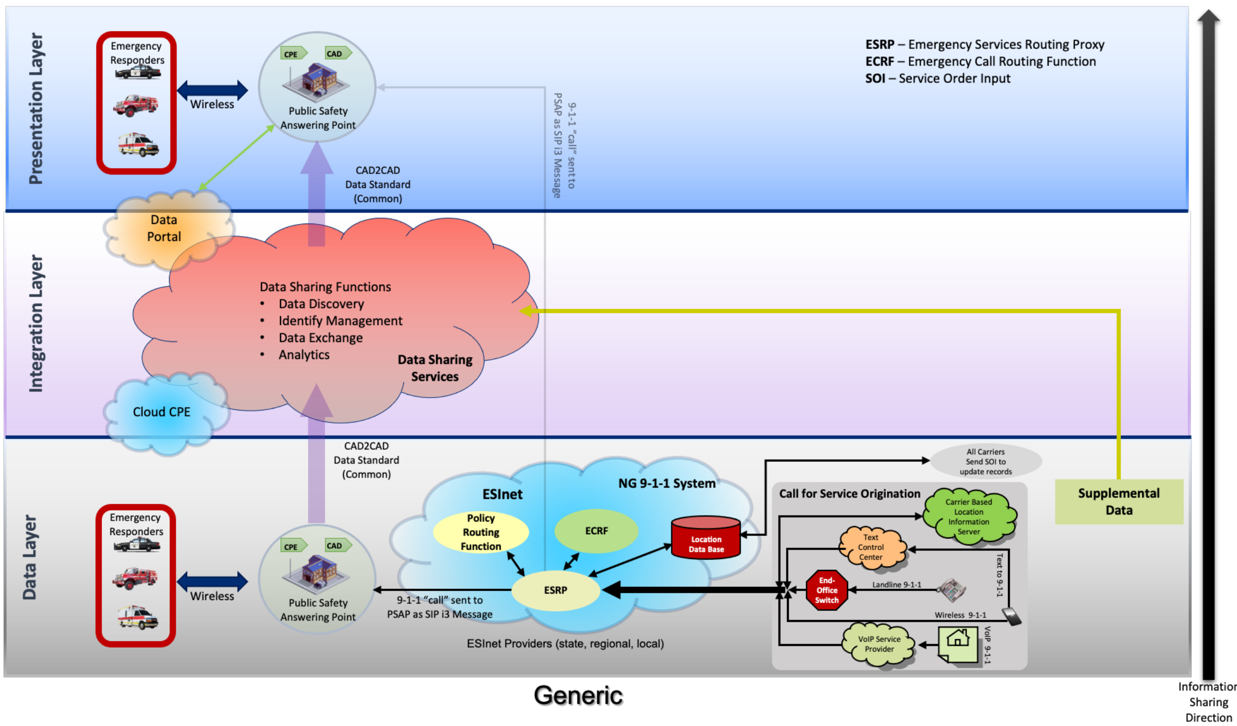


Figure 28: Building Blocks for C2C Implementation along ISF Layers

In Figure 28, starting from the right side of the data layer, private citizens on carrier networks (brown box) dial 9-1-1 to report an emergency. This call traverses the ESInet and an area's NG911 system (blue cloud in the center) and reaches a PSAP (brown circle towards the left). The PSAP has a direct wireless connection to its own jurisdiction's emergency responders (brown rectangle outlined in red) all the way to the left.

If participation with a PSAP in another jurisdiction is required, the CAD-to-CAD functionality in the integration layer is invoked. As shown in the red cloud in the integration layer, there are five fundamental functionalities (the four in the cloud plus Transport) performed at a minimum in order to interoperate with the other coordinating PSAP's CAD system (located in the brown box in the presentation layer). This PSAP connects directly to the emergency responders (rectangle outlined in red to the left in figure above.

Also, as the diagram depicts, there can be additives to the integration layer such as the Cloud CPE functionality (blue cloud between data layer and integration layer), Supplemental Data (green box at bottom right in the data layer provide input to integration layer functionality), the Data Portal (orange cloud between integration layer and presentation layer). The Cloud CPE functionality provides cloud-based access to integration layer capabilities, while the Data Portal provides web-based access for data consumption. Supplemental data can help interoperating PSAPs refine their emergency response. These blocks can enhance the integration layer's capabilities and be customized to each jurisdiction's specific needs.

Often, CAD-to-CAD interoperability systems are assembled incrementally as public safety needs expand and evolve. This incremental assembly can often be conducive to promoting interoperability as it avoids a single vendor occupying solutions along all three ISF layers. A vendor-agnostic approach that is cloud- and standards-based enables the scalability of a region's CAD-to-CAD interoperability approach.

This "generic" approach to integration layer components to achieve CAD-to-CAD interoperability is the culmination of what has been learned by the entities already providing this service. It moves data sharing to the cloud, accommodates the incorporation of other data sets, provides CPE capability for resilience and provides a portal for visibility into calls for service. This modular design allows for a variety of vendors to provide component functional pieces and avoids proprietary data formats. This approach can better position a jurisdiction for NG911 as additional integration layer components can be added to process multimedia while still leveraging the integration layer functions (discovery, identity management, data exchange, and transport). This approach can also allow for the overlay of a data analytics component in the integration layer. As noted above, these integration layer components can be instituted in an incremental way so that this design would constitute a "roadmap" a jurisdiction can work toward as resources allow.

5 Summary and Conclusions

The ISF approach actively considers the three dimensions of interoperability essential to success: People, Processes and Technology. Equal consideration to all three will allow public safety practitioners the ability to mutually develop requirements for an interoperable information sharing ecosystem. Some of the specific elements that need to be addressed from these three perspectives include:

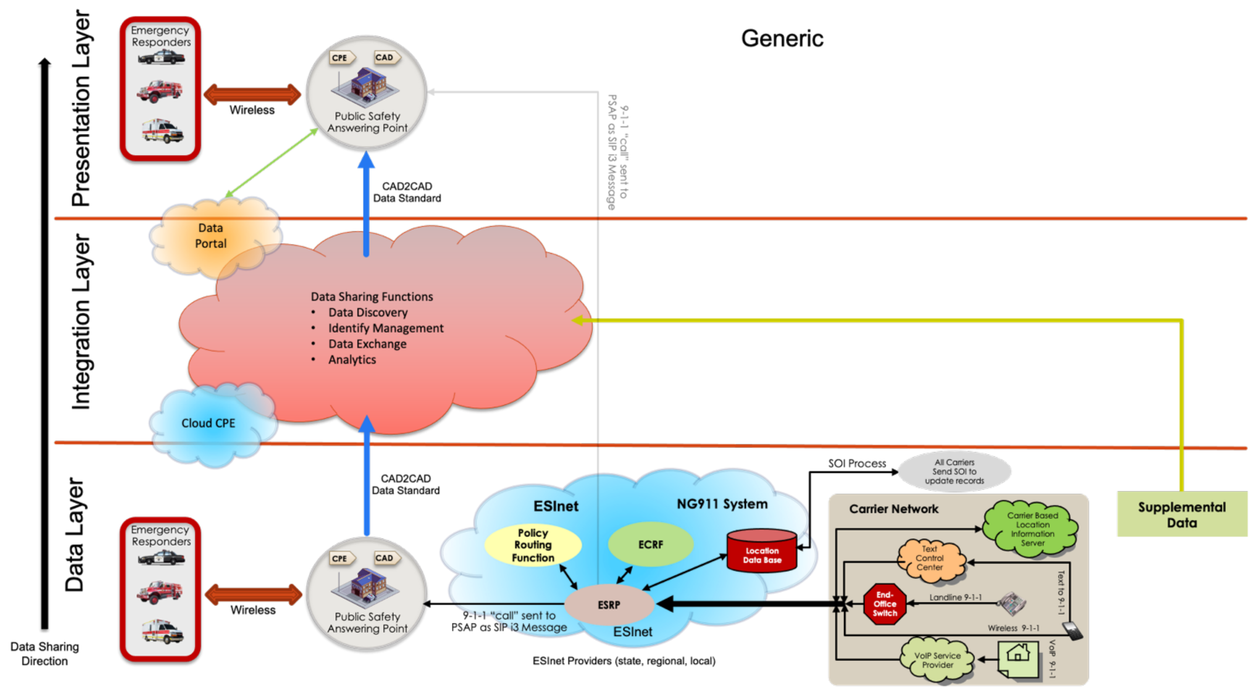
- Are the right people involved in this information sharing initiative?
- Are they committed to working together to solve the issue?
- Have they worked through a process to address the technology specifics? (e.g., data structure, transport/messaging protocols, information requests, networks interconnectivity.)

This report illustrates the application of the ISF to PSAPs and their CAD systems, and demonstrates how the ISF can support a jurisdiction's (Iowa) current efforts to address CAD-to-CAD information sharing requirements. Additionally, highlights other interoperable CAD efforts in the U.S. It also provides an exemplar of how using the ISF can help to *inform and guide the transition of public safety information systems to a more common approach that can be readily adopted by any set of public safety entities to create a more interoperable environment for sharing actionable information.* This report also describes how the ISF project team engaged with the Iowa stakeholders to help ensure an understanding of the ISF approach and its benefits for achieving data interoperability for CAD systems.

The project team's research for this effort began with a CAD-to-CAD interoperability and NG911 readiness survey. Outcomes from this research provided information to help assess readiness and shape future on-site engagement activities with the stakeholders. Based upon the survey results, readiness in the Des Moines area was high and most jurisdictions were planning to upgrade to their CAD systems in the near term to include adopting a commercial CAD-to-CAD interoperability application known as CentralSquare Unify. While this approach certainly meets the needs of the Iowa partners, the project team also researched other approaches to CAD-to-CAD interoperability to provide more comprehensive options. The team reached out to County 1, Virginia and the state of California to learn more about their experience. County 1, as part of the larger National Capital Region, has utilized customized code in the ISF integration layer to allow for mutual aid dispatching across counties. California provided a statewide ESInet, and also procured specific vendor applications and cloud services to enable the integration layer functions. Either approach worked well for the respective jurisdiction. A lesson learned is that other options are worth considering and the eventual solution is based on each region's or jurisdiction's individual needs.

The ISF methodology proved to be of benefit for identifying the data and presentation layer elements and then discussing the discovery/access/exchange/analysis and transport functions of the integration layer for presenting usable information. With some additional effort, this three layer ISF view could lead to a detailed network diagram of what existing systems can be leveraged or extended to facilitate the integration layer functions and improve data interoperability. It is important to note that this exemplar of developing a view of the ISF components considers existing systems and how they can be leveraged first and foremost to achieve the desired information sharing. It is likely some discussion of prioritization is also necessary, as some information sharing may be relatively simple and cost effective to achieve through existing systems, whereas other information sharing activities may require procurement of a new system or feature.

Consistent with ISF principles and largely based upon the California experience, a generic three-layer model has been developed as a more standardized way of approaching CAD-to-CAD information sharing and better position a jurisdiction for NG911. That general model, also referenced in the Executive Summary, is shown below.



Notional CAD-to-CAD ISF Architecture

Based on this framework view, the state of Iowa could consider developing a roadmap to NG911 that moves beyond provisioning of the ESInet to applications and cloud-based services that will support data interoperability. This approach will provide a capability for data sharing, a portal for end user access to the data with appropriate controls, will support call routing, and conform to data standards. This approach is also inclusive of various CAD and presentation layer applications, is scalable and positions the jurisdiction for handling NG911 multimedia data.

Overall recommendations moving forward for Iowa with respect to CAD-to-CAD interoperability include:

- Stronger focus on the People and Process interoperability components to include governance and funding.
- Considerations on how the integration layer functions can be provided, such as:
  - Cloud solutions in the ultimate architecture
  - Choosing a data standard and requiring that be followed in any procurement
  - Plan for the ability of any procured system to scale to statewide over time
  - Data sharing portal and "dashboard" that will allow partners to access selected data in the CAD system securely.

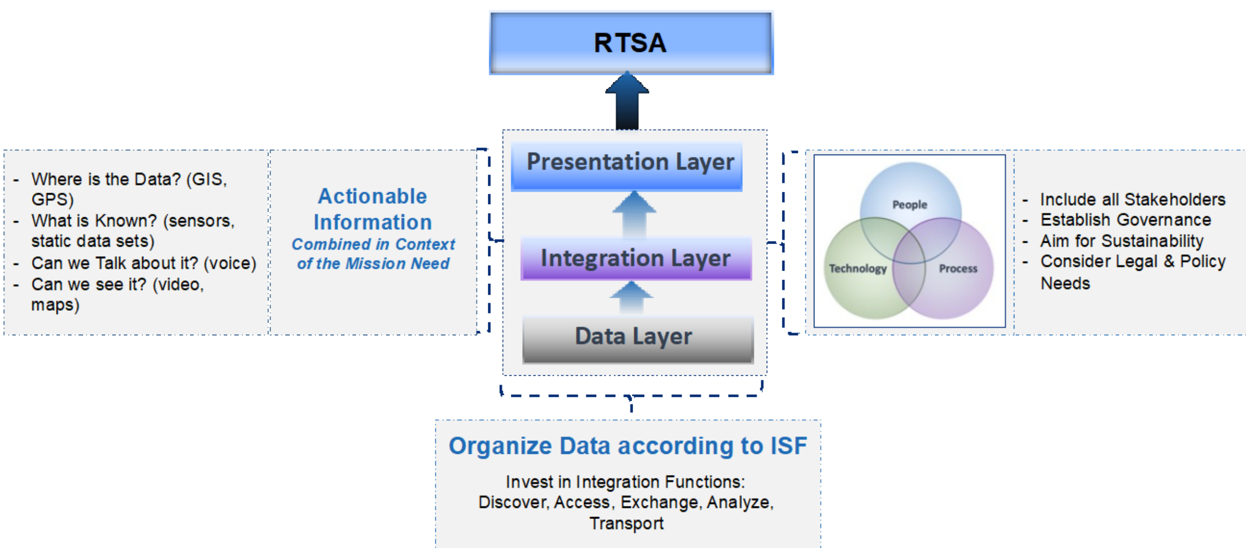
- Plan for incorporating supplemental data services
- Leverage the state ESInet for PSAP to PSAP communications

While the recommendations above are important to the Iowa CAD initiative, it is important to note the larger purpose for improving data interoperability across public safety entities. Improved data sharing will lead to (near) real time situational awareness (RTSA) which will result in more timely and effective decision making during a critical event. This is an important goal that public safety agencies are pursuing in their technology applications, and outcomes from this effort will prove beneficial as public safety communities pursue solutions to improve their RTSA. This report provides insight on the ISF approach and recommends that, in order to achieve RTSA, public safety entities must address the following three key elements:

- Specific focus on People, Process, Technology
- A structuring of systems and data according to the ISF
- Access to relevant data to develop actionable information

These are depicted in the figure below.

Achieving Real Time Situational Awareness (RTSA)



Achieving RTSA requires combining key data in context and asking the right questions about the available data for specific missions. This involves reaching out to the owners of the data and developing processes for sharing these data. These processes might include agreements addressing data quality/security/timeliness and other factors.

In summary, the purpose of this report was to illustrate the various aspects of the ISF and how it may be applied to CAD interoperability for improved RTSA. This effort proved beneficial as it supported the participants' desire to improve the efficiency and effectiveness of public safety communications and information sharing. It provided the ISF tools and techniques to analyze the current environment and recommendations for Iowa to consider in their planned CAD acquisition. With the application of the ISF, a more detailed architecture specific to their systems can be developed and a technical roadmap anticipating their evolution to NG911 can be established. These steps will allow the state of Iowa to work toward a more interoperable public safety communications and information sharing ecosystem and maximize their technology investments for improved situational awareness.

Appendix A Iowa Focus Group Participant Stakeholder Jurisdictions

Jurisdiction	Address
State of Iowa Statewide Interoperability Coordinator	Iowa Department of Public Safety 215 E. 7th St., Ste. 450 Des Moines, IA
Des Moines PD	25 East 1st Street Des Moines, IA 50309
Des Moines State Radio	6100 NW 78th Avenue, Johnston, IA 50131
Polk County	6023 NE 14th Street Des Moines, IA 50313
Westcom	8055 Mills Civic Parkway West Des Moines, IA 50266
Iowa DPS - Des Moines State Radio	215 E. 7th St., Ste. 450 Des Moines, IA
Story County	1315 S B Ave Nevada, IA 50201
Ames	515 Clark Ave Ames, IA 50010
ISU Police	2519 Osborn Drive, Ames, Iowa, 50011
Dallas County	25747 N Ave Ste E Adel, IA 50003
Boone County	1019 W. Mamie Eisenhower Boone, Iowa, IA 50036
Warren County	115 North Howard Street Indianola, IA 50125
State of Iowa 911 Program Manager	6100 NW 78th Ave Johnston, IA 50131
Perry Police Dept.	908 Willis Ave Perry, IA 50220

Appendix B Acronyms

Acronym	Definition
AWS	Amazon Web Services
APL	Johns Hopkins Applied Physics Laboratory
C2C	Cad-to-Cad (CAD2CAD)
CAD	Computer Aided Dispatch
CFS	Call for Service
CISA	Cybersecurity and Infrastructure Security Agency
CONOPS	Concept of Operations
CPE	Customer Premise Equipment
CSU	CentralSquare Unify
DEH	Data Exchange Hub
DHS	Department of Homeland Security
ECD	Emergency Communications Division
ECRF	Emergency Call Routing Function
EIDD	Emergency Incident Data Document
EIDO	Emergency Incident Data Object
ESINets	Emergency Service Internet Protocol Networks
ESRP	Emergency Services Routing Proxy
FirstNet	First Responder Network Authority
GIS	Geographic Information System
GPS	Global Positioning System
HSEMD	Homeland Security and Emergency Management
IC	Incident Command
IP	Internet Protocol
ISF	Information Sharing Framework
ISFTF	Information Sharing Framework Task Force
IT	Information Technology
ITSL	IT Service Unit Leaders

JSON	JavaScript Object Notation
LMR	Land Mobile Radio
MACH	Mobile Architecture for Communication Handling
MDT	Mobile Data Terminal
NCSWIC	National Council of Statewide Interoperability Coordinators
NCR	National Capital Region
NECP	National Emergency Communications Plan
NG911	Next Generation 911
NPSTC	National Public Safety Telecommunications Council
PSAP	Public Safety Answering Point
RMS	Record Management Systems
RTSA	Real Time Situational Awareness
SAFECOM	DHS CISA managed organization, not an acronym
SIP	Session Initiation Protocol
SOI	Service Order Input
TFR	Task Force Responders
VoIP	Voice Over Internet Protocol
WashCOG	Washington Coalition for Open Government
XML	Extensible Markup Language

Appendix C PSAP NG911 DATA

Legend: Majority Yes; Majority N/A or Unknown; Majority No

	NG911 Readiness Survey: Summary of Aggregate Results Based on the SAFECOM Self Assessment	Yes	No	Unknown	N/A	No Answer	Aggregate Assessment	ISF Components
Local Governance and Planning	Are there ongoing efforts to encourage collaboration among NG911 and other public safety governance bodies (e.g., broadband, other jurisdictions) to promote interoperability? If "YES", identify collaborators or governance bodies.	5	0	2	0	2		People Process
	Have you executed strategic plans for NG911 system requirements (e.g., NIEM, standards) adopted and implemented? If "YES", explain.	1	6	1	0	1		Process
	Have you executed strategic plans for system interoperability (e.g., GIS, CAD) been adopted and implemented? If "YES", describe systems.	5	2	1	0	1		Process
	Has joint 911/NG911 MOU for multi-jurisdictional cooperation been adopted and implemented? If "YES", list jurisdictions.	1	2	5	0	1		People Process
	Has a governance body been aligned with the Statewide Communications Interoperability Plan (SCIP)?	2	1	4	0	2		People Process
	Are you actively coordinating with other (adjoining) ECCs/PSAPs to address challenges associated with the evolving emergency communications landscape? If "YES", with which ECCs/PSAPs?	7	0	0	0	2		People, Process
	Have you promoted economies of scale (to reduce overall cost) and interoperability by instituting cooperative purchasing agreements or offering master purchasing agreements for the acquisition of NG911 capabilities? If "YES", with which PSAPs, agencies or others?	3	2	1	1	2		Process
Next Generation Core Service (NGCS) Elements	Have logging capabilities for Next Generation Services been fully implemented and maintained (recording of incoming call data)?	5	1	2	0	1		Technology
ECC/PSAP Call Handling System & Applications	Are you using a singularly connected interoperable multimedia call handling system? If "NO", describe if your call handling system is IP based or planned to be IP based.	5	2	1	0	1		Technology
	Does mapping occur directly in CAD?	7	2	0	0	0		Technology
	Does your system route multimedia information?	1	2	5	0	1		Technology
	Has logging and recording of NG911 multimedia data been implemented?	4	3	2	0	0		Technology
Optional Interfaces	Is computer-aided dispatch (CAD) being used? If "YES", describe how it is being used.	8	1	0	0	0		Technology
	Is a broadband field network being used and which carrier (e.g., AT&T, FirstNet, Verizon, etc.)? If "YES", identify which carrier.	6	3	0	0	0		Process Technology

Figure 13: Aggregate PSAP NG911 Survey Data

Legend	
PSAP Response	Aggregate Assessment
Yes	Majority Yes
Unknown, N/A, No answer	Majority No, Unknown, N/A, No answer
No	Majority No

	NG911 PSAP Readiness Survey: Based on the SAFECOM Self-Assessment	ISU	DMPD	AMES	DALLS	DSM	POLK	STORY	WESTCOM	BOONE	Yes	No	Unknown	N/A	No answer	Aggregate Assessment	ISF Components
Local Governance and Planning	Are there ongoing efforts to encourage collaboration among NG911 and other public safety governance bodies (e.g., broadband, other jurisdictions) to promote interoperability? If "YES", identify collaborators or governance bodies.	Unknown	Yes		Yes	Yes	Yes	Yes	Unknown		5	0	2	0	2		People Process
	Have you executed strategic plans for NG911 system requirements (e.g., NIEM, standards) adopted and implemented? If "YES", explain.	Unknown	No	No	Yes	No	No	No	No		1	6	1	0	1		Process
	Have you executed strategic plans for system interoperability (e.g., GIS, CAD) been adopted and implemented? If "YES", describe systems.	Unknown	Yes	Yes	Yes	No	No	Yes	Yes		5	2	1	0	1		Process
	Has joint 911/NG911 MOU for multi-jurisdictional cooperation been adopted and implemented? If "YES", list jurisdictions.	Unknown	Unknown	Yes	Unknown	No	Unknown	Unknown	No		1	2	5	0	1		People Process
	Has a governance body been aligned with the Statewide Communications Interoperability Plan (SCIP)?	Unknown	Unknown		Yes	Yes	Unknown	Unknown	No		2	1	4	0	2		People Process
	Are you actively coordinating with other (adjoining) PSAPs to address challenges associated with the evolving emergency communications landscape? If "YES", with which ECCs/PSAPs?	Yes	Yes		Yes	Yes	Yes	Yes	Yes		7	0	0	0	2		People Process
	Have you promoted economies of scale (to reduce overall cost) and interoperability by instituting cooperative purchasing agreements or offering master purchasing agreements for the acquisition of NG911 capabilities? If "YES", with which PSAPs, agencies or others?	Yes	Yes		N/A	Unknown	No	Yes	No		3	2	1	1	2		Process
Next Generation Core Service (NGCS) Elements	Have logging capabilities for Next Generation Services been fully implemented and maintained (recording of incoming call data)?	Unknown	Yes	Unknown	Yes	Yes	Yes	No	Yes		5	1	2	0	1		Technology
ECC/PSAP Call Handling System & Applications	Are you using a singularly connected interoperable multimedia call handling system? If "NO", describe if your call handling system is IP based or planned to be IP based.	Unknown	Yes		Yes	Yes	Yes	No	No	Yes	5	2	1	0	1		Technology
	Does mapping occur directly in CAD?	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	7	2	0	0	0		Technology
	Does your system route multimedia information?	No	Unknown	Yes		Unknown	Unknown	Unknown	Unknown	No	1	2	5	0	1		Technology
	Has logging and recording of NG911 multimedia data been implemented?	No	Yes	Unknown	Yes	Yes	Unknown	No	No	Yes	4	3	2	0	0		Technology
Optional Interfaces	Is computer-aided dispatch (CAD) being used? If "YES", describe how it is being used.	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	8	1	0	0	0		Technology
	Is a broadband field network being used and which carrier (e.g., AT&T, FirstNet, Verizon, etc.)? If "YES", identify which carrier.	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No	6	3	0	0	0		Process Technology

Figure 14: Summary of PSAP NG911 Survey Data