RMSI
BRINGING TECHNOLOGY TOGETHER

The Confusion over "Digital" Surveillance

There is a great deal of industry press about "Digital" surveillance systems. Unfortunately, many people find that the more they read, the more confused they become. This confusion is based on two factors. First and foremost is the overuse of the word "digital". Additionally, there are incongruous jargons as disparate industries converge to enable digital IP-Surveillance. The purpose of this paper is to provide the reader with enough knowledge to recognize the varying degrees of "digital" in digital surveillance.

Is it Digital?

As you surf the web, you will find many different surveillance solutions that say "digital", or "IP-based", or "web-based", or "networked". Since these terms mean different things to different people, the terms cannot be taken at face value. Purveyors of older analog technology have added minimal capabilities to their wares and declared them to be digital. As a result, the appropriate question should not be "is it digital?" but "how digital is it?" We live in an analog world and vision is an analog function. No matter "how digital" the surveillance system is, it starts as analog, gets transmitted, manipulated, displayed, and, perhaps, stored. Somewhere in this chain the signal may be converted to digital via an analog-to-digital conversion technique then eventually converted back to analog via a video display for the human eye to see.

Surveillance systems terminate in a monitor, a recorder, or both depending on the security functions desired by the architect. Systems are monitored by having a display, either a TV screen or computer monitor, available for a person to watch. Systems are recorded by having the video signal sent to a recording device so that events captured can be retrieved and reviewed at a later date.

In an analog CCTV system, an analog camera "sees" the event, transmits the analog signal over coax cable, often to be manipulated by a switching mechanism, to terminate at the display and/or recording device. These are typically dumb systems where there can be no intelligence or analysis of the video data without human intervention to retrieve and evaluate the recorded material. The primary benefits of analog CCTV systems are that they are inexpensive, simple to operate, and are well entrenched in the security industry.

At the other end of the analog/digital spectrum are the fully digital systems. In these systems, a digital camera sees the event, transmits the digitized video signal via Ethernet over a cat 5 LAN cable to a LAN switch and into a Video Server (Computer). The server manages and manipulates the video signal from this and other digital cameras and displays, records, and retransmits the image(s) in nearly an infinite number of options that are selected by the administrative software, including sending data via the internet to any site on the world-wide web. The benefits of the systems are many. They are ultimately scalable and upgradeable via software changes. They can analyze and record the data in software selectable formats. As such, they yield truly intelligent security tools that can analyze data and initiate preventive actions.

www.teamrmsi.com
3235 Sunrise Blvd. STE 6
Rancho Cordova, CA 95742
tel 916.858.3300
fax 916.858.3313

RMSI
BRINGING TECHNOLOGY TOGETHER

What about a Digital Video Recorder?

Confusing the issue is a whole range of Digital Video Recorders (DVRs). A DVR-based system should be seen as an interim step on the path fully to digital functionality. A typical DVR-based system has the same camera, cabling, and switching structure as the analog CCTV system. What differs is the replacement of the tape-based VCR with a Digital Video Recorder. The DVR is similar to the VCR except it uses hard disk drives to record the data and it must convert the analog signal to a digital prior to storage. At the 2003 International Security Conference in Las Vegas, it was stated that there are 575 manufacturers of DVRs covering a wide spectrum of specifications and performance. Yet, regardless of the functionality of the DVR, once it replaces the VCR in a CCTV system, the resulting surveillance system is declared to be digital, in spite of the fact that the camera, transmission, and display technologies remain analog.

	Analog		Digital
	Analog CCTV	**Analog CCTV + DVR**	**Digital IP System**
Physical Target	Analog	Analog	Analog
Camera	Analog	Analog	Digital camera or camera with integrated data pump
Transmission	Analog over dedicated coax network	Analog over dedicated coax network	Digital over Cat 5 cable
Manipulation	Switching Matrix	Switching Matrix	Hardware and software manipulation in server/storage
Recording and Storage	Within VCR - recording analog waveform	A/D Conversion within Digital Video Recorder Stored on hard drives	Standard computer storage: HD, RAID, SAN, NAS
Data Retrieval	Manual tape retrieval, rewind and search	Digitally stored. May have std. formats. Various retrieval methods	Intelligent data mining/retrieving
Communication with LAN/WAN	No networking capability	None to standard TCP/IP format	Standard TCP/IP
Display	Analog "TV" monitor	D/A Conversion in Display Monitor	D/A Conversion in Display Monitor

www.teamrmsi.com
3235 Sunrise Blvd. STE 6
Rancho Cordova, CA 95742
tel 916.858.3300
fax 916.858.3313

Probably the largest factor to consider when evaluating a DVR is the video capture, or analog-to-digital function. Typical DVRs have video capture circuits or cards that can process a total of 60, 120, or 240 frames per second (fps). There are a few DVRs supporting 480 frames scheduled to be released. These numbers represent the total number of frames per second that can be accommodated for all of the cameras whose inputs terminate at the DVR. In a 120 fps DVR with 16 cameras, the average frame rate is 7.5 fps. In most systems, specific cameras can be allocated more frames, but this is at the expense of other cameras. The total number of frames is fixed at 120. The frames are recorded, typically on hard disk drives. The compression and recording formats vary; some are standards-based while others are proprietary. As a rule, these systems are not scalable or expandable. Additionally, the analog-to-digital conversion process results in a significant loss of picture fidelity. The primary benefits of the DVR-based system are that it is an upgrade to existing analog CCTV systems and allows for the reuse of the legacy analog cameras and cabling. It does, however, lack the expandability and the ability to utilize most of the exciting new software analysis tools as opposed to a fully digital surveillance system. With the addition of a DVR to an analog CCTV system, analog surveillance technology has reached the end of its evolution.

Confusing Jargons

Another contributor to the confusion surrounding IP Surveillance is the incompatibility of the jargons from at least three industries that are converging to address the need for intelligent video surveillance. Those industries are:

1. Traditional security equipment including access devices and Closed Circuit TV
2. Computer, software, and networking
3. Telecom

Between these industries, there are vocabulary conflicts. For example, the term “Video Server” as used in a CCTV system has a different meaning than it has in the computer industry. In order to interface with legacy CCTV cameras and cables, the analog video signals can be routed into a “video server” and converted to digital. This is the same process that happens on the front end of the DVR and has all of the same bandwidth (fps) and picture quality issues. These video servers, typically single channel or four channels, do allow the continued use of the installed legacy hardware, albeit with significantly poor results compared to a new digital system. In the computer industry, the term “video server” is a server class computer that has been optimized to process and stream video. It is the heart and the brains of the IP-Surveillance system.

3235 Sunrise Blvd. STE 6
Rancho Cordova, CA 95742
tel 916.858.3300
fax 916.858.3313

Confusion also results when telecom/networking people and data storage people use the term "Meg". One typically means Megabits (Mb) and the other typically means Megabytes (MB). There are 8 bits in a byte and 8 Megabits (Mb) in a Megabyte (MB). When data is transmitted in a local or wide area network (LAN or WAN), it is normally specified in megabits per second. Data streams from digital video surveillance cameras are also specified in megabits per second. However, when the data is stored, it is stored in megabytes. The confusion is that they are all are referred to as "megs". There is a factor of 8 mismatch in the vocabulary.

Transmitted: 10 Megabits per second X 4 seconds = 40 megabits of data (Megs)
Stored: 40 Megabits of data / 8 bits per byte = 5 megabytes stored (Megs)

How do I know?
Even after you are armed with the vocabulary or methodology to determine "how digital" a system is it remains a challenge to filter through all of the marketing fluff and determine what a specific black box really is. One quick rule of thumb: When you look at a "Digital" surveillance box, look at the back of it to see what the inputs are. If you see 8, 16, or 24 BNC connectors to accommodate coax cable, it is a Digital Video Recorder for an analog CCTV system. There may or may not be one or two RJ-45 sockets for LAN connectivity. If you see no BNC connectors and many RJ-45 sockets, it is highly likely that it is a true digital surveillance system component. At the system level, the surveillance system is not fully digital unless all the four major component groups are digital: the camera(s), the transmission network, the recording mechanism, and the display. Anything less than a fully digital system is largely obsolete and incapable of utilizing the emerging software surveillance tools. Until you determine "how digital" the system is, you should remain skeptical when presented with information on digital surveillance, whether is called, IP, network, web-based, or digital surveillance.

www.teamrmsi.com
3235 Sunrise Blvd. STE 6
Rancho Cordova, CA 95742
tel 916.858.3300
fax 916.858.3313