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A&E Specifications
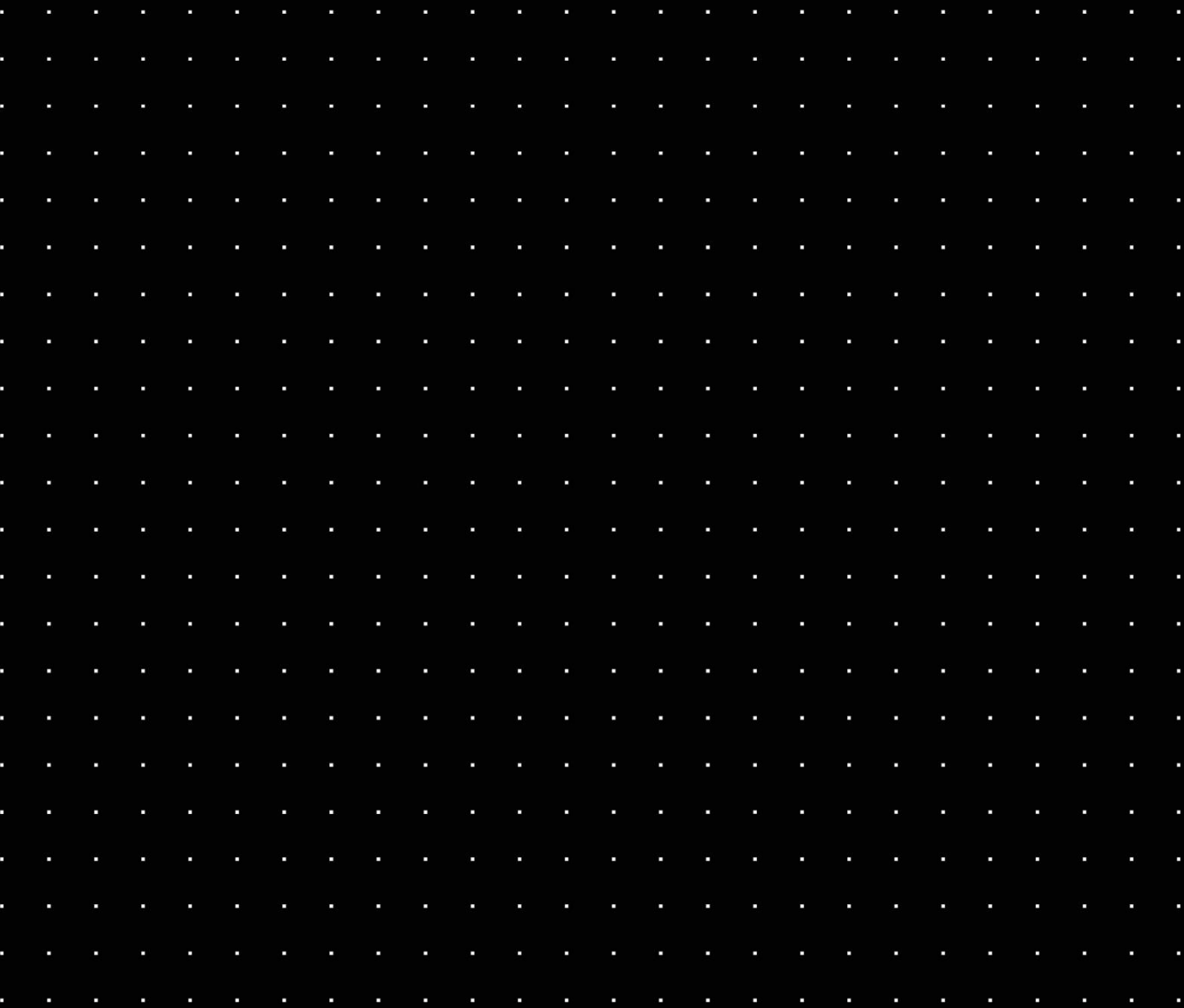
Video Management Software
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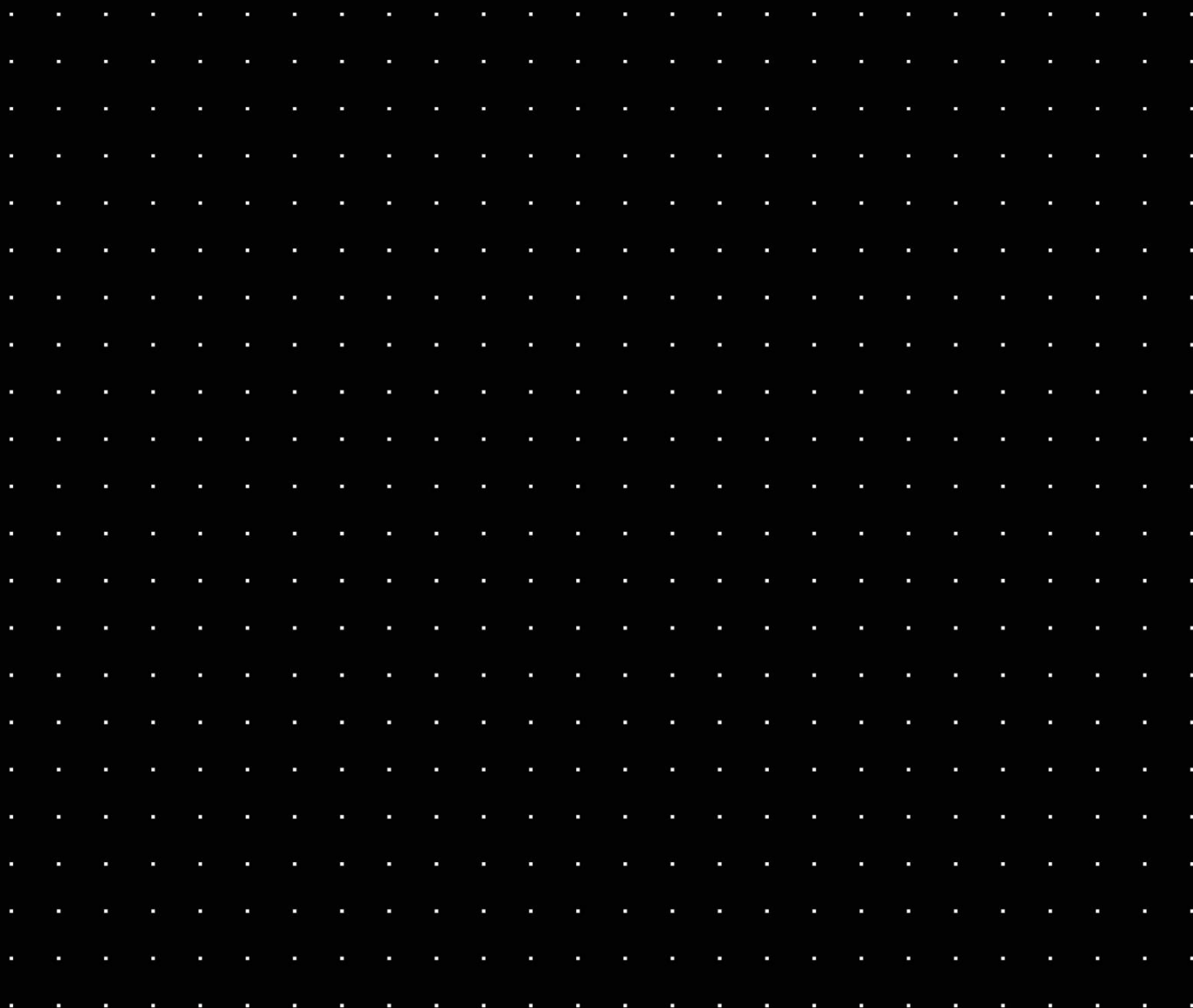
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Section 28 23 00

Video Management Software

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1 General

a. The software used is standard Open Platform software which is regularly further developed and used in the manufacturer's systems.

b. The manufacturer shall have at least 40 years of experience in the manufacture of CCTV components and at least 20 years of experience in the development and worldwide operation of Video Management Software.

c. The software shall have been thoroughly tested and proven in actual use.

d. The manufacturer's warranty shall be valid during a minimum of 36 months beginning with date of delivery. The manufacturer optional shall be able to offer a warranty extension of 4 or 5 years.

e. A technical hotline provided by the manufacturer or one of his representatives shall be available during normal workdays.

f. The manufacturer shall commit to a ten-year strategy with updated software releases and support to ensure the functionality of the software.

g. The manufacturer shall have standardized software upgrade plans that the user can book to automatically receive software upgrades over the specified period of time.

h. The VMS shall allow for functional upgrades via simple software license installation without hardware changes.

i. The manufacturer shall be able to offer standardized, staggered patch management packages in terms of performance and function that avoid discrepancies between Windows updates, the Video Management Software and the hardware used at an early stage.

j.   The manufacturer offers performance tests and certifications for the hardware planned and used to operate the software.

k.   The manufacturer offers regular maintenance of the system, individually adapted to the user, by trained specialists worldwide.

l.   The manufacturer shall have its own series-produced hardware platforms with performance and equipment specifically tailored to the requirements of the Video Management Software.

1.1   Acronyms and Definitions

a.	VMS	Video Management Software
b.	SAM	Software Asset Manager
c.	CCTV	Closed Circuit Television
d.	CCIR	Consultative Committee for International Radio (analogue video signal specification for Europe)
e.	EIA	Electronic Industries Alliance (analogue video signal specification for America and East Asia)
f.	PAL	Phase Alternating Line (Specification of color signal transmission for Europe)
g.	NTSC	National Television Systems Committee (Specification of color signal transmission for America and East Asia)
h.	DVR	Digital Video Recorder
i.	NVR	Network Video Recorder
j.	CPU	Central Processing Unit
k.	GPU	Graphics Processing Unit
l.	GUI	Graphical User Interface
m.	HD	High-Definition - resolution 1280 × 720 px
n.	Full HD	Full High Definition - resolution 1920 × 1080 px
o.	UHD	Ultra High Definition - resolution 3840 × 2160 px
p.	CIF	Common Intermediate Format - resolution 352 x 288 px
q.	QCIF	Q Common Intermediate Format - resolution 176 x 144 px
r.	2CIF	2 Common Intermediate Format - resolution 704 x 288 px

s.	4CIF	4 Common Intermediate Format - resolution 704 x 576 px
t.	D1	Digital Recording Video Standard - resolution 704 x 576 px (PAL), 704 x 480 px (NTSC)
u.	MP	Megapixel, a unit of graphic resolution equivalent to one million or 1,048,576 pixels.
v.	EFlip	Electronic Flip - automatic mirroring of the image to the correct orientation using cameras with 180° tilt function
w.	ONVIF	Open Network Video Interface Forum
x.	JPEG	Joint Photographic Coding Experts Group - compression of single images
y.	M-JPEG	Motion-JPEG (Joint Photographic Coding Experts Group)
z.	MPEG-2	Moving Picture Experts Group 2 - compression of images + audio
aa.	MP4	Video container format
bb.	H.264	Differential video compression works with so-called P-Chains: I-Frame (reference image) - P-Frames (difference images) - new P-Chain: I-Frame (reference image) - P-Frames (difference images) …
cc.	H.264CCTV	H.264 - compression format optimized by the manufacturer of the VMS
dd.	BMP	Bitmap file (raster graphics image)
ee.	FPS	Frames per Second
ff.	GOP	Group of Pictures
gg.	WAV	Wave file (digital audio format)
hh.	CBR	Constant Bit Rate
ii.	VBR	Variable Bit Rate
jj.	ICD	Intelligent Compression Dynamic
kk.	ASM	Adaptive Stream Management
ll.	DLS	Dynamic Live Streaming
mm.	DCS	Dual Channel Streaming
nn.	DSX	Dynamic Storage Expansion
oo.	FLTM	Fading Long Term Memory
pp.	APF	Alarm Push Function

qq.	MOS	Motion Search
rr.	ROI	Region of Interest
ss.	PTZ	Pan Tilt Zoom
tt.	IR headlight	Infrared headlight
uu.	GB	Gigabyte
vv.	TB	Terabyte
ww.	SQL	Structured Query Language - database language
xx.	SD card	Secure Digital Memory Card
yy.	HDD	Hard Disk Drive - storage unit
zz.	SSD	Solid State Hard Drive - storage unit
aaa.	FIFO	First in First out
bbb.	iSCSI	Internet Small Computer Systems Interface
ccc.	RAID	Redundant Array of Independent Disks
ddd.	SAN	Storage Area Network
eee.	JBOD	Just a Bunch of Disks - Array of Independent Disks" without redundancy
fff.	VCA	Video Content Analytics
ggg.	ANPR	Automatic Number Plate Recognition
hhh.	VAM	Vehicle Access Manager
iii.	GCC Countries	Gulf Cooperation Council for the Arab States
jjj.	CSV file	Comma-Separated Values file
kkk.	XML file	Extensible Markup Language file
lll.	SRT file	SubRip Subtitle file
mmm.	LAN	Local Area Network
nnn.	IP	Internet Protocol
ooo.	IP Address	The unique address of a computer or network interface
ppp.	MAC Address	Media Access Control Address
qqq.	TCP/IP	Transmission Control Protocol / Internet Protocol
rrr.	DHCP	Dynamic Host Configuration Protocol

sss.	HTML	Hypertext Markup Language
ttt.	HTLM5	Hypertext Markup Language revision 5 - supports functions such as video, audio, local memory and dynamic 2D and 3D graphics
uuu.	HTTP	Hyper Text Transfer Protocol
vvv.	HTTPS	Hyper Text Transfer Protocol Secure
www.	RTSP	Real Time Streaming Protocol
xxx.	TACI	Telnet Action Command Interface
yyy.	GPS	Global Positioning System
zzz.	AES256	Advanced Encryption Standard with a key length of 256 bits
aaaa.	Salsa	Simple Actor Language System and Architecture
bbbb.	Watchdog	Is an electronic timer that is used to detect and recover from computer malfunctions
cccc.	OCX	OLE (Object Linking and Embedding) Custom Controls
dddd.	ActiveX	Software framework created by Microsoft
eeee.	SDK	Software Developer Kit
ffff.	DLL	Dynamic Link Library
gggg.	CGI	Common Gateway Interface
hhhh.	API	Application Programming Interface
iiii.	ERP system	Enterprise Resource Planning system
jjjj.	ATM	Automated Teller Machine
kkkk.	PPE	Personal Protective Equipment

2 Technical Specifications

2.1 Basic Specifications

a. The Video Management Software shall be compatible with 64-bit Windows operating systems 10, Server 2016 Essentials and Server 2019.

b. The VMS shall run unrestrictedly in virtual environments and use a Software Asset Manager (SAM).

c. The manufacturer shall have an exact specification of the hardware requirements for the operation of the software in all expansion stages.

d. The VMS shall include multi-channel CCTV management and provide the power of real time recording all connected channels onto internal and/or external hard drives or RAID arrays.

e. The software shall work as a client-server system for efficient distribution of the service programs in the network.

f. The VMS shall offer one or more Ethernet Network connections on TCP/IP with a minimum bandwidth of 1 GBit/second.

g. The software shall be scalable and expandable so that it can be adapted to future changing requirements and expanded to a complete system of any size.

h. It shall be possible to use any number of instances in virtual environments.

i. A central user administration shall manage all user rights and accesses to the entire system.

j. The VMS shall contain 10 client accesses to live streams or the media database of the respective VMS instance.

k. The setup shall be possible quickly and easily via configuration wizards.

l. The menu languages shall be adjustable: EN, DE, FR, ES, IT, RU, PL, HU, TR, AR.

m. Each VMS instance shall be able to manage up to 128 camera channels.

n. The VMS shall also be capable of independently processing 2 streams per IP camera to clearly distinguish between recording and live streams.

o. Video Server Software shall have full 64-Bit implementation and GPU acceleration for image processing and viewing functions.

p. The VMS shall provide encrypted data transmission from camera to server and from server to review station.

q. The VMS shall be ONVIF compliant and additionally support all common digital signal sources of IP cameras and encoders of different manufacturers.

r. The VMS shall offer advanced per channel selectable compression technology to cover numerous IP cameras or camera servers from different manufacturers, with a choice between MJPEG and H.264, but shall also accept CCTV optimized codecs such as H.264CCTV for frame accurate stream control.

s. The Software shall allow on the fly transcoding of IP camera signals into CCTV optimized codecs such as H.264CCTV for frame accurate stream control.

t. Each designated live video stream shall be independent from and not interfere with recording.

u. Utilizing a virtual matrix switch functionality, the system will have the ability to direct the video from any camera to any network video client in the system.

v. The VMS shall ensure a jerk-free display of the video streams even with reverse and forward windings.

w. The software shall have an extremely fast metadata search due to the SQL database (Dual Database)

x. To comply with laws and guidelines, the system shall offer the possibility of defining privacy zones within the images, in two independent ways:

    - At source (area is not processed / never shown / never recorded).
    - At client level (area is processed but hidden or blurred in viewer; can be unveiled by authorized persons only). That option shall also be applicable to moving objects within the image.

y. Any live video display with audio shall allow lip synchronous synchronization.

z. The VMS shall include encryption or other verification methods to guarantee the authenticity of recorded images so that they are admissible as evidence in a Court of Law.

aa. In addition to or instead of dedicated remote viewing client software, live and/or recorded images shall also be accessible from standard WEB-browsers via HTLM5 without the use of plugins.

bb. The VMS shall have a multi-level password protection scheme including the definition of single users and user groups with individual access rights as well as a 4-eye-password-option (Two Man Rule).
    These access rights shall enable the differentiation between administrative activities (access to the setup software) and viewing activities (access to DVR/NVR units, live/recorded pictures, defined cameras or camera groups, defined actions in the viewing process including backup, print or export of images or sequences).

cc. The VMS shall include a log-function to document any system or user activity including events, alarms, successful and denied logon/logoff actions, setup changes, changes of system time and date. Each action shall be documented with date, time, computer identification and user identification.

dd. A Software Development Kit (SDK) shall allow software developers to mainly achieve bidirectional event data communication, but also realize in depth integrations with even live and recorded video being embedded into 3rd party GUI's.

ee. The software shall monitor the contrast level of each analog video input in real time to immediately detect deterioration of the camera picture through tampering or lighting failure.

ff. As an option, the manufacturer shall be able to supply powerful monitoring software that automatically performs permanent monitoring of all system components.

gg. The VMS must be capable of allowing directories, recordings, and virtual matrices to failover to another server in the event of an error.

hh. Additional software options shall simply be activated via licence keys.

ii.   The VMS shall have a setup migration that makes it easy to transfer setup settings from one hardware platform to another.

jj.   The VMS shall contain an easily understandable online help in selectable system languages.

2.2 Video Recording Specifications

a.   The installed video recording engine shall use dual database architecture for fast data access, with separate databases for image and process data, whereas process data shall be written into a standardized SQL database.

b.   A VMS instance shall be able to manage up to 450 terabytes for the database.

c.   There shall be the possibility to expand recording capacity to external drives, as for example to external iSCSI RAID's, SAN, or JBOD's.

d.   Storage of up to 50 fields/s (analogue cameras) or 25/30 full frames/s per channel in a CCTV optimized H264CCTV differential image format shall be possible.

e.   The VMS shall use an optimized H.264 version as basic image compression method which displays all single images (not only keyframes) smoothly and consistently during forward and backward playback.

f.   The VMS shall support the compression methods M-JPEG, H.264, H.264CCTV, H.265 and H.265CCTV.

g.   Recording shall comply with any picture format and quality provided by each individual camera model, including Full HD, Megapixel and even UHD (4K). For analog cameras, if adequate, the selectable formats shall be QCIF, CIF, 2CIF or 4CIF (D1).

h.   The following shall be selectable per camera in different conditions, i.e. permanent recording, pre-alarm and alarm recording per alarm type, also depending on time range:

- The image resolution
- The recording picture rate (images per second)
- Video quality settings (compression factor)

i.   The setting of the recording parameters shall be independent of the live stream display.

j.   Images and data shall be stored in a FIFO (First-in-first-out) principal to guarantee overwriting of old images or data.

k.   The recording shall be organized in different ring buffers (min. 16) so that different cameras or event types can have different storage strategies with regard to the archive duration. Several of these rings must be available and several priority levels must provide for the establishment of individual user-specific overwrite strategies.

l.   For adaptation to network bandwidths and storage solutions at all resolutions (max. 4K) and 50 fields/s per channel, Dual Channel Streaming (DCS) shall be used to completely separate the live and storage channels.

m.   Professional fine tunings per camera shall be possible to shape highly customizable video streams, with individual adjustments for GOP (Group of Pictures) or key frame frequency in order to match individual scene characteristics and accurately define bit stream rate parameters and selecting between VBR (Variable Bit Rate) or CBR (Constant Bit Rate).

n.   The distance between two I-frames shall be changeable (variable GOP-Size).

o.   The database shall be able to be expanded dynamically at any time without image loss (Dynamic Storage Expansion -DSX).

p.   To progressively reduce the frame rate of recordings as the retention period increases, the software shall have a fading long-term memory (FLTM) method that minimizes the amount of unnecessary recordings in the storage space.

q.   The VMS shall offer advanced automatic backup options for storage redundancy or long-term archiving.

r.   The backup process can be time as well as event controlled, whereby the target storage medium is freely selectable, HD, CD, DVD, Stick, etc.

s.   Switching off the power of the hardware platform shall not result in any database inconsistencies.

t.   Software updates, setup changes or extension of storage capacity shall not alter images or data already stored. These images and data shall remain accessible.

u.   The system shall be able to use multiple databases, whereby databases can be added at any time.

2.3 Live Streaming Specifications

a.   Each designated live video stream shall be independent from and not interfere with recording.

b.   A maximum of 10 client accesses to live streams or the media database of the respective VMS instance shall be supported in the standard package.

c.   The live stream picture resolution and quality shall be selectable independently per camera and per video stream to various picture formats with scalable compression factors. It shall allow any picture format and quality provided by each individual camera model, including Full HD, Megapixel and even UHD (4K). For analog cameras, if adequate, the selectable formats shall be QCIF, CIF, 2CIF or 4CIF (D1).

d.   The VMS shall be equipped with Dynamic Live Streaming (DLS), which adapts the resolution of the live channel per camera channel to the resolution of the respective

viewing window of a camera in the user interface of the playback computer when transmitting in the network.

e. The system shall be capable to automatically adjust the parameters of any video stream (ASM) depending on time ranges (of day, week, month, year etc.) or event triggered by video analytics or other actions. Such stream adjustments shall include picture resolution as well as compression factor and frame rate (# of images per second). Any stream quality switching shall occur in real time with no latency when using CCTV optimized codecs.

f. The image compression, quality and frame rate shall be adjustable for each video input for live image transmission alternately and independently of each other (ICD).

g. Latency of live video transmission shall be below 150ms (at D1 resolution) to allow smooth manual control of PTZ units. Tenderers shall be able to prove latency figures by providing measured results.

h. The VMS shall allow the display of camera metadata including time/date/event or alarm in predefined positions, below, above, next to or superimposed to the camera picture. The position, size, color, background and font of this information shall be user-definable.

i. Any live video display with audio shall allow lip synchronous synchronization.

j. Lip sync shall be automatically disabled when a PTZ camera (equipped with audio) is moved.

2.4 Camera Integrations

2.4.1 ONVIF

a. The VMS shall also support the ONVIF-S and ONVIF-T standard (ONVIF Profile S & ONVIF Profile T).

b. The VMS shall be able to configure and retrieve multiple video streams from IP cameras or other IP devices.

c. The VMS shall be able to receive and process metadata from an IP camera or other IP device: Alarm messages, fault messages or video analysis messages.

d. The VMS shall be able to control the event handling functions of IP cameras or other IP devices.

e. The VMS shall have an RTSP server (Real Time Streaming Protocol) which converts live streams (Motion JPEG, MPEG-2, H.264) into RTSP standard compliant streams for e.g. the VLC media player or modern monitor walls.

f. The VMS shall support multiple RTSP clients, even if they request the same channel, and allow access to multiple RTSP servers.

g. The VMS shall optionally support an Edge Recording function for ONVIF-G compatible IP cameras in order to be able to store and retrieve image material decentral on a camera-internal SD card.

h. The VMS shall optionally provide a secondary channel function for parallel use of multiple streams per IP camera with different, adjustable resolutions.

2.4.2 Axis Bodycams

a. The VMS shall be able to support the integration of Axis bodycams and the connection to the Axis Bodyworn System.

b. The integration shall support the transfer of video and audio files from an Axis bodycam to the VMS database.

c. The VMS shall ensure an immediate transfer of the recorded video footage from the Axis bodycams to the VMS as soon as the cameras are inserted into their docking station.

d. The VMS shall be able to support video as well as audio recordings and transfer them as MP4 files to the VMS server, where they are stored in the VMS database.

e. It shall be possible to view, search and synchronize the video material in the VMS with other video material.

f. The VMS shall be able to integrate a time stamp and device ID as a manipulation-proof watermark for all video recordings stored on the VMS server.

2.5 Alarm and Event Management Specifications

a. Alarm and event management shall allow flexible adaptation of the system's reactions to alarms or other events according to user requirements.

b. It shall be possible to set up event reactions using logical combinations to generate complex reaction sequences.

c. Times for pre- and post-alarm recording shall be adjustable for each event.

d. Recording parameters for simultaneous recording of several cameras with different quality and speed shall be adjustable.

e. The event-controlled, simultaneous display (live stream) of several cameras with different quality and speed in different viewers shall be parameterizable.

f. The automatic alarm image display with live and/or replay viewers (e.g. with automatic alarm video loops) even at different, predefined user workstations shall be adjustable.

g.   Alarms or events of any kind shall be able to control several output contacts automatically.

h.   It shall be possible to automatically send alarm or event information to users of connected third party systems.

i.   Alarm and event messages shall automatically control one or more PTZ cameras, e.g. to move to preset fixed positions or start a tour.

j.   Alarm and event messages shall be able to control the automatic backup of predefined video sequences.

k.   E-mail messages shall be event-controlled and sent to predefined recipients with alarm images attached.

l.   Each system state shall be able to trigger predefined follow-up actions.

m.   All logic operations can be time-controlled, delayed or edge-triggered.

n.   Alarms shall be able to be assigned different priority levels, highest priority, medium priority, low priority, each with different display scenarios (image switching, acknowledgement dialog, playback of a WAV file) per user.

o.   Generating alarms shall be possible via internal video analytics, but also via external alarm inputs or via interfaces to other equipment (serial or TCP/IP link), or any other internal system event.

p.   A Time scheduler shall allow completely unattended operation to activate/deactivate different profiles for recording and analytics during user defined time windows. This shall include daily, weekly monthly or yearly schedules and allow the importation of national holiday calendars.

q.   In case of using the VMS as satellite to networked CCTV-Systems, any system event shall also be transmittable via IP-network to the other video servers, and to a Central Action Manager containing programmable logics with timings. Those functions shall be standard without the need of customized adaptations.

2.6 Video Analysis Specifications

2.6.1 General Requirements Video Analytics

a.   The system shall integrate different options to analyse images automatically and in real time.

b.   Every video content analysis shall be available through activation with a license key.

c.   All types of video analysis shall be capable of processing images in real time on the video inputs. The video analytic processing shall have the ability to be offloaded to separate computers for the purpose of load balancing and distribution of CPU

processing in order not to reduce the capacity of the recording or live stream, and not to affect other functions of the software in terms of computational speed and performance.

d. At runtime, any of the analytics methods shall be capable to push relevant live and/or recorded images to networked users along with event metadata.

e. The software shall have a central VCA setup editor with its help each camera channel different types of video analysis can be clearly assigned.

f. The installation shall be possible both locally and on a remote computer.

2.6.2 Camera Signal Monitoring

a. The VMS shall automatically detect the failure of video synchronization signals from analog cameras in real time to ensure immediate detection of a camera error.

b. It shall also monitor the contrast level of each video input in real time to immediately detect deterioration of the camera picture through tampering or lighting failure.

c. The VMS shall offer the possibility to monitor the field of view of each camera to detect tampering with cameras through change in position.

d. To monitor the field of view of a camera, the system shall be able to create a reference image (comparison image) as a background model autonomously.

e. To monitor the field of view of a camera, it shall also be possible to assign a reference image (comparison image) manually.

f. The measurement cycle of the image comparison (live / reference image) shall be adjustable.

g. It shall be possible to define a pre-alarm threshold, how often a deviation is detected until an alarm is triggered.

h. A contrast monitor shall display the current contrast of the camera image in comparison to the set threshold value, which must not be fallen below.

2.6.3 Motion / Activity Detection

a. The VMS shall integrate a basic, free indoor video activity detection into selectable camera channels while suppressing global contrast changes such as lighting changes.

b. The setup of the detection areas shall be precise and simple by allowing up to four polygons to be drawn within the image, each polygon permitting individual sensitivity values.

c. The alarm duration shall be adjustable and re-triggerable.

d. For each polygon a direction recognition with adjustable scattering angle shall be selectable.

e. The AD setting shall be exported as a parameter set and imported later for another media channel.

f. It shall be possible to save different templates with different detection areas.

g. A time range setting allows different templates to be applied to a camera channel at adjustable times.

2.6.4 Outdoor Video Analytics

a. The VMS shall be able to integrate an outdoor video analysis option for particularly critical outdoor surveillance tasks.

b. The video analysis shall have 5 different Measure cycles from 40ms to 10s to reliably detect very fast and very slow movements.

c. The video analysis shall use 128 detection fields, which are freely configurable in function, position, size and sensitivity.

d. Detection fields shall be able to be connected to form chains with automatic perspective size adjustment.

e. Detection fields in chains shall include an auto perspective feature that automatically adjusts to the size and speed of objects between near and far.

f. Video analysis shall be able to differentiate between the direction of movement and the speed of an object.

g. The analysis shall be able to differentiate between local and global changes in the video image.

h. It shall be possible to suppress movements in certain areas of the video image to accurately adjust the detection of global changes in the video image.

i. The analysis shall allow different modes of operation of the detection fields: pre-alarm fields, blocking alarm fields, suppression fields and alarm fields.

j. Detection fields with different modes of operation shall be able to be grouped.

k. The motion path of a detected object shall be displayed in the video image by the use of switchable vector lines.

l. It shall be possible to store any number of parameter sets in order to be able to automatically use different settings in adjustable time ranges.

m. The analysis shall work completely independent of image capture and streaming.

2.6.5 Advanced Outdoor Video Analytics

a. The VMS shall be able to integrate an advanced outdoor video analysis option for particularly critical outdoor surveillance tasks.

b. The video analysis algorithms enable the detection of objects and in parallel the real-time detection of movements within marked zones in the outdoor scene to be observed.

c. The function shall operate object-oriented and is thus able to recognize, observe and follow objects (e.g. humans) in an image.

d. Moving objects within polygons or while crossing virtual fences shall be "seen" and trigger predefined system reactions to, for example, provide users with relevant live and/or recorded images.

e. Configuring the perspective match shall be fast, easy and accurate, also by simply drawing lines and entering measurement values into the live or recorded picture.

f. For the exact adjustment of object sizes in the video image (perspective settings near and far), virtual, adjustable measuring rods shall be used during configuration.

g. The analytics method shall take care of the perspective so that objects are recognized independently from their distance to the camera, to allow conclusions about the object size and speed.

h. Virtual walls in the form of a modelled 3D scene model (scene boundaries) make it possible to limit the surveillance area intelligently and 3-dimensionally so that reliable object detection is possible in terms of size, distance and speed.

i. Systematically occurring disturbances shall be reliably suppressed by permanent adjustments of the background model. The system shall filter out real world weather originated motion (rain, snow, shadows, change of brightness, camera shaking in wind etc. etc.). Preference is given to tenderers with real outdoor field experience on the matter.

j. A directional filter with adjustable angle shall make it possible to detect object movements only from one direction as an alarm.

k. A size filter with adjustable area in m^2 shall make it possible to detect only objects of a certain size as an alarm.

l. A speed filter with adjustable speed shall make it possible to detect only objects with a certain speed as an alarm.

m. All filters shall be combinable.

n. In order to exclude certain image areas from motion detection, suppression zones can be drawn as polygons in the video image.

o. The analytics shall also be perfectly suited to the use of thermal cameras for accurate results even in total darkness.

p. Different alarms shall be possible out of the same camera; each alarm may depend on polygon / fence / direction and speed of motion.

q. Video analysis also offers a time-domain-dependent switchover between any number of parameter sets.

r. The analysis shall work completely independent of image capture and streaming.

2.6.6 Simultaneous Multiple Outdoor Video Analytics

a. The system shall be capable to simultaneously activate and run 2 different outdoor analytics methods for the same camera in real time.

b. There shall be a logical, time adjustable "and" combination between the two methods to achieve highly efficient detection results.

c. Such alarm detections shall be very accurate, as both, alarm recognition and false alarm suppression, have gone thru by 2 independent methods of video analytics.

2.6.7 Vehicle Number Plate Recognition

a. The system shall offer the possibility of recognizing and reading number plates on moving and stationary vehicles at a maximum distance of 20 m and a speed of up to 100 km/h in the video image.

b. Recognized number plates shall allow any real time system reaction as well as being used as search criteria for recorded footage.

c. The Automatic Number Plate Recognition (ANPR) shall be able to recognize and read European vehicle number plates.

d. A special version of the software shall be able to recognize and read all vehicle license plates from the USA, Australia and GCC countries.

e. The typical recognition rate of the system shall be > 96%.

f. The system shall contain a Number Plate Configurator in which country codes can be activated or deactivated.

g. The expected size of a number plate (min. / max.) in the video image as well as the expected speed (slow, normal, fast) shall be adjustable.

h. Optionally, the flow direction from which the vehicles come shall be adjustable.

i. Known number plates shall be assigned to certain groups (e.g. company vehicle, staff, etc.) in a category list.

j. In the category list, the individual number plates shall be marked as "black" or "white" in order to be able to define access authorizations.

k. Vehicle access software shall also allow entering additional data, such as driver licenses information.

l. The system shall have output contacts or integrated interfaces to barrier systems to control automatic barrier systems.

m. The feature shall support more than one camera per entrance/exit to ideally get one camera concentrating on number plates only, and one overview camera to show vehicle and/or driver.

n. Recognized license plate data with video shall be accessible on the local DVR/NVR, but also remotely.

o. The automatic Number Plate Recognition shall be able to control additional freely selectable actions (image switching, recording, switching contacts, etc.) via the VMS.

p. The search for relevant image data depending on number plate data and vehicle metadata shall be realized via a special ANPR search dialog or the central search mask.

q. The system must support a wildcard search (*) and a placeholder (?) search.

r. The system shall be able to generate filterable reports of all operations and vehicle data and export them as CSV files.

s. As soon as a vehicle number plate is recognized in the video image, the system shall display the corresponding video images including the corresponding metadata without delay.

t. The system shall optionally have a multiplex mode to cyclically scan up to four lanes.

u. The software shall feature a Vehicle Access Manager (VAM) to integrate cameras located at several access points (entrances – exits), even when being connected to several DVR/NVRs.

v. The Vehicle Access Manager shall display a separate user interface in which live images, stored video sequences and lists of all operations can be displayed and operated.

w. The user interface shall display in tabular form which vehicle, at what time, e.g. on a logistics company site, whether it is currently present and how long it has been on the site when leaving.

x. The system shall include filter options for all captured different metadata to sort the list of current activities.

y. It shall be possible to generate printable reports and daily closing documents for specific time periods.

z. The manufacturer shall be able to supply a hardware complete set for reliable day and night number plate recognition, including camera, lens, weatherproof housing and double IR headlights.

2.6.8 Artificial Intelligence

a. The VMS shall be able to integrate an option for the basic provision of video content analytics using artificial intelligence.

b. It shall be possible to define a region of interest (ROI) that is used for the detection of objects.

c. The VMS shall have a general neural network that allows the detection of people, cars and trucks.

d. The VMS shall enable the use of neural networks. These are used for the detection and classification of objects and enable a checking logic in the video analysis, for the verification of the results.

e. Each available neural network shall have object classes that can be selected for video analysis.

f. The VMS shall be able to check each detected object for its assignment to an object class during video analysis.

g. It shall be possible to assign a threshold to each object class. This value determines the certainty of an object classification or detection needed to be verified and process further system actions.

h. Each available neural network shall have checking logics that can be selected for video analysis.

i. The VMS shall be able to display detected objects in a detection list, organized by selected object classes and checking logic.

j. It shall be possible to change the FPS rate for video analysis.

k. The VMS shall be able to trigger an alarm when the object detection matches the selected object classes and check logic.

l. The VMS shall be able to provide visual feedback on alarms by marking the detected objects with colored rectangles.

m. It shall be possible to specify the alarm duration and the alarm delay in seconds.

n. The VMS shall be able to track objects and count their continuous detection.

o. It shall be possible to configure the sensitivity of the object detection for triggering an alarm. If the sensitivity is high, a single detection is sufficient to trigger the alarm. A low sensitivity causes an alarm to be triggered only when the same object is detected several times.

p. The VMS shall optionally have a neural network for the detection of face masks. Detected objects are face masks covering noses and mouths. The algorithm checks if they are worn by a person.

q. For the detection of face masks, the object classes Unprotected, Protected and Undefined shall be available.

r. For the detection of face masks, the checking logics MaskPresent and MaskAbsent shall be available.

s. The VMS shall optionally have a neural network for the detection of personal protective equipment (PPE). Detected objects are safety vests and/or protective helmets. The algorithm checks if they are worn by a person.

t. For the detection of PPE, the object classes Person, Safety vest and Helmet shall be available.

u. For the detection of PPE, the checking logics PPE_Present and PPE_Absent shall be available.

2.7 User Interface Specifications

2.7.1 Viewing with the Supplier's Viewing Software

a. The viewing/reviewing software (with audio function) shall run on a standard Windows PC and natively support the 64-bit computer architecture and fully utilize the Intel GPU acceleration.

b. The viewing/reviewing software is supplied with the VMS and is free of charge.

c. Using user profiles, it shall be possible to define own viewer arrangements deviating from the standard view.

d. The system shall have a profile manager that can be used to create templates containing not only the number, position and size of viewers, but also scenes with predefined camera connections.

e. It shall be possible to "jump" from one template / scene to another simply by clicking into a viewer (Template walker).

f. The software shall allow the administrator to create options profiles that can be allocated to users or user groups. Each options profile includes all GUI-settings such as sizes and positions of viewing windows, as well as fonts, colors, network connections, alarm reactions, user buttons and more.

g. The viewing/reviewing software shall support multiple monitors (4 or more) and enable its video viewers being positioned onto any of the monitors.

h. A viewer shall be adjustable to the size of the Windows window (stretch mode).

i. It shall be possible to display camera images in the Viewer in the correct aspect ratio (letterbox).

j. The system shall allow different start-up scenarios depending on user login. Such scenarios shall include the connection to predefined DVR/NVRs as well as the automatic display of live/recorded video streams within predefined viewers.

k. Several user workstations shall be able to connect to the same DVR/NVR unit via network without functional limitation.

l. The viewer operation shall include the following functions:

- Fast rewind database (speed adjustment by slider)
- Rewind
- Rewind image by image
- Stop
- Forward image by image
- Forward
- Fast forward database (speed adjustment by slider)
- Live streaming.

m. The viewer operation shall have a timeline in which a time frame from 1 min. to 24 h can be set. It shall be possible to move this time frame over the entire recording area in order to be able to quickly select images from the recording history.

n. For direct switching between event recordings, buttons with the following functions shall be used:

- Begin of database
- Next event
- Previous event
- End of database.

o. The viewing/reviewing software shall provide a Motion Search (MOS) function. It shall be possible to draw a rectangular search area in the video image using the mouse in playback mode to search for motion in this marked area.

p. For direct switching between detected movements in recordings, buttons with the following functions shall be used:

- Begin of database,
- MOS backwards,
- MOS forwards,
- End of database.

q. The software shall include a background motion search. This function searches for movements either in a marked area or in the entire image. All recordings found are automatically transferred to a cut list, limited by date, time range, camera channel and sensitivity, with adjustable pre- and post-run times.

r. All control functions shall additionally be accessible via a self-explanatory context menu.

s. On the Clients side, a snow filter shall be available which eliminates disturbances caused by heavy snowfall, rain showers or strong image noise in moving images without affecting the images stored in the database.

t. A selected image in a viewer shall be printable. It shall be possible to add the following text insertions (font, size, color, orientation can be changed) to the image beforehand:

- Date/time
- Channel description
- Alarm text
- Event name
- Event description
- Event parameter
- Export information.

u. The additional function ExportPrivacy allows the user to mask areas in the image in black before printing.

v. A selected image in a viewer can be exported as BMP, JPEG (low, medium or high quality) or RAW file. It shall be possible to add the following text insertions (font, size, color, orientation can be changed) to the image beforehand:

- Date/time
- Channel description
- Alarm text
- Event name
- Event description
- Event parameter
- Export information.

w. The additional function ExportPrivacy allows the user to mask areas in the image in black prior to export.

x. Access to local DVD / CD burners for exporting images shall be blocked for certain clients.

y. Alarm views shall be freely adjustable by defining the number, position and size of the viewers as well as the automatic connection of camera channels.

z. When alarms are generated, the corresponding sound (audio channel), if available, must be played automatically.

aa. The software shall be able to display several alarms simultaneously in different viewers.

bb. Alarms shall be forwarded to other clients via an alarm push function.

cc. As viewer scenes the following viewer arrangements must be adjustable:

- 16:9 Matrix 1 x 1
- 16:9 Matrix 2 x 2
- Matrix 1 x 1 full
- Matrix 2 x 2 full
- Matrix 3 x 3 full
- Matrix 4 x 4 full
- Matrix 1_5
- Matrix 1_7
- Matrix 1_12
- Matrix 1_16

dd. If no display scene has been defined for the display of an alarm, a suitable viewer arrangement is automatically displayed.

ee. Any user workstation shall be able to connect to several DVR/NVR units at the same time without functional limitation.

ff. The user interface shall allow cameras from different DVR/NVRs being displayed simultaneously on the same screen live and/or replay. This is independently from the video source, whether analog or IP.

gg. The user interface shall enable the parallel display of live and recorded pictures of the same camera or different cameras in multiple viewers.

hh. It shall be possible to create customized buttons in the VMS to play scenarios and send commands (infrared on/off, manual transition mode for day and night, etc.) to the cameras.

ii. In the viewing/reviewing software, it shall be possible to control PTZ (pan-tilt-zoom) cameras via a virtual joystick, mouse or direct click into the image and recall fixed positions via buttons.

jj. A professional hardware unit with joystick for camera selection and PTZ shall also be supported.

kk. The software shall allow the administrator to create rights profiles that can be allocated to users or user groups. Those rights profiles shall grant not only access to DVR/NVRs, but to individual cameras or camera groups and to functions per camera, such as access to live video and/or replay and/or access to remote control for PTZ cameras. Rights for exporting footage or printing images shall also be included.

ll. The number, size and arrangement of the viewers shall be freely editable for each client and saved as one of the views.

mm. The software shall contain a screen splitter function to display the streams of two cameras side by side with a fixed image section each (static zoom) as one image in a viewer.

nn. All viewers shall have digital zoom.

oo. The system shall enable time-synchronous playback of the stored video recordings of the cameras as parallel playback in several viewers.

pp. A set of tools for the enhancing of the picture display including brightness, contrast, color rendering and zoom shall be available. These changes in display shall not affect recorded data.

qq. Options for alarm display shall include alarm pop-ups with automatic alarm viewer scenarios displaying live images as well as automatic post-alarm and pre-alarm footage in predefined loops for single or multiple cameras.

rr. For each camera channel, each event / alarm and each action it shall be possible to assign a text insert.

ss. The following search filters must be available:

- Search by time / date,
- after event / alarms,
- for actions,
- according to transaction data,
- after number plates,
- and barcode data.

Via one or more camera channels, forward or backward with "Jump by time" function.

tt. A data string coming from a connected barcode reader (or other interfaced device) shall also be usable as direct search criteria to directly find footage that has been recorded with the same string (bar code or others).

uu. The viewing software shall allow various replay filters, for example filtering a viewer to show special event footage only, while discarding everything that was recorded outside such events.

vv. The viewing software shall allow the easy creation of automated multi camera video cut-lists (for example concentrating to moments found with motion search – or other criteria).

ww. Cut-list fine tuning shall allow adjusting start-stop times of each cut as well as the adding of cameras.

xx. Such cut lists shall ease the viewing efficiency thru numerous events, but also allow its export to removable media.

yy. Alarms/event data shall be accessible via event lists. Such lists shall be available per camera, but also globally for all cameras. Selecting event list entries shall provide direct access to the event images.

zz. The picture search on a group of cameras shall be synchronized to display all images responding to the search criteria from different cameras in different viewer windows - regardless of the number of DVR/NVR units to which the cameras of the group are connected.

aaa. The user shall be enabled to mark and quickly retrace once found pictures via bookmark lists.

bbb. The bookmark list shall contain preview icons and indicate whether a bookmark has been set in the recorded material or the livestream.

ccc. Single frame forward/back must include all frames, jumping to key frames only will not be accepted.

ddd. Fast forward/rewind shall be smooth and consistent. Supported speeds should include x1, x2, x4 and x8.

eee. There shall be the option of "intelligent video walker" image view organizing. In this mode the selection of one camera shall automatically position viewers with neighboring cameras next to it.

fff. The viewing software shall allow all connected DVR/NVRs to appear as one logical device so that cameras can be selected by camera number or name only, without forcing the operator to first select the DVR/NVR.

ggg. A "directory tree structure" shall be preferred for all cameras and logical groups of cameras (and DVR/NVRs if adequate). PTZ cameras shall be marked as such in the tree view with an appropriate symbol.

hhh. The VMS shall have adjustable alarm dialogs in which it is defined how the system presents an alarm or follow-up alarms, how the user has to handle alarms and which automatic actions are to be started by them.

2.7.2 Viewing using Standard Windows Tools

a. In addition to or instead of dedicated remote viewing client software, live and/or recorded images shall also be accessible from standard WEB-browsers via HTLM5 without the use of plugins.

b. Access via a web browser must also be possible via HTTPS (HTTPSecure) with a signed SSL/TLS certificate.

c. After entering the IP address in the address line of the browser, the VMS must show a login screen in which a valid user name and the associated password for access must be entered.

d. The user interface shall be adapted to tablets, smartphones and desktops.

e. The user interface shall be structured in menu bars and self-explanatory buttons.

f. The viewer operation shall include the following functions:

- Fast rewind database
- Rewind
- Rewind image by image
- Stop
- Forward image by image
- Forward
- Fast forward database
- Live streaming
- Previous Event
- Next event

g. It shall be possible to select up to 6 different templates for the arrangement of the viewers and to view at least 9 simultaneous video streams or images from the same camera at different times simultaneously.

h. The resolution of the transmitted video images shall be automatically adjusted depending on the device resolution, viewer size, quality settings and, if necessary, the digital zoom during runtime.

i. Alarm messages, messages and metadata shall be displayed in active images.

j. The insertion of the texts shall be switchable with a click on the corresponding button.

k. When a PTZ camera is connected to a viewer, control elements must be displayed automatically.

l. The manual operation must automatically adapt to the available operating functions of the device in use:

   - With fingers on smartphones, tap, wipe, gesture
   - With fingers and mouse on tablets, tap, wiping, gestures
   - Mouse on desktops

m. To display images from a camera with fisheye lens (live + database), the following display variants shall be selectable:

   - The distorted raw image of the camera
   - Equalized picture 2 x 180°
   - Equalized image 4 x 90°
   - Image section that can be changed by pan, tilt and zoom control

n. The display of alarm notifications shall be parameterizable:

   - Automatic display of alarm images (live and/or database)
   - Selectable display according to different alarm priorities
   - Selectable display of event or alarm names, event descriptions and event parameters

o. All alarms shall be kept in an alarm list which can be used to select and display previous alarms.

p. It shall be possible to set up user-defined buttons that trigger freely selectable actions in the VMS.

2.7.3 Camera Telemetry Controls

a. The VMS shall allow control of cameras with PTZ facilities including pan, tilt, lens and pre-set movement controls. An on-screen joystick, lens controls and pre-set buttons shall be available for this control function.

b. Controls shall also be possible via computer mouse by directly clicking into live pictures using mouse motion for pan-tilt, and mouse wheel for zoom.

c. PTZ functions shall also be controllable autonomously (e.g. pre-positions) from any event of the VMS.

d. In addition, the VMS must be able to connect external joysticks directly to the system to control PTZ devices.

e. The VMS shall offer the possibility to connect external operator devices of the manufacturer directly to the system in order to control PTZ cameras and the VMS.

f. It shall be possible to control PTZ devices via network or serial interfaces.

2.8 Setup

a. The setup software of the VMS shall be separate from the viewing software and shall run on standard Windows PC's.

b. The connection of the setup software shall be possible locally as well as via network on TCP/IP basis.

c. The software shall contain a user administration in which basic rights can be set for each user, such as logging in alone (without a second user), reading the setup, accessing the web interface, accessing the audit trail, changing setup settings or making only limited changes to the setup. In addition, it shall be possible to block certain alarms, output contacts and functions / properties of the camera channels for users on the basis of blocking lists.

d. It shall be possible to use two different setup files. One variant contains the settings of the VMS including the settings of the used video analysis options and another one without video analysis data.

e. Setup data shall be exportable as system understandable file and additionally as XML file.

f. It shall be possible to import a setup file into the VMS and overwrite previous setup settings.

g. The VMS shall have a tool to execute setup migrations of different software versions.

2.8.1 First Installation

a. With the help of a Connection Wizard, connections to other servers in the network shall be set up easily. The wizard should contain a server search, a list of connected servers and their connection settings, and an import and export function for server lists. In addition, the type of data encryption AES256 or Salsa should be selectable for each connection.

b. A Media Channel Wizard shall guide the user through the configuration of media channels (camera channels):

- Setting up the cameras by selecting the manufacturer with display of the firmware version
- With and without DHCP
- Own camera name
- Automatic assignment of a global camera number
- Assignment to a camera group
- Username and password for access
- Permanent Recording Settings
- Live streaming settings
- Overview of all connected channels

c. An Event Wizard shall guide the user through the configuration of events / alarms:

- Event name / description
- Assignment of event groups
- Runtime of events
- Adjustable archive levels / ring buffers
- Setting the prehistory
- Storage trigger
- Forward message to
- Time range setting
- Selection of follow-up actions
- Recording Parameters / Camera Channels / Runtime
- Alarm texts
- Alarm priority
- Overview of all events / alarms

2.8.2 Parameterization Possibilities

a. It shall be possible to set up a database automatically by selecting a drive and determining the size of the database.

b. It shall be possible to set the video standard (CCIR 25 FPS, EIA 25 FPS, Free 100 FPS) for each camera channel.

c. Analog-to-digital converters can be configured via hardware settings to process analog camera signals. It shall be possible to adjust brightness, contrast, saturation, color, sharpness and the horizontal position of the image and the amplification of the audio signal. In addition, temperature monitoring and a watchdog function shall be adjustable.

2.8.3 Events / Rules of Behavior

a. Each event and each alarm shall be assigned its own behavior rules, which determine the type and length of the recording, the archive level (e.g. 30, 45, 50, 75 days), the type of live image display as well as follow-up actions (all system functions must be possible) in adjustable time ranges.

b. Different video analysis functions (Indoor / Outdoor / Advanced outdoor, Multiple outdoor) shall be able to be assigned to each camera channel whereby all sensor messages of an analysis with adjustable alarm priority can be used to execute assigned behavior rules.

c. In principle, the following options shall be selectable for the display of an alarm:

- Show first alarm picture only
- Live replay
- Replay event pictures

- Continuous event replay in a loop
- Include prehistory
- Play audio
- Alarm forwarding possible to Client XX

d. The behavior rules shall also be able to be assigned user-related parameter sets to start actions of the system, video and audio processing, camera control, digital contacts or network devices. For example, to automatically start a tour of a particular camera when a particular user logs on to the system.

e. All rules of conduct shall be selectable in a trigger and reaction list.

2.8.4 General Settings

a. The VMS shall be able to read or control sabotage-monitored I/O contacts which can be assigned to specific events or actions via a selection list by means of a global contact number.

b. The software shall offer the possibility to create own quality profiles (quality of the video image) in order to change the image size, compression and GOP size of the standard video profiles (4K, Full HD, HD, etc.) or to assign own quality profiles to certain cameras.

c. In order to deactivate and reactivate selectable alarms, events or actions for a specific time period or manually, the software shall have parameterizable blocking filters.

d. To control PT heads and domes from different manufacturers via serial interfaces, a Telecontrol Service shall be included which can control these devices via a user-defined number of serial ports even with different protocols.

e. The software shall have a parameterizable time management in which time ranges can be set, which in turn can switch functions active or inactive. A fixed date, certain weekdays, daily, public holiday, holidays and weekend periods, certain times, times from/to, virtually remaining time ranges as well as the location with longitude and latitude can be selected.

f. The VMS shall have dynamic database management that automatically reduces or increases the storage depth of all recording operations in a consistent manner in the different levels of archiving (number of days) as measured by the total capacity of the database.

g. The ring buffers of the database shall be divisible into 3 archive levels (in days, hours and minutes), whereby a dynamic administration can automatically adjust the respective ring buffer depth depending on the load.

h. The FLTM function (Fading Long Term Memory) of the database shall have two levels (A/B) which can run one after the other and both can be set using the following parameters:

- Suppress FLTM when viewing images

- Percentage suppression factor for image viewing
- Adjustable time range of FLTM suppression
- Shrink mode, keep just event pictures
- Shrink mode, keep every n'th picture
- Shrink mode, at which interval images should be deleted
- Keep audio

i. The FLTM function shall also have a simplified mode (classic) in which the following parameters can be set:

- Priority (dwell time of the images)
- Auto delete after set time

j. The database shall be able to create automatic backups, which shall be saved as protected, tamper-proof files, either action-controlled or time-controlled (time management).

k. Different camera channels, ring buffers and archive levels can be combined as sources and limited in time.

l. The backup files can be stored both locally and on a network drive, for which purpose the network path, a file encryption password, splitting into several files and storage capacity warnings can be set up.

m. The setup shall contain an overview, in which all booked software options (additional function packages) subject to a fee are displayed and where new additional functions can be ordered especially for this own system.

n. To forward alarms (alarm push function), it shall be possible to create and name various client connections, which then automatically start an alarm activation if required. The client name, the client password, the type of transmission encryption, the user login, the desired transmission bandwidth, the behavior when the connection is disconnected and a timeout until disconnection can be set.

o. All operations, events and status changes of the VMS shall be automatically documented in an audit trail area with time/date and description text over an adjustable period of time. In addition to general events, such as a user logging in, changes in the setup, changes in camera displays, VCA messages, etc., all possible actions in the system must also be logged in the audit trail.

p. In principle, it shall be possible to set the minimum DLS / DSS resolution (Dynamic Live Stream / Dynamic Stream Selection) of the video images either with predefined profiles (disabled, CIF, 4CIF, HD, FullHD) or manually (minimum width in pixel x minimum height in pixel).

q. The transcoding from JPEG to H.264 / H264CCTV as well with the quality level and the maximum image resolution for live streaming and permanent recording shall be adjustable in the setup.

r. Optionally, the VMS can also be used in mobile applications. In addition, GPS data such as time stamp, longitude, latitude and speed (adjustable in km/h, mph, m/s) can be collected and sent to the server.

2.8.5 Image Processors

a. The VMS should make it possible to mask adjustable, fixed image areas (static privacy masking) or moving objects (motion privacy masking) in the video images of the camera channels as not recognizable for certain users.

b. It should be possible to draw zones (polygons) in the video image of a camera so that these marked areas can be colored statically black or pixelated.

c. It should be possible to draw zones (polygons) in the video image of a camera in which moving objects are pixelated or blurred masked without changing the background. The following parameters should be adjustable for this function:

- Sensitivity (speed of pixelation)
- Object lifetime (delay before transfer to image background)
- Reference meter (coarsening factor of the pixilation)

d. The VMS shall be able to process and equalize video images from cameras with fisheye lenses on the client side. The following parameters should be adjustable for this purpose:

- Lens
- Installation position, Ceiling, Floor, Wall
- E-Flip
- Position of the fish eye in the viewer
- Views: Board view, PTZ view, Double view, Quad view, Panorama view, Trible view

2.8.6 Central Action Manager

a. The software shall include an Action Center, in which actions and events that take place locally on certain other servers are centrally tracked in order to be forwarded to other locally working servers if required.

b. With the help of adjustable filters, it should be possible to limit that only certain actions or events are captured from other servers and only forwarded to certain other servers.

c. For the automatic display of several camera channels in a time definable sequence, different camera cycles shall be able to be parameterized centrally, which can then run in different viewers.

d. Different camera tours (PTZ cameras) shall be parameterized centrally by saving a series of fixed positions with adjustable dwell time as a tour, which in turn can be assigned to certain camera channels.

e. It shall be possible to set different timers centrally, which can control selectable actions. For this purpose, unique timers, periodic timers and periodic timers with an additional embedded timer shall be available for selection.

2.8.7 User Access and Security Specifications

a. In the central user administration, the rights and blocking settings for users shall be distributed to different roles. The individual users can be assigned to these roles. The system shall already have predefined roles, which automatically get the required rights for the connected servers.

b. To subsequently integrate additional servers into the user administration, locally existing user accounts, channels, alarms and output contacts must be automatically imported for configuring the lock settings after the connection has been established.

c. The four-eye password function should also be able to be created as an independent role to be able to connect cross-system user logins.

d. A user role can be configured to allow access to specific servers, administration, setups or restricted setup functions, and video content analysis. In addition, detailed blocking lists can be used to selectively block specific servers, individual camera channels, specific alarms and alarm notifications, or individual output contacts for a role.

e. Each user shall have individually configurable rights and abilities, with custom role assignments and two-person required authorization can be set.

f. The central user administration shall provide the administrator with an overview that lists all users of the system and their assigned roles.

g. As a security measure, all user settings shall not only be stored centrally in the central user administration, but also on every connected server.

2.9 Export of Recorded Images

2.9.1 Manual Backup

a. A backup file shall contain several files: the videos themselves (also several camera channels incl. Audio), event data / texts, backup comments, the manufacturer's viewer software for 32Bit and 64Bit systems, the VLC player for MP4, an AutoStart.exe and Autorun.inf for automatic playback start.

b. The VMS shall have a proprietary tamper-proof backup file format that can be used as a court evidence and can be protected by true full encryption of the file with a self-selected key of up to 128 characters.

c. A shrink mode can be used to adjust the bandwidth and reduce the size of the file.

d. As an additional backup format, MP4 can be selected with texts "burned" into the image, with texts as subtitles or with texts as a separate subtitle file (SRT).

e. As additional backup format MPEG4CCTV, H.264 raw or H.265 raw with embedded texts or with texts as separate subtitle file (SRT) can be selected.

2.9.2 Automatic Backup of Video Sequences

a. The VMS shall also include a server-based auto backup module in which multiple backups running automatically in the background can be defined and controlled.

b. The software shall be able to manage different backup operations in parallel, with these operations having different sources (system-wide), destinations and start criteria, and they may be stored on both local and network drives with authentication.

c. Backup operations can be started via weekdays with time and via actions. This allows any operation to be used to trigger a backup.

d. The contents of each Auto Backup shall be stored as backup source and shall be adjustable as follows:

   - Video with or without audio
   - Camera channel, recording ring, archive level
   - All categories, event records only or permanent records only
   - Backup new pictures up to the scheduled / effective start time only or backup all new pictures, even those that are recorded after the backup has been started
   - Automatic Backup depth detection or Manual backup depth

e. In addition, the Automatic Backup shall have an Auto Delete function which can be used to automatically delete previous backups after how many days or when a set storage capacity has been reached.

f. The Free Capacity Level (XX GB) and the Allocated Capacity Warning Level (XX GB) can be set for capacity warnings.

2.10 Logistics Applications

2.10.1 Automatic Single Frame Export

a. The VMS shall include an image export tool that provides a simple, image-based interface to other systems (management systems or web services) for automated event-driven or action-driven export of single images.

b. This export tool shall be a stand-alone service that can run on any computer in the network and is connected to the VMS via TCP/IP.

c. The export of single images (jpg or bmp) shall be adjustable by the following parameters:

   - Export only after event stopped.
   - Export/Trigger at: event start time, retrigger time, event stop time with a delay time of (delay by XXXX milliseconds).

- Periodic export (including export interval, distance between two exported images in milliseconds).
- Numbers of Pics.

d. The automatic structure of the file names of the images to be exported shall be possible by means of adjustable templates. Data such as event name, event ID, event type, action data or process data as well as time and date can be used for these templates.

e. The destination drives for storing the exported images shall be freely selectable in the network, whereby a possibly required user name and password must be stored in the export service.

f. It should also be possible to manage the storage space in order to be able to define:

- How much storage space may be used on the target drive.
- How much memory space is to be kept free for new images before the oldest images are deleted.
- Which images older than the specified time should be deleted automatically.

g. The service shall be able to report capacity alerts when the free space on the target drive falls below a specified value (in GB).

h. Besides the normal export of single images from a livestream that has not yet been opened, it shall be possible to select a fast mode that keeps a livestream open for each media channel while the service is running.

2.10.2 Barcode Scanner

a. The VMS shall have a plug-in which can be used to integrate barcode scanners.

b. The plug-in shall be able to manage up to 255 serial barcode scanners as well as an adjustable number of external barcode clients (IP), whose parameter settings can be exported or imported as CSV file.

c. It shall be possible to assign each scanner to one of a freely definable list of locations in order to manage the assignment to camera locations.

d. Dynamic assignment shall be possible with a registration scan.

e. The plug-in shall contain an integrated TACI interface (Telnet Action Command Interface) which can receive, filter and forward barcode data (Barcode, LogBarcodeData, LogBarcodeID) to the VMS to control further system actions.

f. As further options, it shall be possible to set which parts of the barcode are to be forwarded and whether an action is to be forwarded if a logon or logoff scan has been done.

g. It shall be possible to define further output profiles for the adaptation of different barcodes from different scanners.

2.10.3 Vehicle Access Manager (VAM)

a. The Vehicle Access Manager (VAM) integrated in the VMS to manage license plate recognition data shall include database functions specifically adapted for automated yard management with control of the entry and exit barriers in logistics. It shall be possible to assign vehicles to service providers, drivers, contact data or orders, whereby the access roads can be assigned to completely different workplaces.

b. The VAM shall have an integrated editor with which a Microsoft SQL Server (database) can be set up and connected.

c. In the basic configuration, various gatekeeper seats, traffic lanes (entrance or exit), media channels (cameras), users and license plate recognition systems should be able to be linked with recognized license plates.

d. As master data the complete address data of companies with allocation of freely definable company categories, the address data of drivers, transport orders, special instructions to the driver and the complete vehicle data with allocation to company and driver shall be managed. Transport orders consist of:

- Number of the transport order
- Description of the order
- Instructions for the driver
- Period in which the order is valid
- Responsible company

e. It shall be possible to export and import all master data as CSV files.

f. The following authorizations and tasks shall be assigned to vehicles:

- Entry is prohibited.
- Entrance is permitted without restrictions.
- Entrance is only permitted at certain times on certain days.
- Duration of stay on the company premises is limited.
- Entrance is only permitted at certain entrances.
- Exit is only allowed on certain exits.
- Special instructions to the driver or for the gatekeeper, e.g. register at loading ramp 01 or with the supervisor report, etc.
- Vehicle data must be entered by the gatekeeper. These include trailer numbers, weight of the trailer and seal numbers of the trailer.
- The gatekeeper is obliged to assign a transport order to the process.
- The gatekeeper is obliged to assign at least one driver to the process.

g. The VAM user interface shall contain the traffic lanes assigned to the workstation with the assigned media channels (cameras), four viewers for displaying the camera

images, a list of all current processes with quick access to the individual processes and a filter dialog for limiting the processes.

h. Via the filter dialog, the processes of the last 8 hours, the vehicles on the site or processes of a certain time range can be selected. Additional filters can be used to further limit the selection to all existing, different master data.

i. The VAM shall have an integrated report function that generates printable and exportable (CSV-Export) reports on specific, previously filtered processes or vehicle data.

j. The recognition of number plates that are not yet known in the system shall automatically open the input masks of the master data and authorizations.

k. In addition, it should be possible to manually register license plates that are not automatically recognized by the system, e.g. due to very heavy soiling.

l. In addition, the VAM shall have a free flow mode, which is only used for the detection of entrances and exits.

2.10.4 Smartphone Connection

a. The VMS shall have an option to use a smartphone as a mobile IP camera and to transfer and process video images as well as alarms and events from the smartphone to the VMS.

b. The option shall consist of a software package and a smartphone app. The software package is installed on the VMS server and the app on the smartphone that shall be implemented as a camera.

c. The smartphone app shall work with any Android based smartphone that meets the following requirements:

- Android 5.0 or higher
- 1.5 GHz 4-core CPU or better
- min. 2 GB RAM

d. It shall be possible to use the transferred video in the VMS as a live stream or to retrieve it from the VMS database afterwards.

e. The VMS shall be able to store alarms and events in the VMS database to allow later retrieval of the associated video image.

f. It shall be possible to scan barcodes with the smartphone and to send them to the VMS. The scanned barcodes are transferred to the VMS as events.

2.11 Tools / Accessories

a. The VMS shall have a central Software Asset Manager (SAM) which manages the licensing of all software packages of a distributed overall system with any number of VMS instances and software options. It must also be possible to configure the SAM with a cache to have protection against failures.

b. The VMS shall provide an additional tool (Camera Finder) with which IP cameras of different manufacturers can be automatically searched and found within the network. Found IP cameras should be displayed in a table with the following information:

   - IP address
   - Subnet Mask
   - MAC address
   - DHCP / static IP address
   - Model
   - Firmware version
   - Serial number
   - Accessible
   - LAN Adapter
   - Access data valid

c. The VMS shall provide an additional tool (Camera Check) to manually check for maintenance purposes whether the viewing angle of a camera has been changed. In a direct comparison between a previously saved reference image and the current live image, an alteration of the viewing angle can be detected and documented in test reports (text + images).

d. The VMS shall provide an additional tool (Focus Analyzer) with which the focus of very high-resolution cameras (e.g. 4K) can be precisely measured and adjusted. The tool should display the live image of a selected camera and an oscillogram of the minimum and maximum possible focus value as well as the course of the currently measured value. In addition, it should offer the possibility to mark a region of interest (ROI) in a bounding box in the image in order to fix the focus setting on this area. The best possible sharpness setting is displayed in the oscillogram and indicated acoustically.

e. The VMS shall contain an additional module (Streamer), which can control the transmission of images via independently usable transmission channels in web-compliant formats based on the HTTP protocol. For this purpose, the JPEG quality (compression rate), the image resolution and the frame rate can be set for each channel and a text insertion can be parameterized. In addition, the transmission of status messages can be added and the control of PTZ cameras via HTML commands can be activated.

f. The VMS shall contain an additional module (RTSP server, Real Time Streaming Protocol), which allows to parameterize camera channels of a server as RTSP streams via its own setup.

g. The VMS and the VMS viewers shall be able to receive and process multicast streams.

h. The VMS shall contain an ONVIF plugin which supports the following functions of the ONVIF standard:

- H.264 and MJPEG
- Dual streaming
- Dynamic Live Streaming (DLS)
- Pan, tilt, zoom functions of speed dome cameras
- Generic handling of camera meta data like events and alarms

2.12 Licensable Software Components / Options

a. As a software option, a module for redundant VMS design (Failover), controlled by a higher-level security management system, with the processing of 128 IP signals and database sizes of 450 TB per instance shall be used.

b. As a software option, it shall be possible to use a module for the connection and licensing of an IP camera of the system provider or other manufacturers as well as in the ONVIF standard or with RTSP protocol.

c. As a software option, a module for connecting and licensing another user with access (local or remote) to the VMS user interface with individual user settings shall be offered.

d. As a software option, a software instance to install the VMS on a virtual machine shall be usable.

e. As a software option, a module should be available for connecting a VMS instance to a VMS working as a central system, via which alarm messages or process data can be managed uniformly and centrally.

f. As a software option, an interface module for connecting ATMs from different manufacturers (e.g. NCR, IBM, SNI) shall be available, so that transaction data from ATMs can be linked with recorded images.

g. As a software option, a module for reading scan data (barcode scanner) including the assigned location information for linking to video images in real time shall be available.

h. As a software option, a module for activating the Vehicle Access Manager (VAM) shall be available for controlling and documenting vehicle movements within a terrain (license plates, access authorizations, drivers, etc.).

i. As a software option, a module shall be available to enable the streamer function for a channel in the VMS to transcode image data and send it to a connected decoder or HTTP stream receiver that has requested it via HTTP query.

j. As a software option, a module shall be available for the recording of observation processes of images of the cameras which an operator selects in a certain media channel (spot monitor) and observes live. An entire observation sequence is immediately available, e.g. when people are tracked over several camera areas, and can be exported as evidence.

k. As a software option, an Edge Recording module should be available for almost complete recording of the camera images, even if the network connection is interrupted. Video images are permanently stored on a camera-internal SD card. When the connection is reestablished, the missing image material in the database is automatically transferred via an additional stream.

l. As a software option, a module shall be usable to enable a second media channel of an IP camera. Different image resolutions can be transmitted in parallel in two outgoing video streams.

m. As a software option, a module for connecting ERP systems and databases such as SAP, Microsoft Dynamics NAV and many others should be available via the standardized OData interface (Open Data Protocol). During the scanning of a shipping barcode, customer name, address, shipping agent, shipping number, shipping date or also target temperature and weight of the article are assigned as search criteria for the video recording.

n. As a software option, a module for processing GPS data for mobile applications shall be available. The GPS data offered via the WINDOWS Location Services are processed for display in the image.

o. As a software option, a module shall be available for the transmission of live video streams in their original format to an appropriate receiver in the network, e.g. a monitor wall or image analysis programs. Communication (control of data transmission) between the transmitter and the receiver takes place via the Real-Time Streaming Protocol (RTSP).

p. As a software option, a module shall be available to connect third-party systems via the XML format (Extensible Markup Language). This allows information from SQL databases (Microsoft, Oracle) to be imported into the VMS database and used to control actions in the VMS.

q. As a software option, a module shall be available to connect the VMS image database via a standardized OCX/ActiveX component. The OCX component can be used for applications, macro programming, development programs and equally in different programming languages and environments. Via a standardized interface it is possible to display image data in a browser-based viewer window, to navigate in the image data (live and database) and to use the PTZ control.

r. As a software option, a module shall be available for controlling IP cameras or other network devices via CGI commands (API/CGI), which allows to control additional functions in cameras beyond the standard functions of the generic plug-in. IP camera commands can be whitelisted.

s. As a software option, a module for establishing a connection between a stationary VMS and an external, mostly mobile VMS server shall be available, which enables continuous replication of the external database. The replication shall be performed when a sufficient bandwidth is available. It resumes the replication after a connection loss. It should be possible to aggregate the databases of multiple, mobile servers to a single stationary server.

t. As a software option, a module shall be available to enable a connection for live video from an external, mostly mobile VMS server to a stationary VMS server over a limited bandwidth. It allows the live stream of a mobile system to be used at several locations.

u. As a software option, a module for enabling a Telnet Action Command Interface (TACI) for use with VMS systems shall be available. The commands are transmitted as ASCII plain text. TACI is implemented as a server on the respective system. One or more client applications can establish a TCP connection to the set TCP port of the VMS system and exchange actions.

v. As a software option, a module for connecting external Modbus I/O modules to VMS systems shall be available. It enables reading of Modbus input contacts and control of Modbus output contacts by the VMS.

w. As a software option, a module for exchanging configuration files with an Axis System Controller shall be available, with the purpose of showing all bodycams that are registered to the controller. Available bodycams can be selected to be imported as a media channel. The Axis System Controller will henceforth push all video and audio footage as an mp4 file to the VMS server as soon as the body worn device is placed in a docking station that is connected to the system controller.

x. As a software option, a module for connecting an Axis bodycam to the VMS system shall be available to transfer the recordings of this device as MP4 file to the VMS server, where it will be stored in the VMS database. The integration supports video as well as audio footage.

y. As a software option, a module shall be available that allows to use the smartphone as a mobile IP camera and to transfer and store / document video images in real time to the VMS or to trigger alarms and events with a mobile app. Video streams as well as alarms/events from the smartphone will be transferred to the VMS and processed as if they were transmitted from a regular CCTV camera.

z. As a software option, a module shall be available that complements the G-Core/SmartphoneConnect option with the possibility to scan barcodes with a smartphone and send them to the VMS. The scanned barcodes will be sent to the VMS as events to enable the later retrieval of barcode and corresponding video image.

aa. The supplier should be able to offer a standardized, license-based extension of the right to software upgrades for a further year.

2.13 Video Analytics Packages

a. The supplier shall be able to offer a standardized, license-based activation of the outdoor video analysis for one camera channel.

b. The supplier shall be able to offer a standardized, license-based activation of the advanced outdoor video analysis for one camera channel.

c. The supplier shall be able to offer a standardized, license-based activation of automatic number plate recognition for one lane.

d. The supplier shall be able to offer a standardized, license-based activation of automatic number plate recognition with multiplexing for four lanes.

e. The supplier shall be able to offer a standardized, license-based activation of automatic number plate recognition for a lane specifically for license plates from the USA, Australia and GCC countries.

f. The supplier must be able to offer a standardized, license-based activation of artificial intelligence for one camera channel.

g. The supplier must be able to offer a standardized, license-based activation of face masks verification using artificial intelligence for one camera channel.

h. The supplier must be able to offer a standardized, license-based activation of personal protective equipment detection using artificial intelligence for one camera channel.

2.14 Connections to further Manufacturer's own System Components

a. The VMS shall include a system connection to the manufacturer's own, higher-level Security Information Management Software, with the help of which any number of Video Management Systems at distributed locations can be managed as a networked overall system and operated from different workstations with overlapping rights.

b. The VMS shall have a connection to a manufacturer's own integration server which, as a communication platform (translator), interfaces various specialized third-party systems with different data protocols with the VMS.

c. The manufacturer of the VMS shall also be able to supply a monitoring software which permanently monitors all operating states of the system and recognizes critical states, such as a camera failure, database errors or operating temperature changes, and forwards them as an alarm via system message or e-mail. The software can be used for remote maintenance of the system or for planning a maintenance assignment, whereby all system parameters / system states can be viewed and evaluated remotely.

2.15 Integration of 3rd Party Systems

a. The VMS should have a licensable interface to DMT's radar system, where metadata (position and speed) of e.g. ships are assigned to the automatically switched on and recorded video images.

b. The VMS shall include a licensable interface for the mutual exchange of alarm messages and control commands with the LENEL access control system (OnGuard Management System). In addition, video images can be transmitted for display in the LENEL system.

c. The VMS shall include a licensable interface to connect the parking management system of the manufacturer Skidata. Event information controls video recording.

d. The VMS shall have a licensable interface to connect the cash register and petrol station system of the manufacturer Huth. Metadata, such as tank filling or terminal payment data, are linked to event records of complete tank operations.

e. The VMS shall have licensable interfaces to the access control systems of the manufacturers Keba Passador, Inform and Garny. Priority for combining video recordings with bank card data captured to open automatic entrance doors in financial institutions.

f. The VMS shall include a licensable interface to connect the intercom system of the manufacturer Commend. Intercoms, emergency call pillars or light barriers of the Commend system control the image switching and recording.

g. The VMS shall include a licensable interface to connect to license plate recognition systems of the manufacturers Platesmart, CarmenGo and NumberOk. Recognized license plates are checked against a whitelist and barriers can be controlled.

h. The VMS shall include a licensable interface to connect to video content analytics systems of the manufacturers Briefcam and Geutebrueck (VCA Pro). Event information controls video recording.

i. The VMS shall include a licensable interface to connect to radar systems of the manufacturers ThermalRadar and FLIR. Event information controls video recording and displaying objects on a GIS map.

j. The VMS shall include a licensable interface to connect to access control systems of the manufacturers Nedap and UnityIS. Event information controls video recording. Control commands can be sent to the systems.

k. The VMS shall include a licensable generic RESTful service interface to connect any 3rd party system that provides a configurable RESTful client. POST messages to a dedicated URL shall be accepted.

2.16 Integration of 3rd Party Systems via Integration Server

a. The VMS shall have licensable interfaces to access control systems of the manufacturers Lenel, Maxxess, Inner Range, Gallagher, Protege, DSC Digital Security Controls, ASIS and Nedap by using a manufacturer's own integration server.

b. The VMS shall have licensable interfaces to security management systems of the manufacturers AMAG and Software House by using a manufacturer's own integration server.

c. The VMS shall have licensable interfaces to video management systems of the manufacturers iOmniscient, HikVision, Dedicated Micros, Chess Dynamics and Automatic Sea Vision by using a manufacturer's own integration server.

d. The VMS shall have licensable interfaces to perimeter control systems of the manufacturers Fiber SenSys, CIAS and Southwest Microwave by using a manufacturer's own integration server.

e. The VMS shall have a licensable interface to the cash register system of the manufacturer Micros by using a manufacturer's own integration server.

f. The VMS shall have a licensable interface to the Gaming Technology System of the manufacturer International Gaming Technology by using a manufacturer's own integration server.

g. The VMS shall have a licensable interface to the visualization and control system of the manufacturer CyViz by using a manufacturer's own integration server.

h. The VMS shall have a licensable interface to the Laser Management System of the manufacturer Sick by using a manufacturer's own integration server.

i. The VMS shall have a licensable interface to the Network Communication System of the manufacturer Jacques by using a manufacturer's own integration server.

j. The VMS shall have a licensable interface to the Video Content Analysis of the manufacturer AgentVi by using a manufacturer's own integration server.

k. On the basis of its own integration server, the manufacturer of the VMS shall be able to develop custom interfaces to third-party systems and standardize them for multiple use.

2.17 Software Development Kit (SDK)

a. The manufacturer of the VMS shall be able to supply Software Developer Kits (SDK), which can be used to program interface connections to third-party systems by external developers on the basis of the open interfaces of the VMS. The SDKs should consist of native WIN32/64 DLLs with detailed documentation, programming examples and virtual devices.

b. The manufacturer should have its own SDK department that can provide detailed technical support for the external development of interfaces.