When digital signal processing (DSP) was initially introduced amongst the professional audio community, the technology was likened to science fiction. With the widespread acceptance of computers and IT over the course of the past two decades, DSP has been fully embraced and is now over the course of the past two decades, over the course of the past two decades, used in a variety of applications and systems integrators and contractors to meet the needs of the ever-changing audio landscape.

The road to HAL

Director of R&D engineering Kevin Frank explains that the HAL project began as soon as the Mongoose platform was made available in 2008. "Mongoose provides remote A/D and D/A conversion, compatible with any CobraNet DSP. By eliminating a great quantity of copper and microphone cables from systems using this platform, integrators can benefit from increased cost savings and improved sonic performance. However, following the launch we knew we could take DSP to the next level with Mongoose."

Rather than tweak Mongoose or take a closer examination of the technologies promoted by its competitors, Mr Frank and his team went back to the drawing board. "For a product to evolve one has to critically assess what works and what doesn’t, which meant fully evaluating the RPM series and Mongoose platform. We therefore wanted to pick the brains of our customers and now in a variety of positions; design integrators and programmers to get their feedback. From this we drew up a variety of ideas to see who would suffer or benefit from a design choice. Rane’s sanny checking was applied throughout the product development programme in order to constantly monitor feedback. Resultant mantra included ‘you don’t have to be smart to use it, but it uses you smarter’. And greater flexibility and power, yet simpler to manage and configure." Mongoose is now viewed as the stepping stone that bridged RPM to HAL as Rane’s software engineers embarked past deadlines to take digital audio all the way to the wall plates. The manner in which inputs and outputs are configured essentially sets HAL apart. Similar products largely employ fixed and modular I/O and core based designs. In contrast, like Mongoose, HAL is built on a de-centralised I/O approach which remotes the A/D and D/A functionality.

However, HAL’s centralised processor does integrate local I/O, combining eight mic/line inputs, eight line outputs, four proprietary remote audio devices (RADs) and eight digital remotes, together with two relays and four logic ports. An expansion bus based on FireWire protocol can be added to provide a further 64 inputs and 32 outputs of audio. Unlike CobraNet or Ethernet protocols, FireWire protocol offers a consistent latency to each device, and as such, the maximum delay offered by EXP1 is limited to 830µs. No virtual wiring is required to distribute pages and background music to multiple zones. The I/O approach operates at distances up to 150m (60m more than Ethernet) over a Cat 5 cabling infrastructure, and is reportedly less susceptible to interference.

The HAL multi-processor and Halogen software continually checks the status, location, Cat 5 wiring, integrity and audio flow in all peripheral devices, depicted by LED indicators. Three HAL multi-processors provide various audio I/O and control options for a variety of installation sizes.

HAL1 supports 16 in x 16 out audio, but this may be increased up to 80 in x 48 out by adding EXP1 expanders. The DSP horsepower of HAL1 is five times greater than that of the RPM. HAL2 supports 18 in x 18 out audio, of which the additional 2 x 2 comes from AES3 on XLR connections, whilst HAL3 supports 4 in x 8 out audio, of which two ‘line plus’ inputs accept balanced line, or unbalanced line.

Using HAL

The manufacturer’s claim that HAL ‘easily guides novice users through what used to be complex tasks in minutes’ is justified with no intricate matrix mixing or pre-sets required for room combining and paging. The essentially plug-and-play devices can be serviced by a non-technical facility manager, whereby systems such as those in financial institutions, for example, can be managed without having to access the rack room. No separate line or mic input is required when using Cat 5 cabling and the software together with the RADs automatically confirms that all wiring is correct and functional. Programming is conducted via the Halogen software. The Room Combiner Processor module allows for groupings of up to 12 rooms with 11 walls, whereby the programmer can define rooms and operate partitions, whilst the software calculates all the possible configurations. When six rooms are combined, the software produces some 70 to 80 possible configurations with associated routing matrices.

HAL shows the signal flow from the input to the output without...
adding the wiring. A dedicated bus is provided for program material and is discretely sent to each output zone. The varying DSP and volume controls for each combination are calculated, into which paper clip attachments can be added on screen. If the RADs outnumber the amount of ports available, HAL automatically adds an EXP1 expander unit.

The system interfaces with a broad variety of peripheral devices including smart digital remotes, RADs, portable and in-rack auto-mixers, audio I/O and control logic expansion devices, ambient sensing microphones, small remote amplifiers and an advanced paging station. The entire family of RAD models are all hot swappable and interface with either HAL, or Mongoose for 24-bit, 48kHz digital to analogue conversion at the wall. Shielded Cat-5e cabling transports two digital audio channels in each direction, together with power, ground and a communications channel.

It offers status indicators at each RAD, HAL, EXP or Mongoose unit, and Halogen or Tracker software. A green light denotes a working connection, a flashing red light indicates that the RAD, HAL, EXP or Mongoose unit, and in-rack auto-mixers, audio I/O and interface with either HAL or RAD models are all hot swappable and in-rack auto-mixers, audio I/O and control logic expansion devices, ambient sensing microphones, small remote amplifiers and an advanced paging station. The entire family of RAD models are all hot swappable and interface with either HAL, or Mongoose for 24-bit, 48kHz digital to analogue conversion at the wall. Shielded Cat-5e cabling transports two digital audio channels in each direction, together with power, ground and a communications channel.

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There are currently 22 RADs, ranging from one-mic and one-line to two-line in and two-line out, but the RAD team is continually making new additions. Recent examples include the RAD24 plenum-rated 1W, 8-ohm amplifier, which can power a small speaker in a bathroom, and the RAD17 omnidirectional boundary layer microphone.

**Software tools**

With its rotary selector and backlit screen, Pager1 is a device that defines all possible paging zones when used in conjunction with the ‘paging manager’. The GUI displaying this information allows users to define stations, scenarios (pre-set routing configurations) and zones accordingly. The linking module is where hardware/software control associations are defined, whereby the control devices and parameters are selected to form associations. Halogen software includes Ethernet control support for third-party control systems. Since the same software code runs on both Windows and within HAL hardware, third-party control developers can test all their code using only the Halogen Windows software. The software can be used on its own to test the control systems code and the hardware can then be added when the installation is actually in progress. Control protocols exist for AMX, Crestron and Strandw generator. HAL may still be in its infancy as it is gently rolled out by Rane, but it is fast penetrating boardroom, government, educational and sports facilities in addition to houses of worship as Cat-5 cable infrastructures generally don’t require conduits. ‘HAL didn’t go down the CobraNet route and so its users can be assured of future proofing benefits,’ furthers Mr Frank. ‘In the future, we may choose to create a translation box that will allow HAL to talk to Dante and AVB, but it’s within our capabilities. ‘With HAL, we’ll really be pushing scalability but for now we’re just showing the first building blocks,’ he continues. ‘The lack of latency has also grabbed the attention of performance venues where delays to monitoring systems cannot be tolerated. Our in-house designers are offering installers support and advice on site via WebEx. We’re also receiving a lot of attention from museums which use Guideport systems so we can provide noise masking solutions.’

The centralised topology is currently more suited to small and medium sized applications. However, as HAL is rolled out, this will no doubt change – the DSP power can already accommodate up to 2,065 mic inputs via EXP1 modules and AMG cascading auto mixers together with 1,206 parametric filters over 48 channels.

In 2003: A Space Odyssey, HAL the computer has no distinct physical form and resists to killing the astronauts it is meant to serve. Having not taken on artificial intelligence, Rane’s HAL in contrast is actually in progress. Control protocols exist for AMX, Crestron and Strand Control. The varying DSP and volume controls for each combination are calculated, into which paper clip attachments can be added on screen. If the RADs outnumber the amount of ports available, HAL automatically adds an EXP1 expander unit. HAL is rolled out, this will no doubt change – the DSP power can already accommodate up to 2,065 mic inputs via EXP1 modules and AMG cascading auto mixers together with 1,206 parametric filters over 48 channels.

In 2003: A Space Odyssey, HAL the computer has no distinct physical form and resists to killing the astronauts it is meant to serve. Having not taken on artificial intelligence, Rane’s HAL in contrast is actually in progress. Control protocols exist for AMX, Crestron and Strand Control. The amount of tools you can place in a customers’ toolbox will ensure your DSP solution is selected,’ Mr Frank concludes. ‘We’re aiming to deliver the most comprehensive set of tools for every application.’

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