National Highway Traffic Safety Administration

911 DataPath Pilot Evaluation Report

September 2023

Final Report

National 911 Program

911.gov

About the National 911 Program

The National Highway Traffic Safety Administration (NHTSA) National 911 Program (Program), in the Office of Emergency Medical Services (OEMS) at the United States (U.S.) Department of Transportation (DOT), provides leadership and coordination of federal efforts that support 911 across the nation. A seamless interoperable 911 system-of-systems across the U.S. advances NHTSA's mission to eliminate fatalities, illness, and injuries from motor vehicle crashes and improve post-crash care.

The Program works with many stakeholders—including federal, state, local, tribal, and territorial (FSLTT) governments, technology vendors, public safety officials, and 911 professionals—toward a goal of advancing 911 that takes advantage of existing and emerging communications technologies, improving response times and information available to first responders prior to and during a 911 incident.

About this Document

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Contributors

The National Highway Traffic Safety Administration (NHTSA) National 911 Program (Program) would like to thank the following organizations for their participation as 911 DataPath Pilot sites. Without the generous contribution of staff experience and expertise from these public safety answering points (PSAPs), also referred to as emergency communication centers (ECCs), the completion of the pilot would not have been possible.

PSAP Pilot Participants

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Executive Summary

The National Highway Traffic Safety Administration (NHTSA) has set a goal of enhancing the 911 community's ability to improve traffic safety through better emergency-response outcomes. This largely will be achieved through the generation and sharing of actionable data—the more the better.

Public safety is becoming more data driven. Data is invaluable to public-safety agencies because it can be leveraged to locate emergency callers, especially in the 911 environment, and provide the situational awareness needed by first responders—both in the public safety answering points (PSAPs), also referred to as emergency communications centers (ECCs), and in the field—to perform their roles effectively and, in the case of field personnel, as safely as possible.

The advancements in 911 technology provide first responders with more detailed and accurate data about the 911 caller. Sharing this data between first responder agencies is vital to improving response times and outcomes and providing robust situational awareness. Consider that the first hours after a traumatic injury has occurred are the most critical in terms of successful emergency treatment. Thus, the faster a PSAP can dispatch the appropriate response, which hinges on the immediate availability of high-quality data, the more likely that traffic-crash victims, for example, will survive their injuries.

Next Generation 911 (NG911) enables features and functions not available in the legacy 911 environment—including the transfer of calls and sharing of 911 call data between all the nation's PSAPs. In this environment, data consistency and uniformity take on special significance as does cooperation and collaboration among PSAPs. While standards development organizations (SDOs) have completed standards for NG911 system infrastructure components, to date, there is no national uniform set of 911 data elements utilized by PSAPs to receive, process, and share 911 data information—hampering efforts to provide consistent data for 911 decision-making at all levels of government. The completion of a national uniform 911 data system is essential to the advancement of 911. A national uniform data system was included in the formal recommendations of the 911 community to the Federal Communications Commission's (FCC) Task Force on Optimal Public Safety Answering Point (PSAP) Architecture (TFOPA).

In September 2017, a project was initiated by NHTSA's National 911 Program (Program), housed in the Office of Emergency Medical Services (OEMS), to bring national 911 experts together to create a strategic plan for a national uniform 911 data system. The final deliverable of that project, entitled *911 Data & Information Sharing: A Strategic Plan*, describes a future environment where data can be exchanged on a scheduled, ad hoc, or live basis and contains five strategic goals. The five goals, as noted in the strategic plan, "support a vision of routine sharing of 911 data and enhanced data-driven decision making as it relates to administrative, operational, and technical factors of 911 planning, management, and delivery."[1]

[1] 911_Data_Information_Sharing_Strategic_Plan_Final.pdf

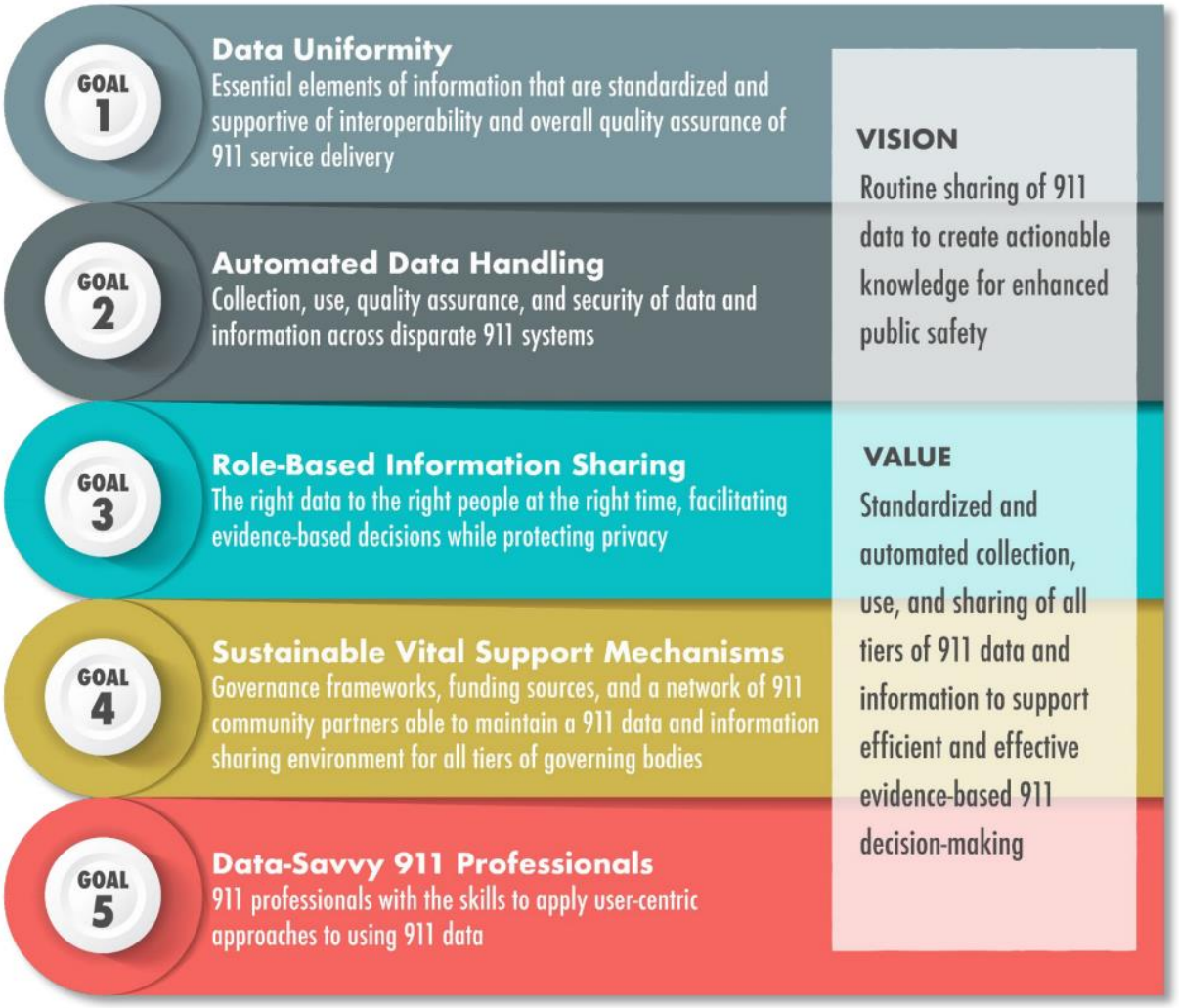

Figure 1: 911 Data and Information Sharing – A Vision, Its Value, and Five Strategic Goals for Getting There

The first step toward achieving the goals set forth in the strategic plan was to develop a data set and data dictionary that identify and describe essential elements of information relevant to 911 decision-making. A framework document was also created describing a notational concept for exchanging 911 data.

The goal of this 911 DataPath Pilot project is to test this framework and data dictionary with a set of PSAP participants. The project also identifies and assesses the benefits and challenges associated with deployment and operation of the 911 DataPath.

This report, *911 DataPath Pilot Evaluation Report*, details the outcomes of the pilot. From January 2022 through April 2022, the project team began work on the repository and assembled the participant pool. The project was formally kicked off with the pilot participants on May 9, 2022. The project team then met with each participant to set up the data collection methodology between their call-handling equipment (CHE) and their computer-aided dispatch (CAD) system and the 911 DataPath repository. Initially, the pilot was only going to collect administrative data; expanding the pilot to a subset of CAD data elements was determined to be in the best interest to test the ability to collect data automatically.

The CHE data was collecting data automatically by receiving a data feed, but the CAD data allowed the pilot to test the ability to query other databases and use that data for analysis and report functions.

The pilot data collection process occurred from May 2022 to May 2023. The first part of the process was to pre-configure a device for each site from the system information that was gathered. These devices were sent to the participants and participant staff installed and interconnected them to their systems. The pilot staff then tested the data exchange and made changes to the configuration to gather the planned data elements from each system. It took several months to install and update the configurations for all systems. Actual data collection occurred from November 2022 to May 2023.

During the data collection timeframe, the project team met with the pilot participants and additional 911 professionals to identify the necessary elements of an effective data-sharing governance framework and the applicable requirements. The team also created the web portal (input) for manual data element entry and the data analysis report (output).

This pilot identified items that will need further research and development prior to a full regional and statewide deployment:

- **Staffing Challenges:** Depending on the size of the PSAP, there are staff time constraints and challenges with understanding the CHE and CAD systems. There are also information technology (IT) resource constraints and competing priorities.
- **Data Dictionary**: Vendors and PSAPs do not speak the same language. There are often multiple ways to describe data functions. Some data descriptions mean different things to different PSAP personnel, and some data descriptions need clearer explanations for ease of understanding.
- **Repository Development**: Formal policies and procedures should be defined to set up an automated process to manage and remove the files created throughout the process of data collection.
- **Interface Challenges**: Cybersecurity lockdowns make it more difficult to make adjustments, data formats change more frequently, and the age of equipment and software version levels can have big impacts.
- **Portal Input**: There is not a set of commonly understood terms for the data elements, which result in the need for more wording for the various data labels and descriptions in the portal.
- **Portal Output**: The data that was collected directly from CHE and CAD systems was not standardized, making it difficult to use the data for analysis and comparison.

A commonly understood data set and data dictionary that identifies and describes essential elements of information relevant to 911 public safety data is key to ensuring the data collected is comparable. Once the data is collected it can be used to analyze how effective 911 call response is to impacting highway traffic safety and emergency response outcomes. These areas represent opportunities as public safety stakeholders consider next steps for expanding the automated collection of data to a state and nationwide focus for the facilitation of universal 911 data sharing that supports multi-agency collaboration; a more visible 911 landscape; informed decision-making at local, regional, state, and national levels; and—most importantly—more efficient response to emergency incidents.

Call to Action:

The public-safety community—specifically the 911 community—needs to rally behind the support of a uniform method to collect data at the local, regional, state, tribal, and federal levels for better-informed 911 and emergency-response decision-making. This ongoing initiative should minimally:

- Drive consensus regarding standards used to define terminology used in the data-collection process
- Create an enhanced data dictionary that associations, 911 centers, and vendors will use to ensure the ability to generate data that is measurable and universally understandable
- Drive consensus regarding data-collection and sharing to include the following:
    - Agreement on standardized language and definitions
    - Agreement on how data is collected, stored, and exchanged
    - Agreement on how data is used and by whom
    - Agreement on how data is secured
    - Agreement on how to train personnel to interpret the data

1 Overview

1.1 Pilot Preparation

1.1.1 System Development

In preparation for the 911 Datapath Pilot participation, the National Highway Traffic Safety Administration (NHTSA) National 911 Program's (Program) technical project team, developed a comprehensive system that includes a repository, data interfaces, a user interface, a data processing pipeline, and data monitoring. To ensure the system was robust, scalable, and secure, the Program leveraged Amazon Web Services (AWS) managed services. The diagram below illustrates the components and their interactions.

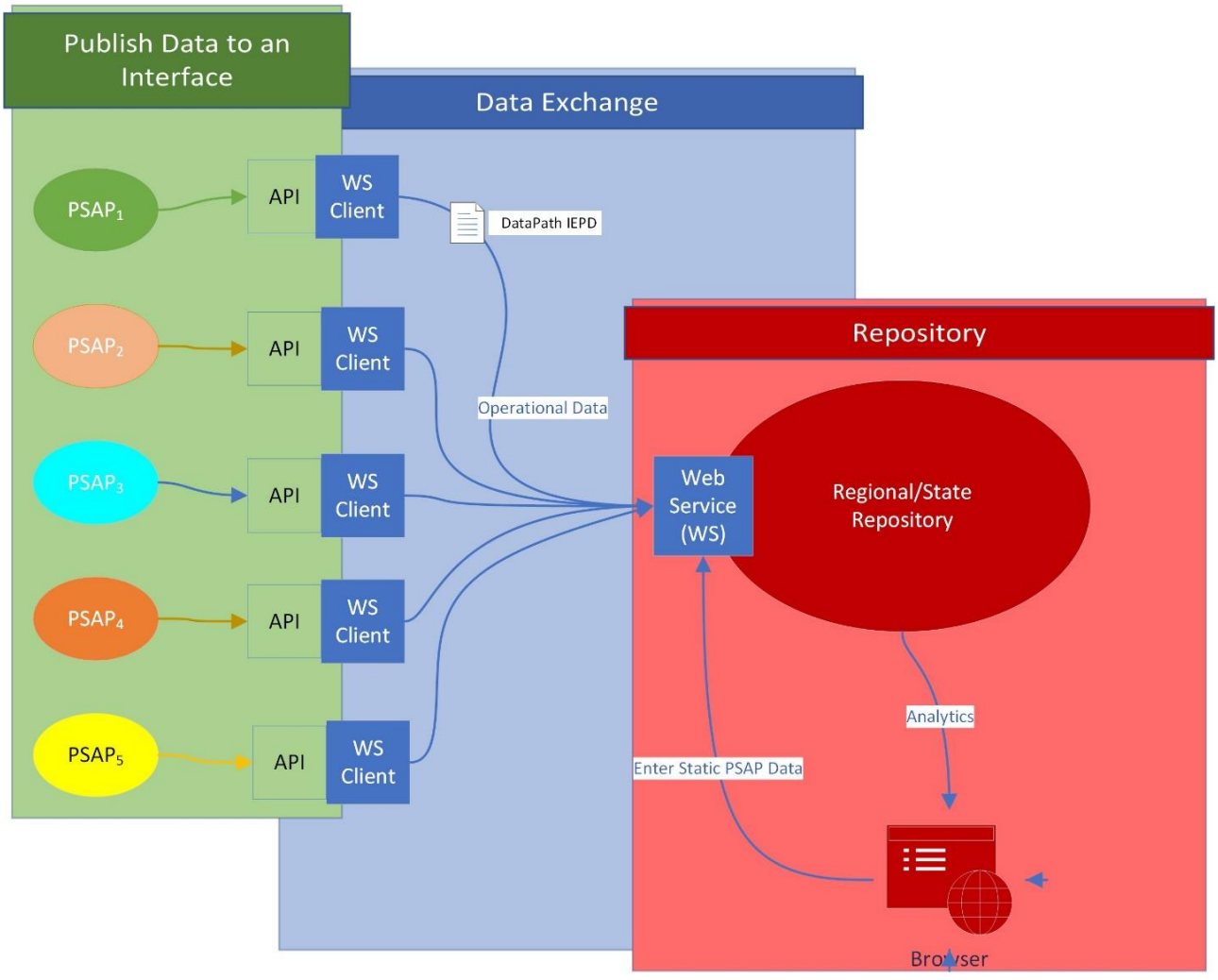

Figure 2: 911 DataPath Infrastructure

1.1.2 Repository

The project team developed a robust repository to store 911 DataPath data sets that can be manually entered through the web user interface or automatically collected from call-handling equipment (CHE) and computer-aided dispatch (CAD) systems. The repository provides web service interfaces to enable the submission of data from multiple sources. AWS was utilized to support this project, providing a scalable and secure cloud infrastructure to store and manage the data in a highly available and durable manner. This ensured the data was always accessible and protected against data loss or unauthorized access.

1.1.2.1 Interfaces

1.1.2.1.1 User Interface

The project team developed a user-friendly web-based interface (i.e., web portal) that allowed authorized administrative staff at the public safety answering points (PSAPs) (or emergency communications centers [ECCs]) to manually enter data into fields that were not automatically captured through web service interfaces. This interface was designed to be intuitive and easy to use, with clear instructions and guidance to ensure accurate and complete data entry. The interface was also designed to be secure, with appropriate access controls and encryption measures to protect the data entered by authorized personnel.

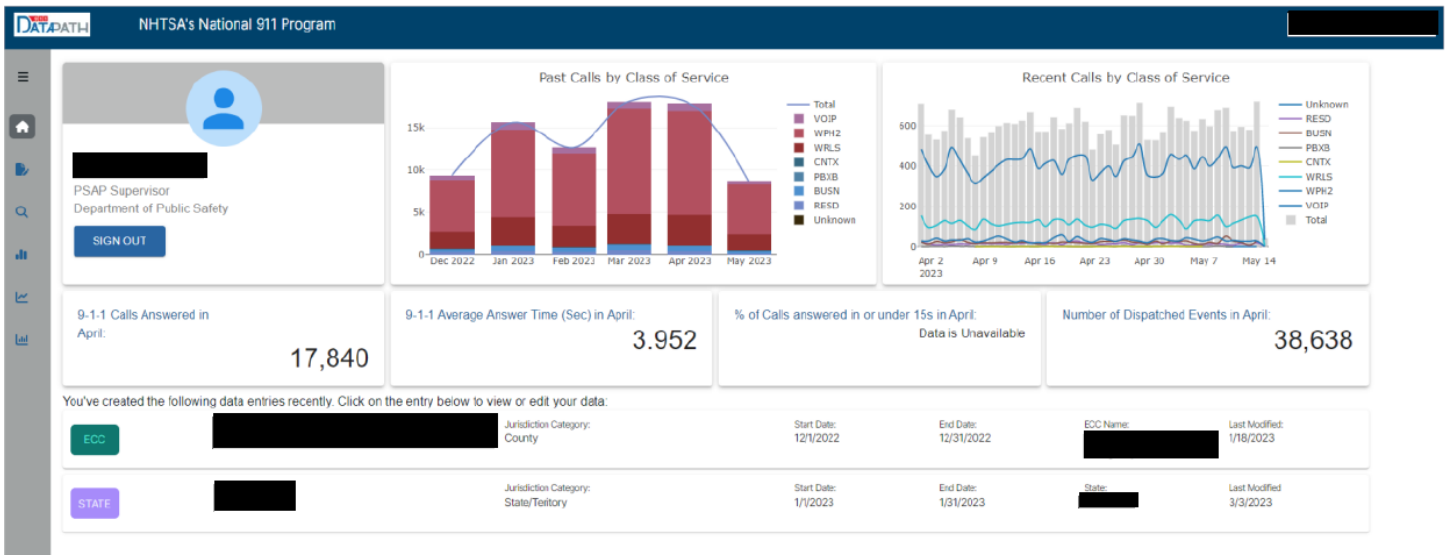

Figure 3: Portal Home Page

The portal is split into six pages: home, data entry, search, CHE dashboard, CAD dashboard, and ECC dashboard.

The home page, shown in Figure 3, showed basic visualizations and metrics of the user's organization over the past month. The home page also showed the most recently modified data entries accessible to the user. By clicking on these entries, the user could access the entry to read or edit it.

The data entry page prompted the user to select the month for which they would like to enter data (Note: it was limited to one entry per month). The user could then enter their data by typing within the text boxes available, selecting an option from a dropdown, or using a slider to indicate yes/no. The different data fields were grouped into categories and the user could click on different tabs to fill in those categories. Initially, there may have been many fields for the user to complete, but after the first save, any data fields that were likely to remain the same (e.g., Available Positions equipped as Call Taking Only with only 911 Call Handling Equipment) would be auto filled with the most recent data entries data. If a field had changed, the user was free to change it, but otherwise the data carried over to save the user's time.

The search page allowed the user to search for any data they had permission to access. This included all their CAD, CHE, and PSAP data as well as summary data for their respective state; for the pilot, all participants were considered a single state. There were basic and advanced search options—a basic search would inspect all fields for the searched term, while an advanced search worked as a filter on explicit fields.

The final three pages—CHE dashboard, CAD dashboard, and ECC dashboard—provided users the ability to create visualizations of the respective data type.

A user had to provide proper credentials to access any page. When each user was created, their PSAP was identified using a unique agency identifier so all members of that PSAP had access to the same data and dashboards.

1.1.2.1.2 Data Merge

The raw data collected from the CAD and CHE interfaces was stored in a temporary file in almost real time. To continuously ingest data from the file and transform it into JSON[2] (an open standard file format), a data merge pipeline was developed; the transformed data was then loaded into the repository.

1.1.2.1.3 PSAP Interfaces

CHE

To collect call information data, the project team collaborated with each PSAP to configure its CHE to deliver serial call detail records (CDRs) and automatic number identification (ANI)/automatic location identification (ALI) data to an Internet Protocol (IP) buffer device. The IP buffer device received the serial data from the CHE and converted it to ASCII[3] data. The IP buffer device was also configured to send the converted ASCII data to a specific folder in the file system on a cloud server using an HTTPS[4] connection.

To ensure that the data collected from each PSAP's CHE was transmitted securely and reliably to its destination, all data in transmission was encrypted using an HTTPS connection. At the heart of HTTPS is the Transport Layer Security (TLS) protocol. TLS provides a secure channel between a client and server. To establish trust between the client and server, digital certificates are used. These certificates contain

[2] JavaScript Object Notation
[3] American Standard Code for Information Interchange
[4] Hypertext Transfer Protocol Secure

the server's public key. They are used to verify the server's identity. By combining encryption, digital certificates, and authentication mechanisms, HTTPS ensures that sensitive data is protected during transmission over the internet.

CAD

The CAD interface was included as an option for the PSAPs that were able to provide the data in the pilot as a first step of a future data set. A limited data set was developed for the pilot, and not all CAD data elements were used. To collect the necessary data fields that provide incident and call information, the project team conducted a thorough analysis and identified the desired CAD data fields. The CAD Data Dictionary was reviewed for each PSAP's CAD system and SQL[5] queries were developed to retrieve the data from the required CAD fields. The SQL queries were specific for each CAD system's vendor. The project team developed the CAD interface service that ran queries every hour and generated the CAD data into JSON format. The service was deployed on one virtual server in the PSAP's environment. The generated JSON data was then securely transmitted to the repository.

All CAD data transmissions from the PSAP were encrypted to ensure the data was transmitted securely and reliably between the participants' systems and the repository.

1.1.2.2 Data Dictionary

The original Data Dictionary was initially created by consensus from a group of PSAP and 911 practitioners and 911 systems vendors. The initial data sets were limited to administrative data and based on assumptions of what were believed to be the most critical elements required to move Next Generation 911 (NG911) forward. It was intended to be used as a starting point to aid in the creation of a Unified Modified Language (UML) class diagram, a visual representation of the message structure that shows the interworking of the system's classes, attributes, and associations.

The *logical* model (UML class diagram) is different than the *physical* representation in the XML[6] and JSON schema, although the mapping spreadsheet implies the relationship between the logical data points from the model to their physical counterparts in the XML and JSON schemas. When creating these class diagrams for the 911 DataPath Pilot, the original Data Dictionary names were modified to conform to the National Information Exchange Model (NIEM)—a federal standard for common vocabulary that improves the ability to exchange data across diverse public and private entities—guidelines for naming conventions. This required a new list of attributes or element names to be identified; thus, the creation of the Mapping Spreadsheet and code lists were derived from the original Data Dictionary element names and reflected changes were made on the class diagrams. (See the 911 DataPath Artifacts at 911 DataPath | 911.gov for details.)

These changes were the result of the initial data models and user interface being created and put into production, which identified areas where the data fields could be modified to better suit the intent of the 911 DataPath portal. The data changes are attributed to four broad categories described below.

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[5] Structured Query Language
[6] eXtensible Markup Language

1. Cardinality or Multiplicity – Used to describe how often an object or element can be repeated in a given data model. Zero to one, one to one, and one to many are often the most commonly used.
2. Data Types – Used to describe the data that was sent through the element or attribute name. Examples include string, Boolean, integer, and float. All describe a different data format that accompanies an element.
3. Added Classes or Attributes – The data model used broad categories to define similar terms; these are known as classes, while the terms that exist within a given class are known as attributes. These UML[7] objects directly affected the schemas by adding more complex types and element names to the XML and JSON schemas.
4. Data Label Updates – During the testing and pilot, some data elements identified were confusing to users. Several changes were made to the label and descriptions to better describe the element's intent and definitions to further clarify the intent of the element name.

1.1.2.2.1 Use of ECC in 911 DataPath

The 911 DataPath adopted the industry term emergency communications centers or ECCs early in the process. The focus groups involved in the initial steps to define data sharing in the 911 environment understood the complexities of what various centers are called, how they vary from state to state, and how they are treated. Some states, in statute, have definitions and rules for various types of 911 centers, while other states do not recognize some types of 911 centers.

The focus groups understood that the information flow from the public to the responders may transit various types of ECCs not just primary PSAPs. The administrative data set was built to be able to collect and categorize all types of ECCs to understand the composition of the 911 systems in the United States (U.S.).

ECCs were categorized by two data elements in the 911 DataPath—the first is the ECC category, which describes the high-level function of the ECCs, and the second is the Jurisdiction category, which drills down to the specific functions of the ECC.

ECC Category Code List

Code	Description
P	Primary ECC or PSAP
S	Secondary ECC or PSAP
B	Back up ECC or PSAP (not staffed)
D	Dispatch only ECC (does not receive 911 calls but dispatches resources)
O	Other

[7] Unified modeling language

Jurisdiction Category Code List

Code	Description
Municipal Limited	City/town but for not all services (e.g., Fire only)
Municipal	All City/town services
County Limited	Countywide but not all services
County	Countywide all services
Tribal	Tribal operated
Joint	Multiple jurisdictions
Private	Private operated center often dispatch-only
DOD	Any ECC or Dispatch center operated by the Military
DOI	Any ECC or Dispatch center operated by DOI
Other Federal	ECC or Dispatch center operated by other federal agency such as FBI, DHS, etc.
Other	Any other ECC or Dispatch center operated by an agency not listed

Understanding the complete picture of 911 is the goal of the 911 DataPath; using the term ECC and further defining what each reporting agency does helps to better understand the environment.

1.1.2.3 911 DataPath Portal User Output

The web portal contained three dashboard pages to let the user visualize their data. The CAD and CHE dashboard pages were very similar in functionality—the only difference was the fields that could be visualized as they corresponded with the data type respective to the page name. Within these pages, the user had the ability to either view a default dashboard, which the project team created, or they could create and save their own dashboards. The default dashboard could also be modified if the user wanted to add more to it.

To view an existing dashboard, the user clicked on the dashboard title they wished to view. To add a new dashboard, the user would click “Create New”. This took them to the dashboard itself. A date filter at the top acted as a universal filter for the dashboard. It defaulted to the past month but could be changed. The user would then add a plot by picking the plot type they wanted, selecting which fields and at what frequency they wanted to see them, and then clicking the “Add” button. The plot types supported were as follows:

- Line
- Bar
- Pie
- Scatter
- Area charts

The added plots would be added to the dashboard and placed in the next available space. The user could resize and move the plot to where they wanted it. If the user clicked on the table icon on the plot, they were able to see the data of that plot in table format. Additionally, there was an “Enable Comparison” checkbox that the user could click to compare their data to other PSAPs that fit within the comparison

they specified. The comparison filters included population, available positions, and staffing. The comparison charts showed next to the corresponding original chart the user had made. Once the dashboard was to the user's liking, they hit "Save Plot."

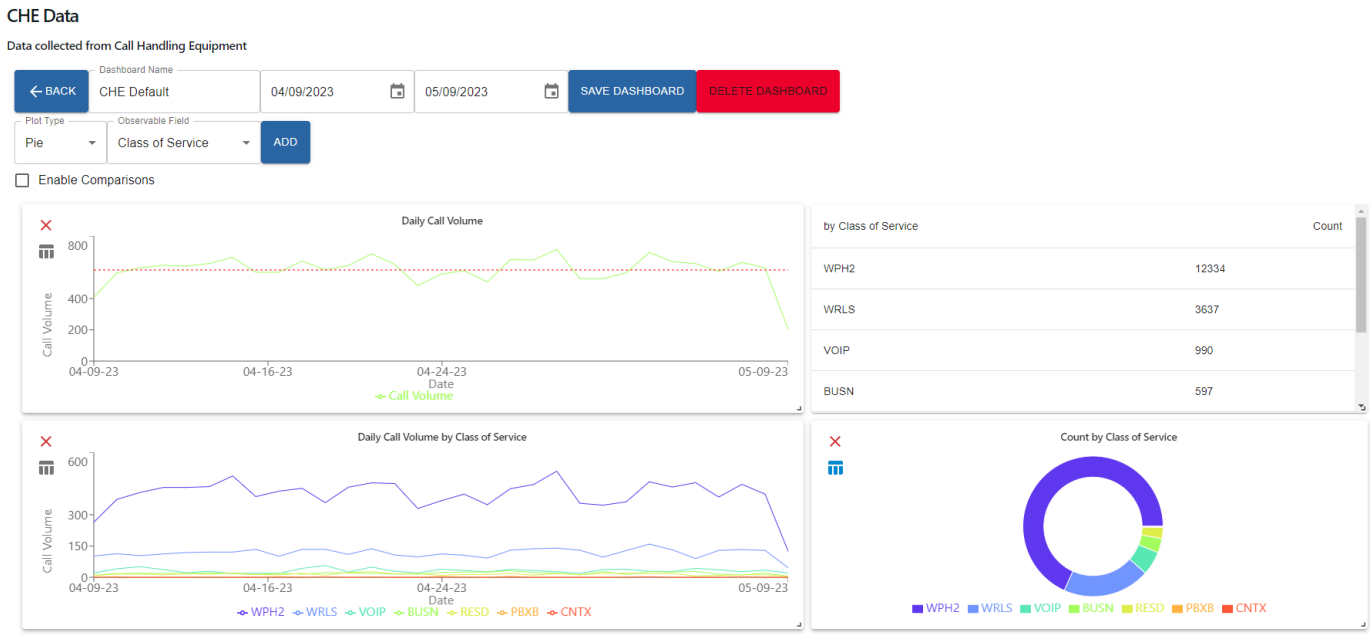

Figure 4: CHE Dashboard View

The ECC dashboard page automatically showed the dashboard when the page was opened. This was because the PSAP data was limited in the pilot to three categories where visualizations were useful—budget, position, and staffing. These three categories were automatically displayed in bar charts with the data the PSAP entered. These charts could be seen in table view similarly to the CAD and CHE charts. The ECC dashboard also had the same comparison ability described above for CAD and CHE dashboards.

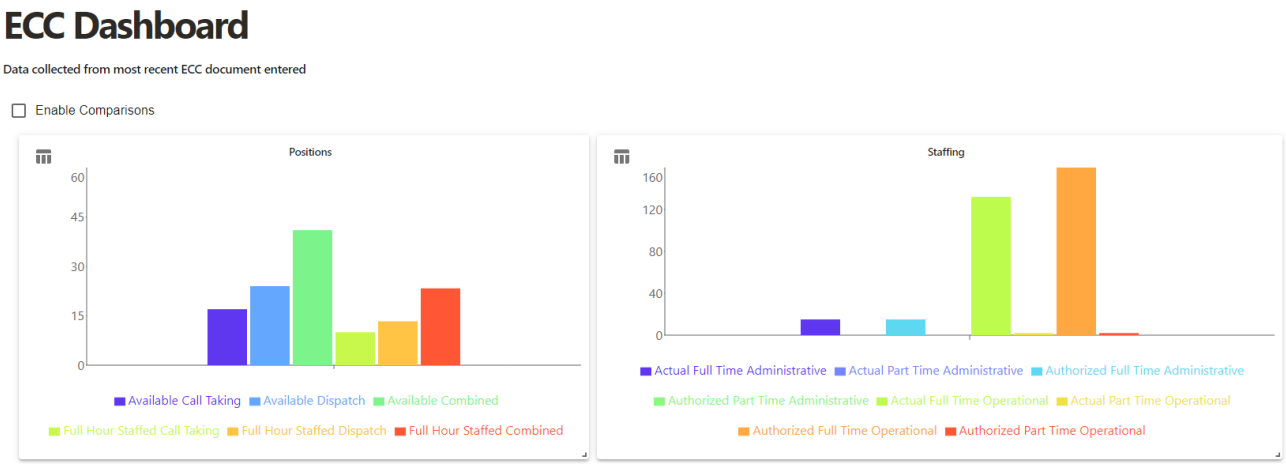

Figure 5: ECC Dashboard View

1.1.3 Recruitment

The Program's goal was to engage six PSAPs to participate in the pilot representing two small PSAPs (2 to 6 positions), two medium PSAPs (7 to 20 positions) and two large PSAPs (21 to 50 or more positions). Ideally, these PSAPs would represent various geographic regions of the U.S. and a variety of CHE and CAD vendors.

Notice went out via National Emergency Number Association (NENA), National Association of State 911 Administrators (NASNA), and various websites soliciting participation in the pilot. Program staff reached out to 911 early adopter PSAPs[8] to gauge interest.

Eighteen participants expressed initial interest. Program staff explained the pilot objectives and time commitment required of participants and interviewed all 18 to better understand the following for each:

- CHE
    - Hardware and software type and version
    - Working relationship with vendor
    - CDR output
    - Ability to install third-party equipment to transport the data to the 911 DataPath repository
- CAD hardware/software
    - Hardware and software type and version
    - Working relationship with vendor
    - Ability to install software on existing servers to extract CAD data and transport it to the 911 DataPath repository
- Enhanced 911 (E911) or Next Generation Core Services (NGCS) vendor
- Emergency Services IP network (ESInet) vendor

After these discussions, some PSAPs opted to participate in the governance discussions but not data collection. The Program identified five PSAPs that best fit the criteria for the pilot, finalizing on one small, two medium, and two large PSAPs. The kickoff meeting with the pilot participants was held May 9, 2022.

1.2 Pilot Implementation

1.2.1 Participant Connection to CHE

Each CHE had a method of providing data for third parties. The project team discovered that while the CDR format is very similar from vendor to vendor, there is an ANI/ALI feed that comes from the carrier and the content and format are very different. The CDR format is preferred. The ANI/ALI feed is also

[8] These public safety communication agencies are forward thinking, collaborative, learn from one another, and prompt further industry developments.

not as complete as the CDR regarding the different data points. The PSAP and/or information technology (IT) staff's lack of knowledge regarding the CHE-provided format output created additional work to determine the data fields that varied between PSAPs—even in cases with the same CHE vendor with a different software version.

1.2.2 Participant Connection to CAD

The project team installed a query to extract data from the CAD database and transport the data to the repository. The installation occurred on the PSAP local environment. There may be different IT resources that support the CAD systems, or it may require outside vendor support. This expands the number of staff resources needed as well as increases the time required to set up the configuration.

To extract the CAD data, the project team needed access to the CAD database and executed a query to copy the selected data elements into the 911 DataPath repository. While developing these queries, the data dictionaries from the CAD vendors were found to often be out of date or incomplete. This also increased the level of effort to identify the key fields needed for the pilot.

When the data imported into the repository did not make sense, figuring out the issues was difficult based on the complexities of the CAD database and lack of updated CAD data dictionaries. For example, the repository was showing negative response times for one jurisdiction. After investigation, it was determined that the value of a specific field, Time_CallEnteredQueue, used in the query was updated after the incident was reopened in CAD. As a result, the field no longer retained the original timestamp it initially held. This issue will be fixed in the next release for that CAD system. Until the fix is deployed, it was not possible to accurately calculate the response time from the respective CAD database.

1.2.3 Participant Training

After the kickoff meeting, the project team met with staff members from each PSAP, reviewing the project goals and requirements of PSAP staff and answering questions. The team understood the capabilities of each PSAP by analyzing the equipment, software, and staff skill sets to determine their ability to support the technical requirements of the pilot. Some locations needed more assistance than others based on their IT support and equipment type. The project team met with participants as a group monthly from May 2022 until January 2023 and conducted individual calls as needed.

On November 17, 2022, a training session on the user portal was conducted. The training included the process to set up an account to access the system. The project team walked through each page of the data entry forms with the participants and provided information regarding how to request help if needed during the pilot.

On February 15, 2023, training was conducted on the portal user output page. The training included how to get to the output page, the use of the prepopulated elements, and how to create custom search outputs. Discussions and training on the portal and portal user output were available on each monthly pilot team call.

Monthly meetings were held to answer questions and gather input on pilot participant experiences until May 17, 2023, when the pilot was completed. Data was collected through May 31, 2023.

1.2.4 Governance

Many regions and states have a strong governance structure for 911 such as a 911 authority board or council of governments. This quality check by elected officials is valuable to build buy-in, educate, and prevent PSAP personnel from making decisions without communication to those with oversight. However, including data sharing within a governance structure has been overlooked in 911. Too often, governance is not considered until something goes wrong and the partnership between the data sharing parties is challenged. The pilot participants and an extended group of 911 professionals examined the prerequisites for an effective data sharing governance framework. Several discussion sessions were held to gather information on:

- Previous issues, problems, and successes
- Data sharing document types
- Inclusions for a governance document
- Governance document examples

The information from the work group was used to develop a draft document that included information on:

- Data-sharing relationships
- Types of data-sharing agreements
- Recommended content of data-sharing agreements
- Examples of governance organizations
- How to formulate a governance organization

The draft governance document was shared with the work group and subsequent feedback was provided to finalize the document. The final governance document can be found at 911 DataPath | 911.gov.

1.3 Production Environment

1.3.1 Tracking Participation

The participation of the PSAPs was important to the pilot's success. The tools used by the pilot were limited in what was tracked.

There were 22 registered users accounts in the user pool with 15 of those users being pilot participants. The remaining users were pilot staff and generic accounts for the data sets such as the NG911 data set user that was not used in the pilot.

Eighteen user accounts successfully signed into the portal, while four users accounts (including two pilot participants) did not activate their accounts. At least one user from each of the five pilot PSAPs successfully logged into the portal and created documents. There were 1,070 logins to the system between August 18, 2022, and June 2, 2023.

1.3.2 Communications

Initially, the project team met with participants weekly, until a pattern of data collection was established. The team then met monthly and focused on the governance framework necessary to share data. In November, the meeting focus was on data collection through the 911 DataPath web portal and report analysis. Participants asked the project team to create a 911 DataPath Talking Points document, which can be found in Appendix A, to share with their leadership.

1.3.3 Data Merging and Analysis

The 911 DataPath conceptual design was based on the NG911 structure of a network-of-networks. This began at the lowest level with the PSAP, which would report up to a region or a state data repository. The region or state would use the data collected to output a summary of that data up to a nationwide data repository.

The 911 DataPath Pilot used this conceptual design. The five participating PSAPs submitted a monthly data entry. The 911 DataPath Pilot system merged the automatically collected data and the data entered in the portal to create an ECC data set.

The five PSAPs were used to simulate a single state for the pilot. The project manager then simulated a state 911 director in using the automated tools and portal to enter state-related data and merge the PSAP data into a state data set. The portal and repository merged data and created the statewide data set.

This was accomplished by granting the state user access to all data from the individual PSAPs. When the state user began making a new document, the create function would aggregate values for all aggregable fields such as budget and position fields from the data previously provided by the individual PSAPs. The state user could then fill in any other state required fields. Similar to a PSAP data entry, the state user would only need to fill in most of the information once, after which any information that could be carried forward monthly was auto filled. Once all required information had been entered, the state user could click the “Save” button, which uploaded their data into the repository.

2 Methods

The methods described below were used to gather the information needed to determine the effectiveness of the 911 DataPath pilot.

- Feedback – During each interaction with the pilot agencies, the project team captured feedback. This feedback often captured more realistic reactions from users and other participants than surveys or feedback forms.
- Focus groups – At key milestones, the pilot participants met virtually to review the progress of the pilot. The general focus of the discussions explored:
    - What was going well?
    - What was not working?
    - What would make it better?
    - Were there variables in other states or regions that could impact the outcomes/success?
- Data analysis – The data collected was reviewed and analyzed. This included times, accuracy, and types of data submitted.

3 Data Summary

The pilot period ran from November 1, 2022, to May 31, 2023. This provided seven full months of data.

CHE

The five pilot sites had their CHE providing automatic data to the 911 DataPath repository. The CHE was scheduled to send one package every hour. During the pilot, data sent from the PSAPs' CHE to the repository included:

- 25,440 packages of data
- 1,371,946 call records
- 50,762,002 total data elements

CAD

Three pilot sites provided CAD data for the entire pilot. One PSAP migrated to a new system and was not able to integrate CAD until the last two months of the pilot. The last PSAP had a CAD system that was locally developed and the data in the database was not able to be integrated into the 911 DataPath. During the pilot, data sent from the PSAPs' CAD systems to the repository included:

- 23,088 packages of data
- 1,431,666 incident records
- 41,518,314 total data elements

ECC

The pilot sites had access to a web portal to enter additional data for the 911 DataPath ECC data set. The data set also imported CHE data from the repository into the ECC data set. During the pilot, data entered by the PSAP to the repository included:

- 12 ECC data sets
- 600 data elements filled out
- 1,152 total data elements

Data Entry

The pilot participants were asked about the time needed to manually enter data components. While this was a limited number of participants, and not all the participants provided answers, the time to enter the data for the ECC data set was reported as:

- 10 to 15 minutes to complete the data collection
- 5 to 10 minutes to enter it into the portal
- 15 to 20 additional minutes if the call data was not directly pulled from the CHE

4 Objectives, Measures, and Targets

The pilot plan established the goals and objectives, which were based on the *911 Data & Information Sharing: A Strategic Plan*, and how the pilot would be conducted. This evaluation is based on the pilot plan and the *911 DataPath Pilot Evaluation Plan*.

The numbering of the tasks in the pilot plan and this evaluation plan was maintained from the *911 Data & Information Sharing: A Strategic Plan* document to maintain the link to the overall vision. Each objective to be examined has the following evaluation criteria:

Measure – Describes what is being measured and how it will be measured.

Target Measure – Describes an expected target set of the measure, which can be minimum and maximum, time frame, an expected document, or specific response.

Result – Describes what was found as a result of the pilot.

The sections that follow present the pilot goals and objectives with the specific measures and target measures as well as the pilot results. The introductory text (italicized), objectives, measures, and target measures are excerpted from the *911 DataPath Pilot Plan*.

4.1 Data Uniformity

For data to be useful and exchanged automatically between systems, data elements must be standardized across all platforms and mean the same thing to those that provide the data and those that consume the data. There must be a common language utilized by all the systems contributing the data for proper data analysis.

Objective	Measure	Target Measure	Result
1.5 Categorize data by source, collector, and user by level.	Confirm data dictionary elements and National Information Exchange Model (NIEM) data packages through their use in the pilot. Categorize data entered and collected by user level, meetings with pilot agency users, and validation of the data collected.	Confirmation of data dictionary or new additions to data dictionary and data package.	Overall, the data dictionary worked well. Changes were changes made to the elements and the labels and public facing descriptions for clarity. The updated mapping spreadsheet, code list, and class diagrams can be found in the 911 DataPath Artifacts at 911 DataPath | 911.gov. The NG911 data set was not used, so it may require additional review. The state data set has several elements that are similar to the PSAP elements (staffing, budget, etc.). These elements will require further refinement to better define the differences between them.
1.6 Create a process for validating and verifying data.	The process will consist of meeting with pilot agencies and their solution providers. Call-handling equipment (CHE) data ingested transactionally via the web service will be validated by ensuring	Data entered using UI and web service successfully validates and is stored in the repository accurately.	The verification of the data submitted from the PSAP to the data uploaded into the repository worked well. PSAP staff were able to review the data in the repository against their systems. This identified two issues.

Objective	Measure	Target Measure	Result
	that CHE data is successfully being stored in the repository. Samples will be exported from the repository, and MCP will work with CHE solution provider(s) to ensure that the data is both valid and accurate. For data manually entered using the User Interface (UI), MCP will work with users to ensure that the data stored in the repository matches the original data entry. MCP will additionally ensure that the manual data entry did not present any unexpected errors at the system and validation level.		The first issue was software related, which changed the time in a CAD incident. This requires a vendor fix. The second issue uncovered concerns about whether all the data was sent to the 911 DataPath repository. One incident was caused by a change to the CHE output that broke the connection between the repository and the CHE for a short period, resulting in lost data. A second incident identified a difference in the number of CAD incidents in the CAD system. One PSAP used one query to determine the data and the pilot used another query; each resulted in a different number of incidents. The pilot tried the PSAP query resulting in the same number as the first, which indicated that the data set in the pilot may be different than the PSAP's data set. The issue was not able to be isolated during the pilot, so additional work should be planned as well as a better method of validating data from the source to the repository.

4.2 Automated Data Handling

In today's 911 environment, data sharing is typically limited within the silo of the public safety answering point (PSAP). There are instances of data being shared regionally. Much of the data is shared manually or through third-party applications, making it difficult to analyze the data beyond the regional environment for any meaningful data-driven decision-making at the state or national level. Automated data handling allows consistency in the data collected, quality assurance of the data, and security to be built into the system.

Objective	Measure	Target Measure	Result
2.2 Establish recommended approaches for how uniform data can be used across various databases, etc.	Participating pilot agencies and their solution providers send uniform data to the repository by sending data conformant to the schema.	All data received by the repository is conformant with standards defined in the IEPD[9].	Not completed. The PSAP systems in the pilot did not have the ability to output compliant data sets. The pilot developed interfaces that put the data received into JSON format in the repository.
2.3 Ensure adoption of nationally-applicable, consensus-driven best practices for 911 service system protection and safe storage and exchange of data and information.	IEPD distributed to participants is fully conformant with National Information Exchange Model (NIEM) standards. To ensure system protection and safe storage of data, MCP will work with the National Highway Traffic Safety Administration (NHTSA) and pilot participants to define data governance and data-sharing agreements.	IEPD is fully NIEM-conformant. NHTSA and pilot participants fully sign off on any data-sharing agreement and data governance artifact.	The data dictionary has been developed with NIEM in mind, but the full data sets should go through the approval process. The governance material developed in the pilot can be found at 911 DataPath | 911.gov.

[9] Information Exchange Package Document

Objective	Measure	Target Measure	Result
2.4 Ensure adoption of common practices for chain of custody/evidence or anonymization.	Data collection will follow best practices for protecting the data. This will include anonymizing the data by removing personally identifiable information (PII) where applicable to avoid compromising any person's identity. Additionally, any data sent to the state or national level will not have any data that could trace back to a specific PSAP. To protect data integrity at the local and regional level, data will be logged so that it can be audited to determine what data was shared and by whom.	All data collected will have all PII removed before being stored in the repository. All data reported to the state and NHTSA will not have any data present that could be traced back to a specific PSAP. Repository data at the local level will have auditing capabilities to ensure data integrity.	The pilot did receive some data that may be considered PII. The CHE data feed included customer name, address, and phone number in the CDR feed. The CHE data included the caller's phone number. When the data was merged into the data set for the state, PII was removed, and the data was aggregated to prevent the data from being separated by PSAP. Situational awareness is a future use of 911 DataPath. The pilot looked at the data collected including the possible PII for linking calls to incidents and the potential for situational awareness.

4.3 Role-based Information Sharing

It is important for users of the data to agree and set policy on what data can be shared with whom, with an understanding of how the data will be used. Role-based information sharing considers what data is available for consumption outside of the PSAP and the region.

Objective	Measure	Target Measure	Result
3.1 Create and define a common list of roles and responsibilities as they apply to those who handle data (e.g., data owners, data custodians, data coordinators).	Roles are clearly defined and communicated to pilot participants.	Roles will be tested within the UI. Users will have the ability to log in with credentials. Credentials will map to a specific role that gives the capability to view/update certain pages/components within the front-end.	An initial list of data roles was developed as part of the governance documentation. The role descriptions were refined, and descriptions were developed. These can be found at 911 DataPath | 911.gov. The pilot used limited roles for agency, state, and administration due to the limited nature of the pilot.
3.2 Establish parameters for role-based sharing.	MCP will work with pilot participants and NHTSA to define all roles and role-based features required.	User-based roles are implemented in the UI during the pilot and fully tested by the completion of the pilot.	The limitation of the roles carried over to the output portal screens; however, each PSAP was able to compare their data against other PSAPs without identifying the comparison PSAP. The portal allowed the PSAP to select parameters to compare data against PSAPs with similar population or call volume.
3.3 Support promotion of nationally-applicable, consensus-driven best practices for creating dashboards, visualization	Authorized users will have the ability to access and create dashboards, visualizations, as well as query data that they are authorized to view.	The ability to access and create dashboards, visualizations, and query capabilities are tied to roles and jurisdictions. MCP will work with NHTSA and pilot participants to	The pilot included a dashboard, and the ability for users to create metrics from the available data and to place charts on their dashboard.

Objective	Measure	Target Measure	Result
tools, and other platforms and tools that support jurisdictional data analysis and shared situational awareness.		identify the scope of each role. These roles will then be tested and signed off on before the completion of the pilot.	These dashboards were created using off-the-shelf tools.
3.4 Permit ad-hoc/on-demand data sharing and discovery processes.	The repository will offer sharing capabilities of dashboards, visualizations, and reports directly in the front-end application for users within the same PSAP. MCP will provide report download functionality enabling users to send reports externally.	Users can share dashboards, visualizations, and reports among users belonging to the same tenant. Users can download and share reports externally to users outside of the same tenant.	The users could save ad-hoc metrics to their dashboard and print or export the results.

4.4 Sustainable Vital Support Mechanisms

A data sharing environment will require a governance approach that ensures that relevance, functionality, and accessibility are maintained.

Objective	Measure	Target Measure	Result
4.1 Develop a user-focused governance and advisory framework.	Using feedback from pilot participants, a governance model for data sharing is developed.	Participant agreement on a governance model.	A governance document was created with participant input and agreement. The governance document, which can be found at 911 DataPath | 911.gov, includes information on governance models for organizations to use to select the best solution for their situation.
4.2 Identify funding needs, funding models, and funding sources for long-term sustainability of the 911 data and information system.	Using analysis of the pilot, a rough order of magnitude is developed of the cost at a state level.	Basic costing is identified.	Basic rough order of magnitude costing was developed and can be found in Appendix B.
4.4 Develop model contractual language that requires vendors and service providers to share data.	Using feedback from participants, model contract language is developed.	Participant agreement on the model contract language.	Draft language that may be used in procurements or contracts for data sharing functions from 911 technology was developed and can be found in Appendix C.
4.5 Develop model jurisdictional agreements/memoranda of understanding (MOUs) that	Using feedback from pilot participants, a model MOU is developed.	Participant agreement on the model MOU.	A governance document was created with participant input and agreement. The governance document, which can be found at 911 DataPath | 911.gov,

Objective	Measure	Target Measure	Result
would facilitate authoritative data and information sharing.			includes information on governance documents for organizations to use to select the best solution for their situation.
4.6 Measure impacts of data sharing (return on investment).	Using feedback from the pilot participants, the value of data sharing is identified.	Demonstrated value of data sharing.	The consensus of the participants was that data sharing was useful. The output portal dashboard provided a method to compare ECC data to a larger group of PSAPs. The limited data collected and number of participants in the pilot limited the ability to clearly demonstrate that value.

4.5 Data Savvy 911 Professionals

While this pilot will not look at staffing or the skills of participants, information on the type of skillsets and qualifications necessary to support data-sharing environments will be captured that contribute to this goal.

Objective	Measure	Target Measure	Result
5.1 Identify role-based skillsets and qualifications for each staff position involved in data management (e.g., data entry, system administrator, data analyst).	Using feedback from pilot participants, specific data roles will be identified. For each role, initial knowledge, skills, and abilities (KSAs) will be developed.	List of roles with KSAs for each.	As a part of the governance document work, an initial list of roles was developed. These were refined and role descriptions and KSAs were developed. These can be found at 911 DataPath | 911.gov.

4.6 Pilot System Objective

An objective of the pilot system is the automatic collection and handling of data.

Objective	Measure	Target Measure	Result
Connect participants' CHE or management information system (MIS) to send call data to the repository	Successfully interface between participants' CHE/MIS with MCP's web service.	Data ingested from the web service and manually entered data using the UI are indexed and available in the repository.	The pilot successfully demonstrated both the push and pull methods of PSAP systems transmitting data to the 911 DataPath. The CHE pushed data via the CDR feed to the repository. The pilot also demonstrated the pull method of querying a database for information from the CAD system.
Demonstrate PSAPs' data sets can be merged to create the regional/state data set *Ability to combine data automatically*	The repository has a separate index capable of combining and aggregating data automatically.	Clearly defined regional/state level indices can be accessed, queried, and updated by authorized systems and users.	The pilot was able to merge data from the five pilot participants into a regional/state data set, pulling both the automatically collected CHE data and the manually entered ECC data. The 911 DataPath system was able to automatically merge data and present it to the user.

5 Lessons Learned

The purpose of this pilot was to test the framework and Data Dictionary of the 911 Datapath in preparation for a wider deployment. This pilot identified items that may need to be addressed before a full deployment.

5.1 System Development

5.1.1 Development of Portal Input

Based on user feedback, it became clear that there is not a set of commonly understood terms for the data elements (e.g., call-taker only positions versus dispatch only positions versus combined call-taker and dispatcher positions). This resulted in the need for more verbose descriptions for the various data labels and descriptions in the portal.

The original data set that was developed was based on an annual data collection. For the pilot, this data set was used monthly to demonstrate the merging of data. Most data were persistent and did not need to be re-entered every month. The portal or a smaller data set could make it easier to move through the persistent data and focus on the more transient data.

There are several data elements in the State/Regional data set that apply to the state or region but are also PSAP data elements such as staffing and budget. Changes to how they were displayed and reported were made, but not fully implemented in the pilot due to time constraints.

5.1.2 Development of Portal Output

Based on the feedback from subject-matter experts (SMEs) and participants, they were looking for more capabilities in the dashboard. The framework used allows for a dashboard that includes more functionality and flexibility in its display. This framework takes longer to build but is much more flexible in creating the output reports that the participants were looking for. The participants wanted more control over the ability to make changes to the reports and flexibility to change and create ad hoc reports from the available data.

The additional data that was collected directly from the CHE and CAD systems is not standardized. To demonstrate the usefulness of the data, the dashboard included metrics like *time to answer* and *time to dispatch*. For the CHE data, the CDR output is different for each vendor, and sometimes even the same vendor and software version, due to the differences in the ALI record formats by carrier. For example, one system may use the term “RingOff,” while another may use “Handling Call” or “Out of ACD” to indicate the call was answered by a call-taker. This makes it difficult to ensure that the data comparison is a valid comparison between systems.

For the CAD systems, not all call nature codes, call types, and call priority data are standardized. In addition, the incident time labels may vary from system to system. Most CAD vendors permit an agency to make changes based on the agency’s specific needs. While there are existing standards to resolve the call nature code issue, it has not been implemented by the vendors. That standard requires the CAD

system to reference a standard code. Again, these factors make it difficult to ensure that the data comparison is a valid comparison between systems.

5.1.3 Data Dictionary Adjustments and Changes

The pilot used the Data Dictionary developed by previous 911 DataPath projects. As expected, the previous dictionary was developed as a data set and never implemented. During the pilot implementation, the project team discovered changes were needed for several reasons:

- Assumptions – The initial data set was reviewed for NIEM structure at the end of the initial development. The SMEs that performed that work had to make several assumptions regarding the data and how it would be collected and used. During the implementation for the pilot, these assumptions were corrected. These were primarily data attributes.
- New Information – The original data set was developed several years ago and the NG911 technology and standards are changing rapidly. Changes to better reflect the current environment were made.
- Understandability – The data set was developed over time by a group of 911 and vendor representatives. This resulted in some common understanding of the group's intent. When presented to the SME test group and the participants, terms and phrases that were clear to the originators were not clear to the users. Labels and descriptions of some data elements required clarifications.

The changes were included in an updated data set. The mapping spreadsheet, code list, and class diagrams can be found in the 911 DataPath Artifacts at 911 DataPath | 911.gov.

5.2 Pilot Participant Activities

5.2.1 Staffing Challenges

The staffing composition and participant availability impacted the pilot in several ways.

The PSAP directors, management, and other staff that participated in the pilot had the following impacts:

- Time constraints – PSAPs are experiencing staffing resources challenges. Pilot participants had limited time to participate in meetings and input data. They had other full-time responsibilities and, in some cases, the PSAP was short-staffed and these participants had multiple roles.
- Staff changes – During the pilot, several participants moved to other jobs or retired. It took time to train the new staff; in one case, there was no replacement during the pilot.

In addition, IT staff availability impacted the pilot. The PSAPs that participated in the pilot had varying levels of IT support. The PSAPs had different levels of technology and different proficiency levels within IT to support the PSAP. The pilot confirmed that the architecture should be designed to minimize the footprint within the PSAP and manual staff activities. It needs to be as simple as possible. The following impacted the pilot:

- Agency Size – Smaller agencies may not have IT staff and larger agencies have very mature IT staff and processes. These differences resulted in varied levels of response during the pilot implementation.
- Staff reporting structure – IT staff may not be in the reporting structure of the PSAP. The PSAP director's control and influence over IT staff can be limited based on how the IT department is structured. This will lead to competing priorities and resulted in IT staff not being available or delayed in making changes or implementing devices.
- Staff knowledge and training of PSAP systems – IT and PSAP staff did not always have specific knowledge or training on the CHE and CAD systems. Some PSAPs rely on their vendors' knowledge of the specific systems. Getting system data dictionaries that some vendors consider proprietary was difficult. To get the best data out of the systems, it is important to understand how the system output is provided and the data output.
- 911 DataPath staff access – The ability to adjust the equipment used to collect the data to adapt to the data formats is needed in the implementation and if changes are made during the data collection. If IT does not allow a certain level of access, then it puts more effort on local IT, which can significantly add to the effort and implementation timeline.

5.2.2 General Interface Issues

Some general interface items impacted the pilot—the first was cybersecurity. Due to a heightened concern about cybersecurity attacks, some IT departments have a security policy against the installation and running of code that is created outside of their environment. One pilot participant had a security breach in the past and their IT locked down and blocked parts of their network from outside software including Java, which was used by the pilot device to collect the information from the CHE and CAD. Understanding an agency's cybersecurity policies and risk tolerance is important before beginning implementation.

Developing alternate collection methods is important. The type of system and method of collecting data will impact the data available. There are two types of data collection—the push or pull method. Not all systems and methods of collection have the same or even all data elements available. CHE has at least two push methods to output the call data to outside systems. Each will output different data elements.

The first output, typically used to provide data from the CHE to populate the CAD record, is sometimes called the ALI spill. This is used by the CHE to output the basic call information such as the ALI data, the position that answered the call, and the received time of the call.

The second output is called the CDR spill that the CHE usually sends to an MIS to track CHE activities. The MIS is an administration system that is used to analyze call-handling activities of the agency. This feed usually includes all the times of the call presented to CHE (e.g., ring, answer, on hold, off hold, hang up, transferred), the position that answered the call, as well as the full ALI data including rebids. The CDR spill was used where available for the pilot.

The other system that provided data to the pilot was the CAD system. The pilot used queries into the CAD database to pull the data requested from existing database. This query requested a specified set of data elements for a period of time.

Both methods have potential issues. The pull method only provides limited data in proprietary formats that may impact data analysis. The database query pulls data at specific times and may get incomplete records.

5.2.3 Participant Connection to CHE

The ports that provide CHE data can be shared by multiple projects or vendors. There was an instance where a change was made for another project and system. The changed format for the other system impacted the DataPath connection. This resulted in a loss of data while the system was not connected. The PSAP able to revert the change once it became aware of the impact but could not recover the lost data. The pilot modified the monitoring, so a notification was sent if this occurred again.

While the CDR format is very similar among vendors, the ANI/ALI format that comes from the carrier is frequently very different. The CDR format was preferred. The ANI/ALI feed is also not as complete as the CDR regarding the different data points.

5.2.4 Participant Connection to CAD

For CAD data, 911 DataPath needs access to the CAD database and must execute a query to retrieve the data. The data dictionaries from the CAD vendors can be out of date, incomplete, or not available, so the level of effort to identify the key fields was a more labor-intensive process than first estimated.

The CAD and CHE systems can have different IT support personnel and may require outside vendors, expanding the number of staff needed to set up the connections.

When the data received does not make sense, the process to figure out what is causing the issue can be difficult based on the complexities of the CAD database.

While most agencies in the country have commercial CAD systems, one participant used a home-grown CAD. There are other small vendors or home-developed CAD systems deployed across the nation. These systems may not adhere to proper data formatting or validation rules, which render the data unusable. For example, a data field for the time of response but the data base field is formatted as text. This would allow the operator to put in 4:00 or 16:00, both of which are correct but cannot be used for analysis effectively.

5.3 Operation of the Pilot

The data set for the PSAP includes both manually entered data as well as the CHE feed data. This resulted in the need for CHE data to be collected automatically to be manually included in the data set. As a result, the PSAP was required to manually submit its data even though the CHE data was automatically collected and pushed to the portal.

The use of the annual data set for the pilot resulted in the need for participants to provide monthly reporting of that annual data set. This created additional workload for the participants. To help reduce this, the data fields for each set were prepopulated from the previously submitted information.

Entering partial data for the data set was overlooked in the development. There was a function to edit previously submitted data sets, but the required elements must be completed before it could be saved.

With the large data set, there was a need for the participants to stop entry and gather information from other sources, or for just normal operational interruptions of a PSAP.

Most of the work for the pilot focused on the data at the PSAP level. This demonstrated the need for additional work on the State/Regional data set. As described previously, there are data elements that apply to both the PSAP and State/Regional such as staff and budgets that should be refined from the findings of the pilot.

6 Call to Action

The public-safety community—specifically the 911 community—needs to rally behind the support of a uniform method to collect data at the local, regional, state, tribal, and federal levels for better-informed 911 and emergency-response decision-making. This ongoing initiative should minimally:

- Drive consensus regarding standards used to define terminology used in the data-collection process
- Create an enhanced data dictionary that associations, 911 centers, and vendors will use to ensure the ability to generate data that is measurable and universally understandable
- Drive consensus regarding data-collection and sharing to include the following:
    - Agreement on standardized language and definitions
    - Agreement on how data is collected, stored, and exchanged
    - Agreement on how data is used and by whom
    - Agreement on how data is secured
    - Agreement on how to train personnel to interpret the data

Appendix A – 911 DataPath Talking Points

Gathering consistent data to understand the 911 environment has been a challenge. Simple things like how many primary and secondary public safety answering points (PSAPs) are in the country are not known. This makes it difficult to make data-driven decisions that justify and support requests for funding, staffing, performance, improvements, and innovation. Public safety data provides insight into the challenges faced by PSAPs today, such as location accuracy, cross-jurisdictional call routing, and continuity of service during surge periods. The characteristics of an ideal future environment—where data can be exchanged on a scheduled, ad hoc, or near real-time basis—align with five strategic goals:

- Data uniformity—data elements mean the same thing to everyone
- Automated data handling—increased efficiency
- Role-based information data elements are shared on a "need to know" basis
- Sustainable vital support mechanisms
- Data-savvy 911 professionals—fact-based decision making

The public safety industry agrees that data is essential. So what is the issue? Collecting data, managing it, and sharing the right information with the right people at the right time is complex.

The idea behind the 911 DataPath project is to create a series of repositories that enable public safety agencies, particularly PSAPs, to cut across traditional boundaries to derive benefit from large datasets. This goal was completed in the fall of 2019, and the National 911 Program (Program) within the National Highway Traffic Safety Administration (NHTSA) has now undertaken a pilot project to evaluate the initial data-exchange model with the help of five participating PSAPs. An additional seven 911 subject-matter experts will contribute to the discussion about data-sharing governance with the outcome to develop a template for a data-sharing memorandum of understanding (MOU).

This pilot project will:

- Test the assumptions made in creating the data dictionary
- Validate the exchange framework
- Collect at least six months of data to test analysis methodology
- Create analysis output reports for feedback

Where we are today?

- The five participant agencies are currently sending data from their call-handling equipment (CHE) automatically into the 911 DataPath repository
- Four of the five participant agencies are sending data from their computer-aided dispatch (CAD) system automatically into the 911 DataPath repository
- Program staff met with participants and the extended governance group to discuss data-sharing models and MOUs
- Some data is being requested via a data portal and requires participants to input that data

What's next?

- Complete the data-sharing governance documentation
- Continue data collection

In the next few months, analytics will be shared with participant agencies for feedback.

By sharing data between local PSAPs, regions, state, and federal levels, the hope is the model will identify patterns and trends that translate into actionable insights. With these, a data-exchange model can emerge to inform governance, data-sharing agreements, technical requirements and more—in short, an approach that all PSAPs across the United States can use.

Additional Resources:

Help wanted: Working together to harness the power of data for 911 - Urgent Comms

Obstacles to Data Sharing in Public Safety Applications Require More Than Technical Solutions Alone (nist.gov)

Appendix B – 911 DataPath Budgetary Costing

The following is a rough order of magnitude (ROM) cost estimate to implement a 911 DataPath repository at a state level. Project Management Institute (PMI) Practice Standard for Project Estimating and the PMI Project Management Body of Knowledge (PMBOK) 6th Edition both suggest that the ROM estimate should have an accuracy of 25 percent less to 75 percent more than the actual costs. ROM estimates are used when there are many unknown variables to make a more accurate estimate.

A range of costs are provided, but each level "low" and "high" is itself an ROM estimate. To prepare this estimate, the following assumptions were used:

- Set up phase hardware/services are based on a six-month timeframe
- Estimate an average of 75 ECCs per state
- Average five positions per ECC
- Staff rates based on BLS Occupational Outlook Handbook (https://www.bls.gov/ooh/)
- Wages were based on the median wage listed
    - Low wage is 75% of the median
    - High wage is 125% of the median
    - Rates used were three times the wage to account for overhead

Cost	Low Cost	High Cost
SET UP		
Repository and core interfaces hardware and services	$21,000.00	$63,000.00
Labor	$397,762.14	$662,936.90
TOTAL	**$418,762.14**	**$725,936.90**
SET UP ECCs		
Hardware at ECC	$112,500.00	$187,500.00
Labor	$664,949.64	$1,108,249.40
TOTAL	**$777,449.64**	**$1,295,749.40**
OPERATIONS (Monthly)		
Maintenance Support	$3,500.00	$10,500.00
Labor	$16,577.76	$27,629.60
TOTAL Monthly	**$20,077.76**	**$38,129.60**

Appendix C – Example Data-Sharing RFP or Contract Language

The following language can be used in Requests for Proposals (RFPs), procurement, or even contracts to ensure a vendor commitment to permit data sharing. The example language is for an agency to use in the procurement or contracting process to define the agency's expected level of data ownership and sharing capabilities for the system being procured. This can be traditional call-handling equipment (CHE) or a computer-aided dispatch (CAD) system, or it can be other new systems such as Next Generation 911 (NG911) services, data collection, alerting, or reporting systems.

Vendors will typically only commit when the target systems or standards are identified; hence, it is in the agency's best interest to identify these in advance. Data sharing can be with specific systems such as CAD or CHE or complex systems like Next Generation Core Services (NGCS) or Emergency Services Internet Protocol (IP) networks (ESInets). Defining data ownership, how it can be shared, and the standards that the system is expected to be able to use will provide for a better process during procurement and implementation.

The agency may select the text that best addresses the current organizational need and can edit, as needed, to fit the situation. An RFP can also include those items that require a respondent to present examples of their experience with the area to include providing examples of successful implementations.

Implementation

The selected vendor shall implement data exchange protocols in accordance with _____.

Note: This can include NG911 standards, Emergency Incident Data Object (EIDO), Emergency Incident Data Document (EIDD), National Information Exchange Model (NIEM) etc.

The selected vendor shall provide a data dictionary and database structures, as-builts, and updated documentation after each change to either the database or dictionary.

The selected vendor shall acknowledge that the agency data used to configure the databases and all data collected during the operation of the system is agency-owned data and shall be provided to the agency upon request.

The selected vendor shall implement, test, and maintain interfaces to _____ and _____ using _____ and _____ standards for data sharing.

The selected vendor shall provide applications or processes to format data into [JSON, XML, etc.] to enhance the ability to share data.

The selected vendor shall provide applications or processes to cross reference data elements into a national standard. For example, agency-specific incident type codes must be mapped to the Association of Public-Safety Communications Officials (APCO) International standard APCO 2.103.2-2019, *Public Safety Communications Common Incident Types for Data Exchange*.

Note: These formatting applications may be built into the system or be a third-party solution. It is best for this to be a vendor's responsibility to perform the function, not telling them how to accomplish it, just that it needs to be accomplished.

Operation

The selected vendor shall maintain all data-sharing interfaces and data exchanges as part of the maintenance and support agreement. This includes early identification of any changes to the vendor's system that may impact the ability to share data and remediation efforts to ensure data exchange capabilities continue unimpeded as contracted.

Note: This is to ensure that planned changes to each system are identified prior to the change being made, allowing coordination with all systems. This can reduce the impact of interfaces breaking when changes are made.

The selected vendor shall provide updated data dictionaries and data formats within 30 days of any change.

Within 14 days prior to implementing a system change, the selected vendor shall notify the agency of the interconnected systems that may be impacted in their ability to share data.

The selected vendor shall provide technical support to troubleshoot any issues with the data-sharing functions, as needed.

Note: The vendor may charge if they have to troubleshoot issues that are not caused by their application (e.g., network, changes made to target system they have no control over).

The selected vendor shall include monitoring of the data-sharing component(s) in its monitoring and security monitoring responsibilities. The vendor shall implement procedures for communicating issues and troubles with the other data-sharing vendors. This includes notifications to the agency and other vendors in accordance with the service level agreements (SLAs).

Note: This is applicable if monitoring is provided by the vendor.

End of Contract Life

At completion of the contract (e.g., end of life, upgrade to new format, etc.), the selected vendor shall provide all data gathered in the data structure used. Documentation of the data dictionary and data structure at completion shall also be provided.

Note: This may require the agency to provide additional hardware and software to accomplish.

At completion of the contract (e.g., end of life, upgrade to new format, etc.), the selected vendor shall provide a standalone system with the data, and search and reporting software that can be used to query the data.

Acronym Dictionary

Some definitions provided are from the NENA's Master Glossary.[10] Others are specific to this project.

Acronym	Term	Definition
	Associations	A logical connection that represents relationships between classes.
	Attributes	A UML object used to define the information, data, or properties that belong to a UML class.
	Cardinality	A value that is used to describe how often an object in a message can be repeated in a given data model
	Class diagrams	A UML model that describes the types of objects in the system and various kinds of static relationships which exist between them. Represents the logical model of the physical XML or JSON model.
	Classes	A UML object in the data model which defines broad categories to define similar terms.
	Complex types	A messaging object used to define a category of elements similar to UML classes.
	Data model	An abstract model that organizes elements of data and standardizes how they relate to one another and to the properties of real-world entities.
	Elements	A data object in XML or JSON used to define the information, data, or properties that belong to a complex type, similar to UML attributes.
	Instance	A data message with information that is well formed in XML or JSON and is validated against the schema.
	Multiplicity	A value used to describe how often an element can be repeated in a given UML data model.
	Schema	A file that defines the structure of the data and how it is to be formatted in an instance.
ALI	Automatic Location Identification	Tabular reference for the current 911 system. Defines destination PSAP for every landline telephone number and cellular tower.
ANI	Automatic Number Identification	ANI is the telephone number associated with the call origination, originally associated with the access line of the caller.
APCO	Association of Public-Safety Communications Officials – International	APCO International "is the world's oldest and largest organization of public safety communications professionals … The association supports its members – and the general public – by providing industry expertise, professional development, technical assistance, advocacy and outreach." An SDO for the 911 community.
ASCII	American Standard Code	A character encoding standard for electronic communication. ASCII codes represent text in computers, telecommunications equipment, and other devices.

[10] https://kb.nena.org/wiki/Category:Glossary

Acronym	Term	Definition
	for Information Interchange	
AWS	Amazon Web Service	It is a comprehensive and widely adopted cloud computing platform provided by Amazon, offering a vast array of cloud services and solutions.
CAD	Computer-Aided Dispatch	A computer-based system that aids PSAP telecommunicators by automating selected dispatching and record-keeping activities.
CDR	Call Detail Record	It is a data record generated by a telecommunications network or service provider for each phone call or communication session that takes place on their network.
CHE	Call-hnadling Equipment	The equipment used to provision call-answering within an ECC or PSAP.
E911	Enhanced 911	A telephone system that includes network switching, database, and PSAP premise elements capable of providing automatic location identification data, selective routing, selective transfer, fixed transfer, and a call back number.
ECC	Emergency Communications Center	ECC is a facility designated to receive and process requests for emergency assistance, which may include 911 calls, determine the appropriate emergency response based on available resources, and coordinate the emergency response according to a specific operational policy.
ESInet	Emergency Services IP Network	Managed IP network that is used for emergency services communications, and which can be shared by all public safety agencies. It provides the IP transport infrastructure upon which independent application platforms and core services can be deployed, including, but not restricted to, those necessary for providing NG911 services.
FCC	Federal Communications Commission	An independent U.S. government agency overseen by Congress, the commission is the United States' primary authority for communications law, regulation, and technological innovation.
GIS	Geographic Information System	A system for capturing, storing, displaying, analyzing, and managing data and associated attributes which are spatially referenced.
HTTPS	Hypertext Transfer Protocol Secure	It is an extension of the HTTP protocol used for secure communication over a computer network, typically the internet. The "S" in HTTPS represents the added layer of security provided by encryption.
IEPD	Information Exchange Package Documentation	A file folder package that designs, builds, and validates the components (artifacts) of an Information Exchange Package.
IP	Internet Protocol	The method by which data is sent from one computer to another on the ESInet, Internet, or other networks.
IT	Information Technology	The use of any computers, storage, networking, and other physical devices, infrastructure, and processes to create, process, store, secure, and exchange all forms of electronic data.
JSON	JavaScript Object Notation	An open standard file format and data interchange format that uses human-readable text to store and transmit data objects consisting of attribute–value pairs and arrays (or other serializable values). It is a common data format with diverse uses in electronic data interchange, including that of web applications with servers.

Acronym	Term	Definition
KSA	Knowledge, Skills, and Abilities	KSAs are qualifications specific to a position or role within an organization.
MIS	Management Information System	MIS is a computer system that collects, stores and correlates data from multiple systems and allows users to readily access data support to operational and strategic decision making on performance, trends, traffic capacities, etc.
MOU	Memorandum of Understanding	An MOU s a document written between parties to cooperatively work together on an agreed upon project or meet an agreed upon objective.
NASNA	National Association of State 911 Administrators	NASNA is the voice of the states on public policy issues impacting 911. State 911 leaders' expertise can assist industry associations, public policymakers, the private sector, and emergency communications professionals at all levels of government as they address complex issues surrounding the evolution of emergency communications. An association that represents state 911 programs in the field of emergency communications.
NENA	National Emergency Number Association	NENA "is the only non-profit professional organization solely focused on 9-1-1 operations, technology, education, and policy issues. We represent tens of thousands of hard-working 9-1-1 first responders who assist individuals in crisis and play a vital role in almost every emergency." An SDO for the 911 community.
NG911	Next Generation 911	NG911 refers to an initiative aimed at updating the 911 service infrastructure in the United States and Canada to improve public emergency communications services in a growingly wireless mobile society.
NGCS	Next Generation Core Services	The base set of services needed to process a 911 call on an ESInet. Includes the ESRP, ECRF, LVF, BCF, Bridge, Policy Store, Logging Services, and typical IP services such as DNS and DHCP. The term NGCS includes the services and not the network on which they operate.
NHTSA	National Highway Traffic Safety Administration	The Federal Government agency tasked with transportation-related education, research, safety standards, and enforcement. Is also the home of the National 911 Program, under its Office of Emergency Medical Services.
NIEM	National Information Exchange Model	A standard for common vocabulary that improves the ability to exchange data across diverse public and private entities, guidelines for naming conventions.
OEMS	Office of Emergency Medical Services	The Office of Emergency Medical Services (OEMS) is responsible for planning and coordinating an effective and efficient statewide EMS system
PII	Personally Identifiable Information	PII is information that, when used alone or with other relevant data, can identify an individual.
PSAP	Public Safety Answering Point	The entity responsible for receiving 911 calls and processing those calls according to a specific operational policy.
SDO	Standards Development Organization	SDO is an entity whose primary activities are developing, coordinating, promulgating, revising, amending, reissuing, interpreting, or otherwise maintaining standards that address the interests of a wide base of users outside the standards development organization.

Acronym	Term	Definition
SME	Subject-matter Expert	An SME is a professional who has advanced knowledge in a specific field.
SQL	Structured Query Language	A standardized programming language that's used to manage relational databases and perform various operations on the data in them.
TFOPA	Task Force on Optimal Public Safety Answering Point Architecture	The federal task force directed to study and report findings and recommendations on structure and architecture in order to determine whether additional consolidation of PSAP infrastructure and architecture improvements would promote greater efficiency of operations, safety of life, and cost containment while retaining needed integration with local first responder dispatch and support.
TLS	Transport Layer Security	TLS is a standard protocol that provides authentication, integrity protection, and confidentiality using mutually negotiated cryptographic capabilities and digital certificates on a connection.
UI	User Interface	UI is a series of pages, screens, buttons, forms, and other visual elements that are used to interact with a device.
UML	Unified Modified Language	A standardized modeling language consisting of an integrated set of diagrams, developed to help system and software developers for specifying, visualizing, constructing, and documenting the artifacts of software systems, as well as for business modeling and other non-software systems.
USDOT	U.S. Department of Transportation	The top priorities at the USDOT are to keep the traveling public safe and secure, increase their mobility, and have our transportation system contribute to the nation's economic growth.
XML	eXtensible Markup Language	A markup language and file format for storing, transmitting, and reconstructing arbitrary data. It defines a set of rules for encoding documents in a format that is both human-readable and machine-readable.