

Upgrading Your CCTV System to IP-Based Video Surveillance

Abstract:

The purpose of this white paper is to provide an overview of upgrading an analog CCTV system to an IP, or networked, video surveillance system. This white paper includes the benefits of an IP video surveillance system, reasons for keeping some components of your analog system, and high-level design for a system that will be easy to upgrade as new technology becomes available.

Reasons to Upgrade Instead of Replace CCTV Systems

IP (Internet Protocol or "networked") Video Surveillance offers many advantages over analog CCTV systems, but that doesn't mean that you should necessarily throw out your old CCTV system and replace it with a new IP Video Surveillance (IPVS) System. There are many reasons that parts of your analog system (and the investment you have made in it) should be preserved including:

- You may have purchased high-quality video cameras that still have a long life ahead of them
- You may use the system primarily for real-time viewing
- You may have a large investment in cabling to existing CCTV cameras
- You can upgrade your existing CCTV system, thus preserving your existing investment, while experiencing the many of the benefits that true digital recording and distribution offers.

Overview of IP Surveillance Systems

An IPVS system is completely standards-based. It uses the same cabling, PCs, and disk drives that you use for data connection and storage in your office. An IP video surveillance system consists of the following:

- One or more digital "network" cameras
- A standard Ethernet network, either shared or dedicated
- A central management server
- One or more client viewing stations
- A digital storage unit

Cameras

IP cameras contain a digital CCD or CMOS sensor, along with an embedded microcomputer to do image processing and interface to the network. Both the digital video output frames from the camera and camera control information flow through standard Ethernet.

Network

The standard computer network that supports the digital video flow and the camera control information are identical to those that support the data flow between office computers, servers, and printers. Network cable, switches and wireless interfaces are standard hardware products. These are widely available and inexpensive. The network for the IP surveillance cameras is often shared with an existing, installed data network. This is appropriate if the current network is 100base-TX or Gigabit Ethernet. Some organizations may desire to run a dedicated network, or a partially dedicated network for the IP surveillance system. Sometimes organizations choose to upgrade an older

network, providing improved data functionality as well as supporting networked cameras.

Server

The central sever is often a standard Windows-based desktop computer, typically running the camera server software as a dedicated application. The server may physically connect to the network at any point. A standard mouse, keyboard and computer monitor connected to the server typically function as a real-time monitoring station.

The combination of the server plus storage is often called a Network Video Recorder.

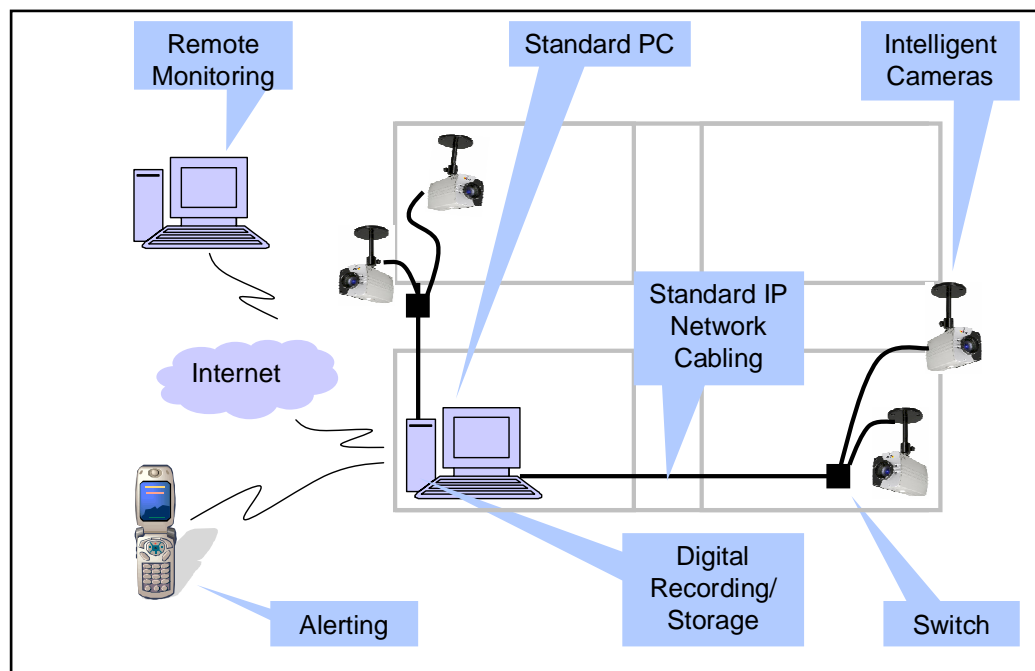
Viewing Stations

The client viewing stations are standard office PCs or laptop computers. The client viewing is via either a simple Windows application or via a standard web browser. Multiple client viewing stations are easily supported anywhere on the network or anywhere in the world, connected to the server via the Internet. PDAs may also be used to view video, as well as to control cameras. The PDA capability of IPVS systems may substantially improve emergency response, crowd and event control, and facility maintenance, by placing key information directly into the hands of personnel in the field.

Storage

The digital storage unit is a standard disk subsystem, consisting of one or more disk drives. Often, multiple disks are used to provide fault tolerant video storage and to store many days of video automatically. A RAID-5 system that holds 14 days of video is the most common configuration. The disk subsystem is normally connected to the server; however it may be placed anywhere on the network, or even remotely via the Internet.

Figure 1: IPVS components



Benefits of Upgrading an Analog CCTV System

Future Flexibility and Upgradeability

One of the largest benefits of an IPVS system is that it is completely standards-based. Using a standards-based system allows you to take advantage of all the latest innovations in technology such as lower cost disk storage, or motion-tracking cameras. It also provides future flexibility, because you are not locked into any one vendor. You can pick the best-of-breed products today and in the future. Software, servers, storage capacity, cameras, network equipment and other features such as remote monitoring may be upgraded or added at any time, without fear of compatibility issues.

Remote Monitoring

The ability to see images from your cameras anywhere in the world is a very important advantage for IPVS systems. Being able to view the images from any camera on any PC on or off the premises provides the ultimate flexibility. Field-based PDAs may be used to both view video, and control cameras.

Efficient Use of Recording Media

IPVS systems have sophisticated software that provides many features including recording only when there is motion. This saves disk space and makes it dramatically faster to locate and archive relevant video clips.

Although Analog CCTV systems only record at an average of 1.85 frames a second, they do provide a higher frame rate for real-time viewing.

The viewing of an IPVS system will be the same frame rate as the recording – typically set at 4-6 frames a second. Camera frame rate may be programmed to increase automatically, following motion sensing.

If you are using your CCTV system for real-time monitoring, you may want to retain that capability by just adding IPVS to your system.

Specialized Alerting

The software also has advanced alerting capability. The software can provide alerts under the following circumstances:

- People traveling the wrong way in crowded environments such as airports
- Motion in just one section of the camera view
- Discrimination between animal, human, and vehicle motion
- An object that is removed from a location
- A new object appearing in a scene, such as a package left under a seat

All of the above can create a virtual “trip wire” that sends out an alert to a PC, pager, or cell phone.

Ease of Finding Video Clips

The software for IPVS systems makes locating a given video segment much easier. The software provides the option of only recording when there is motion (with a 30-second pre-motion buffer) so that the file size is optimized. The software also allows you to choose a location in the frame and then search for a time when something changes in that location. Saving or emailing critical video clips requires only a mouse click.

Better Quality Recording

The average recording rate for an analog system is 1.85 frames a second. The average recording for an IPVS system is 4-6 frames a second, which provides significantly higher quality recorded video. This recording capacity is generally limited only by available disk space and bandwidth.

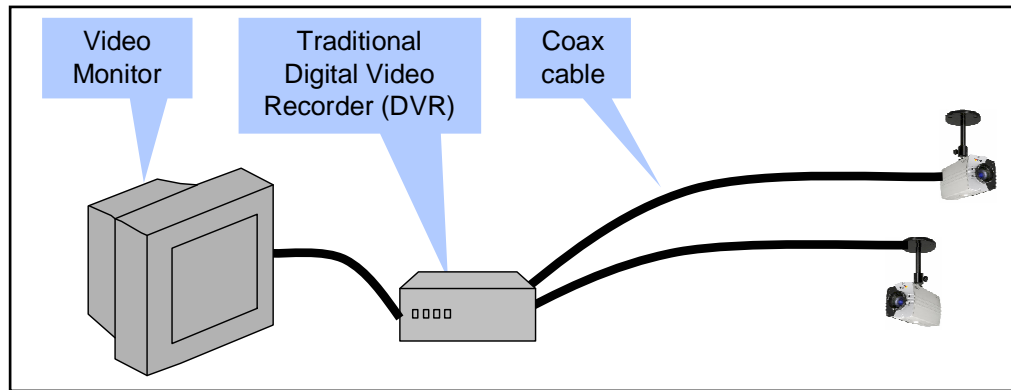
Options for Upgrading

There are three options for upgrading, instead of replacing your CCTV system including:

1. Adding IPVS
2. Upgrading the back-end only
3. Upgrading everything except the cabling

You may choose any of these options, or a combination of these options based on your existing system and your individual needs.

Figure 2: Existing Analog CCTV System

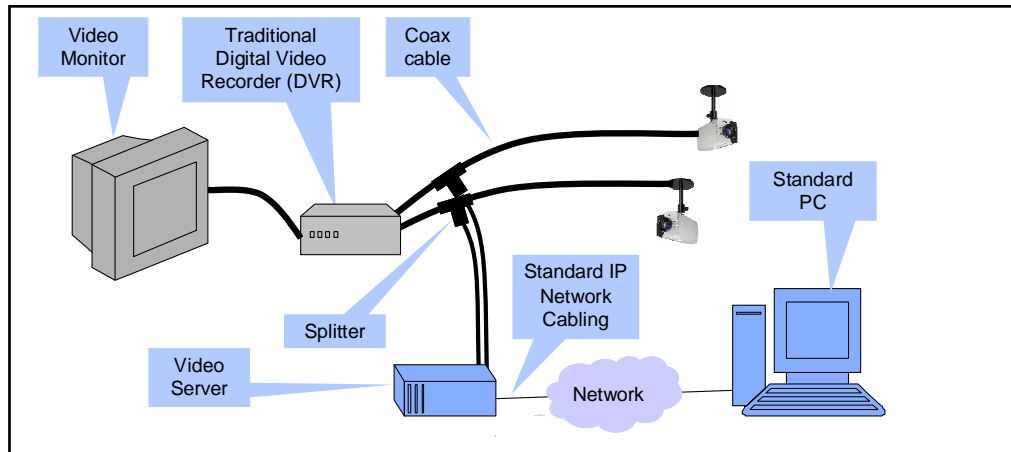


Adding IPVS

If your existing CCTV system is set up just the way you need it, you are satisfied with the existing cameras, then you may want to simply add IPVS capability to give you the additional features of IPVS as well as easy expansion capability.

A video server can be added, serving any number of cameras, which will convert the analog images to digital. Once this is added, IPVS software can be used on a standard PC to provide all the features of IPVS including selective recording and remote viewing.

Figure 3: Adding IPVS to an Analog System



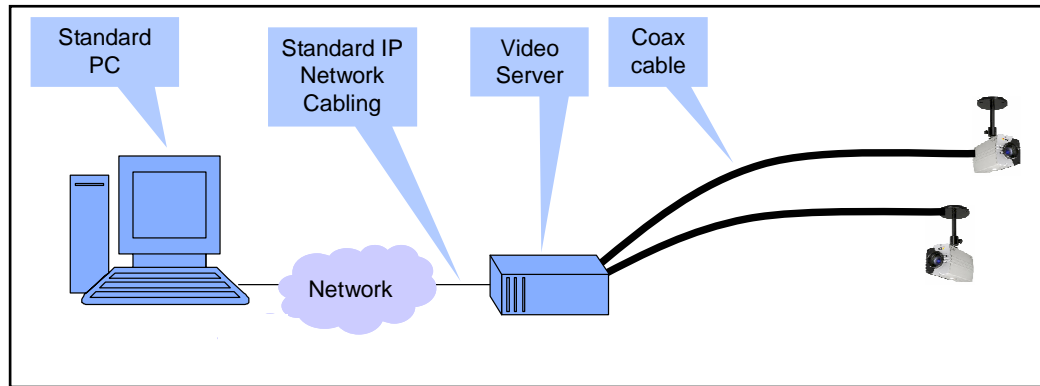
Upgrading the Back-End Only

If you are not tied to your existing guard-station viewing screens, and you have good quality analog cameras in the locations you need them, you may want to upgrade only the back-end of your CCTV system to provide all the features of an IPVS system.

This upgrade is accomplished by replacing the DVR with a Video Server. The video server converts the analog images to digital and then sends them via standard Ethernet

to the PC. The software on the PC then provides all the sophisticated recording and video capability listed in the section above under “Benefits”.

Figure 4: Upgrading the Back-End Only



Upgrading All Except the Cabling

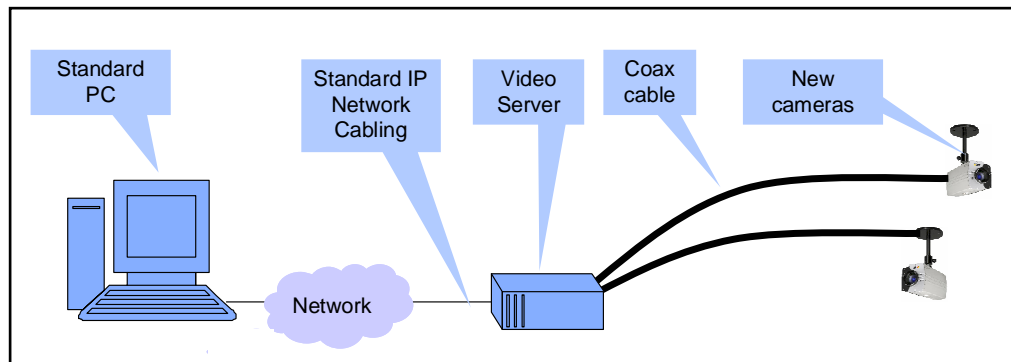
If you don't have high-quality cameras, but the cameras are in the right locations and you have a substantial investment in cabling, you can upgrade both the backend and the cameras, maintain the cabling, and still experience all the advantages of an IPVS system.

There are cameras available from both Sony and JVC that have the option of connecting to either coax or Ethernet. These cameras provide the ultimate flexibility.

This upgrade is accomplished by replacing the DVR with a Video Server that is available in 1 or 4-port models. The video server converts the analog images to digital and then sends them via standard Ethernet to the PC. The software on the PC provides all the sophisticated recording and video capability listing in the section above under “Benefits”.

The one limitation to this configuration, as opposed to replacing the entire system with IPVS, is proving uninterrupted power supplies to the cameras (see special considerations below for more detail).

Figure 5: Upgrading All Except the Cabling



Special Considerations

There are certain configurations that upgrade easily and others that are more difficult. Analog Pan Tilt Zoom (PTZ) cameras are difficult to convert to IPVS.

Another reason to keep analog cameras is lower replacement cost in high-vandalism locations. Although both analog and network cameras may be placed in vandal resistant housings, in some applications these housings are either too large or are ineffective. For example, spray paint or tape can temporarily blind any camera, in any housing.

One of the advantages of an IPVS system is that the cameras are often powered from the room as the digital recording server. This allows a single Uninterrupted Power Supply (UPS) to maintain the power to the entire system. Since analog cameras are usually powered locally, you will not experience this advantage of running a single UPS as you would for a pure IPVS system.

One potential issue with replacing cameras is the power. The power to the existing cameras may not be the same voltage as that of the new cameras. In such cases additional power will need to be run to the new cameras.

It is best to consult with a local IPVS specialist to better understand how your CCTV system can be upgraded and how other special considerations may apply to your specific configuration.

About Ojo Technology, Inc.

Ojo Technology is a solution provider and systems integrator with expertise in both security and in data networking. Ojo specializes in complete customer specific IPVS solutions for educational institutions, local governments, manufacturing, and other organizations. Whether developing a completely new IP surveillance solution, or upgrading and enhancing an existing analog video surveillance platform, Ojo Technology delivers the complete solution including design, hardware, software, data cabling, electrical, and installation services. Ojo Technology also provides user training and offers remote management/monitoring services. Learn more about Ojo Technology online at www.OjoTech.com.