Video Quality in Public Safety
Conference Report

February 4-6, 2009
U.S. Department of Commerce Laboratories
Boulder, Colorado

Homeland Security

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Executive Summary

From February 4-6, 2009, the U.S. Department of Homeland Security's Office for Interoperability and Compatibility, in partnership with the Public Safety Communications Research program, hosted the first Video Quality in Public Safety conference in Boulder, Colorado. The conference convened a wide range of participants, including local, state, and Federal representatives from law enforcement, fire-rescue, and emergency medical services. Additionally, representatives from non-profit research institutions, academia, and industry attended.

The conference brought together public safety video users from various disciplines to discuss their challenges and to identify solutions that are not application-specific, but instead focus on common elements across disciplines.

To continue the work begun at the conference, the Video Quality Working Group was formed. The Working Group will address the high-priority initiatives identified by participants during the conference. These initiatives include developing a user requirements guide, creating a collective glossary of video terms, forming use cases for requirement needs, analyzing and documenting gaps in existing standards, and recommending video specifications.

Table of Contents

I. Introduction

With funding from U.S. Department of Homeland Security's Office for Interoperability and Compatibility (OIC) researchers from the Public Safety Communications Research (PSCR) program began specifying network performance parameters to meet quality of service needs for the *Public Safety Statement of Requirements*. The *Public Safety Statement of Requirements* was produced by the SAFECOM program within OIC. The document focuses on the functional needs of emergency responders to communicate and share information in an effective and timely manner. PSCR first conducted subjective tests of individual public safety video applications and convened panels of recorded video experts to study the outcomes of those tests. PSCR also researched various video quality and interoperability efforts and found that several organizations and agencies were developing their own guidelines aimed at improving the quality and interoperability of video in public safety.

The Video Quality in Public Safety conference brought these groups together to discuss their similar efforts. The conference allowed participants from a variety of backgrounds to learn of other efforts in the field, build relationships, and brainstorm ideas for future collaboration to develop effective solutions.

II. Methodology

Prior to the conference, pre-interviews were conducted with approximately 50 percent of conference participants to determine which topics should be included in the conference discussions. Interviewees, chosen based upon PSCR's recommendation, represented a range of public safety disciplines and were individuals who had worked for a significant amount of time to address video-related challenges. Some of the major themes resulting from these interviews included procedural, technological, and practical use challenges.

A video quality roadmap was created using the data gathered from the pre-interviews and speaker presentations to serve as a reference point throughout the conference reminding participants of the goals for video quality in the public safety community.

III. Conference Summary

The conference's purposes and outcomes provided participants with a shared understanding of the session expectations as well as a way to measure the extent to which conference goals were achieved. The purpose, outcomes, and output of the conference were as follows:

Purpose	▪ To convene public safety video users to identify the major procedural, technology, and practical use challenges of public safety video use ▪ To lay the groundwork for the development of solutions (collaboration, shared language, identification of existing standards and standards gaps, development of specifications)
Outcomes	▪ Identification of high-level requirements, lessons learned, and issues related to public safety video use
Outputs	▪ Skeletal roadmap of initiatives, including a user requirements guide, use cases, standards gaps, a glossary of terms, and specifications

Participants were first introduced to the roadmap, which highlighted various components of the current and future state. Participants formed three breakout groups to discuss the most salient challenges affecting public safety video applications, as identified during pre-interviews, the roadmap, and additional ideas about the future of video use in public safety. Ideas from the breakout groups were then shared with the larger group.

Groups discussed the following topics:

- Common Video Definitions:

  Multiple glossaries exist with conflicting definitions. This breakout group leveraged existing glossaries from the Scientific Working Groups on Digital Evidence and Imaging Technology[1] and the Law Enforcement and Emergency Services Video Association[2] as well as guidelines from the International Association for Identification.[3] Participants discussed the definitions of ambiguous terms and identified broader categories of terms whose definitions need clarification. Creating standard definitions will ensure that all purchasers have a shared understanding of terms when articulating their needs.

- User Requirements:

  Practitioners are often not aware or mindful of the array of factors that must be considered when choosing an appropriate video system. Participants in this breakout group brainstormed these factors and began to categorize them based on the steps a practitioner should follow when selecting a video system.

- Standards Development:

  To ensure a minimum level of quality, interpretability, and interoperability within every public safety video application, participants agreed that the Working Group must eventually develop specifications that can be recommended to standards making bodies for enactment. In this breakout group, participants discussed where some standards currently exist and began to map out current standards gaps, areas where additional standards are most needed.

Following the breakout groups, participants came together to synthesize information. After discussing what they learned from the breakout sessions, participants brainstormed ideas for a path forward and decided on a logical, manageable action plan.

[1] http://www.theiai.org/guidelines/swgit/swgde/swgde_swgit_glossary_v2-2.pdf
[2] http://www.theiai.org/guidelines/iai-leva/forensic_imaging_multi-media_glossary_v7.pdf
[3] http://www.theiai.org/guidelines/swgit/hosdb/digital_imaging_procedures_2_0.pdf

On the final day of the conference, participants began working on the first step of the action plan—a guide for public safety video users—to help practitioners make better decisions about the video system appropriate for their agency's specific needs. Participants determined what types of questions should be asked within the guide and what depth of information is necessary for a user to procure an effective video system.

IV. Conference Highlights

The Video Quality in Public Safety conference was one of the first opportunities for stakeholders from such a variety of public safety fields to gather with the specific goal of improving video quality in public safety. Their combined expertise and knowledge offered experienced insight to an ongoing problem. As the conference discussions transpired, important themes emerged that served to unite the participants. The main session highlights were as follows:

1. *Built a community approach to accelerating standards for utility video*
    - Participants repeatedly spoke of the benefit of leveraging each other's expertise to make the greatest impact. The public safety community has more influence over manufacturers if all disciplines work together to encourage manufacturer compliance. Leveraging each other's expertise will allow the group to be active in the formation of specifications and guidelines, rather than reactive to decisions made by others.

2. *Shared lessons learned from past and current video projects*
    - Many participants were largely unaware of video quality and interoperability efforts underway by others in the field. This immediate sharing of information allowed participants to exchange lessons learned, share major challenges, and make contacts with others in the group. Participants fostered relationships that will aid individual and group efforts in the present and future.

3. *Developed a roadmap to move from current state to future state of video quality*
    - Based on stakeholder interviews, a roadmap for video applications in public safety was created for the conference. The roadmap included main themes that described the current state of video in public safety, the ideal future state of video in public safety, and a series of initiatives and key players bridging the gap between the current state and the ideal future state. Participants discussed the current state of video quality, agreeing that it is best described by the following themes:
        - Disconnect between end users and manufacturers
        - No minimum level of performance metrics or standards
        - Procedural, technological, and practical use challenges
        - Lack of education among end users and consumers
        - Interoperability challenges

A challenge remains to determine what components will advance video quality from the current state to the ideal future state. To achieve the future state, the roadmap proposes a tandem effort of completing key initiatives proposed by conference attendees and involving the appropriate stakeholders. Some key initiatives include creating a glossary that clearly defines a set of agreed-upon terms, documenting gaps in published standards, and establishing a process to develop specification recommendations. To successfully achieve these initiatives, practitioners, Federal partners, academics, researchers, and manufacturers must be involved. As the roadmap depicts, a network of engaged participants supporting the initiatives are an essential aspect of reaching the goal of the future state.

4. *Gained an appreciation for the variety of video uses and challenges*
   - At the conference, participants discussed at length the various applications of video in public safety. There were several opportunities for participants to describe the ways they use video in their professions and how video is useful for making timely and critical decisions.
   - In addition, participants were encouraged to share the various challenges they encounter when using video applications. Many challenges were common across public safety disciplines, while others were more specific to a particular subgroup of participants, such as law enforcement officers. As a result of these discussions, participants became aware of the breadth of challenges.

5. *Empowered to collaborate as a Working Group on the agreed plan of action moving forward*
   - Participants found that the most value could be gained by leveraging each other's experiences to create the most robust outcomes possible. They indicated that without collaboration from all areas—local, tribal, state, and Federal public

safety agencies; Federal partners such as OIC, PSCR, academia; and industry—comprehensive improvements on the use of video in public safety would not be possible.

6. *Designed a plan of action to support the practitioner and inform the manufacturer*
   - Participants designed a practitioner focused plan of action, or a workflow. Participants agreed that video would be more useful in public safety if practitioners were better equipped to articulate their needs to manufacturers.
   - Attendees also identified other practitioners, Federal partners, academics, and manufacturers who were not present at the conference that should be included in the Group's work as it moves forward. A plan for further outreach to those individuals and organizations was discussed.

V. Vision for Future State

Currently, public safety practitioners experience daily frustration with video quality and can easily become complacent with the status quo, believing improvements are out of their reach. Putting aside these frustrations and focusing on a shared goal of the ideal future state helped participants highlight the important areas in which video needs improvement. From this discussion, participants identified the following components of their ideal future state for video in public safety:

- Education of the Practitioner
- Glossary of Shared Terminology
- Specifications for Video Quality
- Data Security
- Inter-agency Conferences to Exchange Information
- Shared Library of Video Clips
- Ability to Archive
- Open Platforms to Share Files
- Adequate Funding
- Interoperability

Attempting to develop a plan to solve each of these issues would be an overwhelming task. Instead, the group decided to concentrate on specific issues with the potential for greatest overall impact on public safety video systems. It is anticipated that as one issue is addressed, improvements may impact other identified issues, eventually rippling through most or all of the identified difficulties.

During conference discussions, it became evident that to achieve the ideal future state, it was vital to educate practitioners. The marketplace is filled with numerous video systems—each offering a variety of applications. Many practitioners do not understand the technical aspects of their own specific needs, environment, and expectations for the video equipment being purchased. Frequently, practitioners look to the market to dictate

which systems are best and as a result find themselves stuck with overpriced systems, often inadequate for their particular needs. Thus, conference attendees agreed that practitioners need guidance as they make purchasing decisions.

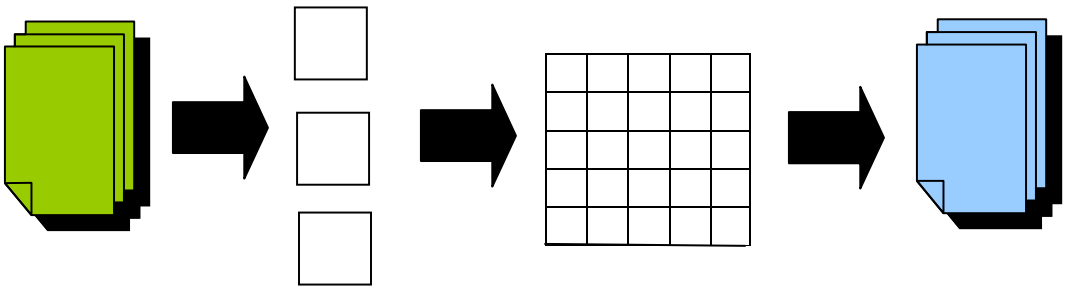
VI. Initiative Workflow

After establishing practitioner education as the primary goal, a comprehensive workflow for next steps began to develop. The workflow organizes large-scale initiatives into manageable and attainable goals. As solutions for these initiatives begin to develop, additional recommendations to improve video quality may also emerge.

The first step in the workflow is the creation of a guide intended to assist typical video users as they select a video system. By developing the guide first, the Working Group is forced to evaluate the needs of video users from all different viewpoints. This will ensure that no scenario is overlooked—an assurance that is essential to later steps of the workflow.

In order to properly educate the practitioner on the appropriate video system for their needs, it was important to determine all the factors that affect video systems. These factors were pulled from the breakout group discussion focused on user requirements and the subsequent discussions among the entire group. The guide will walk practitioners through each of the factors impacting their video purchase.

The next step in the workflow is to develop a finite set of use cases that group together similar practitioner video requirements. These use cases will focus on the function of the video and will not necessarily be specific to individual public safety disciplines. It would be impossible to determine every video use scenario, but the use cases will help narrow the functions into a manageable field. Working with a smaller set will also help standards making bodies determine standards based on function rather than a one-time need. The initial practitioners considered were members of the public sector.



Once the use cases are determined, the next step is to evaluate existing standards documents to determine where gaps exist in standards development. Because each use case aligns with a specific function, the standards analyzed will relate to that particular function.

The Working Group is using a standards matrix to analyze existing standards and locate gaps. The draft standards matrix is included below:

Stage	Specification	Algorithm	Evaluation	Definition	Operations	Model
Scene						
Optics						
Capture						
Process						
Xport						
Display						

The final phase of the workflow will be the creation of video specifications for each of the use cases. These specifications will be recommendations for standards making bodies to consider when developing new video standards. The specifications may also leverage existing standards that the Working Group finds acceptable.

VII. Next Steps

The initiative workflow identified four subsections for the focus of the Working Group. Four subgroups were formed to tackle the four subsections. The subgroups and associated tasks are as follows:

1. User Requirements Guide – Compile all the necessary factors that affect the purchase of a video system.
2. Use Cases – Determine the various applications for video based on similar technical requirements.
3. Standards Gaps – Identify where gaps exist based on the determined use cases and existing standards documents.
4. Glossary – Create a new glossary of agreed-upon terms to accompany the user requirements guide.
5. Specifications - Recommend specifications by use cases to video manufacturers and standards making bodies to ensure a minimum level of video quality

Formed by conference members, the subgroups are each led by one or two volunteers. Each subgroup is responsible for determining the most appropriate method to actively engage its members (e.g., conference calls, SharePoint portal, face-to-face meetings).

In order to ensure each of the subgroups aligns with the original intentions expressed during the conference, additional in-person conferences will be scheduled. These meetings will allow Working Group participants to present the status of their subgroup's efforts and to receive additional input from members of the Working Group.

Appendix – Organizations Represented at the Conference

Organization Name
Boise (Idaho) Fire Department
City of Oakland, California
Cornell University
Denver (Colorado) Police Crime Lab
Draper Laboratory
Fairfax County (Virginia) Police Department
Georgia Technology Authority
Indiana Forensic Institute
Institute for Telecommunication Sciences
Intel Corporation
International Association of Chiefs of Police
Jefferson County (Colorado) Sheriff's Office
Kiamichi Technology Center (Oklahoma), Emergency Medical Services (EMS) Training Program
Los Angeles (California) County Sheriff's Department
Maryland Department of Transportation
Motorola
National Association of State EMS Officials
National Institute of Standards and Technology
National Telecommunications and Information Association
Night Vision and Electronic Sensors Directorate
Noblis
Office of Law Enforcement Standards
Plainfield (Indiana) Fire Department
Plainfield (Indiana) Police Department
Security Industry Association
Touchstone Consulting Group
U.S. Army Crime Lab
U.S. Department of Commerce
U.S. Department for Homeland Security, Office for Interoperability and Compatibility