The IP Video Bandwidth Dilemma

I work for a company that manufactures multi-megapixel (MMpix) IP cameras so I get to talk to a lot of people that are making the switch from CCTV to IP video. They are switching because of resolution; they simply aren't satisfied with the low quality images they've been receiving from CCTV. So they have decided to upgrade and contact me to find out what they need to do. There are a lot of myths and rumors about Multi-Megapixel IP Video. I try to address them so they may make a more informed decision.

First we go through the pros: better images, crisp clear digital zoom on recorded images, replacing several cameras with one MMpix camera, lower system cost, etc… It is pretty clear that there are more than enough reasons to make the switch. Then we focus on the challenges of MMpix systems. The first thing we talk about is the amount of storage (file size) required. Lets face it…MMpix images are big! But are they larger than 640 x 480 images? Actually, no. Comparatively MMpix images take up less storage and bandwidth than the equivalent number of low-resolution 640x480 cameras that you would need to cover the same area, for instance ten 640x480 JPEG images would take up approximately 300K bytes but a single 2048x1536 image will only take up about 250k bytes so in an apples-for-apples comparison, MMpix images are more efficient.

Usually they will also ask "why not compress the images more?" and I remind them why they chose to upgrade to MMpix video in the first place, picture quality. The more you compress images, the lower the quality. There is no mystery to this. Picture quality depends on the number of pixels you have in the picture, or "Pixels-on-target." The U.S. Department of Justice defines the minimum resolution required for identifying an individual as 21 pixels-per-foot. Pixels are translated to digital "bits." When you compress images or files, you are essentially throwing out those bits or throwing out pixels. Now when you try to reassemble the images you are missing lots of bits so you can't reproduce the images.

If that doesn't make sense, try this: Make a copy of this page. The copy should look a lot like the original with very little loss of detail. Then make a copy of the copy. Looks pretty good, right? This is analogous to uncompressed video or slightly compressed video. Now make a copy at 80% size. Then take the 80% copy and make a copy at 125% to get you back to the original size. The picture will still look pretty good but you have lost some detail, this is comparable to medium compression. Now make a copy at 25% size. Then take the 25% copy and make a copy at 400% to get you back to the original size. Guess what, it doesn't look so good anymore. In fact, you can't read a thing. This is what heavy compression algorithms do. They compress the heck out of the images, basically throw away most of the bits or pixels, then try to reconstruct the images based on calculations, essentially guessing at what was there.

Upon understanding that high quality images require large files, there is nothing more to say about that…well maybe one more thing. Storage is cheap and getting cheaper. Heavy compression algorithms were designed when storage cost $50+/gigabyte, today it costs less than $0.75/gigabyte for storage.

Now how do you move those images around to record and view them? When you start streaming them over the network you will take up quite a bit of bandwidth. Uh oh, bandwidth means IT guys get mad and shut off your connection, no connection means no video, no video means big trouble. Panic. So they ask me "How much bandwidth does an IQeye use?" My answer, "About the same as your CCTV system." This really confuses them because their CCTV system doesn't take up any bandwidth, right? Wrong. In fact your CCTV system does take up bandwidth on the coaxial cable but since it is isolated from your data (IP) network, you don't care. Well the same is true of a MMpix IP video system. Use all the bandwidth you want, it won't affect anything else.

If you draw a block diagram of a CCTV system, there are cameras hooked up by cables (coax) to a switch/storage (DVR) and a viewing station (analog monitors). The DVR is then connected to your data network through a network port. Now lets look at a MMpix IP video system. You have cameras hooked up by cables (cat-5) to a switch/storage (switch and storage) and a viewing station (PC). Sound familiar? It should, it's the same. A MMpix IP video system can record high-quality, high-frame rate images with absolutely no impact to your data network, just like a CCTV system.

Network bandwidth only becomes an issue when you want to view live or recorded video from somewhere on your data (IP) network. But this issue is almost the same for a DVR as it is for a MMpix IP video system. I said, "almost." With a DVR, all the video is collected at a single point so if you want to view that live or recorded video you are forced to view it over a single connection. This may be OK for viewing a single stream but presents a real bottleneck when multiple people are trying to view the video or you are trying to view more than a single camera. With MMpix IP video, the intelligence built into the camera and intelligence of your IP network decide the fastest and best path for you to use. If I want to view live video from a camera while someone else wants to view recorded video from a server, we establish two unique, completely independent connections that won't impact each other.

So the myths are dispelled, people are making the switch to IP video and the Security and IT departments are cooperating, communicating and everyone lives happily ever after.

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