SAFECOM

Public Safety Architecture Framework

Trial Report

Chris Redding, Institute for Telecommunication Sciences

Julie Kub, Institute for Telecommunication Sciences

Jeff Lee, SPAWAR Systems Center San Diego

Aileen Morse, SRA Touchstone

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Executive Summary

The SAFECOM Public Safety Architecture Framework (PSAF) provides an industry-validated enterprise architecture methodology to plan and develop the migration from current public safety architectures to interoperable systems. The PSAF methodology is designed to capture information about radio systems and elements to expedite interoperability analysis, along with other related functions, across various communications paths. The PSAF methodology for capturing information has driven the development of the PSAF data model, which will be the foundation for the development of a PSAF tool for use by public safety personnel.

This *PSAF Trial Report* highlights the completion of the PSAF trial. The goal of the PSAF trial, conducted in the Atlanta metropolitan area, was to develop a complete technically accurate definition of a radio system. The trial marks the first step in the process toward developing a PSAF tool. The radio system defined in the trial serves as the basis for a logical data model that depicts the elements of the system, their respective attributes, and the relationships between them. The trial served to validate the data model and thus validate the definition of a radio system.

The PSAF team is comprised of personnel from the Institute for Telecommunication Sciences (ITS), Space and Naval Warfare (SPAWAR) Systems Center San Diego (SSC-SD), and SRA Touchstone. For the trial, the PSAF team selected the Cobb County 800 MHz SmartZone Project 25 (P25) trunked digital radio system as an example radio system. The Powder Springs Police Department (PD) was chosen as an example agency using the radio system. The selection criteria included sufficient complexity for what constitutes a radio system.

The PSAF team created a questionnaire based on the data model prior to the trial. The team populated the questionnaire with existing data from a tool developed by SPAWAR for the Interoperable Communications Technical Assistance Program (ICTAP), called the Communications Assets Survey and Mapping (CASM) tool. The PSAF team provided the questionnaire to Cobb County's radio system communications manager two weeks prior to the trial, allowing data entry time for the delta data between the CASM and the PSAF model. During the trial, the PSAF team made separate site visits to the Communications Manager, the Police Chief, and a Lieutenant at the Powder Springs PD. During the visits, site personnel provided suggestions on the data collected and on the data collection process. Tours of the Cobb County master site, the Cobb County prime site, the Kennesaw Mountain radio frequency (RF) site, and the Powder Springs PD facility identified modifications for improving the PSAF data model.

The PSAF trial concentrated on characterizing one radio system. Going forward, the PSAF pilot will characterize interoperability between two systems. The PSAF team will use the results of the trial and pilot, as well as advice from radio communication Subject Matter Experts (SMEs), to validate a complete data model and develop a set of tool requirements. The PSAF tool will integrate CASM capabilities with additional public safety requirements for interoperability analysis. The PSAF tool will adhere to PSAF

Volume I[1] and II[2].methodology to plan and develop the migration to the interoperable communications systems outlined in the Public Safety Statement of Requirements (PS SoR)[3].

[1] Volume I of the SAFECOM PSAF document is available at:
http://www.safecomprogram.gov/SAFECOM/library/technology/1251_publicsafety.htm
[2] Volume II of the SAFECOM PSAF document is available at:
http://www.safecomprogram.gov/SAFECOM/library/technology/1252_publicsafety.htm
[3] The SAFECOM PS SoR document is available at:
http://www.safecomprogram.gov/SAFECOM/library/technology/1258_statementof.htm

Introduction

One of the main challenges for public safety is the ability to communicate quickly and effectively in difficult environments where critical infrastructure may be damaged or work unpredictably. One important aspect of communication under such circumstances is the ability to plan for and assess communications interoperability under different scenarios and across organizational and jurisdictional boundaries. Public safety is in the process of addressing such interoperability issues through the use of the newly developed Public Safety Architecture Framework (PSAF). This report documents the PSAF trial, a major step in developing a common model for capturing communications information.

Scope

The PSAF is a collaborative effort that spans various public safety-related agencies. More specifically, the SAFECOM program has entered into a Memorandum of Agreement (MOA) with the Office of Grants and Training (OG&T) in the Department of Homeland Security (DHS) to leverage the existing Communication Assets Survey and Mapping (CASM) tool, and to develop an enhanced tool that enables PSAF capabilities for first responder agencies.

The PSAF development team comprises personnel from the Institute for Telecommunication Sciences (ITS), the Space and Naval Warfare (SPAWAR) Systems Center San Diego (SSC-SD), and SRA Touchstone. The Interoperable Communications Technical Assistance Program (ICTAP) at SPAWAR Systems Center-San Diego (SSC-SD) has engaged the PSAF program at ITS to co-develop a tool that incorporates both PSAF and CASM requirements.

Phases I, II, and III of the PSAF development effort concentrate on identifying a unique set of PSAF requirements through data collection and creation of a PSAF data model. Whenever possible, existing CASM data and capabilities are incorporated into the PSAF data model. After Phase III, the PSAF requirements will be complete, and the subsequent phase of the PSAF project will concentrate on combining the CASM and PSAF requirements into one cohesive public safety tool for communications interoperability analysis.

Goal

A goal of the PSAF is to develop standards to help communications professionals document and communicate system-level information in a universally agreed upon way. The PSAF trial is a first step in the process to develop a common semantic set and model in which to capture communications information. Validation from industry experts will provide insight on a model that can capture most, if not all, communications information. The PSAF trial served as an opportunity to demonstrate capabilities of the PSAF data model by capturing actual public safety data. Data collected from the Cobb County 800 MHz SmartZone trunked radio system in Cobb County, Georgia served as the basis to validate the model and potential PSAF capabilities. The Powder Springs Police Department (PD), which uses this radio system, agreed to provide organizational and operational information for the model.

The following goals were identified for the PSAF trial:

- Validate the PSAF data model's ability to define a public safety land mobile radio (LMR) communication system.
- Produce a technically complete and accurate data set for the systems view of that information.

- Validate relationships between system data elements to assist interoperability analysis.
- Produce the dataset necessary to depict operational data as it relates to the system.
- Produce lessons learned and feedback for the tool, the framework, the dataset, and the data collection process.
- Understand what data overlaps with the National Information Exchange Model (NIEM), and what data might be negotiated back into the NIEM framework to further the data standards efforts for public safety and interoperability.

1 Overview

The PSAF provides an industry-validated enterprise architecture framework to plan and develop the migration from current public safety architectures to the interoperable systems outlined in the Public Safety Statement of Requirements (PS SoR). PSAF volumes I and II draw upon the architecture principles and concepts published in Department of Defense Architecture Framework (DoDAF) documents.

PSAF Views

The architecture framework outlines the overall structured approach for helping to foster interoperability and, through the details of this structure, indicates how the architecture and the structure's components will operate through the development of interface standards. In short, the PSAF provides rules and guidance for developing and presenting architecture descriptions. The PSAF tool will provide three perspectives, or views, of public safety communications and information systems that combine to form a comprehensive architecture description, as follows:

- The Operational View (OV) shows how public safety performs its mission.
- The Systems View (SV) shows the systems of equipment, and the flows of information that support public safety.
- The Technical Standards View (TV) shows the technical rules and guidelines that allow the systems of equipment to interoperate.

The PSAF supports the development of interoperating and interacting architectures, and defines the OV, SV, and TV views of the framework. Each view is composed of sets of architecture data elements depicted via graphic, tabular, or textual products. The relationships between these architectural views and the data elements they contain are also clearly defined within the PSAF. Together, the data and corresponding relationships provide the context for interoperability analysis, and in turn provide the basis for the PSAF data model.

Technical Approach

PSAF Volume I: Definitions and Guidelines describes the combination of the OV, SV, and TV data perspectives into one cohesive data model. Within the three views, the underlying information should be complete enough to:

- Depict the communications equipment and systems of a given agency
- Identify a jurisdiction or area of interest

- List equipment and capabilities within a jurisdiction or area of interest
- Evaluate the interoperability of agencies within a jurisdiction or area of interest

The PSAF tool should support additional capabilities the first-responder community deems important. Efforts are underway to identify and rank further application functions for the PSAF tool.

The PSAF must capture an appropriate dataset for all three views to accurately reflect interoperability visibility for the public safety community. The PSAF team is building on the initial efforts and lessons learned from CASM to develop a logical data model that incorporates information CASM captures today, as well as additional public safety requirements for interoperability analysis. This PSAF data model is system-centric—its main focus is to accurately depict public safety LMR communications systems. Developing a system-centric data model is difficult for the following reasons:

- No standards exist for defining the boundaries or components of a system. The boundary of a system differs based on a person's perspective. A local police official's description of his or her radio system will differ in both scope and terminology from that of a state or federal official.
- Communications equipment vendors' development of proprietary terms and definitions causes difficulty in accurately depicting LMR communication systems.
- Communications terms often have multiple connotations for different public safety audiences.
- Equipment information varies widely, depending on the communications system that is described. For example, the elements of a Project 25 (P25) digital trunked communications system are different from those of a conventional analog radio system. Therefore, the data required to depict each system can be radically different.
- Systems can be defined according to what is actually in use, or what is desired for use in the future. Thus, the dataset must be able to portray what is actually owned vs. what may be desired over time (e.g., an office has a conventional system now, but wants to move to a P25 system in the future).
- No single framework exists for defining and reviewing interoperability.
- Business rules for conducting interoperability analysis do not exist.
- A single dataset should handle the representation for traditional conventional systems vs. trunked systems. This affects the notion of channels, frequencies, and talk groups, as well as underlying technology components.
- The discipline of LMR communications is extremely complex, making it difficult to discern the minimum set of information required for interoperability analysis.

2 Methods

The PSAF design and implementation is based on communications interoperability. LMR communications have been selected as a starting point for the PSAF data model, as it is the main form of communications for incident response.

Development Phases

PSAF development consists of three phases:

- **Phase I, the PSAF Trial (June 2006 to January 2007)—**Capture the necessary data to evaluate radio interoperability. Technical and subject matter experts (SMEs) will be employed to evaluate results in the technical accuracy and completeness of data, and the ability to evaluate interoperability correctly and thoroughly.
- **Phase II, the PSAF Pilot (January to June 2007)—**Study the ability to evaluate interoperability between radio systems based on the data. Technical and subject matter experts will be employed to evaluate results with respect to technical accuracy and completeness of the data required to compare two radio systems, as well as the business rules to correctly and thoroughly evaluate interoperability between the systems.
- **Phase III, PSAF Version 1 (June to December 2007)—**Incorporate the results of the trial and the pilot into a set of requirements that will be used to build a tool. The tool will automate the interoperability comparison process. It also will help system planners to assess their current communication needs, as well as plan future purchase requirements, procedural requirements, and installation requirements.

Development of the PSAF tool in Phase III is critical. It will deliver true business value through a working tool strategically aligned with the mission of public safety first responders. In Phase III, the PSAF tool will be beta-tested with LMR SMEs. Version 1.0 of the PSAF tool will produce capabilities explained in the existing PS SoR, and will adapt to developing and emerging standards. The PSAF tool will be developed using input from PSAF working group practitioners throughout the country. It will help these practitioners to improve their communications planning, and will support scenario-based analysis for incidents that eliminate critical infrastructure. Additional capabilities will be planned for subsequent releases as the tool evolves.

Data Model Development

Prior to the trial, the PSAF team developed a PSAF data model based on information from the SPAWAR CASM tool and from industry experts. The team developed criteria to select a site that had existing data in CASM, and sufficient complexity to provide a comprehensive evaluation of the model. Next the PSAF team created a list of business questions based on the data model to solicit information necessary to validate the PSAF radio system definition. (See reference documents in Appendix B.) The team then populated the questionnaire with existing data from the CASM tool. The PSAF team provided the questionnaire to Tracy Roberts, Cobb County's radio system communications specialist, two weeks prior to the trial. This allowed time to enter the data delta between the CASM and the PSAF model, and to validate the CASM data in the questionnaire. The trial concentrated on collecting data from an example radio system (Cobb County 800 MHz SmartZone P25 trunked digital radio system) and an example agency using the radio system (the Powder Springs PD). The questionnaire for the PSAF trial had four sections:

- General organizational information about the Powder Springs PD
- Operational information, such as agreements, radio systems used, connected gateways, connected dispatch, connected systems, and related agencies
- Radio systems information (such as the Cobb County trunked system) used to provide operations, dispatch functions, system information, gateway information, radio sites, controllers (master, site, zone), radio towers, repeater or base stations, antenna towers, and subscriber units
- System use information, such as channel information, talk groups, radio cache information, radio cache channels, and radio cache talk groups

Ms. Roberts met with the PSAF team during the trial. She explained the data she entered into the questionnaire, recommended modifications for improving the PSAF data model, and suggested improvements to the data collection process. Ms. Roberts also arranged for Gary Brady, a Motorola systems engineer for the Cobb County 800 MHz SmartZone trunked radio system, to be present during the questionnaire review. Mr. Brady provided valuable radio system commentary during the trial, and agreed to review the PSAF data model after the trial.

Site Tours

In addition to meeting with Ms. Roberts, the PSAF team also conducted three site tours:

- Cobb County Master Control and Prime Control Sites—To capture communications information from a controlling site.
- Kennesaw Mountain Site (this was one of five tower sites that made up the Cobb County 800 MHz SmartZone trunked radio system)—To capture communications information at a relay site.
- Powder Springs PD—To capture information on operational areas relating to the communications equipment and how it is used.

Figure 1 Kennesaw Mountain Site Equipment Room

From left: Jeff Lee (SPAWAR), Tracy Roberts (Cobb County), Aileen Morse (SRA Touchstone), Julie Kub (ITS), and Chris Redding (ITS).

During the Cobb County master control and prime control site tour, Ms. Roberts and Mr. Brady showed the PSAF team the Cobb County 9-1-1 dispatch center, the Emergency Operations Center (EOC), and the Cobb County radio equipment room, which contained the prime and master site radio equipment. The dispatch center had multiple stations, where personnel monitored several dispatch consoles simultaneously. The EOC contained equipment that was separate from the dispatch center, for use only during emergency incidents. The prime site radio equipment room contained radio equipment to combine voice signals from the five sites that make up the Cobb County 800 MHz SmartZone trunked radio system.

Simulcast equipment in the prime site determines the strongest radio signal from each of the five tower sites, and sends the strongest signal back to the five sites. The master site equipment is used for communication between radio systems, such as between the Cobb County 800 MHz SmartZone trunked

system and the Atlanta Urban Area Security Initiative (UASI) 800 MHz trunked radio system), as well as to monitor radio system usage.

Figure 2 Tower at the Kennesaw Mountain Site

The Kennesaw Mountain site is one of five sites that make up the Cobb County 800 MHz SmartZone trunked radio system. The radio equipment room contains base stations (one for each of the 18 channels on the radio system), combiners, transmit antennas, receive antennas, global positioning system (GPS) and microwave equipment for simulcast operation, routers, switches, and amplifiers.

Figure 3 Powder Springs PD Headquarters

From left: Aileen Morse (SRA Touchstone), Tracy Roberts (Cobb County), Julie Kub (ITS), and L. Rick Richardson (Powder Springs Police Chief).

During the Powder Springs PD visit, the PSAF team met with Chief of Police L. Rick Richardson and Lieutenant Jim Freeland. Chief Richardson explained the importance of human factor considerations on radio system interoperability, such as statutes, agreements, training between jurisdictions, equipment sharing, and planning documents. Chief Richardson and Lieutenant Freeland also explained how the PD uses radio system equipment. They discussed the different types of support equipment that during an

emergency could be valuable shared assets, such as boats for hurricanes, dirt bikes, motorcycles, horses, and golf carts for trail rescue.

3 Findings and Recommendations

After the trial, the PSAF team created a detailed list of comments collected from Ms. Roberts, Mr. Brady, Chief Richardson, and Lieutenant Freeland. The comments pertained to both the data collection process and the data itself. Following is a high-level list of findings and recommendations[4] from the trial efforts:

- The data model developed to support the PSAF is relatively robust. It provides most of what is required to depict an LMR system. Technical experts and SMEs are in agreement on the accuracy of the LMR system representation.
- Reassess the use of PSAF as an inventory tool for agencies in addition to its providing interoperability information. Ms. Roberts and Mike Paulette, a radio operational expert at SPAWAR, believe it would be extremely valuable if the PSAF tool could be used as an agency and radio system inventory tool.
- Investigate how the PSAF data model is affected by the nine overarching federal priorities for interoperability, as Ms. Roberts commented.
- Since there is limited technical LMR expertise (i.e., radio engineers) in first responder agencies, the PSAF tool needs be understandable to non-technical personnel.
- Create a one-page description of the PSAF project to explain its importance.
- Additional research is needed to clarify nuances between the elements of a radio system and the elements of a dispatch subsystem, particularly in the dispatch console.
- Add to the model key interoperability functionality contained in the dispatch system, and more detail about dispatch connections between systems.
- "Master controller" is both a vendor-specific and an industry term. This term needs to be clarified when depicting LMR systems, as does "zone controller" and "site controller."
- The trial identified additional LMR system elements to incorporate in the data model.
- Collect emergency EOC information, and include this as a separate organization of data in the model.
- In addition to operational elements for MOUs or MOAs, the PSAF should accommodate and account for various statutes and laws that affect interoperability at the local, state, and federal level.
- Standards for naming MOUs and MOAs could be developed to help identify and reach agreements between agencies. This area should be populated in the National Information Exchange Model (NIEM).
- Consider user friendliness and ease of use as paramount factors in tool design.
- The PSAF tool should be more "trunking-friendly" to ease data input.
- PSAF tool should provide an easy interface to other systems that have overlapping data.
- The PSAF model should broaden the categories of equipment already considered in the model to ease data entry for a broader range of that data.

[4] *PSAF Trial Lessons Learned,* Appendix B, includes a complete list of findings and recommendations.

- The PSAF pilot should consider using a different radio manufacturer to contrast radio terms and system definitions.

The preceding items, as well as the more detailed list in Appendix B of *PSAF Trial Lessons Learned* will be addressed in the near future by the PSAF development team. They will be incorporated into the data model to establish a baseline before the PSAF pilot. The updated data model will explain the requirements for completely and accurately describing one radio LMR system, so that the PSAF tool can analyze interoperability between radio systems in 2007.

4 Future Efforts

The PSAF trial was a key factor for characterizing one radio system. The lessons learned during the trial will be incorporated into the PSAF logical data model to more clearly define an LMR system. Immediately after the trial, radio communication SMEs reviewed the PSAF model decomposition diagrams to further define and clarify the PSAF data model (see Appendix B of *PSAF Trial Lessons Learned* for detailed SME comments). In early 2007, practitioners from the PSAF Working Group will review the PSAF business capabilities to expand and define capabilities of the PSAF. Requirements gathering will then begin, and the PSAF team will draft the initial requirements set that will serve as the basis for the PSAF tool.

5 Conclusion

The PSAF trial satisfied the Phase I milestone, and will enable the project to continue as planned toward the Phase II PSAF pilot scheduled for second quarter of 2007, and the Phase III Version 1.0 of the PSAF tool, scheduled for completion at the end of 2007.

Phase II of the PSAF project will concentrate on expanding the PSAF data model into system-to-system interoperability. Phase II will further clarify the operational side of the model, specifically the operations performed by an agency in day-to-day and in emergency situations.

Phase III will incorporate lessons learned from Phase I and Phase II to produce Version 1 of a complete PSAF architectural model. In Phase III, the PSAF team will develop a cohesive PSAF tool for public safety communications interoperability analysis.

The final PSAF product will adhere to the specifications in the PS SoR, PSAF Volumes I and II, and the CASM requirements. In addition, it is hoped the standards developed through the PSAF effort will be incorporated into NIEM to provide additional value to the public safety community.

Appendix A: PSAF Trial Participants List

The following people took part in the trial described in this *PSAF Trial Report*:

PSAF Team

Chris Redding
PSAF Project Leader
Institute for Telecommunication Sciences
325 Broadway
Boulder, CO 80305
Phone: (303) 497-3104
credding@its.bldrdoc.gov

Julie Kub
Electronics Engineer
Institute for Telecommunication Sciences
325 Broadway
Boulder, CO 80305
Phone: (303) 497-4607
jkub@its.bldrdoc.gov

Aileen Morse
Principal
SRA Touchstone Consulting Group
1920 N Street, NW, Suite 600
Washington, DC 20036
Phone: (202) 449-7316
Aileen_Morse@sra.com

Mike Paulette
Incident Operations Specialist
SPAWAR System Center - San Diego, Code 2855
53560 Hull Street
San Diego, CA 92152-5001
Phone: (619) 553-6285
paulettm@spawar.navy.mil

Trial Participants

Tracy Roberts
Radio Systems Specialist
Cobb County Department of Public Safety
140 North Marietta Parkway
Marietta, GA 30060
Phone: (770) 449-4164
Tracy.Roberts@cobbcounty.org

Alfred R. Moore
Director of Emergency Services
Fulton County Emergency Services
130 Peachtree St., SW, Suite 3147
Atlanta, GA 30303
Phone: (404) 730-7900
rocky.moore@fultoncountyga.gov

L. Rick Richardson
Chief of Police
Powder Springs Police Department
4483 Pineview Drive
Powder Springs, GA 30127
Phone: (770) 943-1616

Jim Freeland
Lieutenant
Powder Springs Police Department
4483 Pineview Drive
Powder Springs, GA 30127
Phone: (770) 943-1616

Gary J. Brady, Jr.
Systems Engineer
Motorola, Inc.
1000 Abernathy Road, Suite 1700
Atlanta, GA 30328
Phone: (770) 338-3868
garybrady@motorola.com

Rita Lane
ICTAP Deputy Program Manager
SPAWAR System Center - San Diego, Code 2855
53560 Hull Street
San Diego, CA 92152-5001
Phone: (619) 553-6056
rita.lane@spawar.navy.mil

Robert Ryder
Technology Tools Manager
SPAWAR System Center - San Diego, Code 2855
53560 Hull Street
San Diego, CA 92152-5001
Phone: (619) 553-5722
bob.ryder@spawar.navy.mil

Jeff Lee
CASM Development/Support
Contractor - SYS Technologies
53560 Hull Street
San Diego, CA 92152-5001
Phone: (619) 553-6639
jlee@spawar.navy.mil

Robert Drew
CASM Manager
Contractor - SAIC
53560 Hull Street
San Diego, CA 92152-5001
Phone: (619) 553-2195
rdrew@spawar.navy.mil

Henry Bluing
ICTAP Site Technical Lead
SPAWAR System Center - San Diego, Code 2855
53560 Hull Street
San Diego, CA 92152-5001
Phone: (619) 553-6713
bluinghe@spawar.navy.mil

Appendix B: Document References

Contact Chris Redding for copies of the following documents referenced in the development of this *PSAF Trial Report*:

Document	Explanation	File Name
PSAF Business Capabilities	List of the potential business functions for the PSAF tool	PSAF Business Prioritiesv2.doc
PSAF LMR Drawings	LMR decomposition drawings	Object Classes-decomposition 11-29-06 jlee.ppt
PSAF Data Questionnaire (Blank)	Blank data questionnaire developed to test the PSAF data model	PSAF Trial Questionnaire.doc
PSAF Project Schedule	Project schedule for the PSAF effort with project timelines and milestones	PSAF Project Planv7.mpp
PSAF Trial Lessons Learned	A detailed account of lessons learned based on notes from SPAWAR, ITS, and Touchstone personnel	lessons_learned_siteVisit_final.doc
PSAF SME Interview	A detailed account from SMEs on the PSAF data model	lessons_learned_SMEInterview_final.doc
PSAF Logical Model	The logical data model for the PSAF project	PSAF_Logical_Datamodel_61207.vsd