

Analogue versus digital

The digitalisation of technical devices is unstoppable and has already resulted in a significant increase in flexibility within video monitoring technology. In the last five years, renowned manufacturers have invested enormous amounts of money in development and now provide interested customers with a vast but cluttered range of components and systems. To market these products successfully, the manufacturers often swamp customers unfamiliar to the market with empty technical phrases and slogans that the consumer simply can not correctly evaluate due to lack of experience.

With this article, Michael Meissner from HeiTel Digital Video GmbH, intends to provide a neutral, differentiated survey of both technologies.

By Michael Meissner

The general statement that new digital (IP) technologies are better per se than old analogue technologies is not strictly correct. As so often in life, there are two sides to the coin: Both technologies have their advantages and their disadvantages, and these should be analysed separately depending on the application or the intended use of the video monitoring equipment.

Advantages of digital technology

- Higher resolutions may be possible depending on the product, allowing details to be recognised more easily.
- Digital zooming is possible using megapixel cameras.
- Normally, IP cameras can be more easily configured during installation via browsers or software.
- Subsequent system expansion of the cameras as well as of single cameras can be made using all-digital systems.
- There is less noise on (video and control) lines during digital signal transmission.
- If the system is small, the existing network can be used (after a previous check) without causing any performance drops when operating the hardware and software within the network.
- Live or archive pictures can be

made available to all users with suitable access rights within the network on their workstations.

- In all-digital systems, the storage capacity of video depends solely on the size of the hard drive(s) on the server.

Disadvantages of digital technology

- Currently, most IP cameras are inferior to cameras with respect to light sensitivity, low-light colour fidelity, dynamics and resolution (if the camera is not a megapixel camera).
- Frame rates of megapixel cameras that have to transfer and store frames at their highest resolutions can usually not be achieved in real-time due to the significantly increased volume of data.
- The selection of lenses suitable for megapixel cameras is still very limited. It will take time until all current zoom lenses are available for megapixel use.
- IP cameras from different manufacturers are not compatible to each other. This means that if you want to make a multivendor replacement of vital technical components (e.g. HDVR, NVR) or of the video management software (after lets say a period of two years), this is much more difficult than when using analogue cameras working



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with the standardised PAL signal (therefore making them compatible to each other).

- Due to a lack of compatibility, single IP cameras have to be integrated into multivendor hardware and/or software platforms. Due to the design of the system, this often results in a limitation in function during the integration process, as all of the technical features of the IP camera can not always be integrated into these various platforms.
- In particular when it comes to the full-motion picture compression method (e.g. H26x, MPEG-2, MPEG-4) there are often extremely high latency times when operating pan/tilt heads and high speed domes.
- Costs of data protection are also much higher than when using conventional analogue technology – especially when using existing networks and computers. In addition to configuration of video devices themselves, extra administrative time and cost must be calculated for network configuration of routers, switches, repeaters, servers, etc.

Aspects to be considered during installation

Using wire-based analogue video signal transmission, transmission ranges of up to 300 metres can be achieved using one single 75 ohm

coaxial cable (0.6/3.7) without any intermediate amplification. When transmitting digital video signals within local networks, intermediate amplification is already required after 100 metres. This intermediate amplification within the network area is usually carried out using classical components such as switches or repeaters. During the planning and configuration phase, the cost of these components plays an important role, especially when new wiring is required. If network cable connections for external cameras are much longer than 100 metres, this must be taken into consideration. Understandably, the use of in-house network lines in outside areas is not without risk, and requires additional protective measures, even if the network in question is an autonomous video network. In most cases, those arguing for digital technology often completely forget to mention the costs for signal amplification and additional safety measures. Some IP cameras have integrated PoE (Power over Ethernet) supply modules. This ensures that the IP camera is supplied with power by the existing network line. The advantage of this is clear: No separate power supply is required. However, depending on the power consumption of the IP camera, the number of cameras that can be installed between two switches using the integrated PoE function is limited. Additionally, star-distribution wiring to the network cameras is also required. Furthermore, when using outdoor cameras, PoE can often not be used at all due to the larger distances that have to be covered.

Commercial aspects

Due to the use of in-house networks, many companies appoint their own IT departments with the planning and acquisition of video monitoring equipment. In the past, when conventional analogue technology was used, the maintenance department was





often appointed this task. The fact that IT budgets are often much higher than comparable budgets for maintenance will tend to push the use of digital technology.

Marketing slogans

If we are to believe the marketing hype of many brochures and product reports, then the modern user simply must use digital technology, and only digital technology, as this is the current trend. In the following I will be testing the content of such marketing statements (1 – 5) and putting them into their total technical context, thereby illuminating both their advantages and disadvantages:

1. Megapixel cameras have higher resolution

IP cameras that use megapixel image sensors do indeed have a higher resolution (and thereby more clearly structured detail) than an analogue CCD camera limited to a maximum of 440,000 pixels (due to the PAL standard). Digital zooming, whereby a part of the picture is zoomed within the frame, is thereby possible. However: the higher the pixel count, the smaller will be the corresponding pixel, and the camera loses light-sensitivity proportionally. This means that under certain circumstances a lot more effort and cost must be made for lighting within the area to be monitored.

Tip: In identical conditions, compare an analogue camera to a digital megapixel camera from directly within the object being monitored.

Pay good attention to the light-sensitivity and to colour fidelity, especially when lighting conditions are poor. The user only profits from a camera with a megapixel resolution when this high resolution is not simply „lost“ due to additional components connected downstream for transmission or recording. A good example of this is when a VGA resolution has to be converted to MPEG for performance reasons. You should therefore make sure that both the lens and the connected recording and display devices support the high resolution of the camera.

2. Progressive scanning is better than frame scan

The PAL method for analogue cameras is based on 50 frames/second (fps), subsequently interlaced into 25 fps. As the 50 frames are exposed consecutively (at an offset of 20 milliseconds per frame), fast movements may result in a jitter effect, making the still picture on the monitor unclear. Blurring then occurs when this picture is stored or printed. With digital cameras, no (semi-) frames are generated. Instead, you get full-frame, non-interlaced pictures. This is called progressive scanning. However, in all the marketing hype the digital enthusiast often forgets to mention that professional analogue cameras have already been equipped with electronic shutter functions for almost 20 years, thereby allowing them to present even the fastest movements with extreme clarity and sharpness.

Tip: If you need to detect fast-moving objects within the scene you are monitoring then have the definition shown on the monitor both as live picture and as archive picture.

3. IP cameras provide better quality

The quality of a picture is the result of a combination of various technical factors. Among these are resolution, colour rendering, light-sensitivity, contrast, brightness, dynamics when there is backlighting (contra jour), depth of focus, etc. Such a generalised statement is therefore not correct. In particular, IP cameras provided by manufacturers not within the CCTV branch are often clearly inferior to analogue cameras, especially in these disciplines. By the way, a webcam costing 19 € is also an IP camera!

Tip: In the scene you are monitoring, compare an analogue camera to an IP camera and insist on being shown the advantages. Ultimately, you are the person who decides whether the picture quality of an IP camera is really better or not. And don't forget: cameras should also be able to provide acceptable pictures at night in low-light conditions or in artificial light.

4. IP cameras can be easily integrated into existing networks

This statement is true when the responsible system administrator has first cleared up all of the problems circulating around the topics 'safety in the network' and 'network loads'. If video systems are already incorporated into the network then it is relatively easy to increase the number of cameras. Be careful if you hear the following: 'Camera locations can be installed or changed easily simply by plugging the camera in or out of the network socket' This statement is only correct when both network lines and network sockets have already been installed at all planned indoor camera locations (usually in the corner of the room at ceiling height).

Tip: Include your responsible system administrator in the planning of a network-based video monitoring system right from the start.

5. Digital systems can be installed easier and cheaper

This statement is only correct when the number of IP cameras is so limited that the existing network is not disturbed or even fails due to its inherent bandwidth limitation after the extra load is added from the video monitoring equipment. If, however, you plan to use many IP cameras, then for safety reasons you should also plan a separate network exclusively for the video application. If you have to completely rewire for this reason then digital systems are no longer easier and cheaper to install. If both separate network lines as well as 75 ohm coaxial cable have not already been laid to the planned location of the camera(s) then you can also transmit the video signals analogue: using low-priced, 2-wire video transmitters or receivers over existing phone lines or control circuits with unassigned wire-pairs.

Tip: The higher the picture quality you require, the higher will also be the network load of the video monitoring equipment. However, you can considerably reduce the network load by using analogue cameras if these are incorporated into the local network by a digital recorder (DVR). If you are using the DVR conditional refresh compression method with adjustable

network load then in many cases you can even integrate larger video monitoring systems into existing networks. All users with access rights can then access all cameras for live and archive pictures from their computers, even when analogue cameras are used.

Summary

Depending on the application and the reason for video monitoring, the technology to be used should be analysed carefully, targeted to the specific requirements of the user. Many operators have invested in video monitoring technology in the last 20 years. If you consider that several hundred-thousand analogue cameras have already been installed nationwide in the past, you quickly come to the conclusion that today you have to plan and install systems that intelligently and efficiently support both analogue camera technology as well as state-of-the-art IP camera technology. For this reason alone, manufacturers that have been working within the field of safety technology for a long time have developed customised system components that optimally combine the best of both worlds. Modern hybrid recording and transmission systems exploit the advantages of both technologies optimally, to the benefit of the customer. By the way, even in other branches of industry, experts are of the opinion that it is the mixture of the new digital world with the good-old analogue (tube) world that really delivers the goods for the customer: Even today in Germany, analogue camera technology continues to be used in over 90 percent of all cases. You should therefore assume that the proportion of digital video components will rise dramatically in the coming years. The „death“ of analogue camera technology within the next five to ten years, as prophesied by some experts, is something that I just don't see. Users interested in video monitoring should take the time to find the optimum camera technology for each camera location and for each task at hand. If these users with all of their individual requirements turn to a security company that has a proven record with both analogue and digital technology then the result will surely be in the interests of the customer. ■