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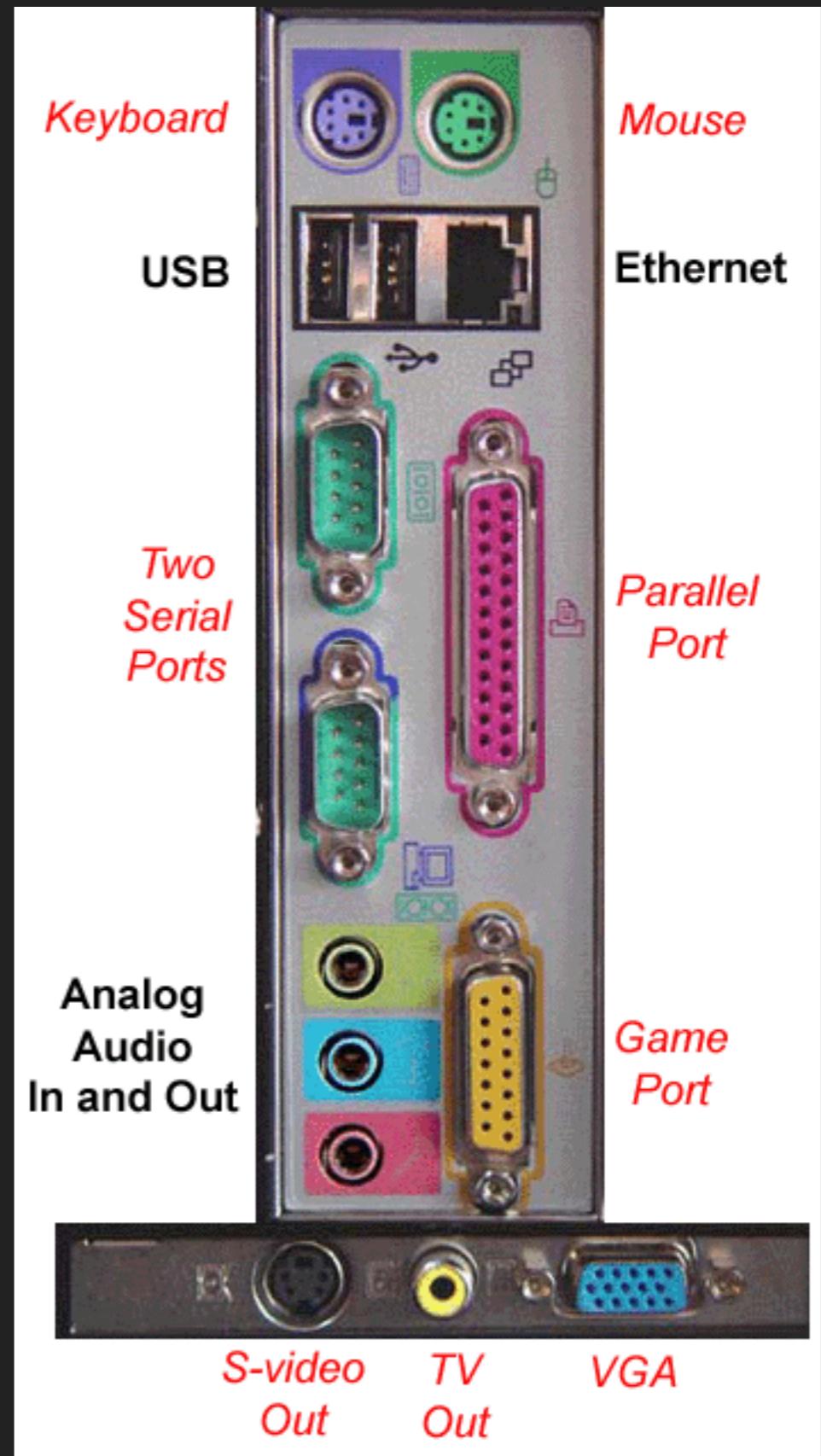
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USB-C AND THUNDERBOLT 3: WHAT FRESH HELL IS THIS?

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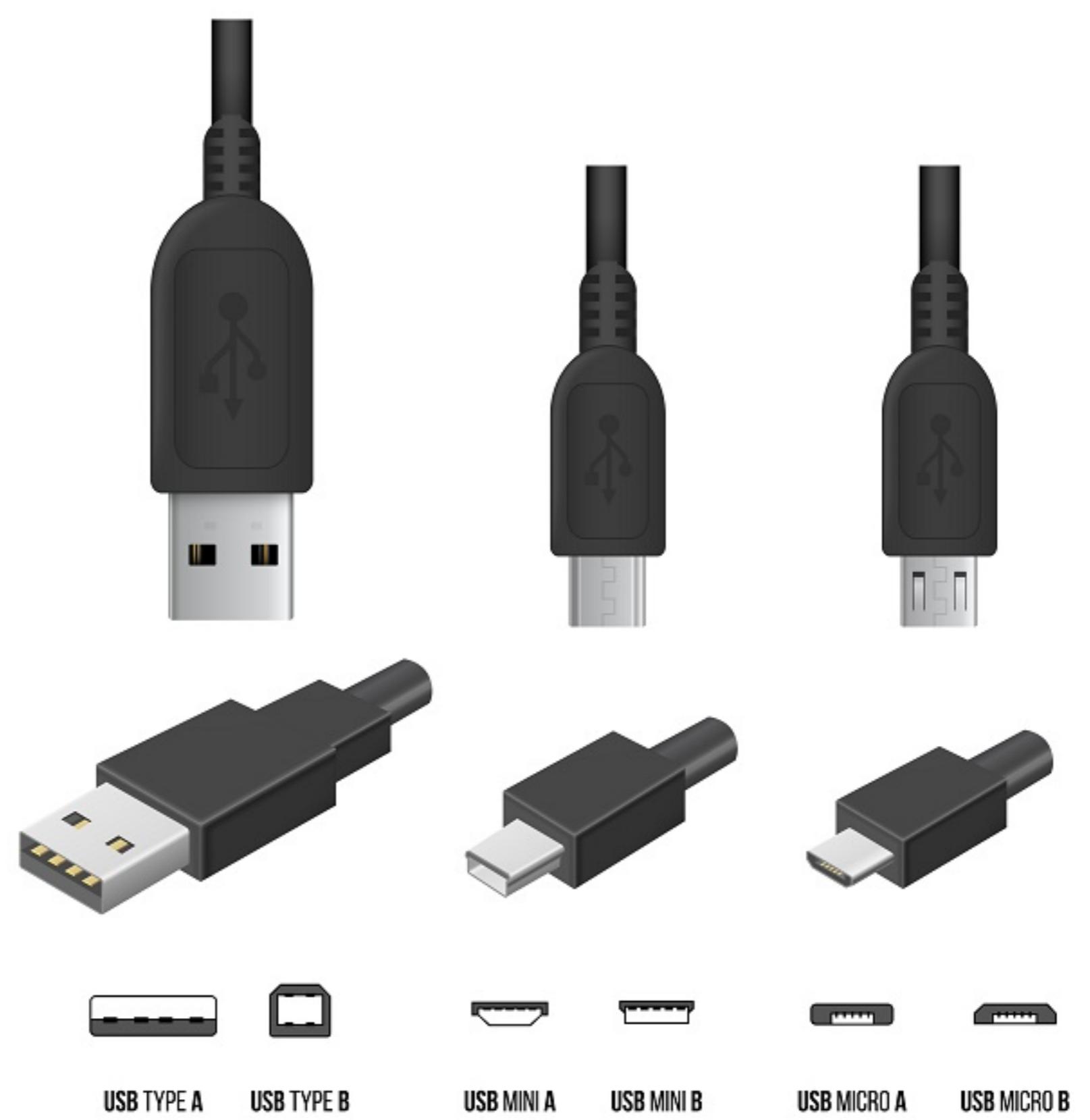
A BRIEF HISTORY OF USB

- ▶ Things used to be so colourful!
- ▶ 1996: USB 1.0
 - ▶ 1.5 Mbps / 12 Mbps
- ▶ 1998: USB 1.1
 - ▶ Popularised by 1st gen iMac
- ▶ 2000: USB 2.0
 - ▶ 480 Mbps
- ▶ 2008: USB 3.0
 - ▶ 5Gbps / 'SuperSpeed'
- ▶ 2013: USB 3.1
 - ▶ USB 3.1 gen 1 = USB 3.0
 - ▶ USB 3.1 gen 2 = 10GBps / 'SuperSpeed+'



USB-C AND THUNDERBOLT 3: WHAT FRESH HELL IS THIS?

PRE USB-C PLUGS



USB-C AND THUNDERBOLT 3: WHAT FRESH HELL IS THIS?

WHAT IS USB-C?

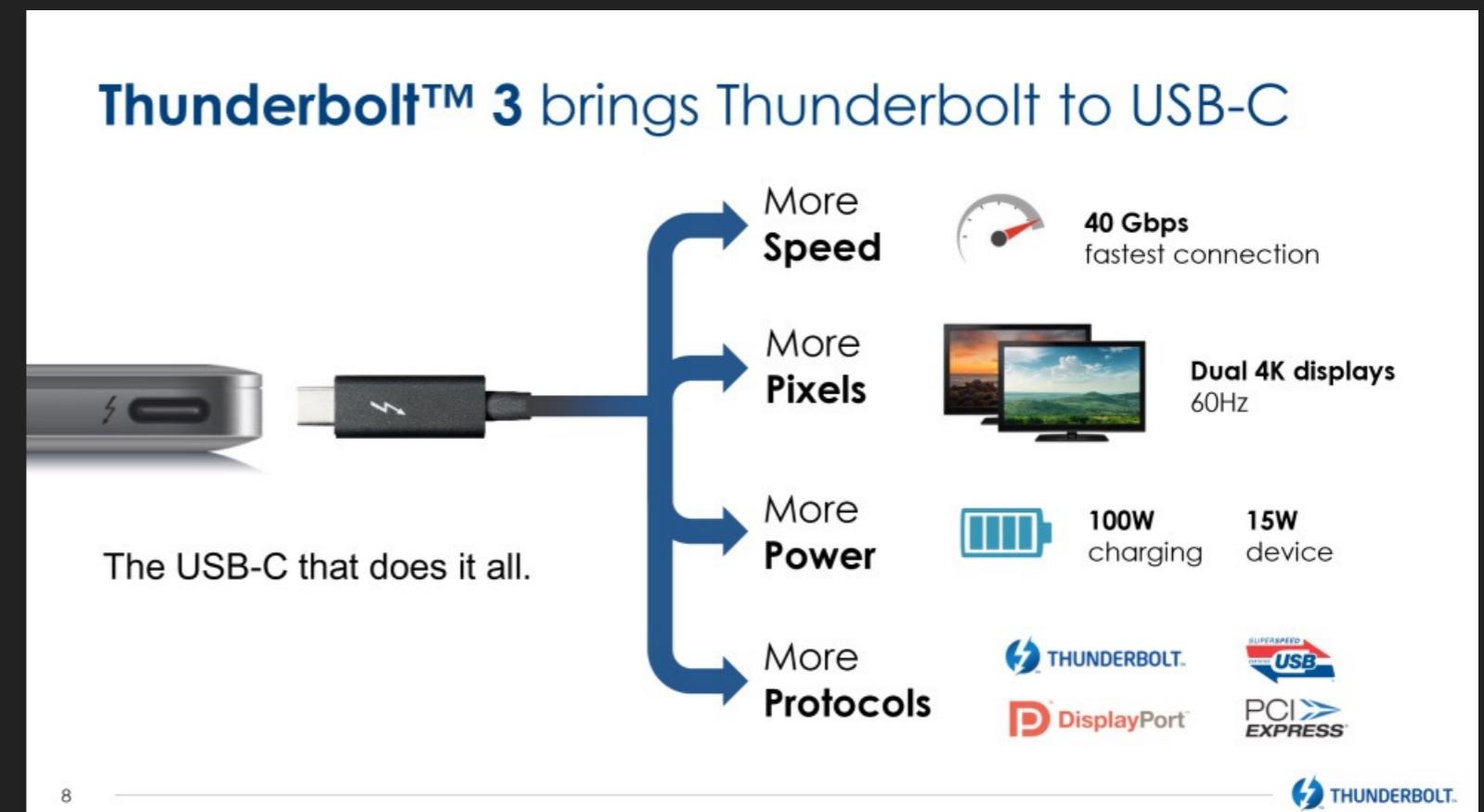
- ▶ 24-pin reversible plug
- ▶ Socket 8.4mm by 2.6mm
- ▶ Data and power
- ▶ Different implementations can support:
 - ▶ USB 2.0 / 3.1g1 (3.0) / 3.1g2
 - ▶ DisplayPort
 - ▶ HDMI
 - ▶ MHL
 - ▶ PCI Express
 - ▶ Audio (incoming, announced by USB-IF 2016)
 - ▶ Thunderbolt 3



USB-C AND THUNDERBOLT 3: WHAT FRESH HELL IS THIS?

WHAT IS THUNDERBOLT 3?

- ▶ Developed by Intel
- ▶ New connector
 - ▶ Thunderbolt 1 and 2 use the same connector as Mini DisplayPort (MDP)
 - ▶ Thunderbolt 3 uses USB-C
- ▶ Supports top end of USB-C standards
- ▶ Found on Mac and PC computers
- ▶ Requires Thunderbolt 3 compatible devices, cables and adaptors
 - ▶ All USB-C devices are not equal



USB-C AND THUNDERBOLT 3: WHAT FRESH HELL IS THIS?

KNOW YOUR USB-C PORTS

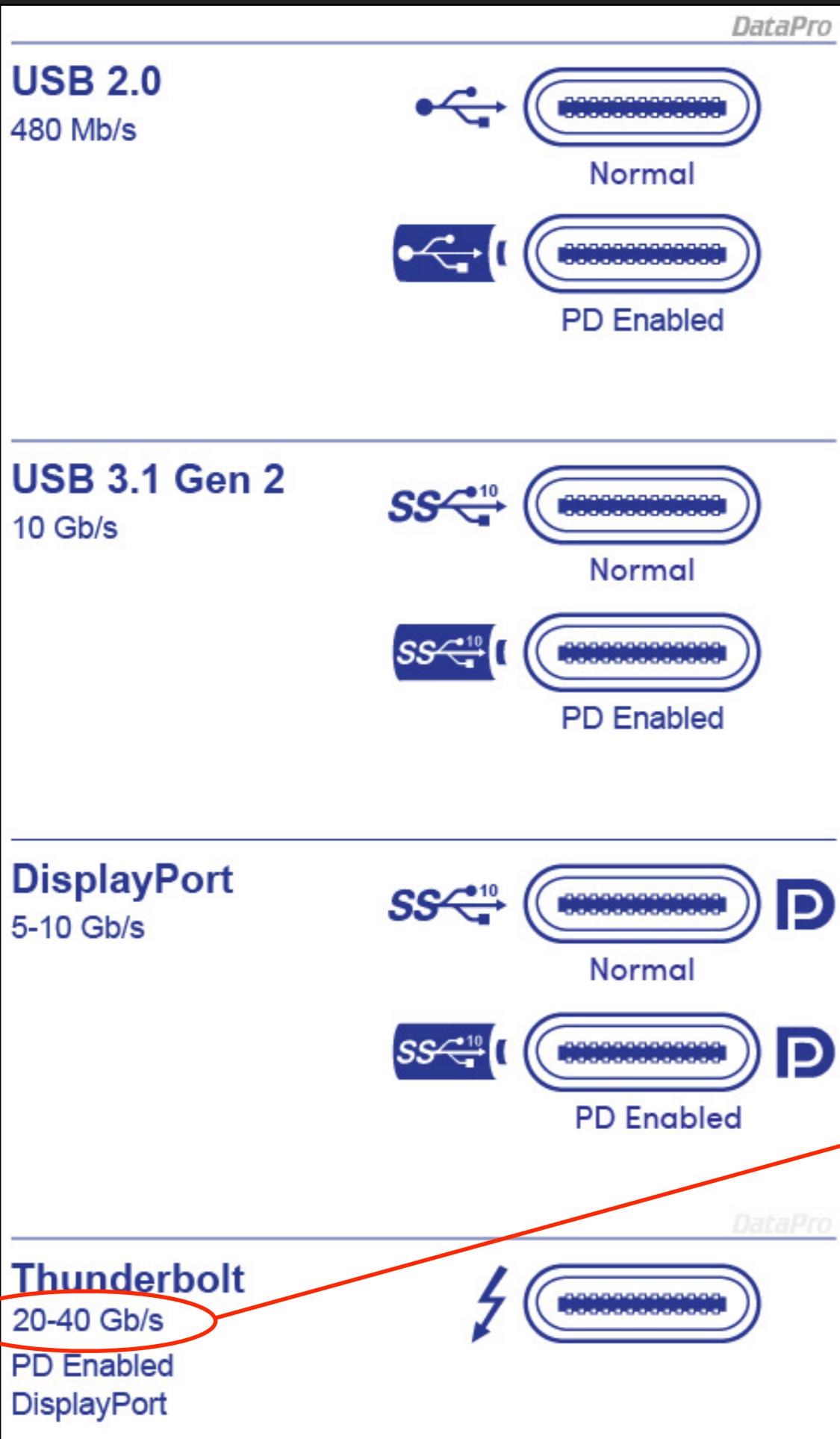
- ▶ Labelling scheme exists. Has it been universally adopted?



Kennzeichnung von USB-Typ-C-Buchsen

Kleine Logos verraten, was die jeweilige USB-C-Buchse kann.
Leider fehlen die Logos oft.

	USB 2.0	USB 3.0 (USB 3.1 Gen 1)	USB 3.1 Gen 2
ohne Power Delivery	High Speed 480 MBit/s	SuperSpeed 5 GBit/s	SuperSpeedPlus 10 GBit/s
	ohne DisplayPort		
mit Power Delivery	mit DisplayPort		
	ohne DisplayPort		
mit Power Delivery	mit DisplayPort		
	Thunderbolt mit Power Delivery, mit DisplayPort		



Logo	Icon	Product	Placement
		Computer	
		Device	
		Cable	

USB-C AND THUNDERBOLT 3: WHAT FRESH HELL IS THIS?

2015 MACBOOK



Charging and
Expansion

USB-C port with support for:

Charging

USB 3.1 Gen 1 (up to 5 Gbps)

Native DisplayPort 1.2 video output

VGA output using USB-C VGA Multiport Adapter (sold separately)

HDMI video output using USB-C Digital AV Multiport Adapter (sold separately)



USB-C AND THUNDERBOLT 3: WHAT FRESH HELL IS THIS?

2016 MACBOOK PRO



Charging and Expansion

Two Thunderbolt 3 (USB-C) ports with support for:

Charging

DisplayPort

Thunderbolt (up to 40 Gbps)

USB 3.1 Gen 2 (up to 10 Gbps)

13" MBP



Four Thunderbolt 3 (USB-C) ports with support for:

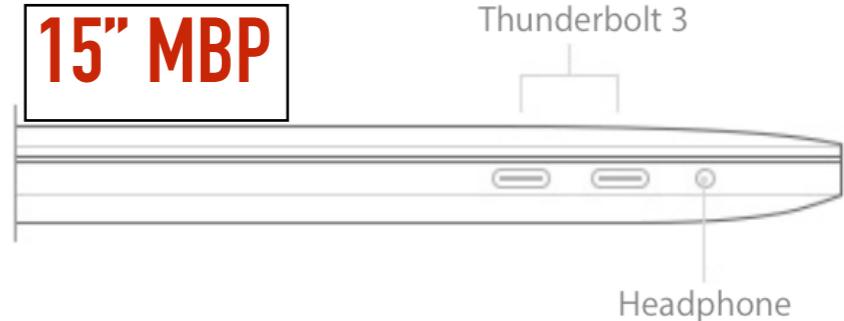
Charging

DisplayPort

Thunderbolt (up to 40 Gbps)

USB 3.1 Gen 2 (up to 10 Gbps)

15" MBP



**2x left ports = 40Gbps
2x right ports = 20Gbps**

Thunderbolt 3

Headphone

Thunderbolt 3

USB-C AND THUNDERBOLT 3: WHAT FRESH HELL IS THIS?

CASE STUDY

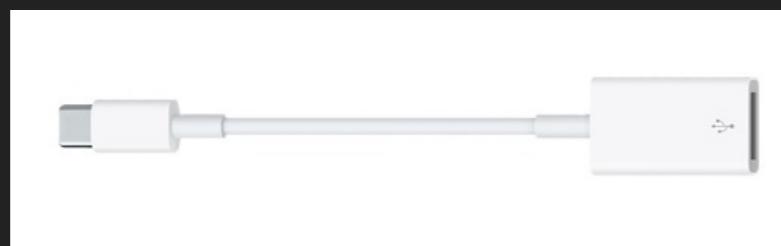
- ▶ 2016 MacBook Pro 15"
- ▶ 2x LG UltraFine 4K displays
 - ▶ USB hub on rear
- ▶ Wired network connection
- ▶ External keyboard and mouse



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CABLES, DONGLES & CHARGERS

[Amazon link for AUKEY](#)



- ▶ See references: *Living with USB-C cables, dongles, and adaptors: The complete guide (11/2016)*

FURTHER READING / REFERENCES

- ▶ *What is USB -C? An Explainer* (03/2017)
 - ▶ <http://uk.pcmag.com/laptops/40348/feature/what-is-usb-c-an-explainer>
- ▶ *Thunderbolt 3 embraces USB Type-C connector, doubles bandwidth to 40Gbps* (06/2015)
 - ▶ <https://arstechnica.co.uk/gadgets/2015/06/thunderbolt-3-embraces-usb-type-c-connector-doubles-bandwidth-to-40gbps/>
- ▶ *Living with USB-C cables, dongles, and adaptors: The complete guide* (11/2016)
 - ▶ <https://arstechnica.co.uk/apple/2016/11/usb-c-cables-dongles-guide/>
- ▶ *Explaining the "USB 3.1 Gen 1" port in the Retina MacBook* (03/2015)
 - ▶ <https://arstechnica.com/apple/2015/03/explaining-the-usb-3-1-gen-1-port-in-the-retina-macbook/>
- ▶ *Einer für alles [One for all]* (02/2017)
 - ▶ <https://www.heise.de/ct/ausgabe/2017-4-USB-Typ-C-bringt-neue-Funktionen-aber-auch-Verwirrung-3610862.html>

50/50 CHANCE



GET IT WRONG 150% OF THE TIME

THANK YOU.

Chris Beard

Orchard Team, Oxford University IT Services