Soliton Systems Whitepaper

Integration Between the Soliton Zao VMS Plus and Milestone Xprotect

Mobile Surveillance

And

Remote Live Video Streaming

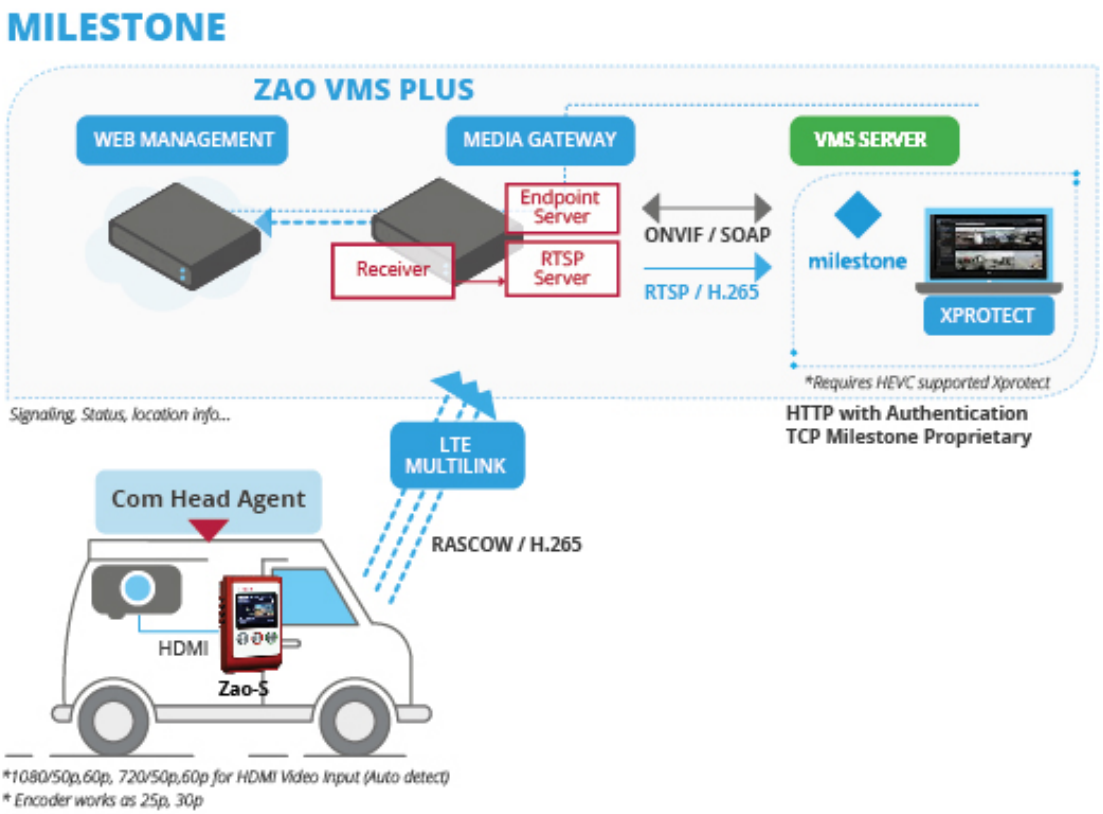
Contents

Integration between the Zao VMS Plus and Milestone XProtect®

Purpose of the paper

This white-paper describes the integration between the Zao VMS Plus from Soliton Systems and the Xprotect® VMS from Milestone Systems. The live streaming Smart-telecaster transmission units of Soliton are used to compress and live stream video from a mobile camera in a remote location, and the Video Management System (VMS) platform from Milestone Systems is used to display, record and manage the video stream(s) back at an operational centre.

This paper describes what is required to set up an integration, some user case scenario's and a summary of the benefits.



Summary

Soliton Systems is a Japanese technology company specialising in IT security and outdoor mobile video surveillance products. Within the outdoor mobile surveillance element of Soliton, the Smart-telecaster range of products consists of:

- **2x H.265 (HEVC) hardware video encoder products:**
  - Zao-S (up to 3x SIM cards and maximum bit rate of 5 Mbps)
  - Zao (up to 6x SIM cards and maximum bit rate of 10 Mbps)

They are typically deployed in a remote or moving location with an external video camera and can live stream over multiple 5G / 4G / PS LTE connections to a receiving platform at the destination (typically a command centre). They can live stream from action-cams on a person or from cameras situated on vehicles, boats, trains, helicopters and/or drones.

- **2 x Live Streaming Apps for Smartphones:**
  - Zao App for Android
  - Zao App for iOS

The Zao App won the Airbus Critical App Award Belgium 2018 for deployment on their Tactilon Dabat, which is the world's first smartphone and full TETRA radio in one device. Zao App supports Full HD, 25fps, H.265 & H.264 codec, AES 256-bit encryption, authentication, GPS information, two-way audio.

- **2 x separate software receiving ("decoder") products for VMS integration**
  - HD View (1 channel or 4 channel software products installed on Win10 platform)
  - Zao VMS Plus (Virtual machine platform can be installed on-premises or in cloud) used for VMS systems – supports up to 12 x live stream channels to create up to 12 x RTSP H.265 ONVIF compliant streams.

The decoders are typically placed at the receiving destination and are used it to either create an IP video stream (RTSP, RTMP or NDI), or to create an uncompressed HD-SDI video stream for broadcast purposes. Xprotect utilises an IP ONVIF compliant RTSP H.265 stream.

The mobile encoders are used to live stream from a mobile camera. They utilise H.265/HEVC to compress the video using the latest HEVC technique. They can create a highly reliable connection by "bonding" up to 3 simultaneous SIM cards from 3 different cellular providers on the Zao-S (or up to 6 different network providers on the Zao) which are then used simultaneously to transmit.

Where 4G connection may be weak or unreliable, by combining all the telco network providers as a single connection, this mitigates the risk of relying on one single provider with the benefit of combining all the bandwidth across all the connections for increased speed and reliability.

The streams are fully encrypted using AES256, and in conjunction with VMS Plus at the receiving end, can provide a fully ONVIF compliant live stream to XProtect.

Milestone Systems is a Danish company that develops the **XProtect®** Video Management System (VMS) to activate, display, monitor and record live video feeds, typically placed within an operational or command centre. Traditionally they are camera agnostic utilising ONVIF compliant fixed surveillance cameras'.

Milestone Systems works with a range of partners to provide an eco-system around their products consisting of camera manufacturers, video storage manufacturers, analytical vendors, door access control manufactures and more recently Artificial Intelligence (AI) developers which includes video analytics.

Traditional uses of Milestone's Xprotect® VMS is for monitoring fixed surveillance cameras. Soliton Systems is now a certified partner of Milestone Systems providing a new concept in terms of providing live streaming from mobile or roaming cameras that could be body-worn cameras, placed in vehicles, motorbikes, video surveillance vans, drones, helicopters, boats, planes or even on dogs.

Official support began end of August 2018 when the Soliton solution was included in Milestones Xprotect device pack version 9.9.

Benefits

Companies do not want to buy products, they wish to buy solutions which are proven, certified, fit-for-purpose and supporting open recognisable standards for interoperability.

The solution being offered from Soliton is the Zao-S or Zao (hardware encoders connected to the camera), or live streaming app on a smartphone, in conjunction with the Zao VMS Plus in combination with Milestone Xprotect VMS system.

The Zao-S has multiple technical benefits when used in the Public Safety and Law Enforcement domain: -

- H.265 HEVC encoding is 50% more efficient than traditional H.264 encoding requiring half the bit rate for transmission
- The units are the smallest and lightest H.265 HEVC mobile encoders globally available
- The units can bond together up to 3 x SIM cards making them highly reliable even when signal strength is low or non-existent on some cellular networks
- Real Time bonding, known as RASCOW, optimizes video quality based on available total bandwidth across all available 5G / 4G / PS LTE networks and adjusts video accordingly in real time in a dynamic situation such as a high-speed pursuit.
- Can be utilised in low cellular coverage or crowded places even when there is competition for network availability
- Future proofing for 5G
- The units support AES256 encryption
- Fully ONVIF compliant
- Low latency – typically 700ms from camera to VMS and as low as 240ms
- Browser based management of all units in field
- Working with any drone or any camera to provide live feeds from the field to HQ for live analytics

User case Scenario

Utilised on a global stage with many law enforcement, first responder and emergency services, the Zao-S allows instant video live streaming from remote mobile situations such as body worn actions cams, police surveillance vehicles, coast guard, fire departments used within drones, helicopters and even in some cases live streaming from dogs. This is achievable by the miniature device utilising multiple 4G connections simultaneously to live stream video reliably back to a command centre in full HD (1080p) with minimal latency.

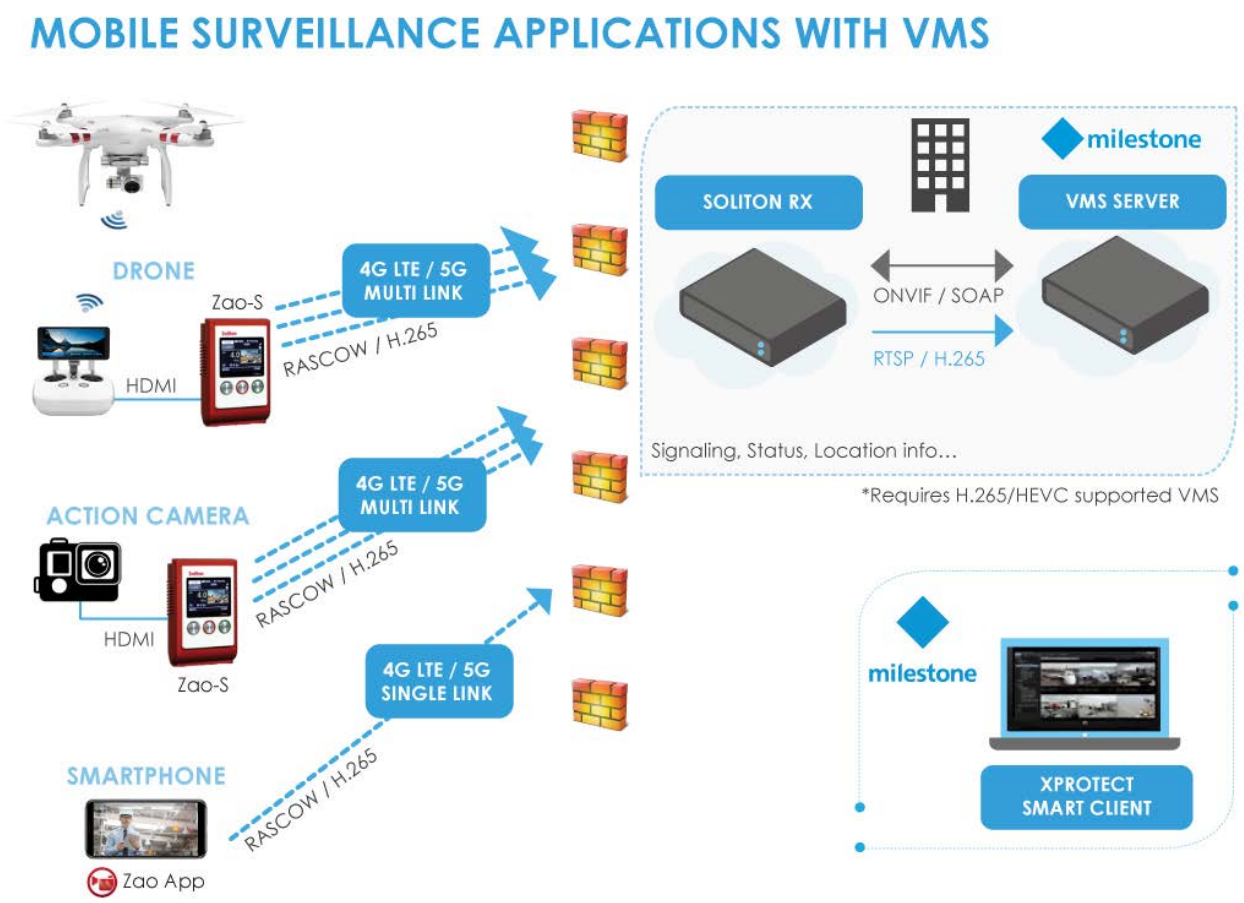
As a user case scenario, the Zao-S is already deployed by the Tokyo Police in conjunction with Milestone Xprotect® and was originally used as a Public Safety tool for the Tokyo marathon. There is a case study that describes the Tokyo Police and Milestone user case in more detail here: -

https://solitonsystems.com/case-study-news-gathering-smart-telecaster-live-news-gathering-2/

Soliton also have another major European Police force using multiple Zao-S with a Milestone Xprotect® VMS system in live operational duties where it is being utilised for special operations, raids and covert operations.

If you wish to read more about the advantages of mobile surveillance with Soliton, then please read this article: https://www.sourcesecurity.com/insights/mobile-surveillance-live-stream-cameras-drones-co-14303-ga.1524220758.html

Application Examples of the Solution: -



Components of the Solution:

Field Side

1) Camera: In case of using ZAO or ZAO-S, any camera with HDMI or SDI output can be used. Drones with HDMI output, body-worn action cameras (helmet cameras), hidden cameras and/or in vehicle cameras.

2) Soliton Transmitter: ZAO / ZAO-S are Soliton's bonding encoders that can use multiple network connections at the same time. ZAO App is the smartphone app solution uses the smartphone's camera. All transmitter solutions use H.265 codec and Soliton's RASCOW transmission technology, therefore, all Soliton transmitters have two-way audio, encryption, GPS and error correction technologies.

important note: Soliton's transmission system is a point to point and fully encrypted solution.

HQ Side

3) Soliton Receiver: Soliton's receiver side is a virtual machine with software packages (VMS Plus) with the main goal of converting Soliton's RASCOW protocol to RTSP and communicate with VMS server via ONVIF. Soliton's receiver solution is ideally located in the same local network as Xprotect® VMS server.

4) Milestone Xprotect® VMS

Soliton – Transmission End

The live streaming side of the solution consists of: -

- Camera (this does not need to be ONVIF complaint given the Zao-S provides this functionality) – 1080i/1080p/720p/….
- Zao-S
- Up to 3 Dongles with SIMs – see here for supported dongles – each configured with the APN setting of the SIM (it is also possible to use Wi-Fi or Satellite to live stream)
- Option – Zao Controller for iPhone/Android (Management tool)

The Zao-S is put together as in this video.

Soliton – The Receiving End

- Zao Cloud VMS Plus

The **Zao VMS Plus** system consist of two major elements: -

1) **Media Gateway** – to receive the RASCOW stream and pass through an H.265 video stream via RTSP/ONVIF to a VMS server.

RASCOW (Real-time Auto Speed Control based On Waterway model) is Soliton's networking protocol to optimise the best video quality based on the multiple network availability. It allows the units to operate effectively even when there is limited bandwidth while maintaining low latency.

Sub blocks consist of: RTMP server, End Point Server and Receiver Software (see diagram above).

2) **Web Management** – Management database and user interface to remotely manage all the units in the field.

Both components of VMS Plus stated above are provided by Soliton as an ESXi VM appliances.

Sub blocks consist of: Comm Post and Web Management (see diagram above).

Milestone Systems – Requirements and Install

Requirements: -

- Xprotect Smart Client
- Xprotect Recording Server

Milestone XProtect version

The following is high level summary of what is required. Note a more in-depth installation manual is available from Soliton detailing the installation.

There are several different Milestone VMS products in the XProtect range, starting at the XProtect Essential+ (single site, free version) all the way to the XProtect Corporate (multi-site, scalability, etc)

More Information can be found at the following URL:

https://www.milestonesys.com/solutions/platform/video-management-software/

- **XProtect Essential+** - Single site, up to 8x cameras
- **XProtect Express & Express+** - Single site, up to 48x cameras, XProtect add-ons
- **XProtect Professional & Professional +** - Multi-site, unrestricted number of cameras, XProtect add-ons & scalability
- **XProtect Expert** - Multi-site, unrestricted number of cameras, XProtect add-ons, scalability, redundancy & hardware acceleration in recording server
- **XProtect Corporate** - Multi-site, unrestricted number of cameras, XProtect add-ons, scalability, redundancy, hardware acceleration in recording server & distributed operation

Milestone XProtect Installation

The Milestone XProtect products can be downloaded at the following URL:

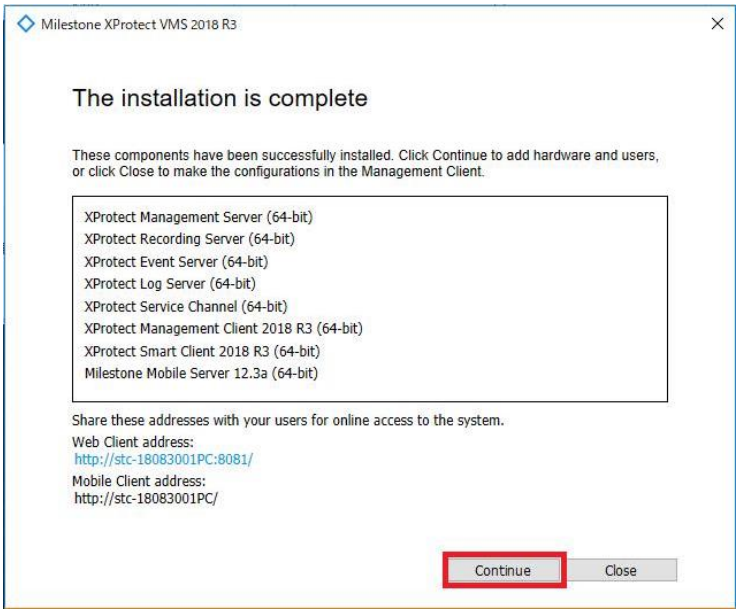
https://www.milestonesys.com/support/resources/download-software/

(For the purposes of this document **XProtect Essential+ 2018 R3** free version was used, current version available is **XProtect 2019 R1**)

After installation is complete select Restart Computer.

The installation process will resume automatically after the reboot and once completed the computer will need to be restarted again.

The final installation menu displays the components that have been installed.



The installation has now been completed and the configuration process begins.

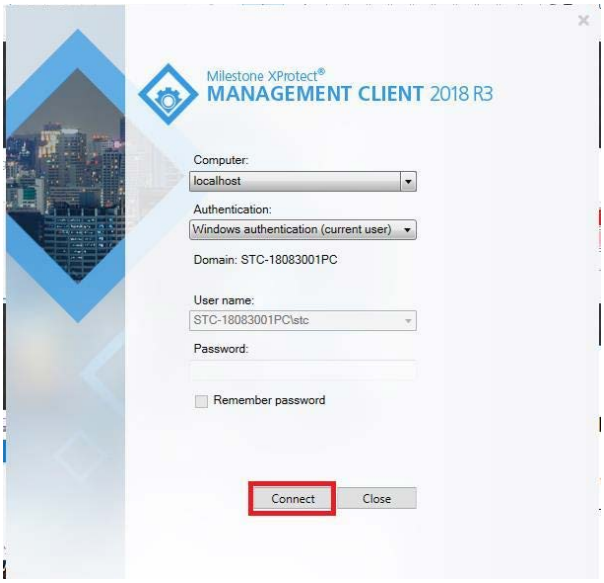
On the first menu, all the fields should be left blank and Continue.

Over the next menus, leave the default and Continue.

Once the final configuration menu appears, just press Close.

The basic configuration of XProtect VMS has now been completed and the setup can begin.

It is important to note that before a live stream can be received in the Milestone XProtect Smart Client a Recording Server will have to be configured through the **XProtect Management Client**.

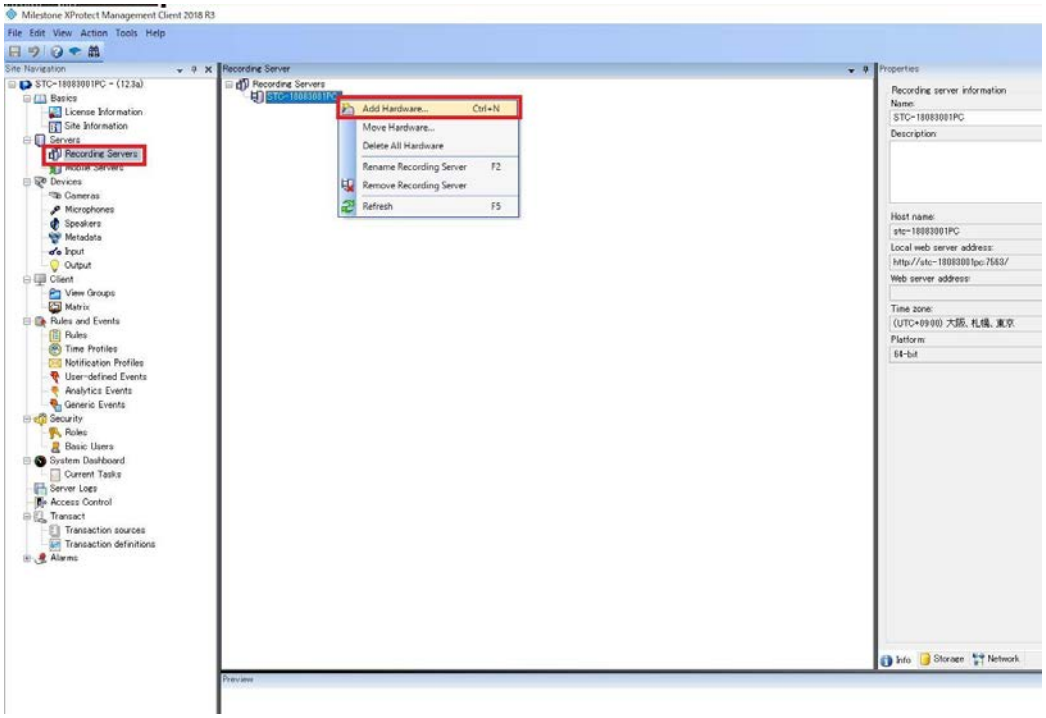


The Management Client has a range of options and configuration settings that will allow anything from a Basic to an Advanced Setup, depending on the needs of the user/customer and allows for customization.

For the purpose of this paper and since a Zao-S H.265 encoder will be used to transmit a live stream, the following steps reflect the configuration of a Recording Server as well as the addition of the Zao-S hardware to the Milestone VMS platform and ultimately receiving the live stream on the Milestone XProtect Smart Client.

Recording Server Configuration & adding Zao-S hardware

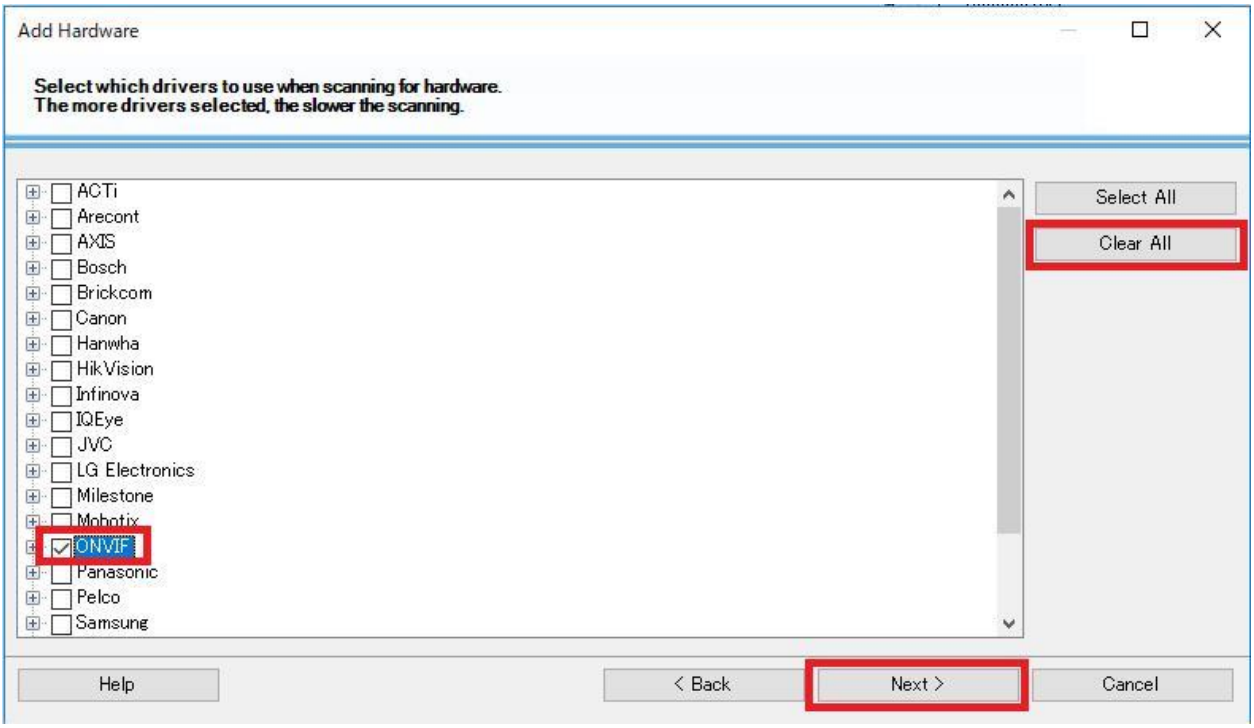
On Site Navigation, select Servers, Recording Servers and Add Hardware (same as image below).



Once the Add Hardware menu shows, select Manual and Next.

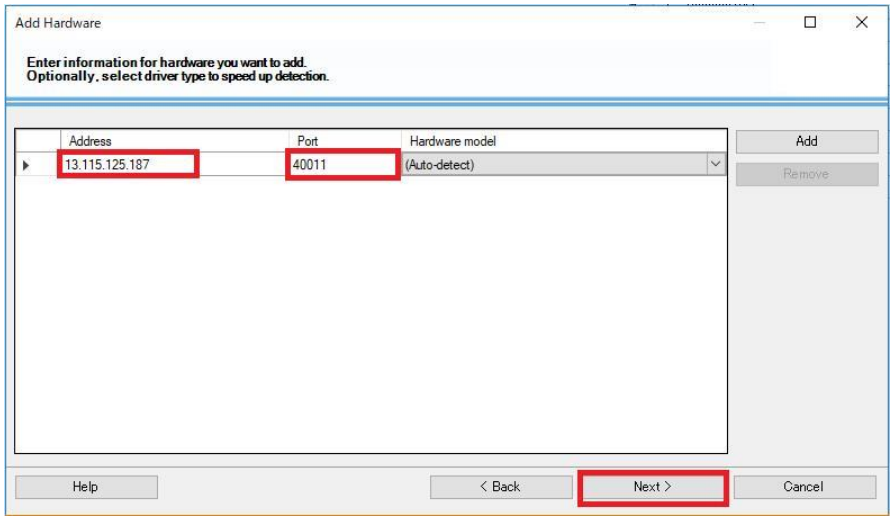
You will then be prompted to specify Username & Password which should be left blank by default and the next.

At the driver selection menu all checked options should be removed and only **ONVIF** should be selected.



The IP Address of the VMS+ (Media Gateway) server and the port to receive will need to be added.

(Refer to VMS+/Media Gateway setup and requirements)



The available port range used to distribute video to XProtect is between 40011-40121 and for each port on the Milestone side there's an equivalent port on the VMS+ platform with range between 20010-20120.

Each side has 12 ports available with each one corresponding to a livestream channel to a total of 12 channels at this time and more are expected to be added in the future. For each added Zao-S encoder, a new available port will have to be assigned.

Port assignment should look as follows:

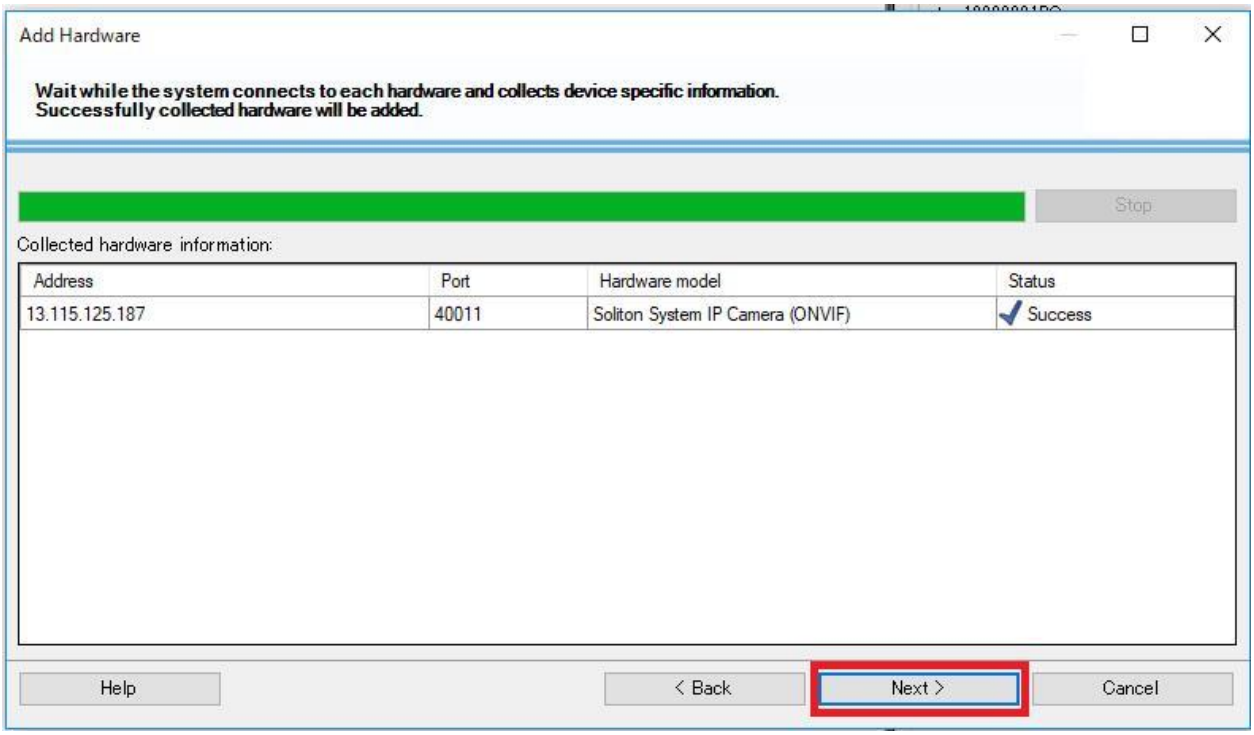
Port information on XProtect	VMS+ Endpoint port information
40011	20010
40021	20020

40031	**20030**
40041	**20040**
40051	**20050**
40061	**20060**
40071	**20070**
40081	**20080**
40091	**20090**
40101	**20100**
40111	**20110**
40121	**20120**

It is important to add that when switching the output destination port of the video in the XProtect side, the VMS+ Endpoint port should be changed to matching port according to the table above.

(Refer also to VMS+/Media Gateway setup and requirements)

Once the registration is successful there should the IP Address, Port, Hardware Model information and the Status will show as Success indicating the Zao-S encoder was successfully added.



In order to enable the device, following options should be selected:

- **Hardware**
- **Camera 1,**
- **Microphone port 1,**
- **Speaker port 1**

Once completed, it will be visible on the XProtect Management Client the recently added fields our Recording Server.

A green triangle mark should be visible on all the added fields indicating that images are now being received on the Milestone VMS platform.

In order to view the configured stream, it's time to open XProtect Smart Client which will be the receiving end of our live stream.

For first-time users a new View will need to be added by performing the following steps:

Select Views -> Default group - > Default view group -> Add View - > 16:9 -> 1+3 and select

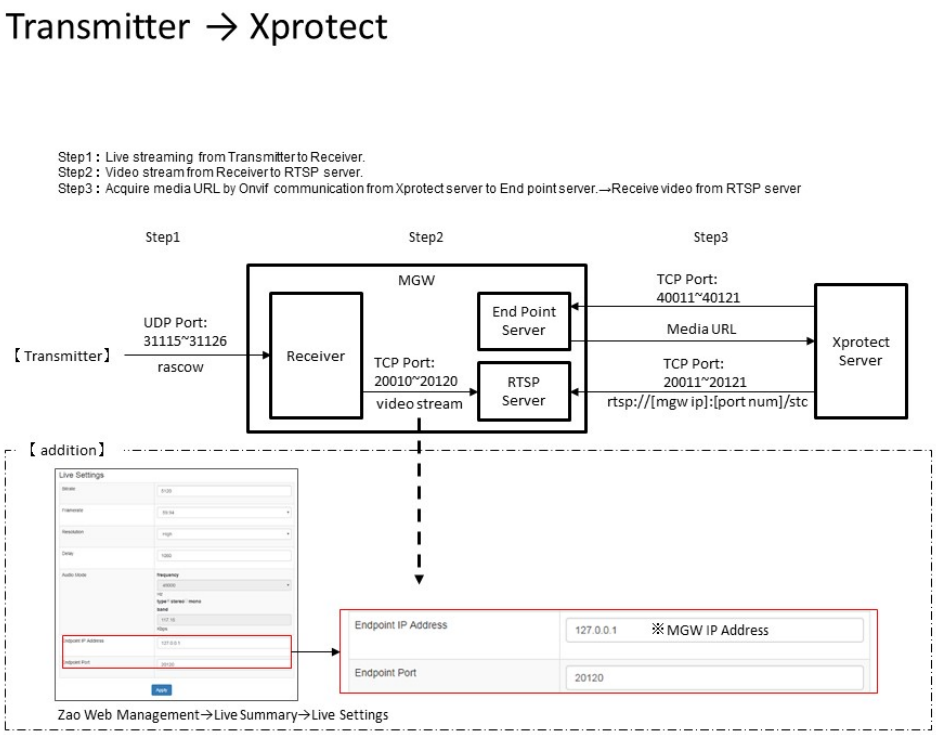
Setup to complete adding the View.

On the left-hand side, the Zao-S (which will show under Cameras) will be visible has **Soliton System IP Camera** and a simple Drag and Drop to the Main View will bring the livestream onto the Smart Client.

Additional manuals & guides for the XProtect VMS products can be found at:

https://www.milestonesys.com/support/resources/download-software/?prod=1419&type=13&lang=27

Installation of Zao VMS Plus (MGW and Web Management)



Please note installation of VMS Plus would be installed by Soliton personnel or by Soliton trained partners.

Both components of VMS Plus (Zao Media Gateway and the Web Management) are provided by Soliton as two separate ESXi VM appliances and are installed in virtualised environments. It is possible to install both components on a single machine or two separate machines and can be on-premise, or can be installed within a Cloud environment such as Azure.

Hardware Requirements:

VMware vSphere Hypervisor ESXi 6.7 environment (Build 8169922)

8Core CPU, 32GByte Memory, 500GB HDD
USB Memory (For copying license file to VM)
2 VM image files for Media Gateway and Zao Web Management*
Certification file for Zao Web Management*
License file for Media Gateway*
provided by Soliton

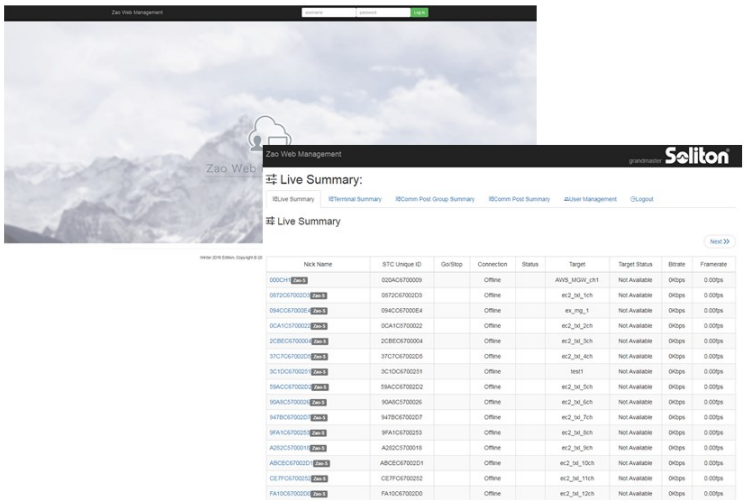
Example Spec (May 2019): -

- HP DL360 G10
- Single 4114
- 32G RAM
- 2 x 1TB RAID1
- OPTICAL
- Dual PSU
- MS Win 2016 ROK

The Web Management solution includes the “Com Head” which effectively manages the network connections and the interface with the Zao Web Management solution. The Zao Web Management is normally a hosted service in an open network environment, but it is normally installed alongside the VMS plus solution in closed networks such as those used by many law enforcement agencies.

The Zao web management allows the configuration of both the receiver and the transmission elements where settings can be administered, and a preview of the network availability and video is available. The web management is browser based.

Zao Web Management



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As a summary, the Zao VMS Plus product will assemble the video arriving from all the separate network connections whether it be via multiple 3G/4G connections, WiFi and/or satellite, translate from RASCOW/H.265 to RTSP/H.265 and decrypt the stream to an ONVIF complaint stream that can be used as

an input to Xprotect. Normally with a latency from the mobile camera to the input of Xprotect is less than a second, typically 700ms.

A user manual is available that details the installation procedure for Zao VMS Plus.

Cloud Providers that can be utilized: Customer preference (AWS and Azure tested)

Where to Buy

Soliton Systems sell through a range of distributors, System Integrators, Resellers and other partners across the globe. Please contact us for more information or see our list of resellers.

Support

Please see our support page for a list of manuals and other useful video and documentation. Here is also an email address to request support if required.

More Information

Online Relevant case studies, videos, blogs: -

Milestone & Soliton Systems - Japanese Police Case Study (text)

Public Safety Video Using Zao-S (Video)

Milestone and Soliton – Sales Value Proposition (Video)

Drones and Wild Fires Blog (text)

Online Product Information:

Soliton – specialist in mobile live streaming for mobile surveillance and outside broadcast

- Used by special operations, first responder, covert operations, drones, police pursuits, helicopters to live stream instantly over multiple 4G networks back to a command centre.
- Zao-S is smallest H265 encoder in the world at only 400 grams for transmission over multiple 5G / 4G / PS LTE networks simultaneously – very reliable even at low bit rates.
- Latency as low as 700ms back to command centre and now looking at lower latency solutions from 50ms.
- Fully encrypted using AES256.
- Fully ONVIF compliant allowing integration into VMS systems such as Milestone that is in use by many law enforcement organisations.
- Receiving end (decoding platform either HD View or Zao Media Gateway) can be securely on-premise with no cloud infrastructure – with encryption all the way.
- Receiving end (Zao Media Gateway) allows up to 12 channels and can create an RTMP/RTSP stream that integrates with Video Management Systems (VMS) that are typically used for fixed surveillance systems.
- Option to display streams on a map for quick decision-making capabilities. E.g. pursuit vehicles and clearly seeing where to deploy additional officers/agents on a map in real time.
- Remote cameras are assumed to be HD-SDI or HDMI. If they are using IP cameras, we may have a product coming that could be of interest though all action and mobile cams I know of do not yet support IP output.
- Potential to control fixed PTZ cameras via a serial port on Zao-S.
- Full browser management capability to control all units in the field with GPS tracking.

More information: -

- Transmitter - Zao (up to 6 SIM cards) - http://solitonsystems.com/products/smart-telecaster-zao/
- Transmitter - Zao-S (up to 3 SIM cards) – new miniature encoder, weighing only 400g with internal battery – http://solitonsystems.com/products/smart-telecaster-zao-s-2/
- Receiver – Zao VMS Plus supports up to 12 channels and can be hosted on an Azure platform or On premise. To create ONVIF complaint H.265 streams for a VMS.
- Alternatively HD-View software decoder that works on standard win 7 / win 10 platform that works with both Zao, Zao-S & ML Cam - http://solitonsystems.com/products/stc-hd-view/
- and ML Cam (iPhone and Android streaming app) - http://solitonsystems.com/products/stc-ml-cam/
- Full SIM cards and dongles can be provided. For HD View you only need the decoding hardware (Win 7 or win 10 server min 16GB RAM) and Blackmagic Decklink card if using HD-SDI workflows. (Decklink card not required for IP workflows – RTMP/RTSP/NDI/Milestone). The decoding hardware requires an external facing (global) IP address.

More Information: Please contact Soliton sales team on: sales@solitonsys.com