The Future of the Networking Standards

USB 2.0 and FireWire™ Fight For Bandwidth With Manufacturers and Consumers

By Michael Goodman

A guy walks into a music store looking for a computer interface to record his guitar. He is setting up a home studio and needs to understand a myriad of digital interconnection choices, while all he really wants is to record a demo.

He finds himself staring at two different guitar processors. Both do the same thing – exactly what he needs to create a digital version of his tune. But one is a USB 2.0 device, and the other is a FireWire/IEEE 1394 device. Which one should he chose?

Anyone involved in the pro audio business – or the consumer electronics business, for that matter – faces the same dilemma today. The two standards have been around for a while. Shouldn't one of them have faded away by now?

The Emergence of Two Standards

We appreciate standards so much that our motto should be "If standards are a such good thing, why not have four or five?"

Sometimes competing standards battle it out and one comes out on top. But other times – most notably with the 33 and 45 RPM records and with VHS and Betamax videotapes – the two standards find niche markets where they can peacefully co-exist.

To understand the difference between USB and FireWire networking standards, we first need to understand their history. FireWire was introduced first, designed by Apple as a fast protocol for sending information between Macintosh computers. Apple saw the licensing opportunity outside of the Mac world, and started charging one dollar for every FireWire port installed on a product (Apple has since changed its licensing policy).

The Windows/Intel side of the personal computer industry didn't take kindly to the idea of paying Apple for every computer they manufactured, so they decided to create their own networking protocol, geared toward their own version of the personal computer and allowing the connection of various peripheral devices to a central PC. Thus was born USB, or Universal Serial Bus.

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Both protocols are extremely fast – faster, in fact, than 100BaseT Ethernet, as shown in the following table.

Format	Speed	Audio Channels @ 24/96
USB 1.1	12 Mb/S	3
USB 2.0	480 Mb/S	80 per end point
Firewire	400 Mb/S	85
Firewire 2	800 Mb/S	170
100BaseT Ethernet	100 Mb/S	32

Table 1 – Speed and audio channel specifications for various networks

But since the originators of USB designed it around the PC, they designed it to connect "dumb" devices like keyboards and printers to a computer, which acted as the host of the USB network. This isn't a problem with low-speed peripherals such as a mouse, but it can be a disadvantage when you have "intelligent" devices like laser printers or digital cameras with processing power that might rival that of the host computer.

This disadvantage comes from the fact that a data exchange between two USB devices taxes the processing power of the host computer, which has to arbitrate the data transfer. With FireWire, you can connect any two FireWire-compatible devices and allow them to exchange data without a computer, as long as the devices have a protocol to recognize and interact with each other.

This difference is evident even at the chip level. FireWire chipsets, which contain the extra "smarts", that allow any device to be a host, are more expensive than most USB chipsets. USB chipsets come in two flavors: the more expensive host chips are built into the PC, and the less expensive client USB chips are part of the peripheral devices. This results in a price advantage for USB peripherals, but the cost difference is diminishing over time as chip volumes grow.

What's The Difference?

For the most part, peer-to-peer (FireWire) and master-slave (USB) peripheral networks yield about the same results. Both are fast, easy to use, and effective. But as computer peripherals and other digital devices become more intelligent – even traditional appliances like televisions and refrigerators contain computer chips nowadays, – the processing power drained from a host computer to manage network transfers gives an edge to the more intelligent FireWire network.

On the other hand, millions of computers and peripheral devices already contain USB 2.0 ports. It's hard to fight that kind of installed base, no matter how hard you try.

So what of our young guitar player? Which device will be best for him? There is little noticeable difference in performance between the two protocols, and one will help him digitally record his next hit as effectively as the other. That's why some pro audio manufacturers have embraced both standards, as we can see from the following table.

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USB 2.0	**Firewire/IEEE 1394**
Edirol	TASCAM
Creative Labs	Metric Halo
Waldorf	MOTU
M-Audio	M-Audio

Table 2 – Some audio companies manufacturing devices for USB or FireWire interfaces

In the future, however, there might develop a difference between FireWire and USB, if only with regard to how they are used. If logic was the driving force behind the market, FireWire will probably gradually migrate to professional applications, as Betamax video did in 1975, while USB sticks with the consumer angle. But this prediction is hard to make – we all know that the market isn't always driven by logic.

So, until logic takes hold, to continue meeting the needs of consumers like our musician friend, and to ensure that he and his brethren always have adequate choices, device manufacturers will need to show compatibility with both FireWire and USB camps. And since the FireWire specification, for example, weighs in at around 1,200 pages, most device manufacturers will need to rely on a partner with available reference designs or ready-made boards to enable as much interoperability as possible.

One thing is for sure, though. The music will keep playing for our mutual enjoyment, no matter how the battle of the standards plays out.

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Michael Goodman is managing director of CEntrance, Inc., a design firm at the forefront of innovation, which develops professional audio and consumer electronics products used in homes, radio stations, recording studios, concert venues, and virtually anywhere else music is made or heard. By paying special attention to product definition, design, and user interface, CEntrance develops products that customers come to rely on-and love. For more information, please contact CEntrance at 847-581-0500 or via email at info@CEntrance.com

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