



**Digital Video Recording &
Management System**
(Honeywell Digital Video Manager R200.1)

Guide Specification

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1 General

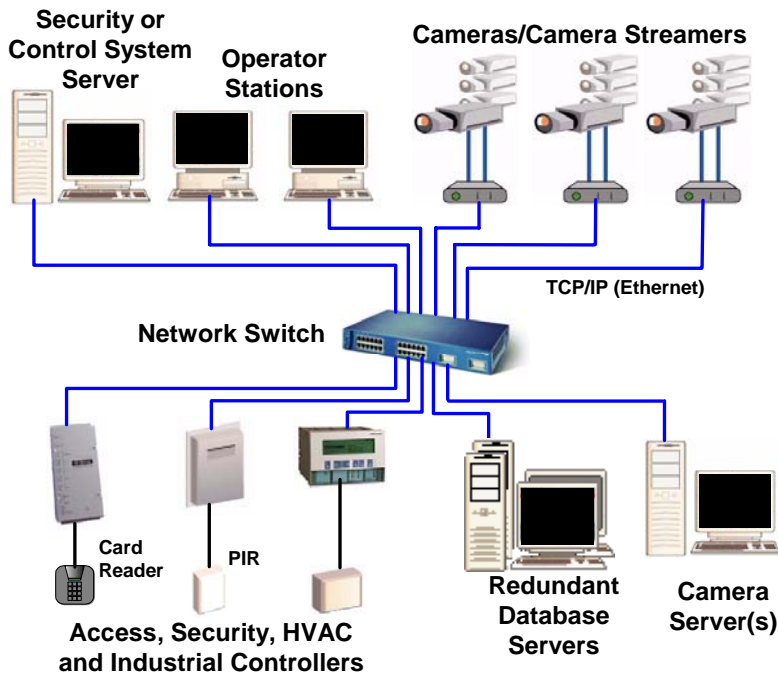
The Digital Video Recording & Management System (DVRMS) shall be designed and developed to the following standards:

- ISO 9001 (2000)
- ISO/IEC 15504 Level 3 or higher (SPICE 2.0 Software Process Improvement and Capability Determination)
- SEI CMM Level 3 or higher (American Software Engineering Institute - Capability Maturity Model)

The Digital Video Recording & Management System shall include:

- Redundant Database Servers
- Camera Servers
- Security or Control Systems
- Operator Stations
- Network connected cameras or network connected camera encoders
- Network infrastructure

The following diagram explains the relationship of these system components:



1.1 Database Servers

The Database Server contains a database of all network-connected cameras and their configurations.

The Database Server shall:

- Manage the system database, containing details including:
 - System configuration.
 - Camera configuration and settings.
 - Recording configuration and settings.
 - Configuration of Quad Views and Sequences.
 - Details of recordings.
 - Schedules.
 - Operator security details.
 - Configuration of Surveillance and Alarm Monitors.
 - Configuration of Video Analytics including:
 - Video Motion Detection.
 - Object Tracking.
 - Object Classification.
- Manage communication between the Operator Stations and the Camera Servers.
- Allow alarms/events in the DVRMS to initiate recordings.
- Report any camera failures or recording failures to the integrated Control system or Security system.
- Provide a full audit log of all system status (camera, encoder, server availability) and operator actions.

The Database Server shall be able to be used in a redundant configuration, using two separate Database Servers (being executed on separate computers). The backup Database Server shall be continuously synchronised with the master Database Server to ensure that it is always up-to-date and ready for a fail-over, when required.

There shall only be one Database Server or Redundant Database Server pair in the system.

1.1.1 Redundant Database Server

The DVRMS must be capable of running a pair of similarly configured computers in a hot backup configuration where at any point in time, one is the acting Primary and the other is acting as the Hot Backup. An on-line database duplication mechanism must be supported.

Having each Database Server scan each Camera Server, or requiring the Camera Servers to send all updates to both Database Servers is not acceptable. The database duplication must be performed on a per-transaction basis for two reasons:

- To ensure that the duplicated Backup database is consistent at all times with the Primary database.
- To avoid unnecessary loading of Camera Servers caused by duplicate polling.

It must be possible to remove one of the redundant systems for maintenance without interrupting operation, and upon its reinstatement, re-synchronize the databases, again without interruption to system operation.

1.2 Camera Servers

The Camera Servers must be capable of supporting a large amount of disk space for online video storage and access to high capacity archiving mechanisms for the removal of stored video to off-line media.

The Camera Server shall:

- Manage live video from camera encoders.
- Transmit live video to Operator Stations.
- Receive camera control commands from Operator Stations and then send the commands to cameras.
- Store live video to hard disk.
- Transmit previously stored video to Operator Stations.
- Archive previously stored video to off-line storage media.
- Retrieve archived video from off-line storage media.
- Provide Video Analytics including:
 - Video Motion Detection.
 - Object Tracking.
 - Object Classification.
- Export the recordings into MPEG format so that it can be viewed using standard tools including Microsoft's Video Player.

The Camera Servers shall rely on the Database Server for all camera database information.

The system shall support multiple Camera Servers, with no limit to the number of Camera Servers used in the DVRMS system.

1.3 System Sizing

The security system or control system for the site/complex requires that operators be able to view, record, and replay video, as detailed in this specification, for an unlimited number of cameras throughout the site/complex. The vendor must size the Camera Servers to accommodate the requirements of the cameras and desired recording frame rates.

2 Hardware

2.1 Database Server

The Database Server shall be able to operate with no performance degradation using the following hardware and operating system configuration:

- Pentium IV or Xeon 2.8GHz.
- 1024 MB RAM.
- Hard Disk storage to meet Section 4 requirements.
- 100/1000 Mbps NIC for network connection to the other components of the DVRMS.
- Windows 2000 Professional, Windows XP Professional, Windows 2000 Server and Windows 2003 Server.

If the equivalent hardware is proposed, then the supplier must be able to demonstrate compatibility of software as described in Section 4.

Proprietary hardware platforms are not acceptable.

The Database Server must provide the following system fault tolerance:

- Support RAID 0+1, 1, 3 or 5 for the Operating System.
- Support RAID 0+1 or 1 for the DVRMS database (SQL Server 2000).

2.2 Camera Server

The Camera Server shall be able to operate with no performance degradation using the following hardware and operating system configuration:

- Pentium IV or Xeon 2.8GHz.
- 512 MB RAM.
- Hard Disk storage to meet Section 4 requirements.
- 100/1000 Mbps NIC for video transmission to Operator Stations.
- 100/1000 Mbps NIC for video transmission from camera encoders.
- Windows 2000 Professional, Windows XP Professional, Windows 2000 Server and Windows 2003 Server.

If the equivalent hardware is proposed, then the supplier must be able to demonstrate the compatibility of software as described in Section 4.

Proprietary hardware platforms are not acceptable.

Each Camera Server must provide the following system fault tolerance:

- Support RAID 0+1, 1, 3 or 5 for video recordings (clips).
- Support RAID 0+1, 1, 3 or 5 for the Operating System.
- For the failure of a Camera Server, all cameras which were managed by that Camera Server shall be able to be dynamically re-allocated to other Camera Servers. This shall only be done through the DVRMS software, without requiring changes to cabling or the network.

2.3 Multiprocessor Support

The Database Server and Camera Server software shall be able to run on both multiple and single processor computers. Where a multiple processor system is used the DVRS software shall be able to make optimal use of that configuration.

2.4 System Fault Tolerance

A failure of any one of the Database Servers or Camera Servers shall NOT cause the DVRMS system to cease operation. As a worst case, only the cameras controlled by the failed Camera Server will be temporarily unavailable until re-allocated to other Camera Servers using the DVRMS software. No physical changes to hardware, cabling or connections shall be required.

Proprietary hardware platforms are not acceptable.

2.5 Cameras and Camera Encoders

The Digital Video Recording & Management System shall be expandable to support a minimum of 4096 cameras.

As a minimum, the system must support the following network cameras and camera encoders:

- Honeywell KD6i Digital Dome PTZ Camera.
- Honeywell Network Video Adapter HNVE130A.
- Honeywell Rapid Eye™ Multi Media LT.
- Honeywell Rapid Eye Multi Media.
- MegaChips OpennetView.
- MegaChips MD-100.
- AXIS Communications 205.
- AXIS Communications 206.
- AXIS Communications 206M.
- AXIS Communications 210.
- AXIS Communications 211.
- AXIS Communications 211A.
- AXIS Communications 213.
- AXIS Communications 2100.
- AXIS Communications 2110.
- AXIS Communications 2120.
- AXIS Communications 2130.
- AXIS Communications 231D.
- AXIS Communications 232D.
- AXIS Communications 2400.
- AXIS Communications 2400+.
- AXIS Communications 2400+ Blade.
- AXIS Communications 2401.
- AXIS Communications 2401+.
- AXIS Communications 2400+ Blade.
- AXIS Communications 240Q.
- AXIS Communications 2411.

- AXIS Communications 241S.
- AXIS Communications 241SA.
- AXIS Communications 241S Blade.
- AXIS Communications 241Q.
- AXIS Communications 241QA.
- AXIS Communications 241Q Blade.
- AXIS Communications 2420.
- Sunjin CamStation CS100.
- Sunjin CamStation CS-3001V.

2.6 Network and Video Cabling

A Local Area Network (LAN) shall be provided for communication between the system elements. All interfaces to the LAN shall be a minimum of 100BaseTX Ethernet. The LAN may use additional technologies within the backbone for greater speed or distance. Acceptable types are:

- FDDI.
- 100BaseFX.
- 1000BaseSX or 1000BaseLX Gigabit Ethernet.
- Asynchronous Transfer Mode (ATM).

The LAN shall use standard network cables. Acceptable cable types are:

- Optical Fiber.
- Category 5e or Category 6 Unshielded Twisted Pair (UTP).

The LAN shall be logically and/or physically separate from any existing LAN infrastructure. Interconnection to other LANs shall be through one of the following:

- A router.
- A Layer 3 capable network switch.
- As an additional VLAN to the existing LAN equipment. Where required to interconnect VLANs, a router or Layer 3 capable switch shall be provided.

2.6.1 Video Cabling

Where standard CCTV cameras are used, RG59/RG11/RG6 coaxial cable or optical fiber shall be used to connect the camera to a video encoder. Video encoders shall be located at locations closest to the CCTV

cameras. In a new installation it is not acceptable to install a star topology video cabling system with all cabling coming back to a single location.

It is not acceptable for video cables to be run back to the Camera Server. All communications with the Camera Server shall be via the LAN.

Each network camera or video encoder shall have a single network interface to be used for video and Pan/Tilt/Zoom communications.

3 System Software

This section describes the required System Software. If other software is proposed then suppliers must be able to demonstrate full compliance with Section 4.

3.1 Database Server

The Database Server will include the following system software components:

- Windows 2000 Professional, or Windows 2000 Server operating system.
- Microsoft SQL Server 2000 database.
- Microsoft Internet Information Server (IIS) (web server).
- Application software with functionality detailed in Section 4.

3.2 Camera Server

The Camera Server will include the following system software components:

- Windows 2000 Professional, or Windows 2000 Server operating system.
- Application software with functionality detailed in Section 4.

It shall be possible to install the Camera Server software for all Camera Servers on the DVRMS from a central location.

3.3 Network

Each Ethernet Switch shall support:

- Simple Network Management Protocol (SNMP).
- IEEE 802.1D bridging capability and loop detection.
- IEEE 802.1Q tagged VLANs.

- IEEE 802.1p traffic prioritization for multiple Quality of Service levels.
- IEEE 802.1w rapid spanning tree with fast link support.
- IEEE 802.3ad link aggregation support.
- IGMP snooping for IP Multicast support.
- Multicast network traffic.
- Non-blocking configuration capable of simultaneous wire-speed switching across all ports.

4 Application Software Functions

4.1 Live Video

The live output from cameras shall be viewed through a series of displays. These shall support:

- Single camera view.
- Quad view of up to four cameras.
- Sequence view of camera preset positions.
- Modifying settings for a camera.
- Modify recording settings for a camera.
- Adding and deleting cameras.
- Creating schedules for recordings and video motion detection.
- Modifying Video Analytics settings and tuning for:
 - Video Motion Detection.
 - Object Tracking.
 - Object Classification.

Users shall be able to select a camera from a tree control listing the cameras available to the user.

The system shall also support multiple monitors in the following way:

- Surveillance monitor: Operators shall be able to send any Quad View, Sequence View or Single Camera View to a surveillance monitor. User shall be able to clear the monitor using the numeric keypad.
- Monitors shall be able to be configured to act as both Alarm and Surveillance monitors. In this case, the monitor behaves as a Surveillance monitor until an alarm occurs, in which case it shall

show the alarm video. Once the alarm is acknowledged, the video previously shown (as a surveillance monitor) is displayed again.

In each of these cases, these additional monitors shall be either connected to a Station using a multi-monitor PC card or to other PCs.

Systems that do not offer this functionality are not acceptable.

4.1.1 Single Camera

From this display, the user shall be able to:

- View the live output from the selected camera.
- Pan, tilt, zoom and focus the camera using a joystick attached to the Operator Station PC.
- Pan, tilt, zoom and focus the camera using a pointing device attached to the Operator Station PC. Standard Microsoft Windows 2000 or Microsoft XP Professional pointing devices such as a mouse or touch-screen shall be supported.
- For cameras that support continuous pan, tilt, zoom (PTZ), a mouse shall be able to be used for continuous PTZ directly in the live video window. By dragging the mouse up or down, left or right in the video window, the operator shall be able to tilt the camera up or down, or pan the camera left or right. Zooming must also be provided using the mouse in a similar way.
- Manually record live video. Recording will continue for the configured period of time. Once recording has begun, a stop button shall be provided as well as a counter showing the recording time remaining.
- Manually store the current frame of video (snapshot) as a bitmap image file. The file name shall be automatically generated by the DVRMS software and include the camera name, date and time of the recording (to millisecond precision).
- Indicate whether video motion detection is currently enabled for the selected camera.

4.1.2 Quad View

The DVRMS shall support quad views. A quad view consists of up to four related cameras viewed simultaneously on a single display.

The quad view shall be divided into four quadrants. For each quadrant the quad view shall have a camera or be blank. Within each quadrant the quad view shall be configured to cycle between any of the cameras accessible to the user on a configurable time basis.

There shall be no limit to the number of cameras that can be assigned to a single Quad View. There shall also be no limit to the number of available Quad Views.

4.1.3 Sequence View

The DVRMS shall support sequence views. A sequence view consists of a single camera view, which can be cycled on a time basis. Pan-tilt-zoom cameras, which support preset positions, can have these presets cycled on a time basis. In this way an operator can view a variety of presets on a series of PTZ cameras. Fixed cameras can also be included in the sequence and cycled accordingly.

There shall be no limit to the number of cameras that can be assigned to a single Sequence View. There shall also be no limit to the number of available Sequence Views.

4.1.4 Camera settings

Users shall be able to change important settings for an individual camera. The details are grouped into several sections:

- Camera Details.
- Camera Connection.
- Camera PTZ Control.
- Security.
- Camera Deletion.

The parameters listed in the sub-sections below are configurable on a per camera basis and their specific selection on a particular camera(s) will not limit the ability to freely select other options on other cameras as required. It will be easy to change any of these parameters for each camera individually as and when required. Systems that do not allow changes to each camera's parameters on an individual basis will not be acceptable.

Only users with the highest level of security are permitted to modify camera connection details, camera PTZ control or delete cameras.

4.1.4.1 Camera Details

The user shall be able to configure the following parameters for each camera:

- Name.
- Location.
- Description.
- Camera Number (for fast numeric keypad call-up).

4.1.4.2 Camera Connection

The user shall be able to configure the following parameters for each camera:

- Camera Encoder Type.
- Resolution: The following resolutions shall be supported (depending on the functionality of the camera and camera encoder):
 - 160x120.
 - QCIF (PAL 192x144, NTSC 176x112).
 - 240x180.
 - 320x240.
 - CIF (PAL 384x288, NTSC 352x240).
 - 480x360.
 - 640x480.
 - 2CIF (PAL 768x288, NTSC 704x240).
 - 4CIF (PAL 768x576, NTSC 704x480).
 - Half-D1 (PAL 720x288, NTSC 720x240).
 - D1 (PAL 720x576, NTSC 720x480).
- Video Frame Rate: The supported frame rates (in frames per second) shall be as follows:
 - For Motion JPEG encoding: 30, 25, 20, 15, 10, 5, 3, 2 and 1. Slower frame rates of 1 frame every 2, 3, 5, or 10 seconds shall also be available.
 - For MPEG encoding: 30, 25, 15, 12.5, 7.5, 6.25, 3.75 and 1.
- Choice of five levels of video compression, equally distributed from minimum to maximum compression.
- Encoder IP Address.
- Encoder Camera Number (when connected to a multiple port Camera Encoder).
- Choice of frame rate or bandwidth limited streaming.
- Unicast or multicast transmission of video.
- PAL or NTSC camera format.

4.1.4.3 Camera Control

The user shall be able to configure any appropriate camera to be PTZ controllable. The following camera types must be supported as a minimum:

- Video Controls Limited (VCL) Orbiter cameras.
- Honeywell Video RapidDome cameras.

- Cameras supporting the Pelco P protocol.
- American-Dynamics Speed Dome.
- Hernis Scan System's Cameras.
- Axis Encoder supported PTZ cameras and devices.

The following PTZ characteristics shall be tuneable on a camera-by-camera basis from the camera definition pages:

- Pan speed.
- Tilt Speed.
- Zoom speed.
- Focus speed.
- Iris speed.
- Increment step size.

For the VCL Orbiter and Honeywell Rapid Dome camera ranges, the following additional functionality shall be provided:

- Configuration of Privacy Zones. The DVRMS software shall allow the user to select the regions for privacy zones and automatically download the configuration to the camera.
- Configuration of Camera Tours. The DVRMS software shall allow the user to fully configure all required camera tours, automatically downloading the configuration to the camera. The user shall be able to select the required camera tour in a similar way as presets are selected. A camera tour may be configured to be a "home" camera tour, similar to a home preset.

For the Pelco "P" and Hernis cameras, ability to control the washer and wiper shall be provided from within the DVRMS software.

4.1.4.4 Security

The following parameters shall be configurable for each camera:

- Area: Allows the system to be configured to only allow users to view specified cameras.
- Control Level: Determines if a user is allowed to operate the PTZ controls for a camera. Also used to allow higher-level users to take control of cameras.
- Control Reservation Period: Once a particular user has controlled the camera no other user can control the camera until this reservation period has expired. If this user controls the camera again within the period, the reservation period is reset. Users with higher security permissions shall be able to take control of the camera at any time.

4.1.4.5 Camera Deletion

The “Delete” function shall allow a user with the highest-level security to delete the camera from the system. Deleting a camera should delete all the records relating to the camera from the database. The name of the camera will no longer appear in the list of cameras. All camera settings will be deleted.

The user shall also be asked if they also wish to delete video clips captured for the camera. If the video clips are not deleted they will stay on the Camera Server and archive media unless they are later individually deleted. The camera name will also continue to appear in the list of cameras used for searching the video clip database.

If the user chooses to delete video clips captured for the deleted camera, all video clips related to the deleted camera will be deleted. The camera name will be removed from the list of cameras used for searching the video clip database.

4.2 Recording

The following methods of recording live video shall be supported:

- User activated.
- Event activated.
- Scheduled.
- Continuous background recording.
- Video motion detection.
- Snapshot.

4.2.1 User Activated

The user shall be able to configure the following parameters for each camera:

- **Pre-Record Duration:** The amount of pre-recorded video that will be associated with a user request for recorded video. This will allow the Camera Server to capture video prior to the user request, as well as after the request. Shall be selectable from a list of values ranging between 0 seconds and 5 minutes.
- **Frame Rate:** Video quality required for user activated recording. It shall be possible to have different frame rates for user and event-activated recordings. Shall be selectable from the entire range of frame rates supported for the camera. For MPEG encoding, support shall be provided to record only the Index frames, or a subset of the Index frames.
- **Record Duration:** User activated recordings shall terminate after this period. Shall be selectable from a list of values ranging between 0 seconds and 5 minutes

- Retention Period: The default period that the Camera Server shall retain user-activated recordings before being deleted. The retention period of individual recordings shall be able to be changed on a per-recording basis. Shall be selectable from a list of values ranging between one hour and forever.

4.2.2 Event Activated

There shall be at least four priorities of alarms/events in the DVRMS:

- Event (journal priority).
- Low priority alarms.
- High priority alarms.
- Urgent priority alarms.

The following settings shall be individually configurable for each alarm and each camera:

- Pre-Record Duration: The amount of pre-recorded video that will be associated with an alarm/event. This shall allow the Camera Server to capture video prior to the alarm/event, as well as after the alarm/event. Shall be selectable from a list of values ranging between 0 seconds and 5 minutes.
- Post Record Duration: Event activated recordings shall terminate after this period. Shall be selectable from a list of values ranging between 0 seconds and 5 minutes.
- Frame Rate. Video quality required for event activated recording. It shall be possible to have different frame rates for user, event-activated, scheduled and motion detection activated recordings. Shall be selectable from the entire range of frame rates supported for the camera/encoder. For MPEG encoding, support shall be provided to record only the Index frames, or a subset of the Index frames.
- Retention period. The default period the Camera Server will retain event-activated recordings before being deleted. The retention period of individual recordings shall be able to be changed as necessary. Shall be selectable from a list of values ranging between one hour and forever.

The pre-record and post-record durations in the paragraph above define the maximum allowable limits for each camera. They shall be configured on a camera-by-camera basis. However each alarm or event causing video to be recorded shall also be capable of individual configuration with pre and post alarm periods being selected from a range defined by the maximum settings for the camera.

DVRMS systems requiring a single pre and post record event period to be defined for all alarms and events on an individual camera are not acceptable. DVRMS systems requiring a single pre and post event period to be defined for all alarms and events on all cameras are also not acceptable.

In the case of multiple alarms/events relating to the same camera, a video clip shall be created for each alarm/event.

For cameras that support Pan/Tilt/Zoom Presets, a specified preset location shall be selected automatically when the alarm/event occurs prior to the event activated recording commencing. For example, when an alarm is detected on a security door, the alarm shall trigger a PTZ camera to move to a preset position, which is pointing at the door prior to the DVRMS commencing recording.

4.2.3 Scheduled

The system shall support the ability to schedule recordings for each individual camera for times in the future. For each scheduled recording the user shall be able to configure:

- Start time.
- Stop time.
- Frame rate for the recording.
- Retention period before the recording will be deleted.
- Recurrence (if this is to be a recurring schedule).
- Description (at least 255 characters).

There shall be no limit on the number of schedules that can be entered for the system. There shall be no limit to the number of schedules per camera.

4.2.4 Continuous background recording

The system shall support the ability to provide continuous background recording from any cameras managed by the system. Background recordings will be stored as a discrete series of clips and will continue to operate in the event that communication between the Camera Server and the Database Server is lost. Once communication is restored, all relevant information will be updated to the Database Server.

For each camera the user shall be able to configure:

- Enable / disable background recording.
- Duration of the recorded clip.
- Frame rate for the recording.
- Enable / disable archiving of the clip and the period after which to archive.
- Retention period before the recording will be deleted.
- Enable or disable audio recording (if available).

Systems that require the configuration of multiple time periods to manage background recordings will not be accepted.

4.2.5 Video analytics

The DVRMS system must be able to activate recordings automatically based on events generated by the real-time analysis of video from any camera on the system that has Video Analytics enabled. The real time analysis comprises several algorithms as follows:

- Video Motion Detection.
- Object Tracking.
- Object Classification (and tracking).

4.2.5.1 Video Motion Detection

The DVRMS system must be able to support video motion detection algorithms, which can be executed by the video encoder or the Camera Server. The enabling of Video Motion Detection shall be either:

- On a continuous basis.
- Scheduled for particular times, dates, days, months, and so on.

The Camera Server-based algorithm must be able to provide the following functionality:

- Detect and track objects.
- Learn the scene.
- Adapt to a changing outdoor environment.
- Ignore environmental changes including rain, hail, wind, swaying trees and gradual light changes.

The user shall be able to configure the following parameters for each camera:

- Detection Type: Continuous or scheduled.
- Actions to Perform When Motion is Detected: When motion is detected, the following actions shall be performed automatically:
 - Start a recording, with the following configurable settings.
 - Pre-Record Duration: The amount of pre-recorded video, allowing the Camera Server to capture video prior to the detection of motion, as well as after the detection of motion. Shall be selectable from a list of values ranging between 0 seconds and 5 minutes.
 - Post Record Duration: Motion detection activated recordings will terminate after this period. Shall be selectable from a list of values ranging between 0 seconds and 5 minutes or until motion has stopped.
 - Frame Rate. Video quality required for motion detection activated recordings. Shall be selectable from the entire range of frame rates supported for the camera/encoder. For MPEG encoding, support shall be provided to record only the Index frames, or a subset of the Index frames.

- Retention period. The default period that motion detection activated recordings will be retained by the Camera Server before being deleted. The retention period of individual recordings shall be able to be changed as necessary. Shall be selectable from a list of values ranging between one hour and forever.
- Send video to an operator station or alarm monitor: Automatically switch an operator station or alarm monitor to view the camera which has motion detected.
- Motion Finished Time: The amount of time where no motion (inactivity) is detected before the previous motion is classified as completed. This shall be used for allowing recordings to continue until motion has finished.

The DVRMS must provide a means of automatic and manual tuning of the Video Motion Detection for each camera. Incorporated within this tuning are the following:

- Selection of the frame rate used for detection.
- Optimization for directions of movement:
 - In any direction.
 - Across the camera view.
 - Towards and away from the camera.
- Sensitivity level to fine tune the motion detection algorithm.
- Specification of a minimum object size to allow noise filtering in the system to reduce false detections and alarms.

The DVRMS must also provide the ability to only detect motion in particular regions of the camera view. The ability to graphically select these regions using the mouse must be provided, with an unlimited number of regions permitted per camera. The regions of interest will be multi-vertical shapes with a minimum of 6 vertices to allow the region to be properly matched to the scene being detected. It shall be possible to add and remove vertices from the defined region of interest as needed. Solutions providing only rectangular regions of interest will not be accepted.

Each region must be able to be individually tuned and have separate tuning parameters. This method of tuning must also provide a live tuning window whereby these settings and regions can be altered and tested prior to being used. This live tuning window shall show the live video as well as the regions of interest. During the time that motion is detected within a region, the border of the region shall change to a different color. In this way, tuning can be performed to achieve the desired performance. Text shall also be provided in the window to alert the user that motion has been detected.

4.2.5.2 Object Tracking

The DVRMS must provide the ability to acquire and track an object within a predefined field of view on selected cameras.

The Camera Server-based algorithm must be able to provide the following functionality:

- Detect and track objects.
- Learn the scene.
- Adapt to a changing outdoor environment.
- Ignore environmental changes including rain, hail, wind, swaying trees and gradual light changes.

The user shall be able to configure the following parameters for each camera:

- Actions to Perform When an Object is detected and tracked: When the event/alarm is raised, the following actions shall be performed automatically:
 - Start a recording, with the following configurable settings:
 - Pre-Record Duration: The amount of pre-recorded video, allowing the Camera Server to capture video prior to the alarm/event, as well as after the alarm/event, shall be selectable from a list of values ranging between 0 seconds and 5 minutes.
 - Record Duration: The period that the recording is active relating to the period of activity in the region of interest. Activated recordings will terminate after this period. Shall be selectable from a list of values ranging between 0 seconds and 5 minutes or the object is no longer in the region of interest.
 - Frame Rate. Video quality required for Object Tracking activated recordings. Shall be selectable from the entire range of frame rates supported for the camera/encoder. For MPEG encoding, support shall be provided to record only the Index frames, or a subset of the Index frames.
 - Retention period. The default period that Object Tracking activated recordings will be retained by the Camera Server before being deleted. The retention period of individual recordings shall be able to be changed as necessary. Shall be selectable from a list of values ranging between one hour and forever.
 - Archive data: enable/disable archiving and set the period after which the recording will be automatically archived.
 - Deletion data: Set the period after which the recording will be automatically deleted.
 - Send video to an operator station or alarm monitor: Automatically switch an operator station or alarm monitor to view the camera which has motion detected.

The DVRMS must provide a means of automatic and manual tuning of the Object Tracking for each camera. Incorporated within this tuning are the following:

- Selection of the frame rate used for detection.
- Optimization for directions of movement:
 - In any direction.
 - Motion to left, right, top, bottom or any direction into a region.

- Motion to left, right, top, bottom or any direction out of a region.
- Sensitivity levels to fine tune the detection algorithm.
- Specification of a minimum object size to allow noise filtering in the system to reduce false detections and alarms.

The DVRMS must also provide the ability to only track objects in particular regions of the camera view. The ability to graphically select these regions using the mouse must be provided, with an unlimited number of regions permitted per camera. The regions of interest will be multi-verticed shapes with a minimum of 6 vertices to allow the region to be properly matched to the scene being detected. It shall be possible to add and remove vertices from the defined region of interest as needed. Solutions providing only rectangular regions of interest will not be accepted.

Each region must be able to be individually tuned and have separate tuning parameters. This method of tuning must also provide a live tuning window whereby these settings and regions can be altered and tested prior to being used. This live tuning window shall show the live video as well as the regions of interest. During the time that motion is detected within a region, the border of the region shall change to a different color. In this way, tuning can be performed to achieve the desired performance. Text shall also be provided in the window to alert the user that motion has been detected.

4.2.5.3 Object Tracking and Classification

The DVRMS must provide the ability to acquire and track an object within a predefined field of view on selected cameras. The Camera Server-based algorithm must be able to provide the following functionality:

- Detect and classify objects.
- Learn the scene.
- Adapt to a changing outdoor environment.
- Ignore environmental changes including rain, hail, wind, swaying trees and gradual light changes.

Object classification will be grouped as follows:

- Person.
- Vehicle.
- Other.
- Any.

It must be possible to combine object tracking with object classification to allow the detection of specific objects in a region of interest while ignoring other object types. The user shall be able to configure the following parameters for each camera:

- Actions to Perform When an Object is detected, classified and tracked: When the event/alarm is raised, the following actions shall be performed automatically:

- Start a recording, with the following configurable settings:
 - Pre-Record Duration: The amount of pre-recorded video, allowing the Camera Server to capture video prior to the alarm/event, as well as after the alarm/event, shall be selectable from a list of values ranging between 0 seconds and 5 minutes.
 - Record Duration: The period that the recording is active relating to the period of activity in the region of interest. Activated recordings will terminate after this period. Shall be selectable from a list of values ranging between 0 seconds and 5 minutes or the object is no longer in the region of interest.
 - Frame Rate. Video quality required for Object Tracking & Classification activated recordings. Shall be selectable from the entire range of frame rates supported for the camera/encoder. For MPEG encoding, support shall be provided to record only the Index frames, or a subset of the Index frames.
 - Retention period. The default period that Object Tracking & Classification activated recordings will be retained by the Camera Server before being deleted. The retention period of individual recordings shall be able to be changed as necessary. Shall be selectable from a list of values ranging between one hour and forever.
 - Archive data: enable/disable archiving and set the period after which the recording will be automatically archived.
 - Deletion data: Set the period after which the recording will be automatically deleted.
- Send video to an operator station or alarm monitor: Automatically switch an operator station or alarm monitor to view the camera which has motion detected.

The DVRMS must provide a means of automatic and manual tuning of the Object Tracking & Classification for each camera. Incorporated within this tuning are the following:

- Selection of the frame rate used for detection.
- Optimization for directions of movement:
 - In any direction.
 - Motion to left, right, top, bottom or any direction into a region.
 - Motion to left, right, top, bottom or any direction out of a region.
- Sensitivity level to fine tune the detection algorithm.
- Specification of a minimum object size to allow noise filtering in the system to reduce false detections and alarms.

The DVRMS must also provide the ability to only track objects in particular regions of the camera view. The ability to graphically select these regions using the mouse must be provided, with an unlimited number of regions permitted per camera. The regions of interest will be multi-vertical shapes with a minimum of 6 vertices to allow the region to be properly matched to the scene being detected. It shall be

possible to add and remove vertices from the defined region of interest as needed. Solutions providing only rectangular regions of interest will not be accepted.

Each region must be able to be individually tuned and have separate tuning parameters. This method of tuning must also provide a live tuning window whereby these settings and regions can be altered and tested prior to being used. This live tuning window shall show the live video as well as the regions of interest. During the time that motion is detected within a region, the border of the region shall change to a different color. In this way, tuning can be performed to achieve the desired performance. Text shall also be provided in the window to alert the user that motion has been detected.

4.2.6 Snapshot

The DVRMS system must provide every operator with the ability to record the current frame of video. This snapshot of video shall be stored as a bitmap file. The file name shall be automatically generated by the DVRMS software and include the camera name, date and time of the recording (to millisecond precision). An audible sound shall be produced by the Client computer, to ensure that the operator has feedback when the snapshot is taken.

4.2.7 Recorded Video

The DVRMS shall allow camera output to be recorded for the following conditions:

- Activated by a Security System Or Control System alarm or event.
- Continuous background recording.
- Manually activated by a user viewing a live camera.
- Scheduled recording.
- Specialised real-time video analysis including:
 - Video Motion Detection.
 - Object Tracking.
 - Object Classification.

Event activated recording is a process that allows a segment of video or a snapshot to be associated with alarm or event.

User activated recording occurs when a user viewing live video chooses to record the currently viewed camera output by selecting the “Record” button.

Scheduled recording allows video to be recorded between start and stop times on defined days.

Video Motion Detection activated recording is a process that allows a segment of video or a snapshot to be recorded when motion is detected by the DVRMS.

Recorded video is stored on the Camera Server. The Operator station shall be able to query the Database Server to locate relevant recorded video and to then replay that video at the Operator Station.

4.2.7.1 Search

The DVRMS shall provide a simple search for all video recorded. The user selects the time indicator which shows a calendar and time line. The user selects the required search period.

Once the time criterion is entered, the “search” is selected. Video recorded during the selected period will be returned by the search.

The user shall be able to search on combinations of cameras by clicking on an “Advanced Search” icon as described in the next section.

4.2.7.2 Advanced Search

The DVRMS shall provide an advanced search of recorded video. The search shall be based on recording time, camera and recording details.

The user shall select from the list of cameras. It shall also include any cameras that have been deleted from the system but still have video stored on a Camera Server or on archived media. If a camera has been deleted and all video associated with the camera has been deleted, the camera name will not appear in this list.

The time criterion shall be selected from a calendar and time line control. Days containing recorded video shall be shown in bold on the calendar control. Cameras shall be able to be added and removed from the search list.

The user shall be able to choose to filter the search based on the following criteria:

- Alarm or event type for alarm/event activated recordings.
- Recording type (schedule, event, operator, video motion detection, all).
- Area.
- Point name.
- Event description.
- Operator name.
- Camera name or number.
- Any comments entered by users in the comments field of recordings.

Wildcards shall be accepted for the Point ID, description, area, priority and value for alarm/event activated recordings.

4.2.7.3 Search Results

The DVRMS shall show the results of the basic and advanced searches in a table format, such that the user is able to select columns within the list to sort the output.

Functionality shall be provided to allow the user to see a list of recordings for a camera from the past 24 hours without needing to use one of the searches.

4.2.8 Live and Recorded Audio

The DVRMS shall provide the ability to have audio included with the video. Two types of audio support shall be provided:

- Single directional audio from the field (camera or encoder) locations to the DVRMS Camera Servers (and Operator Stations).
- Bi-directional audio (intercom) between the field (camera or encoder) locations and the DVRMS Camera Servers (and Operator Stations).

4.2.8.1 Single Directional Audio

The DVMRMS shall provide the following single directional audio support:

- Audio shall be recorded by the encoder using an attached microphone (or similar device).
- Audio shall be streamed along with the video from the camera (or encoder) locations to the DVRMS Camera Servers (and Operator Stations) using the same network used for the video stream. This shall require no additional network cabling.
- Audio shall be played at the Operator Stations using speakers connected to the Operator Station computer.
- Live audio shall be played whenever the live video is displayed.
- Audio shall be recorded whenever the video is recorded.
- For scheduled and continuous (background) recordings, the audio shall be optionally disabled.
- Audio shall be played when the recording containing audio is played. The audio shall be heard in the same synchronization it was recorded in.
- Wherever the audio is played with the video, a mute button and volume control shall be provided on the video player. It is unacceptable to use the Operating System's volume controls for this purpose.
- Recordings containing audio shall be exported with the audio and video in the same synchronization it was recorded in.

4.2.8.2 Bi-Directional Audio (Intercom)

The DVMRMS shall provide the following bi-directional audio (intercom) support:

- Audio from camera location (or encoder) to DVMRMS Camera Server (and Operator Stations):
 - Audio shall be recorded by the encoder using an attached microphone (or similar device).
 - Audio shall be streamed along with the video from the camera (or encoder) locations to the DVMRMS Camera Servers (and Operator Stations) using the same network used for the video stream. This shall require no additional network cabling.
 - Audio shall be played at the Operator Stations using speakers connected to the Operator Station computer.
- Audio from Operator Stations to camera location (or encoder):
 - Audio shall be recorded at the Operator Station using a microphone (or similar device) connected to the Operator Station computer.
 - Audio shall also be streamed from the Operator Stations to the camera (or encoder) locations using the same network used for the video stream. This shall require no additional network cabling.
 - Audio shall be played at the camera (or encoder) locations using speakers (or similar devices) connected to the encoder.
- A intercom call shall be able to be initiated by either the field (camera location) or the Operator Station:
 - Initiated from the field using a push-button (or other device) connected to the encoder.
 - Initiated from the Operator Station using an intercom button provided within the DVMRMS Live Video control.
- Intercom calls initiated by the field shall be alerted to the Operator Station in all the following ways:
 - An alarm raised in the Security or Control System.
 - An intercom button flashing on the Live Video Control of the Operator Station. The Operator shall use this button to answer the intercom call and end the intercom call.
 - An indication in the camera tree that an intercom call is awaiting answering.
- Intercom calls initiated by an Operator Station shall be alerted to the field through a buzzer (or similar device) connected to the encoder.
- Audio from the field shall be recorded whenever the video is recorded.
- Audio shall be played when the recording containing audio is played. The audio shall be heard in the same synchronization it was recorded in.

4.3 Viewing Recordings

The recorded video shall be available to all users, which have adequate security. Each user shall only be able to view recordings from cameras they have security access to view.

A display shall be provided to view recordings from any Operator Station. From this display, the operator can select the recording he/she wishes to view, which shall be immediately shown in an embedded video player.

The following information and controls shall be provided on this display:

- A navigation panel to allow the user to select the required camera.
- A calendar control (similar to Microsoft Outlook) to select the desired date. All days which have recordings for the chosen camera shall be displayed in bold font.
- A table listing all the recordings on the chosen camera for the chosen day. The user shall be able to select the required recording from this table. Each column shall be able to be sorted by selecting the column heading. This table shall display the following information as a minimum:
 - The time each recording was activated.
 - The duration of each recording.
 - The type of recording (operator activated, alarm/event activated, video motion detected, or scheduled).
 - The Operator or user that activated the recording (for operator activated recordings).
- An embedded video player with controls (buttons) similar to a VCR (video cassette recorder). The information displayed on the video player and the controls provided shall include:
 - The time and date of the frame being displayed.
 - A slider control which is used to move backwards and forwards through the recording.
 - Play, pause and stop buttons.
 - Step forward and step backward buttons, to move through the recording frame by frame.
 - Fast forward and rewind buttons, to play the recording at speeds of x2, x4, x8, x16, etc (to a minimum of x1024).
 - A snapshot button, to allow for the frame being displayed to be stored as a bitmap file (in a similar way to the snapshot button for live video).
- Information about the chosen recording. The following information as a minimum shall be displayed with the chosen recording:
 - The type of recording (operator activated, alarm/event activated, video motion detection or scheduled).
 - The Operator or user that activated the recording (for operator activated recordings).
 - The sub-priority of the recording (for alarm/event activated recordings).
 - The frame rate that the recording was recorded at.
 - The resolution of the recording.

- The compression used.
 - The recording start time and date (including pre-record).
 - The recording end time and date.
 - The date and time that the recording will be deleted by default (which can be changed as required).
 - Operator comments and notes about the recording (made by the scheduled recording configuration automatically or by an operator).
- When a recording is displayed, the exact frame of video when the recording was activated shall be shown. The slider shall be positioned accordingly along with the frame time. It is not appropriate to show the first frame in the recording, as the recording may have pre-record.
 - Buttons to allow the operator to archive, delete or export the chosen recording.
 - A button is provided to playback the recording at the recorded resolution. This shall be done using a display that pops up containing the embedded video control with full playback functionality as described above.

4.4 System and User Audit Trail

It is a requirement that all user actions on the DVRMS Operator Station be recorded in a log file. User actions include:

- Interventions such as manual recording and configuration setting changes.
- Cameras viewed.
- Video replayed.
- Video exported.
- Cameras pan/tilt/zoomed and preset switching.

This log must also contain a history of the status of the DVRMS system components. It shall list the status of all cameras, encoders, servers and other system components including when they were disabled or failed.

The log of user and system actions shall be available in text format and automatically included with any video recordings that are exported.

4.5 Digitally Signed Recordings and Audit Logs

It is a requirement for all exported recordings and exported audit logs to be digitally signed. This is required to prove authentication (origin of the recording and audit log) and integrity (exported recording and audit log have not been altered or tampered with).

The DVRMS system shall provide a default digital certificate for signing the exported recordings and audit logs. Customization shall also be provided to allow for the user to supply his/her own digital certificate.

A utility shall be provided to display the exported recording, view the audit log and verify the digital signatures. A visual indication shall be provided to whether the exported recording and audit log have been altered or tampered with.

Watermarking of recordings is not an acceptable method to prove authentication and integrity as it alters the recording and audit log.

4.6 Storage

4.6.1 Online Storage

The system shall hold a configurable amount of video in online storage. The amount of video stored on-line shall only be limited by the Camera Server's disk capacity.

For each Camera Server a limit on available storage space for on-line video shall be configurable.

The system shall support RAID 0+1, 1, 3 or 5 for video recordings (clips).

4.6.2 Off-line Storage

The Camera Server shall be able to manage several off-line media devices for archiving and restoring video. The Camera Server must use a standard archiving method such as Microsoft Remote Storage Services to handle offline media.

At least one of the following off-line devices shall be supported:

- CD-RW.
- DVD-RW.
- Magnetic tape media.

If a user attempts to replay video stored in off-line media then the Camera Server will automatically restore and play the video if it is accessible to the robotic tape unit, or shall prompt the user to make the media containing the video available to the archive device.

4.6.3 Storage & disk administration

The DVRMS shall provide a flexible means to configure storage behaviour within the system administration displays. The system will provide an automated and configurable means to delete those remaining clips closest to their deletion criteria in order to increase available system storage. The disk space configuration will be separately configurable for each drive volume on each Camera Server.

Deletions will commence once the amount of available disk space decreases to below a configurable limit. Alarms will be generated by the system to warn operators of this action. It shall be possible to configure the following parameters for this purpose:

- The Camera Server and volume being configured.
- Threshold values for alarm generation (2 alarms: low and very low).
- Enable or disable automatic deletion of clips based on available disk space.
- The threshold value used to initiate the automatic deletion of clips.
- Inclusion or exclusion of clips marked for archiving in automatic deletions.
- Threshold value to stop recordings when available storage is critically low.
- Threshold value to restart recordings when more disk space becomes available.

The DVRMS shall provide a summary showing the available disk space, total disk space and number of recordings for directories used for this purpose on camera servers.

4.6.4 Automatic Archiving

The DVRMS shall provide the ability to automatically archive all recordings. It shall be possible to automatically archive any type of recording at a preconfigured period after the recording has completed.

4.7 Operator Station

4.7.1 Video Integration User Tasks

The following system tasks shall be performed from the Operator Station:

- View live video.
- Adjust the PTZ position of a camera.
- Live video is automatically displayed on a monitor when an event occurs.
- Search through the stored video clips of a camera.
- An operator records an incident.
- An operator records a snapshot of the current viewed video.
- Add a new camera to the system.
- Change the configuration settings for a camera.
- Search for video clips from different cameras.
- Create a sequence (camera tour).

- Conduct a sequence (camera tour).
- Create a quad view.
- View a quad view.
- View live video from a custom schematic.
- Add live video to a custom schematic.
- Configure, schedule and tune Video Analytics (video motion detection, object tracking & recognition and non motion detection).
- View the audit log.

The following tasks shall also be performed from the Operator Station:

- View the organization's Intranet from within the Operator Station window.

4.8 Network

The Network Management Station shall perform the following functions:

- Provide a graphical display of the network topology.
- Provide network traffic statistics for each LAN port.
- Configuration of network equipment.
- Support standard Management Information Bases (MIBs).

4.9 International Language Support

The DVRMS Operator Station shall be fully translatable into the local language. This includes languages not supporting the European character set (e.g. Chinese). All text displayed in the DVRMS user interface shall be stored in the DVRMS database to allow for easy translation to another language. The process of translating a system shall be done by editing the DVRMS database and replace all English words with the required local language equivalent.

4.10 Application Development Interface

The DVRMS shall provide for the ability of custom developed applications to access and control the DVRMS system using a complete application development interface. These applications shall be able to be developed without the need to contact the DVRMS manufacturer. Complete documentation of this application development interface shall also be provided.

5 Services

The vendor should be capable of providing supporting services as detailed in the following sections.

5.1 Training

The vendor either at vendor's premises or on site shall provide standard training on all aspects of the system.

5.2 Configuration Services

The vendor should be able to supply all necessary configuration services if required including controller configuration, database configuration, and so on.

5.3 Installation Services

The vendor should be able to provide installation services for the system including validation services if necessary.

5.4 Hardware Maintenance

The vendor should be able to provide hardware maintenance and spare parts support if required.

5.5 Software Enhancement & Software Support

The vendor should be able to provide a comprehensive software maintenance and enhancement program for on-going support of the system.