NDI For Broadcasters

Frequently asked questions

19th November 2024

An IP Video Protocol which works today

NDI Protocol

The NDI (Network Device Interface) protocol has delivered broadcasters and video professionals with a practical, and useful mechanism to connect video software and hardware on a local area network. NDI carries high quality compressed video, uncompressed audio and bi-directional metadata over a TCP socket connection. NDI includes a very fast, good quality codec to allow low latency, low CPU overhead encoding and decoding to pass resolution, aspect ratio and frame rate independent video across existing gigabit networks. NDI Services are advertised with mDNS and are thus automatically discoverable by other NDI devices on the same LAN. A wide variety of products, and utilities exist to support the NDI protocol, including free utilities to create, and view NDI sources. NDI is offered to the world, without qualification and with a royalty free license by its creators, Newtek Inc (now NDI, a part of VizRT).

- **Works perfectly on existing Gigabit LANs and high quality WIFI networks**
- **Compressed video - ProRes / DNxHD type quality**
- **Very fast, license free codec included - 250 fps HD encoding per CPU core**
- **~ 100mBit/s for HD, scalable to 4K and beyond.**
- **Low latency, typically about 1 frame**
- **Uncompressed multi channel audio**
- **Use bonjour discovery for very easy deployment**
- **Bi-directional metadata support**
- **Compatible with Mobile Devices - mobile phone NDI Camera products**
- **Embedded support for Alpha Channel on same stream using BGRA**

Unsurprisingly NDI has been rapidly adopted by hundreds of product developers and the end user installed-base of NDI now dwarfs that of all other professional IP video protocols combined.

NDI was designed for local area networks, using TCP sockets and bonjour (mDNS) service announcements. With the rapid adoption of NDI, customers are now beginning to ask for a mechanism to extend their NDI local area networks, to create entire production facilities with native NDI across the workflow.

Frequently Asked Questions

Q: I have heard that NDI is not "Broadcast Quality" - is that true ?

A: NDI is based on a variation of the MPEG2 codec which has been used for years in broadcast television as a primary format. NDI runs this codec in an i-Frame only, high data rate mode so every frame is discrete, and this avoids GOP structure breakup, and gives each frame a complete picture maximising quality. NDI uses 4:2:2 encoding for HD formats which is the same as regular SDI. NDI Supports any image size and frame rate seamlessly, providing forwards and backwards compatibility and flexibility in a way never before seen in broadcast. The same NDI Infrastructure can easily support SD through to UHD in the same setup, freely mixing progressive and interlaced signals. It also supports non standard sizes and frame rates without any special configuration. For broadcast quality audio, NDI uses uncompressed 32-bit floating point audio, with an unlimited number of audio channels.

Q: I have heard that NDI is an 8 bit system - but my existing SDI systems are 10-bit - how can it compare ?

A: NDI was designed from the start to provide up to 16 bits of dynamic range within the codec, but until NDI version 6, only 8bit interfaces were supported, which meant that NDI was indeed effectively 8-bit. However, since the release of NDI 6, 16-bit interfaces are exposed allowing vendors to upgrade their hardware and software NDI products to provide 10-bit range. In fact NDI provides an effective dynamic range of at least 11-bits, so 10-bit is fully supported. It's important to note that 10-bit is essentially an opt-in mode in NDI so it requires vendors to make changes to their product to add 10-bit support when implementing NDI6

Q: I have heard that the NDI codec has too many artefacts to use for Tier 1 broadcasting ? - is that true ?

A: By default NDI uses a data rate of around 100mBits for an HD 1.5G type signal. This gives a good balance of quality vs data rate, and gives visually lossless performance in a number of typical broadcast applications like News. As with any codec, its possible to stress the performance when encoding very challenging content such as fast action sports, or scenes with very complex content like confetti cannons, crowds and water, and in these cases it is possible to see artefacts in NDI when encoded at the default data rate. However, some professional NDI products like Sienna and others now have a configuration parameter which allows the user to increase the encoding rate to 200%, 300% or more, and this delivers a *dramatic* improvement in quality for these very challenging video content types. Independent testing has shown that NDI at these higher data rates compares very favourably with latest generation JPEGXS encoding used in many Tier 1 broadcast products.

Q: I have a lot of SDI equipment, how do I integrate that into a Hybrid NDI infrastructure ?

A: There is a vast choice of SDI to NDI and NDI to SDI hardware and software from a variety of vendors. You are spoilt for choice and many of them are extremely cost effective without compromising quality. There is no vendor lock-in with NDI so you get to mix and match technologies with full compatibility without pain.

Q: How do I integrate ST2110 into a Hybrid NDI infrastructure ?

A: There is a smaller choice of native ST2110 to NDI and NDI to ST2110 options, but these do exist and provide seamless integration with ST2110. An example is Sienna's ND Processing Engine, with a choice of software or hardware ST2110 conversion. Alternatively, many broadcasters simply use ST2110<->SDI converters and interface with NDI via the wide range of SDI interfacing options.

Q: How do I integrate Dante and AES67 into a Hybrid NDI infrastructure ?

A: Sienna's ND Processing Engine offer native integration and conversion between NDI and AES67, with an option to add a license for Dante which provides up to 256 channels of NDI<->Dante conversion.

Q: I have heard that NDI is not 'locked' - what does this mean and surely that is bad ?

A: NDI was designed to revolutionise IP Video for a modern age using pragmatism over idealism. It breaks with traditional concepts of the past which commonly caused challenges and problems. Facility wide clocking is a good example - SDI and ST2110 based infrastructures have very fixed clocking, required to maintain sync between streams and this has been a major cause of pain when integrating broadcast systems. Ironically very many modern SDI systems such as vision mixers end up having to use a Frame Synchroniser on every input to accommodate the typical variety of sources, which makes a mockery of centralised clocking. Instead of following this mechanism NDI uses a pragmatic design where clocking is *optional* - NDI will work perfectly fine out of the box without centralised clocking and 95% of all NDI infrastructures in practice work like this. Since NDI 'clocks' typically derive from the host CPU of the hardware or software device, it is good practice to simply connect all devices to a common NTP clock reference which easily tightens up all NDI 'clocking'. However, if you have a specific need, many NDI systems can also be traditionally genlocked in different ways, although typically this is not necessary.

Q: How is HDR supported in NDI ?

A: The NDI core infrastructure allows 10bit HDR encoded content to pass through without compromise, so essentially NDI is 'transparent' to HDR. If it is necessary to signal an HDR based content, NDI provides rich metadata support which allows for tagging of streams as 'HDR' so downstream equipment can respond accordingly. In practice it seems that more commonly HDR is configured manually at sources and destinations and NDI is simply a transparent carrier of the 10-bit content, whether SDR or HDR. In all cases HDR support is device-specific - so your NDI source would need to be HDR compatible, and your final destination would also need to provide HDR support. Your choice of NDI vendor and device will effectively dictate HDR support, not NDI itself.

Q: I am interested in Cloud Production - How can NDI help realise this goal ?

A: NDI was designed to allow for video production on gigabit local area networks. Incidental to its primary design goals, it turned out that the NDI protocol happened to be highly compatible with cloud based production criteria. Whilst the default NDI mechanism relies on mDNS (Multicast DNS) in order to discover NDI sources on your network, all professional NDI Installations instead use a dedicated NDI Discovery Server which removes the multicast requirement, and allows NDI to operate seamlessly in cloud based platforms which block multicast between devices. NDI has emerged as a perfect protocol for cloud based production, delivering broadcast quality streams which flow easily between cloud based compute instances.

Q: In Cloud Production - How can I get content into and out of the cloud ?

A: The 2 other main requirements for cloud based production are contribution uplinks and low latency monitoring. There are a variety of options here, but the most common contribution uplink is to use the SRT protocol supported by most SDI encoders. This can get camera feeds from SDI and HDMI into the cloud 100% reliably, even over public internet, or 4G/5G connections. Other contribution options include relay products such as Sienna NDI.Cloud and NDI Bridge which use intermediate long-gop codecs to relay NDI streams from ground to cloud. For broadcasters wanting to maintain the full quality of their ground based NDI Streams, Sienna's ND Processing Engine offers NDI over SRT which transparently wraps Native NDI with SRT without re-encoding. This maintains the full bandwidth and quality of the NDI stream without any compromise, and transfers this to the cloud reliably and with super low latency.

The other challenge of cloud based production is low-latency monitoring - essential for tasks like live vision mixing in the cloud. There are a number of options, such as SiennaLink - an NDI compatible monitoring protocol which delivers full frame rate, full resolution, super low-latency downlinks for remote monitoring on desktop computers, mobile devices and hardware such as Apple TV boxes using free client-side apps. Other options include low latency SiennaLink-Web or WebRTC feeds which are viewable in web browsers, or simply use relay systems like NDI.Cloud or NDI Bridge to localise cloud based NDI streams back down to the ground.

Q: How do create a redundant infrastructure with NDI ?

A: Sienna's ND Processing Engine and ND Router provide mechanisms to run in redundant configurations, to provide a fault tolerant base NDI infrastructure. They can also support dual network infrastructure. For more details on functional redundancy in Sienna ND workflows, please contact an Approved Sienna NDI Systems Integrator from http://sienna.tv/newsite/integrators.html

Q: The broadcast industry seems to be transforming very rapidly, how can I make sure my TV station survives these changes ?

A: You are absolutely right that traditional TV broadcast faces a potential extinction event as consumer habits and demand change. The key to surviving this is to properly understand what is happening, and why, and how you can transform your business to embrace the changes and ride the incoming wave. Sienna published a seminal white paper on this topic in 2018 which remains a key point of reference to make sense of the future of broadcast TV. You can read the free white paper at : http://sienna.tv/A_Vision-The_Future_of_Television.pdf

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