



NDI infrastructure and what it means for Pearl-2 users

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Introduction

NDI® support on Pearl-2 presents new opportunities to design Pearl-2 into your AV system with more flexibility and ease. You can access multiple cameras, software on computers, mobile devices, and more on the network using a single LAN port. No expensive multiple-port HDMI switches or SDI routers are needed. This white paper defines NDI and NDI|HX protocols for video transport over Gigabit Ethernet and describes the discovery and registration processes. Details about the Pearl-2 specific NDI features and implementation are also provided, as well as links to some practical live video applications using Pearl-2 with NDI.

NDI overview

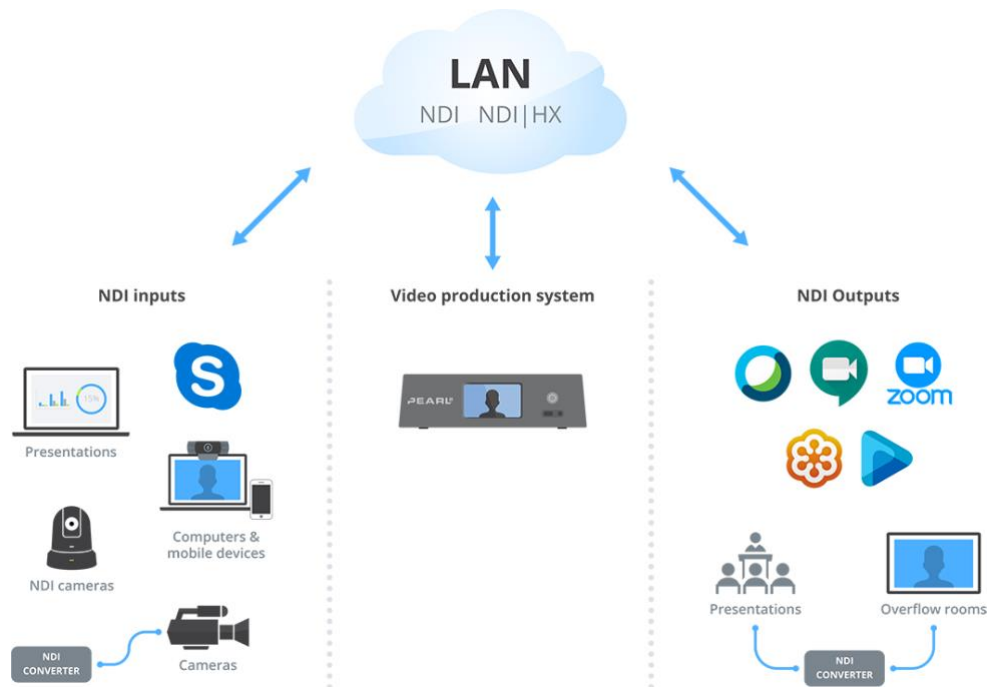
Network Device Interface (NDI) is a royalty-free, video compatible standard developed by NewTek. NDI enables users to transmit and receive broadcast-quality video with very low latency over Gigabit Ethernet networks. With NDI, video and audio can be transmitted farther over existing LANs using cost-effective CAT5/6 cables and the quality is virtually lossless.

With NDI you have the flexibility to choose from a wider variety of video input sources over a single LAN port. All your video sources are readily accessible from anywhere over the network.

NDI's encoding algorithm is resolution and frame rate independent and supports 4K@30 fps and beyond.

NDI includes:

- Restricting who can see the NDI stream
- Grouping to limit which NDI systems a local source can discover or which remote NDI systems can discover a source
- Bi-directional metadata and IP commands allowing an NDI receiver to communicate tally information back to NDI sources or to control NDI-enabled PTZ cameras
- Integrated alpha channel enabling features like chroma keying and titling



NDI modes and compression

Two modes of NDI have been defined since version 3.0 of the protocol: full NDI and NDI|HX (high efficiency). The primary difference between the two is the amount of video compression. NDI is lightly compressed, whereas NDI|HX is more compressed, using H.264 video compression. NDI|HX requires much less network bandwidth due to the file compression; however, its latency is higher than that of NDI.

The main differences between NDI and NDI|HX include:

- NDI|HX uses H.264 as a codec, whereas full NDI uses NDI as a codec
- NDI|HX is a more compressed version of NDI and therefore requires less network bandwidth and is more suitable for bandwidth constrained networks, such as wireless networks
- Due to higher compression of NDI|HX, the latency of NDI|HX is more than that of full NDI
- NDI|HX does not support alpha channels

Bandwidth usage

NDI video consumes a lot of bandwidth. For better efficiency, NDI|HX uses H.264 video compression but will contribute a small bit of latency in comparison to NDI (maybe a frame or two) – still acceptably minimal. Audio is transported uncompressed in both NDI and NDI|HX.

Recommended dedicated bandwidth for NDI and NDI|HX:

- A single 1920×1080@30 fps NDI stream needs at least 125 Mbps of dedicated bandwidth
- A single 1920×1080@30 fps NDI|HX stream needs from 8 to 20 Mbps of dedicated bandwidth

The actual amount of bandwidth needed depends on the video content. As a rule, relatively static content like a document camera or someone standing at a podium consumes less bandwidth. Content that is more dynamic needs more.

NDI discovery and registration

NDI relies on mDNS (multicast Domain Name System) to create a zero configuration environment. Unlike other video over IP based protocols, there is no need to remember IP addresses, host names, or port numbers.

To find other NDI sources on the LAN:

- The NDI receiver sends an IP multicast message to all hosts on the network
- Each NDI host on the LAN responds with a multicast message...
- The NDI receiver uses the information in the response to...
- For an NDI receiver to connect to NDI sources on different subnets, the NDI receiver must know the IP address of the NDI source. Multicast-based discovery doesn't work when the NDI receiver and the source are on different subnets.

NDI video data flow

After discovery, audio and video is transmitted from sender to receiver using TCP. The destination IP address of the video stream can be either unicast (default) or multicast. Multicast is a lot more bandwidth and resource efficient for a source than unicast. In multicast connection mode, the sender transmits a single video stream that can be received by multiple receivers. On the other hand, in unicast connection mode the transmitter sends N video streams to N receivers. To use multicast connection mode, the underlying network must be multicast aware and support IGMP snooping to prevent network flooding.

Pearl-2 supported NDI features

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| NDI Discovery | Automatic and manual discovery of NDI and NDI HX sources on the LAN. Search for NDI sources using their NDI name and/or the NDI Group Name. |
| NDI modes | Pearl-2 can receive a mix of NDI and NDI HX sources simultaneous. For example, PTZ, NDI/NDI HX converters, Skype, etc. |
| NDI Connection | Pearl-2 can receive NDI from both multicast and unicast NDI sources. Pearl-2 supports up to three 1080@30 inputs from NDI sources and one 4K NDI input source. |
| NDI Input resolutions | Pearl-2 can receive up to 4K@30 fps from NDI sources. |
| NDI output | When enabled, Pearl-2 can be discovered as an NDI source on the network and can send a program view using NDI unicast. NDI output is enabled on a per channel basis. Pearl-2 can output up to two 1080@30 unicast NDI streams. |
| Mixture of NDI and local sources | Pearl-2 supports using both local and NDI sources as part of the same channel. |
| NDI inputs capabilities on Pearl-2 | You can select and use NDI inputs just like a local HDMI, SDI, and USB video input using the Admin UI, Epiphan Live, and the Pearl-2 API. |

NDI-supported equipment

Pearl-2 supports NDI-capable hardware devices and software. Common devices include cameras, encoders, routers, video mixers, graphics systems, capture cards, and PTZ cameras. Pearl-2 also accepts any NDI aware HDMI/SDI source using a converter or the free NDI Virtual Input software, webcams connected to remote computers using the free NewTek Connect application, output from iOS and Android mobile devices using the NewTek NDI Camera app, and direct input from NDI compatible software (Skype, EasyWorship, etc). The list is virtually endless.

NDI use cases for Pearl-2

Here are some practical ways you can use NDI with Pearl-2:

- Networked video and audio sources for Pearl-2
- Remote guest via Skype
- Overflow rooms
- Live events
- Meetings and conferences

See [NDI® and NDI|HX for network video production](#) for Pearl-2 NDI applications.

Summary

NDI opens up new opportunities to make your live video production workflow easier and more flexible. With NDI on Pearl-2, you gain easy access to a lot more video sources at broadcast quality over a single RJ-45 Ethernet port.

Pearl-2 accepts multicast and unicast NDI sources, as well as high efficiency NDI|HX.