PoE and Access Control Systems

Is PoE technology a viable solution for your access control system?

Power Over Ethernet is being widely advertised as a panacea for access control system users. Certainly we have all looked forward to the day when a single network drop at the door will satisfy all of the system wiring requirements between the controller and the doors. One simple cable that will replace the multitude of cables currently needed for reader communications, request to exit, door position, and lock power.

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As is commonly the case, along with technology that is new to our industry comes advertising claims and counter claims by various vendors each vying for a prominent spot at the top of the tech-tree. This paper will address this emerging technology, the standards that guide it's implementation, and the claims that warrant further scrutiny. Its focus is to help you sort out what is viable in real world applications and what is advertising hype.

The Objectives of PoE

The primary objective of any PoE system is to reduce costs. The technology was designed as a solution for the implementation of various network appliances in applications where it would be too expensive or inconvenient to provide a separate power supply and wiring. It is commonly used to power wireless network access points, remote network switches, and IP telephones. Stringing wire throughout a building for a proprietary access control network has long been a cost prohibitive proposition and often the most expensive

part of the total system. Certainly if any system commonly found in today's modern building needs an alternative to hardwired devices, it is the access control system.

Cost of wire: Although not as costly as the labor needed to install it, the various combinations of wire needed for a full fledged access control system can represent a significant cost. For today's typical system you will need a 6 conductor, 22 AWG, stranded, shielded for the reader; a 4 conductor, 18 AWG, stranded for lock power; a 2 conductor, 22 AWG, stranded for door position; and a 4 conductor, 22 AWG, stranded for request to exit. The outer limit for this wiring architecture is usually 500 feet and is often pushed to that limit. The advent of modern customized bundled cables allows the required combination of conductors to be incorporated into a single cable which makes installation much easier but can still represent a significant cost. By injecting power onto the readily available, commonly installed CAT 5 or CAT 6 cable, PoE promises to bring down the cost of installation.

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Cost of labor: If you have ever been on the pay check writing, or even cost estimating, end of a security system installation contractor you clearly understand that labor will represent the bulk of the costs associated with providing today's systems. The installation of wire is responsible for the lion's share of those labor costs. A "rule of thumb" that has long been used in the industry is the 60/40 rule. This rule states that roughly 60% of your costs will be in labor and the remaining 40% will be in equipment costs. To the extent that this rule is true, innovative alternatives such as PoE can dramatically reduce the overall cost to the end user for these security related systems.

PoE System Components

Along with the aforementioned CAT 5 (or better) cable infrastructure, a basic PoE system will consist of powered devices (PD) and power sourcing equipment (PSE).

Powered Devices: An example of a PD is PCSC's Fault Tolerant (FT) access control system door interface module (DIM). The DIM is installed away from the Master Controller (MC) and near the associated door. Through the DIM, power is distributed to the reader, door locking mechanism, and request to exit device (REX). The door status switch and and REX status are also monitored by the DIM.

An example of a PD is PCSC's Fault Tolerant access control system

Power Sourcing Equipment: A good example of PSE is American Fibertek's (AFI) Commander C10e PoE switch. This switch was designed to meet the below detailed IEEE P802.3at specification and specifically for networks consisting of IP video cameras and other security related devices.

Given the cabling limitation of 328 feet it is obvious that a cascading technique using smaller switches (8 ports vs 24 ports) will more commonly be deployed.

Relevant Standards

PoE - IEEE P802.3af - 2003f: Since 2003 the applicable IEEE standard for PoE has been P802.3af. This standard calls for a maximum allowable 12.95 watts of power per port and allows the use of CAT 3 cable. As PoE has become more popular, more and more devices have been designed for its use. The power limitation of this standard has stifled the device manufacturers ability to meet the demands of the marketplace.

PoE Plus - IEEE P802.3at (coming soon)

The new PoE Plus (or Hi PoE) standard is nearing completion and is expected to be ratified soon. Switch manufacturers are already producing switches that conform to this standard, at least to the extent that they can anticipate the final standard's requirements.

It is important to note that PoE Plus requires the use of Cat 5 (or better) cable. The eight wires of CAT 5 cable verses the four wires of CAT 3 allows more power to be transmitted.

Draft 3.0 of the new AT standard, dated March 2008, states that the maximum current will be nearly twice the current allowed under the AF standard.

It is important to note that PoE Plus requires CAT 5 (or better) cable

One objective of the IEEE P802.3at Task Force was to ensure that PoE Plus will operate in modes compatible with existing requirements of IEEE P802.3af. This is good news for forward thinking companies that have already made a significant investment in PDs designed to the older standard. Another objective of the Task Force requires PoE Plus PDs, which require a PoE Plus PSE to provide an active indication of that requirement when connected. This will alleviate the inevitable problems caused by connecting PDs designed to the new AT standard to PSEs that comply only with the older AF standard. Conversely, PoE Plus PDs that operate within the more limited power range of P802.3af will work properly with 802.3af PSEs.

Power Requirements

Power requirements for PDs vary according to the device type, manufacturer, load, cable length, and other factors. Our example PD, PCSC's FT system DIM, requires 200mA at 12vdc or 2.4W. A typical door locking mechanism may require 500mA at 12vdc or 6W. A REX sensor may require another watt. A card reader may require 3W. Even without allowing for environmental factors and cable length, a fully loaded access control system can easily start to approach the upper limit of the older AF standard.

Powered Device (PD) at the door	**Required Power**
Door Interface Module (DIM)	2.4W
Reader	3W
Lock	6W
Request to Exit (REX) device	1W
Total	12.4W

Table 1 - Power required at the door

Table 2 shows the powered device classification defined in P802.3at. Minimum power available for PDs, factoring in cable length and environmental factors, is shown.

Powered Device Classification	Power Available for the Powered Device
Default, Type 1	0.44W to 12.95W
Type 1	0.44W to 3.84W
Type 1	3.84W to 6.49W
Type 1	6.49W to 12.95W
Type 2	12.95W to 25.5W

Table 2 - Powered Device Classification

An important concept to recognize when considering the deployment of a PoE network is that of power sharing

Type 1 PDs, or IEEE P802.3af devices, have a maximum wattage requirement of 12.95W. Type 2, or IEEE P802.3at devices have a maximum wattage requirement of up to 25.5W

Back-up Power

One of the biggest advantages offered by the PoE infrastructure is the inherent ability to facilitate system wide power back-up. If your system is PoE based, then backing up power for the entire system is simplified. Employing an emergency generator or a network UPS will ensure that the access control system continues to be fully functional during a power outage. Legacy systems typically employ battery back-up techniques that fail to provide sufficient power for critical components such as door locks or request to exit devices.

Security for the Security System

When considering PSEs for PoE based security systems look for features that will provide protection for the system that protects your facility. Temperature will greatly affect the performance of your PoE system. AFI's C10e switch, for example, provides local and remote environmental sensing and alarm generation. If a fan fails and your PoE switch is overheating, you want to know about it immediately. A good PoE command

center will also have the ability to constantly poll activity on the power output ports to establish trends and anticipate problems.

Power Sharing

Caveat Emptor: An important concept to recognize when considering the deployment of a PoE network is that of power sharing. This concept has largely been ignored by PoE marketeers. Simply stated, power sharing is when the total power available from a PSE is shared across all of its ports. So if the PSE delivers 12.95W of power and 9 or 10 watts are required on each port, your PSE will only power one port. The slight of hand that the industry marketing fails to acknowledge is that yes, while you can power your access control system with an older IEEE P802.3af PSE with 12.95W of available power, they don't tell you that you'll need a switch for every access control door in the system. Not every pre-IEEE P802.3at switch employs the power sharing principle, but it is something that any potential PoE system user needs to be wary of.

Today's Switches: Newer systems, such as our example of American Fibertek's Commander C10e switch do not utilize this methodology. Each port can be configured by the operator to deliver a specific class of power, as indicated by signature classes 0 - 3 shown on Table 2 above. This ensures that your purchase of an 8 port switch will enable you to power the PDs required at eight different doors if needed.

Conclusion

PoE is quickly becoming a viable alternative for access control system designs. Network switch manufacturers, like American Fibertek, are producing power sourcing equipment (PSEs) designed specifically for our industry and at least one access control manufacturer (PCSC) offers PoE capable powered devices (PDs) for their new Fault Tolerant (FT) access control system.

Well designed PoE based access control systems will:

1. Utilize PSEs that avoid power sharing across the various PoE ports of the device.
2. Comply with the new IEEE P802.3at standard including CAT 5 or better cable and Hi PoE power availability.
3. Incorporate a cascading technique that employs smaller switches in a distributed architecture.
4. Consist of PDs that have been designed and tested to meet the PoE Plus standard.
5. Incorporate power back-up systems that keep the access control functioning during a power failure.
6. Have built-in protection features that help your security system stay secure.

The long awaited panacea for access control systems may very well be a reality given the new, soon to be ratified, IEEE P802.3at Power Over Ethernet specification. Be careful when looking through the marketing hype to identify those access control system and PoE device manufacturers that understand and conform to the developing industry standards.