Ethernet adapter tests via Studio Display

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The issue

When connecting Ethernet via a hub directly to my MacBook Pro, I have gigabit internet speed at about 1Gbps/1Gbps. When it connect the same hub indirectly, via my Studio Display, the speed drops to about 600/600Mbps down/up. The speed is also unstable and seems to drops over time/heat, noticed 3 times during Teams calls.

Context

I have used an older MacBook Pro (13-inch, 2019, Four Thunderbolt 3 ports) with HyperDrive for Ethernet and HDMI display since 2019. This has always worked reliably over the direct connection. When Studio Display was introduced to the setup and Ethernet went over indirect connection, internet issues started. Why indirect connection? Because I want 1 cable in my MacBook Pro. I ascribed it to my "old" MacBook Pro and waited, since I was about the receive new MacBook Pro from work. However, the new MacBook Pro did not resolve the issue, nor did a firmware update to 15.4 on the display, or different ports on Mac or display. I assumed it was a problem with USB-C to Thunderbolt 3 translation, but when I started testing different hubs and adapters, I found some that *did* work correctly...

Devices

- New MacBook Pro (14-inch, 2021), with Apple M1 Pro and 32GB RAM, running macOS 12.3
- "Old" MacBook Pro (13-inch, 2019, Four Thunderbolt 3 ports), running macOS 12.3
- Studio Display, running firmware 67.1 (15.4?)
- Several different hubs, see next page

Hypothesis

The **Realtek 0x8153** chip that is used many of the hubs and adapters, is unreliable when used via the Studio Display. Could be hardware, could be drivers.

Tested hubs and adapters

HyperDrive GEN2 18-port USB-C Hub

- Originally from Kickstarter
- Using a longer Fasgear USB-C 3.1 cable
- Chip: Realtek 0x8153

Anker PowerExpand 6-in-1 Ethernet Hub (a8365)

- Chip: Realtek 0x8153

Anker PowerExpand 5-in-1 Ethernet Hub (a8338)

- Chip: Realtek 0x8153

Anker PowerExpand USB-C to Gigabit Ethernet Adapter (a8313)

- Chip: Realtek 0x8153

Belkin USB-C to Ethernet Adapter (F2CU040)

- Chip: Realtek 0x8153

Anker PowerExpand 8-in-1 Data Hub (a8383)

- Chip: ASIX AX88178A (**0x1790**)

UGREEN USB-C to Gigabit Ethernet Adapter (CM483)

- Chip: ASIX AX88178A (**0x1790**)

Trendnet TUC-ET2G Ethernet-adapter

- USB-C 3.1 tot 2.5 Gbase-T
- Chip: Realtek **0xe02b**

Test results and screen shots

The next few pages will include screen shots from the System Information app, in the Ethernet and USB section. And network speeds are tested with both the Speedtest app by Ookla and fast.com from Netflix, over direct and indirect connections.

Direct connection: **Router** ←*Ethernet*→ **Hub/adapter** ←*USB-C*→ **Macbook Pro 2021**

Indirect connection: **Router** ←*Ethernet*→ **Hub/adapter** ←*USB-C*→ **Studio Display** ←*Thunderbolt 3*→ **Macbook Pro 2021**

A possibly related thread on Apple Discussions: https://discussions.apple.com/thread/253395967

Conclusion

My conclusion so far is that the hypothesis is correct, the Realtek 0x8153 is unreliable. The ASIX AX88178A (0x1790) chip seems to be more reliable, though inconsistent with the fast.com speedtest. Realtek 0xe02b chip does not seem to suffer from any of these issues. Only the HyperDrive with its Realtek 0x8153 chip has been "stress tested" and seemed to drop connections, including during my tests for this document.

The cause for 0x8153 being flaky is unknown to me. It could be related to the Studio Display running a version of iOS that might be missing drivers for this chip, but when connecting these hubs to a 6th gen iPad mini, fast.com gives 1Gbps/1Gbps too.

HyperDrive GEN2 18-port USB-C Hub

https://www.hypershop.com/collections/hyperdrive/products/hyperdrive-gen2-18-in-1-usb-c-hub
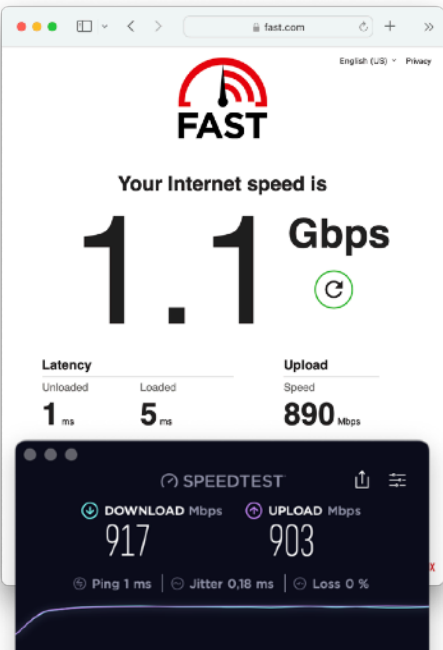
- Chip: Realtek 0x8153

System Information Ethernet

```
USB 10/100/1000 LAN:

    Bus:                USB
    Vendor Name:        Realtek
    Product Name:       USB 10/100/1000 LAN
    Vendor ID:          0x0bda
    Product ID:         0x8153
    USB Link Speed:     Up to 5 Gb/s
    Driver:             com.apple.DriverKit.AppleUserECM
    BSD Device Name:    en12
    MAC Address:        a0:ce:c8:39:01:8a
    AVB Support:        No
```

System Information USB

```
USB 10/100/1000 LAN:

    Product ID:                   0x8153
    Vendor ID:                    0x0bda  (Realtek Semiconductor Corp.)
    Version:                      30.00
    Serial Number:                000001
    Speed:                        Up to 5 Gb/s
    Manufacturer:                 Realtek
    Location ID:                  0x03331300 / 11
    Current Available (mA):       900
    Current Required (mA):        288
    Extra Operating Current (mA): 0
```
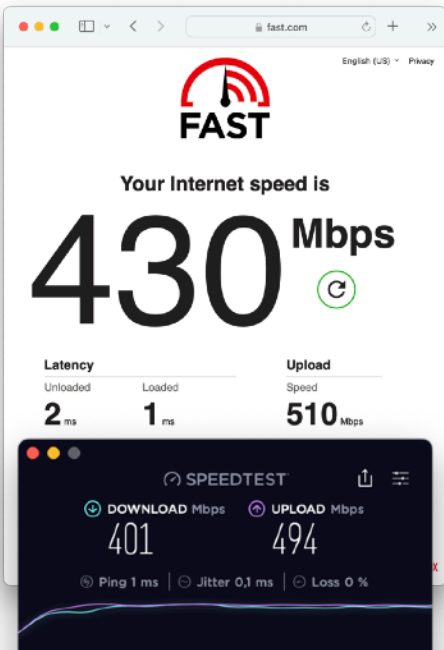
Direct on Mac

Indirect, via Display

Anker PowerExpand 6-in-1 Ethernet Hub (a8365)

https://us.anker.com/products/a8365

• Chip: Realtek 0x8153

System Information Ethernet

```
USB 10/100/1000 LAN:

    Bus:                   USB
    Vendor Name:           Realtek
    Product Name:          USB 10/100/1000 LAN
    Vendor ID:             0x0bda
    Product ID:            0x8153
    USB Link Speed:        Up to 5 Gb/s
    Driver:                com.apple.DriverKit.AppleUserECM
    BSD Device Name:       en15
    MAC Address:           a0:ce:c8:f7:0e:73
    AVB Support:           No
```
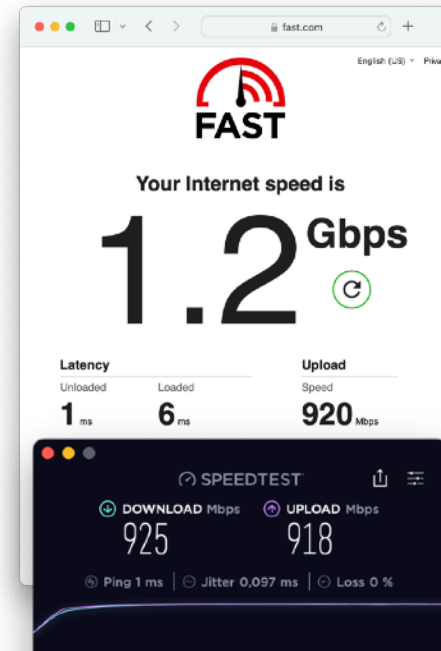
System Information USB

```
USB 10/100/1000 LAN:

    Product ID:            0x8153
    Vendor ID:             0x0bda   (Realtek Semiconductor Corp.)
    Version:               30.00
    Serial Number:         000001
    Speed:                 Up to 5 Gb/s
    Manufacturer:          Realtek
    Location ID:           0x02210000 / 3
    Current Available (mA):    900
    Current Required (mA):     288
    Extra Operating Current (mA): 0
```
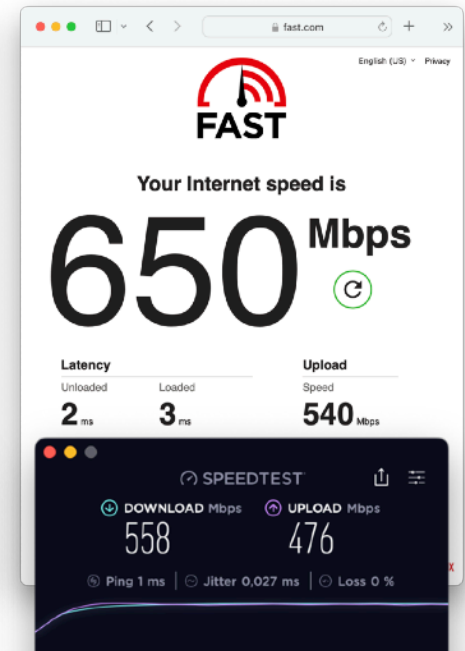
Direct on Mac

Indirect, via Display

Anker PowerExpand 5-in-1 Ethernet Hub (a8338)

https://us.anker.com/products/a8338

- Chip: Realtek 0x8153

System Information Ethernet

```
USB 10/100/1000 LAN:

    Bus:                USB
    Vendor Name:        Realtek
    Product Name:       USB 10/100/1000 LAN
    Vendor ID:          0x0bda
    Product ID:         0x8153
    USB Link Speed:     Up to 5 Gb/s
    Driver:             com.apple.DriverKit.AppleUserECM
    BSD Device Name:    en14
    MAC Address:        a0:ce:c8:74:01:1f
    AVB Support:        No
```
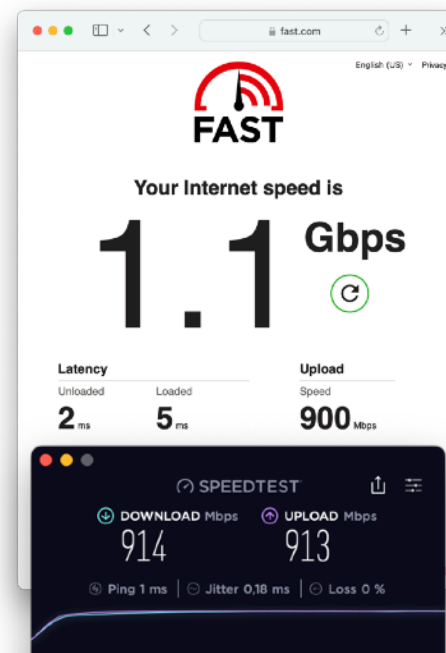
System Information USB

```
USB 10/100/1000 LAN:

    Product ID:                     0x8153
    Vendor ID:                      0x0bda  (Realtek Semiconductor Corp.)
    Version:                        30.00
    Serial Number:                  000001
    Speed:                          Up to 5 Gb/s
    Manufacturer:                   Realtek
    Location ID:                    0x02240000 / 3
    Current Available (mA):         900
    Current Required (mA):          288
    Extra Operating Current (mA):   0
```
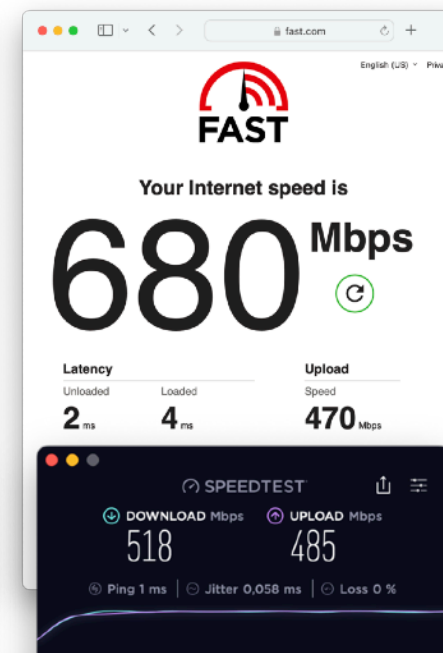
Direct on Mac

Indirect, via Display

Anker PowerExpand USB-C to Gigabit Ethernet Adapter (a8313)

https://us.anker.com/products/a8313

- Chip: Realtek 0x8153

System Information Ethernet

```
USB 10/100/1000 LAN:

    Bus:                USB
    Vendor Name:        Realtek
    Product Name:       USB 10/100/1000 LAN
    Vendor ID:          0x0bda
    Product ID:         0x8153
    USB Link Speed:     Up to 5 Gb/s
    Driver:             com.apple.DriverKit.AppleUserECM
    BSD Device Name:    en5
    MAC Address:        00:e0:4c:cd:5b:70
    AVB Support:        No
```
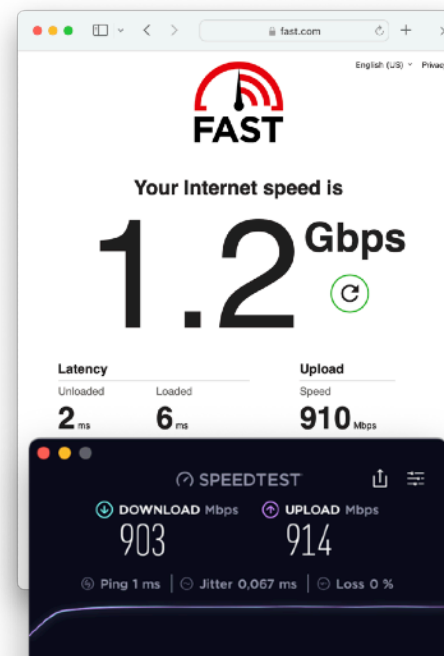
System Information USB

```
USB 10/100/1000 LAN:

    Product ID:                   0x8153
    Vendor ID:                    0x0bda  (Realtek Semiconductor Corp.)
    Version:                      31.00
    Serial Number:                001000001
    Speed:                        Up to 5 Gb/s
    Manufacturer:                 Realtek
    Location ID:                  0x03330000 / 33
    Current Available (mA):       900
    Current Required (mA):        288
    Extra Operating Current (mA): 0
```
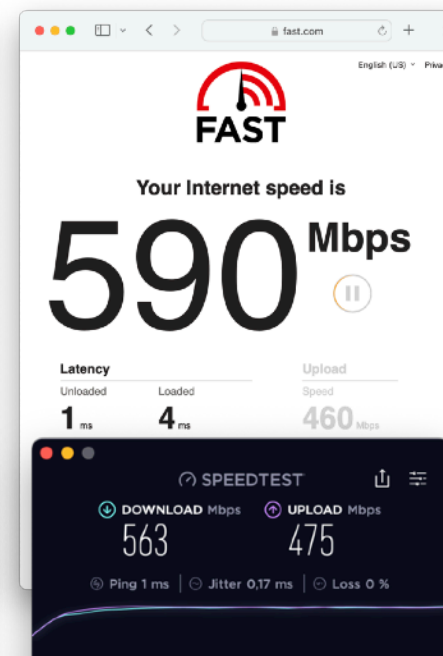
Direct on Mac

Indirect, via Display

Belkin USB-C to Ethernet Adapter (F2CU040)

https://www.belkin.com/us/adapters/audio-video/usb-c-to-gigabit-ethernet-adapter-usb-type-c/p/p-f2cu040/

- Chip: Realtek 0x8153
- Also tested by directly connecting it to iPad mini, capable of full speed there

System Information Ethernet

```
Belkin USB-C LAN:

    Bus:                USB
    Vendor Name:        Belkin
    Product Name:       Belkin USB-C LAN
    Vendor ID:          0x0bda
    Product ID:         0x8153
    USB Link Speed:     Up to 5 Gb/s
    Driver:             com.apple.DriverKit.AppleUserECM
    BSD Device Name:    en13
    MAC Address:        d8:ec:5e:11:22:08
    AVB Support:        No
```

System Information USB

```
Belkin USB-C LAN:

    Product ID:                     0x8153
    Vendor ID:                      0x0bda  (Realtek Semiconductor Corp.)
    Version:                        30.00
    Serial Number:                  112208000000
    Speed:                          Up to 5 Gb/s
    Manufacturer:                   Belkin
    Location ID:                    0x02200000 / 1
    Current Available (mA):         900
    Current Required (mA):          256
    Extra Operating Current (mA):   0
```
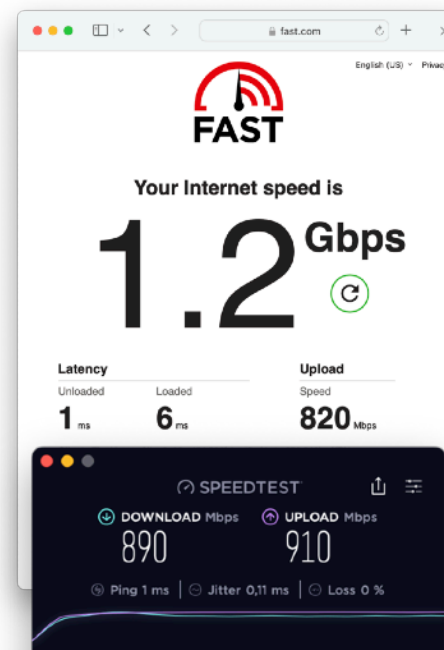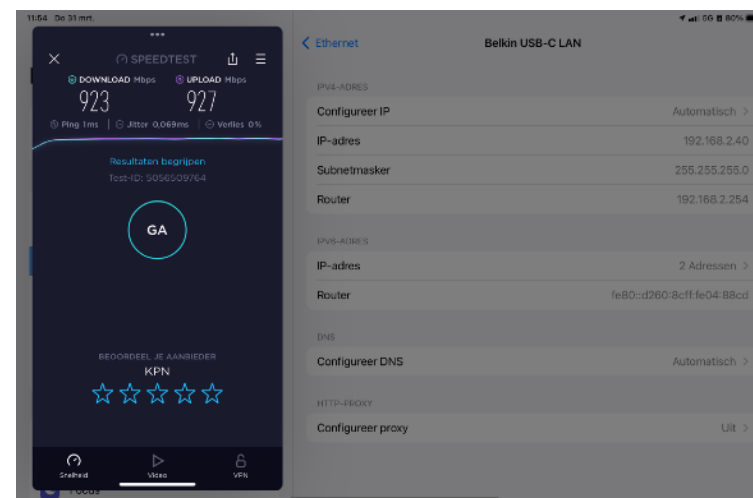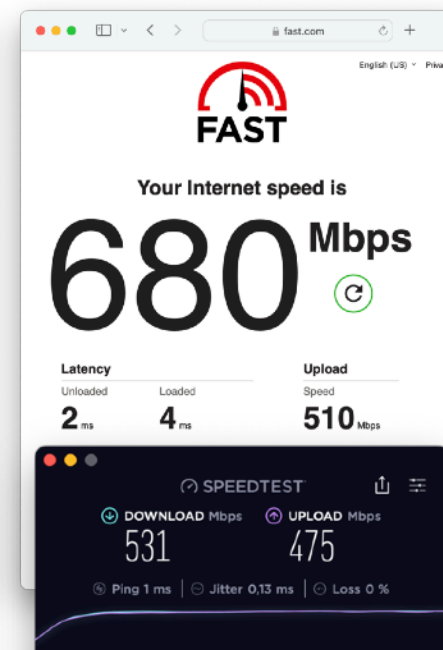
Direct on Mac

Indirect, via Display

Anker PowerExpand 8-in-1 Data Hub (a8383)

https://us.anker.com/products/a8383

- Chip: ASIX AX88178A (0x1790)
- System Info mentions "Maximum Link Speed: 2.5 Gb/s" with this chip
- *Direct* speedtest via fast.com unreliably inconsistent

System Information Ethernet

```
AX88179A:

  Bus:                   USB
  Vendor Name:           ASIX
  Product Name:          AX88179A
  Vendor ID:             0x0b95
  Product ID:            0x1790
  USB Link Speed:        Up to 5 Gb/s
  Driver:                com.apple.driver.usb.cdc.ncm
  BSD Device Name:       en10
  MAC Address:           f8:e4:3b:9a:be:2c
  AVB Support:           No
  Maximum Link Speed:    2.5 Gb/s
```
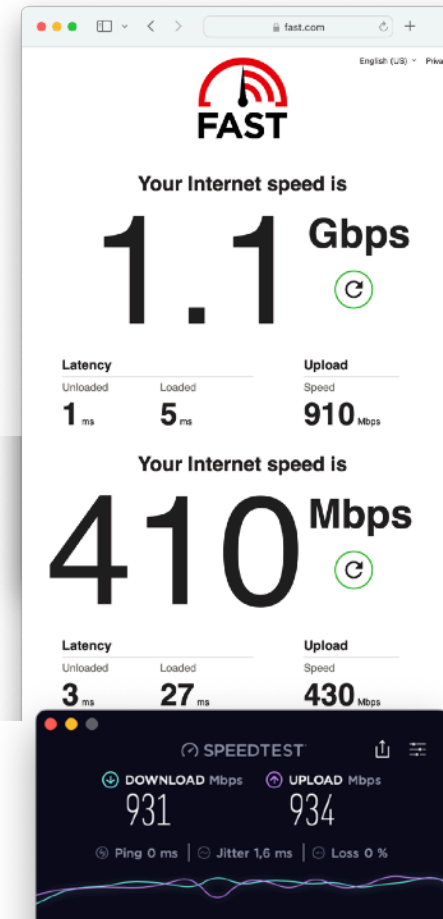
System Information USB

```
AX88179A:

  Product ID:                    0x1790
  Vendor ID:                     0x0b95  (ASIX Electronics Corporation)
  Version:                       2.00
  Serial Number:                 009ABE2C
  Speed:                         Up to 5 Gb/s
  Manufacturer:                  ASIX
  Location ID:                   0x02221000 / 6
  Current Available (mA):        900
  Current Required (mA):         184
  Extra Operating Current (mA):  0
```
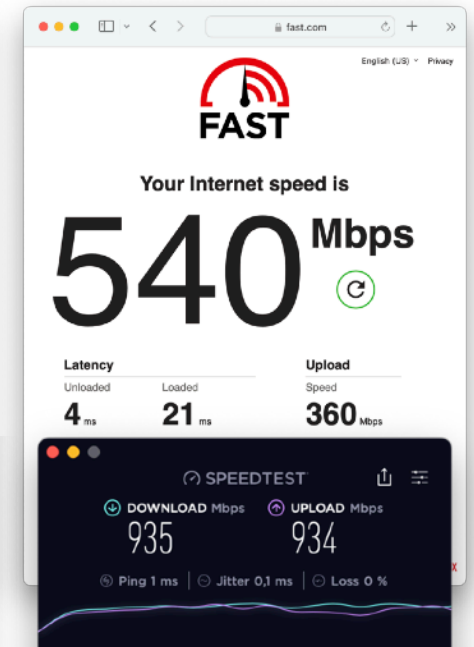
Direct on Mac

Indirect, via Display

UGREEN USB-C to Gigabit Ethernet Adapter (CM483)

https://www.ugreen.com/products/usb-c-to-gigabit-rj45-ethernet-adapter

- Chip: ASIX AX88178A (0x1790)
- System Info mentions "Maximum Link Speed: 2.5 Gb/s" with this chip
- *Indirect* speedtest via fast.com unreliably inconsistent
- They actually advertise on their website as using a "more stable high performance chip" in the adapter. This seems to be true, it's at least different from other adapters.
- Also tested by directly connecting it to iPad mini, capable of full speed there

System Information Ethernet

```
AX88179A:

Bus:                  USB
Vendor Name:          ASIX
Product Name:         AX88179A
Vendor ID:            0x0b95
Product ID:           0x1790
USB Link Speed:       Up to 5 Gb/s
Driver:               com.apple.driver.usb.cdc.ncm
BSD Device Name:      en10
MAC Address:          08:26:ae:32:cd:29
AVB Support:          No
Maximum Link Speed:   2.5 Gb/s
```
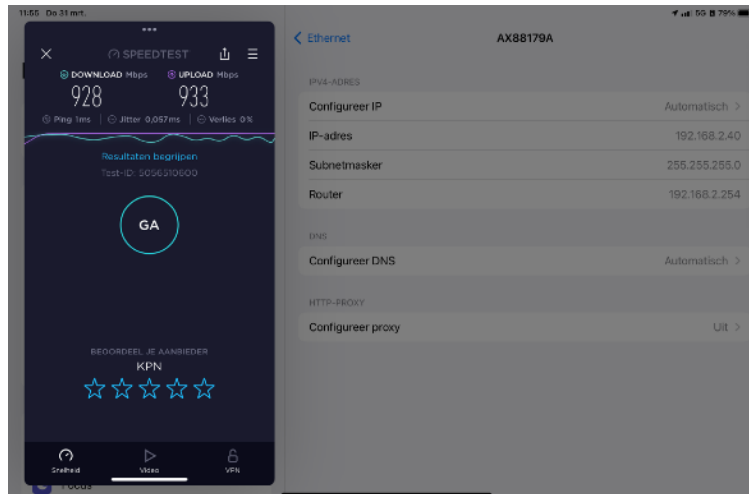
System Information USB

```
AX88179A:

Product ID:                     0x1790
Vendor ID:                      0x0b95  (ASIX Electronics Corporation)
Version:                        2.00
Serial Number:                  0000000000245C
Speed:                          Up to 5 Gb/s
Manufacturer:                   ASIX
Location ID:                    0x03330000 / 51
Current Available (mA):         900
Current Required (mA):          184
Extra Operating Current (mA):   0
```
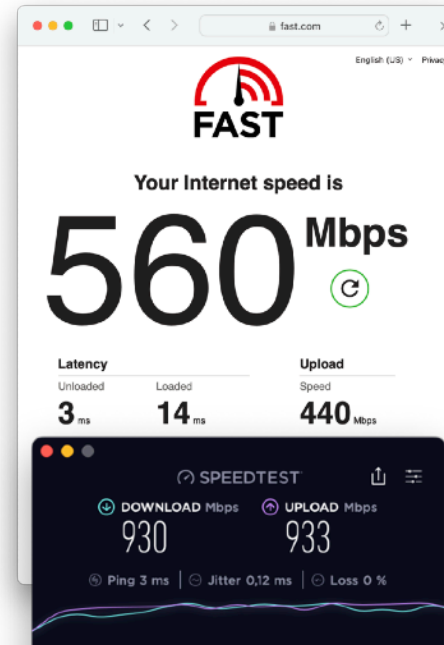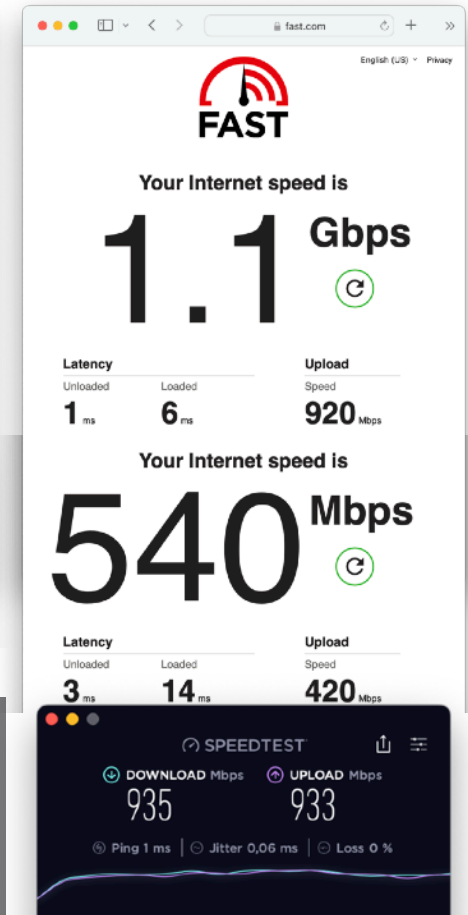
Direct on Mac

Indirect, via Display

Trendnet TUC-ET2G Ethernet-adapter USB-C 3.1 tot 2.5 Gbase-T

https://www.trendnet.com/support/TUC-ET2G-v1

- Chip: Realtek **0xe02b** (not Realtek 0x8153, same brand, different chip)
- System Info mentions "Maximum Link Speed: 2.5 Gb/s" with this chip
- Also tested by directly connecting it to iPad mini, capable of full speed there
- This is the only adapter in the test that is advertised as being 2.5Gbps
- Seems to be to fastest, most reliable and most consistent adapter in the test

System Information Ethernet

```
USB 10/100/1G/2.5G LAN:

  Bus:                    USB
  Vendor Name:            Realtek
  Product Name:           USB 10/100/1G/2.5G LAN
  Vendor ID:              0x20f4
  Product ID:             0xe02b
  USB Link Speed:         Up to 5 Gb/s
  Driver:                 com.apple.driver.usb.cdc.ncm
  BSD Device Name:        en17
  MAC Address:            3c:8c:f8:f9:cb:c4
  AVB Support:            No
  Maximum Link Speed:     2.5 Gb/s
```
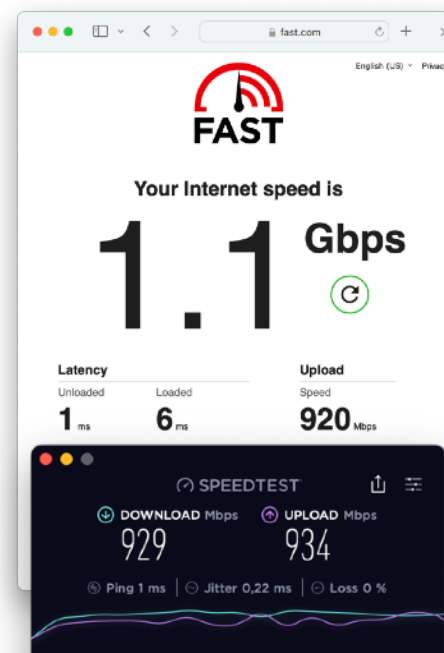
System Information USB

```
USB 10/100/1G/2.5G LAN:

  Product ID:                   0xe02b
  Vendor ID:                    0x20f4
  Version:                      30.04
  Serial Number:                400000001
  Speed:                        Up to 5 Gb/s
  Manufacturer:                 Realtek
  Location ID:                  0x02200000 / 1
  Current Available (mA):       900
  Current Required (mA):        512
  Extra Operating Current (mA): 0
```

Direct on Mac

Indirect, via Display