All seeing eyes

There's increasing hype surrounding megapixel cameras and not without reason. When compared with standard IP and analogue cameras, it's easy to see that megapixel cameras offer comparable cost and superior performance.

WHEN you talk to suppliers of analogue, standard IP and even HD cameras, there is often the suggestion that megapixel cameras come with baggage so significant it impinges on their ability to handle real world applications. But such talk ignores the strengths of megapixel camera technology.

One of the beautiful things about megapixel – (MP) cameras is that they capture an entire scene all the time and to great depth. That means with a megapixel camera you're installing a virtual PTZ that retains the ability to zoom into a vast horizontal and vertical scape long after the footage is recorded. In comparison, ordinary PTZs store images based on the focal length and the field of view at any given moment of a timeline.

Megapixel cameras are so good it's hard to deny every external system should have some as part of an overall solution. Sure, you can drone on about challenges like image stream size and the need for adequate light levels with MP, but the benefits of a topical MP application are simply undeniable and their power makes them worth the spend.

Another perceived negative that invariably pops up when talking MP is the need for capable and expensive system elements in order to supply the necessary bandwidth and storage. But once again, such talk ignores the payoffs in improved performance.

While you may need to option shared networks to handle large MP camera numbers and resolutions, this is not fundamentally challenging and the gains outweigh the costs in a number of areas.

A major benefit of megapixel cameras is their ability to replace multiple standard IP or analogue cameras. It's a fundamental that means the math is not one for one – instead it's one for 3 or 4 and sometimes many more. Such elements need to be taken into account when it comes time to make a decision.

BALANCING ACT

The 2 oldest suppliers of megapixel cameras in Australia are Arecont (distributed by Pacific Communications) and Avigilon. Each has taken a different approach to the challenges posed by megapixel technology and to its delivery and storage on networks.

Avigilon employs scientific grade CCD cameras, JPEG2000 compression and clever software in order to deliver huge dollops of performance. Avigilon's High Definition Stream Management is the key to its superb handling on networks. The company's powerful Control Center software offers excellent features like auto lighting control and auto contrast controls.

During a product demonstration, the company's Matthew Fisher shows me how Avigilon's purpose-built proprietary Control Center software handles multiple MP cameras with ease thanks to HDSM.

"The choice of Video Management System (VMS) is the key when working with larger MP cameras," Fisher explains. "Without a purpose-built VMS, the system may not be able to fully handle the images generated by large megapixel cameras and introduce additional installation challenges.

Fisher says there are ways to ensure a network is not overloaded with unnecessary data when using megapixel technology.

"For example, when we drill into a scene we only send those image packets that are required to view that part of the scene – we don't send all the superfluous information," he explains.

"Using the HDSM capability of our Control Center software we can view 3, 5, 11MP cameras even across a simple ADSL connection. And this efficiency applies at the workstation level. We can run 6 x 16MP Avigilon megapixel cameras on a laptop and have multiple other windows open with multiple zoom levels. It works because our system does not load up the chipset with huge levels of processing."

As part of the demonstration we take a look at a 16 megapixel camera view of a large open area in a city including a tramline, a dock area, a large carpark, a public square and various buildings and carparks. The scene is huge yet this one camera is viewing and recording all of it.

It's when we start zooming in that the fireworks start. We can see numbers on trams, we can read the names on the boats, we can identify people throughout the entire scene (it's a huge view, remember) and we can identify car makes inside a nearby carpark.

When we look at the street we can see number plates. There's nothing in the scene that we can't zoom in on. It's awesome performance and when Fisher points out that we're looking at one camera capable of replacing 50 analogue VGA cameras, I look at the scene and think – yes - that seems right.

Such capability is where the strength and economy of megapixel cameras becomes obvious. Installing dozens of surveillance cameras is a seriously expensive business, whereas installing a single megapixel camera at the end of a single blue cable is a no-brainer.

Using Avigilon's Control Center and taking advantage of Avigilon's HDSM, Fisher starts calling up multiple camera views and the laptop all this is running on doesn't miss a beat. The ability to pull up windows within windows and zoom in on them while still viewing the whole scene shows the great power of the Avigilon solution. You can see the system would be ideal for video walls thanks to its ability to deliver what Fisher call 'situational awareness'.

Best of all, performance remains superb – there's no boxing inside images – no sign of a compression engine running on the edge of its capabilities.

"Because we are a medical imaging company we learned early what the downfalls were with any interframe compression codec very early on," Fisher explains.

"As a result we use JPEG 2000 as our compression codec – our experience means we know what the limitations of the other compression algorithms are. With other codecs you are very limited to what you can do. They are lousy, they have a high error rate and high latency.

"They have to rebuild the video streams. You see scenes in which artefacts from previous images remain in the current
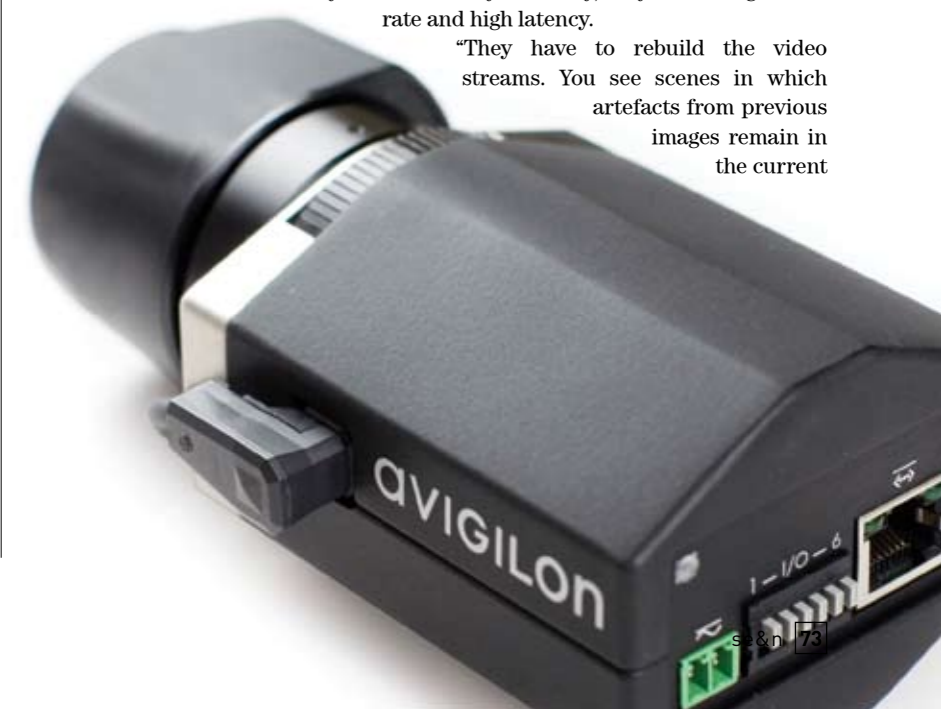
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>
> *Matthew Fisher, Avigilon*

image all because of the challenges of constantly having to rebuild the video streams.

"With our JPEG2000 compression we can go through streams frame by frame but with an interframe compression codec you have to go back to the last I-frame and then step forward.

"This impacts on your ability to drag a timeline. On our Control Center NVMS or viewer you can just grab a timeline and pull it backwards or forwards and everything updates instantaneously and beautifully because there is no the high processing need on the decoding side of the client."

According to Fisher, with interframe compression codecs there are issues with the level of movement in a scene and how it impacts on the average bit-rate of a camera.

"At 80 per cent movement the camera will go to full I-frame anyway – so is that actually saving bandwidth? It is when there's low movement but the saving comes at the expense of image quality."

As part of the demo we take a look at the image from a very good analogue camera installed beside the Avigilon unit. Fact is, it's not possible to read some license plates with absolute certainty on the analogue camera. Even the colour reproduction is not as good as the Avigilon megapixel – it's interesting to see how capable Avigilon's cameras really are.

Next we check out a single Avigilon 5 MP camera inside in food court – we can zoom down to the lifts, the scene lightens and we can see what's going on deep in the scene. Then we make a window and use that part of the scene as a camera view.

"You'd need half a dozen cameras to do the same job as the 5MP and you would not have the ability to drill into scenes," Fisher explains. "It's possible to clearly see the possible savings of using a single Avigilon camera in open areas."

With a reputation as a manufacturer of 16MP cameras, it's possible to forget that Avigilon actually has a wide range of cameras including 1, 2, 3, 5, 11 and 16MP units. An obvious question that springs to mind when considering the depth of this range is which cameras to use where.

"The question of what cameras to use and what quality of images it's possible to get from scenes relates to a number of factors – the angle of the lens, the distance to target – it's a big question," explains Fisher. "Avigilon has a clever software tool to assist with lens and camera choice.

"You plug in mounting height (say 4m), distance to target (say, 15m), scene width (say 12m). Once this information is entered into the system, the integrator knows there's a 42-degree angle of view and the system has also advised the installer of the required focal length in mm needed to achieve that scene and then the pixels per metre – that's the resolution," he says.

"The resolution might be low – 67 pixels per metre – up to a high resolution photographic quality of 328 pixels per metre in the scene. You then need to choose

what sort of images you want. Do you want full facial recognition throughout a scene? Do you just want a general surveillance application? Or do you want to be able to recognise clothing colour, gender, general demeanour and what the person is doing?"

As Fisher quickly demonstrates, once all the parameters are plugged in it's possible to establish that a 1MP camera of 720p will give a pixel count of 107 pixels per metre viewing this scene. With 2MP it's 160 pixels, while 3MP gives 171 pixels, 5MP gives 216. 11MP offers 334 and 16MP dishes up a stonking 406 pixels per metre of resolution. To put this into perspective, around 165 pixels per metre is considered a high quality image.

"Using this tool, the system allows you to establish everything you need from lens to camera angles or view – horizontal and vertical, scene resolution, combined camera/lens length," explains Fisher. "Each camera view can be engineered in this way. Across a scene you might want general surveillance and at choke points you might want face recognition and license plate recognition.

"This allows you to choose applications when you would need to use a 5MP or a 16MP camera. I would argue there really is not a niche for large megapixel cameras – the scene you need to cover determines the camera you need. Why put in 6 2MP cameras when you could put in a single 16MP in applications like stadiums, airport lobbies, loading docks – locations you might not be able to get around and cable multiple cameras in. There might only be a single position possible but you need to cover the entire scene."

H.264 IS THE KEY

At Arecont Vision, Raul Calderon agrees that megapixel cameras are suited to all applications and should not be limited to just external or very large indoor applications.

"Multi-megapixel cameras using H.264 compression from Arecont Vision are suited for all applications," says Calderon. "It really depends on how megapixel cameras are implemented. The important thing is to

understand whether you want increased resolution, decreased camera count relative to standard definition cameras or a combination of higher definition and camera reduction.

"Megapixel cameras are exceptional for installations that require large areas of coverage or extreme detail for forensic purposes. Frankly, they deliver the image quality that one has always wanted but rarely ever achieved out of their video security system.

"For example, a recent installation employing Arecont Vision MegaVideo Day/Night dual-sensor cameras in a newly constructed traffic tunnel in South Korea was implemented to capture license plates at high speeds in a dimly lit environment – a feat that would prove very challenging using conventional cameras considering the pixels on target requirement to capture license plates," he explains.

"Another example is the installation at an American high school where coverage was needed for an open, hexagonally shaped hallway. The imaging solution incorporates Arecont Vision's 5 megapixel cameras with ultra wide angle lenses to provide warp-free images of high traffic areas with the ability to electronically zoom in live as well as after the event to extract forensic information and view the smallest of details in high definition of

these applications clearly refute the misconception that multi-megapixel cameras are for specialty applications.

"The truth is that with H.264 compression, bandwidth is no longer an issue making multi-megapixel cameras ideal for virtually any application as they can greatly reduce the actual number of cameras needed to cover an area versus conventional cameras, and so lower the total cost of ownership for customers."

And Calderon says that while there are always challenges with network bandwidth and storage H.264 has changed things completely.

"H.264 compression has alleviated the bandwidth issues associated with early JPEG based megapixel cameras," he explains. "As a result, the amount of storage required is significantly less than it used to be. Calculating the proper field of view to achieve the pixel density desired within the scene can also be a challenge.

"To assist installers with these challenges, Arecont Vision provides calculators to help in designing a system with the right amount of storage as well as the correct field of view and pixel density within the scene to resolve the target."

Calderon says that another commonplace challenge for security professionals is to understand the long-term value and return on investment (ROI)

that large format megapixel cameras offer relative to cheaper and far less efficient standard definition surveillance cameras.

"Translating the technical capabilities and benefits of this relatively new technology into management and bottom-line benefits can be difficult as it is challenging to assess the cost-savings these devices provide relative to what they can deter or prevent from occurring," he explains.

"Fortunately multi-megapixel cameras are proving to be more efficient in large system configurations as they actually reduce the physical number of cameras required to cover large areas versus conventional cameras, and consequently reduce the associated installation expenses.

"The latter provides a tangible measure of cost-efficiency. But the superior performance capabilities of multi-megapixel cameras to help ensure cost avoidance and improved forensic information are not readily documented at this early stage of multi-megapixel cameras' deployment history."

According to Calderon, big megapixel cameras are not expensive.

"Consider Arecont Vision's new AV10005 10MP camera which provides two times the pixels but only costs 10 per cent more than its AV5105 5MP camera," he says.

"Multi-megapixel IP cameras and systems can make a profound positive impact on budgets because they vastly improve image quality and improve ROI. For example, a single 180 degree panoramic 8 megapixel camera (AV8185) from Arecont Vision can been used for parking lot surveillance replacing as many as 10 to 15 analogue cameras," he says.

"Not only is there a reduction in total installation costs but there is also a reduction in total storage requirement and fewer cameras to manage, service and maintain. This ROI case is made time and time again all over the globe for virtually any megapixel parking lot or wide open area application."

As Calderon explains, while the actual camera device might be a little more expensive, the total solution cost or total cost of ownership is not.

"Megapixel IP cameras on IP recording platforms are extremely cost effective," he says. "It takes fewer megapixel cameras to cover the same physical area and picture quality is greatly improved over standard resolution cameras.

"Using fewer cameras offers the additional benefits of fewer cables, fewer camera housings, fewer lenses, fewer network video recorder (NVR) licensing fees, fewer NVR servers, and far less installation expenditure."

In general, higher resolution cameras have increased performance challenges in low light environments and Calderon says Arecont Vision has implemented several technologies to combat this issue.

"For example, our new AV10005 is the world's first 10 megapixel and 1080p H.264 Dual Mode camera that resolves many of the issues commonly associated with multi-megapixel cameras," he says.

"The camera offers a binned mode that combines and averages pixels for better low-light performance, greater sensitivity and improved signal-to-noise ratio (SNR).

"Other features include on-camera real-time motion detection with our enhanced noise cancellation technology, a programmable shutter speed to control motion blur, and MoonLight mode for extended exposure. The performance and functionality of this camera will change the landscape for multi-megapixel cameras."

And Calderon says that in the future larger megapixel cameras will be commonplace.

"We firmly believe that megapixel cameras will eventually become the dominant platform for general video surveillance applications we are already seeing evidence of this as megapixel popularity continues to grow," he says.

"Video surveillance imaging, recording and processing technologies continue to evolve rapidly and driving the demand for higher performance systems. As more installations employ megapixel cameras with high levels of success, the industry's migration to megapixel cameras will continue to accelerate." ◢ ◢ ◢

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Raul Calderon, Arecont Vision