The IT Professional's Guide to 8K Connectivity

From full HD 1080p to 4K to 8K, the world of display resolutions has seen some impressive advancements over the last 10 years. While people often discuss the resolution capabilities of display technologies, the focus is rarely on understanding how to enable these new resolutions. As you probably already know, it takes a lot more than simply plugging an old cable into a new display.

While the introduction of 8K technology might not be the latest news, the 'implementation of 8K connectivity' certainly is. With the help of this guide, IT professionals will learn the ins and outs of enabling and navigating the uncharted waters of 8K technology. We'll cover:

- The Leap from 4K, What is 8K resolution, 4k vs 8k
- The Industries and Applications Adopting 8K
- DisplayPort 1.4 and HDMI 2.1: The Keys to Enabling 8K
- The 8K Ecosystem: Implementing an 8K Connectivity Solution
- Forecasting the Future of 8K
- Single vs Dual 8K Display: The Possibilities and Limitations
- Your 8K Checklist

So, without further ado, let's jump in to discover how you can prepare to enable 8K technology across your workplace.
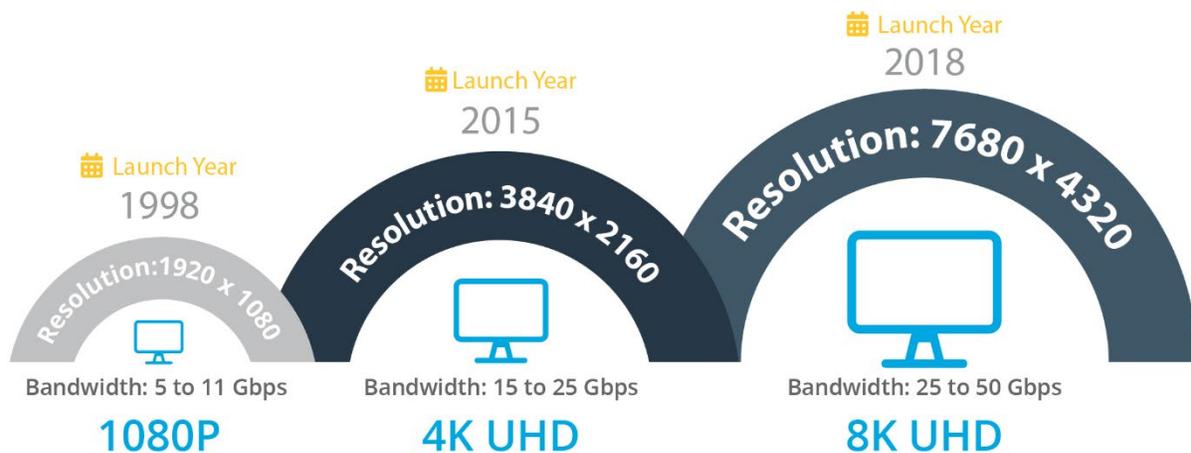
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The Leap from 4K

The Leap From 4K

At first glance, 8K might seem like twice the resolution of 4K, but actually, it's 4 times the pixels of its predecessor (4k).

Launch Year
1998

Launch Year
2015

Launch Year
2018

Resolution:1920 x 1080

Resolution: 3840 x 2160

Resolution: 7680 x 4320

Bandwidth: 5 to 11 Gbps

Bandwidth: 15 to 25 Gbps

Bandwidth: 25 to 50 Gbps

1080P

4K UHD

8K UHD

To answer the question – when will 8K be standard?

Truth is, such a big leap in the resolution requires extensive development and all major players in the electronics industry are working towards developing the necessary chipsets and the supporting software to enable this technology. Considering the progress that has already been made, full implementation of 8k hardware doesn't seem to be a distant dream anymore.

The Industries and Applications
Adopting 8K

Industries & Applications

Before we get into the technicalities of 8K, let's quickly review some of the industries and applications that might be first to adopt 8K technology.

1)   M e d i c i n e
MRI's, CT scans, and ultrasounds can all benefit from higher resolutions, giving doctors an edge in early diagnosis.

2)   C o n t e n t   C r e a t i o n
Video editing and content development industries are also expected to upgrade to 8K. Editing software manufacturers will all be preparing for this transition as 8K content developers are expected to edit video that is shot with 8K resolution.

So, is 8K worth it? Absolutely.

Besides these applications, enhanced worker productivity is a key benefit across multiple industries. With 8K resolution, users can consolidate multiple monitors into a large single monitor that allows for enhanced visualization and thus increased productivity.

DisplayPort 1.4 and HDMI 2.1: The Keys to Enabling 8K

As an extension to VGA and DVI protocols, HDMI and DisplayPort are the latest serial interfaces capable of transmitting audio and video. According to the recent trends, the market has gravitated towards HDMI and DisplayPort interfaces as a predominant choice, with the older technology protocols being gradually phased out with every subsequent hardware update.

Now, with the latest introduction of DisplayPort 1.4 and HDMI 2.1 standards, video transmission has taken another leap towards making advanced resolutions like 8K a reality. The figure below provides a quick snapshot of the most critical updates to both standards that have helped enable higher resolutions. The implementation of DisplayPort 2.0 is not too far either. DisplayPort 2.0 can further boost the bandwidth capabilities that would allow for even higher resolutions up to 16K.

21.6 Gbps	32.4 Gbps	80 Gbps	VS.	10.2 Gbps	18.1 Gbps	48 Gbps
0 Gbps 100	0 Gbps 100	0 Gbps 100		0 Gbps 100	0 Gbps 100	0 Gbps 100
DisplayPort 1.2	DisplayPort 1.4	DisplayPort 2.0		HDMI 1.4	HDMI 2.0	HDMI 2.1

Of course, there are a number of significant improvements within both standards, including progress in dynamic HDR and comparatively higher refresh rates, but the most notable advancement for enabling 8K is the breakthrough in achieving an extremely high bandwidth.

DisplayPort 1.4 enables a 50% increase in bandwidth compared to its predecessor (4K UHD). It raises data capacity from 5.4 Gbps to 8.1 Gbps per lane, increasing the total to 32.4 Gbps over four transmission lanes.

HDMI 2.1 more than doubles the bandwidth of the previous generation, providing an increase from 18.1 Gbps to 48 Gbps data rate.

These upgrades to DisplayPort and HDMI are critical to enabling the new world of 8K pixel clarity. A single full color 8K display at 30Hz requires 24.48 Gbps of data, while a single full color 8K display at 60HZ requires 49.65 Gbps of data.

24.48 Gbps for a single, full color 8k display

49.65 Gbps for a single, full color 8k display

It might also be useful for IT professionals to understand the use case behind DisplayPort 1.4 and HDMI 2.1 and how implementing either of these technologies can be beneficial according to the end goal.

1. If the end goal is to connect multiple 8K computer monitors, then DisplayPort is best as it allows users to daisy chain up to four monitors whereas HDMI can drive a maximum of two at the same time.

2. But if high definition audio is also a priority then HDMI standard offers a better solution as it uses audio return channels (ARC) to deliver high resolution audio, and therefore is a preferred choice for audio/video (A/V) applications.

The 8K Ecosystem: Implementing an 8K Connectivity Solution

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To understand how to best implement an 8K solution, at least from a hardware configuration standpoint, it is essential to:

1. Consider the current technological landscape
2. Account for future hardware development that is currently underway

In an ideal world – considering DisplayPort 1.4 and HDMI 2.1 are both capable of handling the high throughputs required to enable 8K transmissions – users would be free to choose either interface. Unfortunately, that is not the case. Based on what's currently available in the market, only 8K televisions are equipped with HDMI 2.1 connectors while most 8K monitors are only available with DisplayPort 1.4. This poses a unique set of challenges for IT professionals determining the appropriate hardware to implement an 8K solution.

The Current Landscape

To complicate the matter further, not only are there differences in available ports on 8K TVs and 8K resolution monitors, but also with host desktops and laptops. For this reason, and for the sake of simplicity, let's evaluate various configurations for desktops and laptops separately.

Desktop connections

Theoretically, there are three options when connecting a desktop computer to an 8K display:

1. The easiest and most convenient option is to connect your desktop to an 8K TV via a single HDMI 2.1 rated cable.

2. The next best option would be to use a single [DisplayPort 1.4 cable](#) to connect your desktop to an 8K@30Hz monitor.
3. Lastly, in order to connect your desktop to an 8K@60Hz monitor, you'll need two separate DisplayPort 1.4 cables to drive the necessary bandwidth. In this case, both DisplayPort 1.4 cables needs to be plugged into the same monitor to allow for the increased bandwidth transmission required to enable 8K ultra HD with a 60Hz refresh rate.

For these setups to be functional, there are a few key variables that need to be accounted for:

1. The desktop processor and graphics card (internal or external) should be capable of outputting a high enough bandwidth signal to support 8K.

2. Both HDMI 2.1 and DisplayPort 1.4 cables should be certified to their respective standards. Any older standard certified cable will not be able to handle the required signal throughput.

Present Hardware Availability for Desktops

HDMI 2.1 Cable — 8K TV

DisplayPort 1.4 Cable — 8k@ 30HZ Monitor

2x DisplayPort 1.4 Cable — 8k@ 60HZ Monitor
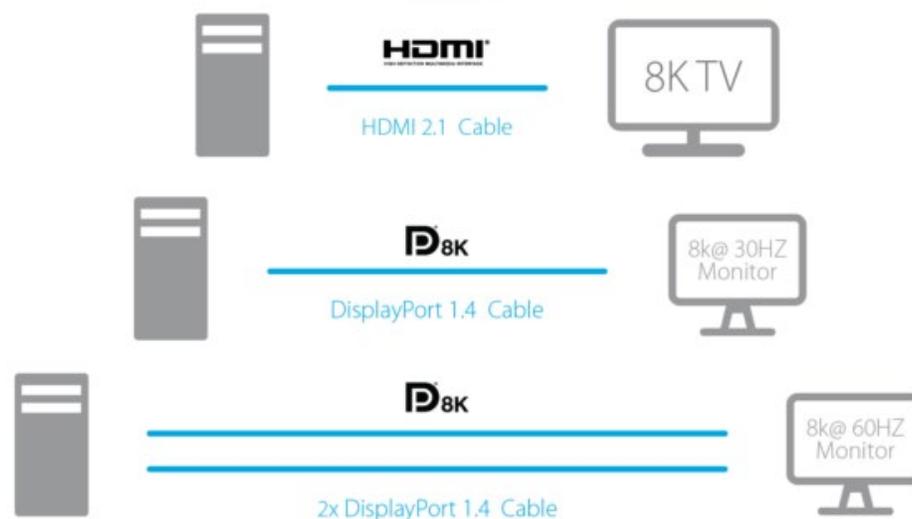
* Host systems internal/external graphics card should support DisplayPort 1.4

Laptop connections

Laptops, due to space constraints, are generally considered to be slightly less dynamic in offering extreme functionality. Consequently, current laptops are not able to offer the dual DisplayPort 1.4 connections required to drive a single 8K@60Hz display (in native uncompressed signal form).

Nevertheless, with the current versions of available Thunderbolt™ 3 laptops, driving a single 8K@30Hz display is realistically achievable. A simple setup to connect a Thunderbolt 3 laptop to an 8K@30Hz monitor can be seen in the diagram below. With this configuration, the DisplayPort 1.4 signal would pass through a

Thunderbolt 3 cable into an 8K docking station, which would be connected to an 8K@30Hz monitor via a certified DisplayPort 1.4 cable. As an alternate configuration, an external DisplayPort 1.4 capable graphics card can also be utilized to achieve the same setup.

Present Hardware Availability for Laptops

Thunderbolt 3 Laptop — Thunderbolt 3 Cable — 8K Dock — DisplayPort 1.4 Dock — DisplayPort 1.4 Cable — 8k@ 30HZ Monitor

* Thunderbolt 3 laptop should be able to support DisplayPort 1.4.

Forecasting the Future of 8K

Forecasting the Future

Now that we understand the bandwidth and connectivity requirements to enable 8K, let's take an early peek into the future and examine how improvements in connectivity hardware solutions can impact the 8K ecosystem.

Laptop connections

The entire premise of the future 8K ecosystem is dependent on the following factors:

1. Wide availability of DisplayPort 1.4 compatible 8K docking stations (recently released)
2. Availability of 8K docking stations that offer HDMI 2.1 ports
3. Introduction of HDMI 2.1 on 8K monitors
4. Future generations of laptops introducing hardware to convert the DisplayPort 1.4 signal into the HDMI 2.1 format

If these conditions are satisfied with next generation revisions, then a few possible configurations for an 8K setup can be envisioned.

1. **The DisplayPort 1.4 Docking Solution**
   If the docking station is DisplayPort 1.4 compatible but not HDMI 2.1 compatible, then it can be connected with a single DisplayPort 1.4 cable (to DisplayPort monitors only).

2. **The HDMI 2.1 Docking Solution**
   The next generation of 8K connectivity hardware is expected to be introduced with an HDMI 2.1 output port. Despite this, the native display output signal from a Thunderbolt 3 laptop is still likely to be in DisplayPort 1.4 form. Therefore, the signal will need to be converted over to HDMI form to be compatible with an HDMI 2.1 capable monitor. In this scenario, users will need an 8K docking station that supports the HDMI 2.1 protocol in order to pass the signal from their Thunderbolt 3 laptop to an 8K monitor that has an HDMI 2.1 port.

3. **The USB-C Adapters Solution**
   As a third option, there will be a possibility to plug the 8K laptop into an 8K monitor directly via a USB-C to HDMI 2.1 or USB-C to DisplayPort 1.4 adapter. In this scenario, the adapter can convert the signal format to the desired output form. One thing to note in this setup, however, is that by foregoing the docking station in between, the user is losing all of the additional productivity and port consolidation options a dock can offer.

4. **The Built-in Conversion Solution**
   If future laptops have built-in hardware to convert video signal from DisplayPort to HDMI, then it would allow for a direct connection via a high-quality HDMI 2.1 cable.
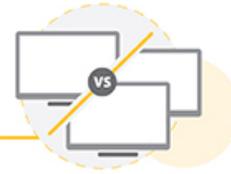
Future Hardware Availability
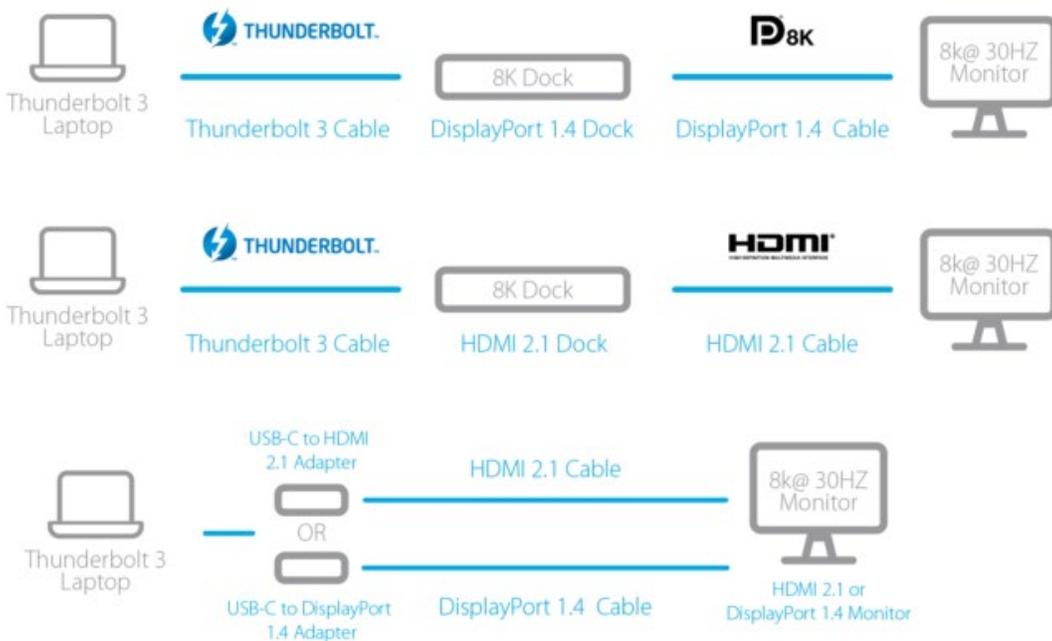
* Thunderbolt 3 laptop should be able to support DisplayPort 1.4.

Single 8K Display vs Dual 8K Display:
The Possibilities and Limitations

Single 8K Display vs Dual 8K Display: The Possibilities and Limitations

So far, we have explored various configurations to connect to a single 8K display. But what about dual 8K displays? Is it even possible given the current technology landscape?

The answer here is a bit more complicated. Let's do a quick back of the napkin analysis of the bandwidth needed to drive a dual 8K@30Hz display. 8K@30Hz with RGB 8-bit full color requires a bandwidth of 24.48 Gbps.

To drive dual displays, a 48.96 Gbps data rate (2 x 24.48 Gbps) would be required when considering transmission in an uncompressed native signal format.

24.48Gbps
0   Gbps   50
Required Bandwidth

8K@30Hz with RGB 8-bit full color

8K 30HZ

48.96 Gbps
(2 x 24.48)
0   Gbps   50
Required Bandwidth

8K@30Hz with RGB 8-bit full color

8K 30HZ   8K 30HZ

Considering Thunderbolt 3 laptops, in a best-case scenario (i.e. not accounting for any technology adjusted overhead), can output a bandwidth of 40 Gbps, even at maximum bandwidth, their downstream transmission bandwidth falls short of the required 48.96 Gbps needed to drive dual 8K@30Hz displays. Similarly, a single 8K@60Hz is even more difficult to implement as required bandwidth at RGB full 8-bit color is 49.65 Gbps.

With a Thunderbolt 3 Laptop (max output 40 Gbps)

So, with the bandwidth limitations of current laptops, is single 8K@60Hz or dual 8K@30Hz even possible?

Yes – it is possible.

Introducing Display Stream Compression (DSC). DSC protocol is a type of lossless compression that allows for the same cables to transmit considerably higher rates of data. However, this protocol is not widely adopted in the industry yet.

While it's difficult to predict a definite timeline, we can certainly hope for DSC to become mainstream technology soon, thereby making it a standard offering amongst all 8K compatible hardware.

Your 8K Checklist

Just in case you are considering updating your hardware connectivity equipment, we've compiled a few key points to keep in mind to future proof your solutions.

1. **Start with the basic accessory: Cables.**
   It would be prudent to ensure that all new DisplayPort and HDMI cables are rated to DisplayPort 1.4 and HDMI 2.1 standards.

2. **Pay attention to the graphics cards.**
   It would be best to pay extra attention while upgrading your host systems as well. Ensure that all your systems graphics cards are DisplayPort 1.4 compatible. The older DisplayPort 1.2 compatible graphics cards max out at supporting 4k graphics.

3. **Prepare your annual budgets for the upgrade.**
   There might be a slight incremental cost now with DisplayPort 1.4 and HDMI 2.1 rated products, but it would be much more cost effective to future proof your solutions in the long run. As an added benefit, both these standards are reverse compatible with previous generations, so essentially you have nothing to lose.

Prepare Yourself for 8K with the Right Tools

It's no secret that any new technology poses its own unique set of challenges and 8K is no different. Signal integrity complications associated with high resolution video transmissions are the reason it's critical to choose a connectivity provider that can develop fully functional and compatible products. Ensure your products are certified, backed by reliable warranties, and that you work with a manufacturer who can provide the support you need when troubles or questions arise.

We hope you now feel a little more prepared and informed about the upcoming 8K revolution. Making connectivity easy for our customers is in our DNA and this time around with 8K will be no different.

StarTech.com is a leading technology and connectivity provider who is prepared to support you through your transition to the next generation of display technologies. For a full list of our 8K connectivity products visit our 8K Connectivity Accessories page and stay tuned for our upcoming 8K connectivity products including docking stations, display adapters, and cables.

View our 8K Accessories