HEADER HERE

An interview with Vlado Damjanovski – Australia's renown author of many books on CCTV, Standard's Australia CCTV committee chairman, a lecturer and presenter, an innovator and a true specialist in his field.

Q: Specifically what has changed most in video surveillance over the past 10 years?
Firstly, thank you for the interview invitation. Without any doubt – digital storage and transmission is the biggest change. More precisely, switching from analogue VHS Time Lapse recording to digital storage on large capacity hard disk drives. I can clearly remember 1997 when I did my first digital CCTV project for Star City Casino, we used 9GB hard disk drives per machine. Only 10 years later, the largest capacity became 100 times of that size. Seen with statistical eyes, each year the capacity of hard disk storage "ten-folded."

Also, the internet and network technology matured by the end of last century, offering new methods of transmission. This fact, combined with the lowering prices of digital encoders and decoders, made the digital CCTV very attractive and affordable technology.

Q: Would you say that we are witnessing a complete shift in technology with this swing to digital – by this I mean digital from end-to-end – or are we going to be hybrid for some time yet?
We already have mature digital end-to-end products, and it happens that I have been involved (again :-) in some pioneering "complete" IP projects with as much as 5,000 IP cameras and recorders (e.g. City of Dreams in Macau) and it works. So the technology is here and it can be implemented complete end-to-end. The reality is this has been done on brand new installations, where the customer has requested such an approach, and as you know, casinos are not shy of spending the money if they can do it the way they want.

Most of the existing CCTV systems are using analogue cameras and many users want to maximise their investment in the cameras that still produce acceptable video. So, in such cases, it is more economic to design and install a hybrid system. Good analogue CCTV cameras still produce a superior video to many IP cameras, at least when compared to same size chips (pixel count). In my opinion, there will be at least another 5~10 years where such hybrid systems will still be in existence.

Q: How do you feel about the HD standard – is it likely the CCTV industry will go with HD, will bigger megapixel prevail or will there be a smorgasbord of standards?
There is no doubt in my mind – HD CCTV will be the new standard.
When I say HD I am referring to the broadcast industry definition of HD as 1920x1080 pixels with true "live" motion of 25 images/second. This should not be confused with "megapixel" CCTV, although technically HD is a 2 MegaPixel video stream. Many companies will say – we have 3 MP, 4 or maybe 10 or 16 MP, so they can also say "we offer better CCTV than HD."
If you consider just the pixel numbers, this would be a correct statement, but I bet you that many security operators, users and law agencies will prefer "only 2 MP" but with full motion video so that they can see what happened exactly in that incident, instead of say 10 MP but with only 1 or 2 images per second. On top of that, an HD "live" stream compressed with H264, will take much less bandwidth than say 4, 10 or 16MP MJPG with 2~5 i/s.
Another very important reason why I consider HD will definitely be the next CCTV standard is the fact that HD is now de facto broadcast TV standard. Consumer "True HD" camcorders (1920x1080pixels) and displays are widely available and they becoming cheaper and cheaper every day. Traditionally, CCTV users don't want to pay too much money for a CCTV system, so they will always opt for a cheaper compromise. HD electronics is becoming cheaper with the mass acceptance of HD television standard, and CCTV, which traditionally trails the broadcast TV will follow suit.

Q: From your perspective, how are installers in the surveillance industry responding to IP video – is there a clear shift in their focus or are some being left behind?
I hate to say it, but many installers like

"HD electronics is becoming cheaper with the mass acceptance of HD television standard, and CCTV, which traditionally trails the broadcast TV will follow suit."

"gadgets" (like me :-), but most of them blindly follow the trends of "buzz-words" in new trends and technology. Only a handful, but educated installers, do analyse the products critically, as engineers and technical people should do.
Only when technology is proven in practice and only when you know how it works and what are the benefits, but also limitations, only then it should be accepted. Not because it is a "buzz-word" and it's new.

Q: What do you think are the key features of IP cameras that end users need to be on top of when making camera choices?
The number of pixels is one important feature, but not the only one. Other, equally important, features are the physical size of the imaging chip (same pixel count on a smaller chip will produce lesser quality picture with more noise and poor low light performance); the compression used (is it image or video compression?, e.g. MJPG vs. H264); the number of images/second produced (this depends on the pixel count, but also on the compression electronics, as well as transmission – network,...).
The latency of the camera itself, plus the network latency, i.e. how much time it takes to see a live image from an IP camera. This is defined by the pixel count and by the speed and the design of the electronics.
Let's not forget the feature that is probably most important of all, although it is not the camera itself - the lens attached to it. The smaller the chip is and the more megapixels it has, the more critical is the optical quality of the lens.

Q: Would you say that IP cameras are as good or better than analogue cameras or is it horses for courses?
The answer will depend on what you consider "better" in a camera.
If you compare different resolutions, then logic says the higher resolution should be termed "better." This is not always the case. I work with cameras all my life and I see cameras as complex device where each component plays a role, as mentioned earlier. If you compare same resolution cameras, e.g. analogue SD (Standard Definition) and the same SD camera, but in IP version, you can get the IP to be very close to the analogue, but there is always that little bit of loss, since all IP signals are compressed. If you choose a good compression, you may get a signal that is almost the same as the uncompressed (hence analogue signal), but a good analogue camera will always have that little extra. If however you now compare a megapixel IP camera with an SD analogue

camera, it is unfair comparison because there is no megapixel analogue camera. I could however argue that I can setup a good analogue SD camera to have the same detail as the megapixel IP, by just choosing a good narrow angle lens so that the details of a person's face is as good, and possibly better than the IP camera taking a wider view.
Basically what I am saying here is very simple: a megapixel IP camera is typically used and recommended in areas to replace multiple SD cameras, hence they are rarely used to have narrow angle of view, but always wider than normal. The arguments for such a megapixel camera you would hear from a sales guys is that you can replace 3 or 4 SD cameras to see the same details. This is of course true, but to an extent. I could argue that putting 4 SD cameras with narrow views will be cheaper than one megapixel camera, offer the same, if not more details of the quarters they are viewing, and the recording of such cameras would most likely need less bandwidth for real time "live" streaming.
This argument is based on the current prices, and, as I said previously about the HD, without any doubt in the very near future the prices of HD will come down so much, that I can no longer defend this argument.

"Network is a "living" organism and it can fail. The vital organs are the switchers and routers, the veins are the network cables. Networks are practical, adding new cameras to the system is almost "plug and play," and this is the main attraction from system design perspective. Network systems are easily expandable. But, being "living" organisms, they do have certain downfalls which we should be aware of."

Q: What, if any, are the weaknesses of networked applications when compared to coaxial or is a networked comms infrastructure superior?
Network is a "living" organism and it can fail. The vital organs are the switchers and routers, the veins are the network cables. Networks are practical, adding new cameras to the system is almost "plug and play," and this is the main attraction from system design perspective. Network systems are easily expandable. But, being "living" organisms, they do have certain downfalls which we should be aware of.
The first is the possibility of complete failure, or at least data packets losses. The efficiency of data transfer (your images) is never 100%. If a data packet is not transmitted properly due to packet collision, bad cabling, noise, inefficient switchers or software, it has to be retransmitted. This does not affect visibly your e-mailing or web browsing, but when you are recording 25 images per second of thousands, or hundreds, or even tens of cameras, each packet lost, could be the very important for live viewing or recording.
Then, it is the possibility of network switches or routers to fail, or maybe just a software glitch or bug. Many cameras, if not the entire system can fail. I can tell you some stories from my experience on this one day, but not in this interview.
Next, network distances are very limited. Many people have preconception that once you are on the network, there is no limit to how far you can go. This is not true. The theoretical Cat-5 and Cat-6 maximum distance is 100m. To go further you need a switch in between. You can, of course use fibre network, but this is more expensive, and distances are limited with this too, although much longer than copper.
You may argue that Internet is everywhere and has no distance limitation, but you DO have many many switches and cables in between. This is all introducing latency, which, again, is OK for your browsing, but not OK for live surveillance. This is especially critical when CCTV operators need to interact with a live signal and control a PTZ camera for example. Latency makes it a bit difficult.
On the other hand, coaxial analogue transmission is full-proof. Once in place, you have no worries about network failure. You loose coax video only if somebody cuts it, or termination is bad (which could also be the case with the network). Over coax you can only transmit one signal at a time over the one cable. Coaxial cables are especially prone to induction, which creates ground loops.
So, lately we also use Cat-5 and Cat-6 in CCTV where we transmit analogue video, using "balanced" twisted pair video. Today this is a better alternative then the coax, especially for longer distances, as twisted pair doesn't have ground loop issues. In fact, I give preference to this transmission over IP for cable to recorder SD signal transmission, as it goes further then the Ethernet limit of 100m. With good active twisted pair distances of over a kilometre are possible.
As you can see, things are never just black and white.
Engineering challenges are always in choosing the best compromise, even if this has to mean using a mixture of technologies or infrastructures.
Knowing all of the above, creative engineers do not give up, but always find inventive ways to overcome obstacles and problems, and combine benefits from both coax and network infrastructure.
Many installations I have been involved with are actually using the benefits of both analogue and network infrastructure.

Q: Low light – do IP cameras have an issue with it or not?
The question is simple, but I am afraid I am tempted (again)to give a long answer, because (again) things are not just black and white. But, I will spare some ink on this question and answer as short as I can: The smaller the pixel of an imaging chip is, the more problems will have with low light. This means, the more megapixels you have on smaller area the smaller the surface area of an active pixel will be, hence it will have low light issues. Here again, there are some smart engineering solution, like the so called "pixel-binning" for low light, intelligent 3D noise reduction, and these work too, but reduce resolution.

Q: The thing too many end users don't think about with IP and especially with megapixel cameras, is the cost of storage – it's huge isn't it – especially for larger systems?
Yes, and part of this answer is contained in my response to your question about the HD. The more megapixels you have and the more images per second you have – the more storage space you require.

This is even more critical if you don't have intelligent motion detection analysis, which means you need to record megapixels in permanent mode, or only when external trigger initiates it.
Some will even say – I don't care, hard drive prices are falling every day, so I can always add some more TB at very low cost.
This is true, but a reminder from practical experience: somebody has to eventually go through the recording and find that incident that happened one week ago. If you don't know exactly when it happened, and on what camera, you could spend hours, if not days, searching for it.
Remember, large amount of data, means not only large storage requirement, but also large portions of your productive time to find an incident.

Q: Is recording on movement adequate in most cases and do end users really need 30 days of storage on all inputs?
My opinion is that if you have a good motion detection, and add to it the pre-motion and post-motion recording (most recorders do have this feature) you won't miss anything.
Having said this though, I know that some customers (like casinos) will accept nothing less than continuous permanent recording.
As for the storage days required, I don't think there is a "need" for 30 days storage. In most cases 1-2 week is sufficient. It really depends on the application. Only in systems where incidents are not reported or discovered quickly there might be a need for more two weeks. But, in my opinion, an active place, like a shopping centre, university campus or casino, will have incidents reported and discovered in a matter of days, if not hours.
Reducing the demand to one or two weeks recording instead of a month will reflect on the bottom line very positively, which in my opinion is better spent on better and more cameras, rather than more storage.
Don't forget, when we had VHS tapes, one picture per second at VHS quality was sufficient for 24 hours of recording only.

Q: Do most applications need megapixel or is it best used as a typical application?
I think I partially answered this question earlier. The secret is in finding the best compromise. Applications should be designed so that a customer requirements are fulfilled, irrespective if it needs a mix of megapixel and SD camera, or just megapixel or just SD. They can be mixed and mixed solutions are typically more flexible and more effective today.

Q: Which of the CCTV standards being developed would you support, or are in supportive of all of them?
If you are referring to the ONVIF and PSIA proposals, I think that it is a waste of resources if they are working separate. Firstly, they are not going to be standards as such, but we should call them agreements on some common protocols and formats for the purpose of the interoperability of CCTV equipment produced by various people.
I have spoken about this issue in other overseas media and conferences, and my opinion is that the CCTV industry is so small that I believe all positive energy and initiatives ONVIF and PSIA should be merged and put together under one common idea.
You may not be referring to the Australian Standard initiative for Digital CCTV standards (it would probably end up as AS 4806.5), but I have been working on this with some of my colleagues, and for the readers that are not aware I would like to invite them to download the Draft2 from the CCTV Forum site (http://www.el51televisionstandards.com.au/cctv.html) and comment on it.
Basically, all the questions you have asked me so far, and some more, are treated there.

Q: How important are lens choices with HD and megapixel cameras?
Is there a need to comment here? It is absolutely the most important thing. I will spare some of your space with my typically long answers (sorry, but that's my job :-), and invite you to read the above mentioned draft, the details of what resolution a lens should have for the particular megapixel chip are outlined there.

Q: From an installation perspective are there fundamental differences between analogue and IP/megapixel cameras or are they very similar?
Well, today, most of the IP/megapixel cameras would be slighlty bulkier and bigger (as they have compression circuitry, as well as network built-in, and some add storage to it), which means a bit more consideration for brackets, housings.
There are makes and models that have this already sorted by their design, but yes, it will be generally correct to state that there are some extra installation consideration about IP/megapixel camera.
Usually, megapixel cameras will run hotter (because of extra electronics inside) so it needs a bit more power juice, and certainly cooling needs to be considered.
Some people want Power over Ethernet (PoE) which has it's own limitations and requirement, so the installers need to be aware of that too.
Other practical issues are focusing and positioning of the IP cameras. Not all of them have composite video out for adjusting purposes, which means and installer should always have a notebook PC for setup and camera adjusting. And be patient and slow when adjusting focus. Because of the latency, if you use a PC to see the camera setup, it will take a second or two to see the result of your focusing and positioning (remember the latency I mentioned earlier?). Then, there is obviously the IP addressing issue. Many installers still do not understand the reasoning behind IP addressing, private IP and public IP addresses, fire-walling and perhaps special ports opening. Education is required all the time.

Q: Video analytics – how capable are they

in your opinion? Are we talking about the future, or are there real world applications where analytics can support secure applications?
In short: very attractive on paper, but haven't seen a real revolution in video analytics yet. Yes, there are numberplate recognition algorithms, directional movement sorting out or counting, loitering detection, and picture gallery protection, but none of them is 100% accurate, and will never be. There will be some time yet for a real video analytics that will help an operator in real time to pay attention to an ongoing incident or to prevent a crime.
I would suggest that today a better use of Video Analytics would be in slow but accurate and continuous analysis of already recorded footage. This could help find and index incidents after they have happened, but before they are overwritten by the system. That way, maybe even some storage space can be saved, as if the system ca find for you incidents automatically, you may not need weeks or months of recording.

Q: How do you feel about the exceedingly low minimum scene illumination numbers quoted by most CCTV manufacturers – numbers that include IR (Infra Red) sources very few end users actually have installed? What should end users be looking for in order to guarantee good low light performance in the real world?
I have had some very nice article a few years ago published in a good old technical magazine that I was publishing (and I think you and your readers know it :-), where I had some very nice explanations and calculations answering such question.
In short, do not blindly trust camera manufacturers' specifications that quote numbers below 0.1 lux. The best and the only way to know if these are correct is to test and try it yourself.
When somebody is saying "we can produce a picture at 0.001 lux" it could be the same as saying "we will give you noise and we will call it a useful signal." Everybody knows that noise is unwanted signal. There is no meaning in noise, it is random and it masks the real detail.
For starters, there is hardly an illumination measuring device that can measure such a low light illumination as 0.001 lux.

In astronomy, CCD cameras are used to detect weak stars millions of light years away. Their worst enemy is the noise coming from normal temperature, and for that reason they cool their megapixel chips to -30˚C or -40˚C to minimise each thermally generated electron."

In practice, it would mean that a CCD or CMOS chip can produce a meaningful signal out of one or two photons. This would be equivalent to saying that you can find the same grain of sand on the Gold Coast beach that you stepped on last time you were there on holiday.
In astronomy, CCD cameras are used to detect weak stars millions of light years away. Their worst enemy is the noise coming from normal temperature, and for that reason they cool their megapixel chips to -30˚C or -40˚C to minimise each thermally generated electron.
We, in CCTV, basically "heat up" such cameras to +40˚C or +50˚C and pretend to not see the thermally generated electrons, which are nothing but noise. If you have noise, you can't see the low light detail.
Exception to the above might be the special military style low light intensifying cameras (which would be very expensive, and very rarely used in a typical CCTV system).
Some might be also thinking of cameras with Infra Red LEDs on them. Low light performance on such a camera does not qualify the camera itself as having such minimum illumination capabilities.
IR lights have very limited distance, you can't use colour, and if they are used very close to the people's faces they may affect vision. As you may well be aware, the IR frequencies are invisible to human eye and if you don't see it, your iris would not close to protect the retina. I would question the OH&S with such cameras.

Q: Discounting brands, if you were the security manager of a high security site what would your perfect video surveillance installation include taking into account infrastructure, storage, camera type and management system?
If I was a security manager, I would firstly educate myself, to the basic level at least, of the technology and products available around.
I have high respect for security managers, and I am not saying they should go and start studying at the University to understand CCTV, but if they know at least a little bit about the technology, it will help immensely in modelling what they want to achieve. I would then define my risks, my priorities and the type of surveillance work I would prefer for my business. How many operators, what kind of CCTV I want, pro-active 24hrs or passive, etc.
Then, I would choose a knowledgeable installer or consultant (yeah, I know, there are not many around, unfortunately), and work together with him/her and go through the design itself. Designing is a process, it is an evolution of ideas and creative thinking. You cannot copy a design (as some do), each project and each system is different and may require different approach.
Secondly, I would never consider the cheapest solution as the best choice (as many, especially larger customers, have done in the past).
I would always look at the long term cost, and very often this means slightly more expensive design, but in the long term, the best choice. I would not go for the "buzz-words" technologies until I understand them and see them working.
Finally, what would be my "pefect" system will depend on whether the installation is a brand new, or it is an upgrade of an old one which may require a mix of technologies.
I can mention names and products here, but I don't want to use your magazine for advertising purposes, people that know me would know the type of equipment I use, which is not to say that there are no alternatives to my choice of products. There are many good products out there, the trick is to learn them well so that they can be used to the full extent. Satisfaction from making a system design work in practice the way you have intended it to, cannot be paid with any money.