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White Paper

Migrating from Analogue to IP

Infrastructure.
Networking.
Electronic Security.

All together.

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+ Introduction.

This paper has been written to help professional security installers to understand the options available when assessing the effectiveness of their existing building security systems and how they can migrate their physical security from analogue to network based systems.

End users are beginning to demand greater flexibility from their systems and the IT departments are expecting convergence of systems onto their network. This is coupled with the drive of manufacturers who are developing even more sophisticated technologies and special applications, such as analytics that can only be deployed on IP based systems. The effect of these factors is that security installers need more information to be able to advise their customers.

Within this paper we look at the history and evolution from Analogue to Digital, the types of technologies that you can use to migrate from Analogue to IP on a site and how you would deploy these technologies in a phased approach to migration.

+ History of the market drivers for digital network based cameras.

When video cameras first came onto the security market in the 1980'S the term CCTV was first used to describe the configuration of systems: Closed Circuit TeleVision. These systems were easy to install with a single copper COAX cable carrying an analogue signal from each camera to the control equipment over a point-to-point connection. This signal would then be recorded onto an analogue VHS video time lapse recorder.

As time has passed the disadvantages of installing these traditional analogue systems have become clear:

+ High installation costs due to labour and material costs
+ Lack of expansion capability due to limitations of star topology
+ Higher costs per camera on larger systems which required costly matrix hardware
+ Low quality analogue recordings which degrade over time
+ High maintenance costs of recording equipment due to wear and tear
+ Operator intensive - Events difficult to find on time lapse based tape systems
+ Limited information – The number of fields captured per second on larger systems with high camera counts, limited the amount of images per camera due to the Multiplexer/VCR limitations

In the early 1990's a number of pioneering manufacturers addressed a number of the issues by developing Digital Video Recorders. The main advantages to these systems were easy to see and included: fast advanced search capabilities, simultaneous record, playback and view options, no image degradation and all within a single box solution rather than a separate multiplexer, controller and video recorder. For the following decade, systems were upgraded at the control point into digital-based systems and users were satisfied as all you needed to do to move to a digital system and gain the benefits, was swap out three devices with a DVR.

+ The issue of cost.

On a typical installation the cost of materials and labour for the transmission portion of a system (the point to point coax) represented 25-40 % of the total cost. With the advent of UTP (unshielded twisted pair) transmission systems in early 2001 installers were able to run multiple cameras on one backbone cable and then distribute out a 4 pair CAT5 cable to individual cameras. This type of distributed network massively reduced the cost of installing systems and also allowed the installer to transmit low-voltage power and telemetry data down the same cable alongside the video.

Crucially though cameras were still analogue as the network camera revolution was still to come. There were still concerns about bandwidth utilisation, early picture quality and limited availability of IP cameras, many of which weren't able to perform as well as analogue in specific security applications, such as low light or where speed domes were deployed.

+ Innovative Technologies.

Since 2005 massive investments have been made by traditional CCTV manufacturers together with new IT companies entering the marketplace. This has dramatically changed the market and the quality of available technologies expands each year. We are now seeing increased camera image sizes, improved picture quality, reduced storage and lower bandwidth requirements. So much so that it has reached a critical mass that is irreversible and we will soon be at a point where only the smallest of systems will be deployed on analogue platforms.

It is now generally accepted that the network based technologies are superior in many areas and the ability to make gradual migrations and enjoy the benefits such as analytics, sophisticated apps, 360 degree views and much lower total cost of ownership is helping installers and end-users alike.

We have also reached a point of convergence where all business services and applications are being run on a corporate network and so the utilisation of an existing network becomes an obvious choice for video systems, albeit the video surveillance system is often run on a separate structured cabling network and VLAN.

+ Benefits of going digital.

If your customer has already invested in an analogue CCTV system then, assuming the system is still working, there is often a reluctance to move a system over to a digital networked solution.

However, there are a number of recognised benefits to migrating to a network based system and the end-user can benefit from:

+ Increased remote access
+ Integration with other systems
+ Flexibility
+ Scalability
+ Increased return on investment
+ Improved image quality

+ Migration Strategies.

Deploying a migration from analogue-based technology to a network based solution can be achieved in a number of ways and it is recommended that this is completed in a phased programme as budgets and infrastructure become available. Another important advantage to this phased migration model is that cameras can be transitioned cost effectively individually or in groups. For example when expanding a site where it is desirable to add several new network cameras to an existing analogue system.

There are several technologies available that can be used by the installer and these are discussed in the following section which aims to cover the main migration techniques.

In situations where there is more flexibility with budgets, then the ideal solution is to deploy a new structured cabling network installed to the ISO11801 standard ensuring the cabling medium has been deployed to the optimum performance level, ready for high definition video transmission.

However for the purposes of this white paper we have identified the main technologies that you can use when migrating from analogue to digital using existing infrastructure. The advantages of this methodology are:

+ New cabling is not required
+ Existing infrastructure assets are sweated
+ Cameras outside of the LAN can be used
+ The limitations of traditional network cabling (100 metres) are not a factor
+ Installations are quicker to deploy

+ Technologies.

Encoders and video servers

The entry level starting point is normally to consider an encoder device in the control room sometimes referred to as a video server which is a device that has COAX inputs from the existing cameras which are then plugged into the BNC's on the encoder which is connected to the network. The encoder then performs the A – D conversion and streams the video using Internet protocol (IP) onto the network and this enables the images to be viewed on a PC acting as a client. The advantage of this method is cameras can be seen by any PC on the network and there are no additional costs for hardware or software.

The disadvantage of this type of migration is that the user cannot manage their system, add more cameras or take advantage of the recording and management features offered by most software manufacturers. If using one of the main camera vendors then the addition of more cameras and a VMS platform (Video management software) will enable the end-user to utilise existing IT hardware and manage performance of the cameras.

This type of configuration does require careful planning with regard to storage times and where the footage will need to be accessed from, in the event of an investigation. Another advantage of this configuration is that the images can be viewed from remote sites once a connection from the site to an ISP enables connection to the internet.

By utilising existing analogue infrastructure in this way the end user can enjoy a number of benefits such as:

+ Increased functionality
+ Sweating of existing assets
+ Future proofing of an existing system
+ Distributed architecture
+ No single point of failure

Wireless bridges

Building to building applications where multiple IP streams need to be moved between premises on a campus style site can be used on wireless bridges. By deploying wireless in hard to wire applications, an installer can create a backbone of data that easily carries multiple video streams and provides broadband connectivity across a site of unconnected buildings.

HD over COAX

HD-CVI technology delivers megapixel picture quality over coax, meaning you can upgrade your existing analogue systems to HD resolution over a single point to point connection.

A number of manufacturers now build HD-CCTV cameras which perform somewhere between standard definition and mega pixel IP-CCTV. The advantage of these is one of cost. These cameras are fitted in place of existing analogue as the signal is carried over conventional COAX cable as long as it is RG 59 quality. Which means that a full re-cable is not required.

However, it is not a system that can be improved upon as it is a closed system which can only be added to with the same technology in the same positions as the cables are pre installed. This is fine if the expectations of a user are met but if new cameras are required, new COAX would have to be installed and any future upgrades to full IP-CCTV will also require a re-cabling of the whole installation.

Media Converters

In applications where cameras are on the perimeter of a site and therefore a long distance away from the control room, the use of media converters is recommended. These small devices enable video and data to be converted from coax and data cabling onto fibre which can transmit signals, loss free, over extended distances and these signals are then reconverted at the rack and put onto the network in the control room (headend) area.

Using media converters at the camera enables the installer to extend distances and utilise power over Ethernet (PoE) to deliver power to cameras over UTP. This topology takes the local power that is being used for the media convertor at the remote end and injects power over the final leg of the UTP link to drive the camera.

When bringing the video (data) back into the control room the media conversion is done at the rack and then is fed onto the network via a network switch.

Ethernet over COAX

In applications where budgets are limited and the end user wants the installer to utilise the existing UTP or coax cabling infrastructure, they can upgrade the camera from analogue to a network camera with the use of Ethernet over Coax Convertors.

The advantage of these devices is that an existing cable can be utilised by simply installing a device on either end of the copper cable. Another advantage of this technology is that extended distances can be achieved and PoE versions enable power to be fed remotely. With this type of technology distances as far as 800m with 100 BASE-T connections are available. These devices are ideal for cameras that are outside of the 100 metre limitation such as perimeter cameras on the edge of a site.

+ Conclusion.

The benefits of digital network cameras are well established with ever increasing features and functionality available to the security end user. It is also generally accepted that the migration to digital is well under way as end users demand more from their systems and digital technology offers better returns on their investments.

The IT departments are increasingly involved with the decision making process and they seek converged systems on their networks which offer better scalability, open architectures and integration with other systems.

These two factors together mean the professional installer should be armed with the knowledge and skills to help their customers deploy these new technologies. This can be achieved using a planned approach to migration, using existing assets and infrastructure where possible and then deploying the new technologies discussed in this paper. Together they bring CCTV, High Definition video and other systems efficiently and effectively providing the customer with a true ‘converged’ system.

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