Vigitron IP Infrastructure Design Educational Series

What IP Video Security Systems Need

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When the news of purchasing a network switch arises, many IT directors immediately turn to two favorite brands, HP or Cisco. To the networking environment, they have become what IBM was to computers. “No one ever got fired for buying IBM”.

The transition of video security systems from analog to digital, the rush for IT network directors to increase their jurisdiction for networking by adding the video security element overlooked a key point. IP video security networking requirements are not the same as those used for data networks. True video transmitted over a network is data, but that is where the similarities end.

No where is that more apparent than in network switches. Let’s start by examining a standard network switch and its non functional relationship to IP video security cameras. We will begin at the switch port. In networking information is transmitted in the form of packets. For most network switches, when the port is set at 100Mbps the packet size is limited to about 1518 bytes. This is equal to about a two to three megapixel camera depending on the codec used, H.264 generates the smallest packet size and MJPEG generates the largest. Some switches that have port speeds up to 1Gbyte and can be programmed up to the Jumbo Frame, which defines packet sizes up greater than 1581bytes. Jumbo frames range between 1518 bytes and 9600 bytes. This latter ability wouldn’t present a problem with the exception that in networking the output speed of a device must be matched to the input speed of the port. As all IP cameras have output bandwidth speeds of 100Mbps, the input speed of the port must be set to 100Mbps. If the switch has an automatic port speed setting, it will sense the input speed from the camera and no manual setting is required. The problem exists when the packet output from the camera exceeds the limitation of the switch port setting at 100Mbps. You can have issues with any cameras that are 3MP or greater. In short, it operates as if it were two IP cameras and requires that usage of all four pairs within Cat cabling.

Port	Link	Speed		Flow Control			Maximum Frame Size	Excessive Collision Mode	Power Control
		Current	Configured	Current Rx	Current Tx	Configured			
*			<>			☐		<>	<>
1	●	1Gfdx	Disabled / Auto / 10Mbps HDX / 10Mbps FDX / 100Mbps HDX / 100Mbps FDX / 1Gbps FDX	✕	✕	☐	9600	Discard	Disabled
2	●	Down		✕	✕	☐	9600	Discard	Disabled
3	●	Down		✕	✕	☐	9600	Discard	Disabled
4	●	Down		✕	✕	☐	9600	Discard	Disabled
5	●	Down		✕	✕	☐	9600	Discard	Disabled

Figure 1: Vigitron switches can handle jumbo frames up to the 9600 byte limit at 100Mbps, assuring compatibility with the highest megapixel cameras.

The second concern is the internal switch connection between all the ports. This is called the switch fabric or throughput. In most normal data applications, either not all ports are used or the data at each port is far less than the port’s highest capacity. Again, this is not the case with IP video security application where all ports are used and each port needs to operate at its highest bandwidth capacity. For this requirement the switch fabric must be able to handle at least two times the total bandwidth of all the ports. For example, if you have a 24 port and each port has the ability to operate at 1Gbytes, the switch fabric must have a bandwidth of at least 48Gbyte. Please note, there are no standards for switch fabric or port bandwidth packet size capacity. These are both quality issues.

Figure 2: Vigitron switches have the required fabric bandwidth throughput to pass all cameras at their maximum bandwidth, even when all ports are used.

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The potential problems become clear as the MegaPixel size of camera increases, as does the camera's codec and the number of cameras in your system approach the maximum number of switch ports connected. The problem is often misunderstood as operators don't understand why they only have good video quality when the camera capacity is less than the switch's input maximum.

Just as critical is the interaction between switch functions, or lack of, concerning PoE. Many of these center around the lack of protection. This starts with the individual port which is not fused. Shorts in any individual channel can render the entire switch inoperable when the main power fuse is broken. During normal start-up, PoE power required by each connected camera is sensed. If a short exists, or no camera is detected, or the amount of power requested by the camera exceeds the available port, the port will shut down. This is a function of the normal safety built into the 802.3 standards designed for PoE. When this occurs, the port is basically off and remains in the off condition as the physical Ethernet connection between the camera and switch port has already been established and new detection pulses are not generated. There are several reasons this may occur. Even in properly installed systems, a good port to camera connection is not always established on the first try. Again, the blame usually is placed on the camera. In some cases, removing the Ethernet cable and reinserting will reestablish the connection. However, the first reactions are most likely to request a return authorization from the manufacturer or ask for a service call from the dealer.

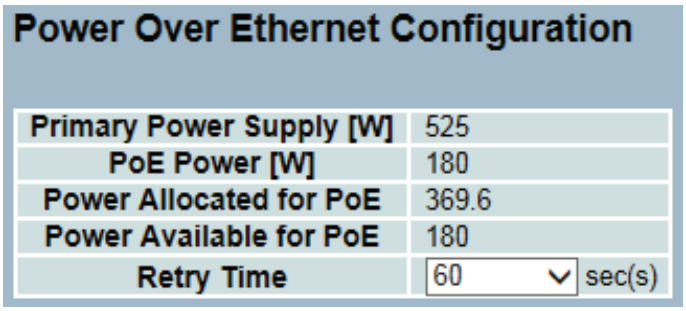

Figure 3: *Vigitron switches can be programmed to retry PoE application up to three times, providing the highest potentials for PoE application and avoiding shutdowns.*

The second PoE related problem is best illustrated by an actual installation. Several schools in a distant had PTZ cameras with more than half their inputs into a single PoE switch. As PoE power was applied, the PTZ domes move to their reference position resulting in a huge surge so great that it damaged the switch's power supply. While the safety built into the 802.3 standard can protect the individual port if it reads a proper camera request, power will be transmitted if it does not account for potential high power surges at the actual start-up. For PTZs and other accessory features, the surge occurs only after the initial communication is established and PoE power applied. The standard only applies to sensing the need for PoE and if the PoE power requested is available. There is no protection against surges or the the number of ports within a switch that are subject to surges.

During normal operation, a PoE network switch has not ability to account for surges occurring from PTZ, LED, Day/Night, Auto Backfocus, and other accessory features. If these occurrences have durations of greater than approximately 40ms or require more power than available at the port, the port PoE will simply shut down rendering the camera useless. This is concerning when the normal operating power of the camera is at the edge of an individual power class and the surge exceeds that class power limit.

POE Power Delay

Port	Delay Mode	Delay Time(0~300 sec)
*	<>	
1	Disable	0
2	Disable	10
3	Disable	15
4	Disable	20
5	Disable	25
6	Disable	30
7	Disable	35
8	Disable	40
9	Disable	45
10	Disable	60
11	Disable	120
12	Disable	180
13	Disable	240
14	Disable	300
15	Disable	0
16	Disable	0
17	Disable	0
18	Disable	0
19	Disable	0
20	Disable	0
21	Disable	0
22	Disable	0
23	Disable	0
24	Disable	0

Figure 4: *Vigitron switches can be programmed to delay the application of per port PoE up to 5 minutes. This avoids the potential for high power surges and damages to the switch power supply.*

Within a network, connected devices pass through the switch. There is no connection accountability between the switch port and the device connected to it. For example, if a NVR or VMS server is not communicating with an individual camera, you don't know if the problem exists at control site device or the camera. Little consideration is given to the idea that the problem may be the switch port and the camera.

POE Auto Checking

Ping Check: Disable

Port	Ping IP Address	Interval Time(sec)	Retry Time	Failure Log	Failure Action	Reboot Time(sec)	Total Reset
1	192.168.1.101	30	3	error=0 ,total=0	Reboot Remote PD	15	☐
2	0.0.0.0	30	3	error=0 ,total=0	Nothing	15	☐
3	0.0.0.0	30	3	error=0 ,total=0	Reboot Remote PD	15	☐

Figure 5: *Vigitron switches have an unique ability to program the IP address to individual switch ports providing for automatic unattended reconnections if the connection is lost and rebooting the camera to provide PoE. A failure log maintains a record and send a detailed report via Sys log and SNMP.*

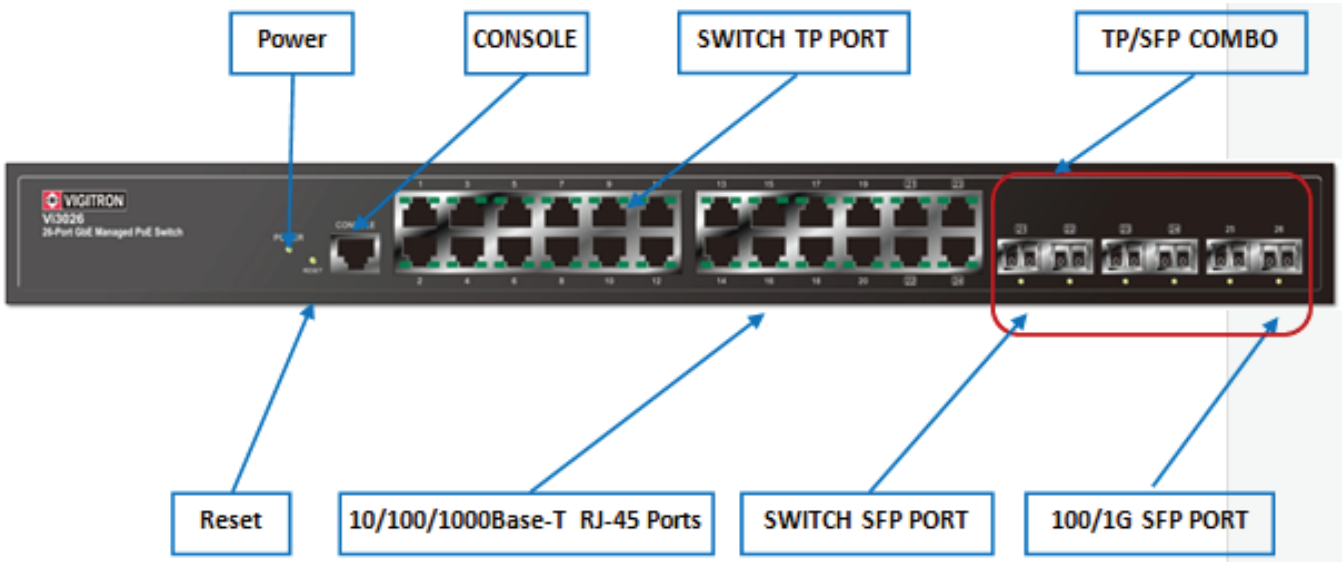

Figure 6: *Vigitron switches contain two extra ports resulting in the most ports available for camera connections. A 24 port switch actually has 24 ports for cameras and 8 port for 8 camera connections.*

Finally, there is the AUPC or Actual Usable Port Count. A 24-port switch does actually have 24 ports, but when you consider that a least one port is connected to the recording or viewing device, the usable port count is reduced to 21. If the switch is connected in a series that uses 2 ports, then the count is further reduced to 22.

All of these define the differences between standard data applications and the requirements of networks designed for IP video security applications. These differences are not define by nor part of any of the standards which govern compatibility in networking standards. They, however, be critical in the performance and reliability of your system.

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Suggested Vigitron Product(s):

Vigitron offers free and without obligation Design Center Services staff by trained factory engineers. To access Vigitron's Design Center, click here or direct any questions on any Vigitron related subjects to support@vigitron.com.

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