CathexisVision 2024

Product Architecture Overview

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2. Glossary of Terms

To avoid confusion, a glossary of terms has been included, where terms or acronyms may differ from industry-used standards.

1.	**AI**	Artificial Intelligence
2.	**Alarm Management Gateway**	Centralised alarm management interface, offering alarm logs and comprehensive reporting abilities for large site installations across single or multiple sites, whether local or remote.
3.	**API/SDK**	Application Programming Interface/Software Development Kit.
4.	**Archive Player/Viewer**	CathexisVision in-house/external application for playing archives created in/exported from CathexisVision.
5.	**Archiving**	Archiving is a facility to enable users to select recordings and copy them to archiving media, such as USB key, hard drive, or CD/DVD. Unlike normal recordings, archived recordings retain their authenticity, and can be verified as authentic (unaltered) on replay, making them suitable for use in courts of law. **Note**: Unlike other systems, CathexisVision does not use 'archiving' and 'recording' interchangeably.
6.	**Base station**	Principally, the station receiving recorded content from a "capture" station and/or connecting to the capture station in response to alarm stimuli.
7.	**Client**	Any CathexisVision platform which can connect to and view the server.
8.	**Carbon**	User interface, supported in CathexisVision 2022 and after.
9.	**Event Action**	An automated action that the system takes in response to a trigger.
10.	**Event Recording**	Uses storage space efficiently by recording only the event of interest.
11.	**FPS**	Frames Per Second.
12.	**GOP**	Groups of Pictures: In a motion sequence, GOPs are individual frames of pictures grouped together and played back, delineated by key frames (see below).
13.	**H.264/H.265**	Types of video compression standards.
14.	**I/O**	Input/output.
15.	**I-Frame**	Frame subsequent to a keyframe, which uses the keyframe as a reference point to determine what has changed in the picture.
16.	**JPEG**	Image compression format.
17.	**Keyframe**	A reference frame used in H.264/H.265 compression.
18.	**LPR/ANPR**	License Plate Recognition/Automatic Number Plate Recognition.
19.	**Master/Slave**	A Master server regulates the settings of other attached servers (slaves) on a site.
20.	**MJPEG**	Motion JPEG: A sequence of JPEG frames that play back as video.

21. MPEG-4	A method of defining compression of audio and visual digital data.
22. NVR	Network Video Recorder. This term is used interchangeably with Server, below.
23. Object classifiers	Identifying objects in a camera scene using AI.
24. ONVIF	Open Network Video Interface Forum.
25. P-frame	Predicted frame: holds only the changes in the image from the previous frame.
26. PoS	Point-of-sale.
27. Pre-Event Recording	A mechanism to 'go back in time' to capture recordings that happened before an event trigger was received.
28. PTZ	Pan-Tilt-Zoom (in reference to cameras with this capability).
29. Recording	Live video which has been databased in the system and made available for review.
30. Server	Refers to unit on which the CathexisVision Server software is running, and encompasses all CathexisVision Server software processes such as recording, archiving, databasing, and video analytics.
31. Sherlock	A facility by means of which a user can save the configuration and audit trails of a system onto removable media, with the purpose of supplying that data to a support desk for diagnostics.
32. Site	A geographical location that may be served by multiple VMS units.
33. TCP/UDP	Types of internet protocol (IP) traffic: Transmission Control Protocol (TCP) and User Datagram Protocol (UDP).
34. Video Wall	Monitor/s dedicated solely to displaying video feeds.
35. VMD	Video Motion Detection.
36. VMS	Video management software.

3. Introduction

This document describes the architecture of the CathexisVision 2024 system components, including associated software products and features (such as the CathexisVision Map Editor, the CathexisVision Video Wall, the CathexisVision Alarm Management Gateway, and CathexisVision Carbon).

Illustrations and descriptions will provide detail about the architecture of each of these components (including associated software products), and will explain the dataflow between each of these components.

This document will refer to the architecture of the **CathexisVision Premium Software Package** (and associated software products), which utilises all available system components.

(**Note**: Other CathexisVision software packages have restricted access to one or more of these system components, but users can unlock them by purchasing licenses or upgrade packages.)

3.1 Target Audience

This document is targeted at anyone looking to select, deploy, maintain, and/or expand their VMS, and particularly at engineers, system integrators and IT personnel who require better understanding of the structure and function of the CathexisVision VMS.

The reader of this document is assumed to have general/basic experience with IT networks and installations.

3.2 Document Purpose

The purpose of this document is to provide the user with insight on the architecture and functioning of the CathexisVision software and associated hardware, as well as to highlight the simplicity and benefits of use of the CathexisVision system.

This document will provide a description and illustration of the overall system architecture, as well as a description and illustration of the primary system components.

4. CathexisVision at a Glance

The CathexisVision software suite provides an extensive range of sophisticated solutions to satisfy all security and infrastructure management requirements across a wide variety of market sectors. These include retail, banking, hospitality, mining, education campuses, residential and commercial estates, manufacturing, healthcare, transport, logistics, city monitoring and many more.

Installation of any CathexisVision software is simple. It requires only one installation file for the server, and one for the client.

CathexisVision works on a licensing basis: the whole package is installed, and features are unlocked using licenses. The sections below indicate some of the major features/abilities of CathexisVision.

4.1 Main Features

- Open architecture Video Management platform.
- Advanced video analytics.
- Automatic Number Plate Recognition (ANPR).
- 3rd-party system integration.
- Sophisticated command centre environment.
- Advanced video search.
- Multi-language GUI support.

4.2 Architecture

- Enterprise, Multi-Site Architecture.
- Standard storage and configuration of your choice, like SATA, SAS, SSD, DAS, SAN, NAS, iSCSI, etc.
- Standard network equipment with configuration and layout of your choice including support for VLAN, VPN, etc.
- Support for port customisation and forwarding to support routed networks and firewalls.
- Dedicated hot-standby failover recording servers.

4.3 Operating Systems

Supported operating systems apply to all contents of CathexisVision software installation, including:

1. CathexisVision software
2. Map Editor
3. Archive Viewer

The table below shows the supported operating systems for major CathexisVision releases.

● **Supported**   - **Not supported**

CathexisVision	2016	2017	2018	2019	2020	2021	2022	2023	2024
Netbsd 4	●	-	-	-	-	-	-	-	-
Fedora 16	●	●	●	-	-	-	-	-	-
Ubuntu 12	●	●	●	●	●	-	-	-	-
Ubuntu 16*	●	●	●	●	●	●	●	●	●
Ubuntu 20	-	-	-	-	-	●	●	●	●
Windows XP	●	-	-	-	-	-	-	-	-
Windows Vista	●	●	-	-	-	-	-	-	-
Windows 7	●	●	●	●	●	●	-	-	-
Windows 8	●	●	●	●	●	●	-	-	-
Windows 10**	●	●	●	●	●	●	●	●	●
Windows 11	-	-	-	-	-	●	●	●	●
Windows Server 2008 R2	●	●	●	●	●	●	-	-	-
Windows Server 2012	●	●	●	●	●	●	●	-	-
Windows Server 2012 R2	●	●	●	●	●	●	●	●	-
Windows Server 2016	●	●	●	●	●	●	●	●	●
Windows Server 2019	-	-	-	●	●	●	●	●	●
Windows Server 2022	-	-	-	-	-	-	●	●	●
Windows 32-bit	●	●	●	●	●	●	-	-	-

*   The CathexisVision 2024 release is server installation only - there is no UI/Client support. As such the CathexisVision UI software and Videowall UI (which run on the Ubuntu 16 server) will no longer be available. CathexisVision 2024 is the last release to support Ubuntu 16.

** Version 1809 or later

4.4 Licensing

The CathexisVision site-based licensing system and process make it easy for users to accurately predict the license requirements for their system, even if the hardware has not been finalised.

Four base software products:

- o CathexisVision Lite.
- o CathexisVision Core.
- o CathexisVision Professional.
- o CathexisVision Premium.

Features easily added on and unlocked by application of relevant licenses, e.g.:

- o Integrated devices (for example, access control, fire/intrusion panels, point-of-sale, fence management systems, etc.)
- o Site maps,
- o Video Wall,
- o Failover,
- o Alarm Management Gateway,
- o Video analytics.

Per-site licensing model for site-wide features:

- o Single "base" license required for each site, no matter how many hardware servers are installed and connected.
- o Single failover "base" license required per site (failover camera licenses still required).
- o Single Video Wall license required per site, no matter the number of Video Wall servers or monitors.
- o Single (optional) Alarm Management Gateway server license required per site (client license required per client connecting to gateway).
- o Site "base" licenses do not require additional maintenance/upgrade licenses to be upgraded.

Easy camera licensing:

- o Single IP camera license required for a single camera, regardless of camera being multi-sensor or having multiple channels, provided the camera has only a single IP Address and is registered in the software. (**Note**: The CathexisVision software packages have limits on camera channels.)
- o Easy maintenance/upgrade licensing: Application of a single camera maintenance license upgrades camera one year, two licenses upgrade two years, etc.

4.5 Hardware Requirements

The **CathexisVision** software architecture is designed to use the various hardware system components with maximum efficiency. When choosing hardware, there are many system issues to consider. Some examples are:

- Camera resolution
- **Camera bitrates** for recording
- **Camera Frame rates** and resolution for "live" viewing
- **Video Analytics**: is the IP camera or the CathexisVision software being used to perform video analytics?
- Are cameras being viewed "**live**" from the same server on which recording is done?
- Are "**multicast**" video streams being streamed from the camera?
- **Storage** methodology (on-board, Network Storage etc.)

4.5.1 Hardware Selection Guidelines

The table below provides guidelines to assist in choosing hardware for the application. The figures in the table were generated using the CathexisVision Design Tool (see **System Design Tools**).

Note: the following parameters were used to determine these guidelines:

1. These are conservative figures for recording servers only.
2. Live viewing not included in these numbers.
3. 3MP cameras with 3MP/24fps recording stream.
4. CIF/12fps analytics stream running Smart VMD.
5. External storage on a 1/10 Gbps network.

Note: These guidelines are not exhaustive. For assistance with design, contact the distributor or a **Cathexis** regional office. Alternatively, navigate to cathexisvideo.com and use the online Design Tool.

Processor	RAM (GB)	Server Storage throughput Mbps	No. of 3MP cameras per server
i7-7700k 4.20GHz	16	600	152
Xeon E3-1290 V2 3.70GHz	16	500	122
Xeon E5-1680 V4 3.40GHz	32	700	187
Xeon E5-2640 V2 2.40GHz	32	650	164
Xeon E5-2695 V3 2.30GHz	32	900	223
Xeon E5-2699 V3 2.30GHZ	32	1000	253

4.5.2 Minimum Primary Drive Size

Note: The minimum primary drive size for a CathexisVision server is 256GB. The **recommended** minimum size is 512GB.

4.6 Routing/Port Requirements

The following information regards the router ports that need to be opened on the network firewall/router/anti-virus. These ports are important in allowing several **Cathexis** services to run correctly. Please ensure that these ports are also opened on the anti-virus (if installed).

4.6.1 Ports to Open

Operational Ports	Protocol	Application	Description
30010-30100	TCP	CathexisVision Software, CathexisVision Carbon, and CathexisVision Mobile software.	Required ports for access to the CathexisVision software and associated configuration, live and recorded view, etc.
30014	TCP	API (CathexisVision 2016 and previous versions) *	Required port to allow API connection to server when using software versions CathexisVision 2016 and previous. **Note**: Video also needs to be streamed from the server using TCP port 30010.
33104	TCP	API (CathexisVision 2017 and later versions) *	Required port to allow API connection to server when using software versions CathexisVision 2017 and later. **Note**: Video also needs to be streamed from the server using RTSP on TCP port 554.

* For full list of API ports, please consult API help guide or contact support@cathexisvideo.com

Maintenance Ports	Protocol	Application	Description
22	TCP	Secure Shell (SSH) - Linux	Port required to enable remote access to Linux server using Secure Shell network protocol.
3389	TCP	Remote Desktop – Windows	Port required to enable remote access to Windows server using Remote Desktop application.
NA	NA	TeamViewer Access	Application for allowing remote access to a Windows server. No port required.

4.6.2 Remote Support

Please download and install one of the following programs relevant to your operating system to ensure remote support is available (see port requirements above).

Linux: Secure Shell (SSH - TCP port 22).
Windows: TeamViewer, or Remote Desktop.

4.7 Installation and Upgrade

The architecture of CathexisVision software provides clients with the flexibility to upgrade and expand their system or add features whenever necessary. If the number of cameras or recording servers needs to increase, or new features need to be unlocked, the CathexisVision solution is easily upgradeable to meet the new requirements.

- Installation of any CathexisVision software requires only one installation file for the server, and one for the client.
- CathexisVision software suites can be easily updated and upgraded by applying the updated software installation file; the software will update itself and all settings are retained. The software does not have to be uninstalled. A software license is not required for an update, only an upgrade.
- CathexisVision software features may be easily unlocked through the application of the relevant license file to the system.
- The CathexisVision drivers for 3rd party devices and cameras are automatically updated when the software is updated.
- When updating to a later version of the CathexisVision Software, e.g. CV2022 to CV2023, a Camera Version Migration license will be required for each site camera.

4.8 Management and Administration

- Complete remote setup and maintenance client; no need for remote desktop applications for remote connection.
- System access by user name and password; all user actions are recorded against the username in an operator audit trail.
- Integrates with standard Active Directory and OpenLDAP using LDAP communication.
- User access to site resources (e.g., view live/review footage, control PTZ cameras, etc.) and/or system configuration (e.g. video analytics setup, user creation, database control) is strictly controlled by administrative users.
- Bookmarking allows users to save camera layouts in live/review on client systems for resources to which they have been given access rights. Bookmarks can be exported as archives.
- Reference image management system to capture sets of reference images for server's cameras and compare to previous reference images or current orientation. Comparisons can be reviewed and exported.

4.9 Cybersecurity and System Health

- All external site connections support various levels of encryption.

- Secure communication between CathexisVision components (e.g., server to server, server to client, server to Video Wall, server to Alarm Management Gateway) ensured by the following measures:

  o Encryption engine uses openssl (SHA512 hashes, ephemeral DH-RSA with forward secrecy [DH 2048 bit] and AES-GCM 128-bit symmetric ciphers) equivalent to TLS 1.3.

  o Passwords are never stored as plain text, instead are hashtagged using SHA512.

  o Login credentials are negotiated using RSA1024 and sensitive communication channels are encrypted using AES128/CBC, and HMAC is used for integrity verification.

  o Public key infrastructure (PKI) is managed internally by the VMS for added security.

- Security and integrity of recorded video ensured by the following measures:

  o Dual RSA1024 keys (for signing) are used to secure integrity of video being exported/archived.

  o Optional encryption uses AES128 block encryption with a randomised IV per block and user generated passphrase.

  o Video can be watermarked to indicate source of the information (i.e., user info).

  o Video footage and metadata restricted to playback via the VMS's proprietary video player.

  o Exported/archived video can have the option to restrict playback only under password control.

- Secure peripheral equipment and IP camera connection ensured by the following means:

  o Secure camera connection ensured using:

    ▪ HTTP (hyper transfer protocol),

    ▪ HTTPS encrypted control connections (where supported by manufacturer),

    ▪ Encrypted SSL/TLS, and

    ▪ Supported by CURL (client-side URL transfer library).

  o Secure camera control ensured using:

    ▪ RTS (real time streaming protocol),

    ▪ HTTPS encrypted control (where supported by manufacturer).

  o Secure video streaming:

    ▪ RTP (real time transport control),

    ▪ Encrypted video (where supported by the manufacturer).

- Generate technical alarms and reports on hardware and software conditions; alarms present notifications and reports may be emailed, printed, and archived on once-off or on scheduled basis.

- Ability to audit sites and servers, providing an historical log of all user-based actions.

- Forensic tool offers site analysis and troubleshooting to obtain site data which can be presented in graphical format and exported.

4.10 Supported Virtualisation Technology

CathexisVision can run in all major virtualisation technologies (e.g. VMWare, VBox) which support either Windows or Linux operating systems.

From software version 2018, CathexisVision is aware of running in a virtual environment/machine and has knowledge of the underlying hardware.

4.11 Multi-Language Support

The CathexisVision GUI supports the following languages (from CathexisVision 2023.2):

- Croatian,
- English,
- French,
- German,
- Hungarian,
- Italian,
- Polish,
- Portuguese,
- Russian,
- Spanish,
- Ukrainian.

5. CathexisVision System Architecture Overview

A CathexisVision site is a collection of one or more individual servers which are consolidated in the software as an individual site. Multiple sites may be created and managed from a central location.

The CathexisVision system comprises two core components: The **server** and the **client.** They have identical interfaces. The difference is that the server runs the core system management and recording processes and the client does not. The server can act as a 'client' by connecting remotely or locally to other sites and servers.

Server software	CathexisVision server software can be installed on a suitably specified hardware server platform for an advanced and comprehensive site video configuration and management system.
Client software	CathexisVision client software gives the ability to connect remotely from a Windows OS PC into a CathexisVision server as a client station, without the need for a full server installation. Client software's access to the server is dependent on the login credentials as configured on the server. This can be from administrator level with full site configuration rights, down to operator level, with restricted access to site resources.

Other peripheral products, such as the Video Wall and the Alarm Management Gateway, can be used alongside the server and client software to enhance the video surveillance management experience. Some of these come ready-to-use with the software, while others need to be activated.

Note: The server and client software cannot be installed on the same unit.

5.1 Site-Based Architecture

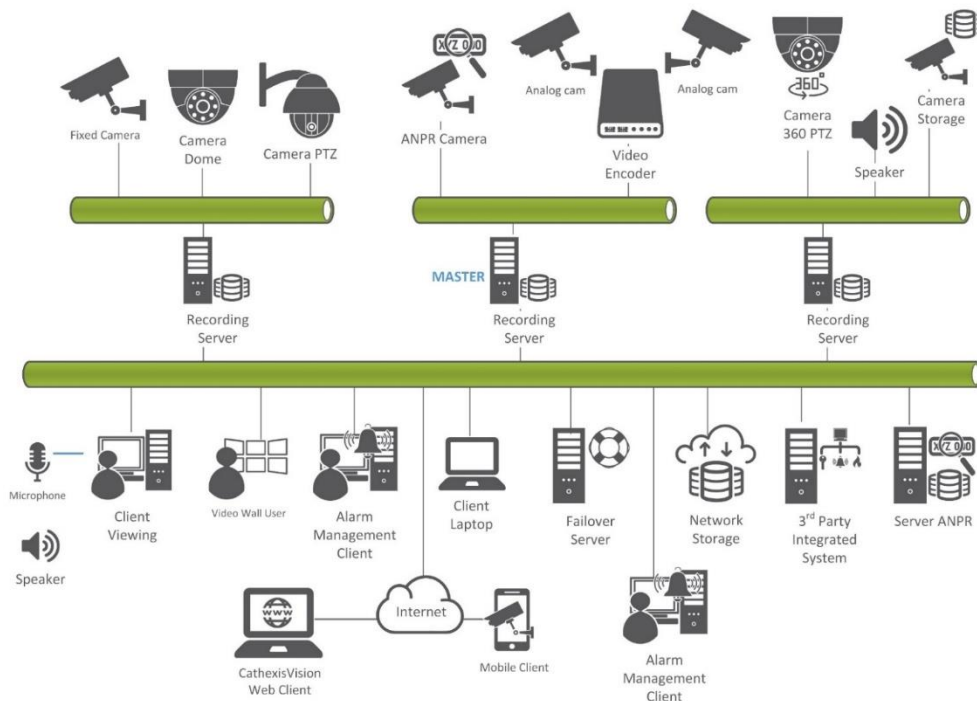The components shown in Figure 1 depict a typical 'site'-based environment and are described below.

Figure 1: Site-based architecture

5.1.1 Cameras and Encoders

CathexisVision is integrated with most popular camera brands and video encoders. Features include (camera-dependent):

- JPEG, H.264, H.265, MxPEG integration,
- Audio support,
- I/O support,
- PTZ support with "zoom to area" feature,
- Plug-and-play (UPnP) interface),
- Covert option,
- De-warping support,
- Fixed or variable bitrates,
- Edge recording and review support,
- Edge Video Analytics support,
- Encrypted connection support,
- ANPR camera support.

There is no software limit to the number of cameras that can be supported on a single server. However, camera video stream bitrates, resolution and other factors need to be taken into account when selecting the server hardware.

5.1.2 Recording Servers

The **recording server** is the central VMS component. It is responsible for running all video management processes, such as receiving and recording video from site cameras, live and review video display and running video analytics and 3rd party systems. The server software can also connect to multiple remote sites and servers.

Note: Any server running the CathexisVision server software can be allocated to assume the role of the "Master" server, which acts as a site management server. This effectively means that there is no requirement for an additional management server hardware on site.

The recording servers are either physical or "virtual" hardware platforms. They perform and manage the major functions of the VMS, including:

- Writing encoded video streams to either one or more storage databases at the selected framerates and resolutions. Databases can reside on the recording servers or on a network storage system.
- Routing video to client viewing servers and/or video walls for live viewing.
- Decoding streams to perform video analytics and ANPR.
- Managing the delivery of video streams for reviewing recorded footage.
- Managing the "events" and "action" management.
- Integration with 3rd Party systems.
- Server and site access rights.
- Technical alarms.

If more than one server is used on a site, one of the servers can be designated as the "Master Server". This Master assumes the role of the "Site Management Server" and removes the need for a separate management server to be added on the site. Any server can assume the role of the Master, and if a Master fails, it can be "failed-over" via CathexisVision's failover function (see sections 5.1.5 and 6.8).

The CathexisVision software is hardware-agnostic and, as such, the hardware used for the recording servers is very flexible. The main determining factors for server hardware specifications are:

- camera recording bitrate throughput (CPU & RAM),
- on-board storage requirements, if any (hard drives),
- Video analytics algorithms (CPU/GPU).

Cathexis provides a system design tool that will assist with recording server hardware design. See section 9 for further details.

In general, the CathexisVision software is very efficient, with more than 600Mbps throughput achieved on a standard i7 server with 8GB RAM. On some hardware, up to 5000Mbps throughput to NAS storage devices has been achieved.

5.1.3 Client Servers and Users

The **Client** software connects locally/remotely to the server in order to view/access server resources. When connected to a server, the Client software can assume all functions and abilities of the server software (provided the user has the correct permissions). Site management is thus not limited to the local server but can be done via remote client connection.

The CathexisVision client software functions include, but are not limited to, the following:

- Complete site and recording server setup and management,
- Live viewing of cameras,
- Viewing site maps,
- Controlling of camera layouts,
- Reviewing of recorded footage from one or more servers and/or databases,
- Connection to the Alarm Management gateway (see sections 5.1.7, 5.2.2. and 6.7) and viewing of alarms,
- Managing and controlling the Video Wall (see sections 5.1.4, 5.2.3 and 8.1).

This software can be run on any system with a compatible Windows or Linux operating system (see section 4.2). The hardware requirements for the Client systems are determined by the number of cameras and the resolutions frame rates of those cameras, as well as the number of monitors connected to the systems. (See section 4.5 for hardware considerations.)

5.1.4 Video Wall

The video wall acts as a "virtual matrix". The user interface provides a MIMIC panel, which enables multiple monitor control from a single point to:

- Switch cameras from one or more recording servers to one or more video monitors
- Control layouts on the selected monitors
- Run scheduled tours (sequences) of cameras and/or camera layouts
- Automatically switch cameras to selected monitors or monitor panels upon and event or alarm
- Drag cameras from the GUI or from a map into selected monitor panels

5.1.5 Failover Servers

The Cathexis failover uses a "hot" standby model, in which the functions of any recording server or NVR (including the "master") on a site that fails can be inherited by a failover server. These functions include all recording and "client" server functions such as Video Wall control, client access rights, events, alarms, and video analytics configuration.

Multiple failover servers can be applied to site for additional redundancy. All the failover servers on the site keep a continuous log of all the configurations of all the recording servers/NVRs on the site.

"Fail-back" occurs when the failed over server/NVR is replaced. When this occurs, the video footage and related items, like audio, are automatically written (trickled) back to the original database.

5.1.6 Network Storage

The CathexisVision software is compatible with most commonly used network storage platforms (e.g. Dell, EMC, Pivot3, Fibrenetix, Intransa, Infortrend, Netgear, Huwawei, Promise, Seagate etc.). Supported technologies include SATA, SAS, SSD, DAS, SAN, NAS, iSCSI, and FTP. For more info on database management, see section 6.4.

5.1.7 Alarm Management Gateway

While the Alarm Management Gateway is really a software application and database, it is depicted here as a separate server. This product manages alarms from multiple servers on sites and can also be used at a central location to manage alarms from and connections to multiple sites.

See section 6.7 for more detail on the functionality of this product.

5.1.8 Alarm Management Client

Any viewing client can perform the role of the Alarm Gateway Client if the Alarm Client License is enabled. This will enable any user connecting to the Alarm Management Gateway to view and manage the alarms on the database. See section 6.7 for more detail.

5.1.9 Mobile Client

The mobile client application can run on any iOS or Android platform. See section 7.3.

5.1.10 Third-party Integrated Systems

In the diagram in section 5.1, third-party integrated systems are depicted as a server connected to the network. In reality, third-party systems can be completed by many different forms of communication, including USB, RS232, TCP, UDP, BACNet, etc.

The basic concept of third-party systems integration is to enable the system to receive transaction information from devices like Intrusion panels, Fire Panels, Access control, Fence monitoring systems, Weighbridges, Point-Of-Sale systems, and others to facilitate:

- Recording of transactions information to a database,

- Overlaying live transactions information on the video,

- Association of one of more cameras with the specific point (e.g. Access control door),

- Enabling the "mining" of the database to enable the user to find transactions and the associated video and play them back and/or archive (export) them,

- Create system events triggered on 3rd party system transactions,

- Initiate "actions" on 3rd party transaction events, for example:

  o Play a pre-determined alarm or custom message in the control room or on the "edge",
  o Switch selected cameras or layouts to selected monitors,
  o Control relay outputs,
  o Send email with event video/snapshot or SMS,
  o Send an alarm to an Alarm Management Gateway (local or remote) or to a local or remote client,
  o Move a PTZ camera to a preset position.

5.2 Multi-site Architecture (in CathexisVision)

The CathexisVision software provides a true "enterprise" based, multi-site centralised management capability. This enables organisations to manage multiple sites from a central location and provides off-site-monitoring and management capability.

The capabilities are summarised below.

- Viewing of one or more cameras from one or more sites simultaneously on separate monitors/tabs
- Reviewing (playback) of cameras from one or more sites simultaneously on separate monitors/tabs
- Archiving (exporting) of video footage to selected, central location
- Receiving and managing user defined alarms or notifications form multiple sites
- Receiving and managing technical alarms or notifications form multiple sites
- Setup and configuration of functionality and hardware (cameras, alerts, databases)
- Set up on-site video analytics
- Mapping interface
- Video wall functions

The components of the multi-site infrastructure are shown in the diagram below and described in the following paragraphs. Some of the components are identical in nature to the single site infrastructure but are applied across multiple sites.
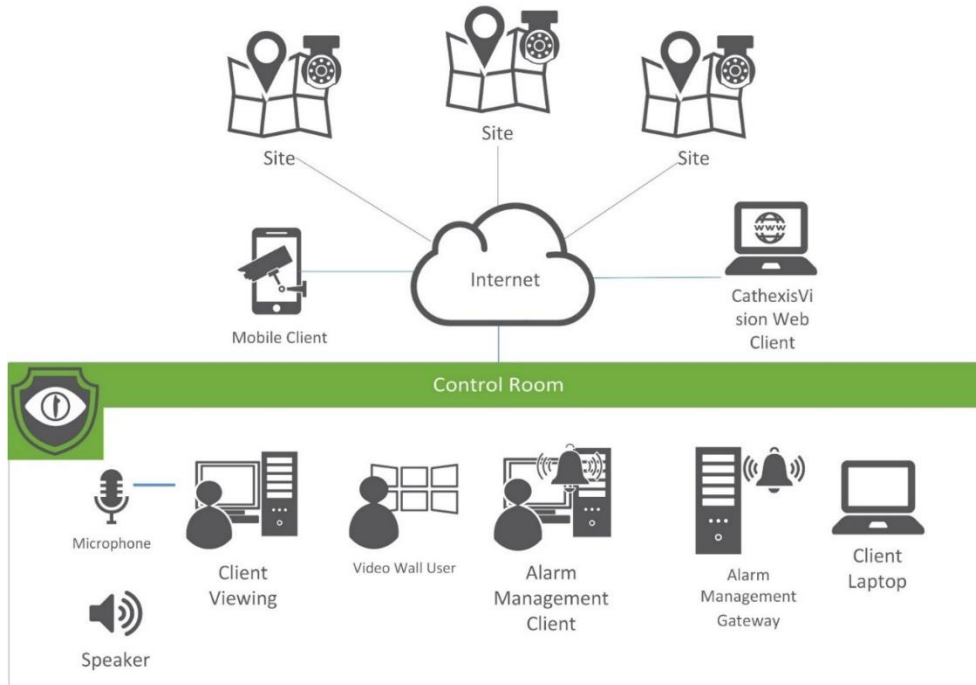

Figure 2: Multi-site based architecture

5.2.1 Client Servers and Users

The CathexisVision client software will provide an interface to enable the user to:

- Easily add/manage multiple sites,
- Easily connect to one or more sites,
  Note: The Carbon client interface does not have the ability to configure the site. See the **Carbon Manual** for more information.
- View live camera feeds from one or more cameras from one or more sites simultaneously,
- Change the camera feed to achieve the best effectiveness according to the bandwidth available,
- Review recording footage from one or more cameras,
- Archive (export) video footage from a site to a local database or writable device,
- Automatically view maps of any site to which it connects,
- Perform ALL the functions of the on-site client server,
- Control the video wall in the centralised control room,
- Connect to the Alarm Management Gateway to enable the user to perform all Alarm Management Gateway functions.

5.2.2 Alarm Management Gateway

The Alarm Management Gateway is used as both a site connection gateway and alarm manager. See section 6.7 for functionality of this product.

5.2.3 Video Wall

The Video wall in a centralised, multi-site scenario performs much the same role as the on-site. The user interface provides a MIMIC panel, which enables multiple monitor control from a single point to:

- Switch cameras from one or more sites to multiple monitors
- Control layouts of single or multiple sites individually on the selected monitors
- Run scheduled tours (sequences) of cameras and/or camera layouts
- Automatically Switch cameras to selected monitors or monitor panels upon and event or alarm
- Drag cameras form the GUI or from a map into selected monitor panels

5.3 CathexisVision MultiSite and CathexisVision Enterprise Architecture

The components of the CathexisVision Multisite and CathexisVision Enterprise infrastructure are shown in the diagram below.
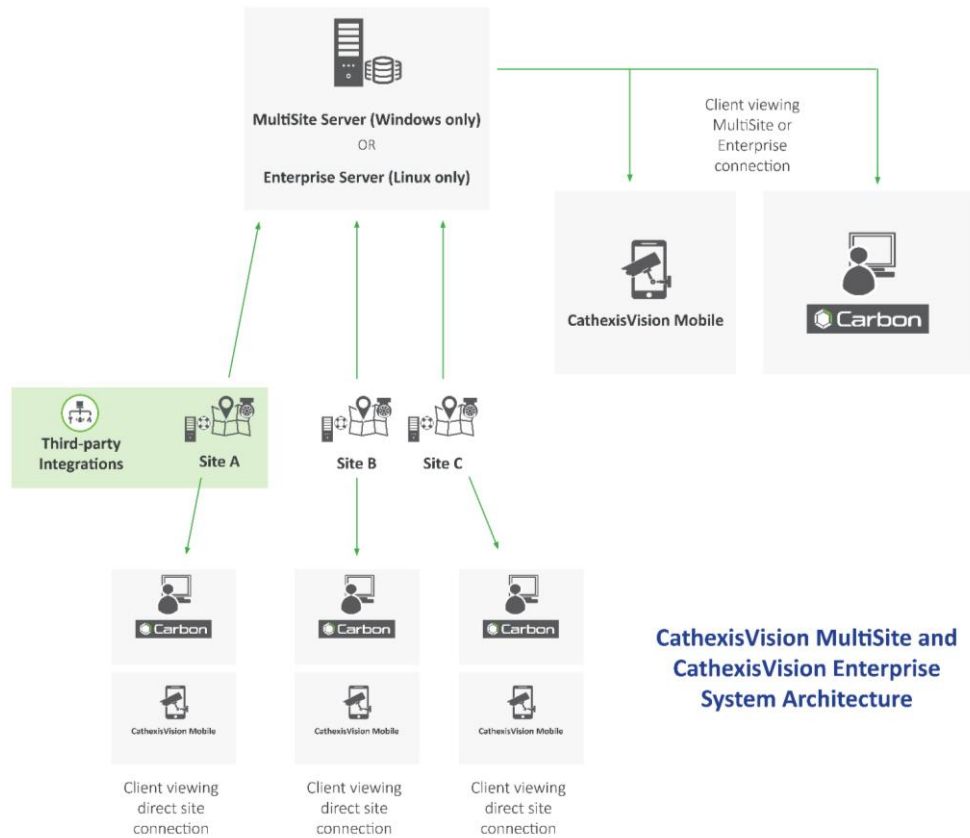

Figure 3: CathexisVision MultiSite and CathexisVision Enterprise architecture

5.3.1 MultiSite Server or Enterprise Server

This is the server on which CathexisVision MultiSite or CathexisVision Enterprise is installed.
Note on operating systems: MultiSite runs on Windows only, and Enterprise runs on Linux only.

5.3.2 Client Servers and Users

The Carbon client software enables the user to access:

- A single site (a single CathexisVision site installation)
- Multiple sites (a CathexisVision MultiSite installation)
- Multiple sites (a CathexisVision Enterprise installation)

6. Server Components and Processes

This section deals with the CathexisVision system components and processes which are run by the CathexisVision Server. Unlike other systems, the CathexisVision system does not require multiple types of distributed software in order to run its processes. Only the CathexisVision Server software is required as it handles all necessary processes (like recording and events logs).

However, depending on the size and makeup of the site, multiple units running the CathexisVision Server software may be required. This can be determined by consulting either a Cathexis representative, Cathexis Support (support@cathexisvideo.com) or the CathexisVision Design Tool (found online at www.cathexisvideo.com).

6.1 System Configuration and Management

The CathexisVision Server handles the configuration and management of the system. From the server software, an administrator may add and remove units from sites, and configure and manage both the individual servers comprising a site, as well as the entire site itself. System administrators may perform the following management tasks from within the CathexisVision server software:

6.1.1 General Site Configurations

- Configure network speed, default access levels, and emergency site contacts.
- Configure site users, including configuring login levels, passwords, and permissions (such as permission for remote access and permission to change own passwords).
- Configure Site Resources, including control which resources are visible to operators, and organise resources into manageable folders, etc.
- Configure Site Actions, which are applied to the entire site and can be configured to run during set schedules and can be set to be triggered by a system event.
- Configure reports to be drawn on the state of the hardware and software resources of the site. Reports can be run on a schedule.

6.1.2 Configure Site Servers

CathexisVision server allows administrators to configure and manage any server connected to the site, from any server/client software (as long as the user has administrative rights). Server-specific configurations possible from within any CathexisVision server software include:

- General Server Setup, for example: setting server names, configure backups, configure user recordings, enabling CathexisVision Mobile app client connections to specific units, etc.
- Configure/manage Cameras, for example:
  - Add, edit and disable/remove cameras.
  - Configure cameras and camera feeds:
    - Enable feeds for live/recording/analytics,
    - Set recording channel,
    - I/O setup,

- PTZ configuration (if applicable),
- Configuring camera recording schedules,
- Preliminary event setup,
- Set user level-based rights to access the camera,
- Configure privacy zones on camera to obscure sensitive data, etc.

- Configuring/manage Video Analytics on cameras and devices,
- Configure/manage
  - Alarm Management Gateway,
  - databases and manage storage,
  - scheduled recordings and archives,
  - system events and technical alarms,
  - Video Wall monitors,
  - user-level access rights to site resources,
  - third-party integrated devices,
  - virtual inputs, network I/O's, specified hardware.

6.2 Recording

The server is responsible for recording management and handles on and off-site client viewing and management stations, as well as all processes related to devices such as cameras, video/audio encoders, etc. The system may be expanded with the addition of multiple recording management servers and is capable of managing multiple IP camera video streams, limited only by hardware processing capability and availability of local/remote storage.

Depending on the camera capabilities, CathexisVision allows recording frame rates of more than 30 frames per second.

CathexisVision allows four types of camera recording:

- **User-initiated recordings**, in which users with the correct access rights may manually trigger a recording.
- **Event Recording**, in which events may be configured to trigger a recording.
- **Scheduled recording**, in which camera are set to record on a fixed schedule.
- **Continuous recording**, in which devices (such as integrated devices and cameras) are continuously recorded and create time markers in the recording.

6.2.1 Device Drivers

Recording video from the devices to the server is facilitated by device drivers. CathexisVision provides ONVIF and proprietary camera integration drivers as well as proprietary third-party integration drivers which interface between the devices (such as cameras, video/audio encoders, I/O modules, etc.) and the CathexisVision server software.

6.3 Archiving

Archiving is a facility to enable users to select recordings and copy them to archiving media, such as USB key, hard drive, or CD/DVD. CathexisVision exports audio and video in a proprietary video format, with an optional player (the CathexisVision Archive Player), from which archives can be exported in MP4 Media or archive format.

Some of the CathexisVision archiving features include:

- Archiving multiple cameras simultaneously.
- Archiving and viewing files containing non-ASCII characters (e.g. Arabic).
- Retaining all video metadata present at the time of archive (e.g., overlays, privacy zones, etc.).
- Scheduling archives to archive only selected cameras, only a selected period of recorded footage, and/or to perform archives at selected times of days.

Archives are secured during export, and can be verified as authentic (unaltered), making them suitable for use in courts of law. Some security features of the CathexisVision archiving system include:

- The ability to perform archives is controlled by access rights.
- Users can be assigned an archiving profile by administrators which restricts access
- Archives can be "watermarked" and locked with user or system assigned passwords.
- For prosecution and other legal purposes, archived images shall be digitally signed with the unique identifier of the original archiving server that is lost if an attempt is made to manipulate the image.
- A verification report on archives can be provided.
- Archives that are exported to MP4 Media format will not retain the original server signature, and their authenticity cannot be verified by CathexisVision.

6.4 Storage and Database

This section outlines the storage and database components of the server, including the general video database as well as the integrated devices database, the system events database and the ANPR integration database.

6.4.1 Storage

CathexisVision allows creation and management of multiple databases which can span multiple local or Network Storage Systems (NAS) devices. Support for SAN storage systems is also included, as well as on-server storage with various RAID configurations.

Windows network shares may be accessed from within the software itself, and existing databases may be expanded by adding more storage space.

6.4.2 Video Database

CathexisVision allows multiple databases to be configured, and multiple cameras and/or camera groups to be directed to one or more databases. Access to all databases from within CathexisVision is quick and

easy, and access to view database entries is restricted according to user access rights. Some additional features of the CathexisVision database system include:

- A proprietary video database system which is not reliant on third-party database engines (such as PostgreSQL and MySQL).
- Databases may be split across multiple disks and/or network storage devices.
- Camera footage can be stored to multiple databases and multiple servers simultaneously in order to ensure maximum redundancy.
- Databases may be imported, as well as exported and moved from one server to another.
- CathexisVision databases allow for variable disk sizes and distribution of write load across multiple disks.
- CathexisVision will continue writing to database even if one/multiple disks fail in multiple disk systems.

6.4.3 Integrated Devices Database

Dedicated metadatabases may be created for each integration in CathexisVision. Among other things, these databases include:

- An integrated video player.
- Ability to link integrated device metadata with video pulled from associated cameras; and ability to export metadatabase entries in PDF and CSV file format.

6.4.4 System Events Database

CathexisVision allows the creation of a dedicated system events database to which, once created, all system events are directed automatically. The benefit of this database is that it pulls all system events into one place for quick and easy event searching and does not require manual creation of event actions in order to record events to this database.

6.4.5 ANPR Integration Database

CathexisVision is capable of creating a designated ANPR database which allows easy viewing, sorting, and filtering of ANPR data by various ANPR-specific conditions, including:

- Plate details including number/license plate group, place of issue (region specific), background colour/text colour/shape of license plate, position of license plate on car.
- ANPR detectors.
- Confidence rating.
- Vehicle type/make/model/colour (where available on the device)
- Driver/company name/details.

6.5 Video Analytics

CathexisVision utilises in-house analytics and algorithms, as well as on-board analytics on the I.P camera/encoder/device, which can be configured on live and recorded footage and can be used as event triggers. CathexisVision is also capable of integrating with third-party analytics suites. Video analytics include:

- Motion detection,
- Line crossing,
- Object counting,
- Head counting/people counting (standard/3D camera),
- Camera tamper detection,
- Activity Trails (shows recent motion using colour trails),
- Motion Area Search (search parts of the image for recent motion),
- Adjacent Camera Mapping,
- Recent motion heatmapping (heatmap overlay of recent motion),
- Snap search (search database recordings for frames similar to the current image),
- Automatic Number Plate Recognition (see more in ANPR section).
- Object Classification and human pose estimation

Note: The system shall restrict access to analytics configuration to administrators only.

6.6 Automatic Number Plate Recognition (ANPR)

CathexisVision provides automatic number plate recognition (ANPR) as an optional in-house feature, unlocked by license, as well as integrating with third-party ANPR analytics suites and third-party ANPR cameras, both of which send triggers to CathexisVision.

A designated database can be created for ANPR. Please see the **Storage and Database** section.

6.6.1 CathexisVision ANPR Features

Some features of the in-house CathexisVision ANPR include:

- License plate data overlaid on live and recorded video streams.
- Multiple libraries of languages and license plate characters, including Arabic.
- License plate detection using triggered solutions (which uses physical trigger such as a ground loop, IR beam or VMD solution), or a Free Flow solution, which detects license plates on moving vehicles.
- Configuration of various ANPR rules, including:
  - Grouping license plates into specific categories, such as Visitors, Staff, Whitelist, Blacklist etc.
  - Setting traffic analysis rules to generate system messages when defined traffic patterns are detected, such as a vehicle visiting certain locations multiple times within a defined time period.
- Import/export ANPR data in CSV file format.

6.6.2 ANPR Events and Alarms

CathexisVision allows ANPR events to trigger CathexisVision system events, which can then be configured to generate system alarms. Some features of CathexisVision ANPR system events:

- Trigger events using specific license plate and license plate group data.
- Events triggered using license plate data may then initiate event actions, such as controlling I/O devices (e.g., open access control door).
- Generate ANPR event reports which can be exported in CSV/PDF file format.

CathexisVision ANPR system events which can be configured to generate system alarms include:

- ANPR event data appears on a data blacklist.
- ANPR event data for the same vehicle being recorded multiple times within a specified time period.
- ANPR event data for the same vehicle being recorded multiple times within multiple zones within a specified time period.
- ANPR event data for the same vehicle being recorded exceeding an average speed (configurable) between 2 ANPR detectors.

6.7 Alarm Management Gateway

The CathexisVision Alarm Management Gateway (AMG) provides a centralised alarm management interface with complete alarm logs and comprehensive reporting abilities for large installations across single or multiple sites, whether local or remote. Instead of having to watch potentially hundreds or even thousands of hours of video feeds looking for specific event footage, the AMG allows the operator to quickly and efficiently respond to defined events in real time. AMG events/alarms can be user-defined site events, technical alarms, or a breakdown in communication between the AMG and the site it is managing. Some features of the AMG:

- A "connection" gateway to connect to multiple sites from one or multiple client users.
- Receives and queues alarms/events from multiple sites:
  - o Manages incoming and historical alarm queues and their levels/priorities.
- Facilitates an "auto" connection to the sites upon alarm "handling" to:
  - o Automatically open relevant site maps
  - o Automatically switch to the relevant cameras associated with the alarm/event
  - o Automatically show a low resolution "thumbnail video" of the associated camera
- AMG can be configured to attach video to the alarm or automatically archive a snapshot of the event.
- Administrators can create alarm procedures which dictate how operators should handle certain alarms.
- A case manager allows one or multiple alarms to be added to a case file to improve event management and organisation and ensure alarms are escalated to the correct people.
- Providing a forensic tool for alarm history management and reporting.
- Because the AMG is a high-security orientated feature, the AMG itself can also be audited in order to view behaviour and actions taken by specific users within the AMG.

Note:

1. The AMG is not a separate software product, but an add-on function of the CathexisVision VMS that is unlocked via license.
2. AMG database can only be configured on a server, but any client or server can connect to the gateway.

6.8 Failover

For high security and mission-critical applications where server downtime is not an option, CathexisVision offers the ability to failover any server. Failover is an additional feature option contained within the CathexisVision server software but unlocked via a license. CathexisVision uses a hot-spare model for failover.

In this model, failover servers continuously monitor the site servers for failure. In failover mode, the failover server operates exactly like the failed server, and the site continues to function as if the server had not failed. Video is buffered on the failover server and reinserted into the original server's database when it restarts. It is possible to have multiple failover servers monitoring a site.

Notes:

1. Failover is only supported in CathexisVision Professional and Premium software packages.
2. From CathexisVision Professional 2018, the failover feature must be unlocked via application of a site failover base license, and enough failover camera licenses to match total number of site cameras.
3. Premium sites include site failover base license. Failover camera licenses still need to be purchased.
4. For CathexisVision 2016 and 2017, sites require a failover base license and failover camera licenses equivalent to the highest number of cameras on any one site server.
5. DVRs cannot be failed over.
6. 3rd-party integrated devices connected directly into the server that fails will not be failed over.
7. For external connections to the Master server, the IP address of the Failover Server needs to be a secondary option.

The diagrams below illustrate how failover servers are incorporated into the system.
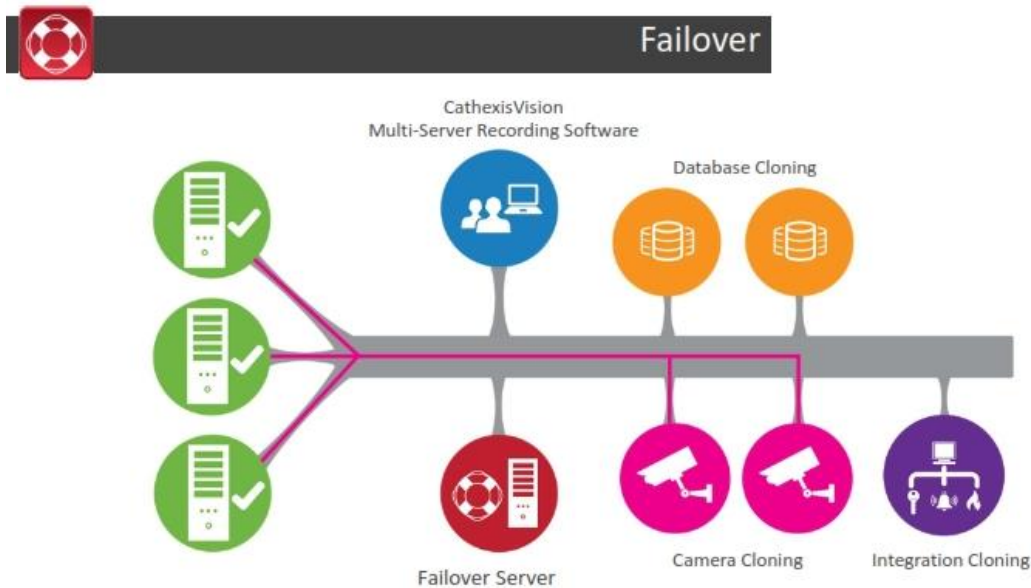
6.8.1 Failover Inactive

Figure 4: Failover inactive
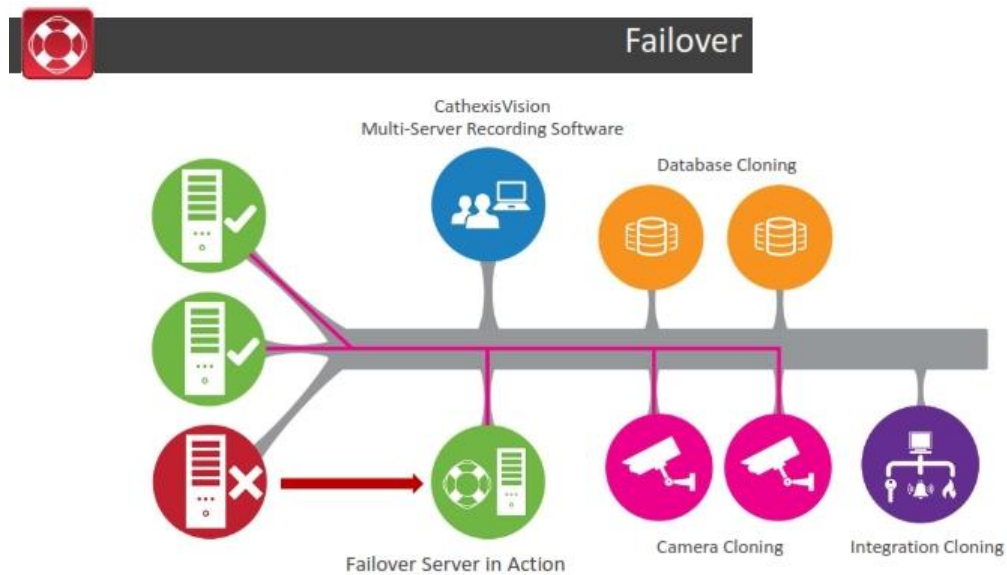
6.8.2 Failover Active

Figure 5: Failover active

6.9 Events

CathexisVision uses configured triggers to generate system events which initiate configured event actions. All system events are stored in the CathexisVision events database, even if the event was not configured to record video to a database.

CathexisVision uses the following triggers to generate system events:

- Triggers from encoders/cameras on the networks (includes physical inputs as well as video analytics triggers from the cameras).
- CathexisVision in-house motion detection and analytics/algorithms.
- Third-party integrated devices, e.g., Access control, Fire Panels, Point-of-Sale, etc.
- User-initiated events.
- Scheduled recordings, etc.

Some examples of the actions that CathexisVision can perform once an event triggers are:

- Record video footage from one or more cameras to selected/multiple databases.
- Record pre-events from one or more cameras,
- Record synchronised video and audio.
- Control a virtual output.
- Control a PTZ camera.
- Send an email with the event information including the recorded video or a snapshot.
- Send an alarm to the Alarm Management Gateway, etc.
- Control an integrated device.

6.10 Site Maps

CathexisVision Site Maps feature a multi-layered, hierarchical, interactive interface which can represent the physical layout and organisation of a site and its resources and offers certain controls over resources and events. Resources include cameras, input/output devices, various integrated devices (such as access control doors or alarm/fire panels points). Some examples of controls offered in the map are: the ability to represent and control preset PTZ dome positions from the GUI, to drag-and-drop cameras from the map to selected monitors, and control selected integrated devices or systems (e.g., bypass an alarm, lock, or open a door).

Site maps are created in the CathexisVision Map Editor software (see section 8.2) and then uploaded in CathexisVision.

6.11 API

The CathexisVision Application Protocol Interface (API) enables third-party software to retrieve and manage information from the VMS, as well as control system resources, via HTTP. For sites using CathexisVision 2020 and previous versions, OS can be either 32/64-bit. For CathexisVision 2021+ sites, OS can be 64-bit.

The current API is for CathexisVision 2017++ sites only.

Examples of information retrieved and managed by the API:

- Site Details,
- Camera Resources,
- I/O Management,
- Receiving Event/Technical Alarms,
- Receive ANPR detections.

6.12 Health Monitoring and Diagnostics

The ongoing software enhancements of CathexisVision allow for the efficient utilising of low and high-end VMS hardware. CathexisVision also recognises the complexity of hardware and networking environments and therefore provides comprehensive analysing/monitoring tools.

6.12.1 Health Monitoring

The Cathexis Health Manager provides real-time analysis of the system and can be configured to send alarms to selected recipients if problems are detected. Some of the parameters which are monitored include:

- Camera failures,
- Hard drive analysis,
- Environmental conditions,
- Communication integrity,
- Software errors, etc.

System health reports may also be generated.

6.12.2 System Diagnostics

In addition to health monitoring, CathexisVision has a powerful diagnostics suite which provides tools for analysing entire system environments, both in real time and historically. The diagnostics suite allows for easy trouble-shooting of problems on site, as well as providing real intelligence on the integrity of the solution.

Some of the parameters which are monitored by the diagnostics suite are:

- Network camera video streaming performance,
- Recording bitrates,
- Live viewing statistics,
- Network throughput, etc.

7. Client Components

7.1 CathexisVision Client

The CathexisVision Client software offers a full set of advanced features and is designed for day-to-day use by operators, as well as system administrators. The client software enables local/remote connection to the server, allowing operators to view cameras and allowing administrators to access all system configurations and settings.

7.2 CathexisVision Carbon

Carbon client software is supported for CathexisVision 2022 and later. Sites cannot be configured through the Carbon client software..

7.3 CathexisVision Mobile Client

CathexisVision Mobile is a mobile client that is supported for CathexisVision 2022 and later. For more information, consult the following documents, available on the Cathexis website (https://cathexisvideo.com/):

- *CathexisVision Mobile App Guide*
- *CathexisVision Mobile White Paper*
- *CathexisVision Mobile Quick Guide*

8. Additional Software Products

8.1 Video Wall Software

The CathexisVision Video Wall software provides intelligent management of video streamed from specified servers and displayed on selected screen/s. Usually the Video Wall software is run on units that are solely dedicated to showing video feeds.

Besides view and review of cameras, the Video Wall provides the ability to manage and perform camera and layout sequences, automatically switch cameras to monitors (or panels within monitors) upon a specified event, and automatically or manually control monitor layouts via an interactive mimic panel, among many other things.

Notes:

1. Video Wall software is automatically installed with installation of CathexisVision Server or Client, but functionality of Video Wall must be **unlocked** by applying a license.

2. One Video Wall license is required for every CathexisVision 2018 and later site intending to run a Video Wall.

3. This license is included with CathexisVision Premium.

8.2 Map Editor Software

Site Maps are created in the additional CathexisVision software product, the CathexisVision Map Editor. Once created in the Map Editor, maps are saved and then uploaded to the CathexisVision software.

In the Map Editor, images and graphics can be imported and used in the map to accurately represent the site environment, a drawing tool allows creation of various shapes, objects and text boxes, and site-specific resources can be added. Resources can then be configured to perform certain actions upon the initiation of either manual inputs or site/device events.

For example, a floorplan of a site building can be imported into the Map Editor and used as the base layer upon which cameras, PTZ dome cameras, and integrated devices (e.g. Access Control device) can be added. These resources can be set to perform actions (such as animating the icon, switching to camera/monitor, connecting to a different site, loading another map, going to a camera preset, etc.), which can be configured to initiate upon a user input (such as a left/right-click), or a site/integrated-device event (such as a door being forced open or a camera going down).

Notes:

1. Map Editor software is automatically installed with installation of CathexisVision Server or Client and does **not** require a license to function.

2. Uploading and using maps in CathexisVision requires a **license**.

8.3 CatObserver Software

CatObserver is a feature which, when enabled, treats the unit on which it is installed as a 'camera' and monitors all on-screen activity. Configuration on the recording server is the same as for other IP cameras. CatObserver can monitor multiple screens on an individual computer and can monitor the activity of any computer on the same network as the recording server unit.

The advantages of this include **easy archiving and access** to all that an operator has viewed during an incident, without having to archive or find and view footage from multiple cameras.

Notes:

1. CatObserver only runs on Windows units.
2. CatObserver requires application of a Cathexis IP camera **license** to function.

8.4 CathexisVision Archive Player Software and Archive Viewer

The CathexisVision Archive Viewer software is a stand-alone application which enables viewing, review and exporting of video that has been archived or exported from CathexisVision. The Archive Viewer performs the same function as the Archive Player in CathexisVision, but the Archive Viewer does not require the user to enter the CathexisVision software in order to view archives.

The Archive Player software can also be included in an archive exported from the CathexisVision software when an archive is generated.

Notes:

1. Archive Player software is automatically installed with the installation of CathexisVision Server or Client.
2. Archive Player comes ready to use and does **not** require a license to function.

For information on the process of archiving, consult section 6.3.

9. System Design Tools

The Cathexis Design Tool allows the user to input all the parameters and requirements of their site, such as number of cameras, frame rates, resolution, and number of days storage required.

The tool will then suggest the best recording servers for the application and supply a bill of materials (BOM) for the CathexisVision licenses that are required to satisfy the requirements provided.

The design tool can be found on the Cathexis website:
https://downloads.cathexisvideo.com/support/design-tools/.

Alternatively, please contact support@cathexisvideo.com to discuss system requirements.

10. Hardware Products

Cathexis produces a number of hardware products that are specifically designed to integrate with the CathexisVision software to enhance the video surveillance management solution. However, the hardware products can be used in conjunction with most video management systems.

For information on any of the below products, please consult the Cathexis website or contact support@cathexisvideo.com.

10.1 Keyboard and Joystick Controller

The Cathexis KBD-3100 keyboard has been designed specifically to meet the needs of VMS operators. The keyboard is fully programmable, providing exceptional integration with VMS functions.

With an ergonomic design and textured finish, the KBD-3100 is an effective complement, aesthetically and functionally, to the powerful VMS system.

10.2 Network I/O Device [EOL]

The Cathexis network base I/O expander device enables comprehensive access and control of remote in/output relays over an Ethernet network. In applications where an Ethernet network already exists, this is a significant cost-saver as it does away with the requirement for cabling. Through the CathexisVision software control, opening and closing of integrated relay contacts can be incorporated into any response of a critical event.

Important note: The Cathexis network base I/O expander is end-of-life.

10.3 Network Video Recorder Systems

Cathexis produces a number of network video recorder systems, allowing the CathexisVision software to be managed and used from any workstation on the network and from remote locations by multiple users. The Network Video Recorder Systems are associated with IP-network based camera systems.

10.4 Video Encoders [EOL]

Cathexis SAM-3 video encoders integrate analogue cameras into an I.P video solution by encoding the analogue feed into an Ethernet video stream. This enables you to embrace the latest network video technology whilst utilising your existing cameras, providing a cost-effective solution.

Important note: The Cathexis SAM-3 encoders are end-of-life.

11. Training Tools

11.1 FAQ

A list of frequently asked questions about the software can be found on the Cathexis website:
https://cathexis.crisp.help/en/?1557129162258

11.2 Training

Training on the CathexisVision software can be arranged for groups or individuals, both locally and internationally.

Please contact support@cathexisvideo.com to discuss your training needs.

11.3 Tutorial Videos

Video tutorials on configuring and operating the CathexisVision software can be found on the Cathexis website: https://cathexisvideo.com/resources/videos/tutorial-videos/

11.4 Manuals and Documents

Comprehensive setup manuals, end user guides and app-notes can be found on the Cathexis website:
https://cathexisvideo.com

12. Conclusion

This document was designed to deal specifically with the Cathexis product architecture. For further information about the CathexisVision software, please consult the ***CathexisVision Setup Manual*** (http://cathexisvideo.com/).

For support, please contact support@cathexisvideo.com

USEFUL LINKS

*To view **tutorial videos** on CathexisVision setup, visit https://cathexisvideo.com/resources/videos*

*Find answers to Cathexis **Frequently Asked Questions**: https://cathexis.crisp.help/en/?1557129162258*