

# NDI<sup>™</sup> Network Device Interface

GETTING STARTED  
WITH NDI



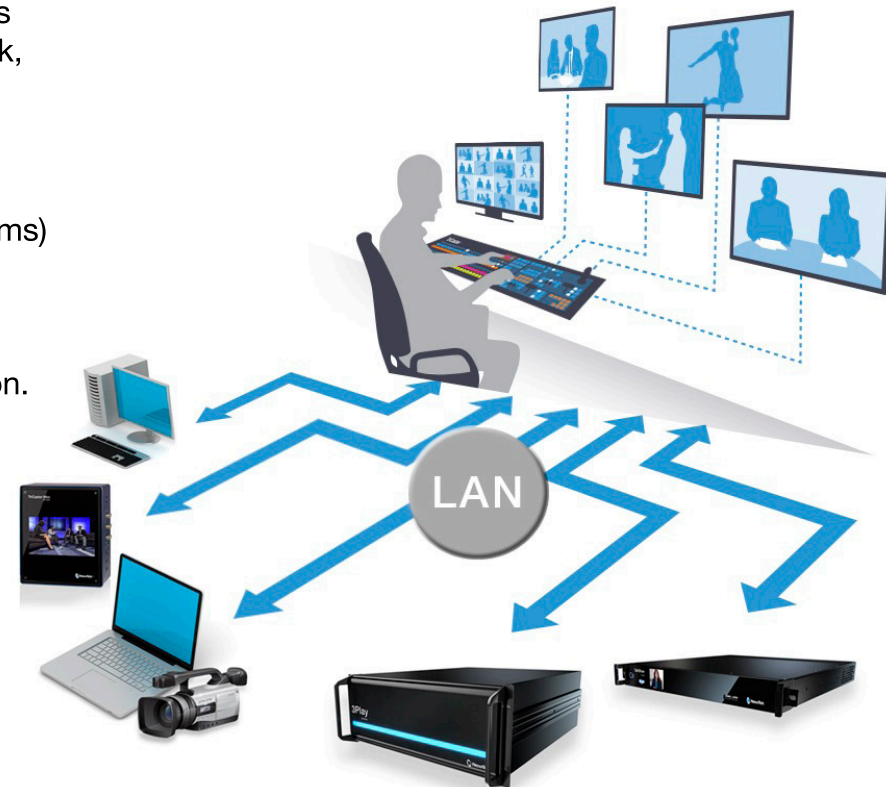
# What's NDI All About?

Every few decades, the video production industry goes through a revolution that forever changes the way we work, and what we can achieve. It is thrilling to know that one is happening right now—and you can be part of it.

For example, the industry largely abandoned analog cameras, video, and transmission (in favor of digital systems) more than a decade ago. This, in turn, paved the way for vastly more efficient non-linear workflows. Similarly, the explosion of the Internet and the widespread adoption of high-speed networking set the stage for the next revolution. We confidently predict that, twenty years hence, it will be clear that this was far more profound and important than matters like resolution, frame-rate, and the like.

We live in a world in which virtually every computer system in the world is potentially connected to every other. Billions of these devices have high quality screens, fast processors, and cameras. Ultimately, in this environment, it is inevitable that efficient, economical, non-linear video transfer in IP space will supersede traditional linear connection methods (SDI, HDMI, etc.) and systems.

NewTek NDI (Network Device Interface) makes it easy to share high-quality video over a local Ethernet network. **However, the NDI vision is vastly more exciting than any mere “cable upgrade”.**



# What's NDI All About? (Continued)

Because it connects everyone and everything, everywhere together in non-linear fashion, the Internet is vastly more than a better way to move data from point to point. Thus it enabled and inspired innovators, who truly changed the world in fundamental ways, to create tools and workflows that use data in ways that no one had ever imagined. A similar quantum leap for video production is at hand.

From the outset of the personal computer revolution, NewTek foresaw that video production would inevitably leverage the exponential progress of general computing. Our vision also embraces the commensurate advances in general purpose networking and the Internet. Production systems using IP to integrate data, video, and audio are transforming live video production yet again—in ways that would have seemed miraculous just a few years ago.

NewTek's mission is to give storytellers a voice through video, using innovation and technology to fundamentally change the way video is created and used. NewTek NDI springs from these core values. We are providing it to the world for free to make it easy to connect video products over IP, in turn greatly expanding creative options for video producers—providing them with greater power, increased efficiency, and economy.

This document will introduce NDI, inform you as to what it is, and explain how to get started using it right now.

**NDI**<sup>™</sup> Network  
Device  
Interface

# Why Do I Want NDI?

Consider the impact of the Internet on your life and work. You use it at the home, the office, and everywhere in between.

You, and your associates, use many different devices at once—tablets, smartphones, laptops, workstations, and more. You might each be working independently, or collaborating on shared files while communicating by video chat with someone in the next office or on another continent.

**You can think of NDI as turning your network into a “video internet”.**

Like a webpage, each NDI source is instantly available to many viewers and devices. Wherever your network extends—throughout your office, broadcast studio, hospital, campus (etc.)—NDI is ready for immediate display, capture, replay, production, and more.

NDI operates bi-directionally over a local area network, and supports many ultra-low latency, ultra-high quality video streams on shared connections. It is resolution and frame-rate independent, supports 4K (and beyond) along with 16 channels (and more) of floating-point audio. Alpha channel, command channels, tally data, bi-directional metadata, and things like access rights and grouping are natively supported.

**NDI’s superb performance over standard 1Gbit/s networks makes it possible to transition facilities to an incredibly versatile IP video production pipeline without negating existing investments in SDI infrastructure,**

or costly new high-speed network installations (though 10Gbit and beyond can provide even more simultaneous channels of video). It is an important distinction that NDI is built to work today and in installations that already exist, not those of the future. Better installations make NDI better instead of making it function in the first place! We expect you to find all of this hard to believe. That’s why we want you to try NDI for yourself.

# How Do I Get Started With NDI?

The NDI concept is simple: You supply a video source, and NDI makes it available to other machines on your network. At that point, anyone else on that network can see it and work with it (unless you deliberately limit access), just as if it were locally connected to their system.

In this brave new world of IP video, you do not need to think about capture cards, SDI, HDMI, etc., unless you want to use those sources (as we will discuss a bit later). You might also enjoy freedom from dependency on distribution amps, video matrix routers, and the like.

**[Let's begin our adventure by creating an NDI source.](#)**

For more than 40 years, the need to physically connect cameras, graphics systems, video switchers, and routers has dictated studio design, architecture, and workflows. This is no longer true.

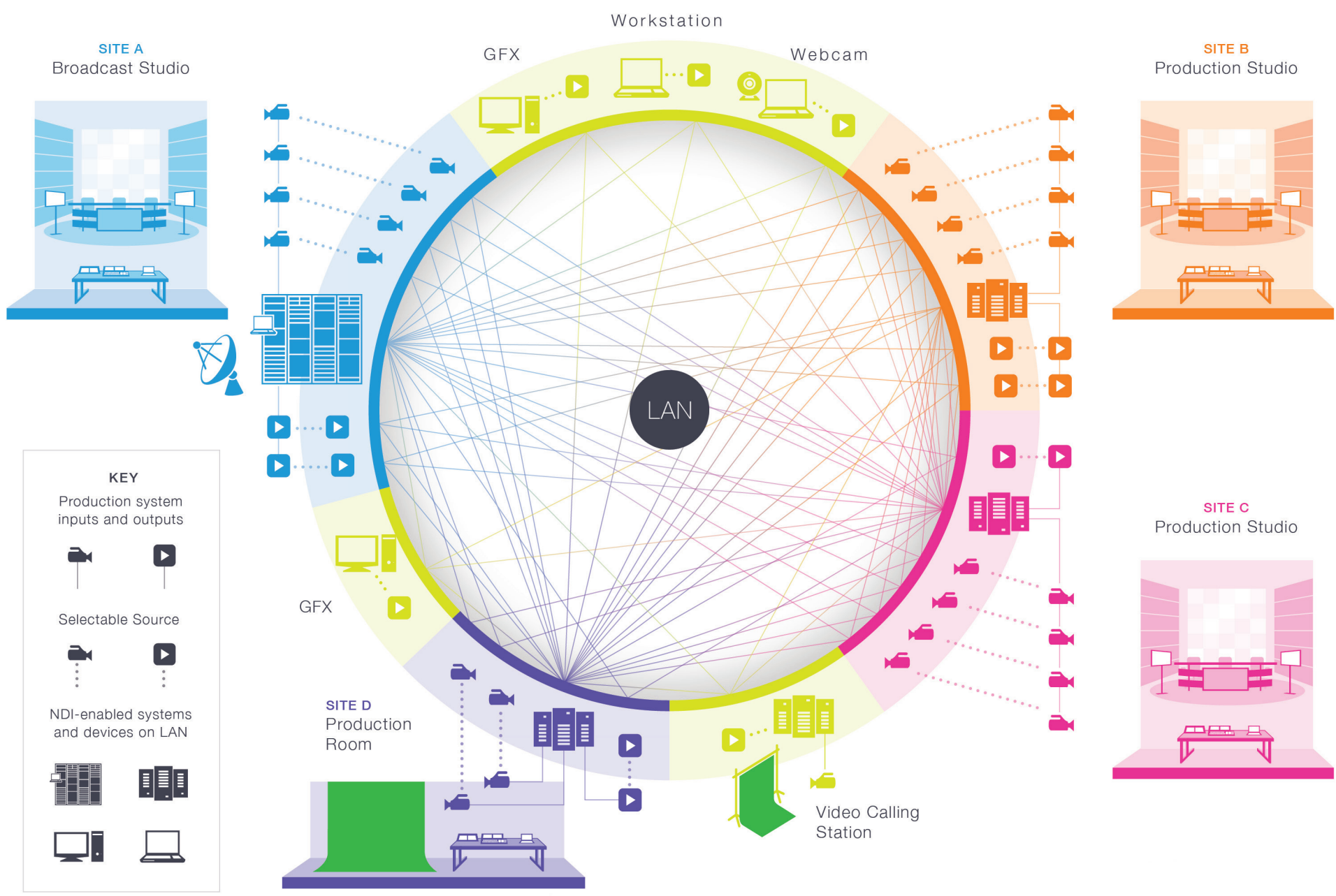
Production operations, including video mixing, can be performed wherever it is convenient (and quiet), rather than being shoe-horned into the actual production space.

So, you might be producing a video in your office; someone in the next office can also view it, and so can still others down the corridor, elsewhere on your campus, or on the other side of the world—all at once.

Your graphics systems need no longer be in your control room (with bi-directional communication they can be controlled from somewhere else as well).

Naturally, the reverse is also true. If someone takes your source and inserts it into their program, you can connect to their NDI output and see the result.

You can even use other NDI channels to video chat to collaborate on the production.



# Sending Video Over NDI

Our first exercise will generate an NDI test pattern and 1 kHz audio signal.

- Download and install the *NewTek NDI Tools Pack* from [NDI.NewTek.com](http://NDI.NewTek.com)
- Launch *NewTek NDI Test Patterns* (Figure 1) from the Windows® Start menu.

You're already making NDI video and audio visible on your network. Of course, you can't see it without a suitable video monitor, though, so let's add one next.



FIGURE 1

# Viewing NDI

We now have an NDI video source—the test pattern you configured in the previous section—and since your computer almost certainly has an IP connection already, it is already visible to any other system on that network.

The next step is to simply open a video monitor that can see it. (Since we're dealing with an NDI source, client systems do not need to have a hardware card with SDI I/O connectors installed. Nor must you run heavy cabling, or add an external video monitor to view your NDI source.)

- Launch *NewTek NDI Video Monitor* from the Windows® Start menu.

**Hint:** Simple instructions are shown at upper-left in the *NewTek NDI Video Monitor* window (Figure 3).

- Right-click and select the “Test Pattern” source from the menu (the first part of the source menu entry is your computer’s name on the network).



FIGURE 2

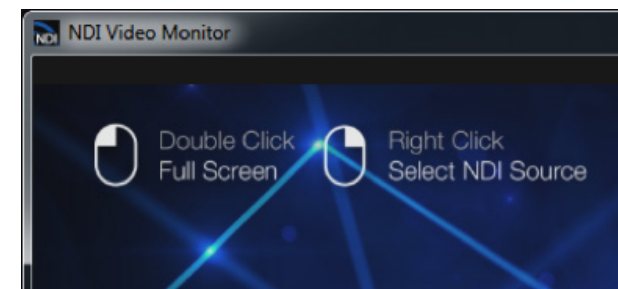


FIGURE 3



# Viewing NDI (Continued)

*NewTek NDI Video Monitor* is now showing the content from the NDI channel output by the *NDI Test Patterns* generator—Figure 4.

**Hint:** Double click the image to toggle full display.

To prove to yourself that this high-quality video source is really available network-wide, install *NewTek NDI Video Monitor* on a second networked system, too. Then display the same NDI source on that second system.

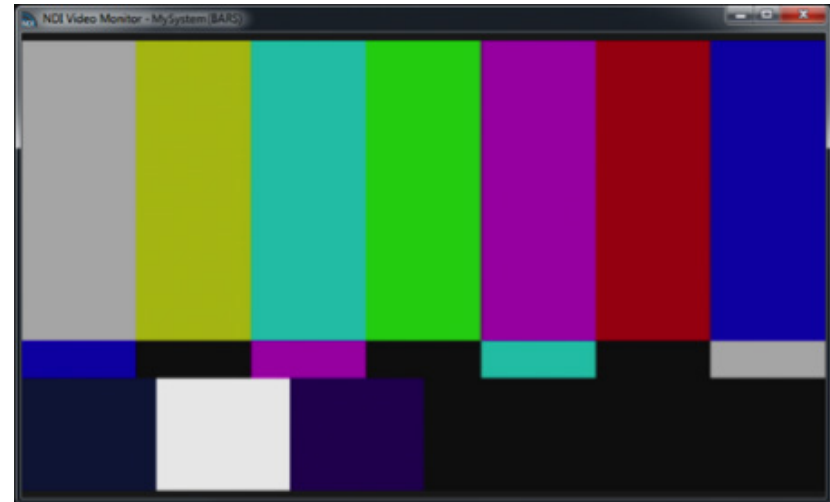


FIGURE 4

# Viewing NDI (Continued)

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You are already broadcasting NDI video across your local Ethernet network, and each NDI-enabled application and system has real-time access to it.

In many ways your NDI-enabled network is operating like a powerful video matrix router connecting everything to everything, with NDI maintaining complete visibility, identification, bandwidth management, and so on.

Even if there are hundreds of NDI channels available, and lots of machines viewing them, they are all managed correctly, automatically.

**NDI is so efficient that a single machine can receive and send an astonishing number of sources. Bandwidth consumption is limited to those sources that are actually being used.**

Compare this with the traditional production pipeline world based around capture cards, distribution amps, and routers. A computer system able to support 100 SDI sources is a pipe dream—but not so with NDI. Actually, for many purposes, an existing gigabit network may supply all the bandwidth you need.

# Send An Application Window Via NDI

While test signals are good, let's now consider sending a video stream that has moving video in it. For the sake of simplicity, we will use some computer applications that you might already have. We will be capturing these applications in real time and making them visible on the network. This might, for instance, involve a web browser that you wish to display within your live show, or a PowerPoint presentation that your CEO needs to display while presenting to employees.

Now let's see how NDI can distribute many different video sources across your network.

- Launch a video player (e.g., QuickTime Player™), load a video clip, and start playback.
- Launch *NewTek NDI Scan Converter* from the Windows® Start menu.
- Right-click the small *NewTek NDI Scan Converter* icon in the system Task Tray at lower right on your screen to show the menu, and checkmark the entry for the video player (Figure 5).
- Use the *NDI Video Monitor* application (installed earlier) to confirm that your video player window now appears on your network as an NDI source.
- Open a web browser, and navigate to your favorite online video.

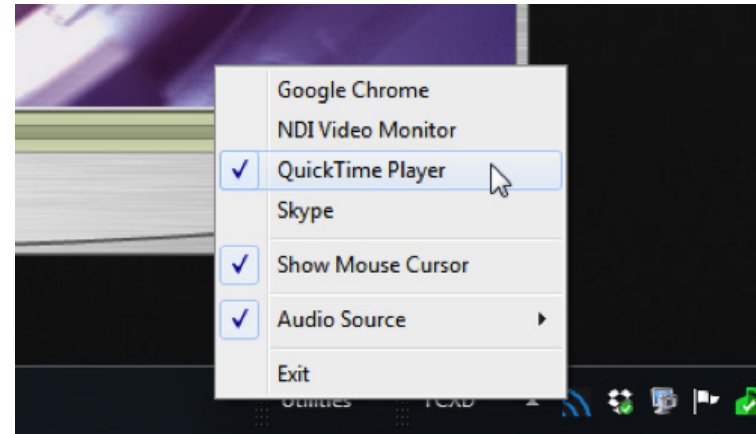


FIGURE 5

# Send An Application Window Via NDI (Continued)

- Re-open the *NewTek NDI Scan Converter* menu, and notice that your web browser is now listed as a source.
- Checkmark the video player entry, and you'll see that both your web browser and the video clip player are now available as NDI sources across your network.

**While you're at it, why not launch a second instance of NewTek NDI Video Monitor on the same machine to display the video player we previously configured.**

Take a moment to reflect on NewTek NDI's ability to publish high quality audio and video from multiple sources to your network. Note how you can select a huge number of applications, and they are all available for immediate use. Still better, consider how multiple clients can connect to any one (or more) of those sources simultaneously.

Here, again, we see the efficiency and magic of NDI, as even when you are generating hundreds of sources, the resources required are determined by what is actually in use. You might have 100 windows being captured and available for immediate use, but if no one is connected to an application's output, no processing is even done.

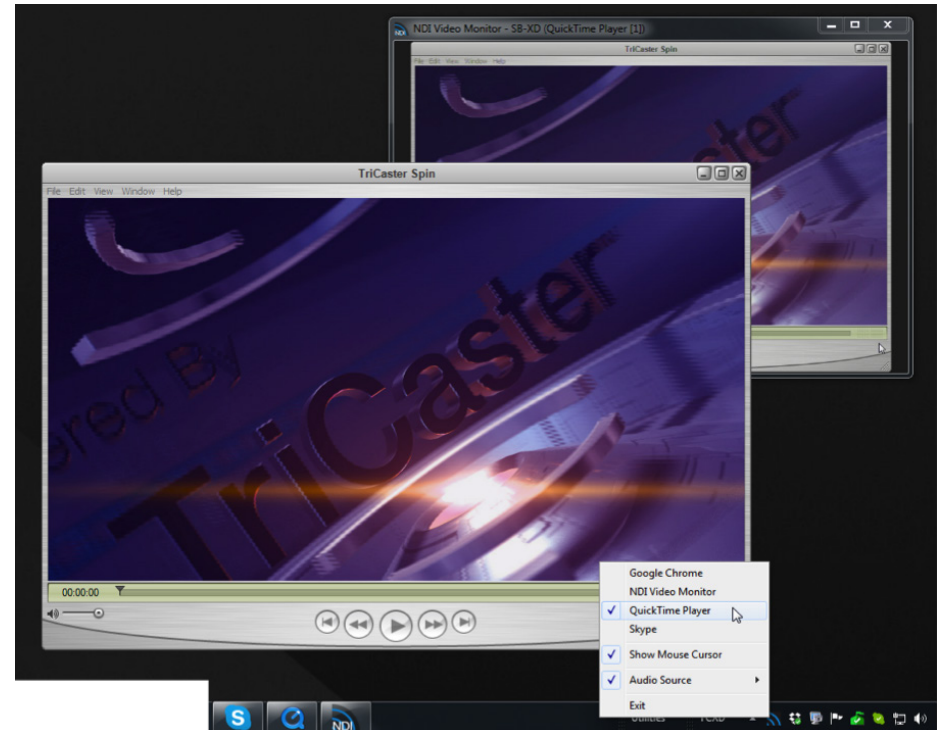


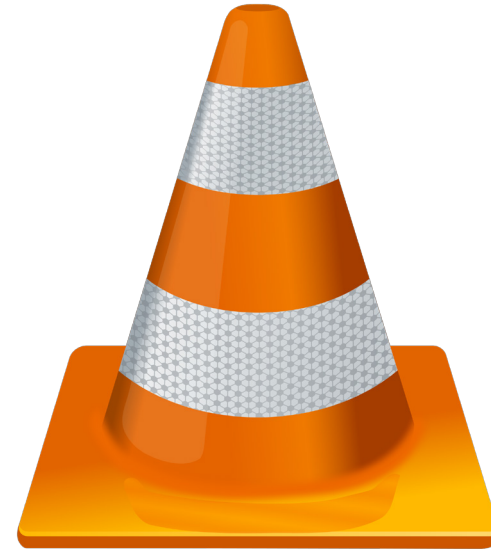
FIGURE 6

# Play A Video Clip As NDI

Do you have VLC media player for Windows® installed? If not, download and install the latest version from the link below:

<http://www.videolan.org/vlc/download-windows.html>

VLC media player is a powerful and popular open source utility, with capabilities extending well beyond what we can discuss here. Given its name, you will not be shocked to discover it is also a media player. Conveniently, too, it supports almost every known media file, is highly customizable, and can easily be controlled externally. Let's use it to create an NDI channel on your network.



# Play A Video Clip As NDI (Continued)

You previously installed the *NewTek NDI VLC Plugin* as part of the *NewTek NDI Tools Pack*. Let's continue from there as follows:

- Launch VLC media player, and use the Tools menu to open the Preferences panel.
- Click the Video icon in Preferences, and select NewTek NDI Video from the Output menu (Figure 7).

This tells VLC media player to direct its video output to the *NewTek NDI VLC Plugin*.

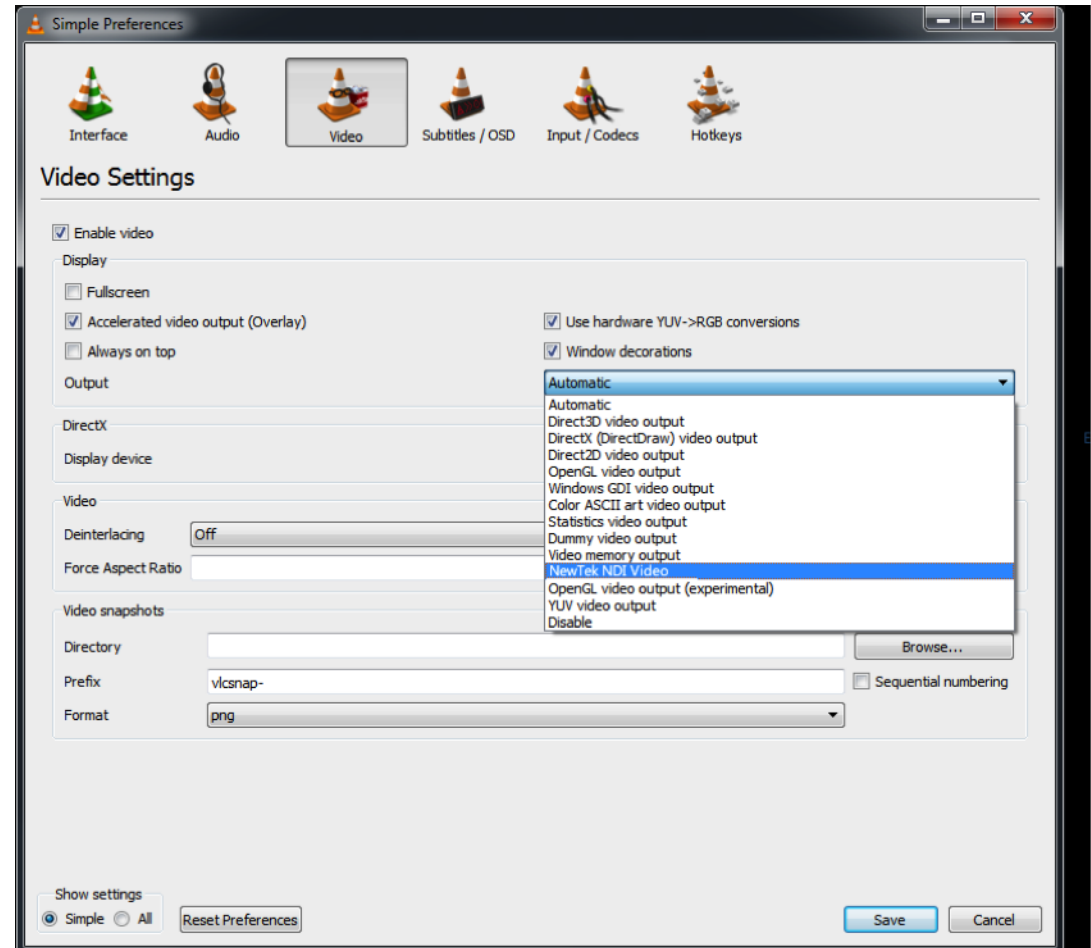


FIGURE 7

# Play A Video Clip As NDI (Continued)

- Click the Audio icon at the top of Preferences, and repeat the steps above to select NewTek NDI Audio as VLC media player's audio output.
- Exit and re-start VLC media player.
- Choose Open File in the Media menu of VLC media player to select a video clip to play.
- Finally, choose your new NDI channel as the source for *NDI Video Monitor*.

*NewTek NDI Video Monitor* now shows the NDI output from VLC media player. The audio and video played within VLC media player is being encoded in real-time by the *NDI VLC Plugin*. It is then sent to the local *NewTek NDI Video Monitor* window, and is also supplied to your network, and any systems connected to it.

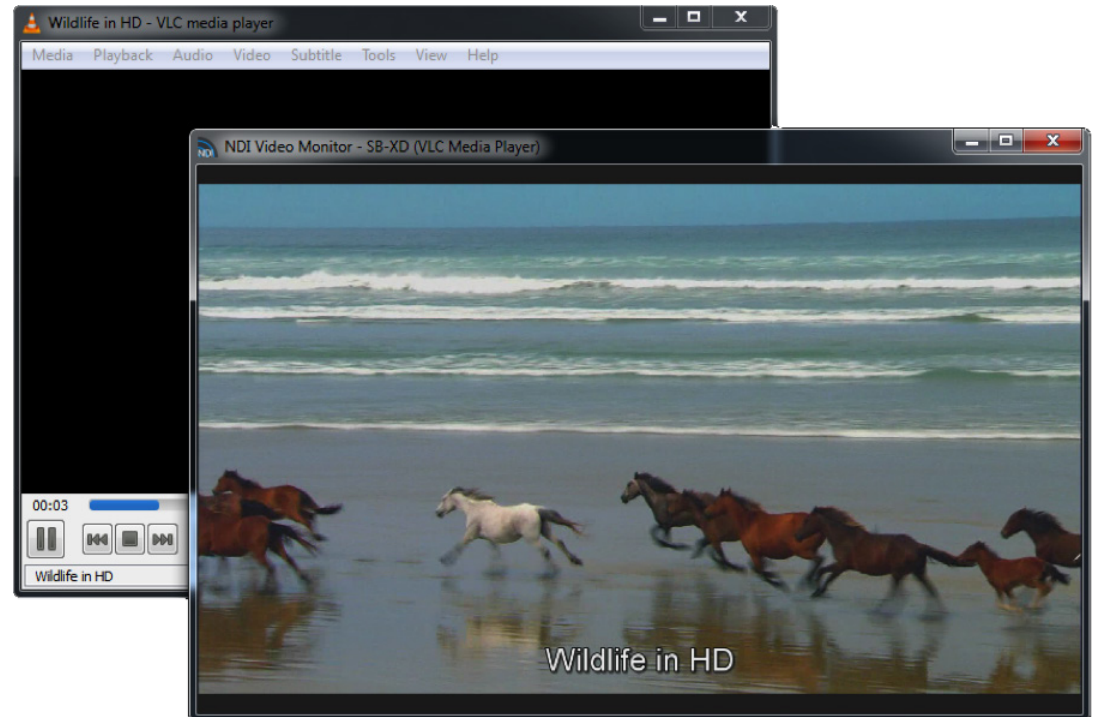


FIGURE 8

# Transmit NDI Video To Skype

More than 300 million people use Skype. Wouldn't it be wonderful to supply a truly high quality video source to your Skype connections? You could, for instance, hold a company meeting using a group Skype video conference, and present pristine quality video to participants.

Assuming you already have Skype installed, proceed as follows:

- Launch the *NewTek NDI Transmit Trial Version* application from the Windows® Start menu.
- Right-click the NDI icon that it adds to the Windows® Task Tray, and select one of the NDI sources you have previously added to your network, and which are now listed in the popup menu.
- Launch Skype, and select Options from its Tools menu.
- Click Video settings in the column at left (Figure 9). Use the Select webcam menu to choose NewTek Video Source (you can do the same thing in the Audio settings pane if you wish the remote Skype viewer to hear audio from the NDI source).

Skype is now ready to send your high quality NDI source out to contacts in the usual manner. (Naturally, the watermark visible in the NewTek NDI Transmit Trial Version is absent in the pro version of this tool.)

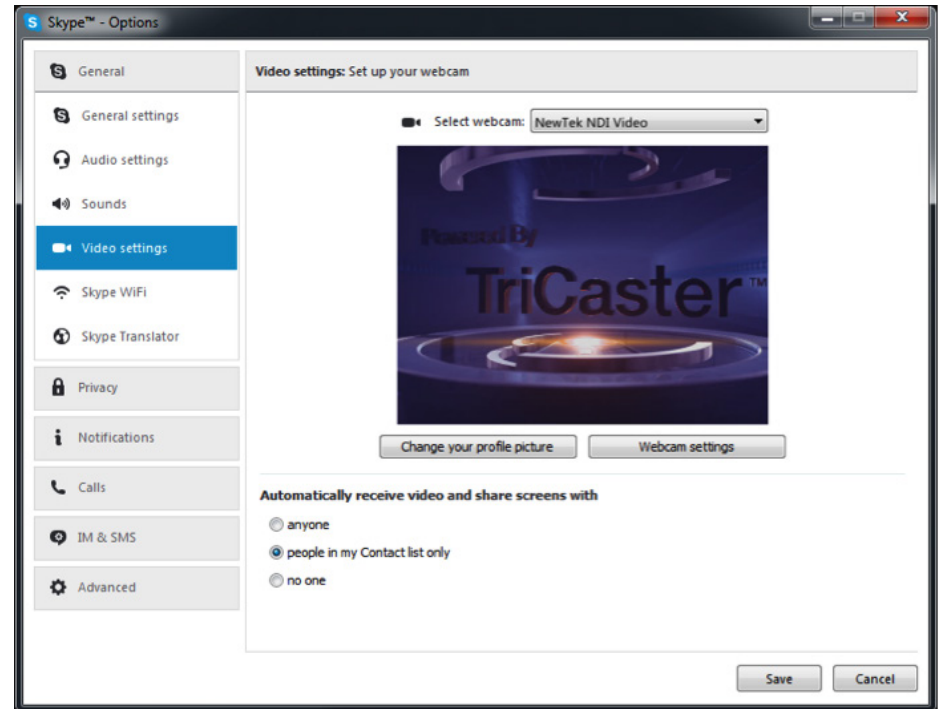


FIGURE 9



# Send NDI Video To Google Hangouts, YouTube, And More...

Likewise, the output from the *NewTek NDI Transmit* can be detected by such applications as Google+ Hangouts (and Hangouts On Air), YouTube Live, Adobe Flash Media Live Encoder, VLC media player, and many others.

- Configure a suitable NDI source in the *NewTek NDI Transmit* menu (Figure 10).
- Select the output from *NewTek NDI Transmit* in your desired application, in the same manner as you might previously have selected a webcam.

The gorgeous video quality NDI supplies to your viewers will make you and your message look great\* (Figure 11).

*\*Note that, by default, Hangouts shows your video source as a mirror image on your local display only.*

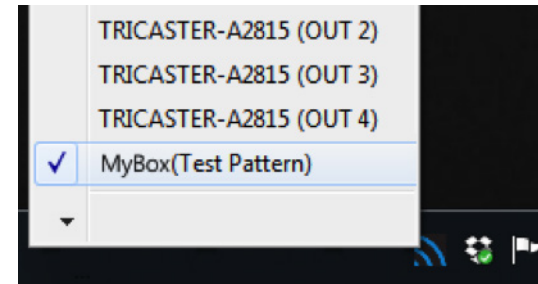


FIGURE 10

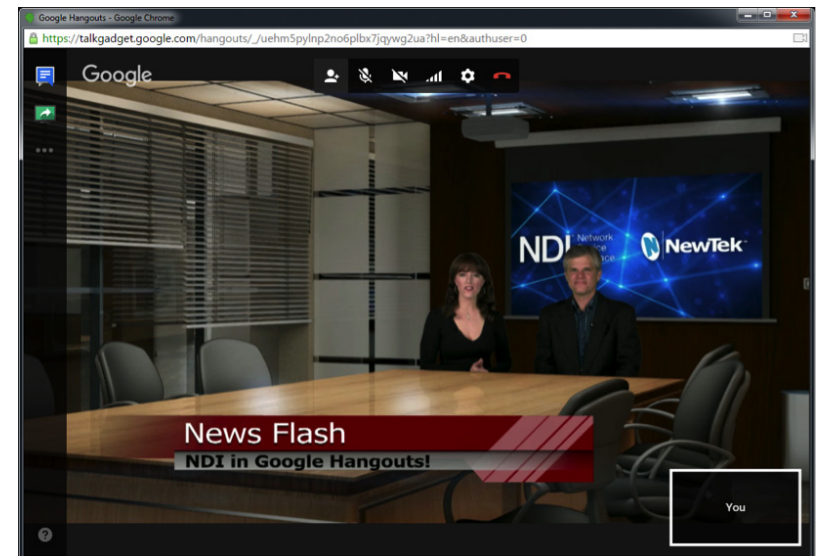


FIGURE 11

# Control Access To NDI Channels

**As you come to appreciate the power of NDI, you'll doubtless want more and more of such convenient video sources. You could easily wind up having hundreds of video sources available (clearly, this was impossible before NDI).**

In many production facilities, though, you will want to limit visibility of NDI channels from selected systems to certain viewers or specified systems.

The *NewTek NDI Group Manager* (included in the *NewTek NDI Tools Pack*) makes all of this quite easy. It enables you to group video sources together, choose which groups your local sending sources are members of, and which groups you want to see listed on your (or any) system.

By default, all NDI channels on your network are in the Public group, making them visible to all other NDI clients. Adding a custom Output group allows others to access your local NDI output by simply adding that entry to their local Receive group list. Then, if you remove Public from your Output groups, only those systems configured to receive one of your active Output groups will ever see your NDI streams.

Similarly, by removing Public from your own Receive groups, your system will ignore all channels that are not members of your remaining Receive groups. This simple mechanism allows completely configurable NDI channel control at each NDI-enabled access point on your network.

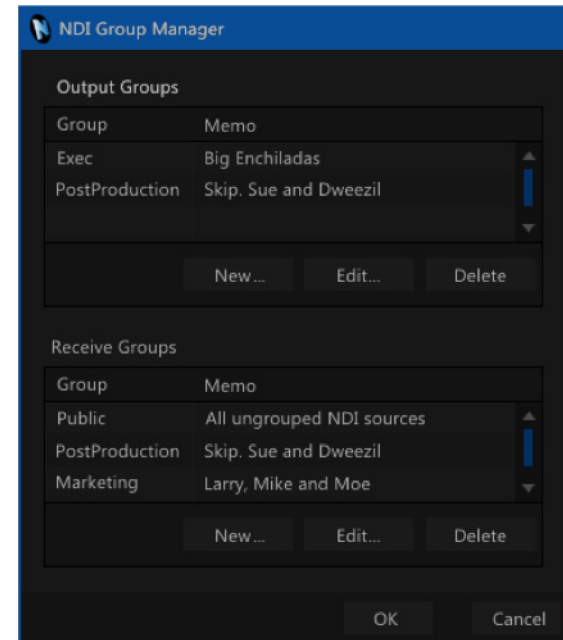


FIGURE 12

# Connect To Hardware

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For the sake of convenience, we've focused on computer sources up to this point. Obviously, though, "real video" (i.e., input from cameras and output to other devices) is equally vital for production.

You may want to send NDI video across the network to production devices and displays connected to an output card at the opposite end of the building. Or possibly you need to capture the signal from a video camera for use both inside and outside your control room.

**Thankfully, NDI provides full and easy connectivity to and from traditional production devices.**

Perhaps you may already rely on hardware audio-video I/O cards, such as the fine products from TeraDek, AJA Video systems, Blackmagic Design, or DELTACAST, using these for capture or display of audio and video.

Imagine how useful it would be if sources you connect to those cards were immediately available as NDI channels for use anywhere on your network, or conversely, if NDI sources could be sent to the card's video outputs. You could then connect a high quality camera to the input the card and (with the help of *NewTek NDI Transmit*) stream to YouTube Live or Google+ Hangouts, etc. Alternatively, you might display remote NDI sources on local monitors connected to a card's outputs located anywhere (in your studio, office building, or campus) that the network runs.

# Connect To Hardware (Continued)

The free *NewTek NDI Connect* software does all of this and more, and is available at [NDI.newtek.com](http://NDI.newtek.com) (Figure 13).

Here's a feature list for *NewTek NDI Connect Pro Version*:

- 4 NDI output channels
- Accepts multiple NDI channels as sources
- Supports Blackmagic, DELTACAST, and AJA, Matrox hardware, Teradek I/O devices and others, along with webcams and custom sound cards for professional connectivity (including XLR).
- Separate Key/Fill Input and Output
- Convert separate key and fill supplied to the card to a single 32bit NDI channel on your network, and vice versa.
- Make your webcam an NDI source
- Supports 8-channel audio I/O, with per-channel level control
- Supplementary NDI Viewer (e.g., for program return)
- Versatile display configurations, including independent dual monitor workspaces
- Media file playback (with Autoplay for systems supporting NDI tally)
- Integrated Waveform/Vectorscope
- Professional Color Correction, including White Balance and Auto-color
- Overlays (VUs, Title Safe, 4:3, Checkerboard, Center Cross)

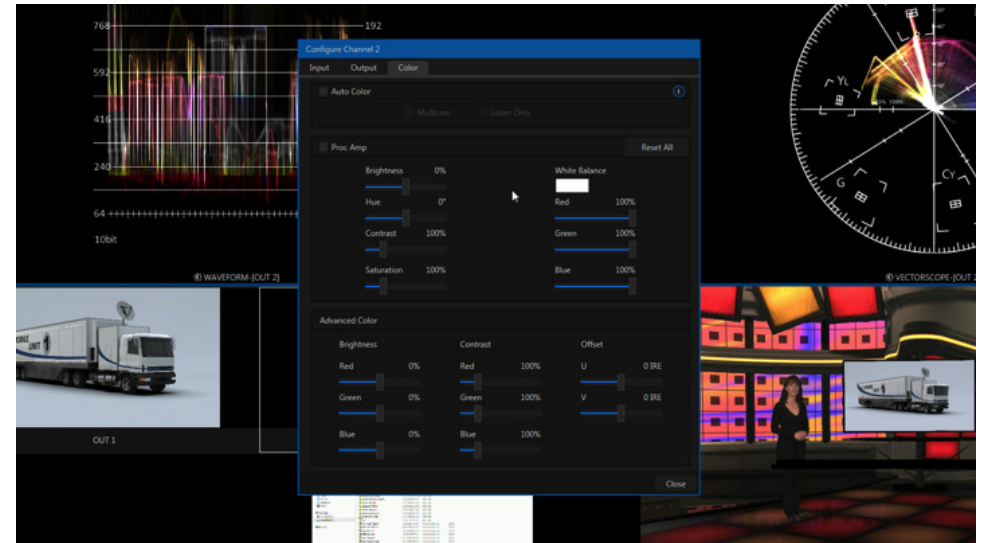


FIGURE 13

# Capture NDI Sources

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Obviously you will often want to capture video sources to media files. The previous generation of video production methods, although digital, required specialized cabling and systems for video transmission; in turn this meant that specialized devices were needed to record.

In the IP realm, that is no longer the case. Your local Ethernet infrastructure carries a plethora of video feeds, and these can also be recorded to drive at any convenient location served by the network.

The ability to record any media to storage, anywhere is part of the IP-based revolution. And it will soon be the case that a show—and all of the media that was used to produce—it are available for use in a stored format.

# Record Multiple Channels At Once

*NewTek NDI IsoCorder™* provides the necessary functionality, allowing a huge number of channels to be monitored and recorded all at once.

Capture from different sources can be started and stopped independently or simultaneously, and files are encoded to a broadcast quality QuickTime™ format compatible with all common production software.

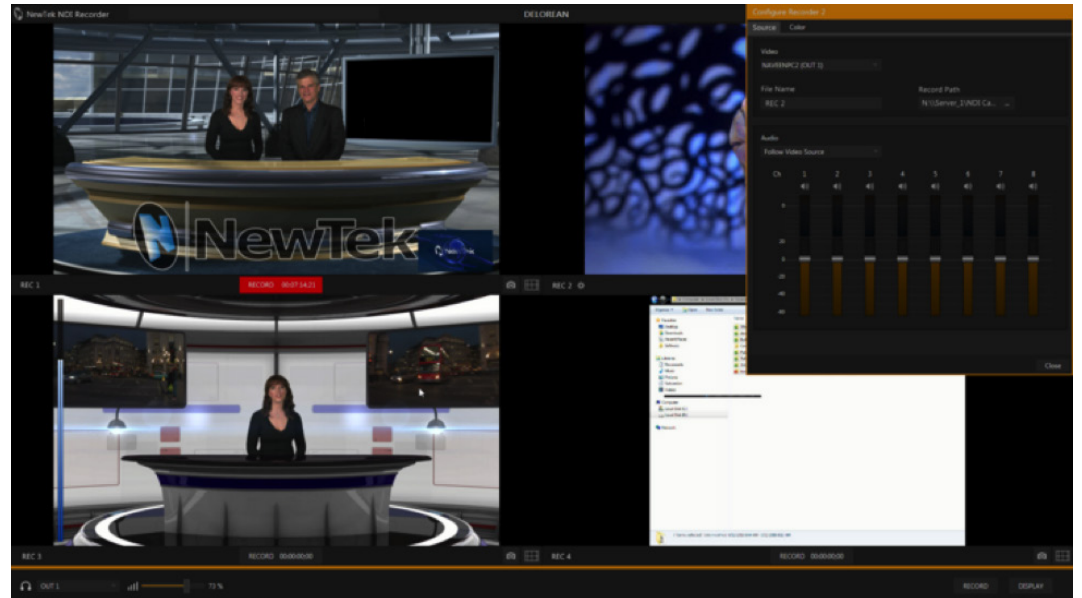


FIGURE 14

# The NewTek NDI SDK

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**As the foundational technology of the NewTek Advanced IP Workflow, NDI employs refined encoding and communication protocols to efficiently package and send information over a standard LAN.**

NewTek's NDI Software Developer Kit (SDK) supplies all of the information, tools, and examples needed to build applications and products with native NDI support. Both inputs and outputs of devices and applications (including switchers, graphics engines, laptops, etc.) that you prepare using this SDK can serve as video sources exposed to other NDI-enabled devices on a shared network. Interested parties are encouraged to visit <http://NDI.newtek.com> for further details.

The specific goal of the NDI SDK is to make it as quick and easy for you to create software and hardware applications that allow you to create and use video over IP as is physically possible. Indeed, if you have the ability to render video frames, we believe that NDI sending functionality can be added in less than 10 lines of code.

# Frequently Asked Questions

It all seems too good to be true, doesn't it? No doubt you have many questions. We want to comment on a few of the more common ones here, so that you can come to the conclusion that there's really nothing preventing you from trying NDI right away.

We're confident that you'll be happy you did.

## IS IT COMPLICATED?

Nope. NDI is no harder to use than the Internet (maybe easier).

## WHAT IF OUR PIPELINE IS ALL SDI?

NDI is fully compatible with SDI, and can easily be implemented alongside your existing infrastructure without disruption. You can augment and extend your existing systems without expensive investment or downtime.

## WILL IT COST ME A FORTUNE?

NDI is available without cost. While a number of providers offer NDI-enabled products for sale (and more are on the way), a variety of NDI solutions with powerful capabilities are being offered to you without charge.

## WON'T ALL THAT VIDEO OVERLOAD MY NETWORK?

Only if you try really, really hard. NDI's extremely efficient encoder supplies broadcast quality audio and video that is shockingly "small". Data demands are from 50-100 Mbps per channel.

## WHAT ABOUT UHD?

Got it covered. NDI supports any and all resolutions, frame rates, audio sample rate, and channel count, from HD to 4K and beyond.



# Frequently Asked Questions

## IS LATENCY AN ISSUE?

Forget about it. NDI transmission speed typically requires considerably less than one video frame.

## WHAT ARE THE SYSTEM REQUIREMENTS FOR CAPTURE?

On most Windows®-based systems with a gigabit network connection and reasonably fast hard drive (i.e., write speeds > 20 Mb/Sec per NDI channel recorded), the NewTek NDI IsoCorder™ application can capture two different HD NDI channels to disk at once.

## IS IT COMPATIBLE WITH SMPTE 2022, ETC.?

Our goal with NDI is to make the transition to IP as easy as possible. With that in mind, interoperability is very important to us, so our goal is to make NDI work with other popular IP infrastructures. For example, it is our goal in the very near future (as soon as devices are available) for NDI-enabled applications to automatically support SMPTE 2022/1-6 without any change. We expect to extend this standard-agnostic philosophy further, as hardware supporting other IP video transport methods advance from the planning phase to real world availability.

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