milestone

White paper

Remote Connect Services -

Axis One-Click Camera Connection

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Introduction

Milestone Systems is the first open platform video management software (VMS) vendor in the world to introduce support for Axis One-Click Camera Connection with the Milestone XProtect Corporate 5 release.

Axis One-Click Camera Connection is a technology that allows Axis cameras and video encoders installed behind firewalls or Internet routers at customer premises to be easily connected to the central video surveillance system without having to configure port forwarding in the firewall or Internet router. This is essentially achieved by having the Axis camera or video encoder "phone home" to the video surveillance system, creating a secure tunnel through the firewall or Internet router – much like a virtual private network (VPN) connection.

This simplifies the installation greatly as the administrator or system integrator does not need to hassle with configuring the firewall or Internet router or set up dynamic Domain Name System (DNS) addresses to handle Internet connections with dynamic IP addresses.

Target audience and white paper purpose

The primary audience for this white paper is surveillance system architects/designers and surveillance project consultants, as well as companies, organizations and governments working on surveillance projects/installations with cameras at remote sites.

The purpose of this white paper is to give a general overview of the Axis One-Click Camera Connection implementation in XProtect Corporate, the technology behind it and the benefits of using it. This white paper should enable the reader to understand the architecture and technology behind the implementation of Axis One-Click Camera Connection in XProtect Corporate, as well as how to design and implement a surveillance system using Axis One-Click Camera Connection.

The white paper assumes the reader has a general understanding of Milestone XProtect Corporate and IP network management in general.

Technical overview

Axis One-Click Camera Connection is the ability for Axis cameras and video encoders to "phone home" through firewalls and Internet routers. In this way, the cameras and video encoders connect themselves to the central video surveillance system providing a secure tunnel for general communication and audio/video streaming.

System components

The Axis One-Click Camera Connection solution includes several new components and extensions to both the Milestone XProtect Corporate software and the Axis camera or video encoder firmware.

- **Milestone - Recording Server:** The standard Milestone XProtect Corporate Recording Server has been extended with the capability to communicate with the "Axis – Secure Tunnel Server" and thus cameras using Axis One-Click Cameras
- **Axis One-Click Connection Component[1] (hereby referred to as Axis-OCCC):** This is a new component in the XProtect Corporate system that the Axis One-Click Cameras connect to, in order to create a secure (VPN-like) connection to the video surveillance system. It also provides the interface that the Recording Server uses for communication and video/audio streaming from the Axis One-Click Cameras
- **Axis One-Click Camera Connection Dispatcher:** This is the service the camera or video encoder initially "phones home" to, in order to get the address of the Axis-OCCC in the surveillance system
- **Firewall or Internet router:** This is the customer's Internet access point for his network, and it typically protects the network with either network address translation (NAT) in the Internet router or a dedicated firewall on the network
- **Axis camera or video encoder:** This is the actual camera or video encoder installed at the customer premises

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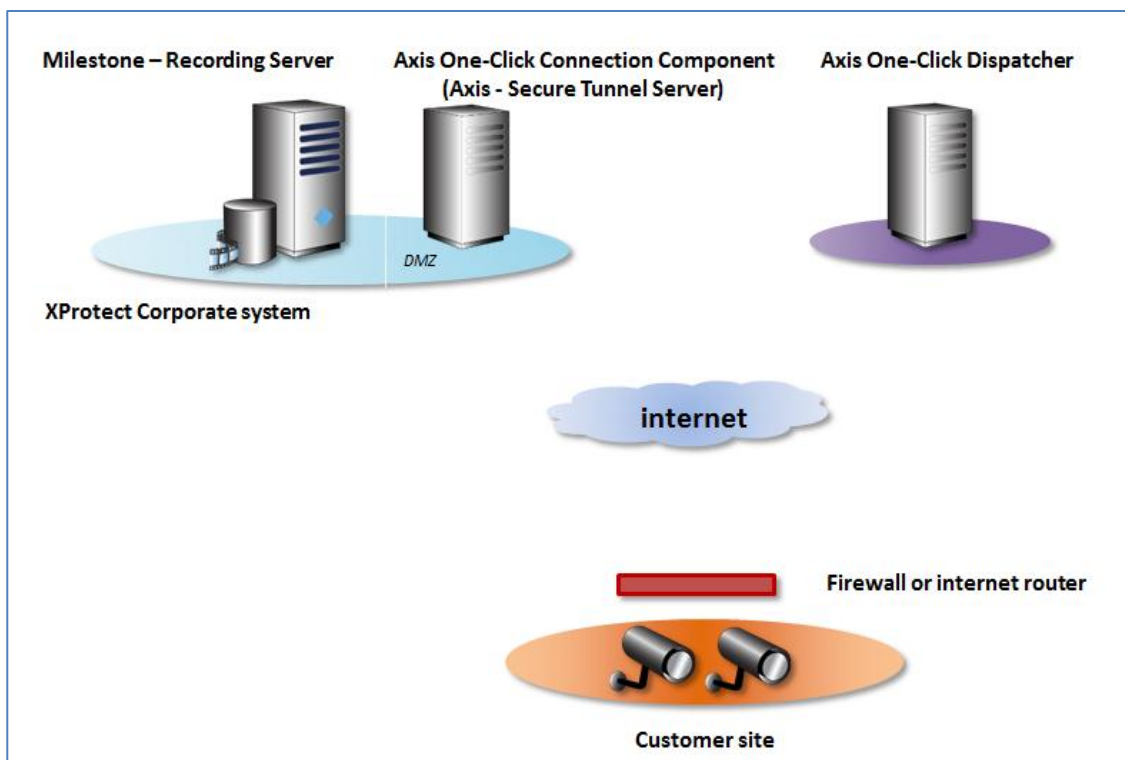
[1] In the XProtect Corporate Management Client, the Axis One-Click Connection Component is called "*Axis – Secure Tunnel Server.*" The reason for this is that Axis renamed the component just before the release of XProtect Corporate 5. The name in the Management Client will be updated for the next release.

Default Connection flow – using default user name/password:
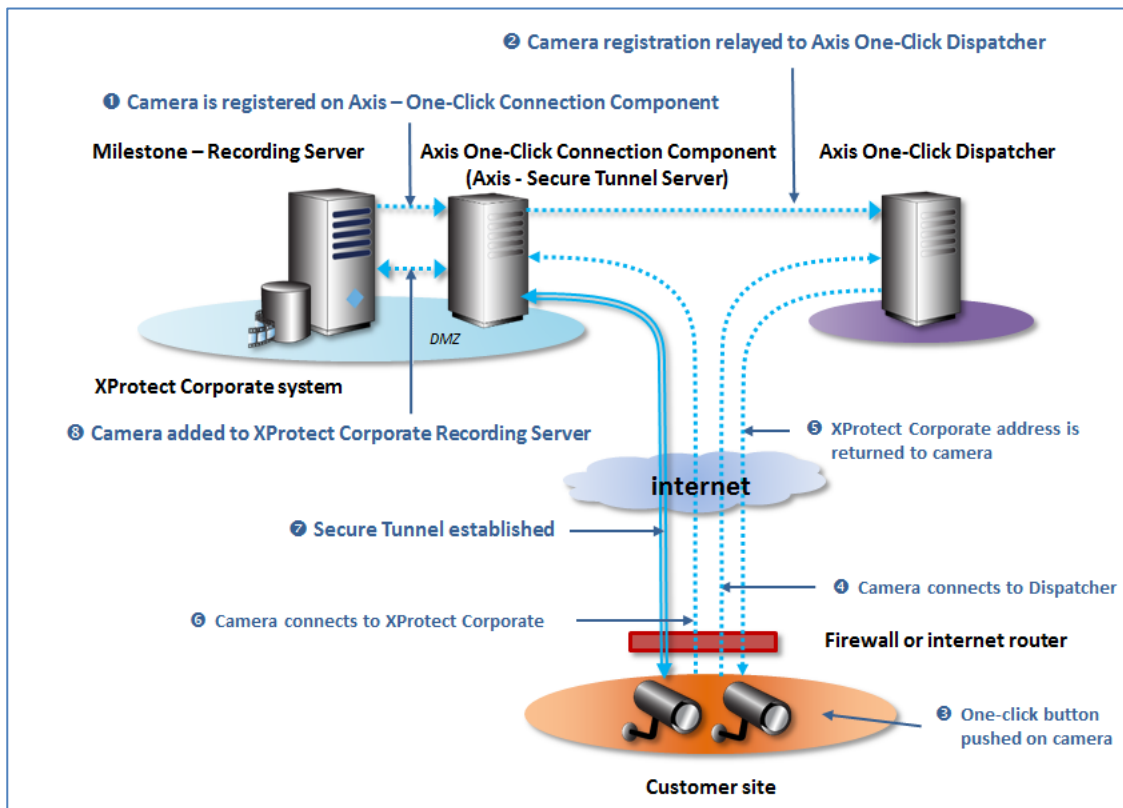
The work and communication flow for connecting Axis cameras and video encoders via Axis One-Click Camera Connection is as follows:

1. **Camera is registered to Axis-OCCC**
   - Using the XProtect Corporate Management Client, users can register a camera or video encoder to the Axis-OCCC. To register the camera or video encoder, the user name and password for the camera or video encoder is needed as well as the serial number and Owner Authentication Key (OAK)
2. **Camera registration relayed to Axis One-Click Camera Connection Dispatcher**
   - As soon as the camera or video encoder is registered on the Axis-OCCC, the registration is relayed to the Axis One-Click Dispatcher
3. **One-Click Camera Connection button pushed on the camera or video encoder**
   - At the customer premises, the camera or video encoder is installed and plugged into a network with Internet access
   - Once connected, the One-Click Camera Connection button is pushed
4. **Camera or video encoder connects to Dispatcher**
   - Once the One-Click Camera Connection button has been pushed, the camera or video encoder "phones home" to the Axis One-Click Camera Connection Dispatcher by attempting to connect to one of the dispatchers in the camera's or video encoder's internal list of dispatchers
5. **XProtect Corporate address is returned to camera or video encoder**
   - Once connected to the Axis One-Click Camera Connection Dispatcher the

dispatcher logs in to the camera or video encoder using the credentials used during registration of the camera or video encoder to the Axis-OCCC
- After successfully authenticating the camera or video encoder, the dispatcher gives the camera or video encoder the address of the Axis-OCCC in the XProtect Corporate installation

6. **Camera or video encoder connects to XProtect Corporate**
- Having received the address, the camera or video encoder disconnects from the Axis One-Click Camera Connection Dispatcher and then connects to the Axis-OCCC in the XProtect Corporate system

7. **Secure Tunnel established**
- Once connected and authenticated to the Axis-OCCC, the camera or video encoder establishes a secure tunnel for general communication and audio/video streaming
- After successfully establishing the tunnel, the Axis-OCCC indicates that the camera or video encoder is ready for use

8. **Camera or video encoder added to XProtect Corporate Recording Server**
- The surveillance administrator uses the "Add Hardware" wizard in the Management Client to add cameras or video encoders to a Recording Server
- In the wizard the administrator chooses to import the camera or video encoder from an Axis-OCCC
- This will list all new cameras or video encoders that are registered and connected to the Axis-OCCC
- Once the cameras or video encoders are added to a Recording Server they appear as any other standard camera or video encoder and can be managed normally

Connection flow variations

The connection flow described above assumes that the camera is using the default user name/password and is offline at the time it is registered, but there are actually a total of four possible camera registration scenarios:
- Camera not connected to the Axis Dispatcher at time of registration:
    A. Default user name/password (Default - Described above)
    B. Custom user name/password **(Not supported)**
- Camera connected to the Axis Dispatcher at time of registration:
    C. Default user name/password
    D. Custom user name/password

Note: Scenario B is not supported because the Axis One-Click Dispatcher currently cannot store the custom user name and password until the camera comes online.

The connection flow for scenarios C and D is slightly different compared to the default connection flow listed above because the camera's Axis One-Click Connection button is pressed as the first step. In these scenarios, the connection flow listed above follows this step order: 3, 4, 1, 2, 5, 6, 7 and 8.

Preparation for installing Axis One-Click Camera Connection

Before Axis One-Click Camera Connection can be used on the surveillance system there are a few things that need to be prepared in addition to installing a standard XProtect Corporate system.

Installation of the Axis-OCCC
The Axis-OCCC must be installed on a server and placed on the network in a place that can be reached by both the XProtect Corporate Recording Server and the cameras connecting in from the Internet. The Axis-OCCC is typically installed in a "DMZ,", but if this is not possible or desirable, the Axis-OCCC can be installed within the surveillance network or even on the XProtect Corporate Recording Server itself.

The installation steps of the Axis-OCCC installer are as follows:
1. **Server IP configuration**
   - "External address" is the IP/port that the Axis-OCCC should listen to for incoming camera connections routed through the firewall or Internet router/gateway on the server running the Axis-OCCC
   - "Internal address" is the IP/port that the XProtect Corporate system should communicate with on the server running the Axis-OCCC when registering new cameras in the Axis Dispatcher and when retrieving audio/video streams from the remote cameras
   - **Note:** If the Axis-OCCC is installed on a server where the same IP address should be used for both incoming camera connections and for management from the XProtect Corporate system, both the internal and external address must be entered as this address, but at different ports
2. **External network**
   - The "public IP address" should be set to the public address of the Internet router/gateway of the central XProtect Corporate surveillance installation site
   - **Note:** The address must be an IP address, a DNS name cannot be used even though the text and example in the dialog says that
3. **DNS name**
   - Enter the name of the domain – If no domain is present leave this field empty
4. **Settings for authentication**
   - Select if the Axis-OCCC should require authentication when communicating with it from the XProtect Corporate system
   Note: It is highly recommended to enable authentication to secure communication with the Axis-OCCC
5. **Specify username and password**
   - If authentication is enabled, the username and password must be entered
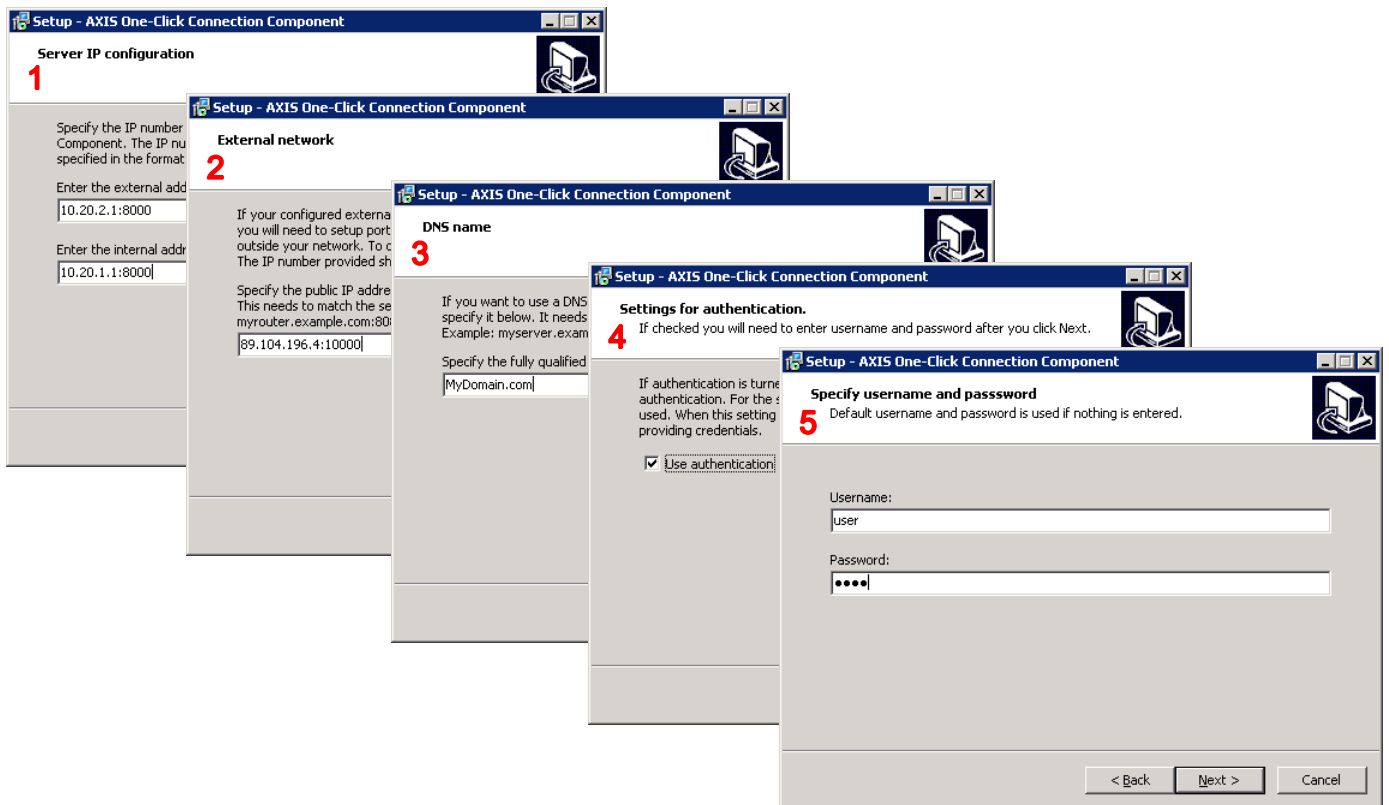
The installer for the Axis-OCCC can be found on the standard admin download page on the XProtect Corporate Management Server
"http://[management-server-address]/installation/admin/default-en-US.htm"
If needed, it is possible to have more than one Axis-OCCC in the system. They just need to be installed on separate servers and configured individually.
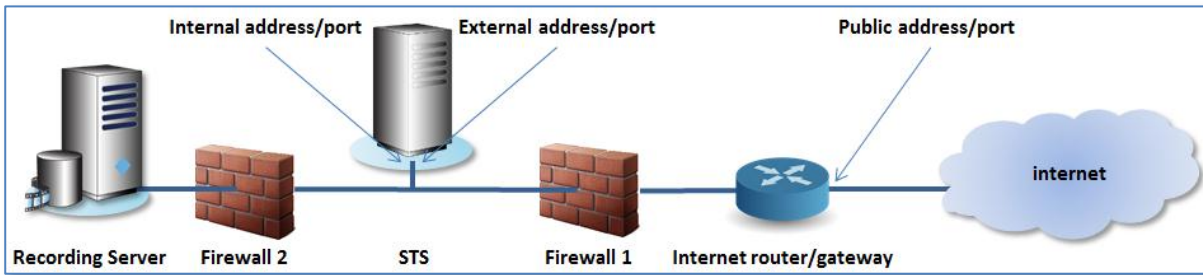
Network configuration examples
Axis-OCCC placed in a DMZ with two network adaptors:
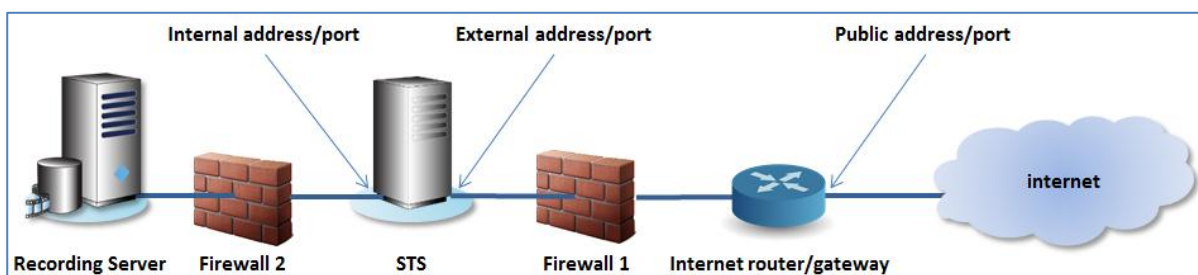
Remarks:
- Camera connection ports must be forwarded through router and Firewall 1 to the Axis-OCCC
- Axis-OCCC configuration and streaming ports must be forwarded though Firewall 2 to the Axis-OCCC
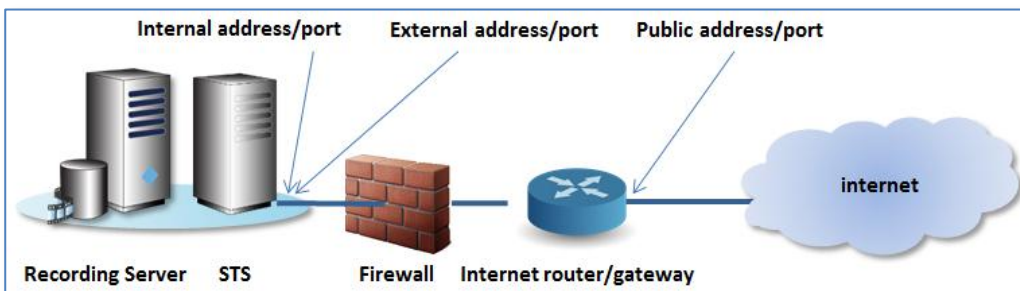
Axis-OCCC placed in a DMZ with one network adaptor:

Remarks:
- Internal and external addresses of the Axis-OCCC are the same, but the ports <u>must</u> be different
- Camera connection ports must be forwarded through a router and Firewall 1 to the Axis-OCCC
- Axis-OCCC configuration and streaming ports must be forwarded though Firewall 2 to the Axis-OCCC

Axis-OCCC placed on the same network as Recording Server:

Remarks:
- Internal and external addresses on the Axis-OCCC are the same, but the ports <u>must</u> be different.
- Camera connection ports must be forwarded through a router and firewall to the Axis-OCCC

Add Axis-OCCC to XProtect Corporate
Once the Axis-OCCC is installed and port forwarding for it has been configured, it must be added to the XProtect Corporate system. This is done within the Management Client under the "Remote Connect Services – Axis One-Click Camera Connection" node.

If there is more than one Axis-OCCC in the installation each of them needs to be registered individually.

Axis One-Click Camera Connection Dispatcher account

In order to register cameras or video encoders to the Axis One-Click Camera Connection Dispatcher via the Axis-OCCC, it is necessary to obtain an Axis One-Click Camera Connection account. The account can be obtained by contacting Milestone Inside Sales.

Axis camera and video encoder support

All Axis camera and video encoders with 4-digit model numbers are supported by Axis One-Click Camera Connection – Currently Mxxxx, Pxxxx and Qxxxx models.

In addition to the current models, all new Axis camera and video encoders released from 2012 and forward will support Axis One-Click Camera Connection.

Benefits of Axis One-Click Camera Connection

The main benefit of using Axis One-Click Camera Connection is that it is extremely easy to connect and set up the camera or video encoder at the customer premises or site of surveillance without having to configure anything in the customer/site network or Internet router/gateway.

The camera or video encoder simply needs an IP address on the network and access to the Internet. Typically, any corporate or home network will work as they normally have a dedicated Dynamic Host Configuration Protocol (DHCP) server or have DHCP enabled in the Internet router/gateway providing the device with an IP address.

Once the camera or video encoder is connected to the network and assigned an IP address, it will dial home to either (initially) the Axis Dispatcher or to the Axis-OCCC in the XProtect Corporate system.

As it is the camera or video encoder that is connecting back to the surveillance system from the customer premises or site, it is not necessary to configure or forward ports in the customer's or site's Internet router/gateway. This also means that it does not matter if the camera, video encoder or the Internet router/gateway gets new local or public IP addresses from time to time or if the camera or video encoder is moved altogether to another location.

This makes the solution extremely easy and flexible to use and it also makes it possible to install the camera or video encoder in locations where it is not possible to control the configuration of the Internet router/gateway.

Use cases

Small company or shop installation

A surveillance system integrator sells video surveillance systems to regional customers, and because the system integrator expects to sell video surveillance to many customers with smaller installations, he decides to offer a centrally managed surveillance solution that

does not require a dedicated on-site Recording Server. Because integrators can manage and record everything centrally, as well as run multiple customers on the same setup, they will save costs on hardware and management of the system.

A small company or shop in the region needs video surveillance with just a few cameras and asks the system integrator for a solution. Because the customer only has a few cameras and no special needs, the system integrator decides to offer a central video management and recording solution using Axis One-Click Camera Connection devices to the customer.

The customer already has an Internet connection, which allows the reseller or system integrator to simply ship the cameras to the customer with instructions on how to mount the cameras, connect them to the network and push the Axis One-Click Camera Connection button on the camera. The rest can then be managed centrally by the reseller or system integrator.

Construction company

A construction company has trouble with thefts of building material from their building sites. To do something about this, they decide to create a "mobile" surveillance installation that can be moved from site to site depending on needs.

To do this, they use Axis One-Click Camera Connection cameras and video encoders which they configure to connect to their central surveillance system. Once the cameras and video encoders have been signed on via Axis One-Click in their headquarters, they can be freely deployed at the different building sites.

On the building sites, they deploy a small network with a wireless access point and Internet access. The cameras and video encoders are then connected either via Ethernet cables or over the wireless network.

Once construction is complete or the expensive materials/equipment have been used or removed, the site's network and cameras can be taken down and moved to a new building site.

Additional use cases

The use cases described above are examples of some typical installations that will benefit from using Axis One-Click Camera Connection, but use is not limited to these types of traditional surveillance installations. The technology could be used in any place where a video feed is needed and it is desirable that connection and configuration on the site is as simple and dynamic as possible.

Axis One-Click Camera Connection can be beneficial for installations such as temporary exhibitions; on ships for central monitoring while loading/unloading in harbor; in private homes temporarily monitoring sick or elderly people; or in vehicles with 3G/4G/LTE Internet connections.

Bandwidth considerations

Cameras using Axis One-Click Camera Connection are typically installed in remote locations and connected to the surveillance system over the Internet. This means the bandwidth of the Internet connection on both the remote site and central surveillance installation sites must be considered.

In the remote site the Internet connection must be fast enough to send the camera stream(s) to the central surveillance installation. Axis One-Click Camera Connection does not change how much bandwidth is used for a given stream, it just provides a means for getting the camera connected to the video surveillance system. It must be carefully considered how much bandwidth each stream may use, especially in cases where the Internet connection is based a technology that offers an asymmetrical bandwidth with less bandwidth upstream than downstream, for example cable, ADSL, VDSL, 3G, 4G, LTE and WiMax.

In the central surveillance installation the bandwidth must also be considered. In this case the bandwidth is downstream data being sent from all the different remote sites with cameras or video encoders, so to calculate the bandwidth needs on the surveillance site, the upstream bandwidth from all remote sites must be added to get the total needed downstream bandwidth on the central site.

The example below shows a setup with 50 remote sites running four cameras each, all being recorded on a central surveillance system. Each camera is configured to stream video in H.264, 8 FPS at 500 Kbit/s.
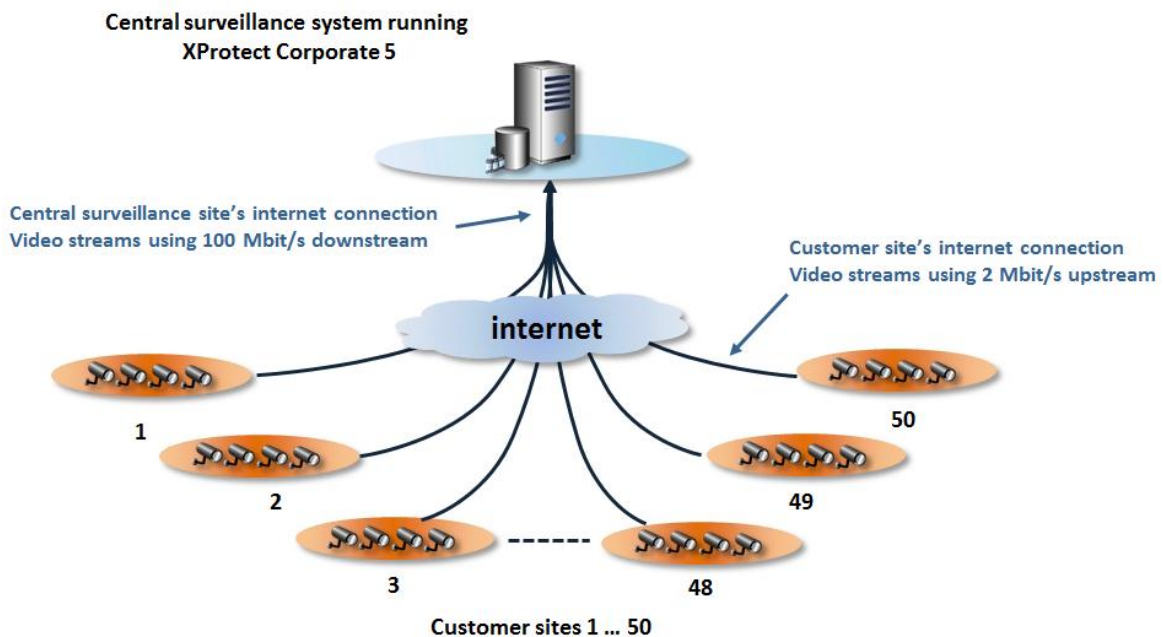

So each site needs at least 2 Mbit/s upstream and the central site needs at least 100 Mbit/s downstream.

Administrator's experience in Management Client

Axis One-Click Camera Connection is located under "Remote Connect Services" and offers all the management interfaces needed for administrating the Axis Dispatcher account, Axis-OCCC (named Axis Secure Tunnel Server in the Management Client) and Axis One-Click cameras and video encoders.

The screenshot below shows where the Axis Dispatcher account credentials must be entered.
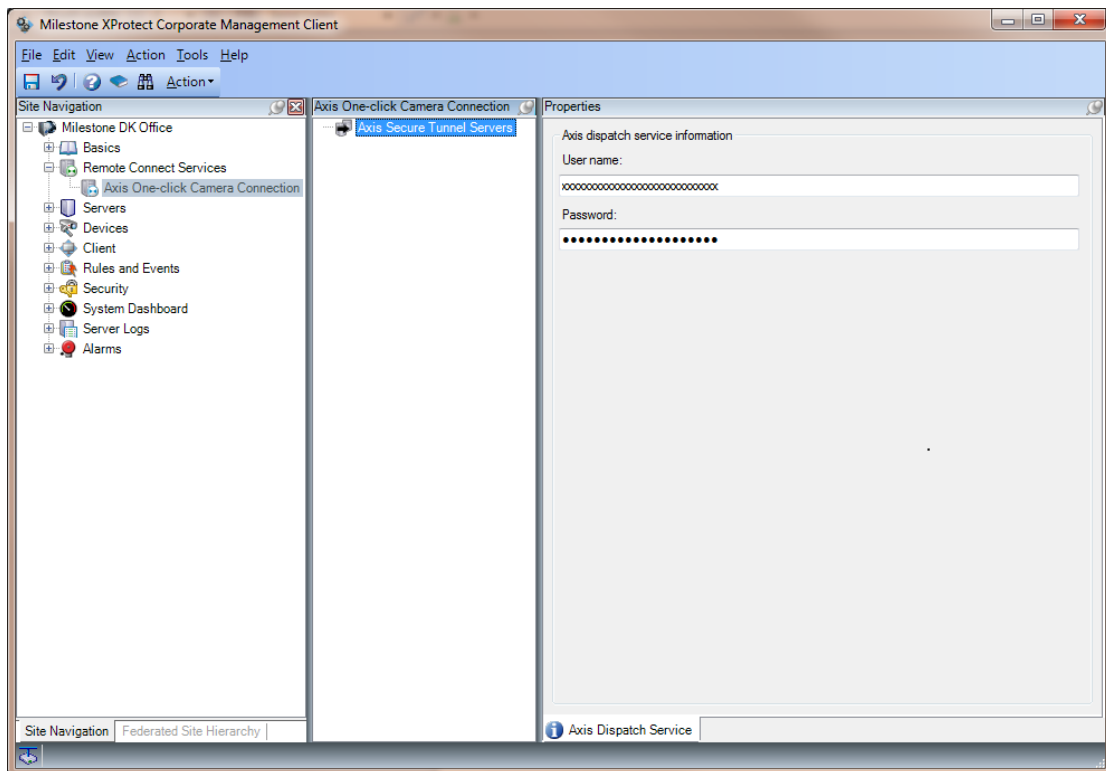
Once the credentials have been entered, the next step is to add at least one Axis Secure Tunnel Server (Axis-OCCC). This is done by right-clicking the "Axis Secure Tunnel Server" node and entering the details for it in the opened dialog.


Note: The "External address" is the public Internet address and port on the Internet router/gateway that the Axis One-Click cameras or video encoders should
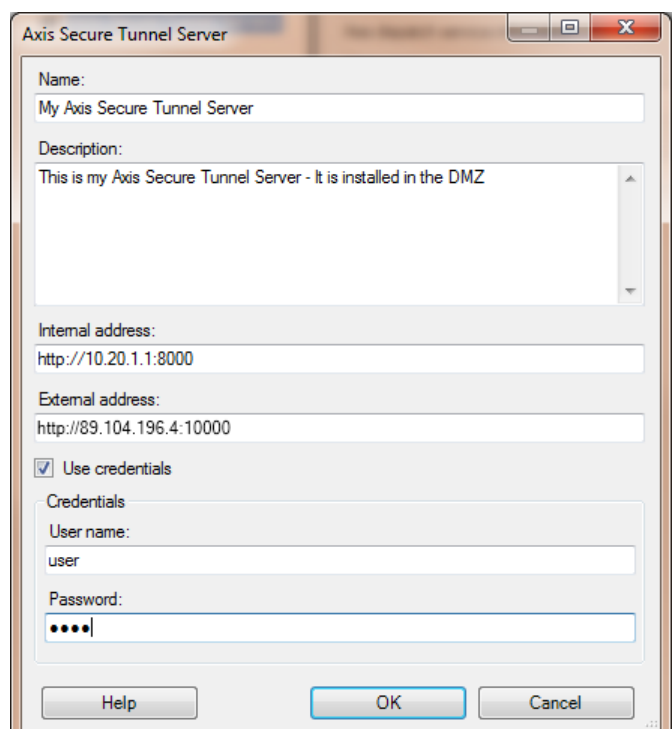
connect to (not the external address/port of the Axis-OCCC).

Before the cameras or video encoders can be added to the XProtect Corporate Recording Servers, they must be registered and signed in to the Axis-OCCC.

Registering the cameras or video encoders on the Axis-OCCC is done by right-clicking the Axis Secure Tunnel Server it should use and then entering the camera details including the Media Access Control (MAC) and OAK
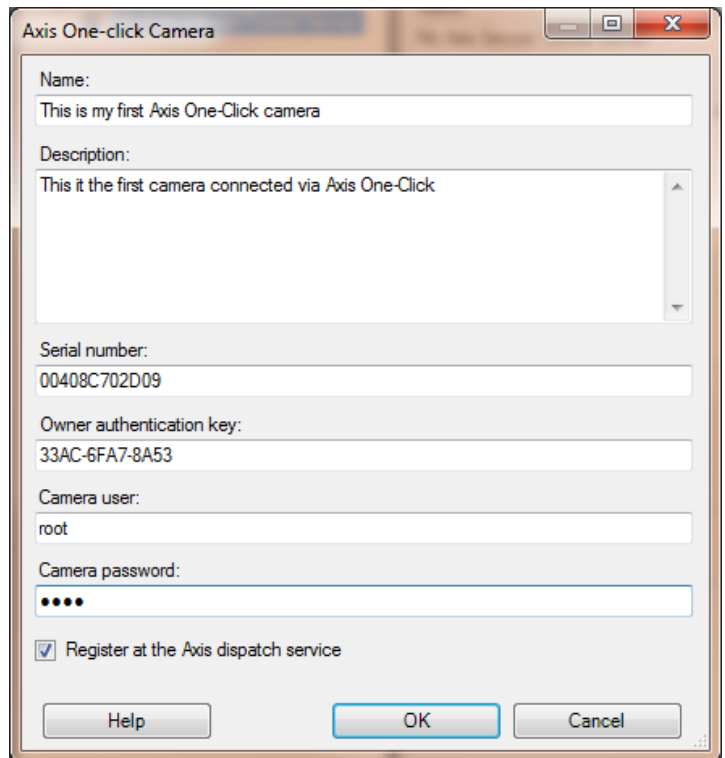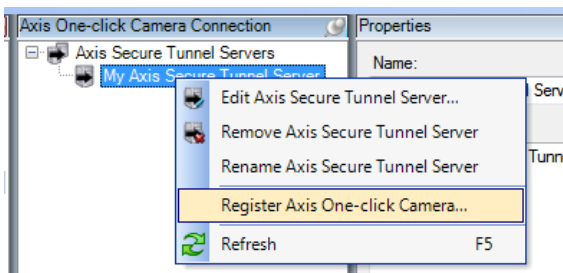

The OAK is provided with the Axis camera, or if has been lost can be retrieved from Axis or alternatively Milestone Support.

The Axis One-Click Camera status will be indicated for each of the registered cameras on the Axis Secure Tunnel Server (Axis-OCCC).

Red = Registered on the Axis-OCCC but not connected to it
Yellow = Connected to the Axis-OCCC but not added to a Recording Server
Green = Added to a Recording Server
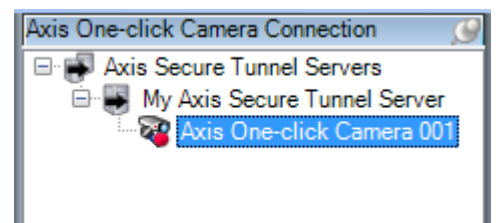
Note: Once the camera is added to a Recording Server the camera indication under the Axis-OCCC will always be green, even if the camera is offline. Because of this, the actual state of the camera must be monitored under the Recording Server like any standard camera.

Once the Axis One-Click device(s) have signed in to the Axis-OCCC they can be added to an XProtect Corporate Recording Server by using the standard "Add Hardware" wizard and selecting the "Remote connect hardware" option.

Note: Axis One-Click Camera Connection devices do not support hardware events, such as motion started/stopped, tampering or tripwire.
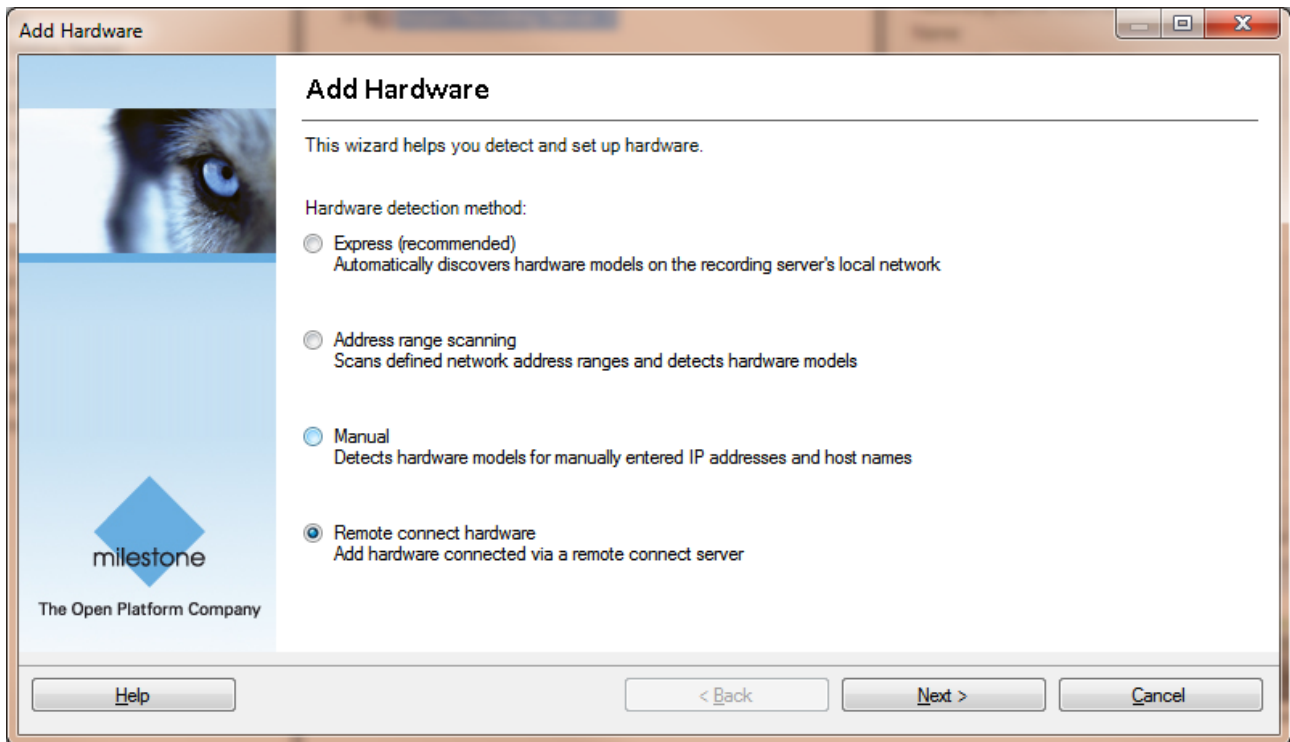
User's experience in clients

Once the cameras have been added to the XProtect Corporate system's Recording Servers, they will appear in the clients like any other standard camera and the operator can use them like he would any other camera.

Summary

Together, Milestone XProtect Corporate and Axis One-Click Camera Connection provide the perfect solution for remote surveillance or monitoring of customer premises or remote sites.

Once the XProtect Corporate system with Axis Secure Tunnel Server is installed and configured, it is very simple to deploy cameras at customer or remote sites. It is simply a matter of plugging the camera into a network with Internet access and pressing the "One-Click Camera Connection" button on the camera – it could not be simpler than that.

About Milestone Systems

Founded in 1998, Milestone Systems is the global industry leader in open platform IP video management software. The XProtect platform delivers powerful surveillance that is easy to manage, reliable and proven in thousands of customer installations around the world. With support for the widest choice in network hardware and integration with other systems, XProtect provides best-in-class solutions to video enable organizations – managing risks, protecting people and assets, optimizing processes and reducing costs. Milestone software is sold through authorized and certified partners. For more information, visit http://milestonesys.com

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