SECURITY SALES & INTEGRATION PARTNER SERIES

EXTENDING LONG-DISTANCE PERFORMANCE, LEVERAGING EXISTING COAX INFRASTRUCTURE WITH ENHANCED POE TECHNOLOGY

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At up to three times more distance compared to standard IP devices, patented ePoE technology provides newfound savings without repeaters.

Developments in video security and surveillance solutions, based on IP technology, are helping a wide range of security and surveillance professionals protect people and property, provide situational awareness and enhance operations. Compared with traditional analog solutions, IP-based surveillance systems are more versatile and cost effective.

This shift from traditional analog technology to IP video comes at a time when facilities need to make the most of their budgets, and they have already seen significant cost savings and productivity benefits from IP-based and networked solutions in everything from administration and patient records to accounting and communications.

This white paper discusses the cost and performance advantages of a new technology known as Enhanced Ethernet Technology or Enhanced Power over Ethernet (ePoE). Enhanced PoE allows video integrators and installers to utilize existing coax cable infrastructure, exceed standard long-run distance limitations, and utilize analog cameras with the many advantages of IP network connectivity.

Enhanced Ethernet Overview

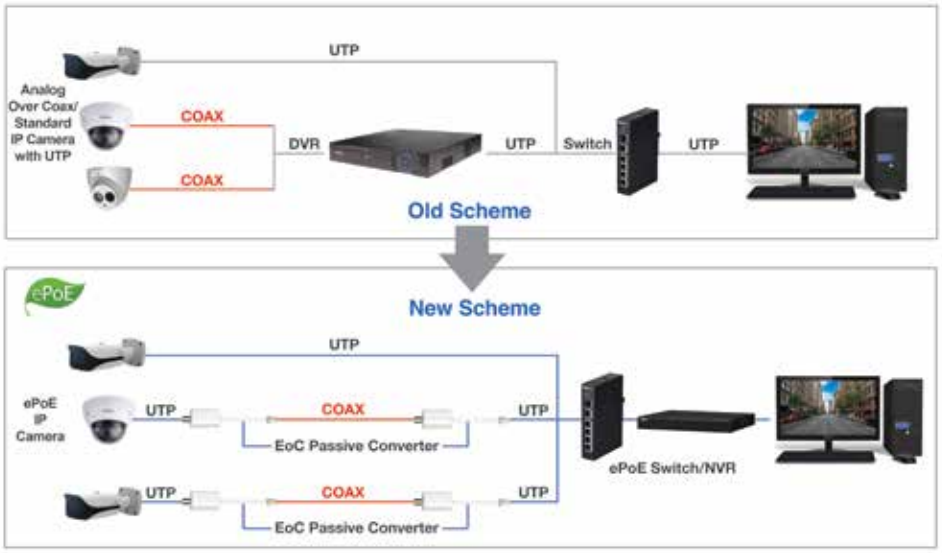
New advancements in ePoE promise to slash installation costs while providing customers with a pure IP, high-definition (HD) solution. Long-distance transmission requirements for traditional video surveillance devices can add extra equipment and labor costs to applications that require longer runs. Although PoE-powered devices provide a flexible and convenient way of eliminating the expense of direct electrical wiring, reaching remote locations outside the limitation distance of UTP cabling (100 meters / 328ft) can be daunting.

To combat these challenges, ePoE technology for long distance transmission offers up to three times more distance compared to standard IP devices. An ePoE solution provides newfound savings without repeaters.

Another benefit to ePoE technology is the ability to seamlessly upgrade a coaxial infrastructure to pure IP by inserting a passive Ethernet over Coaxial (EoC) converter at each end. With the use of EoC converters, the solution has the ability to convert an analog-to-IP integrated solution for long-range transmission.

And, since ePoE has the ability to convert coaxial cabling to a full network solution via Power over Coax (PoC), it also eliminates the need for a separate power supply cable when utilizing coaxial infrastructure. This is a simple and effective solution that delivers seamless plug-and-play installation, significantly reducing the cost of upgrading from analog to IP.

Enhanced Power over Ethernet Topology



Enhanced PoE is automatically compatible with three connection modes operating over the same network at the same time: traditional network, long-distance network and coaxial network. For example, in an analog to IP HD upgrade project, ePoE technology can take advantage of existing coax cabling to transmit power and video between the new high-definition IP camera and the backend ePoE-enabled switch or NVR. This topology reduces wiring and construction time, and increases the return on investment (ROI) of the project.

Additional network cameras can be connected to the back-end via the network switch or NVR to create a centralized surveillance system, regardless of the Ethernet mode. This architecture allows the system to monitor enhanced ePoE devices and standard PoE devices at the same time.

There are a range of new ePoE cameras available, including 6-megapixel models in dome, bullet and eyeball-type housings with a choice of either a fixed or a motorized zoom lens. To achieve maximum technical benefits the enhanced Ethernet technology must be used as a full solution, ePoE cameras at the edge and the ePoE-enabled switch or NVR at the back-end. (Note: the ePoE gear is backward compatible, meaning it can be utilized with any Ethernet device. So, the cameras can be utilized on a non-ePoE switch or recorder and maintain functionality.)

ENHANCED POE IS AUTOMATICALLY COMPATIBLE WITH THREE CONNECTION MODES OPERATING OVER THE SAME NETWORK AT THE SAME TIME: TRADITIONAL NETWORK, LONG-DISTANCE NETWORK AND COAXIAL NETWORK.

Taking a Closer Look

New ePoE devices utilize patented technology developed on the underpinnings of enhanced Ethernet: a passive converter device with a PoC power supply. This device easily converts the data and power of an original PoE system to coax via common mode extraction, high and low frequency division, and impedance transformation to ensure the stability of the coaxial transmission.

Legacy analog systems cannot take advantage of PoC technology because interference caused by the noise of the low-frequency power signal compromises the data signal (transmitted on a low-band frequency). This degradation of the data signal leads to poor video and explains why traditional analog PoC systems have not been widely deployed.

In contrast, ePoE technology places the data signal in the high frequency band, separated from the noise of the power signal transmitted on the low frequency band. This separation of signals delivers a faultless coaxial power supply to the camera while preserving the high-definition video.

Varied Benefits of ePoE

For installing security contractors, ePoE technology can result in significant cost savings in time and materials. A complete ePoE solution offers the following advantages that can achieve up to 30% cost savings over traditional analog to IP system upgrades:

- Long-distance power and video transmission replaces the need for repeater devices.
- Lower network cable specification requirements reduce cable costs.
- Single cable pair transmission lowers network cable fault rate.
- Full network compatibility and self-adaptation with common Ethernet technologies eliminates the need to upgrade existing basic devices resulting in lower upgrade costs.
- Upgrade IP networks seamlessly and reduce analog upgrade costs.
- Power over Coax (PoC) eliminates the need to install separate power supply cabling, simplifying installation.

Surveillance Technology Development

The developing technologies of the surveillance industry have given rise to a significant number of solutions, which can be divided into two main areas: analog technology and network surveillance technology.

Analog surveillance systems adopt a point-to-point connection to transmit data directly from one device to another — namely, an analog camera connected by coaxial cable to the port of a DVR allows the camera feed to be viewed; thus, achieving its surveillance functionality. If the camera feed is to be viewed remotely, a remote network connection must be established through the DVR.

A network video monitoring system adopts modern Ethernet technology and uses a LAN connection between camera devices and an NVR. All front-end network cameras and back-end network storage devices are connected to the same Ethernet network, which is then used for communication between the devices. Any node on the network may access any device on the network as long as it obtains authorization from the accessed device.

Analog Pros and Cons

The main advantages of an analog video system are convenient plug-and-play connections and no delays in transmission. Disadvantages include that it is difficult to improve resolution and it is hard to achieve unified management in large-scale system solutions. In order to overcome these disadvantages, a new generation of analog monitoring technologies has emerged in the industry, including CVI, AHD, and TVI, which provide HD resolutions for analog systems. As for unified system management, hybrid DVRs have been created alongside other unified management platform product solutions.

In a network video monitoring system, its advantages lie in easy unified management, flexible upgrade to higher resolutions and remote PoE power supply. However, disadvantages include long video feed delays and network bottlenecks caused by multiple devices sharing the same amount of bandwidth.

As with analog devices, with the development of the industry, network

video monitoring technologies are also continuously being upgraded. For example, the new generation of H.265 encoding technology has greatly reduced network bandwidth usage and stronger encoding processers have lessened video codec delay. Currently network camera video delay has been reduced to just 150ms, basically unnoticeable when viewing video feeds.

On the whole, along with differentiation of the industry and technological development, two systems are constantly merging. In a word, it is nothing more than merging of the best of both technologies.

Speaking from a macro perspective, there are mainly two main appeals in the development of security industry: higher resolutions and greater networking. However, there are currently still a large number of HD analog monitoring systems on the market which adopt standard resolution basic coax wiring, and in addition to this, due to many factors, the cost of labor for transforming such a system is continuously increasing while the device costs are decreasing. This has led to a situation where reconstruction during the system upgrade or transformation process has become less and less viable, giving way to a new requirement: coaxial upgrade. However, so far the new generation of HD analog technologies, such as CVI, AHD and TVI has only satisfied the first and third requirements (HD and coaxial upgrade).

In accordance with the future development of the Internet of Things (IoT), connecting devices over LAN is becoming an irresistible trend. Therefore, it is necessary that analog monitoring is transformed into network management in order to improve the operability of centralized management and dispatch, which is the second requirement in networking.

As for current analog technology, it is hard to meet this second requirement. Equally, for network technology, it is hard to achieve the third requirement of coaxial upgrade. Coaxial Ethernet technology which converts network into coax already exists on the market, but the technology is only achieved through multiple parts and at a high cost, making it unviable as a universal technology. Therefore, the most urgent need in the current market is for a technology which provides network coaxial functionality at a low cost.

Enhanced PoE Rundown

Leading enhanced Ethernet technology consists of two core technologies: the first is advanced physical layer 2D-PAM3 coding modulation, achieving full duplex transmission over 800 meters at a speed of 10Mbps or 100Mbps at shorter distances via one pair of twisted-pair or coaxial cable media. In addition, the technology supports PoE and PoC power supply technology for both twisted-pair and coaxial cable as the transmission media, greatly simplifying construction and wiring.

The second technology is a patented application-layer synchronous negotiation mechanism that guarantees self-adaptive compatibility of enhanced

TO ACHIEVE MAXIMUM TECHNICAL BENEFITS THE ENHANCED ETHERNET TECHNOLOGY MUST BE USED AS A FULL SOLUTION, EPOE CAMERAS AT THE EDGE AND THE EPOE-ENABLED SWITCH OR NVR AT THE BACK-END.

or traditional Ethernet networks. This self-adaptive technology automatically determines the network architecture of a system and configures the connected devices for enhanced or traditional Ethernet communication. Thus, the system is fully self-sustaining and requires no manual configuration, achieving true plug and play operation

Application Scenarios

Enhanced PoE technology is automatically compatible with three connection modes operating over the same network at the same time: traditional network, long-distance network and coaxial network. Enhanced Ethernet technology can reuse original switches, IP cameras, and other network devices, as well as leverage existing coaxial infrastructure to create a centralized surveillance system from traditionally disparate network architectures. For example, upgrading a traditional analog system to an HD IP solution required installing Ethernet cabling, midspans to extend power and data runs, and power cables to ensure all devices are operational.

Enhanced PoE technology removes the need for replacing cables because ePoE directly converts data and power between Ethernet and coaxial cables via a passive (no power required) converter between cameras at the edge and the switch or NVR at the backend. The mixing of enhanced and traditional Ethernet topologies with an existing coaxial infrastructure creates a truly centralized management system that simplifies installation and reduces surveillance costs.

Power over Coax (PoC) functionality provided by this technology eliminates the need for renovations to add power wiring for new cameras. Finally, future surveillance area expansion can be performed without need of adding additional repeaters. Simply use additional cables to add new monitoring devices into the 800m-capable network. Introducing ePoE makes systems scalable.

Long-Distance Coax, Network and Power Technology

The network cable power supply technology known as PoE technology works through imposing a 36~57V common-mode voltage signal over 12- and 36-line pair or 45- and 78-line pair cables via common-mode transmission. Data is sent through difference-mode transmission, so power supply and data do not interfere with each other.

The PoE power supply technology adopted by enhanced Ethernet is a unique power supply technology that guarantees power over-long distance network cable connections through increasing power from the supply.

PoC utilizes patented technology developed on the underpinnings of enhanced Ethernet: a passive converter device with a PoC power supply. This device easily converts the data and power of an original PoE system to coax via common mode extraction, high and low frequency division, and impedance transformation to ensure the stability of the coaxial transmission.

Legacy analog systems cannot take advantage of PoC technology because interference caused by the noise of the low-frequency power signal compromises the data signal (transmitted on a low-band frequency). This degradation of the data signal leads to poor video and explains why traditional analog PoC systems have not been widely deployed.

In contrast, ePoE technology, with its 2D-PAM3 coding modulation, places the data signal in the high frequency band, separated from the noise of the power signal transmitted on the low frequency band. This separation of signals delivers a faultless coaxial power supply to the camera while preserving the high-definition video. Load capacity and bandwidth speeds at specified distances are shown in the following table:

Load Capacity and Bandwidth

ePoE Transmission Distances over RG59 Coaxial Cable
ePoE switch supply voltage 48V
RG-59, max. DC resistance < 5Ω/100m

ePoE Transmission Distances				
Cable Length, m (ft)	Bandwidth (Mbps)	PoE Load Capacity (W)	Hi-PoE Load Capacity (W)	Working Mode
100 (328)	100	25.5	50	IEEE/E100
200 (656)	100	25.5	30	E100
300 (984)	100	18	18	E100
400 (1312)	100	15	15	E100
500 (1640)	10	12	12	E10
800 (2624)	10	6	6	E10
1000 (3280)	10	5	5	E10

ePoE Transmission Distances over RG59 Coaxial Cable
ePoE switch supply voltage 53V
RG-59, max. DC resistance < 5Ω/100m

ePoE Transmission Distances				
Cable Length, m (ft)	Bandwidth (Mbps)	PoE Load Capacity (W)	Hi-PoE Load Capacity (W)	Working Mode
100 (328)	100	25.5	52	IEEE/E100
200 (656)	100	25.5	48	E100
300 (984)	100	25.5	30	E100
400 (1312)	100	20	23	E100
500 (1640)	10	16	16	E10
800 (2624)	10	10	10	E10
1000 (3280)	10	8	8	E10

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ePoE Transmission Distances over CAT5E/CAT6 Cable
ePoE Switch Supply Voltage: 48 VDC
CAT5E/CAT6 Coaxial Cable, Maximum DC Resistance: < 10 Ω / 100 m (328 ft)

ePoE Transmission Distances				
Cable Length, m (ft)	Bandwidth (Mbps)	PoE Load Capacity (W)	Hi-PoE Load Capacity (W)	Working Mode
100 (328)	100	25.5	53	IEEE/E100
200 (656)	100	25.5	33	E100
300 (984)	100	19	19	E100
400 (1312)	10	17	17	E10
500 (1640)	10	13	13	E10
800 (2624)	10	7	7	E10

ePoE Transmission Distances over RG59 Coaxial Cable
ePoE Switch Supply Voltage: 53 VDC
CAT5E/CAT6 Coaxial Cable, Maximum DC Resistance: < 10 Ω / 100 m (328 ft)

ePoE Transmission Distances				
Cable Length, m (ft)	Bandwidth (Mbps)	PoE Load Capacity (W)	Hi-PoE Load Capacity (W)	Working Mode
100 (328)	100	25.5	53	IEEE/E100
200 (656)	100	25.5	47	E100
300 (984)	100	25.5	32	E100
400 (1312)	10	23	26	E10
500 (1640)	10	20	20	E10
800 (2624)	10	13	13	E10

Summing Up ePoE

ePoE technology is a viable, cost-effective solution for extending transmission distances and for converting existing, coax-based analog systems into IP systems. For video security and surveillance installers, ePoE technology saves time and money by reducing overall cabling requirements, allowing for existing coax cable to be used, and minimizing the number of peripheral devices needed. For new installations, ePoE offers the ability to design long-distance applications without the need for additional repeaters.

In a typical analog to IP retrofit installation, installers can potentially save up to 30% by reusing existing coax cabling, just by inserting the passive converter. Additionally, savings will be realized by not having to install repeaters throughout the cable run. This technology is ideal anywhere there is an existing coax infrastructure and the application requires an upgrade to IP.