RealityMobile

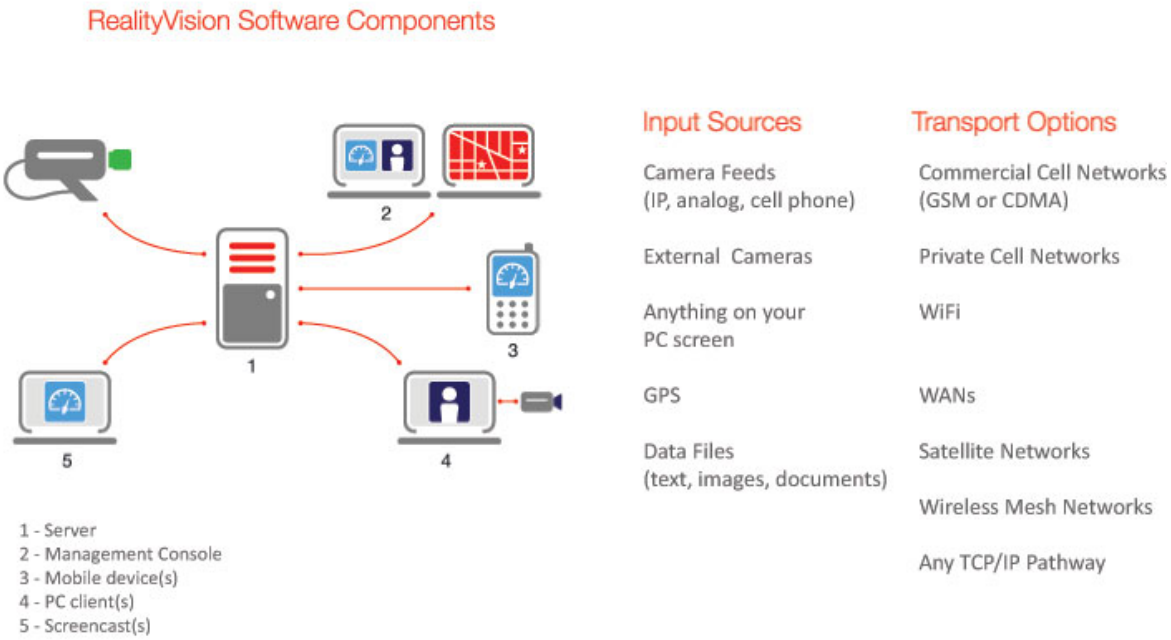
A Reality Mobile White Paper
November, 2010

Mobile Video Collaboration

How the RealityVision® platform stands apart from mobile video streaming services that target the same general feature set to everyone from teenagers to multinational enterprises.

13921 Park Center Road, Suite 400 ▪ Herndon, VA 20171 | phone: +1.703.636.7200 | fax: +1.703.636.7201
www.realitymobile.com | info@realitymobile.com

RealityVision at a Glance



Built on industry-standard infrastructure and operable on wireless networks including cellular, tactical wireless and satellite, RealityVision allows enterprise users to collectively visualize high-value assets and share data with colleagues anywhere in the world. The system has been designed to maximize performance across a wide range of commercial hardware and to position the enterprise for future hardware innovations.

As discussed in detail in this white paper, core elements of the platform include:

- ✓ Enterprise architecture and security
- ✓ Ubiquity of available information sources
- ✓ Dynamic information creation and distribution
- ✓ Integrated annotation and notification
- ✓ Ease of integration with other enterprise components

For additional details, please see the How It Works section of our website or contact us at info@realitymobile.com to arrange a live product demonstration.

Table of Contents

Introduction

It's happened to many of us: you're at a family event or some other function, you want to take a picture but you don't have your digital camera with you. In a crunch, you use your cell phone to take the picture or create a video clip, and then forward a copy by email or text message to someone else. It's a very handy feature and easy to use. Ongoing rapid innovations in the mobile industry—more powerful device processors, improving camera quality, better user interfaces and faster broadband networks—have only helped. But there is still the main drawback that the user experience is not real-time. Images are being captured and stored on the device for subsequent viewing and distribution. Video files in general can also be large and cumbersome to send. To address that, numerous vendors have introduced mobile streaming services: letting users stream live video from their phones in a way that allows for immediate distribution to virtually anyone with access to the Internet.

This white paper proceeds in two parts, beginning with a high-level introduction to the consumer-focused mobile video streaming industry and then exploring a different, enterprise-grade, approach to information creation and delivery. What we refer to as mobile video collaboration—a seamless way to share many different video sources that enhances real-time decision-making and satisfies enterprise performance, security and interoperability requirements.

A Snapshot of the Mobile Streaming Video Industry

The industry vocabulary can get confusing: "mobile video service," "mobile video solution," "mobile video streaming," "video chat," "mobile collaboration," "live video streaming" and so on. In practice, multiple vendors are offering the same general service: giving users a one-button option to stream live video from a supported mobile device to a remote server, where it can then be shared via the Internet to many different audiences. In one brief illustration, several of the vendors target broadcast media as one potential customer base. The idea is straightforward: a professional camera crew can't always be available for every story, so a reporter can fall back on streaming live video from the phone to a server where it can then be accessed by the studio for editing and viewing by TV and web audiences.

It's a point-and-share model that is generally available to consumers and businesses, but the precise offerings vary. We have highlighted some of the variations below. For an independent perspective on the various service offerings, including a comparative table summarizing key features and differences, see this article at MasterNewMedia.org entitled "*Mobile Live Video Streaming: Best Tools to Broadcast Yourself From Your Mobile Phone*."

By way of brief overview:

- Many of the vendors host the remote servers themselves in a SaaS model and act as the distribution conduit, but at least one vendor offers to allow the enterprise to host its own streaming server.

- Some require a 3G wireless network to support the video stream, while others advertise that they optimize their video transmissions in different ways to account for marginal network conditions.
- Some support many different mobile devices—including webcam-enabled laptops—and some just support a single mobile platform like the iPhone.
- Some also stream and store location information captured from the device, allowing the user's position to be tracked on a map, and many allow auto-posting of incoming video feeds and the associated mapping data to social media sites. As the MasterNewMedia article notes:

> "Among the newer features adopted by mobile live streaming services is the ability to share your geolocation by leveraging the built-in GPS many mobile phones now have, as well as the option to autopost your live video clips to multiple video sharing sites (YouTube and others) and microblogging services (Twitter etc.)".

- Some also allow hyperlinks to the video feed to be shared via email or text message—typically with an advertised privacy feature limited user access.
- Some offer video management tools for enterprises, including the ability to archive the video feeds and to use a Web-based studio to visualize multiple live and prerecorded streams at the same time.
- Some support text-chat messages with viewers as the video is being broadcast.

The initial services leveraged the device's rear-facing camera, but that is now being extended to available front-facing cameras as well to offer a mobile-to-mobile video chat experience, with each party streaming its video to the other simultaneously. That technology continues to evolve and the streaming quality can vary greatly depending on the available wireless network.[1]

Mobile Video Collaboration

Live streaming from a mobile device can be a very helpful information source and, from a consumer perspective, a point-and-share model makes perfect sense. Push a single button and start streaming live video of any event—a child's soccer game, a school function, a family vacation—that is auto-posted to your favorite social media site. From an enterprise perspective, the ability to stream from a mobile device can also be highly valuable, but the challenge lies in how that capability is implemented. Enterprise performance, security and interoperability are all critical factors, and a single purpose,

[1] A case in point: "Since the [Samsung] Epic has a front-facing camera for video calls, Sprint preinstalls Qik for your video-chatting pleasure. I was able to test Qik only over 3G, and its quality was too choppy to carry on a conversation." *Samsung's Epic 4G: A Fast Multimedia Phone*, PC World Magazine, November 2010, page 57.

unidirectional software application focused on consumer user is not easily absorbed into the enterprise. One size really does not fit all.

Enterprise information requirements are highly complex and can vary in an instant. Government agencies and corporate entities daily use expressions like "situational awareness" and "assembling a common operating picture" to emphasis how difficult it can be to make real-time decisions based on widely dispersed assets and personnel and incomplete access to information. By itself, a stand-alone tool to route live streams from mobile devices is a missed opportunity, because it is only one visual input and does not contemplate giving the enterprise and its mobile users real-time access to other potential sources of critical visual information at the same time. By way of illustration:

- Many military and law enforcement agencies have access to aerial assets, such as unmanned aerial vehicles (UAVs). A mobile user is streaming video from a moving vehicle—how can the agency share a live UAV feed of the user's projected path without interrupting the mobile user's stream?

- A utility is grappling with severe storm damage when one of its field employees is injured. Another employee arrives first at the scene and wants to know how to help stabilize the employee until medical help can arrive. What can the remote operations center do?

- An oilfield operator is experiencing a critical tool breakdown. A remote expert is analyzing schematic diagrams and other diagnostic information on his PC screen—how can he share a portion of the screen with the field technicians on the rig?

- An intruder has breached a secure port facility, and the operations center is trying to track the person's movements using the port's extensive surveillance camera network. How can the operations center share specific camera feeds with the closest officers and how can those officers independently access those camera feeds themselves from their mobile devices?

As a result, enterprises have to fall back on using different applications for different visual information sources: one to handle outgoing mobile device streams, one to access surveillance cameras, one to process incoming data to the mobile device, one for sharing PC screen content and so on. It's a real challenge—enterprises don't want to be in the business of managing disparate tools that function independently from each other, do not communicate easily with each other and raise their own unique hardware and security requirements.[2]

So, what's the answer? A single software platform that delivers all those multidirectional information sources in real-time in a secure, seamless process we call mobile video collaboration.

[2] As one illustration, when the Port of Los Angeles Port Police Department issued a competitive RFP in early 2008 soliciting proposals for a new Integrated Command Console System, they emphasized that they wanted a fully integrated solution of "best of breed technologies" that would "work together seamlessly." We were part of the winning team for that RFP. Please see pages 21-22 of this white paper for additional information.

Introducing the RealityVision Software Platform

From day one, our focus has been on the enterprise need for strict security, rigorous manageability and simultaneous information flows in multiple directions—often ad hoc and in emergency situations—and a very high value on collaboration and real-time decision-making. To accomplish that, the RealityVision platform was built on a principle of mobile video collaboration: incorporate many different visual sources and allow each enterprise to easily tailor the sources it wants to share with authorized users.

The key platform differentiators include:

- ✓ Enterprise architecture and security
- ✓ Ubiquity of available information sources
- ✓ Dynamic information creation and distribution
- ✓ Integrated annotation and notification
- ✓ Ease of integration with other enterprise-class systems

Enterprise Architecture and Security

RealityVision is built upon common standards, technology, and practices with the goal of providing a secure but well understood solution. Based on years of experience working with enterprise IT departments, the RealityVision platform incorporates many architectural, security and assurance measures to meet enterprise performance requirements and to support IT best practices. A partial list includes:

- Network bandwidth optimization—A critical enterprise performance requirement is the ability to allow a user to stream video and watch incoming video sources over low and variable

bandwidth networks. You never know where you will be when you need to stream or receive critical imagery. Even with modern cell networks it can be difficult to predict what bandwidth will be available at any given moment. RealityVision allows users to stream and receive actionable visual information in high bandwidth conditions, low bandwidth conditions, or while switching between the two. It doesn't matter if the person is using commercial or private cellular carriers, Wi-Fi networks, or a mesh network based on tactical radios. Our transmit protocol for streaming from the device over those networks is also optimized to adapt instantly to changing network conditions, maintain image quality, and prevent partial reconstruction of the images at the viewer.

- Distributed architecture—System components can be installed behind the enterprise firewall on different hardware and in different locations/zones in support of IT best practices.
- Secure communications channels—SSL/TLS support out of the box; FIPS 140-2 compliant VPN options. Please contact us if you require Suite B level encryption.
- Access controls—User authentication and authorization; authentication module support.
- Data traffic optimization—Power management and heartbeat checks are used to minimize network traffic and preserve device battery life, a critical factor for mobile users.
- Server scalability—Flexibility to pool, segregate and group users across physical and virtual servers; a new import-export feature allows data to be shared across servers while preserving server autonomy.
- Metadata indexing—Incoming video streams are indexed against a multitude of metadata elements, including user, device, location information and user-generated descriptive text tags, enabling broad searches but accurate identification of videos.
- Automatic video transcoding and bandwidth adaptation.
- Customizable transmit compression, image quality and bandwidth allocation.
- Data management system.
- Audit logs.

Please contact us to receive a copy of our separate October 2010 white paper on security and information integrity.

Ubiquity of Available Information Sources

Our working philosophy is that any critical information that an enterprise can access in the field or on a PC screen should be able to be shared instantly and securely with every authorized employee who needs see it. As shown on the system diagram on page 2 of this white paper, the RealityVision system today supports many different kinds of information sources:

- User-initiated streams – From virtually any camera source, including:
    - Supported cell phone cameras
    - A wide range of cameras tailored to an organization's specific operational requirements, from microscope cameras to webcams to handheld camcorders to long-range telephoto cameras.
- RealityVision® Screencasts™ — As discussed further below, this allows any RealityVision console operator or PC user to define any region of the PC screen and stream its contents as a live video source.
- Network Cameras – Select any fixed or mobile network cameras to be viewed securely by remote users. The system supports the use of multiple video formats and camera types and remote pan-tilt-zoom (PTZ) controls.
- IP video feeds, such as UAV feeds.
- Other data sources, such as web pages, text messages, video files, images and documents.

RealityVision Screencasting. We refer to this feature set as an ad hoc integration tool. By that, we mean it offers the ability to couple disparate systems without having to formally integrate them in order to meaningfully share data between them in real-time. As one illustration, enterprises have many existing tools to render complex data on a PC screen—SCADA data, 3D modeling, schematics, diagrams and much more. Screencasting allows the organization to share that data in real-time with RealityVision users without any integration between the systems. In Figures 1 and 2 below, a 3D model based on surveillance and reconnaissance imagery is being shared in real-time with soldiers on their mobile devices while en route to a mission. The feed is simultaneously being saved in the RealityVision archive for subsequent retrieval, annotation and analysis at any time by the recipients or other authorized users. The 3D model could just as easily be industrial information, such as schematics to assist in the remote repair of a tool breakdown or an industrial control system.

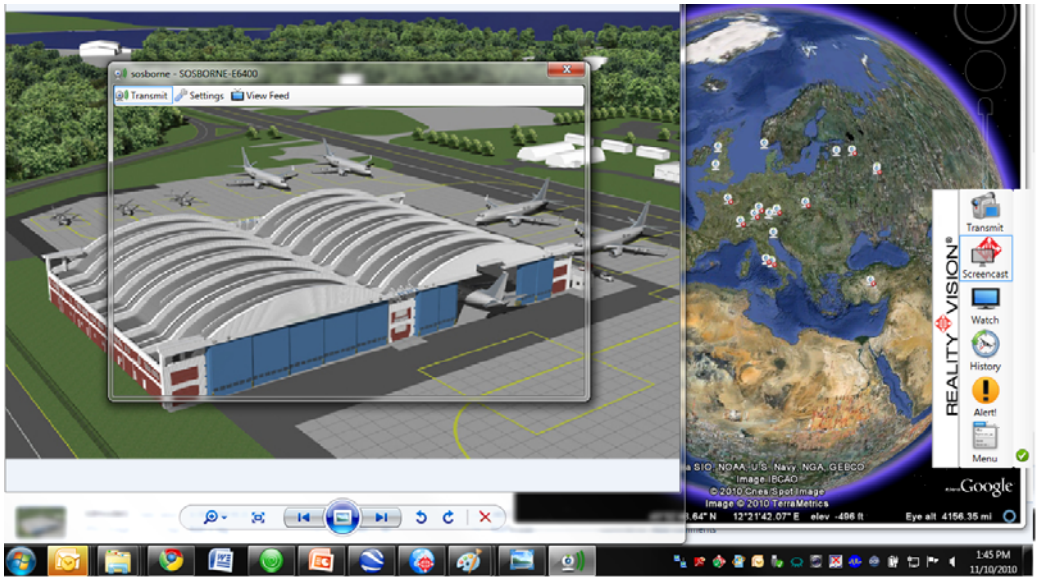


Figure 1: The Screencast region streaming the hangar visualization

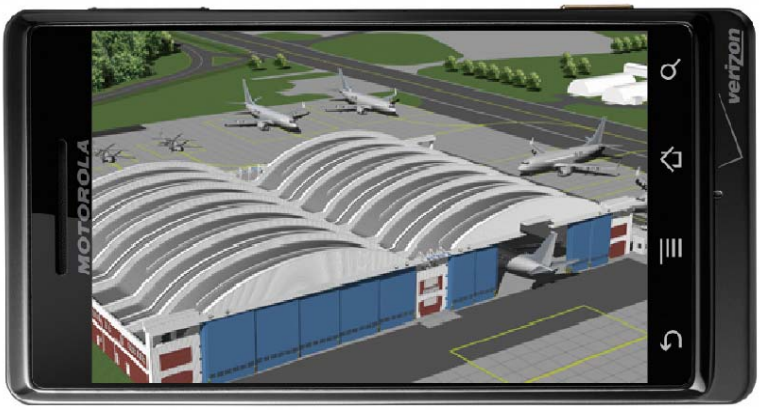


Figure 2: As the Screencast appears on the mobile device.

Dynamic Information Creation and Distribution

As shown on the system diagram on page 2, the RealityVision server software is the system hub and is typically installed behind the enterprise firewall. Each server has its own available video sources, and the enterprise determines user access to each server. RealityVision does not support auto-posting of data files to social media sites or other auto-distribution options. It is a bedrock security principle that an enterprise must control access to its own information, and no enterprise can afford the risk that an unauthorized release of an internal operational video will go viral on the Internet.

As illustrated in Figure 3, video sources are categorized in different ways for ease of presentation to console operators and mobile users. Multiple server installation options are available to support IT security policies.

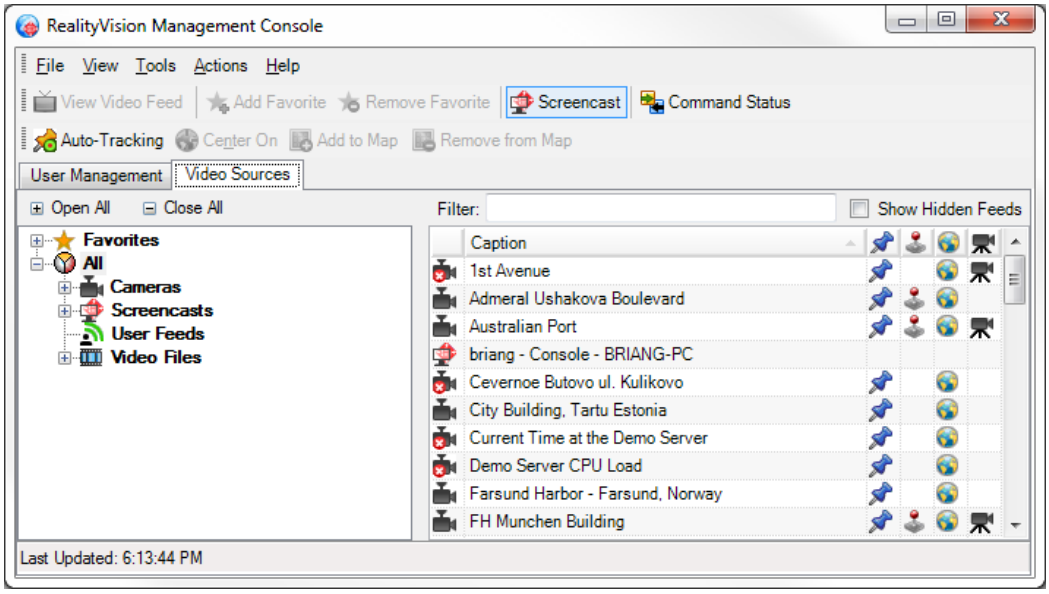


Figure 3: Some of the video sources available to the console operator for distribution to users

Console Operators. A console operator can share with any number of authorized users access to any available live or archived video source. It's a simple process: select the source, pick the users (or a predefined group of users), and hit "OK". As discussed in the next section of this paper, additional annotation and notification options are available for enhanced user context. The operator can initiate other actions as well, such as turning on or off remote cameras to control incoming video streams and requesting mobile devices to automatically dial a designated phone number, such as a conference bridge, in order to establish immediate verbal communications among users. The operator can also track the location of system users and video sources on a map display. The RealityVision platform also supports simultaneous voice and data connections on the mobile device, if permitted by the wireless carrier and the device itself.

Device Users. Depending on the device, authorized users have multiple ways to create and access video sources as well, including the ability to:

- Stream live or prerecorded video feeds from virtually any camera source, along with user-initiated text tags for greater context and to expedite archive searches.
- Automatically report their location information. If they are streaming video at the same time, the corresponding location information will also be embedded in each of the video frames.

- Access any available video source—any user-initiated stream, Screencast, camera feed or imported video file—and view it alongside a map with its available location information.
- Remotely control network camera movements.
- Initiate a one-button silent alert for assistance.

As one illustration, we have included in Figure 4 two side-by-side images: the left one shows the home page for our new Android phone application and the right one shows the user's ability to enter a text tag with a video stream. Text tagging is discussed further in the next section of this paper.

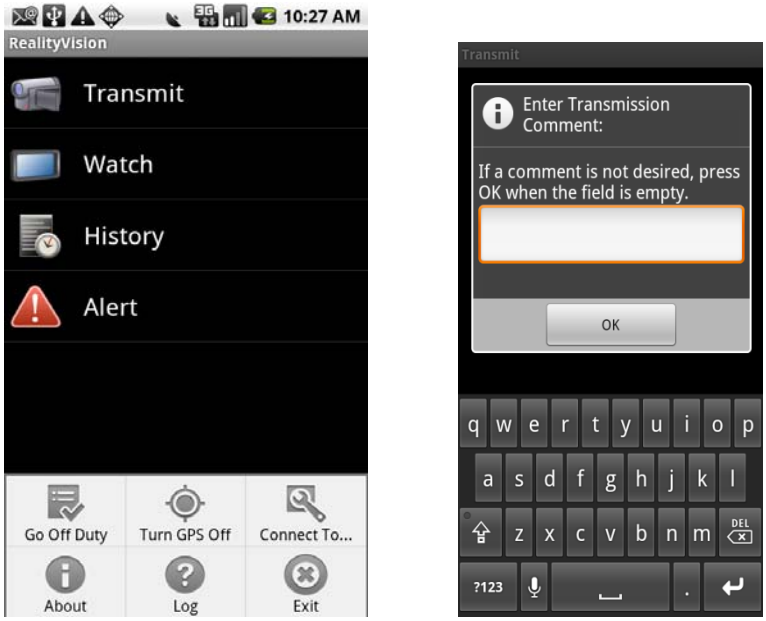


Figure 4: Android home screen and our latest text-tagging capability for user-initiated streams

On the home screen menu:

- A user pushes the Transmit button to initiate a video feed.
- The Watch button accesses the catalog of all available video sources; the user can also bookmark favorite video sources from the catalog or as they are watching them for faster subsequent retrieval.
- With the History button, the user can access a personal history log to retrieve any video stream or other data file sent previously to that user by a console operator. A police officer, for example, can instantly retrieve a suspect's photo or a commercial employee can retrieve operational information, such as a schematic or 3D rendering.

- The Alert button initiates the silent alarm. Depending on the device, that could trigger multiple actions, such as automatically causing the device to start streaming video, to share location information or to initiate a phone call to a predefined phone number.

Multidirectional Sharing. Different video sources can also be shared at the same time for real-time collaboration. In one illustration, in Figure 5 a field user operating a ruggedized device is transmitting a live feed from the device camera to one or more remote experts (the transmitting window on the left side) and simultaneously receiving a live RealityVision Screencast of the relevant schematics to help fix the problem. Conversely, if the U1 operator had been running a diagnostic tool on the device itself, he or she could have initiated a Screencast from the U1 to stream that information to remote experts.

Figure 5: Real-time mobile collaboration

Import-Export Feature. Working with IT departments, we have developed a new import-export feature that allows information to be shared between servers in a manner that preserves each server's autonomy. As an example, if Employee A has streamed live video to Server #1 and the organization wants to share that feed immediately with employees assigned to Server #2 and Server #3, but without giving those employees access to Server #1, an authorized employee can use a one-step process to export the video from Server #1 and then, as illustrated below, import it into the other servers, where it is now available for immediate access and viewing by those employees.

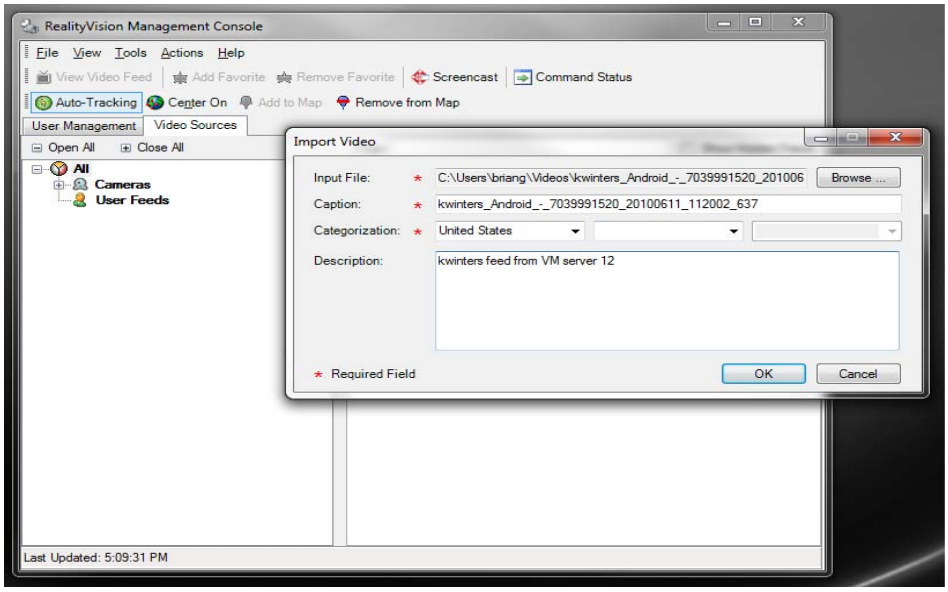


Figure 6: A video source being imported for ease of user access

Integrated Annotation and Notification

Our latest RealityVision release, version 3.0, greatly extends our integrated annotation and notification capabilities based on extensive enterprise user feedback. In doing so, we continue to reinforce four core themes: secure access, speed of delivery, ease of use and information context for the user. All video sources are stored and managed centrally, categorized in multiple ways for ease of access by authorized users, and shared within the system through a dedicated communications channel. Each time a user signs on to the RealityVision system, the device maintains a secure continuous connection with its assigned server, optimized for power consumption. Because of the dedicated connection, it can take seconds for an operator-initiated video feed to be presented to the user. The RealityVision platform does not use SMS messages or email to share information within the system. In our experience, SMS is too unreliable and email is too clunky a mechanism. You can't expect busy first responders to dig through all their emails to figure out what they really need to see at any moment in time.

Instead, RealityVision console operators can employ multiple annotation and notification options to let users know exactly what they are being presented for viewing. At that point, the user has the option to view the visual information immediately or to retrieve it at any later point through that user's personal history log. In the same fashion, each time a user signs on, he or she will be notified of any video sources or other data that had been sent to that user while they were signed off. As shown in Figure 7, the user can decide at that point whether or not to view the pending video sources immediately:

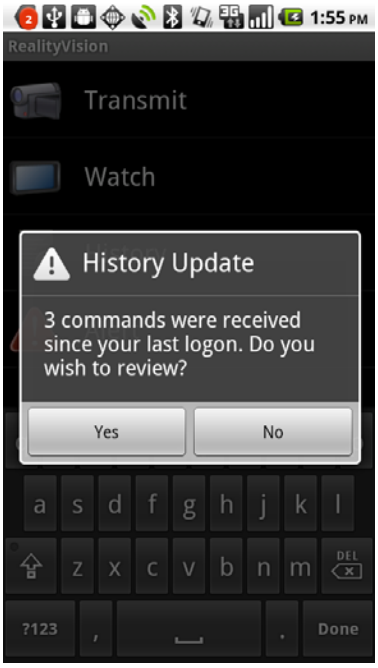


Figure 7: User notification of pending video sources

When a console operator selects a live or archived video source to share with authorized users, the operator has multiple options to add immediate context to the video source, including the ability to include a text message, to use simple annotation tools to highlight specific aspects of the visual information, and to request a one-push yes/no response from the users. After distributing the video source to the users, the operator can also access a real-time read receipt at any point to determine each user's status, as illustrated further below in Figures 14 and 15.

Text Tagging. As noted earlier, any user can include a text tag with an incoming video stream for ease of subsequent identification. A console operator can also initiate a text tag while viewing any user stream. All text comments are stored with the associated video. From the video archive, authorized users can initiate text searches to find the video, can review the full set of available comments, and can add additional comments. Each tag is time-stamped with the username for auditing purposes. In essence, each video stream has its own associated library of comments that grows as the organization identifies additional relevant information. Figure 8 shows a partial set of comments for a video session. The Add Comment button allows the authorized user to add a comment to a specific frame (for example, "note the brittle wiring in the upper left chamber") or to the video session in general, as shown in Figure 9.

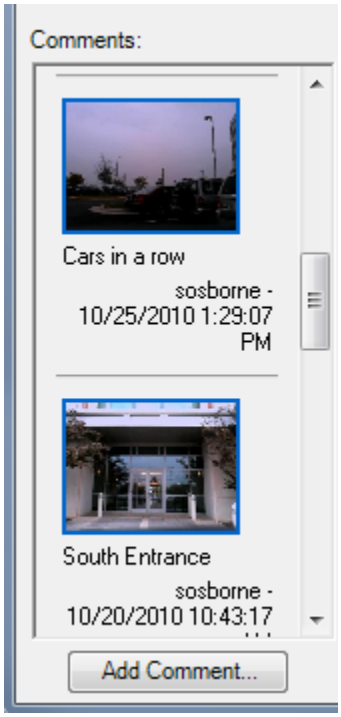


Figure 8: Text tags for an archived video frame

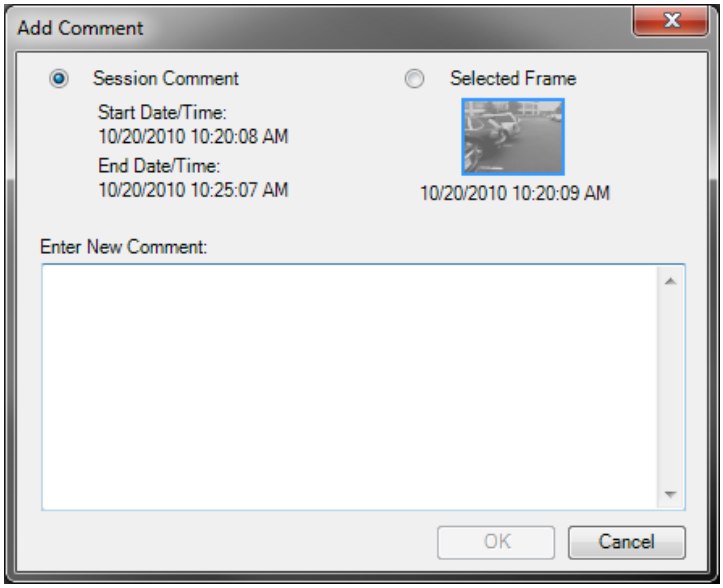


Figure 9: Extending the comments with updated information

The Scenario. To illustrate the integrated nature of the annotation and notification capabilities, we have set out the following scenario based on an undercover investigation in Las Vegas. You could substitute any governmental or commercial fact pattern where the real-time sharing of visual information can help solve an immediate need.

Three undercover officers are monitoring a crowded trade show in Las Vegas based on an anonymous tip that a con artist is targeting the event. With just a vague physical description of the individual, the undercover officers are using their mobile devices to stream video, their location information and text tags to the temporary operations center set up in one of the hotel rooms. The operations center and each officer are able to independently view all the video streams, like this one:

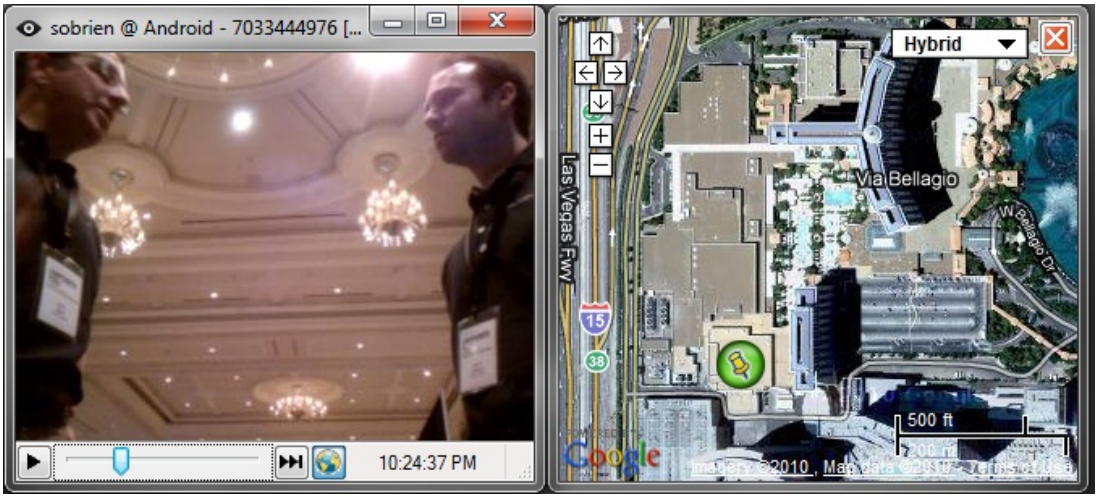


Figure 10: A video viewing window with associated map location

As further information is being gathered, the command center is able to update the text tags with additional information, as shown in this view of the video history for those video sessions. The growing set of text tags associated with the video appears in the lower left corner:

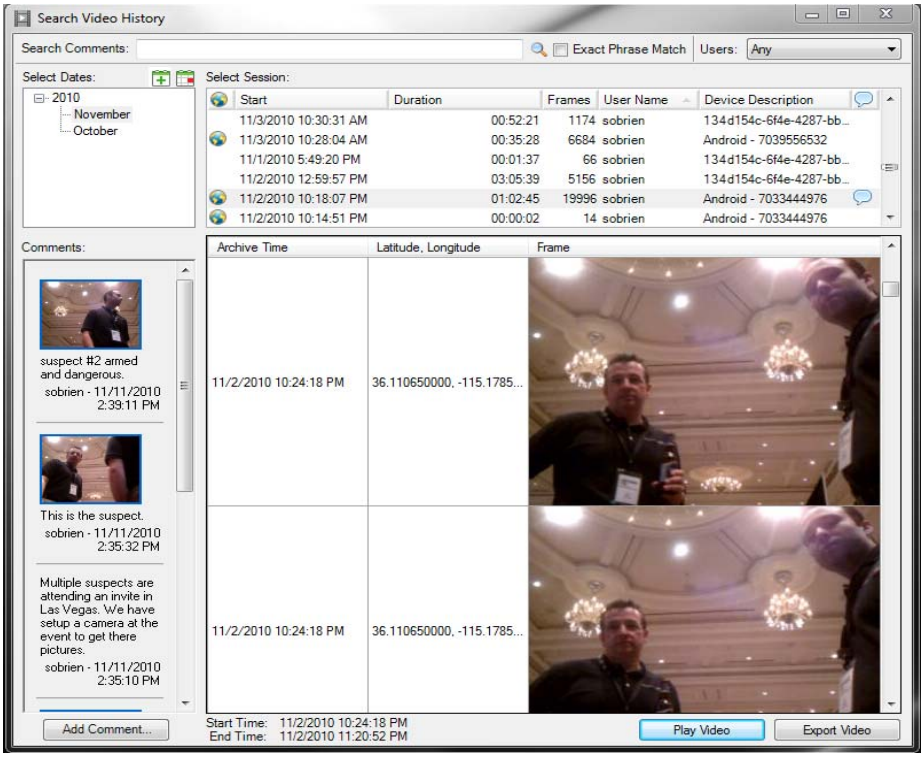


Figure 11: Video history shows frame-by-frame video with all associated text comments and location information

The temporary command center has now identified a potential suspect and shares one of the archived images with the undercover officers at the event. Before sending it, the operator types in the message "This man is armed and dangerous. Have you seen him?", annotates the image with a red circle and arrow, and includes a requested yes/no response to make it as easy as possible for the officers to reply:

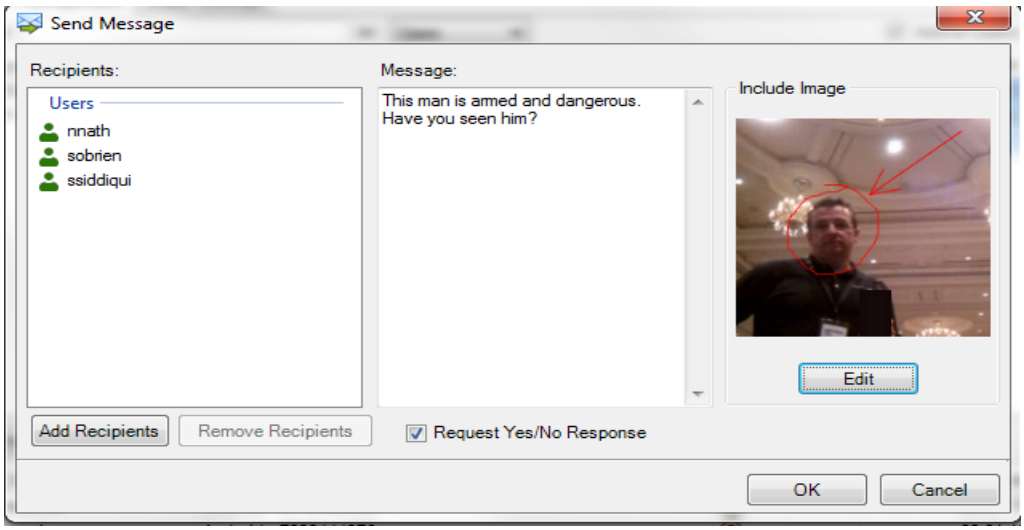


Figure 12: Console message window

After hitting the OK button, the integrated message immediately goes out to the officers, giving them the option to view the image with or with the annotation overlay:

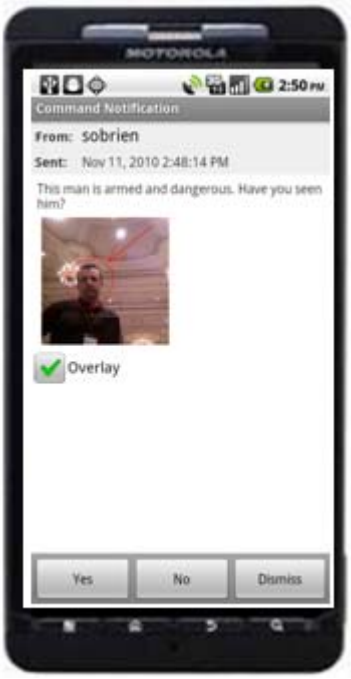


Figure 13: Message received on the device

Meantime, the console operator wants to know which officers have accessed the annotated image without interrupting them, and so she checks the read-receipt window available from the console:

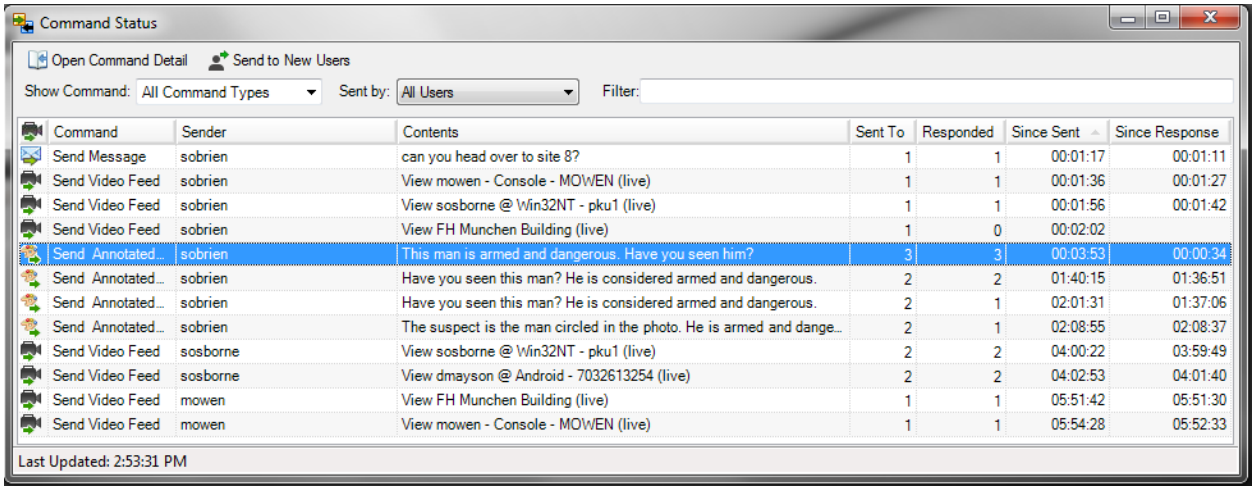


Figure 14: Rolling status of all actions initiated with users

At this point, all three officers have responded. She then checks the status details to learn that 1 officer has responded yes and 2 have responded no:

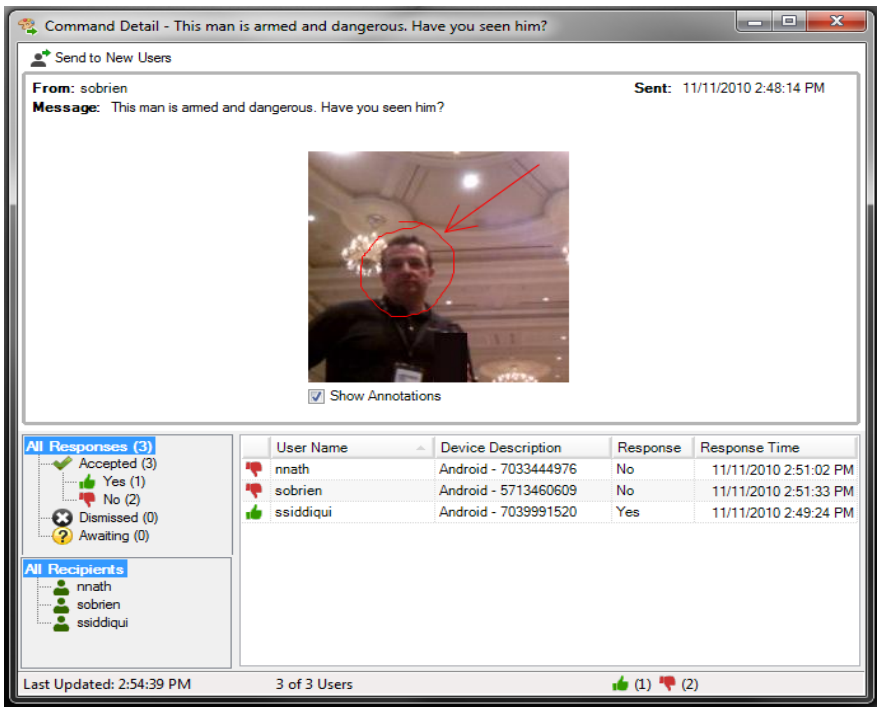


Figure 15: Status details for an annotated image sent to users

Some minutes later, one of the officers who answered “no” sees an individual that seems to be a match. To be sure, the officer goes to his personal history log on the device and retrieves the message (the bottom one shown in the log), which causes the annotated image to reappear on the device:

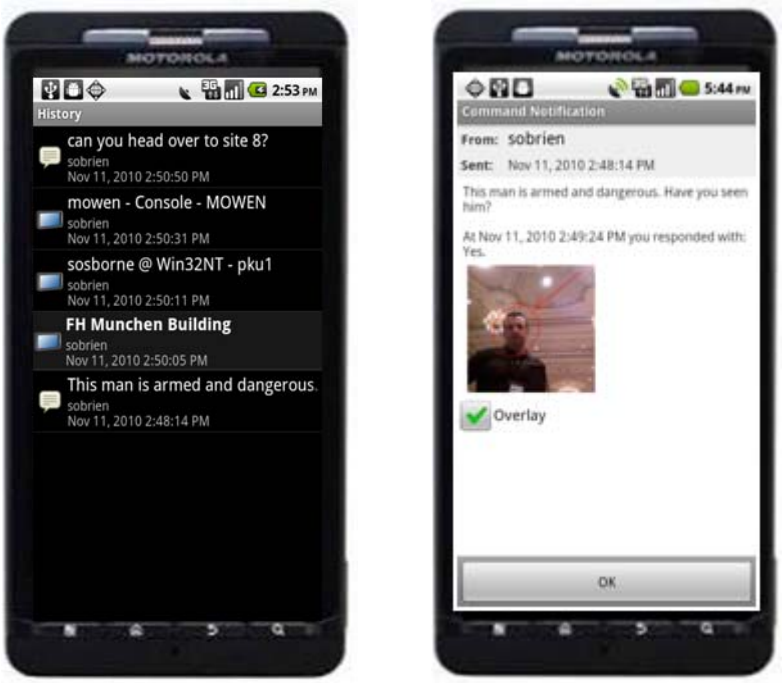


Figure 16: A user's personal history log and the associated message

With that match, the suspect is arrested and Las Vegas is saved. The end.

Ease of Integration

Based on the same core principle that enterprises want different components to function seamlessly, the RealityVision system was designed from the ground up to allow for integration with other enterprise components and systems when required to meet the organization's business processes, such as:

- Situation management software platforms
- Video surveillance tools and infrastructures
- Enterprise content management platforms
- Artificial intelligence solutions

Among other reference customers, the Los Angeles Harbor Department Port Police Department has integrated RealityVision with its existing security infrastructure, including video and access control technologies, to incorporate feeds from more than 350 fixed cameras in the Port complex. The RealityVision platform is a key component of the new Port Police Operations Center, where the Port Police are implementing an Integrated Command and Control System that will serve as an important emergency operations hub for monitoring daily Port security.

The Port Police are one of a few forces in the nation tasked with protecting a complex mix of assets on land and in the water, around-the-clock, 365 days a year. Their primary goal is to maintain the safety and security of the Port, which is the busiest container port in the US and the 8th busiest in the world, as well as the busiest cruise ship center on the West Coast. The Port's 46 miles of waterfront and 14 square miles of heavy industrial complex make domain awareness a critical task:

> "Our current Threat Detection Center monitors video feeds but, for example, if an officer monitoring video saw someone jump a fence at the Cruise Terminal there was no way to share that video with our field officers in a timely manner, nor could officers on the front line share visuals with commanders back at the center. RealityVision allows us to do all of that and more, creating an instant shared awareness among the Port Police force that is invaluable in our ability to quickly assess and respond to critical situations."
>
> Julia Kirwan, Manager of Port Police Technologies

Here is an aerial view of the Port courtesy of the POLA photo gallery:

Please see these linked articles in Forbes and CIO Magazine for additional details.

Conclusion

The ability to stream live video from the phone is a great convenience for consumers and enhances social networking through the ability to auto-post video feeds to personal blogs and other favored social media sites. That kind of streaming capability can also be invaluable to enterprises in enhancing their situational awareness, but only when properly deployed in support of enterprise performance, security and interoperability requirements. Especially in emergency situations, it is unmanageable to require employees to access multiple different applications on their device to handle incoming and outgoing video sources. The better answer is mobile video collaboration—using a single software platform to manage access and delivery of all the disparate video sources available today to enterprises. A platform that promotes omnidirectional information flows, that meets IT security requirements and that supports integration with other enterprise back-end systems when necessary to meet the organization's workflow requirements. Welcome to RealityVision.

Brian Geoghegan, Chief Product Officer, Reality Mobile LLC