help desk

Crystal balls | By Wayne Howell

"In a concert situation, you get the system working perfectly, and then 50,000 radio jammers (punters with phones) walk into the building . . ."

I imagine we've all noticed changes in behaviour over the course of this truly odd year. I've noticed that the Artistic Licence *Help Desk* receives more philosophical questions. No longer do we just see "how do I enable feature X" - posts now include questions such as "do you think radio-DMX will take over from cable" or "will ethernet replace DMX512". This has led me to think that a crystal ball column on the future of lighting control could be fun. I do not consider my crystal ball to be any better than the next, but I do get to watch a lot of technology updates with my participation in the TSP, the standards organisation that manages DMX512, RDM, sACN, RDMnet and so on), so here goes . . .

RADIO-DMX

So, *do* I think that radio-DMX will take over from cable? No. I've never wavered in my opinion that (realtime) radio data links should only be used if you physically cannot run a cable from A to B. The reason: cables are deterministic, the signal delay and the bandwidth that you achieved yesterday are likely to be the same today. With radio data links, that is not true. In a concert situation, you get the system working perfectly and then 50,000 radio jammers (punters with phones) walk into the building. There are really good reasons for using radio-DMX: physical barriers, moving scenery, building to building links, swarming technology, battery-powered lights and much more. But if you can run a cable, then do so because by definition it is more reliable.

EVOLVING WIRES

What about the wires? Is the current status quo of DMX512 and ethernet protocols likely to stay for the foreseeable future? About two years back, ESTA ran a satisfaction survey on lighting control protocols, and its results have been used to guide development of control protocols. My rather general analysis of the conclusion is that everyone wanted the simplicity and robustness of DMX512 with its ability to loop through devices (called multidrop), combined with the speed of ethernet.

Sadly, you can't have both. Ethernet gives you the speed, but it's a point-to-point protocol. DMX runs at 250kbps (1kbps is 1000 bits per second) whereas the slowest ethernet protocol of 10BaseT starts at 10Mbps (1Mbps is 1 million bits per second). Simplistic comparisons between DMX512 and ethernet speed are dangerous, but here goes: 250kbps=0.25Mbps. The slowest ethernet is 40 times faster than DMX512.

At this point, I have already upset purist engineers by my simplistic comparison, so let's continue. The chart below gives a comparison of the speed and features of DMX512 and the slowest common ethernet 'physical layer' of 10BaseT.

	DMX512	10BaseT
Speed	250kbps	10Mbps
Distance	300m	100m
Multidrop (Devices per cable or loopThoughs)	32	2
Cable	Twisted pair / Cat5+	Cat5+

(Note: I use the term Cat5+ to encompass all UTP cables from Cat5 upwards such as Cat5e and Cat6.)

It's pretty clear that you either go for speed (ethernet) or distance and loop though (DMX512). But what if that was not the limitation?

HISTORY

Ethernet first entered the lighting industry in the 1990s with protocols such as Strand's ShowNet. It used an ethernet physical layer called 10Base2 (aka thinnet). Connection was via a coaxial cable terminated with a BNC (British Naval Connector). 10Base2 has long since fallen out of use, but there was actually much to like about it. Its speed was a very credible 10MBps. The '2' in 10Base2 was intended to indicate 200m, but it could actually only reach 185m. But perhaps most interestingly, it was a multidrop protocol that could 'loop through' some 30 devices. This outdated technology is suddenly looking quite interesting. Let's run that chart again:

	DMX512	10BaseT	10Base2
Speed	250kbps	10Mbps	10Mbps
Distance	300m	100m	187m
Multidrop	32	2	30
Cable	Twisted pair / Cat5+	Cat5+	Coax
Status	Live	Live	Obsolete

BRINGING IT UP-TO-DATE

Why did the use of 10Base2 die out? The coaxial cable was relatively expensive and fragile compared to Cat5 and there was no way to increase the speed in a world ever hungry for more bandwidth. Multidrop ethernet largely died with 10Base2. So, has anyone looked at bringing back multidrop ethernet? Well, it turns out the answer is yes . . .

AUTO INDUSTRY INFLUENCE

The Controller Area Network (CAN) protocol has been in use in automobiles for many years. It's a relatively slow multidrop protocol used to communicate between the different electronic

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	DMX512	10BaseT	10Base2	10BaseT1L	10BaseT1S	802.3da
Speed	250kbps	10Mbps	10Mbps	10Mbps	10Mbps	10Mbps
Distance	300m	100m	187m	1000m	25m	50m
Multidrop	32	2	30	2	8	16
Cable	Twisted pair / Cat5+	Cat5+	Coax	Single twisted pair	Single twisted pair	Single twisted pair
Status	Live	Live	Obsolete	New	New	Future

components in a vehicle. CAN is robust and well-suited to the harsh vehicle environment, but does not have the bandwidth for modern vehicle needs such as multiple cameras. Something faster would be needed, but with a robust and multidrop implementation. Around three years ago, the IEEE started a project called 802.3cg and it became a standard last year. As yet, there is very little equipment supporting the standard, but this is likely to change quickly. This was to be a new ethernet standard that runs on a single twisted pair, supports PoE and provides 10Mbps. For the automobile industry, this was to be CAN on steroids, but it also offers interesting possibilities for lighting control.

There are two flavours of 802.3cg: 10BaseT1L - a point-to-point protocol that sacrifices multidrop for distance and offers 1000m reach; and 10BaseT1S - a multidrop protocol allowing connection of 8 devices at up to 25m distance. 10BaseT1S could be good for lighting control but 25m and eight devices would be limiting.

BUT WAIT . . .

IEEE 802.3da standard development has just started. This is an evolution of 10BaseT1S that would give 10Mbps, 50m reach and 16 or more connected devices (*see table above*).

SUMMARY

Currently, smaller applications run with just DMX512 from the lighting console out to the devices using multidrop loop-through. Larger applications use ethernet (100BaseT or Gigabit) to gateways that generate DMX512. The DMX512 is then used for the 'last 50m' because it has the all important multidrop loop-through.

This works, but increasingly we see a bandwidth squeeze in the middle. DMX512 is not fast enough for the next generation of media-hungry devices such as moving lights that can also render video. I think there is a good chance that 802.3da will replace DMX512 in the above scenario - but I would not care to wager on when that may happen!