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# An Insight to the Differences Between IP and Analog CCTV Systems

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## **Introduction**

Video surveillance offers powerful, effective, and affordable security protection for both residential and commercial area. Technological innovations have made video surveillance options customizable and scalable tailored specifically for your purpose. Changes in CCTV technology have been driven by three main requirements. The first is the need to reduce the cost of recording and storing video for long periods. The second is the need to reduce the amount of space required by these systems. And the third is the need for improved accessibility.

One of the most significant technological changes in the CCTV market is the advent of the so called "IP cameras." Despite the fact this technology has been available for quite a few years it is only recently that IP CCTV has been given importance. In the past years little objective information has set IP CCTV apart from the analog cameras, which has been powering the industry for decades.

It's not uncommon when approached with the choice between IP and traditional analog CCTV one tends to lean on the traditional analog system. There are two primary reasons for this: complexity and price. To counter both of these objections one must explain the key differences between the two systems. A detailed insight to both systems will help to distinguish key points between analog and IP.

## **Analog CCTV System**

As with any imaging device, the analog CCTV camera has a sensor which captures the video image. The resolution of the sensor varies, but is limited to 720x575. This is 720 pixels across the screen (horizontal resolution) and 575 up and down (vertical resolution). The video is



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captured at 60 intervals called "fields" and transmitted to the receiver. Two fields together are called a "frame." This is called interlaced transmission.

The structure for an analog CCTV system is as follows. A single coax cable and power cable (12v or 240v) connects the analog camera to the DVR and power supply. The length for coaxial cable between the DVR and the camera may be over 700m. The signal is sent to the DVR (Digital Video Recorder) where it is recorded on a hard disk. The DVR is capable of transmitting the video signal live on a monitor connected to the DVR and if there is an internet connection one can transmit the signal over internet to any device with internet access for remote viewing. The image below (Fig1) shows the latest structure for Analogue CCTV systems.

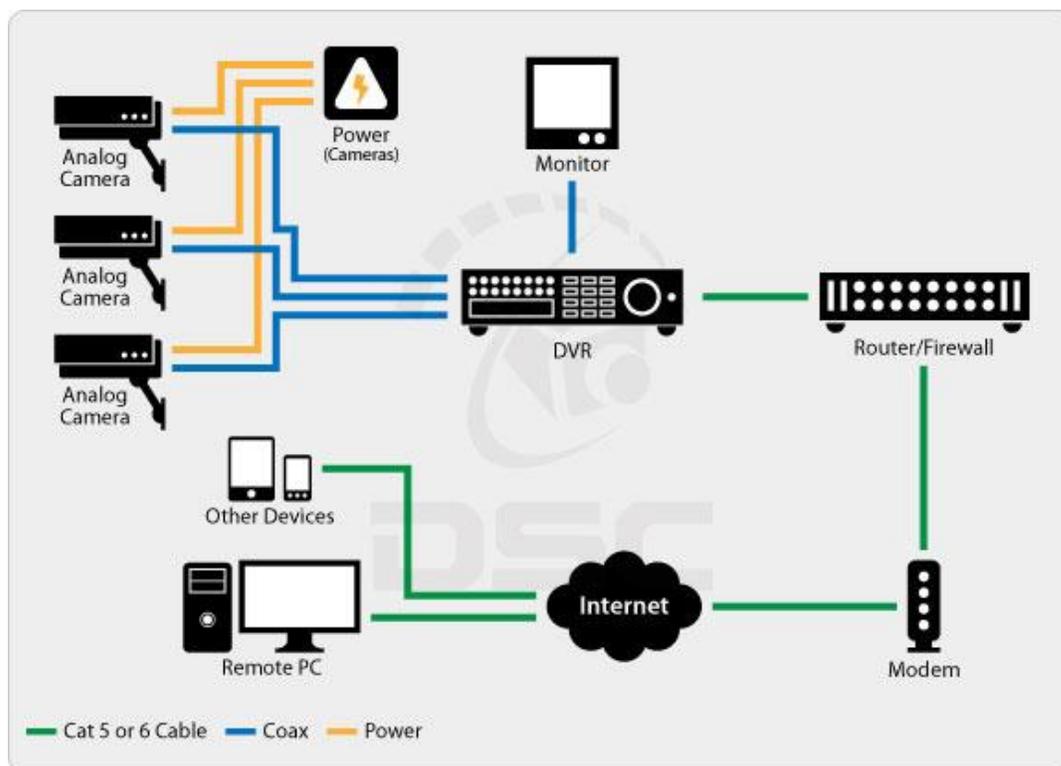


FIG 1: Analog CCTV structure.



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Analog video is a universal standard and has been for several decades. Virtually any analog CCTV camera can be plugged into any DVR, regardless of brand. While there are regional varieties of analog video (NTSC, PAL and SECAM), cameras available in a region conform to that region's standard. Many analog cameras and DVRs work with any of the standards. So CCTV literally is as simple as plugging a cable into the camera and into a DVR. However, that simplicity is accompanied by significant limitations.

## **IP CCTV SYSTEM**

An IP camera has an image sensor much like the analog camera. However, once it has captured its image, it transmits it as "data" over a network connection. That data is in the form of compressed video frames sent over standardized networking protocol used for computer applications which is where it gets its name. "IP" stands for Internet Protocol which is the low-level language used to transmit data between computers in your home and the Internet. What this implies then is that the IP camera is like a little computer that you connect to, to access your video. Indeed, IP cameras are computers and run operating systems not all that different from the PC.

The fact that the camera uses IP for transmission is not very important. What is important that we are no longer bound by the broadcast standard. In theory, one could now have any resolution we wanted. You could as easily envision a camera with 10,000x2000 pixels as you can 800x800.

As the resolution climbs above broadcast level, the sensor type will always be progressive.

By convention, IP camera companies advertize the resolution in "megapixels." To arrive at megapixels, simply multiply the horizontal resolution by vertical and divide by one million. If a camera has 1280x720 resolution, it would have 0.9 million pixels but this is often rounded to one megapixel.

A useful feature of some cameras is the ability to capture a subset of sensor data. Since an IP camera tends to have a lot more resolution than its analog counterpart, one can still have ample resolution left for the "area of interest," allowing users to save hard disk space in the recorder.



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## IP CCTV Structure

The structure for IP CCTV is slightly more complex than analog CCTV. IP CCTV requires UTP cable i.e. Cat 5 or Cat 6 cable. UTP cable connects the IP camera to the POE switch (Power of Ethernet) Maximum distance of 100m. The POE switch will power up the camera. The camera itself compresses and encodes the digital signal and then sends it to the NVR via IP (Internet Protocol) The NVR then records or copies the actual video file from the camera and as there is no conversion between digital and analogue and back there is no loss in picture quality. Instead of an NVR a server computer may be used with management software for detailed surveillance. Once the recording station is connected to the Internet authorized users may access the cameras live at any point in time at any location as long as internet is available. Figure 2 shows a typical IP CCTV layout.

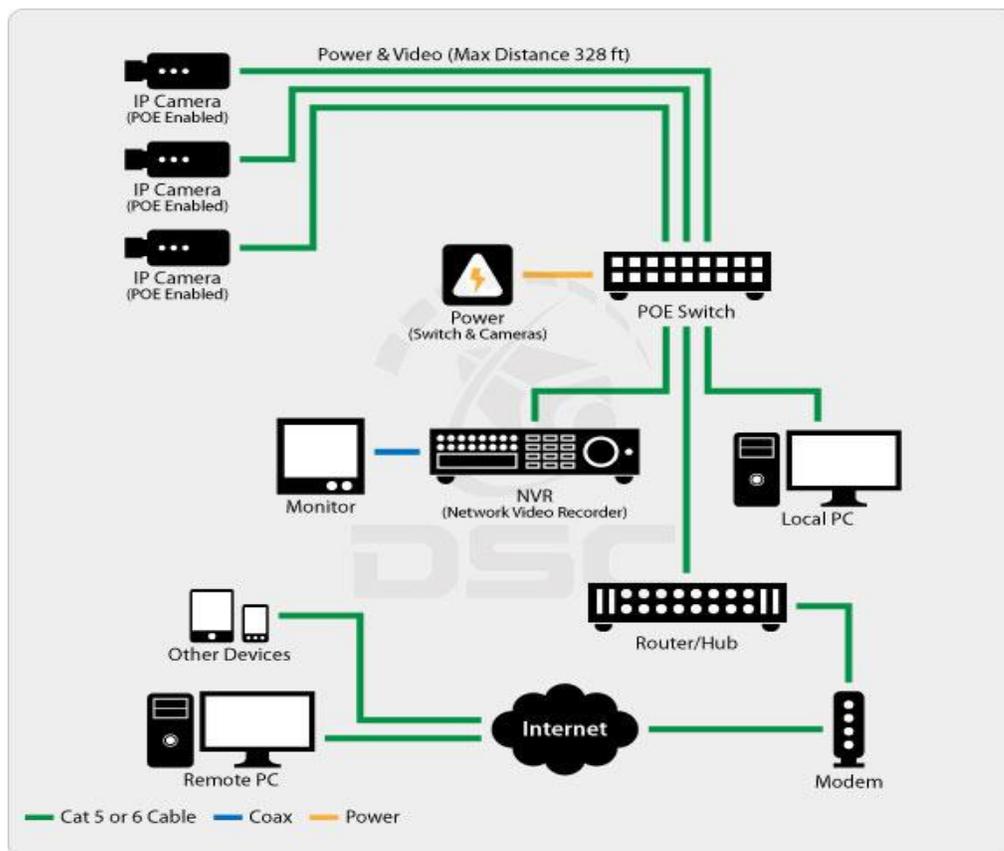


FIG: 2 IP CCTV Layout



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# IP VS Analog

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## **Advantages of analog systems over IP systems**

### **Analog CCTV systems are often less expensive overall**

Analogue CCTV products are at this point in time still cheaper than their IP counterparts – NVRs can be twice as expensive as a DVR for example. The installation of an analogue surveillance system can also be less expensive because they are quicker to install with minimal network set-up and configuration.

However in some situations a single IP camera can be installed in the place of a number of standard analogue CCTV cameras therefore one recommends looking at both options before making a final decision.

### **Analog CCTV systems are easier to maintain**

Overall analogue systems need little maintenance once installed. It is recommended to perform a basic check once a week to confirm all cameras are recording and footage can be retrieved from the DVR.

Since an analogue system is not attached to the business or home network it won't be at the mercy of network issues. Large file sizes, limitations to the bandwidth, viruses or too many devices trying to use the network (congestion) are just some of the challenges facing the installation and ongoing maintenance of an IP system.

### **Longer cable runs with analogue CCTV cameras**

IP camera cable distances are limited to 100 metres between the camera and network switch by structured cabling regulations. It is possible to run Cat5 cabling that will allow analogue cameras to be mounted up to two kilometres away from the DVR.



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## **Mix and match analog surveillance products**

Virtually any analogue CCTV camera will plug in to any DVR allowing you to easily customise and upgrade your system. An IP megapixel surveillance system is set up specifically to work with the network protocol it is designed for. This means different IP camera and NVR brands may not be compatible.

## **View analog footage in true real time**

Because the image from an analogue CCTV camera is processed and compressed at the DVR (not the camera) it can be viewed live with no delay. IP cameras can experience 'lag' for up to 2-seconds which can cause issues in some situations.

## **Advantages of IP systems over analog CCTV systems**

### **IP CCTV systems offer far superior image quality**

The biggest advantage with a megapixel CCTV system is much, much higher resolution pictures. Today IP cameras range from 1.3 megapixels to 5 megapixels and this resolution is retained by the NVR. That means you will see the same level of detail when you play back your recorded footage and take stills from it. An analogue CCTV system can produce a maximum of 700 TVL which is equivalent to around 0.4 megapixels.

Older technology DVRs record in CIF gives about a quarter of the detail you got from your old, non HD TV. Today's DVRs record in 4CIF which gives about the same level of detail as that same non HD TV. To get resolution that is similar to a HD (high definition) TV you need a megapixel IP camera system.

One may ask, is the image quality all that important? In many instances, yes, particularly if you need to capture detail such as face recognition, to see what is being picked from your warehouse or what changes hands over your till. Poor quality images captured by basic analogue systems can be all but useless for retrieving detail or attempting a positive identification. It is very important to take the time to consider the issue of image quality very carefully.



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## **Megapixel cameras cover a much wider area than analog CCTV cameras**

An IP camera can cover a much wider area than a standard analog CCTV camera – for example a single megapixel camera can often easily cover the same area you would need up to four analogue cameras for. This means in some situations installing an IP surveillance system is actually more cost effective plus you get the benefit of much more user-friendly footage from a single camera.

## **IP systems offer much more powerful search functions**

Another advantage with an IP system is the playback and search functionality is much better than even the most advanced analogue DVR. An NVR will include such features as object search – if an object goes missing one simply draws a box around the space it was in and the NVR will automatically search out activity in that area. When considering a CCTV system for a warehouse or a busy retail or restaurant environment it is likely the users will often need to refer back to recorded footage. Don't underestimate the time (and money) savings possible with an IP system's back-end functionality – it can make a big difference.

## **IP systems offer superior expansion and wireless opportunities**

An IP camera can be simply wired in to the nearest network switch where it uses the existing network infrastructure to take the video signal back to the NVR. This means some IP system installs require less wiring than an analogue system would. Analogue CCTV cameras also need to be wired directly back to the DVR which can limit the ability to install them in some situations (or make the installation very expensive).

IP cameras can also be integrated with a wireless network allowing almost unlimited expansion. Analogue wireless CCTV systems are fraught with problems, particularly from interference on the radio frequency band they transmit on (this is becoming more and more prevalent).

## **IP systems are likely to be the future of CCTV**

The reality is we now live in a high definition world. More and more companies (and home owners) are upgrading existing analogue systems for IP. Eventually IP systems will be the



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standard for CCTV installation. The technology is changing so quickly that there is always a newer and better option six months later in for both analogue and IP products. However, IP will provide you with a longer term solution.

## **Conclusion**

There is no one size fits all when selecting the two competing technologies, or the sub-technologies within each architecture. It really does depend on the specific needs, and priority of the user. It also depends on the sophistication of the people who are going to use it. If the user requires a small surveillance system, then analog CCTV system is the best solution, it will be cheaper, easier to set up and maintain.

If a network structure already exists and the requirements are of a larger demand and high definition is a must, then an IP setup would be far more ideal.

While IP cameras have been around for more than a decade, they still only represent 15% of the overall CCTV camera market. IP cameras are technologically immature and have a long way to go. Today's models will be quickly replaced by higher quality, more efficient, feature-rich, less expensive and more reliable products.

Analog cameras are stable and mature and have a well defined history and roadmap and purpose. Analog cameras will continue to make more sense in most applications as indicated by its continued market share dominance.



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