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USB versions differences and development history

Since the introduction of USB interface in 1994, after 26 years of development, through USB1.0/1.1, USB2.0 & USB3.x finally developed into the USB4

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USB AV: Resolution vs. Uncompressed Bandwidth

Format	Horiz	Vert	Mega Pixels	FPS	BPP	BW (Gbps)	USB AV 3.0 (4gbps)	USB AV 3.1 (9.8gbps)	DP x2 (8.64gbps)	DPx4 (17.3Gbps)	HDMI 1.4 (10.2gbps)
HD 1080P	1920	1080	2.07	24	24	1.2	Y	Y	Y	Y	Y
HD 1080P	1920	1080	2.07	60	24	3.0	Y	Y	Y	Y	Y
HD 1080P	1920	1080	2.07	60	36	4.5	N	Y	Y	Y	Y
QFHD 16:9	3840	2160	8.29	24	24	4.8	N	Y	Y	Y	Y
QFHD 16:9	3840	2160	8.29	30	24	6.0	N	Y	Y	Y	Y
4K HDMI 1.4	4096	2160	8.85	24	24	5.1	N	Y	Y	Y	Y
4K HDMI 1.4	4096	2160	8.85	30	24	6.4	N	Y	Y	Y	Y
4k Cinema	4096	2304	9.44	30	24	6.8	N	Y	Y	Y	Y†
4k Cinema	4096	2304	9.44	60	24	13.6	N	N	N	Y	N
4k Cinema	4096	2304	9.44	60	36	20.7	N	N	N	N	N

† HDMI 1.4 limited to 30fps @ 4kx2k

USB AV + USB 3.1
same bandwidth
as HDMI* 1.4

Leo Zhi June 16, 2022 10:11 am



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Since the introduction of the USB interface in 1994, after 26 years of development, through USB1.0/1.1, USB2.0, and USB3.x, finally developed into the present USB4; The transmission rate has also increased from 1.5Mbps to 40Gbps.

USB版本				标志	传输速度 (bit)	理论速度 (Byte)
目前官方版本名		官方市场代号	原名			
USB 2.0	LowSpeed	低速 Low Speed	USB 1.0		1.5Mbps	0.1875MB/s
	FullSpeed	全速 Full Speed	USB 1.1		12Mbps	1.5MB/s
	HiSpeed	高速 Hi-Speed	USB 2.0		480Mbps	60MB/s
USB 3.2	Gen 1	超高速USB5Gbps SuperSpeed USB	USB 3.1GEN1		5Gbps	500MB/s
	Gen 2	超高速USB 10Gbps SuperSpeed USB 10Gbps	USB 3.1GEN2		10Gbps	1212.12MB/s
	Gen 2x2	超高速USB 20Gbps SuperSpeed USB 20Gbps	N/A		20Gbps	2424.24MB/s
USB4					40Gbps	5GB/s
USB On-The-Go						
USB Power Delivery						
Wireless USB						

USB1.0

- USB1.0 interface specification was introduced on January 15, 1996
- The low transmission rate is 1.5Mbit/s
- The external supply voltage is 5V and the maximum current is 500mA
- Generally applicable to low-speed HID devices such as mice and keyboards.
- Supports hot-swap

USB1.1

- On September 23, 1998, the original USB1.0 was upgraded and USB1.1 was proposed
- USB1.1 sets the full transmission rate to 12Mbit/s and is compatible with 1.5Mbit/s of USB1.0
- The maximum degree of transmission cable is 3m
- The external supply voltage is 5V and the maximum current is 500mA
- Generally applicable to mouse, keyboard, USB disk, CD-ROM drive, and so on.
- One USB port can theoretically support 127 devices.

USB2.0

- On April 27, 2000, the USB2.0 bus protocol specification was proposed by the USB-IF organization
- It has a high transmission rate of 480Mbit/s and is compatible with a low speed of 1.5Mbit/s and a full speed of 12Mit/s
- The maximum degree of transmission cable is 5m
- The external supply voltage is 5V and the maximum current is 500mA
- One USB port can theoretically expand 127 USB devices through HUB cascades
- Four transmission modes are supported: control transmission, interrupt transmission, synchronous transmission, and block transmission.

USB3.0 / USB 3.2 Gen 1 / USB 3.0 Gen 1

- The ultra-high-speed USB3.0 specification was launched by the USB-IF organization on November 17, 2008.
- It provides a higher ultra-high transmission speed of 5.0Gbit/s and is compatible with a low speed of 1.5 Mbit /s, a full speed of 12Mbit/s, and a high speed of 480Mbit/s
- The external supply voltage is 5V and the maximum current is 900mA
- The maximum degree of transmission cable is 3m

- Added a new power management function, support standby, sleep, and temporary mode, more power saving.
- Full duplex communication.

USB3.1 / USB 3.2 Gen 2 / USB 3.1 Gen 2

In July 2013, USB 3.1 was released, doubling the speed to 10Gbps. USB-if renamed USB 3.0 to USB 3.1 Gen 1, and the new USB 3.1 was called USB 3.1 Gen 2.



- Released in July 2013
- Double the speed to 10Gbps
- Added USB A/V audio transmission. It is more suitable for the output interface of mobile devices, especially the reversible Type-c.
- The maximum permissible standard for power supply has been raised to 20V/5A and 100W.
- USB Type-C must be used to achieve 10Gbps speed.

Audio and Video features

The new USB AV 3.1 provides a 9.8Gbps bandwidth and supports up to 4096 x 2304@30fps 4K display. The 4K display is the same as HDMI 1.4, and the USB AV also supports HDCP image encryption technology with a larger power supply. Larger monitors can also be expected to display 4K resolution via USB AV 3.1. In addition, the existing devices and monitors can transmit audio and video via a USB AV adapter via USB cable. If USB AV can be popularized, it is bound to bring a lot of convenience to life. USB line may also replace other display interfaces and become the most practical audio and video transmission wire.

USB AV: Resolution vs. Uncompressed Bandwidth

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4k Cinema	4096	2304	9.44	30	24	6.8	N	Y	Y	Y	Y +
4k Cinema	4096	2304	9.44	60	24	13.6	N	N	N	Y	N
4k Cinema	4096	2304	9.44	60	36	20.5	N	N	N	N	N

+ HDMI 1.4 limited to 30fps @ 4kx2k

USB AV + USB 3.1
same bandwidth
as HDMI* 1.4

Power supply characteristics

Specification for Power Supply – USB Power Delivery (USB PD), is designed to be compatible with existing USB 2.0 and USB 3.0 cables and connectors, the new USB 3.1 Type-C connector is also universal. The USB PD supports higher voltages and currents to suit different applications, while also being compatible with existing USB Battery Charging specifications. USB PD is port-to-port architecture. USB and power communication signals are separated. The power supply is communicated through the host and device side VBus communication protocol. USB PD is divided into 5 Profiles depending on the device, all of which require the use of new detectable wires to provide power greater than 1.5A or 5V. Configuration 1 for mobile phones, 5V/2A (10W), the basic power output, has been more than USB 3.0 5V/0.9A (4.5W); Configuration 2 is 5V/2A or 12V/1.5A (maximum 18W), which can charge the tablet and pen; Configuration 3 is 5V/2A or 12V/3A (it can provide the power of 36W for a larger pen); Configuration 4 is the maximum 20V/3A (60W) power supply (not supported by the Micro-A/B connector), and configuration 5 is the maximum 20V/5A (100W) power supply (not supported by the Type-A /B connector), that is, only Type-C can fully support the maximum

100W power supply. Improvements in USB 3.1 power supply and support for charging applications will make it possible for USB 3.1 to dominate mobile phone, tablet, and PC transmission interfaces.

USB3.2 / USB 3.2 Gen 2x2

- USB 3.2 was released in September 2017.
- According to the latest specification, the names USB 3.0 and USB 3.1 will disappear completely. They will be renamed USB 3.2 Gen 1, USB 3.2 Gen 2, and USB 3.2 Gen 2X2, respectively.
- They are also marketed under the names SuperSpeed USB, SuperSpeed USB 10Gbps, and SuperSpeed USB 20Gbps.
- The name USB 3.2 Gen2x2 probably came from the fact that it uses both the top and bottom pins of the USB Type-C port to double its speed.

- USB Type-C must be used to achieve 20Gbps speed.

Version	Date	Bandwidth	Other Names
USB3.0	Nov.17th, 2008	5Gbps	SuperSpeed USB, USB 3.2 Gen 1, USB 3.1 Gen 1
USB3.1	July 2013	10Gbps	SuperSpeed USB 10Gbps, USB 3.2 Gen 2, USB 3.1 Gen 2
USB3.2	November 2017	20Gbps	SuperSpeed USB 20Gbps, USB 3.2 Gen 2×2

USB4.0

- The release was in the first half of 2021
- Use existing USB Type-C cable for dual-channel operation and use 40 Gbps certified cable for up to 40 Gbps operation
- Multiple data and display protocols effectively share maximum aggregation bandwidth across the bus
- Backward compatible with USB 3.2, USB 2.0, and Thunderbolt 3 (Thunderbolt protocol)
- Dynamically share a high-speed link with multiple terminal device types to optimally service data transfer by type and application.

Because USB4.0 is directly connected to the PCI-E bus of the CPU, the highest transmission rate can reach 40Gbps, while also transmitting Displayport video signal and USB PD fast charging stream, it is the next generation OF USB peripherals transmission protocol, which is essentially Intel Thunderbolt3 technology, But it also supports USB, so it is perfectly backward compatible with Thunderbolt3, USB3.2, USB3.1, and USB2.0, paving the way for USB4.0 to begin mass adoption. It is foreseeable that in the future all the external interfaces of our devices will be unified by USB 4.0.

END.

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It's Leo Zhi. He was born on August 1987. Major in Electronic Engineering & Business English, He is an Enthusiastic professional, a responsible person, and computer hardware & software literate. Proficient in NAND flash products for more than 10 years, critical thinking skills, outstanding leadership, excellent Teamwork, and interpersonal skills. Understanding customer technical queries and issues, providing initial analysis and solutions. If you have any queries, Please feel free to let me know, Thanks

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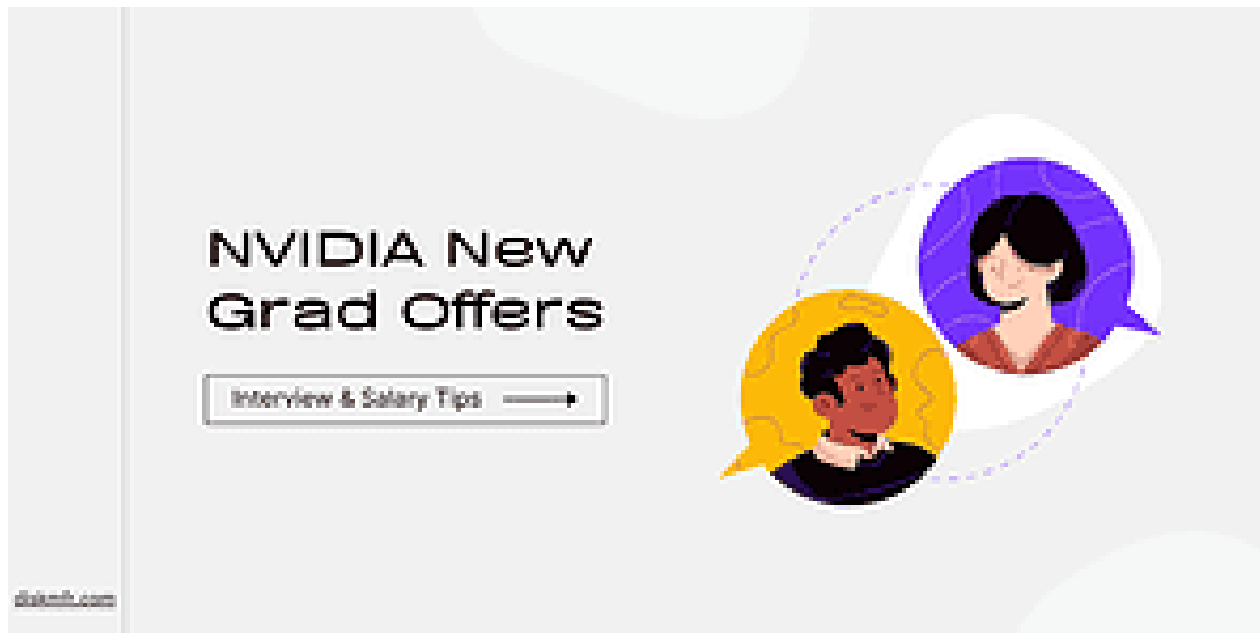
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 0086-15914030689(tel:0086-15914030689)

 info@diskmfr.com(mailto:info@diskmfr.com)

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