Les **A**venturiers du **B**out du **M**onde

by Yves Cornil

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In the jungle of drives and cables

Les Aventuriers du Bout du Monde.
Rampe de Lancement.

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As Jean-François would say, "How far will he go?"

This document is the translation of "Rampe de Lancement 210", originally written in French.

The translation was carried out by Copilot in Microsoft Word for Mac (version 16.110).

Enjoy your reading.

Yves Cornil

Drives and cables

Report produced by Yves Cornil

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- The publications called "Rampe de Lancement" are documents intended to introduce the general public to the use of software, mainly for Mac and iPad.

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  https://www.cornil.com/abm.htm

DRIVES AND CABLES

A small sample of drives, hubs, and cables.

A T7 drive with the supplied cables.

7

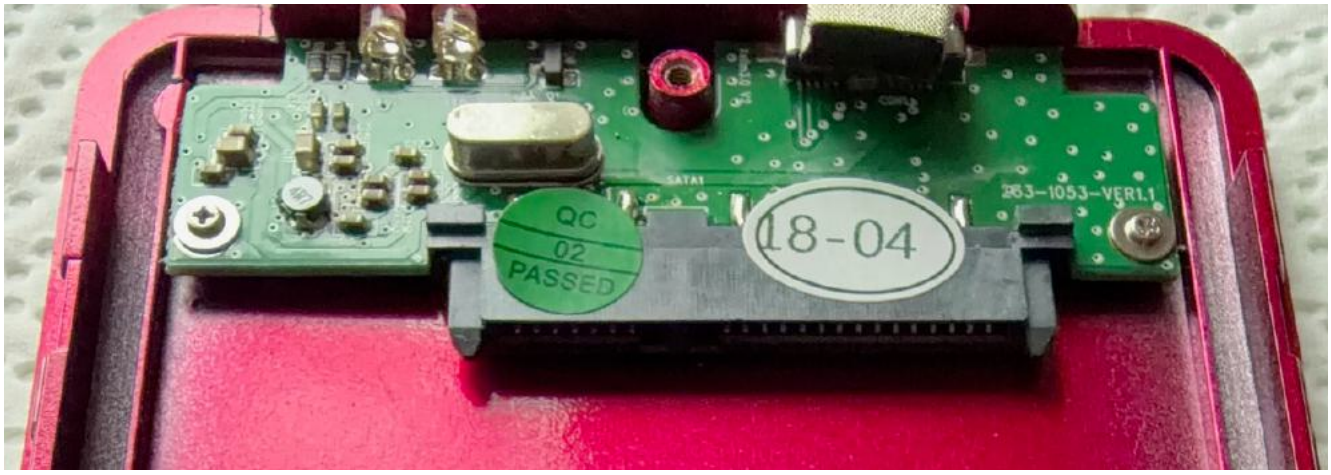
Samsung internal SSD to be inserted into an external enclosure.

8

Here, an NVMe drive and an enclosure.

There are several types of NVMe drives in different sizes.

Storeva enclosure for an internal drive and internal view.



Close-up of the connector for the drive to be inserted (SSD or HDD).

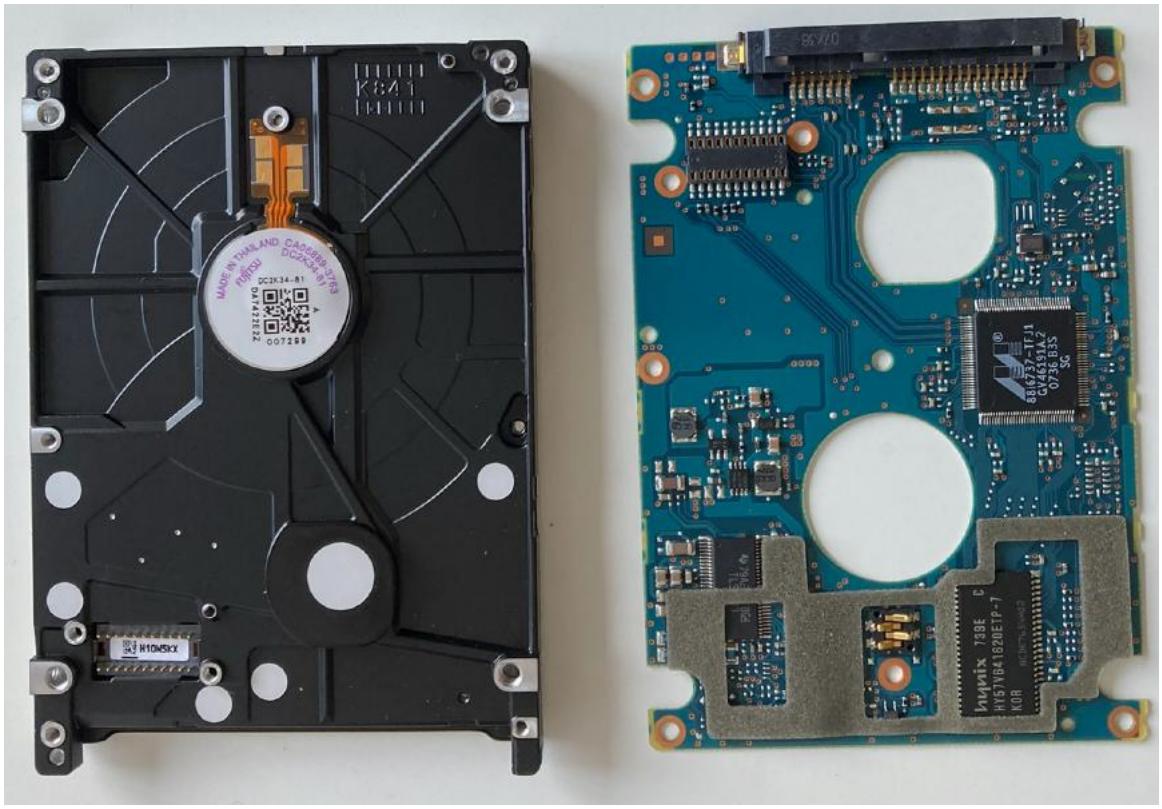
On the left, an enclosure for an SSD; on the right, an enclosure for an NVMe drive.

There are several types of drives:

- Complete drives;
- Drives to be inserted into enclosures;
- Drives can be:
    - Hard disk drives (HDD Hard Disk Drive);
    - SSD drives;
    - NVMe drives.

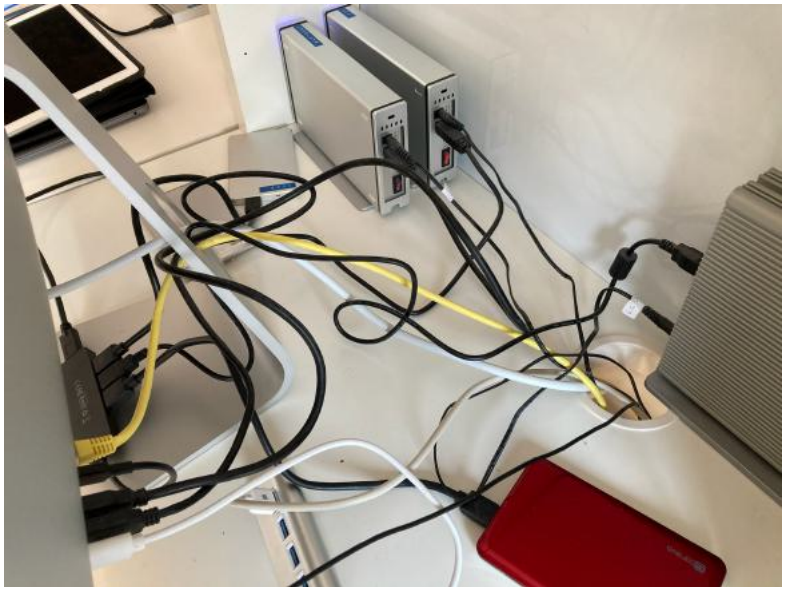
USB 3 enclosure for HDD or SSD drive.

Close-up of the USB 3 connector on a drive.



HDD drive to be inserted into an enclosure

A disassembled HDD drive.



Desktop HDD drives

CABLES.

Cable drawer; I added colored stickers to distinguish them quickly.

Even though connections via USB-C cables are becoming the norm, you probably own older devices that require other connectors, for example devices with USB-A, mini-USB, or USB 3 ports, etc.

Let’s take a closer look at a few cables and other devices.

USB 3 – USB A

USB A – mini USB

USB c – USB c

20

Multifunction cable and adapters.

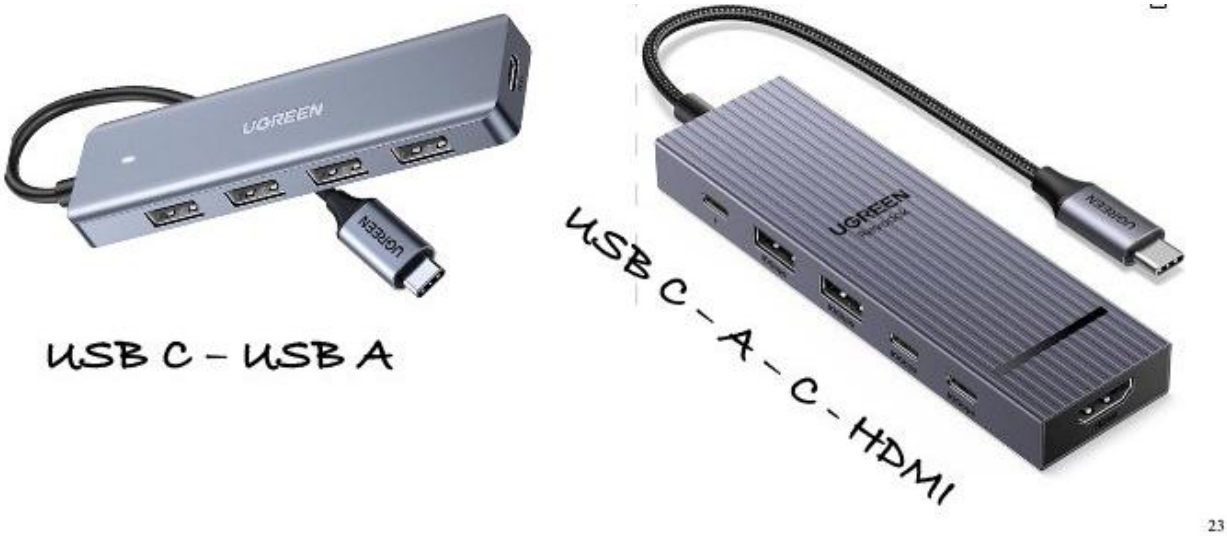
If there is no Wi-Fi connection, you can use a printer cable (USB Type-B).

We still need USB-C to Lightning cables to charge a mouse, keyboard, and trackpad.
MFI-certified Lightning cable (Made For iPhone, iPad, iPod).

Views of a few cables.

HUBS.

Hubs are "power strips" that allow you to connect several devices (drives, USB sticks, with different ports).



USB-C – USB-A hub – USB-C – USB-A – USB-C – HDMI hub.

Multifunction hub (USB-C – USB-A – SD cards – Ethernet – VGA).

T7 drive connected via a hub and Crucial SSD connected to a MacBook port.

HUB FOR MAC MINI M4.

Mac mini M4 and hub with internal NVMe drive

USB FLASH DRIVES.

Here too, you can find USB-A or USB-C flash drives, and sometimes both.

USB flash drives and adapters.

USB-C – USB-A flash drive on a MacBook.

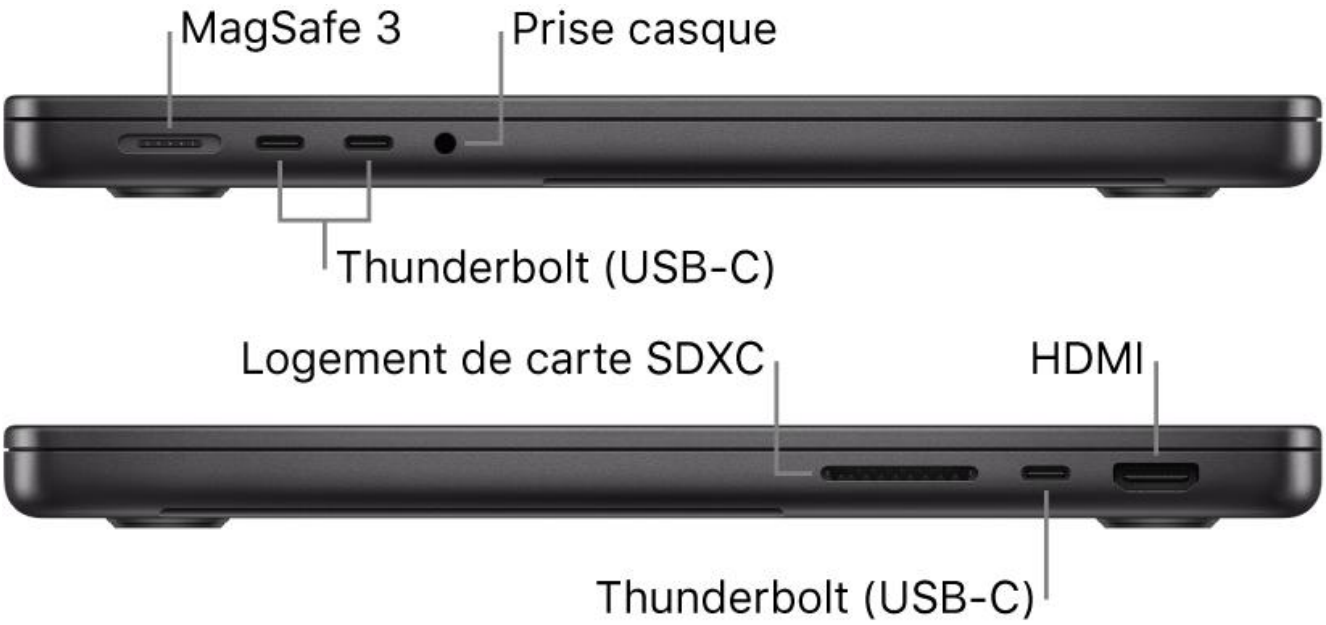
Ports on Mac.

Ports on a MacBook Air.

Thunderbolt 4 (USB-C) ports:

- Charge your computer, transfer data using Thunderbolt 4 or USB 4 speeds (up to 40 Gbit/s), charge devices (such as an iPad, rechargeable trackpad, or keyboard), and more.
- You can also connect a display or projector to a Thunderbolt 4 (USB-C) port.
- On a MacBook Air with the M4 chip, you can connect up to two external monitors.

Ports on a MacBook Pro.



Thunderbolt (USB-C) ports:

- Use one of the three Thunderbolt (USB-C) ports to transfer data at Thunderbolt speed (up to 40 Gbit/s for Thunderbolt 4 on MacBook Pro models with the M4 chip and up to 120 Gbit/s for Thunderbolt 5 on MacBook Pro models with the M4 Pro or M4 Max chip), connect to a display or projector, connect USB 4 devices, and more.
- The ports can also charge devices such as an iPhone, a keyboard, or a rechargeable trackpad, as well as your MacBook Pro via a USB-C charging cable.

Ports on a MacBook Neo.

USB 3 and USB 2 ports.

- Your MacBook Neo is equipped with two **USB-C ports**.
- The *left port* can support an external monitor and transfer data at USB 3 speed (up to 10 GB/s).
- The *right port* transfers data at USB 2 speed (up to 480 MB/s). You can charge your MacBook Neo and connect accessories through either port.

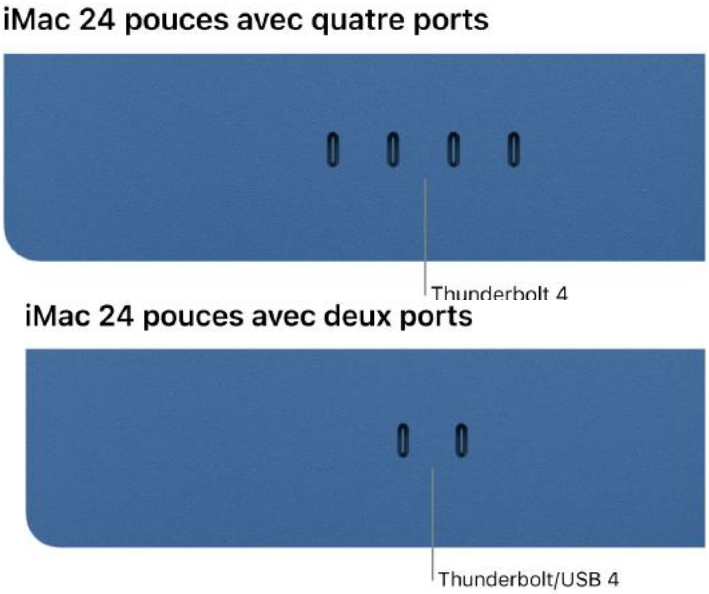
Charging the MacBook Neo.

- You can use either port to charge your computer with a USB-C charging cable and a compatible power adapter.

Ports on an iMac.

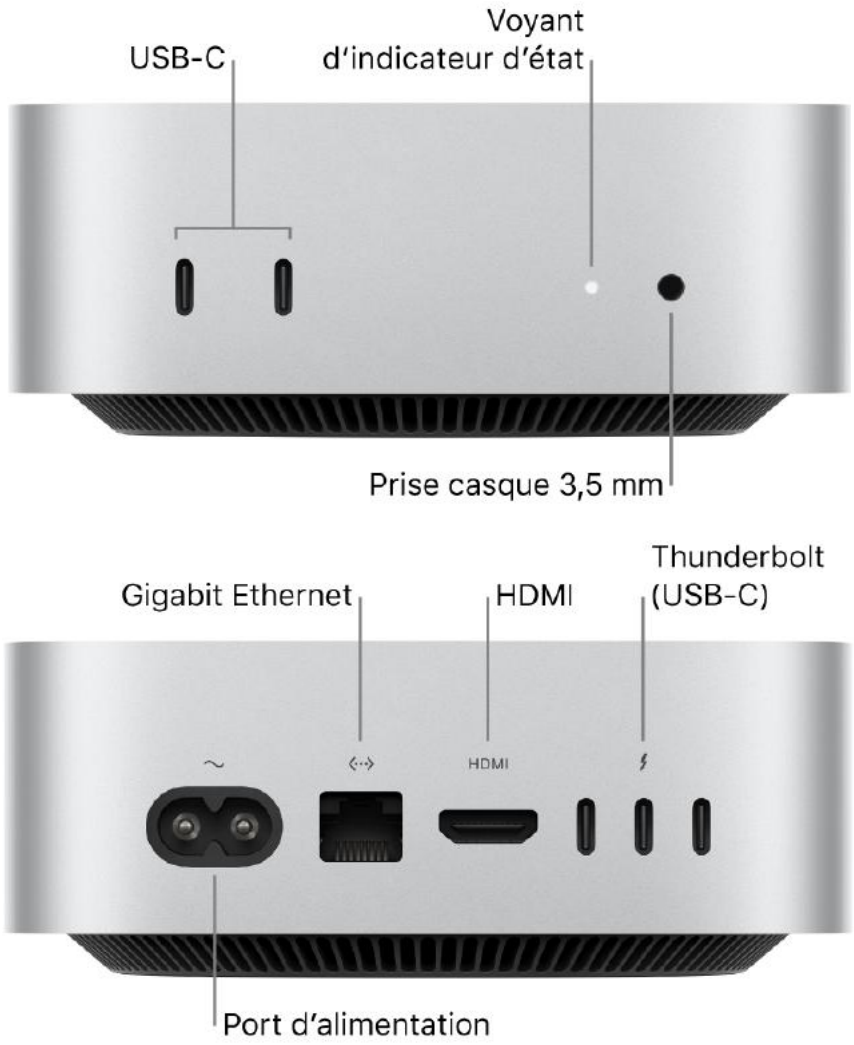
- *Thunderbolt (USB-C) ports:*
- Transfer data at Thunderbolt speed (up to 40 Gbit/s) and charge devices such as a rechargeable mouse or keyboard, or an iPhone.
- Connect Thunderbolt devices and up to two external 6K monitors, such as the Apple Pro Display XDR.

***Note**:* models with four ports are equipped with Thunderbolt 4, which can support up to two external 6K monitors.
Models with two Thunderbolt / USB 4 ports can support one external 6K monitor.



These ports also support Thunderbolt 3, DisplayPort 1.4, and USB 3.2 and earlier, so you can connect external storage devices, webcams, audio devices, and more. You can also use an adapter for USB devices with other types of connectors.

MAC MINI M4.

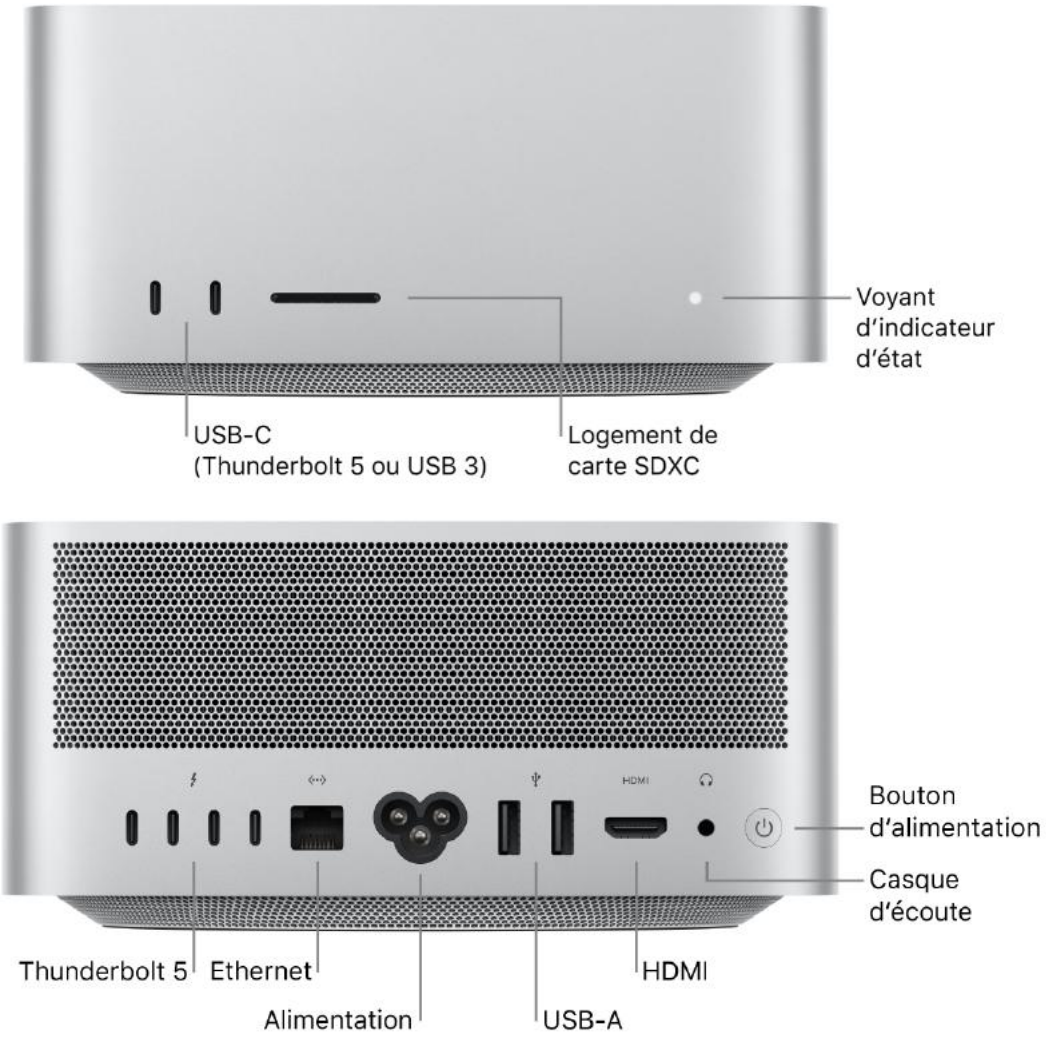


- ***USB-C ports****:* The Mac mini has two USB-C ports on the front, making it easy to connect and charge all your favorite accessories, such as a mouse, keyboard, and RAID arrays.
- ***Status light*** *(voyant d'indicateur d'état):* If the light is on, your Mac mini is on or asleep. If it is off, your Mac mini is turned off.
- ***3.5 mm headphone jack*** *(prise casque 3.5):* Connect headphones or stereo speakers to listen to music or watch movies with high-quality sound. Or connect analog headphones with a built-in mono microphone to make audio and video calls.
- ***Power port*** *(port d'alimentation):* Plug the power cord into the power port on the back of your Mac mini, then connect the other end of the cord to a power source.
- ***Gigabit Ethernet port****:* Connect a router or modem to access the Internet, or connect it to another computer to transfer files without Wi-Fi.
- ***10 Gigabit Ethernet port (RJ-45)****:* If your Mac mini has the optional 10 Gigabit Ethernet port, it can use Nbase-T Ethernet technology that supports multiple data rates to achieve speeds up to 10 Gbit/s over a standard twisted-pair copper cable up to 100 meters long.
- ***HDMI port****:* Use an HDMI-to-DVI adapter or an HDMI cable (sold separately) to connect your Mac mini to a TV or external monitor. See the section Connect a monitor to Mac mini.
- ***Thunderbolt (USB-C) ports:***
- Use one of the three Thunderbolt (USB-C) ports to transfer data at Thunderbolt speed (up to 40 Gbit/s for Thunderbolt 4 on Mac mini models with the M4 chip and up to 120 Gbit/s for Thunderbolt 5 on Mac mini models with the M4 Pro chip), connect to a display or projector, connect USB 4 devices, and more.

- The ports can also charge devices such as an iPhone, or a rechargeable trackpad or keyboard.

Mac mini models with an M4 chip can support a maximum of three monitors: two 6K monitors and one 5K monitor.
Mac mini models with an M4 Pro chip can support up to three 6K monitors.

MAC STUDIO.



- ***USB-C ports*** *(Thunderbolt 5 or USB 3):*
- Use the two USB-C ports on the front of the Mac Studio to connect external storage devices or charge devices such as an iPad or a rechargeable keyboard, mouse, or trackpad.
- On the Mac Studio with the M3 Ultra chip, these ports are Thunderbolt 5. You can therefore transfer data at Thunderbolt 5 speed with a Thunderbolt cable (sold separately) or connect to an external monitor. On the Mac Studio with the M4 Max chip, these ports support USB 3 (up to 10 Gbit/s).
- ***SDXC card slot****:*
- Transfer photos, videos, and data to and from your Mac Studio, with support for high-capacity SD 4.0 cards.
- ***Status light****:*
- The status light on the front of the Mac Studio shows a steady white light when your Mac Studio is on or asleep. When no light is on, it means your Mac Studio is turned off.
- ***Thunderbolt 5 (USB-C) ports****:*

- Transfer data at Thunderbolt 5 speed, connect a display or projector, connect USB 4 devices, and much more.
- *10 Gigabit Ethernet port (RJ-45)*: **The 10 Gigabit Ethernet port can use Nbase-T Ethernet technology** that supports multiple data rates to achieve speeds up to 10 Gbit/s over a standard twisted-pair copper cable up to 100 meters long.
- Depending on the device you are connected to, the type and length of cable, and the technology used, the fastest link speed is negotiated automatically. For example, if the connected device can reach 10 Gbit/s and the cable supports that speed, both devices negotiate that 10 Gbit/s speed.

IDENTIFYING PORTS.

Image du port	Icône	Type de port
	Aucune icône	USB-C
		Thunderbolt 3 (USB-C), Thunderbolt/USB 4, Thunderbolt 4 (USB-C) et Thunderbolt 5 (USB-C)
		Thunderbolt et Thunderbolt 2
		Mini Display Port
	HDMI	HDMI

TECHNICAL ADD-ONS WITH COPILOT.

Let's look at a few technical additions obtained with Copilot.

USB.

The different types of USB fall into two main families:

1. connector shapes (USB-A, B, C, Micro, Mini)
2. speed standards (USB 1.0 → USB4)

Here is a clear and complete overview.

🔌 1. The different USB connectors (physical shapes):

- USB Type-A — the classic rectangular connector

The oldest and most widespread: computer ports, USB flash drives, chargers.
Rectangular shape, non-reversible.

- USB Type-B — the square connector (printers, scanners)

A square connector, used mainly on printers and some external drives.
It also exists in Mini-B and Micro-B versions for older cameras and smartphones.

- USB Mini-USB — an older compact format

Used in cameras, GPS units, and older phones.

- USB Micro-USB — very common before USB-C

Used on most smartphones before 2018.

- USB Type-C — the new universal standard

Reversible, compact, capable of carrying data + video + fast charging.
Supports USB4, Thunderbolt, DisplayPort, and Power Delivery (up to 240 W depending on the standard).
Adopted by Apple, Samsung, laptops, consoles, and more.

⚡ 2. USB standards (speeds and capabilities)

USB versions define speed, independently of the connector.

Standard	Max speed	Comment
USB 1.1	12 Mb/s	First widely used version
USB 2.0	480 Mb/s	Very common, still present
USB 3.0 / 3.1 Gen 1	5 Gb/s	Blue ports, "SuperSpeed"
USB 3.1 Gen 2	10 Gb/s	Faster, often on USB-C
USB 3.2	20 Gb/s	Lane multiplexing
USB4	40 to 80 Gb/s	Unifies USB and Thunderbolt, USB-C only

🎯 3. What to remember

- The shape of the connector ≠ the speed.

A USB-C cable can be slow (USB 2.0) or ultra-fast (USB4).

- USB-C has become mandatory in Europe for mobile devices since 2024.
- Compatibility is backward, but speed adapts to the slowest link in the chain.

THUNDERBOLT.

It is a high-bandwidth technology developed by Intel and Apple that uses the same physical connector as USB-C, but with much higher performance and more features.

Simply put: all Thunderbolt ports are USB-C, but not all USB-C ports are Thunderbolt.

⚡ The key point in one sentence
Thunderbolt = USB-C + very high speed + advanced video + daisy-chaining + PCIe.

🔍 What Thunderbolt is (versions 3, 4, and 5)

THUNDERBOLT 3 AND 4

- Speed: 40 Gb/s (≈ 5,000 MB/s theoretical)
- Video: up to 2 4K displays or 1 8K display
- Charging: up to 100 W
- Daisy-chaining: up to 6 devices
- Compatibility: backward-compatible with USB-C

THUNDERBOLT 5 (NEW IN 2025–2026)

- 80 Gb/s bidirectional, up to 120 Gb/s in "Bandwidth Boost" mode
- Support for 3 4K displays at 144 Hz or multiple 8K displays
- PCIe Gen 4 for faster external SSDs and eGPUs
- Charging up to 240 W

🔌 THUNDERBOLT VS USB-C: THE KEY DIFFERENCES

Criterion	USB-C	Thunderbolt
Type	Physical connector	High-bandwidth protocol using USB-C
Max speed	40 Gb/s (USB4)	40 Gb/s (TB3/4), 80–120 Gb/s (TB5)
Video	Varies depending on the device	Always supports high-resolution multi-display output
Daisy-chaining	Not guaranteed	Up to 6 devices
PCIe	No	Yes (SSD, eGPU)
Compatibility	Universal	USB-C compatible, but not the other way around

🧐 HOW DO YOU IDENTIFY A THUNDERBOLT PORT?

- Presence of the lightning-bolt logo near the port
- On Mac: Option ⌥ → Apple menu → System Information → Thunderbolt

SSD AND HDD.

The difference between an SSD and an HDD mainly comes down to technology, speed, reliability, noise, heat, and price.

Here is a clear, structured summary based on the sources found.

🎯 Summary in one sentence
An SSD is much faster, quieter, and more durable than an HDD, but it costs more.

⚙️ 1. Technology difference (mechanical vs electronic)

- HDD: mechanical storage with spinning platters and a read head, like a mini record player.

→ Physical limits in speed and sensitivity to shocks.
- SSD: electronic storage using flash memory, with no moving parts.

→ Near-instant access to data.

⚡ 2. Speed: SSD has a huge advantage
- HDD: ~100 to 200 MB/s read/write.
- SATA SSD: ~550 MB/s.
- NVMe SSD: up to 7000 MB/s on recent models.

👉 Result:
- System startup: a few seconds with an SSD vs 1 minute or more with an HDD.
- Heavy software (Adobe, video, games): drastically reduced loading times.

🔊 3. Noise, vibrations, and heat
- HDD: makes noise, vibrates, and gets moderately warm.
- SSD: completely silent, no vibrations; may heat up under heavy use.

🛡️ 4. Reliability and durability
- HDD: mechanical parts → more vulnerable to shocks.
- SSD: no mechanics → better resistance and durability (less mechanical wear).

💾 5. Storage capacity
- HDD: very large capacities, up to 20–32 TB at a reasonable price.
- SSD: more limited capacities (128 GB to several TB), although some professional models go much higher.

💶 6. Price
- HDD: much cheaper.
- SSD: between 4 and 20 times more expensive depending on capacity and model.

📊 SSD vs HDD comparison table

Criterion	HDD	SSD
Technology	Mechanical	Electronic (flash)
Speed	Slow (100–200 MB/s)	Very fast (550 MB/s to 7000 MB/s)
Noise	Yes	No
Durability	Low	Excellent
Heat	Moderate	Can heat up under load
Capacity	Very large (up to 32 TB)	More limited
Price	Low	Higher
Ideal use	Mass storage, archives	System, software, speed

🎯 Which one should you choose?
- For a fast computer: an SSD is essential.
- To store lots of data at low cost: HDD.
- Best compromise: an SSD for the system + an HDD for data.

SSD vs HDD: understanding the difference

🧠 1. The general idea
- HDD = mechanical hard drive

→ Like a small record player that reads data.
- SSD = electronic memory

→ Like a large ultra-fast USB flash drive.

⚙️ 2. How does it work?

HDD (Hard Disk Drive)

- Contains spinning platters.
- A read/write head moves to find the data.
- The more movement there is, the slower and more fragile it becomes.

SSD (Solid State Drive)
- No moving parts.
- Data is stored in electronic chips.
- Result: fast, silent, durable.

⚡ 3. Speed (the most visible difference)

HDD
- Computer startup: 30 to 90 seconds
- Opening software: slow
- File copy: 100–200 MB/s

SSD
- Startup: 5 to 15 seconds
- Software: almost instant
- Copy: 500 MB/s to 7000 MB/s depending on the model

👉 For the user: everything is much faster.

🔊 4. Noise and heat

Criterion	HDD	SSD
Noise	Yes (spinning + clicking)	No
Vibration	Yes	No
Heat	Moderate	Low to moderate

🎯 5. Which one should you choose?

For a fast computer
➡️ SSD required (Mac, PC, laptop, or desktop).
To store lots of data at a low price

➡️ HDD (archives, photos, videos, backups).
The best compromise

➡️ SSD pour le système + HDD pour les données.

What is an NVMe drive?

An NVMe drive is an ultra-fast SSD that uses the NVMe (Non-Volatile Memory Express) protocol to communicate directly with the processor over the PCIe bus, allowing it to reach speeds far beyond SATA SSDs and hard drives.

🔍 What defines an NVMe drive
- NVMe = a modern protocol designed specifically for SSDs, unlike SATA, which comes from hard drives.
- Connection via PCIe, offering very high bandwidth.
- Very low latency thanks to massively parallel queues (up to 64,000 queues × 64,000 commands).
- Response times far faster than HDDs and even SATA SSDs.

🚀 Why is it so much faster?

Because NVMe:

- uses PCIe lanes directly → massive data throughput;
- uses a protocol optimized for flash memory;
- enables huge parallelism in I/O operations.

According to Kingston, an NVMe SSD can be up to 25× faster than an equivalent SATA SSD and can exceed 2 million IOPS.

📌 What is it used for?

- Near-instant startup
- Very fast app launches
- Video, photo, and audio editing
- Virtual machines
- Gaming
- Local AI and heavy data processing

🧩 Common formats

- M.2 NVMe (the most common)
- PCIe NVMe (expansion cards)
- U.2 / U.3 (servers)

SATA.

A SATA drive is a storage device (HDD or SSD) that uses the SATA interface — Serial ATA — to connect to the motherboard. It is a standard introduced in the early 2000s to replace the older PATA/IDE standard and provide faster data transfer, thinner cables, and hot-swapping.

🔍 Simple definition
SATA (Serial Advanced Technology Attachment) is an interface that connects a hard drive, SSD, or optical drive to the motherboard via a data cable (7 pins) and a power cable (15 pins).

⚙️ How does it work?

- Serial communication (more reliable than the old parallel IDE standard).
- A thin data cable → better airflow inside the PC.
- Hot-plug support: some devices can be connected or disconnected without turning the machine off.

🚀 SATA speeds
The main versions are:

- SATA I: 1.5 Gbit/s (≈150 MB/s)
- SATA II: 3 Gbit/s (≈300 MB/s)
- SATA III: 6 Gbit/s (≈600 MB/s) — the current standard, suitable for SATA SSDs.

👉 In practice, a SATA SSD tops out at around 550 MB/s because the interface is the limiting factor.

IF YOU LIVE IN THE LILLE METROPOLITAN AREA (MEL).

The CILAC computer club is a non-profit association under the French 1901 law, hosted by the C.C.A. of La Madeleine. It is run by volunteers and funded through members' subscriptions.

- CILAC's core focus is the Macintosh, as well as Apple iPad® tablets and iPhone® smartphones.

CILAC's objectives.

- Bring together people who want to use a microcomputer, a tablet, a mobile phone, and everyday digital tools, in order to help them get started and address their problems.
- Help more experienced users improve their skills, explore specific software, and get to grips with new technologies in the Apple ecosystem.
- All of this takes place within a club that encourages exchange and a warm, friendly atmosphere.

How is CILAC organized?

The CILAC club is open, outside school holidays, on Monday, Tuesday, Wednesday, and Thursday from 2:30 p.m. to 4:30 p.m.
The Piet Mondrian room is equipped with 6 Macintosh computers (1 iMac and 6 Mac mini) and a large modern television for introductory and advanced training in Mac use (operating system, office software, photos, video, data sharing, photo and video sharing, social networks, etc.).
Open workshop sessions are also organized, where everyone brings their own MacBook, iPad, or iPhone. It is an opportunity to share computing knowledge in a friendly atmosphere.

Note: the times are given for information only.

The club's website should also be mentioned, as it contains a wealth of very useful information.

cilaclamadeleine.org