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PSTA Mapping Technical Subcommittee Report

Introduction

Public safety organizations are dedicated to ensuring the safety and security of the communities they serve. The scope of and breadth of these missions is great and includes all of the federal, state and local agencies dedicated to keeping our citizens safe. But to fulfill missions and mandates, public safety organizations need access to the latest technology and timely, accurate data. In today's increasingly digital world, this means agencies have access to a vast network of connected devices, sensors, and systems that are generating enormous amounts of data. But to be able to leverage the Internet of Things (IoT) and make all of this data useable, organizations need a common language of interoperability. Often, the universal commonality of sensor and system data is location. Mapping technology can provide the framework for connecting, managing, and sharing IoT data between technology systems, internally within agencies, and externally to share information with other public safety stakeholders.

Background

Because the PSTA recognizes the critical importance of geospatial technology to first responder missions, not only as an IoT integration tool, but also a driver of information sharing and collaboration across all public safety sectors, it has become a top priority of this organization to define and recommend a common set of open standards that will support the mapping needs of all public safety agencies at the federal, state and local level. For these reasons, the PSTA created the Mapping Subcommittee as a means to assemble thought leaders from both practitioner and industry organizations and giving them a forum for the sharing of ideas around best practice mapping standards for all first responder agencies and as a mechanism for the sharing of these ideas with the larger public safety community. The inaugural commission of this committee will be to create a mapping standards document that will then be the vehicle for guiding future work of the committee in promoting open standards for the mapping and sharing of public safety data.

Mapping Subcommittee Workplan

This workplan includes an evaluation and assessment by the subcommittee of current standards that have been developed by existing standards organizations for geospatial interoperability as they stand today. Subcommittee members then provided recommendations as to the best practice mapping standards and any gaps or new trends in public safety mapping technology or practice that may need to be addressed.

These four focus areas of mapping standards were identified by PSTA:

- Standards for Outdoor Mapping for Public Safety
- Standard API for Sharing and Mapping Public Safety Data
- Standard API for Sharing Real-Time Mapping and Event Data with Other Public Safety Stakeholders
- Standards for Indoor Mapping and Location

Subcommittee activities included:

- Discuss outcomes and use cases
- Evaluate current standards
- Identify gaps in current standards
- Define requirements and scope of subcommittee work
- Draft report on findings and recommendations
- Publish draft plan and solicit feedback
- Revise draft and finalize for publication

Public Safety Mapping-Related Workflows

Key workflows that require mapping technology include:

Emergency Call Taking and Dispatch – Mapping is a foundational piece of emergency communications and is important for address management, routing of emergency response vehicles, and the evolution of Next Generation 911 systems. For the purposes of this document we have broken emergency call taking workflows into two general focus areas, current computer-aided dispatch and mapping standards associated with it, and Next Gen 911 and related standards.

Computer-Aided Dispatch (CAD) – As CAD systems receive calls GIS technology is used to manage and analyze address data, identify the location, and store and analyze spatially referenced intelligence. Most CAD solutions require a geodatabase that includes:

- Address database
- Street center line data
- Other data such as points of interest, parcel information, aliases, etc.

Next Gen 911 - These systems enhance traditional CAD functionality by using advanced analytics to identify and validate call taker location data and route the appropriate emergency services to the caller. Components of NG911 systems supported by GIS:

- GIS data to support addressing
- Publication and sharing of an agency's authoritative routing data
- Real-time routing data
- Interoperability with other NG911 systems
- Indoor and z-elevation routing

Operational and Situational Awareness - GIS can be an integration tool for IoT data and sensors by connecting data systems via geocoding of addresses and the collection and mapping of any location-enabled devices. Public Safety professionals need the ability to collect, process, and analyze this data in real-time and as IoT and big data technology have become more prevalent, we are seeing the need for machine to machine communications as well as the ability to use machine learning and predictive analysis to improve decision-making and response, enabling operations centers.

Types of IoT sensor data that can be processed and integrated include:

- CAD
- AVL
- FMV
- CCTV
- Mobile Devices
- Weather
- Live Traffic
- Drones
- Social Media

Pre-Planning and Decision Support - Mapping is increasingly being used by public safety agencies to create pre-plans for disaster preparedness, large-scale public events, and for site security and safety plans. These can include both 2D and 3D mapping products:

- 2D – Digital 2D maps have replaced traditional paper maps and map books as modern mapping applications enable agencies to create plans that can be easily shared with personnel and other stakeholders via web apps that can be displayed in dashboards, pushed mobile devices, or ingested in other systems
- 3D – The next generation of digital mapping are 3D applications that enable planners to better understand complex spatial problems with tools that support:
    - Line-of-sight analysis
    - Location selection
    - Indoor routing
    - Imagery Analysis
    - Change detection
    - Damage assessments

The Mapping Standards Matrix

The above identified public safety workflows were cross-referenced with one of five distinct areas of applicable standards focus areas as follows:

- Content Standards
- Data Management
- Analytics and Geoprocessing
- Mapping and Visualization
- Information Sharing and Collaboration

In addition to use case specific standards, we also identified the scope of each of the above standard domains as well as general applicability of each of the identified reference standards. Taking this approach, the PSTA was able to highlight both existing open standards and industry specific standards that have been field-tested and adopted by a significant assemblage of organizations and vendors from across public safety industries. Where the above criteria have not been met, guidance is given regarding standards, whereby implementation would solve a known interoperability challenge. The goal of the Public Safety Mapping Standards Matrix (PSMSM) document below is to make it publicly available to be used as a guide for public safety organizations and vendors seeking to align their systems with current public safety industry best practice standards. This document does not attempt to provide an exhaustive list of every known standard for mapping, but rather a list of those most relevant to public safety based upon the above criteria.

Legend

Use Case Specific Standards contents take precedent over General Standards contents

Green text denotes emerging technology areas where there's an opportunity to provide research and guidance to the industry, or align with other authorities.

Blue text denotes links.

Standards Topics		General Standards	Use Case Specific Standards		
Standards Domains	**Scope**	**General Applicability Reference Standards**	**Emergency Call Taking & Dispatch**	**Operational/Situational Awareness**	**Pre-Planning & Decision Support**
Content Standards	Data Schemas: • Road Centerlines • Address Points (Site/Structure) • Boundaries: PSAP, ES, Provisioning • CAD Event Coding	• NENA Standard for NG911 GIS Data Model (NENA-STA-006) • NENA Standard Data Formats for E911 Data Exchange & GIS Mapping	• NFIRS Incident Codes • NIBRS Incident Codes • NEMSIS Incident Coding • Micro-Addressing	• FEMA Lifelines Toolkit • DHS GeoConops • Weather | **NDFD** • Transit: GTFS	• DHS GeoCONOPS • Hazardous Materials, others | NFPA 950
Data Management	Data format and encoding specs to support read, import, edit, and write capabilities. • Metadata • Spatial Reference (2D, 3D) • Nonspatial: Imagery, Video	• GeoData Files: FGDB, .SHP, GeoPackage (OGC), • Geo Metadata: ISO 19115-1/2/3 • Spatial/Coord Reference: WGS84 • 3D Files: . **OBJ** • Imagery: **JPG**, **GeoTIFF** • Video: MP4 (ISO 14496-1) • MISB • General: NFPA 950	• V&H Uncertainty Values | NENA NG911 • BIM-Indoors | AIA, ISO 13567 (CAD), IMDF, AIIM • Indoor Positioning | WiFi, Bluetooth, iBeacon, GPS	• Grid Reference | **USNG** | **NAPSG**	• LIDAR | **LAS 1.2+** • BIM | **Wavefront .OBJ** • Grid Reference | **USNG (NAPSG)**
Analytics and Geoprocessing	Services to perform key tasks such as: • Geocoding • Routing • Raster Analysis • Predictive Analytics	• Geocoding/Routing • ArcGIS REST API (Web/Offline) • Google API (Web only) • Other Geoprocessing: ArcGIS REST API	• Indoor Routing	• Drones | Orthorectification • Geofencing	• Line of Sight | 3D Objects • Viewshed Analysis • Elevation Analysis
Mapping & Visualization	Includes file types and formats for use by: • Geospatial mapping • Visualization and analytical client software • Symbology	• Maps: Feature Class Layers • Network Dataset • Geodatabases: FGDB • Mobile/Offline Maps: Mobile Map Packages (.mmpk) • 3D Transport - I3S (OGC) • NAPSG **Symbology Guidelines v2.0**	• BIM | I3S-Building Scene Layer	• Drone Processed Data | I3S-Integrated Mesh Scene Layer • Imagery Products | OrthoImagery, DSM, DTM, Slope	• BIM | I3S Building Scene Layer • Terrestial LIDAR | I3S Point Cloud Scene Layer • Imagery | OrthoImagery, DSM, DTM, Slope • ERG Plume Modeling
Web-based Information Sharing & Collaboration	• Open standard APIs to share public safety information with a mapping solution	• Web Service Protocols: HTTP/REST • ArcGIS REST APIs: GeoServices (Feature, Map, Image, Network) • OGC APIs: WFS 2.0, WMS 1.1.1, WCS 2.0, WMTS 1.0.0 • Text: ISO 8879 SGML (NFPA 950)	*No Use Case-Specific APIs Known*	*No Use Case-Specific APIs Known*	*No Use Case-Specific APIs Known*
	• Open standard API to share real time and event data with public safety	• **Protocol Buffers** • WebSocket Protocols • ArcGIS REST API Stream Service • Video Streaming: **User Datagram Protocol** (UDP), **Real-time Streaming Protocol** (RTSP)	• Automatic Vehicle Location (AVL)	• Transit: **GTFS-RT** • Live Traffic: HERE, Google, Verizon… • AVL • Social Media • FMV, CCTV	*No Use Case-Specific APIs Known*