White Paper: Digital Video Systems and Back-End Solutions – the Coban EDGE represents a total solution

This white paper describes aspects of digital video systems that should be taken into consideration by law enforcement agencies when preparing to adopt in-car digital video recording and video management solutions. Coban Technologies TopCam EDGE® and DVMS are used as a representative system in an effort to highlight underlying technologies that have been implemented in the industry, and further demonstrate how these technologies comply with and adhere to generally accepted practices, specifically in instances of court challenges (Daubert Challenges).

Whatever the system, a complete in-car digital video solution should include the following four major hardware/software components:

1. In-Car Video Capture
2. Video Transfer Solutions (from the vehicles to back-end storage)
3. Back-end Video Storage Solutions
4. Back-end Video Management

In-Car Video Capture

A simple and uncomplicated user interface design is a key component to an effective in-car recording system. The operation of the in-car recording system should be straight-forward with a control panel designed with ease of access in mind. The ability to utilize dual wireless microphones should be supported and works best for agencies if they operate on the same frequencies, alleviating the need to pair up a 2.4 GHz unit with a 900 MHz unit for example. Recorded videos should be recorded in an industry-standard, non-proprietary format and should be able to collect metadata (such as emergency equipment status, GPS data) as well as event-related data (such as event type and offender's information).

TopCam EDGE is designed as a high performance standalone mobile digital video recorder that incorporates all of the above stated features. It is best suited for departments that already utilize an in-car computer system allowing Coban to provide optional MDC integration software that can be installed on the in-car computer to give officers the ability to control the TopCam EDGE via their in-car computer.

TopCam EDGE utilizes touch screen technology that provides context-related, on-screen buttons allowing for the richest user interface possible and the elimination of unnecessary or wasted space on the console. All of the interaction between the user and the TopCam EDGE has been designed with the end user in mind and features large, boldly marked buttons on the touch screen. Compared to interfaces that use hard-wired buttons, adding new functions to the TopCam EDGE user interface is as simple as a software update; a process that Coban has completely automated. By using a touch screen interface, the TopCam EDGE mitigates vehicle downtime for service and provides fewer mechanical buttons to wear out or breakdown._

TopCam EDGE supports dual wireless microphone use plus an in-car covert microphone and allows all three microphones to be controlled separately. When the "dual wireless microphone use" functionality is enabled, both Coban wireless microphones are interchangeable within the vehicle. This capability means that agencies do not have to manage the paring up of different microphones in the appropriate vehicles (for example, pairing up an 900 MHz microphone with a 2.4 GHz microphone). TopCam EDGE microphones use DSS frequency hopping technology to avoid channel conflict; an industry standard for cordless voice communications.

TopCam EDGE supports up to six cameras and can capture recordings from five cameras simultaneously. The system encodes videos into the H.264 (MPEG-4 AVC) format; the current standard for video compression. H.264 is the latest block-oriented, motion-compensation-based, codec standard developed by the ITU-T Video Coding Experts Group (VCEG) together with the ISO/IEC Moving Picture Experts Group (MPEG). MPEG, established in 1988, was formed by the ISO to set standards for audio and video compression and transmission. MPEG's official designation is ISO/IEC JTC1/SC29 WG11 - Coding of moving pictures and audio.

Video Transfer Solutions (from the vehicle to back-end storage)

The process of video transfer refers to the following two procedures:

1. The transfer of videos from the in-car units to the back-end storage
2. The transfer of videos between police sub-stations when there are multiple stations in major metropolitan or State agency environment

Uploading videos from vehicles to a back-end storage system is commonly done through a wireless network, a hard-wired network, or via removable media. In-car recording units should support at least two of these three methods in order to ensure that there is always a secondary transfer method in the event that the primary method fails to perform.

TopCam EDGE transfers videos to the back-end storage system in the following three ways:

1. Removable hard drive: The removable hard drive connects to an upload cradle that is connected to a workstation on the back-end network. The upload cradle uses an industry standard USB 2.0 interface to connect to any Windows based computer (Windows XP, Vista, or Windows 7). The design of the USB is standardized by the USB Implementers Forum (USB-IF), an industry standards body incorporating leading companies from the computer and electronics industries.
2. Wired Ethernet connection: Giganet Ethernet is typically deployed with the TopCam EDGE system. Ethernet is standardized as IEEE 802.3, and is the most widespread wired LAN technology, in use since 1980.
3. Wireless LAN: 802.11 a, g, and n, a set of IEEE standards maintained by LAN/MAN Standards Committee (IEEE 802), is supported by TopCam EDGE. As it is an industry standard protocol to exchange and manipulate files over a TCP/IP based network, TopCam EDGE utilizes upload software via an FTP protocol.

In a multi-station environment, agencies should have the freedom to select how videos are stored and accessed: centrally distributed or stored based on specific event descriptions. Depending on the underlying infrastructure, videos can be transferred to central storage on a scheduled basis, or stay at the sub-station level to be transferred on an on-demand basis.

For departments that have multiple stations, Coban has designed several different solutions to achieve high video availability to multiple stations in a secured environment. These solutions include both centralized and distributed video storage. All of Coban's solutions are based on the infrastructure available to the department and can be modified based on budgetary constraints. No matter how the department-wide network is setup, so long as the sub-stations are connected, the Coban solution allows any user on the network the ability to retrieve any video as soon as the video is uploaded to a sub-station on the network.

Back-End Video Storage Solutions

For most major agencies, video storage can be the most challenging part of a digital video management system. An increasing number of policies and rules require that digital evidence collected by law enforcement agencies remain in storage for extended periods of time. Any worthwhile video storage system should consider accessibility, capacity, and maintenance of digital video in its solution and should achieve this goal through a two-tiered storage architecture. This type of architecture ensures that the newest videos as well as videos supporting court cases can to be accessed more frequently and be housed on fast, RAID storage. Other videos should be stored on lower cost, easier to maintain, near-line or off-line storage such as digital tapes (LTO) or optical media (DVD). The system should automate, or semi-automate the procedure for the users to access videos stored on this near-line or off-line storage.

A RAID system is commonly used by small agencies to store all videos; or used by large agencies to store the most recent videos for fast access. RAID is the computer industry standard that can divide and replicate data among multiple hard disk drives. However, due to the cost and maintenance involved with huge RAID systems, LTO tape libraries can be used for mid to large agencies to fulfill long term video storage needs. LTO is a magnetic tape data storage technology originally developed in the late 1990's as an open standards alternative to the proprietary magnetic tape formats that were available at the time. Seagate, Hewlett-Packard, and IBM initiated the LTO Consortium, which directs development and manages licensing and certification of media and mechanism manufacturers.

Coban video storage solutions support both RAID based solutions (SAN, DAS, ISCSI) and LTO tape libraries.

Coban's tape library solution is the most sophisticated, fully automated storage solution in the digital recording and management market. Videos are archived to digital tapes within twenty-four hours after having been uploaded to primary storage. This quick archival process ensures that the department gets a backup copy of the videos as soon as possible. Once the videos are recorded to tape, the system marks the videos as archived allowing them to be removed from RAID storage when space is low or once

retention criteria is exceeded on primary RAID. However, videos can be manually tagged by users and retained on the RAID storage at will.

In cases where a video has been removed from RAID storage but is needed for review, Coban's DVMS software instructs the tape library to use its built-in robotic arm to retrieve the tape and the requested video back to the primary storage. This fully automated process ensures that the agency does not need to manually manage the process of archiving tapes, keep track of where the tape is located or know in which section on the tape the video resides.

Coban also offers an "Automated DVD Solution." This ability to store videos on DVD's offers a low-cost storage solution for any size agency as an alternative or addition to tape libraries. Videos can be backed up to DVD's automatically using an Auto-DVD writer that prints labels on the DVD's for easy retrieval. Once the videos are backed up to DVD, the system automatically marks the videos as archived so they can be removed from the RAID when space is needed. The resulting video retrieval procedure is similar to the tape solution except the operator has to allocate the DVD manually.

Back-End Management

Back-end management functionality directly affects the usability of any video recording and management system. A good video management system should allow administrators the ability to perform all of the following functions:

1. Setup video retention policies based on video classes
2. Manually overwrite default retention policies based on practical requirements
3. Control video access based on group of users, chain of command, or other criteria
4. Grant access exceptions for selected videos

With the Coban Digital Video Management Solution (DVMS), the system administrator determines which types of videos are backed up to the extended storage system (tape library or DVD) and the retention period for each type of video. Once the retention period expires, videos are removed from the system automatically. Active Case Management and Delete Approval procedures are two additional functions in Coban's DVMS to help administrators more easily control the lifespan of video evidence in the real world. Access exceptions can be made through "active case management" by the administrators. Extended holding and removing of evidence is accomplished through "hold requests" and "delete approval". All video related activities are logged for the purposes of following the chain of custody.

To further ease the management effort, the Coban DVMS is designed to automate system update procedures. When in-car software needs to be updated or in-car settings are changed, an administrator can simply load the changes on the main server and push the new updates to sub-servers (in a multi-station environment) and in-car units automatically. This is the same for back-end software; administrators don't need to update each workstation manually, just the main server.