VIZRT

The Ultimate Guide to Cloud Live Productions

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CHAPTER

1

The basics of
cloud live productions

Getting off the ground with cloud live productions

THE PROBLEM WITH TRADITIONAL CONTENT PRODUCTION

Content has been produced in the "traditional" way for decades, and there will likely always be a need for it. But there's a problem with traditional content production that can't be ignored.

Producing on-location live content in the traditional way can be incredibly expensive, logistically difficult, and takes a significant toll on the environment. Arranging and transporting OB vans and other equipment alongside travel costs for staff uses vast amounts of budget, and the environmental impact cannot be ignored, with reports suggesting *every hour of production generates 9.2 tons of CO_2* which translates to 27.6sqm of sea ice loss.

Traditional in-studio content production isn't much better, with production systems running 24/7 for fear of them not working properly if shut down, and the significant cooling and maintenance costs, both monetary and environmental. The broadcast industry is waking up to the problem, with broadcasters such as Sky leading the way with their goal of being carbon net zero by 2030.

But it isn't just the environmental concerns that are a problem. Limited local talent pools, stretched budgets, and geographical and time zone restrictions fight against the ever-growing need to produce more content at higher quality to keep audiences engaged. Having the flexibility to produce where and how you want is essential. If traditional production is the right choice, then great. But if you could produce amazing content in another way – a way that reduces costs and carbon footprint – why wouldn't you do it?

THE SOLUTION TO THE PROBLEM

Cloud live productions are the best way to produce more content at higher quality with lower costs and lower carbon footprint.

With the cloud, your production teams can work from anywhere. Excessive transport and travel become a thing of the past, removing the transport and travel costs and related carbon impact, enabling more sustainable productions. Reduced costs and environmental impact, more flexibility, access to global talent pools, and happier production crews.

Learn more at **vizrt.com**

Cloud at the speed of live sports

entertainment
morning shows
news
events
esports
politics

> "If you can't tell the difference, why wouldn't you do something that makes more sense, that requires less travel, less cost and I think this is one of those things."
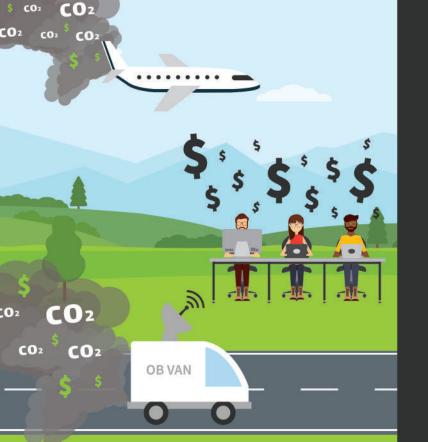>
> – **Jeff Proctor**, *President, ProAngle Media*

> "Having less equipment and not having to go to a city and staff people there. You can just have your best guys available for you, that's just amazing it just sounds like the future is here now…"
>
> – **Steve Lee**, *Viz Producer, Bally Sports*

Whether you're looking to kit out a new studio, refresh an existing studio's setup, or to add more live production ability for on-demand and on-location events, choosing end-to-end software-defined visual storytelling tools such as the Vizrt Live Production Solution and hosting them in the cloud is the best way to achieve high-quality productions without the monetary and environmental price tag. "Going cloud" is something all broadcasters and content creators can benefit from. Niche sports broadcasters like The Døds "Death Diving" Federation are turning to cloud as eagerly as major broadcasters, like Sky.

With the speed at which the industry and technology is moving, it's no longer a case of whether you will adopt cloud for your live productions, it's when.

Adopting innovative technology and ways of working can seem daunting – but it doesn't need to be. This guide will walk you through the basics of getting started so you can enjoy cloud at the speed of live.

Clearing up confusion: what do we mean by "cloud live productions"?

When we say "cloud live productions", we're talking about the proven Vizrt and 3rd party live production tools used and loved by large and small broadcasters and content creators around the world, but hosted as software-defined solutions in the cloud rather than installed on-premises. All your tools, operators, cameras, and talent are connected wherever they are by the "interoperability glue" that is NDI® (Network Device Interface), the leading high-performance video standard that makes cloud live productions possible. Everything you need for end-to-end live productions is available in the cloud, including 4K switching, broadcast-quality graphics and rendering, studio automation, audio mixing, replay/slow-motion, and intercom.

FIRST UP – WHAT IS CLOUD?

Amazon Web Services (AWS) say it best, describing (public) cloud as:

"the on-demand delivery of IT resources over the Internet with pay-as-you-go pricing. Instead of buying, owning, and maintaining physical data centers and servers, you can access technology services, such as computing power, storage, and databases, on an as-needed basis".

Rather than owning, maintaining, upgrading, and running your own server stack, the cloud lets you "rent" cutting-edge IT resources as and when needed.

The proven benefits of cloud vs. traditional on-premises IT setups are many and varied for all aspects of content production, playout, and asset management, but this guide will focus on the live production side of things. In short, the cloud offers cost savings, greater agility, flexibility, and scalability in your IT, and greater security. But the benefits of "going cloud" span well beyond the IT benefits.

SO, WHAT ARE CLOUD LIVE PRODUCTIONS?

The principle of cloud live productions is the same as traditional live productions. Switching/mixing, graphics, replay/slow-motion, audio mixing, studio automation, and intercom are all there – but instead of relying on physical hardware managed and supported by you (and hosted on-premises or in a datacenter you manage), you use software-based tools that run virtually in the cloud (controllable via software GUIs or physical control panels).

In a traditional setup, you would likely have a packed gallery or Outside Broadcast (OB) van – with cloud setups, all the technology that would be in the OB van or gallery becomes virtual, with operators remotely accessing their tools from anywhere.

The underlying technology and functionality can be the same but think of it as just being a (much) longer cable connecting you to the technology (i.e., over the Internet instead of connecting to a device on your desk or in a server room).

NDI®'s role in cloud live productions

Serial Digital Interface (SDI) camera feeds are far too large to send easily over the Internet and into the cloud; Network Device Interface, or NDI® for short, is the "interoperability glue" that makes cloud live productions possible.

NDI is a high-performance video standard that makes it easy to move video across your networks, whether that's on-premises, in the cloud, or both, over the public Internet. It allows content creators to use real time, ultra-low latency video on existing IP (Internet Protocol) video networks, giving everyone access to easy-to-use, high-quality video using existing equipment while preserving visual quality, frame accuracy, and source synchronization.

NDI is bi-directional and the only format that enables true end-to-end workflows, connecting on-premises studios and sources into the cloud for easy remote live productions as well as post-production workflows with one single format.

NDI unlocks millions of sources for your productions by enabling any mobile device to become an NDI camera feed, regardless of where it is in the world. And with plenty of SDI-NDI and SRT-NDI encoders available on the market (and SRT-enabled cloud switchers, such as Viz Vectar Plus), it's easy to encode your existing SDI and SRT camera feeds into NDI feeds for your cloud live productions.

NDI® TOOLS

The NDI protocol comes with a *range of free tools* designed to make it possible to connect to any device, in any location, anywhere in the world – and send live video to wherever you are. These tools make it easy to produce live shows from anywhere and bring in millions of content sources from virtually any device.

FLAVORS OF NDI®

There are two main "flavors" of NDI to consider – NDI Full Bandwidth and NDI|HX. Your choice depends on production requirements and network capabilities and can affect the cameras you use.

NDI Full Bandwidth's compression is nearly visually lossless, so these IP streams have greater bandwidth requirements and are widely used in live productions. Generally, a channel of 1080p60 NDI needs about 130Mbps of bandwidth while a channel of 4Kp60 requires about 250Mbps.

NDI|HX utilizes the common compression method H.264 and HEVC which drastically lowers the bandwidth required by about 90%; a channel of 1080p60 video only requires about 16Mbps and a channel of 4Kp60 video only requires about 30Mbps. The trade-off comes in the form of a slight increase in latency due to the time needed to compress and decompress the video; the latency of NDI Full Bandwidth is less than 100ms, while that of NDI|HX is about 100ms-200ms.

It isn't a one-or-the-other choice, however – using NDI Bridge (part of the NDI Tools package), it's possible to connect on-premises networks using NDI Full Bandwidth to networks using NDI|HX in the cloud, for example.

Learn more at **vizrt.com**

BRIDGE
Share NDI sources with others beyond your local network

REMOTE
Share or receive an NDI source over the web

WEBCAM
Send NDI streams (e.g. from the NDI HX Camera app for iOS/Android) to webcam apps

AUDIO DIRECT
Bring audio in/out of any Digital Audio Workstation that supports Steinberg VST3 plugins

STUDIO MONITOR
View or display any NDI video sources across your network in real-time

SCREEN CAPTURE
Present a computer display, webcam, or a region of interest as NDI output with audio

ROUTER
Matrix routing for NDI sources

TEST PATTERNS
Output a standard reference or custom image with tone as NDI

Credit Trippel-M Connected Venues

CASE STUDY

CUSTOMER

The International Døds Federation / Trippel-M Connected Venues

CHALLENGE

Providing a rich viewing experience for audiences, and make it as easy as possible, cost effective, and sustainable for its global production crew.

SOLUTION

Trippel-M Connected Venues remotely produced the action happening in Texas from their offices in Oslo, Norway, using cloud-hosted switching, replay, audio mixing, and intercom, connecting the cameras and camera operators at the event to the cloud and to Trippel-M through NDI. Not only that, but they used Viz Now to automatically deploy all the tools they needed straight into AWS in minutes, with no setup time or costs.

READ THE FULL CASE STUDY AT:

vizrt.com

"Death Diving" makes a splash with cloud live productions

For the Austin, Texas leg of the Døds "Death Diving" 2022 World Tour, the Døds Federation wanted to bring its production value of the niche but growing sport to the next level, providing a rich viewing experience for audiences, and make it as easy as possible, cost effective, and sustainable for its global production crew.

On behalf of the Døds Federation, Trippel-M Connected Venues remotely produced the action happening in Texas from their offices in Oslo, Norway, using cloud-hosted switching, replay, audio mixing, and intercom, connecting the cameras and camera operators at the event to the cloud and to Trippel-M through NDI. Not only that, but they used Viz Now to automatically deploy all the tools they needed straight into AWS in minutes, with no setup time or costs.

"When we can elevate our production value, audience satisfaction skyrockets and it increases the likelihood of more viewers being exposed to and engaging with our content. Working with the cloud also helped reduce our carbon footprint as we had no need to ship hardware, or people down to Texas where the event took place, allowing us to do more of this type of production in the future, in a sustainable way

Stine Brun Kjeldaas
Head of Sports and Media, The International Døds Federation

Why are broadcasters turning to cloud?

So, you know what cloud live productions are – but why are broadcasters turning to them for core and on-demand programming?

Better quality content, reduced climate impact, decreased time-to-market – there are many reasons regional and national broadcasters are exploring the benefits of cloud live production.

BETTER QUALITY CONTENT

Use your best team –
not the most local team

NDI® = more sources,
more interesting content

Easy access to the best
broadcast software

90%

REDUCE CARBON FOOTPRINT

119kg
CO_2

10kg
CO_2

Reduce CO_2 emissions by 90%

IMPROVE IT COSTS, RESILIENCE, AND PRODUCTIVITY

42%

42% reduction in IT costs

50% IT tasks

10x IT projects

Increased IT staff
productivity

99.999%
uptime

99.9%

Improved IT resilience,
security, and agility

DECREASE TIME-TO-MARKET

6 months

vs.

3-4 weeks

Reduce channel deployment
from months to weeks

TRY NEW THINGS WITHOUT THE RISK

*We love the Cloud because
we can test new things, fail
fast, learn from it, and go
again until you get it right*

Discover what works and what doesn't:
cloud enables quick and easy testing
and failing of new ideas

Read the full article "Broadcasters have their heads in the cloud -
and are reaping the rewards for it" **here**

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CHAPTER

2

Which live production tools are available in the cloud?

Which live production tools are available in the cloud?

Built on an NDI-native backbone, the Vizrt Live Production Solution, combined with trusted 3rd parties for audio mixing, replay/slow-motion, and intercom, supplies everything you need and are used to using for end-to-end live productions in the cloud (or on-premises, or a hybrid deployment). With NDI as the "interoperability glue" joining everything together – whether it's hardware/software or cameras on the ground or software in the cloud – your live productions can be produced remotely from all around the world as easily as they can with your operators crammed into an OB van.

On-Demand Demo:

How to: End-to-end remote live productions in the cloud

► *Watch this on-demand demo* to "follow the signals" through a remotely produced end-to-end multi-camera production, covering video switching/mixing, graphics, replay/slow-motion, audio mixing, and intercom

<div style="border:1px solid orange; padding:10px; display:inline-block;">

WATCH NOW!

</div>

4K switching, DDR, and audio mixing with Viz Vectar Plus

Viz Vectar Plus

Combining NDI®-based audio application interconnectivity, multiple version program output, remote operation, and integration of video conference call applications as live sources, Viz Vectar Plus provides the future of software-based switching in the cloud or on premise.

✓ 44 external NDI® sources
✓ 8-M/E video mixing, plus PreViz
✓ 15 frame buffers
✓ 68 Keyers
✓ 16 Outputs
✓ 4 DDR media players (NDI®) (with key+fill)
✓ Built-in 44 channel audio mixer
✓ 3 configurable multiviewers
✓ ISO and Output recording
✓ Configurable video and audio delays at every input
✓ 3 integrated streaming encoders
✓ Extensive macro and automation capabilities
✓ Custom panel creation in operator UI and web browser
✓ Control via UI or 2-stripe or 4-stripe physical control surface

On-Demand Demo:
NDI®-native live production
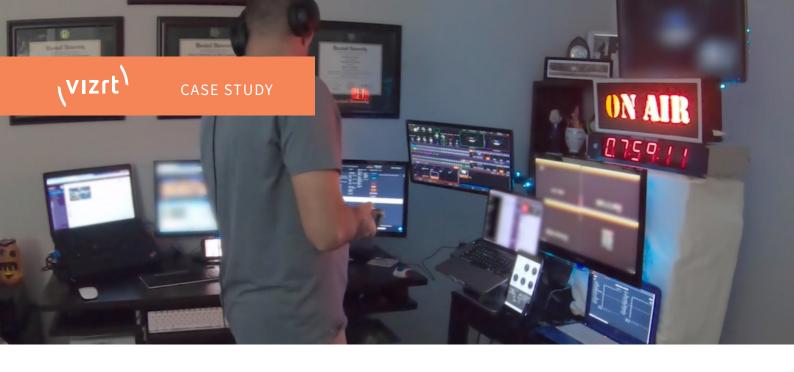in the cloud with Viz Vectar Plus

Viz Vectar Plus

WATCH NOW!

Want to see Viz Vectar Plus in action?
▶ *Check out this on-demand demo* for a deep dive into Viz Vectar Plus's video production capabilities!

Media.Monks remotely produce 20 sports games in 4K - despite serious COVID restrictions

THE CUSTOMER

Media.Monks – a global digital-first marketing and advertising services company – were tasked by a major US sports league to remotely produce 20 sports games in pristine 4K UHD.
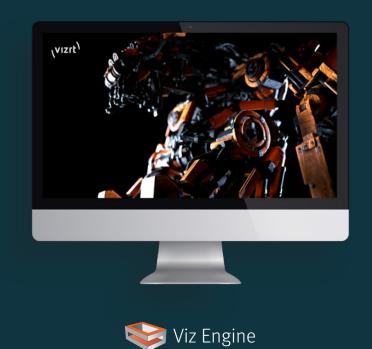
THE CHALLENGE

COVID-restricted to 2 on-site technicians and a mere 4x4ft tabletop encoding setup, traditional on-site production with OB trucks wasn't possible. Media.Monks needed a solution that would enable their global team to remotely produce the games with a slim on-site presence.

THE SOLUTION

- 6 fixed (unmanned) cameras in the stadium
- 2 Media.Monks Technicians on-site monitoring 20+ Haivision SRT encoders
- **Viz Vectar Plus** deployed in the cloud for remotely controlled 4K switching.

THE RESULT

20 games remotely produced in 4K UHD with zero issues, with real-time global collaboration from Media.Monks' production staff from the UK, US, and Brazil. Following the success of this project, Media.Monks now have almost all of their production staff using the Vizrt Live Production Solution for their client projects, helping Media.Monks to enjoy their most productive year ever – despite the COVID-19 pandemic!

> "
>
> ### *It's like being in a broadcast truck, except in the cloud*
>
> Lewis Smithingham,
> Creative Lead,
> Media.Monks
>
> Watch the Media.Monks case study video *here* for more information!

Simply the best real-time broadcast graphics with Viz Engine

With superb photo-realism, stunning effects, adaptive graphics, and advanced compositing features combined with unrivalled performance, Viz Engine reduces complexity so you can increase your creativity. With absolute reliability, speed, and precise control, you get access to the best graphics in the world to help you produce the most engaging, high-quality content possible.

✓ High performance real-time 2D and 3D rendering, compositing, and processing
✓ Produce and serve graphics with different aspect ratios across multiple platforms with Adaptive Graphics
✓ Simultaneous rendering pipeline including Unreal Engine 4
✓ Multi-channel graphics and video playout with key + fill
✓ NDI input and output support
✓ Embedded audio
✓ Versatile plug-in API with 600+ plug-ins available
✓ Option to run embedded in Viz Vectar Plus

Viz Engine

OnDemand Demo:

Viz Engine 5
& Adaptive Graphics Demo

Did you know that a whopping 69% of your audience watch your content on their mobile phones without sound? Your graphics need to be visually "loud" enough for the viewer to understand your story and the content interesting and immersive enough to retain them – are you achieving that, or are you transplanting 16:9 graphics to mobile screens? ► *Watch this on-demand demo* to discover how Viz Engine 5's new Adaptive Graphics capabilities streamline your graphics workflows.

Learn more at **vizrt.com**

Control your live graphics with the world's most advanced CG

Viz Trio is the number-one character generator (CG) for live televised events anywhere in the world. The system's flexibility and the high level of built-in intelligence sets it apart from the rest.

✓ Template-based and real-time 3D graphics
✓ Transition Logic
✓ Live Motion Graphics
✓ Preview while editing
✓ Automation system control
✓ Multiple channel control
✓ Supports HD and UHD

Viz Trio

On-Demand Demo:
The New Viz Trio 4
More Control

▶ *Watch this on-demand demo* to learn what you can get out of the most recent version of the most powerful graphics control tool in the market - Viz Trio

Create consistent, error-free content with Viz Mosart studio automation

Viz Mosart represents the best of simplified operation and advanced device control, providing the highest quality and speed while eliminating mistakes and lowering operational costs for greater flexibility in news, sports, and other live productions.

✓ Brand assurance guaranteed
✓ Production accuracy
✓ Freedom to change on-air
✓ Instant feedback from controlled devices
✓ Integration with most NRCS
✓ Customizable UI and shortcuts
✓ Seamless control of Vizrt Live Production components
✓ Switcher-less production automation workflows

Learn more about the cost-effective production automation solution, Viz Mosart, in this ▶ *on-demand demo.*

The best plays, replayed better, with 3Play 3P2 by Viz Now

The cloud-hosted version of NewTek's unmatched sports replay production solution, 3Play 3P2 by Viz Now ensures sports broadcasters never miss an angle or unforgettable sporting moment, with unparalleled connectivity and efficiency across the whole production workflow.

✓ Up to 2160p60 video on all channels with end-to-end IP connectivity

✓ 10 channel replay system supporting up to 8 external inputs and 2 outputs with 3 multi-viewer outputs

✓ Playback zoom and tracking for area of interest replays

✓ Synchronized continuous capture to full-resolution QuickTime® files for instant replay, live editing, post-production, and archive

✓ Simultaneous record and playback with ability to preview all angles simultaneously

✓ LivePanel™ add-on to build browser-based user interfaces and workflows

✓ Powerful production automation with custom macro commands, cross-platform workflow integration, and flexible control options

✓ Support for MIDI, GPI (General Purpose Input), AMP protocol, and much more

Check out how to create the best plays, played better, with 3Play 3P2 in this ▶ *on-demand demo video*

Learn more at **vizrt.com**

Complete audio control with Harrison Mixbus Virtual Broadcast Mixer (VBM)

Harrison Mixbus VBM is a cloud-ready virtual broadcast mixer that supports the NDI Audio Direct Plugin for inputs and outputs, seamlessly integrating into your NDI signal flow.

Based on Harrison Consoles decades-long experience producing analogue and digital mixing consoles, VBM uses software mixing technology developed for Harrison's Mixbus DAW (Digital Audio Workstation) platform. It is tailored to applications that require multiple mix minus feeds and can supply multiple program outputs. It can be run locally or on a remote virtual server. Audio inputs and outputs to VBM are over network connections and are not necessarily local to the broadcast engineer's physical location.

✓ World-class signal processing and user interaction... only from Harrison

✓ Mini-mixer for each output supplies visual feedback of the signal flow, plus manual level controls

✓ VCA faders allow arbitrary grouping of input or output channels

✓ IFB (Interruptible foldback) compressor on every mix-minus: ducks the talent's program feed when a producer talks to them

✓ Full monitoring system with solo modes and options, speaker level controls, and flexible metering

✓ Supports mono, stereo, or multichannel input plugins

✓ Configurable screen layout, with shortcuts to focus on inputs, mix-minus feeds, VCA's or programs

Communicate and collaborate in real-time with cloud intercom from Telos Infinity VIP

Telos Infinity Virtual Intercom Platform (VIP) is an award-winning fully featured cloud intercom system, delivering sophisticated comms virtually, making cloud media production workflows available on any device—smartphone, laptop, desktop, or tablet. Users can even use third-party control devices, like Elgato's Stream Deck®, to control Telos Infinity VIP.

✓ Cost-efficient – less maintenance, infrastructure, and space needed

✓ Scalable – pay for only what you need

✓ Ease of use – virtual panels on familiar devices (smartphone, computer, tablet)

✓ Workflow flexibility – at home, on-prem, site-to-site, In the cloud

✓ Reliable, proven cloud workflows

✓ Flexible deployment options

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6 steps to getting started with cloud live productions

CHAPTER

3

What technology do your remote and on-location operators need?

What technology do you need on location?

Much of your existing live production technology can be used for cloud live productions, either as is, or with tools that enable its use in the cloud.

CAMERAS

You'll need cameras on the ground for your live production, but the beauty of NDI-powered cloud live productions means you have far greater choice.

You can use:

- A range of *NDI-enabled cameras* from manufacturers such as Panasonic, Sony, and many others

- SRT cameras (provided your switcher works with SRT signals, as Viz Vectar Plus does)

- Cameras connected to cellular bonding services such as LiveU or Aviwest that can output NDI streams

- SDI cameras (using an SDI-NDI encoder such as the *NewTek NC2 I/O* (also sold by Vizrt) to adapt the workflow to NDI)

- Any mobile device with the free *NDI® Remote app* installed on it

- Remote guest video and audio feeds via popular web conferencing apps

An example of this is ▶ *Sky Germany, who cloud-produced the Bundesliga Handball Final* using a combination of broadcast cameras and mobile phone cameras, connected over O2's 5G network, providing viewers with far more camera angles and bringing them closer to the action than ever before.

> "…with the support of Vizrt, we were bringing the handball action very close to the TV viewer in unprecedented 5G transmission quality, allowing fans to immerse themselves particularly deeply in the live action in the arena"
>
> **- Alessandro Reitano**, *Senior Vice President Sport Production at Sky Deutschland*

TALLY LIGHTS

Tally is easily achievable in the cloud and can be set up with NDI® and non-NDI® cameras.

NDI supports tally light indications with NDI cameras, mobile device sources, screen capture sources, and more, and can also work with traditional broadcast cameras when used with NDI encoders, such as the NewTek NC2 I/O. Tally is also built-in option for the *NDI Studio Monitor application* which will provide red or green outlines for the video sources to communicate how that source is currently being used in production.

NDI devices can use the tally light function in different ways. There are tally light systems that read the tally information from the NDI network and control external tally lights, such as *Tally-Lights, LLC* (owned by PTZOptics). Some NDI cameras have built-in tally lights that use indication lights on the front of the camera to inform the talent of when the camera is off, in preview mode, or live on air. Other cameras can connect to dedicated tally light systems for more complex setups. As Viz Vectar Plus uses the same control API as the famous NewTek TriCaster®, all *tally light systems supported by NewTek TriCaster* are also supported by Viz Vectar Plus and most of them also work connected to the cloud via a small VPN connection.

DEDICATED AUDIO EQUIPMENT

Whatever dedicated audio systems and equipment you need on-site – mics, headphones, speakers, etc. and the systems to run them – can be integrated in cloud live productions. You can use NDI-enabled audio equipment, or you can use non-NDI equipment that uses the popular AES67 or Dante standards and then use the NewTek NC2 I/O encoder/decoder or other converters to convert the signals to and from NDI.

BACKHAUL

Backhaul is a consideration for remote guests, news anchors, camera operators, etc., and is made possible using NDI Bridge both in the cloud and on-premises, and a NewTek NC2 I/O module on-premises.

NDI Bridge outputs video and audio feeds from the cloud and connects to a NewTek NC2 I/O device on-premises to supply video feeds for any local or remote talent to view, or to provide PGM feeds for camera operators. It can also supply audio feeds for in-ear equipment for presenters, interviewers, etc., either through intercom, or via an audio mixer, returned via a mix-minus audio channel (supplying all audio apart from the voice of the speaker themselves).

Making use of the ability of NDI to be used over Wi-Fi, the NDI feeds in the on-premises network – i.e., the return feeds from cloud – can also be made available to other staff members using mobile devices running NDI viewer apps.

Credit: Tally-Lights, LLC

COMMUNICATION AND INTERCOM

Communication in the production team is vital to achieving the highest quality output, and this is even more significant when producing remotely.

At a basic level, community communication services, such as Discord, can be used to set up temporary communication platforms for your remote productions, offering a combination of voice and text chat.

For more feature-rich capabilities, however, cloud live productions enable the use of cloud-hosted intercom systems, such as Telos Infinity Virtual Intercom Platform (VIP). Telos Infinity VIP intercom server in the cloud supports NDI input and output, which allows it to integrate it seamlessly into the NDI signal flow. All that's needed on-premises is the hardware your talent and production crew on-site need to communicate, and this can be achieved in a few ways.

• Using a mobile device with the Telos Infinity VIP browser app

• Using the Telos app for Elgato Stream Deck

• Using Telos equipment, such as their belt packs and headsets, connected to the cloud via their Infinity Link Gateway

• Using existing non-NDI intercom equipment that works with the AES67 standard and using the NewTek NC2 Studio I/O module to convert the signals to NDI

Trippel-M Connected Venues operators remotely producing the Austin, Texas leg of the Dødsing "Death Diving" event from Norway

What do operators need?

A STABLE INTERNET CONNECTION

As the production tools are hosted in the cloud, your production crew will be accessing them over the internet. We recommend low latency connections with a minimum connection speed of 40 Mbps.

Vizrt Live Production Solution tools such as Viz Vectar Plus for video switching can be accessed and controlled by multiple operators, providing a level of redundancy if one operator becomes disconnected from the internet.
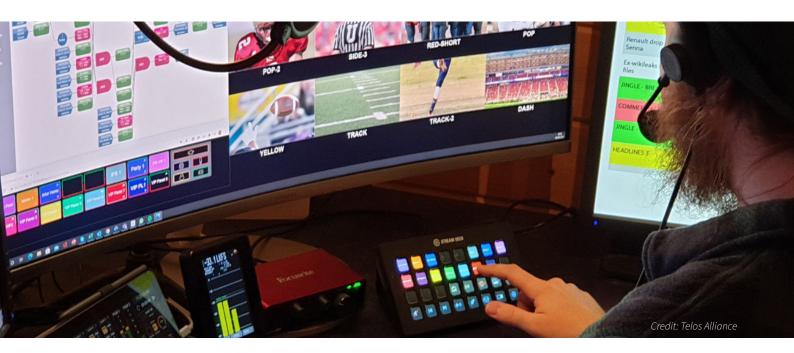
Despite being a common concern for operators considering cloud live productions, latency isn't an issue – provided the right NDI-native tools are used and the internet connection is decent enough, with broadcasters experiencing latency of less than half a frame, completely unnoticeable to the operators.

" *"What Vizrt is doing is eliminating latency. Getting rid of the time disparity from when it actually happens to when I'm seeing it happen as the director, and it's kind of a game changer."*

*– **Jon McKelvey**, Freelance Director/Technical Director*

Learn more at **vizrt.com**

As an example of this in practice, Vizrt recently hosted an event to highlight the powerful capabilities of Vizrt's Live Production in the Cloud Solution in sunny Los Angeles at a beach house. Our point of it being on the beach? That anyone can continue to create enterprise-grade content as if on-site, from anywhere they are in the world. If they have a beach view to do it? Even better.

Credit: Telos Alliance

COMPUTING POWER

For operators to remotely access their live production tools, they need a standard workstation capable of running remote desktop. To get a good user experience, we recommend that the GPU can deliver a minimum output of 2560x1440px (to as many screens as they need for their role).

For remote access, various PCoIP tools are available (such as Teradici), and Vizrt recommends the use of *AWS Nice DCV* for the lowest latency.

MULTIPLE SCREENS ARE IMPORTANT

The operators will generally need at least two screens – one for the multiviewer, and one for application control.

INTERCOM CAPABILITIES

Intercom can be controlled in the cloud using hardware control panels, such as *Stream Deck*, or through a software GUI, such as *Telos Infinity IP Intercom Dashboard.*

VISION, AUDIO, AND REPLAY CONTROL PANELS

Intuitive software user interfaces are great, but nothing beats the tactile feel of pressing a physical button or moving a throttle, so consider that your vision, audio, and replay operators may need hardware control panels at their location, whether that's in the gallery, on-location, or at home.

Vizrt offers dedicated 2-stripe and 4-stripe vision and audio mixing control surfaces for varying levels of production complexity, and *replay/slow-motion control panels from NewTek.*

Alternatively, Vizrt tools also work with popular control panels from manufacturers such as Skaarhoj.

The Vizrt control surfaces connect to cloud via IP network. In cases where the control devices are USB-connected (such as the NewTek 3Play control surface), the USB forwarding of the PCoIP tools (such as AWS Nice DCV) are used and offer such a low latency that there is no impact even on fast-paced replay operation.

Setting up your physical devices on-location may be a manual task but deploying your live production tools in the cloud doesn't have to be! Viz Now automates the process for you in minutes, breaking down your barriers to cloud *– learn more about it in our Viz Now launch blog!*

Learn more at **vizrt.com**

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6 steps to getting started with cloud live productions

CHAPTER

4

Managing audio and overcoming audio challenges

Video + Alpha Multichannel Audio Metadata	256 channels

A single NDI Stream can support up to 256 audio channels.

Managing audio and overcoming audio challenges

Audio in cloud live productions presents unique challenges over traditional live productions, but these are easily managed through the power of NDI.
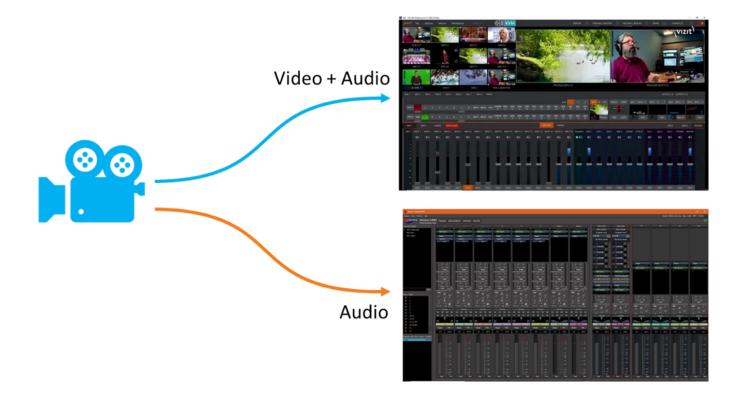
There are several advantages that make NDI a unique solution for cloud audio production workflows. NDI supports video, alpha channels, metadata, and supports audio compression with Opus and AAC up to 256 audio channels per stream. Audio can be:

- Uncompressed

- PCM 48 kHz, 32-bit floating point

- Compressed with AAC or Opus codec

An NDI transmitter can send audio-only or audio+metadata streams under requests from the receiver, which is especially useful for network traffic optimization. Audio channels are interleaved inside the NDI streams which keep the synchronization between channels, removing the need for the complexity of a synchronization layer such as PTP (Precision Time Protocol).

Thanks to the free application, NDI Audio Direct, any Digital Audio Workstation that supports VST3 plugin can receive and send Multichannel NDI Streams, enabling straightforward creation of mix minus and IFB workflows.

Additionally, through the NDI SDK (Software Development Kit), developers can create applications that receive NDI audio only. As such, NDI-native switchers like Viz Vectar Plus, audio plugins like NDI Audio Direct, or audio mixer applications like Harrison Mixbus VBM can call NDI transmitters to get NDI Audio-only streams.

Video + Audio
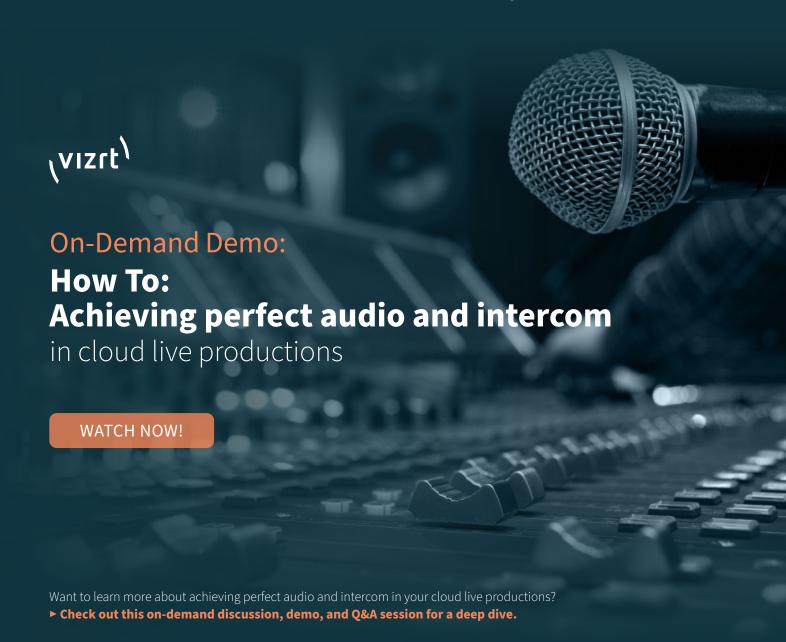
Audio

Complete audio workflows in the cloud

The combination of NDI Audio Direct, Viz Vectar Plus, and Harrison Mixbus VBM offers the unique possibility of creating a complete audio production workflow in the cloud.

Viz Vectar Plus supports up to 16 audio channels per input, and all the outputs and the internal sources (such as the media players) are available as NDI Audio Direct outputs. On top of this, remote sources or destinations can be easily interconnected through NDI audio streams.

On-premises, NDI Audio Direct allows audio applications to use ASIO or WDM (Windows Driver Model) physical soundcards. This enables a very flexible workflow where the audio application can be used as a gateway between NDI and physical audio interfaces. In combination with NDI Bridge, a bi-directional multichannel NDI audio stream can be shared between cloud and on-premises infrastructure.

Finally, NDI audio enables full cloud interoperability; integrated video production platforms like Viz Vectar Plus can be empowered by dedicated audio applications like Harrison Mixbus VBM and intercom applications like Telos Infinity VIP to create a complete cloud production workflow.

Interoperability is key to NDI's success, providing a "library" that broadcasters and vendors alike can implement and work with, ensuring complete compatibility across any technology that uses it, including audio and video in the cloud and on-premises. Thanks to NDI Bridge, NDI sources can reliably be transported over the internet to and from your on-premises tools, and thanks to the NDI Software Development Kit (SDK), technology companies have had the freedom to create a wide choice of tools available on-premises to achieve full interoperability between an NDI environment and other audio over IP technologies.

On-Demand Demo:
How To:
Achieving perfect audio and intercom
in cloud live productions

WATCH NOW!

Want to learn more about achieving perfect audio and intercom in your cloud live productions?
▶ **Check out this on-demand discussion, demo, and Q&A session for a deep dive.**

6 steps to getting started with cloud live productions

CHAPTER

5

Cloud sizing:
calculating IT resources and cost

Cloud sizing: calculating IT resources and cost

Before embarking on cloud live productions, it's a good idea to calculate your expected cloud costs. Thanks to the "only use what you need" nature of the cloud, this is relatively easy to do once you know what kind of cloud setup you need and how long you'll need it for.

The cloud makes it easy to "rent" virtualized IT services such as computing power, storage, and databases. Several types are available, depending on requirements; for example, computing power is available with GPUs and/or CPUs, depending on the type of processing power needed for each production tool installed in the cloud. And remember, you are not only "renting" the hardware, but it's full operation, cooling, power, monitoring, fixing, always keeping at latest level – and you can select the right sizing for every single production.

Computing power can be rented as Elastic Compute Cloud (EC2 instances from AWS), with different instance types available depending on needs, while storage can be rented as Elastic Block Storage (EBS) instances.

AWS "Accelerated Computing" G4dn or G5 instances are the
recommend instance types for most applications as these carry NVIDIA Tesla T4 GPUs and are designed for graphics-intensive workloads.

A FULLY FLEDGED EXAMPLE SETUP AND COSTS IN AWS

The following tables shows the AWS services required and estimated costs to host the full Vizrt Live Production Solution, including vision mixing, graphics, intercom, audio mixing, replay/slow-motion, and associated NDI services.

For this example, we'll assume this is a 2-hour live sporting event, with 6 cameras feeding NDI|HX streams in 1920*1080 resolution.

You can estimate your own costs using the *AWS Cost Calculator here.*

Learn more at **vizrt.com**

$82.15

Total AWS costs for an average 2-hour live sports game production

Based on the example calculated below

$6.42

Total AWS costs per hour for end-to-end live productions in the cloud

HOURLY AWS COSTS

Live production tool	AWS instance needed	Example hourly rate (based on AWS Frankfurt region pricing)
Viz Vectar Plus	1 x g4dn.4xlarge instance	$1.08
	300-500 GB EBS storage for media file content for playback/recording during a show	$0.12
Viz Engine	1 x g4dn.2xlarge instance	$0.67
	300-500 GB EBS storage*	$0.12
Viz Trio	1 x g4dn.2xlarge instance	$0.67
3Play by Viz Now	1 x g4dn.4xlarge instance	$1.08
	300-500 GB EBS storage for media file content for playback/recording during a show*	$0.12
Telos Infinity VIP	1 x c4.2xlarge instance	$0.45
Harrison Mixbus VBM	1 x g4dn.2xlarge instance	$0.67
NDI® Remote	1 x g4dn.2xlarge instance	$0.67
NDI® Bridge	1 x g4dn.2xlarge instance	$0.67
NDI® Discovery Server	1 x t2.medium instance	$0.05
Viz Licensing Server	1 x t2.medium instance	$0.05
	Total cost per hour	**$6.42**

AWS has certified the Vizrt Live Production Solution runs as needed on these specifications as part of the AWS Foundational Technical Review (FTR). The EC2 instance types are constantly being updated, it is therefore recommended to consult the Vizrt Customer Success team for information about the latest recommended EC2 instance types.

The total cost for this setup is approximately $6.42 per hour. Consider that each production will likely be setup for several hours before the event, plus the actual production time that it will run for. On the basis that the system is setup and run for an 8-hour day, the AWS costs will be $51.36 for this example production.

Comparing traditional production costs vs. cloud is an almost impossible task but compare that $51.36 cost with just the travel costs for one operator for a traditional live production and you immediately see the potential for the cloud to enable incredibly low cost, yet high quality live productions.

LONGER TERM STORAGE COSTS

Storage will likely be needed for longer than the production itself runs for, to allow time to ingest into your media asset management system, archive etc. Using the example above and storing the data for 1 week, the storage cost for 1 TB (2 x 300-500 GB EBS) would be a **total of $16.80 for the week.**

Storage type	Hourly cost	Hours needed
500 GB EBS	$0.12	168 (1 week)
500 GB EBS	$0.12	168 (1 week)
Total cost		**$16.80**

DATA TRANSFER (EGRESS) COSTS

In addition to the computing and storage costs, there will be some data transfer (egress) costs to consider. This is entirely dependent on how much data you're transferring, which will be closely tied to the number of camera feeds you have coming into the cloud, and how long you'll be receiving them for. With one NDI|HX stream in 1920*1080 resolution creating roughly 7 GBs of data to transfer per hour, 6 cameras recording in the cloud would create roughly 87 GBs of data transfer and **cost approximately $14 in egress.**

TOTAL COSTS PER PRODUCTION

This example of a cloud live sports production would cost a total of

$82.16

This example is meant as a guide only. Your specific requirements will depend on your overall setup and production needs. Vizrt Professional Services are available to help with this, and Viz Now is available to automate the process for you.

Want to deploy these tools in the cloud without the significant IT headaches, cost, and complexity?

Break down your barriers to cloud with Viz Now, a free-to-use deployment tool that automatically deploys all the Vizrt and 3rd party tools in the extended Vizrt Live Production Solution into your AWS cloud, in 15 minutes.

DISCOVER VIZ NOW

Learn more at **vizrt.com**

6 steps to getting started with cloud live productions

CHAPTER

6

Cloud security, networking, connectivity, bandwidth, contribution, compression, and encoding/conversion

Cloud security

Like traditional on-premises IT deployments, there are many aspects to cloud security. Aside from the obvious – strong passwords, limiting access to those who need it, etc. – the best approach to cloud security is to lock down everything, and only open what is needed. Vizrt recommends putting each production into its own Virtual Private Cloud (VPC), and only open the ports needed for access and the connections needed (i.e., whitelisting your remote operator's specific IP addresses for remote access). Additionally, use a firewall where technically possible.

According to a *Gartner report*, 99% of cloud security failures will be the customer's fault by 2025, made up largely of misconfigurations and human error. Scripting and automating the deployment process and baking in cloud security best practices is the best way to ensure security is always considered and to avoid human error in deployment. This could be achieved by IT teams with the right knowledge, experience, and time – but can also be far more easily achieved by using Viz Now, which automates the deployment of your cloud live production tools and the best security protocols, while also providing easy and secure remote access for those who are allowed, without any IT headaches. Viz Now deploys your live production tools for you in minutes, guaranteeing cloud security best practices are used every time, and saves countless days or weeks of manual deployment time.

99%

of cloud security failures will be the customer's fault by 2025

Take the guesswork out of your cloud deployments with Viz Now

Why spend months scripting the deployment process when Viz Now can already do it for you? Viz Now provides automated and secure deployment of all your Vizrt and 3rd party live production tools in the cloud in minutes
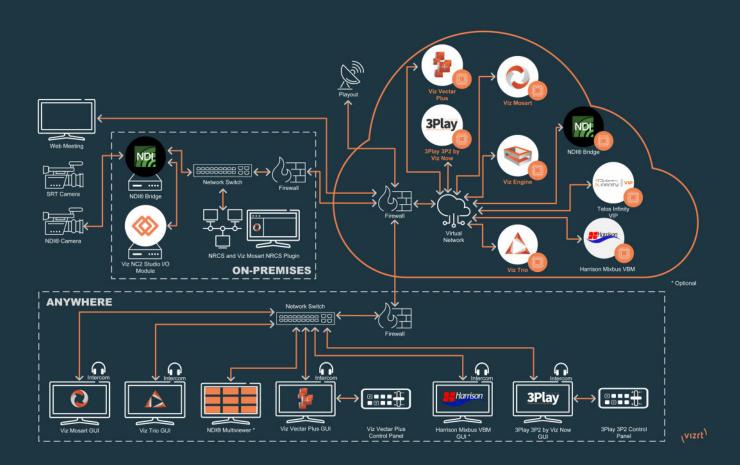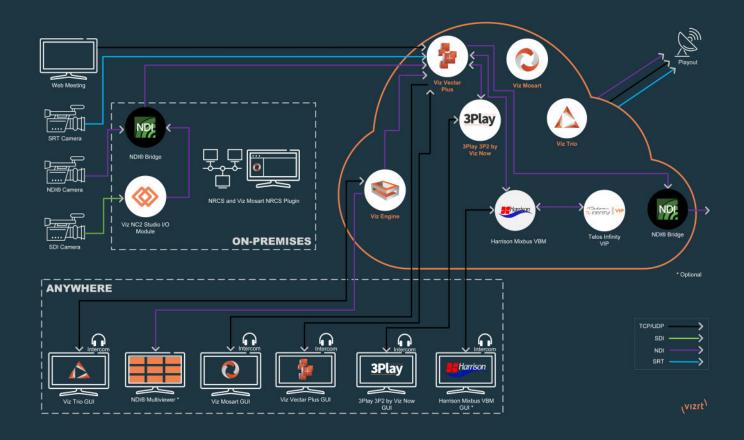
DISCOVER VIZ NOW

Networking, connectivity, and bandwidth considerations

NETWORK AND SIGNAL SETUPS

A typical end-to-end cloud live production setup, including vision mixing, studio automation, graphics, replay/slow-motion, intercom, and audio mixing, could look like this:

And from a signal perspective, the setup might look like this:

Calculating bandwidth requirements

Bandwidth requirements will depend on your on-premises setup and other considerations, such as what flavor of NDI you're using. As an example, in a setup with 6 cameras transmitted and 4 outputs plus 4 PCoIP return the expected bandwidth requirement is 100 Mbps each way.

NDI runs most efficiently in a dedicated network with high bandwidth and high availability. This contrasts with unmanaged environments such as the public Internet or networks where video rides along with data without priority.

Gigabit (1000 Mbps) networks are essential in production workflows. A typical NDI stream consisting of 1080 60P video yields a data rate up to 130 Mbps per stream. This extremely efficient stream is designed to have exceptionally low latency and allows multiple streams to be stacked together on a single Gigabit network. Even so, it may be that a production environment will require more capacity based on simultaneous number of NDI streams needed.

The following tables are intended as a guide for calculating bandwidth needs based on video resolutions and frame rates. It should be noted however that NDI is not deterministic. The bandwidth needed for NDI should be based on the determination of the average utilization required.

Resolution	Maximum Bandwidth Mbit/Sec	Maximum Bandwidth w/ Alpha Mbit/Sec	Proxy (no Alpha support)
1920 x 1080	105-132	128-165	640 x 360 - 30Mbit/s
3840 x 2160	158-249	197-312	3840 x 2160

Resolution	NDI|HX Maximum Bandwidth Mbit/Sec	NDI|HX H.264 & HEVC Maximum Bandwidth Mbit/Sec
1920 x 1080	9.6-15.9	6.7-10.9
3840 x 2160	19.1-30	13.2-21

For a full breakdown of bandwidth requirements per NDI stream type and for more information on getting the most out of NDI and your network, look at *NewTek's Networking Best Practice White Paper on ndi.tv.*

VENUE CONNECTIVITY

Ideally, you'll be using a dedicated internet connection at the site/venue, and it needs to be fast enough to handle as many NDI streams as you intend to use. You can calculate your internet speed requirements using the "Calculating bandwidth requirements" section above.

In addition to using traditional fiber optic connectivity, the 5G mobile network now offers an alternative connectivity option, enabling cloud remote productions without the need for dedicated fiber optic cables and the associated setup. Sky Germany proved this during their cloud live production of the *Bundesliga Handball Final* where they used mobile phone cameras (with the LiveU LU-Smart streaming app) and 5G-enabled *LiveU LU800 field units* to deliver the feeds over O2's 5G network directly to the cloud in real-time.
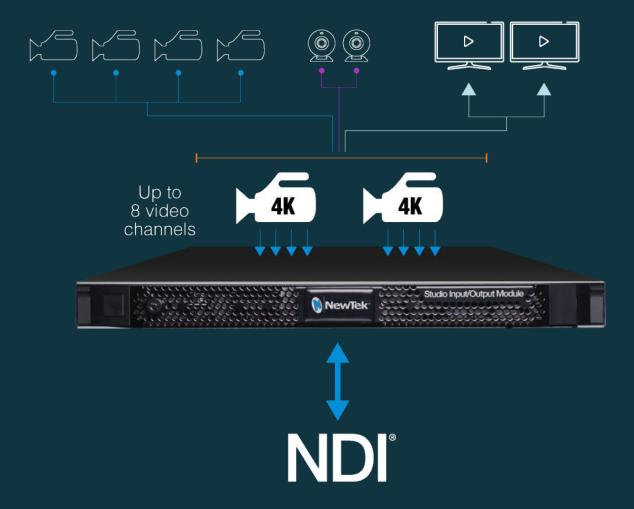
SRT CONTRIBUTION MECHANISM

Viz Vectar Plus natively works with SRT streams, so no other encoding is needed if you're only using Viz Vectar Plus in your live productions. However, some live production tools such as 3Play 3P2 in the cloud don't work natively with SRT streams; if your live production uses these other tools, then we recommend using the NewTek NC2 I/O module to convert SRT streams to NDI or using conversion services such as NewTek's Connect Pro running in the cloud.

SIGNAL CONTRIBUTION

Using remote signal contribution services, as such LiveU Cloud Connect, you can seamlessly interconnect high-quality, low latency live video feeds from the field with your Vizrt Live Production tools. Thanks to seamless integration between LiveU and Vizrt Live Production tools, you simply plug your on-site cameras into any LiveU field unit or 5G backpack and send your live feeds directly to the cloud, allowing you to bring high-quality, low latency live feeds from anywhere.

Learn more at **vizrt.com**

Up to 8 video channels

ENCODING/DECODING AND CONVERSION

Unless you're running a setup that is entirely NDI-native, you'll likely need some form of encoding/conversion capabilities on-premises where the action is happening to convert other signals into NDI.

Whether it's to integrate non-NDI tally light systems, converting SDI feeds into NDI, connecting your audio systems, or anything else, the *NewTek NC2 Studio I/O module* helps you connect technologies, translate video, and expand any workflow in one box.

NETWORK SWITCHING AND CONNECTIVITY

NDI-enabled switches are available to connect all your on-premises devices, designed to optimize your NDI network by simply selecting the NDI functionality in the switcher settings, such as the *popular Netgear M4250 switch.*

We recommend a switch capable of 10 GB throughput, depending on your requirements. The bandwidth needed for your on-premises network depends on how many devices and streams of NDI you have; see the section above for suggestions on calculating bandwidth.

As an example, if using NDI Bridge in NDI HX mode with 8 NDI streams into the cloud and 1 coming back, then a network switch capable of 1 Gbps throughput would work. If using NDI Bridge with NDI Full Bandwidth, then a 10 Gbps switch would be needed.
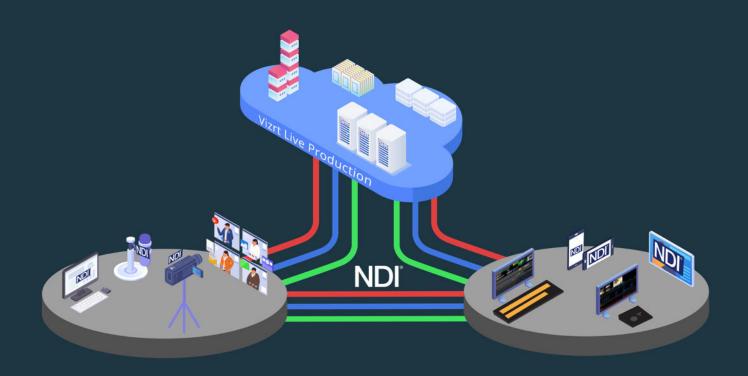
BACKUP ROUTER

If you want to enable remote network control and plan to have no technical staff on-site, then Vizrt recommends having a cellular router (LTE, 5G or bonding) in place. This allows for a remote route back into the network if accidental changes are made to the main router/switch settings that end up blocking direct access. If you have technical staff on-site, this probably isn't necessary.

MULTI-SITE SETUPS AND CONNECTING CLOUD TO YOUR ON-PREMISES HARDWARE AND SOFTWARE

Securely connecting multiple sites for your live productions is easy, thanks to NDI Bridge.

NDI Bridge allows you to securely connect two entirely different NDI networks – anywhere in the world with full management of all audio and video streams automatically, no matter how many sources. Using just one publicly available IP address as Host, any number of networks can connect and share sources, allowing teams of any size to connect from anywhere on the planet.

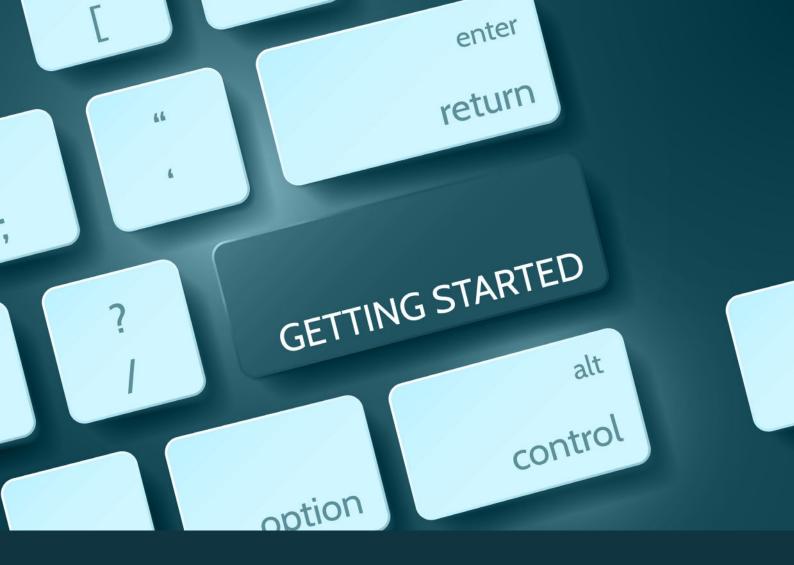## ACCESSING CLOUD-HOSTED PRODUCTION TOOLS FROM OPERATOR WORKSTATIONS

For remote access, various RDP tools are available (such as Teradici), but Vizrt recommends the use of *AWS Nice DCV* for the lowest latency.

Viz Now not only enables the automated and secure deployment of live production tools in the cloud, it also provides an easy access portal for users to access their live production tools from anywhere, thanks to its integration with AWS Nice DCV.

COMPRESSION

In a video production workflow at some point signals will be compressed, either for transmission, recording, archive, editing, or for transforming raw content into a product. The benefit of using NDI to power your cloud live productions is that it provides a very efficient compression of the sources and avoids any further recompression until delivery.

One of the most efficient codecs in existence, NDI achieves significantly better compression than many codecs that have been accepted for professional broadcast use. In fact, a unique property of NDI is that once data enters the compressed video space, any further compression does not incur any significant generational loss.

GETTING STARTED

All that's left to do is… start producing in the cloud!

This guide to cloud live productions should arm you with what you need to successfully get started with producing from anywhere, in the cloud – but Vizrt is here with you every step of the way with the tools, knowledge, and expertise you need to reap the rewards that going cloud provides and produce the best content you possibly can.

WANT THE QUICKEST AND EASIEST WAY TO GET STARTED?

Then *request a demo of Viz Now* to see how it can do the hard work for you, by automatically deploying the Vizrt and 3rd party tools you need for end-to-end live productions straight into the AWS cloud, in minutes, with no technical skills needed!

VIZrt

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