Network-enabled media storage device
Made by: Roon Labs LLC, New York
Supplied by: Henley Designs Ltd, UK
Telephone: 01235 511166
Web: https://roonlabs.com; www.henleydesigns.co.uk
Price: £2500

AUDIO FILE

Roon Nucleus+

Making the step from software supplier to hardware brand, Roon has developed a pair of boxes designed to sit at the heart of a system. But what do they actually *do*?
Review: **Andrew Everard** Lab: **Paul Miller**

Having been something of a 'sleeper' for a while, favoured by an admittedly growing group of computer-based audio enthusiasts, there's every sign that Roon – the music server/database software – is finally going rather more mainstream. A number of manufacturers have launched products with, or updated existing models to, Roon-ready status, and now the company behind the software has entered the hardware market with a pair of hub components co-developed with Intel: the £1500 Nucleus, and the £2500 Nucleus+ we have for review here.

ROCK WITH THE ROON

Both are compact matt black boxes some 21cm wide, and housed in casework with pronounced heatsink fins to the top and sides, with all control via a connected computer or a smartphone/tablet running the Roon app. Both models are built around an Intel processor – an i3 in the Nucleus, with 4GB of RAM, and an i7 in the Nucleus+, backed up with 8GB of RAM. These prices don't include a hard drive: these two will accept any 2.5in SATA drive, SSD or HDD, subject to a maximum drive height of 9.5mm, and the instructions show how easy it is for users to install or swap out drives.

An SSD is preferable for speed of response, but this isn't really about internal music storage. Yes, you can load some music on to the drive if you like, but a partition of about 2GB is set aside for the Roon operating system at the heart of the Nucleus, while some of the remaining space is taken up by the indexing database Roon creates. The intention is that the real music library should be stored externally, either on connected USB drives or in the form of network storage (for example on a NAS unit). To connect those content stores there's a pair of rear USB ports, plus an Ethernet socket for networking, and one of the USBs can also be used to feed audio to a suitable DAC. There's also an HDMI output, which can handle both stereo and multichannel audio, and a Thunderbolt port that isn't currently used but, says Roon, 'may become active in a future firmware update'.

So what exactly is the Nucleus, and what is it actually doing? Well, effectively it's an Intel NUC, the company's small form-factor 'Next Unit of Computing' – remove the SSD and the Intel NUC board is clearly visible, along with its in-house processor. This comes loaded with the snappily-titled 'Roon Optimised Core Kit' (or ROCK), which combines a lightweight Linux OS with the RoonServer software to create the Roon operating system. This OS is optimised for its purpose, and so is unable to run other software, nor is it designed for any user customisation. Indeed, Roon suggests you avoid any temptation to tweak or update the basic Linux installation, as future Roon OS updates 'will blow away any "custom" changes you may have made to the OS'.

> 'It will keep Roon users out of mischief for a very long while'

LIFETIME INVESTMENT

The Nucleus is fanless, which may explain the extravagant heatsink provision, and is powered by an offboard 19V 'computer-style' power supply. In addition to the cost of one of the Nucleus models, you'll need to factor in the price of a Roon subscription, which is $119 for a year, or $499 for a lifetime subscription. I'll get a little further into what that subscription gets you in a moment, but I'd suggest anyone willing to invest the price of a Nucleus in their system is likely to go for the lifetime deal, and that's going to add around £350 extra.



RIGHT: The Roon Nucleus+ is based on an Intel Nuc7i7BNH motherboard solution, complete with Intel Core i7 processor (running Roon's custom Linux-based operating system) and 8GB of SDRAM. A SanDisk SSD drive is fitted here



Working out what Roon does, and thus the role of the Nucleus devices, will also help explain why there are two models. The whole basis of Roon is not just providing server software for your music, but also indexing it and adding information from the company's own servers to make listening both more intuitive and pleasurable, including extended metadata, background notes and so on [see screenshots, p51]. It can even integrate Tidal and Internet radio streams with your music collection for truly seamless listening, and serve the whole lot to multiple devices simultaneously, or let each access different content.

Among other things, Roon will handle files all the way up to multi-DSD, in stereo and multichannel, and also provide DSP equalisation, optimisation for speaker position and more, as well as providing on-the-fly upsampling or downsampling to suit the output device, DAC, or 'endpoint' in Roonspeak. That takes processing power, which explains the presence of the two Nucleus models. The basic Nucleus is designed for libraries of up to 12,000 albums or 120,000 tracks and to serve up to five Roon zones simultaneously, with limited DSP functionality with PCM-based files, including EQ, crossfeed for headphones, and adjustable speaker delay/distance. To this the Nucleus+ adds capacity for larger numbers of tracks/files and zones, and the full suite of DSP functionality for both PCM and DSD files.

SUBTLE GAINS

One of the attractive aspects of the Nucleus design is its near-instant boot-up. You'll need to register your Roon account, or log in to an existing one, and point the software at the location(s) where your music is stored or import the settings from your existing account. This only needs to be done once before you can use the Nucleus+ to directly feed a USB DAC, or share what it's playing with other Roon-capable devices on the network. I tried it with my Naim NDS player, a Marantz ND8006 and also via HDMI to my Onkyo TX-NR818 AV receiver.



ABOVE: The Nucleus(+)'s fascia really is a case of 'move along now, nothing to see here'. The whole enterprise is about stealthy black-finished aluminium, with nothing on show bar a logo

Getting to the 'how does it sound?' bit is tricky because the Nucleus+ really doesn't 'sound' like anything [see PM's Lab Report, p53]. Yes, there were gains in clarity and bass definition when comparing the Roon device with my usual Mac mini 'computer music' player, giving the music a shade more vibrancy and presence, but these changes were extremely subtle, and far outweighed by the differences between various DACs when fed from the Nucleus+.

If you like, you can view the Roon 'black box' as a neutral source to supply your music to your DAC. I greatly enjoyed playing some of the multichannel hi-res content I have stored on my servers, which remains mostly unheard, as my main Roon set-up is all about stereo playback.

The effect of being enveloped in the original, unreleased multichannel recording of Pink Floyd's *Dark Side Of The Moon* was suitably nostalgic, and the Nucleus+ allowed the Onkyo/Naim/PMC hybrid system to wrap the sound around the room, while still delivering serious bass punch and huge amounts of detail. Even more thrilling were some of 2L's 'in the round' classical music recordings in hi-res DSD multichannel, ⇨

NUCLEAR ENGINEERING?

Roon says that its Nucleus models are a simple way of tackling the task of adding its capabilities to your system, and is upfront enough to include on its website links that enable you to buy all the parts required to DIY-build a system offering similar capabilities. In fact, it goes so far as to offer one-shot Amazon links to 'kits' comprising an Intel NUC, RAM, and an SSD. From these one can see that the equivalent of the Nucleus in a NUC case will cost you £348, and a Nucleus+ in kit form around £600 – depending, of course, on the size of SSD and amount of RAM chosen. Now putting a NUC together isn't exactly that tricky – along with the small form-factor, that's kind of the point – and neither is setting one up. What the Nucleus/Nucleus+ offer, apart from that rather attractive chunky casework, is the reassurance that everything has been done for you and will work straight from the box, guaranteed.



ABOVE: Recessed connections provide Ethernet hook-up, a pair of USBs for external storage and USB audio out, HDMI audio out and an as-yet-unused Thunderbolt socket. Power is from an external 19V supply, switch gives lightning-fast boot-up

where the use of the surround channels merely to add ambience is striking even in an ostensibly simple recording such as Ning Feng's set of *Bach Sonatas And Partitas For Solo Violin* [Channel Classics CCS 39018; multichannel DSD64/128/256]. Remarkably, the three-dimensional sound has the effect of concentrating the mind on performance, rather than distracting from it – maybe it's just that the ambience seems more 'natural' than with a 'front-only' stereo picture.

OPTIMISED PLATFORM

A key benefit of the dedicated Nucleus approach is its rock-solid operation – Roon software running on multipurpose devices can be prone to (very occasional) pauses when the computer in question is working hard doing other things. So perhaps I can, after all, answer that question about how the Nucleus+ sounds – simply, it's one of the most convincing digital 'transports' I have used, delivering more of the music than the best of the computer sources I have encountered.

Maybe that's no surprise, since what we have here is a computer dedicated to a single task – as indeed I have tried to do with my own 'music Mac mini' by removing all software, and ripping out all the hardware, not immediately related to playing music. The little Mac uses an SSD and expanded RAM, has an improved power supply, does without its wireless capability even to the point of having the antennae removed, and even sits on some isolating feet when I'm trying to work out whether or not they actually make any difference.

The Nucleus does much the same, but then goes further with its fanless design, lightweight operating system, lack of graphics output, and hefty casework – so really everything is in place for it to offer an optimised platform for audio playback.

Although I tend to take a 'light touch' approach to the various DSP functions Roon offers, some of them can be remarkably effective. Even in my desktop system, which uses an Asus Tinkerboard via a Gustard U12 digital interface into a first-gen NaimUniti powering Neat Iota speakers, it was surprising how much difference to the image was made by applying the tiniest of delays to one of the two speakers to compensate for marginally different distances between them and my ears. Meanwhile, a small amount of crossfeed between the speakers also had some interesting effects on the soundstaging – yes, I know it's meant for headphones, but...

I have to admit I approached the Nucleus+ with some degree of cynicism – after all, it's just an expensive way of buying a computer running Roon, isn't it? – but I came away a convert, having spent an enjoyable time experimenting with this supposedly 'tinker-proof' concept. It may be 'plug and play', but the level of performance available – and the amount of experimentation allowed by the software – means that it will keep Roon users out of mischief for a very long while.

HI-FI NEWS VERDICT

The sound quality rating is more indicative of what the Nucleus+ *doesn't* do than what it does, as it offers a solid platform on which your chosen DAC can strut its stuff. Its combination of style, joined-up thinking and sheer user appeal makes this an intriguing addition to any 'computer audio' system. It's as easy to use as Roon implies, the software is extremely clever and it'll add immeasurably to your listening experience.

Sound Quality: 87%

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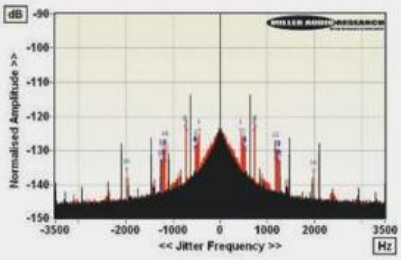
LAB REPORT

ROON NUCLEUS+

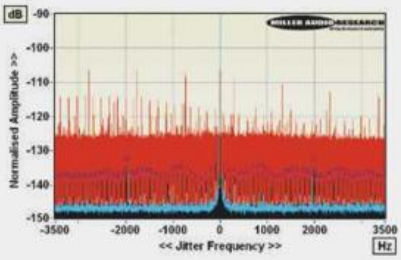
The Roon Nucleus+, like the Melco N1ZS20/2 [*HFN* Jun '17], the N1ZS10 [*HFN* Feb '15], the N1AH40 [*HFN* Aug '15] and N1ZH60 [*HFN* Jun '16], is a data storage and delivery device so any uplift in performance – over a conventional NAS or PC/Mac – can only be inferred via a third-party player or DAC. This brings into play the efficacy of the USB sink's jitter suppression and/or galvanic isolation, so a USB DAC with excellent data recovery/reclocking may not express a significant difference. Similarly, a DAC that incurs jitter at the chip level, through clock noise or other in-circuit interference, will suffer the same jitter sidebands in the analogue domain regardless of the coherence of the digital data.

So... driven directly from the Roon Nucleus+'s USB output, the 'full fat' OPPO Sonica DAC [*HFN* Oct '17] offered a generous 115.4dB A-wtd S/N ratio, a mere 0.2dB boost over our 'standard PC' and just 0.2dB behind the Melco N1ZS20/Sonica pairing. Jitter suppression followed a similar pattern – the PC/Sonica offered the untidiest spectrum at 155psec, followed by the Roon/Sonica at 125psec [red spectrum, Graph 1] and 114psec for the Melco/Sonica [black spectrum]. Often, however, it's the more rudimentary hub-powered USB DACs that provide the best indicator of incoming data integrity and noise on the +5V supply.

A DAC with moderate jitter suppression – iFi Audio's iDSD – showed a near-total drop in jitter from 140psec to <5psec coupled with a huge gain in A-wtd S/N ratio from 88.9dB to 108.2dB (the Melco/iDSD managed 105psec/94.6dB). Another battery-powered DAC, Chord's Mojo [*HFN* Jan '16], witnessed a big improvement from PC (50psec/103.8dB) to 35psec/114.5dB with the Roon Nucleus+ in the driving seat [black spectrum, with markers, Graph 2]. The Melco/Mojo pairing [blue] avoided the spray of ±100Hz sidebands at a near-invisible <5psec jitter but the overall A-wtd S/N was 1dB less at 113.5dB. **PM**



ABOVE: 48kHz/24-bit jitter spectra from an OPPO Sonica DAC over USB (black, via Melco N1ZS20/2 USB player out; red, via Roon Nucleus+ with markers)



ABOVE: 48kHz/24-bit jitter spectra from a Chord Mojo over USB (red, via standard PC; black, via Roon Nucleus+; cyan, via Melco N1ZS20/2 USB player out)

HI-FI NEWS SPECIFICATIONS

LAN (1000BASE-T)	Gigabit Ethernet
Digital outputs	2x USB 3.0 Type A; 1x HDMI
Digital jitter (OPPO Sonica)	125psec (155psec via PC USB)
Digital jitter (iFi Audio iDSD)	<5psec (140psec via PC USB)
Digital jitter (Chord Mojo)	35psec (85psec via PC USB)
Power consumption	10W
Dimensions (WHD) / **Weight**	212x74x156mm / 2.5kg