

# Vigitron IP Infrastructure Design Educational Series



*IP Infrastructure and Your Security System*

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These series of articles are designed help you understand the unique considerations involved in IP networks. Too often as we continue on the transition from analog to digital, we make the assumption that networks designed for data communication are the same as those designed for IP video. In fact, they are very different from each other. While we focused on camera, NVR, and VMS specifications, we often overlook that in reality it is the transmission of IP video that determines quality and performance. Often, we are quick to blame system failures on the products connected to either end of the transmission line when it is the transmission itself.

Most of the considerations and differences between data and video security IP networks center around two general areas, bandwidth and power over Ethernet (PoE). We'll start with bandwidth.

Security transmission from cameras through a network is usually at transmission speeds of 100Mbps. The first rule is that transmission speeds within the network must be matched. So a camera with an output of 100Mbps must be connected to a switch port set at 100Mbps. Many times, we mistakenly make two critical assumptions. The first assumption is that how we transmit the signal has no effect on bandwidth and the second assumption is that the total bandwidth is available for transmission. The latter leads us to the conclusion that if our camera transmits images at 1Mbps, we can feed 100 cameras into the transmission line.

Any physical transmission media has internal resistance. When we deal with the Ethernet standards, the transmission distance is fixed at 328 feet or 100 meters and the performance standards are set to that distance based on the resistance of Cat 5 cabling. Shorter distance has no negative impact on performance; longer distance does. However, the distance isn't the only factor. IP transmission is interactive. All factors contribute to affecting performance. To better understand this, we need to examine IP video.

There is an important similarity between analog and IP video. Analog video is transmitted as individual pictures. IP video is transmitted in packets referred to as video frames. Both are similar because the number of these images per second determines the fluidity of movement. The key difference is while video comprises 100% of the analog frame, only 50% of bandwidth or less is reserved for the IP video image. The other 50% or more is taken up as packet overheads. This is the information that directs the video image to a destination and if required, responses back to your computer. So for IP video, we start by losing 50% of our transmission space. The second consideration is the size of the packet. As megapixel images increase, so does their packet size. Data communications were designed for smaller data applications such as word and accounting documents. In fact, almost all data products determine their performance specifications based on a packet size of 64 bytes. Even the smallest 1MP camera will have a packet size of at least 1024 bytes. Standards and testing for data packet transmission end at around 1518 bytes or about 2 to 3MP cameras. Above that, packets are called Jumbo Frames. They exist from about 1518 to 9600 bytes. In general, megapixel camera with 3MP and greater exist at jumbo frame packet sizes.

#### What is a video packet and why is its size important?

A video packet is sometimes referred to as a video frame. There are several important differences:



In analog, the complete frame is reserved for video.



For IP video, almost half the total bandwidth it takes up with "overheads" can use up to 55% of the total bandwidth.

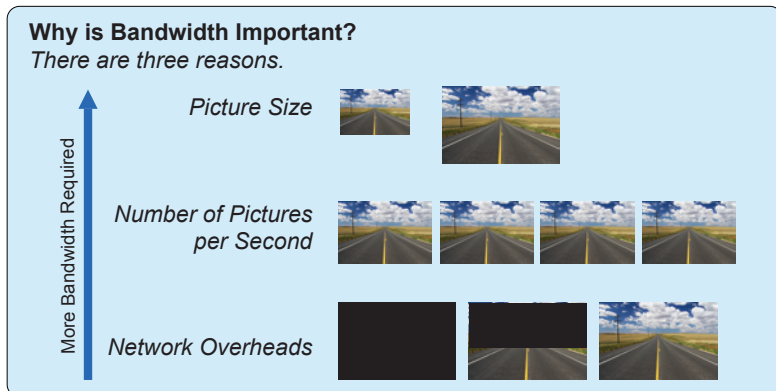
← This section contains information directing the packet to its proper destination.

**Figure 1:** In IP transmission up to 55% of the total bandwidth can be used by packet overheads. It is important to take this into consideration when determining how much bandwidth is actually available. Bandwidth losses can critically effect performance. Vigitron transmission products are tested and certified to maintain all the available bandwidth throughout the quoted distances.

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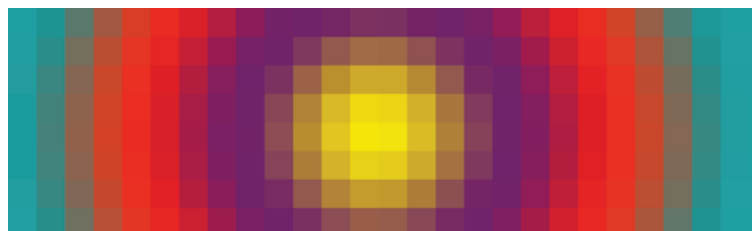
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These two considerations are added to the several others affecting bandwidth. The type of codec used affects the image size. The general rule is H.264 requires the smallest bandwidth and MJPEG requires the highest bandwidth. Next is the number of images per second. More images requires higher bandwidth.



**Figure 2:** Bandwidth also has an effect on packet size transmission. The greater the megapixel size, the higher the transmitted packets, the more pictures per second transmitted the greater the bandwidth requirements. Vigatron products are certified in all areas of packet and bandwidth transmission.

Consequences of bandwidth limitations vary. They can result in an image looking pixelated or the NVR not recognizing an image and displaying a dark screen. Depending on the number of bandwidth requirements in your system, the problem may not remain constant or change between the cameras depending on which camera's bandwidth dominates at a given time.



**Figure 3:** The inability of a typical network switch to pass packet sized greater than 1518 bytes at 100Mbps can result in image distortion for higher than 3MP cameras.

The takeaway is that equipment designed for standard data transmission simply does not meet the requirements for IP video transmission.

Vigatron's Symmetric Bandwidth (SBW™) and Pass-Through-PoE (PTP™) assure minimal loss of bandwidth and PoE over the quoted distances using standard CAT cabling, RG-59, and single pair UTP/STP wiring. Performance claims are backed by certification and interoperation testing with leading IP camera manufacturers.

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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](mailto:support@vigitron.com).

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