Audio Processing Accelerators

At the Frankfurt Musik Messe, Waves gave *Resolution* an advance look at its new Audio Processing Accelerator hardware units, designed to allow users to run multiple instantiations of Waves' most CPU-hungry plug-ins. Released at the Barcelona AES, the Accelerators offer the ability to combine units for extra power and to share resources among multiple units in a manner that has interesting implications for the future of DAW work. Waves' GARRETT SODEN gives an insight into how the products were developed and outlines the benefits to end users.

AMONG MANUFACTURERS OF audio plug-ins, Waves have long been known as a developer of several industry-standard tools, and was the first developer of third-party plug-ins for Digidesign products back in 1992. So the company is no stranger to the effort required to produce powerful audio software that fits within the confines of a specific DSP chip or CPU. However, advanced plug-ins, such as Waves IR-1 Parametric Convolution Reverb and L3 Multimaximizer, have begun driving hardware right to the edge of its capability. The situation is frustrating not only for users, but also for Waves engineers, who yearn to build radical plug-ins (think multiband tools covering dozens of bands instead of just five) if they can only access system resources that are up to the demand.

More than two years ago the company foresaw the looming system crunch and began research to address the problem. The obvious approach was to build an outboard box similar to those already marketed by other plug-in manufacturers containing a dedicated DSP chip programmed to handle the extra load. But given the exponential growth of software power, Waves engineers doubted that this solution could keep up with future developments. 'Over the last few years DSP chips haven't advanced very quickly compared to CPU power,' notes Meir Shaashua, co-founder and chief technology officer of Waves. 'The power of a typical DSP chip has gone from 20MHz to 200MHz, while over that same time CPUs have gone from 12MHz to 4GHz.'

Harnessing the power of a second CPU, then, seemed like an obvious choice (and one recently developed by Apple), but that approach brought its own challenges. The first was that dedicating another computer entirely to audio duties is an expensive and inelegant solution. This could be overcome easily enough by creating a product that contained a CPU and just the hardware necessary to handle the job. The second problem was more daunting: how to get the signal to and from the box efficiently.

Again, the Waves team looked at the available solutions: a PCI-card inside the host computer, a FireWire connection, or a USB connection. The PCI-card approach was rejected as the least desirable as it takes up valuable real estate inside the computer and is trickier for users to install. But the newer FireWire and USB methods also didn't thrill the engineers at Waves; once again, these standards had not kept up. 'We finally realised that there was already a standard out there which had surpassed FireWire and USB in terms of speed, efficiency, cost-effectiveness and flexibility,' Shaashua comments, 'and that was Ethernet.'

The advantage of using stock CPUs and Ethernet components meant that the envisioned Waves hardware box could easily keep pace with DAW evolution because it would be based on industry standards that are constantly being upgraded. Waves could therefore upgrade its box anytime by employing more powerful CPU and Ethernet components whenever they became available. Moreover, using Ethernet meant that standard Ethernet switches could be used to combine the power of multiple boxes, share the resources among several users, and use long cable runs if needed. At that point the conceptual components of the Audio Processing Accelerator, or APA, were in place.

This was all very well in theory, but the devil is always in the details. The challenge facing Waves was to develop software that could ship audio to and from the APA without undue latency and that would work with the myriad requirements of the host DAWs that Waves has traditionally supported. And that raised questions. Should the software be a driver installed separately from the plug-ins on the host computer? Should it require separate authorisation? Should the software employ the 'giant dongle' approach that requires the hardware to be present before the software will work?

'We rejected all of these options because they would negate the flexibility of Ethernet connectivity,' states Shaashua. Without going into the details, Waves engineers found a clever way to turn Ethernet to their own ends, sending the audio over the wire using a proprietary method.

The resulting software was dubbed Netshell, in keeping with the Waveshell tag familiar to Waves users. Like the Waveshell, Netshell is a utility that is all but invisible to the user; it is installed along with the plug-ins themselves and takes care of the details required to make an APA unit work with the various DAW platforms on Mac or PC. Because neither Netshell nor the APA units require authorisation, a user is free to connect an APA to any computer that contains authorised Waves plug-ins.

The last hurdle was to rewrite the code of the

Waves plug-ins to be compatible with Netshell. To bring APA to market as soon as possible, the team decided to focus on the most CPU-intensive plug-ins for the initial release and to bring others in later. For the less CPU-hungry plug-ins, Waves is planning to release a plug-in 'chainer' that will allow several plug-ins to share the audio shipping overhead, so that running them on the APA will be more efficient than running them on the host.

There are two flavours of APA: the APA32 (MSP US$1600) and the APA44-M (MSP US$2400). The APA32 is a 1U rackmount designed for use away from a recording environment, such as in a machine room. As an example of its power, the APA32 can run six IR-1 Convolution Reverbs, or six L3 Multimaximizers, or 11 Linear Phase Equalisers, or 14 C4 Multiband Processors at 44.1kHz.

The APA44-M is a half-rack unit that that features up to 30% more processing power and nearly silent operation; it is ideal for mobile use. A kit enables two APA44-M units to be mounted in a 1U space.

APA units are connected to the host computer via a standard Ethernet port. To increase power, up to eight units can be used together with an Ethernet switch. The units can also be shared among several DAW workstations via a suitable V-LAN configuration, with each workstation accessing up to eight APA units.

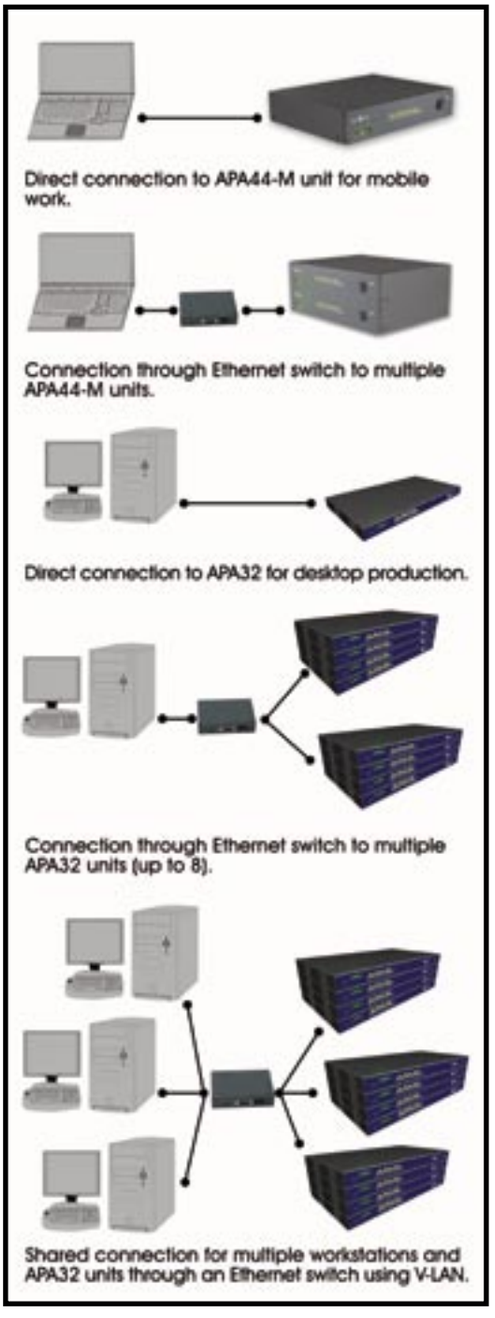
While it is physically possible to connect an APA on the same network as an Internet connection, this defeats the effort that has gone into the software to make the APA work as fast as it does; therefore, Waves strongly recommends that an Ethernet card be dedicated solely to the APA. It is also possible to use a 100mps Ethernet card, but again, a 1000mps Ethernet card is recommended for full functionality, and is required for multiple APAs or multiple users sharing APAs.

With the advent of the APA units, Waves' engineers now have the processing muscle needed to realise some of the more elaborate audio tools that have danced in their heads over the years. The first is the upcoming Waves L4, which builds on technology introduced in the company's L3 Multimaximizer, released in August last year.

The L3 is a 5-band linear phase equaliser and limiter combination with a new twist: the processor intelligently and automatically determines how much attenuation to apply to each band, allowing it to use all the headroom available to dramatically increase loudness without artefacts or overshoot. Release behaviour can be customised for different tonal characteristics, while the 'priority' and 'separation' controls allow for very fine adjustment of the limiting applied to each band. The magic behind the L3 is Waves' patented Peak Limiter Mixer, or PLM.

While the L3 used the PLM to intelligently control bands, the L4 will do the same for audio tracks. This new plug-in concept allows for mixing 64 tracks of audio based on level, priority and global limiting. The L4 will decide, depending on user defined priority, when and which tracks to limit, based on the overall output level desired. This plug-in will perform such complex calculations that it will almost certainly need the Netshell technology to handle a large mix.

As for networking, while today's APA is designed to increase processing capacity, subsequent Netshell releases will build on the technology's capabilities to dynamically share and allocate resources. 'Networking is the next big thing,' states Gilad Keren, co-founder and CEO of Waves. 'Networking both in an intranet sense and in a wide area sense, such as citywide, countrywide and worldwide. Both backbone products and services will be opportunities for growth.'



Keren sees the company's Netshell products as a strategic move in that direction and he envisions that there will be a need for much more. 'I think we'll see servers dedicated to audio and that can serve multiple clients simultaneously, providing services such as mixing, project management, format conversion, data compression, backup and archiving, and much more. It will be a paradigm shift for the way we think and work with audio.'

For Waves, then, the years of work put into the APA and Netshell was not just toward the development of a single product or even a line of products, but rather a large wager that the future of audio will be in powerful, flexible, and shared resources. Only time will tell if the wager will pay off, but in the meantime Waves has taken the familiar DSP box and refashioned it into a new kind of beast soon to be on the prowl along network paths near you. ■