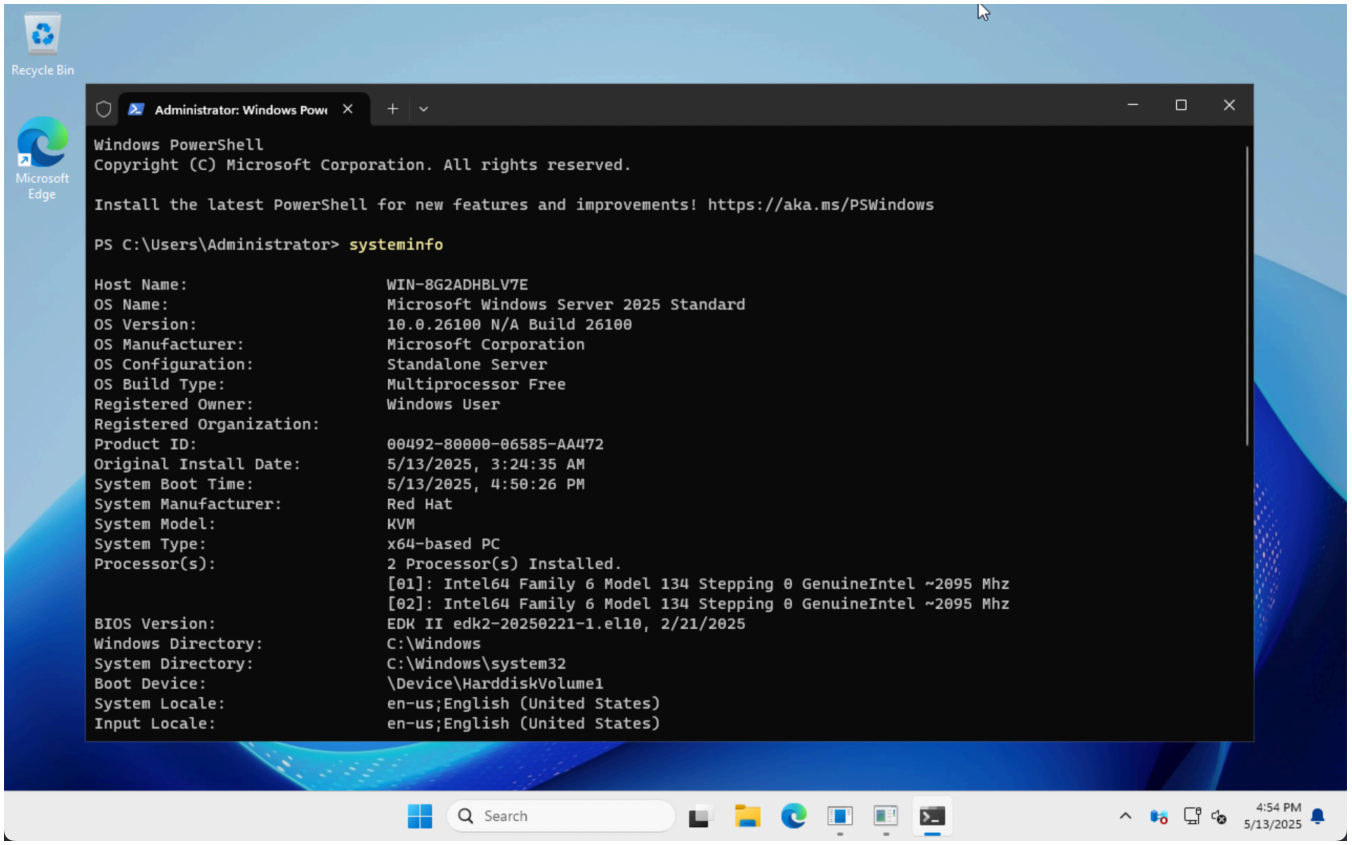
RHEL Week - VirtIO-Win-NetKVM - UDP Segmentation Offload

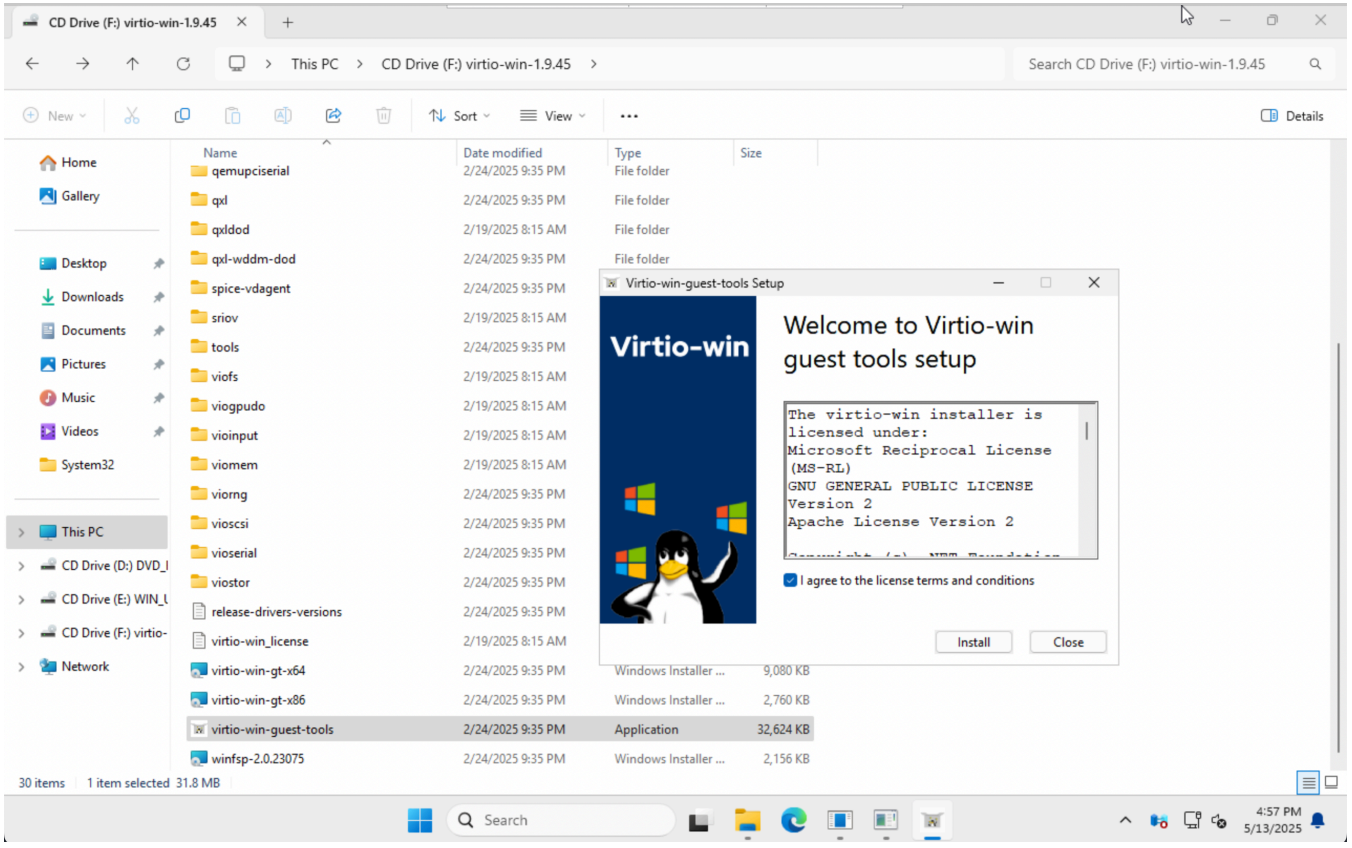
> 本文档将使用中文完整记录测试流程和结果，方便大家查阅。

一、客户端配置

1. 系统环境

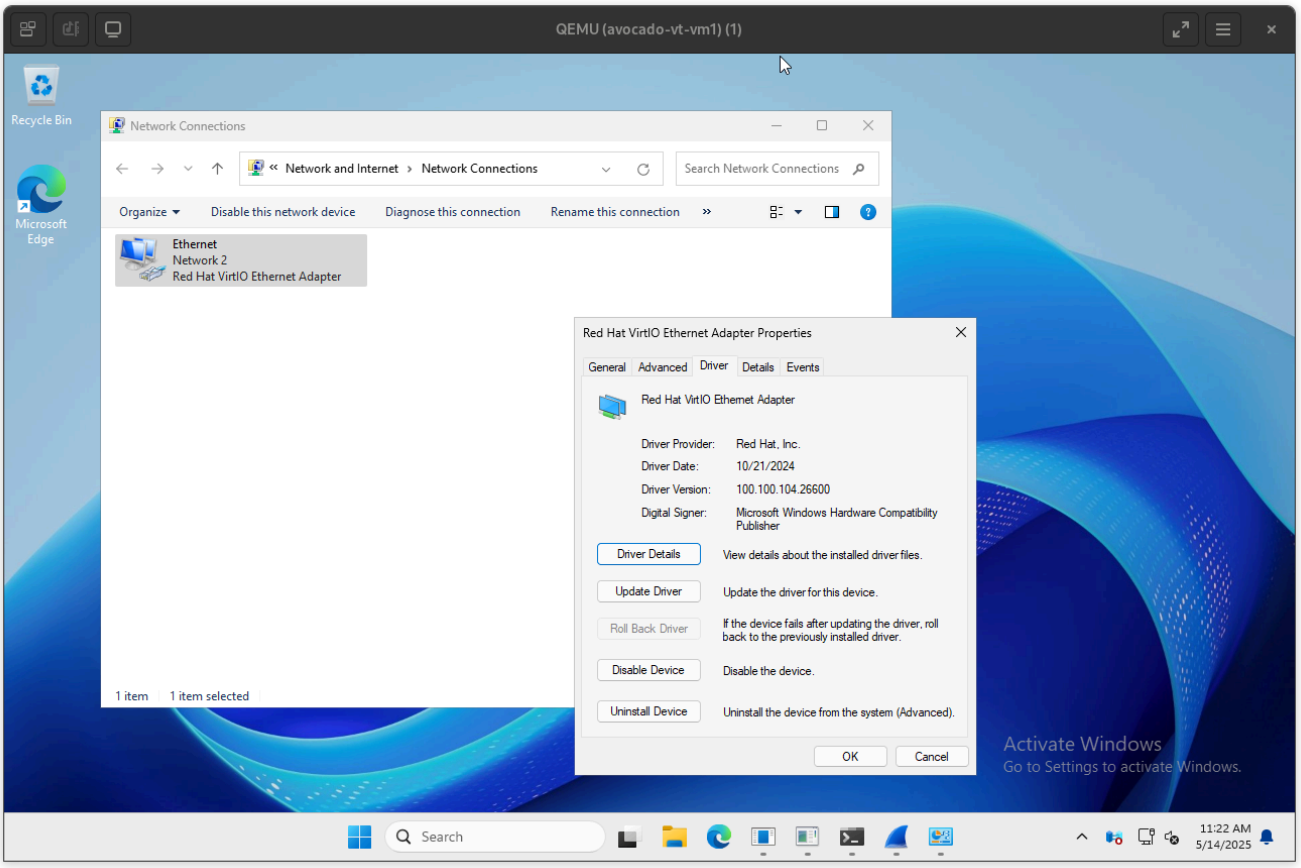


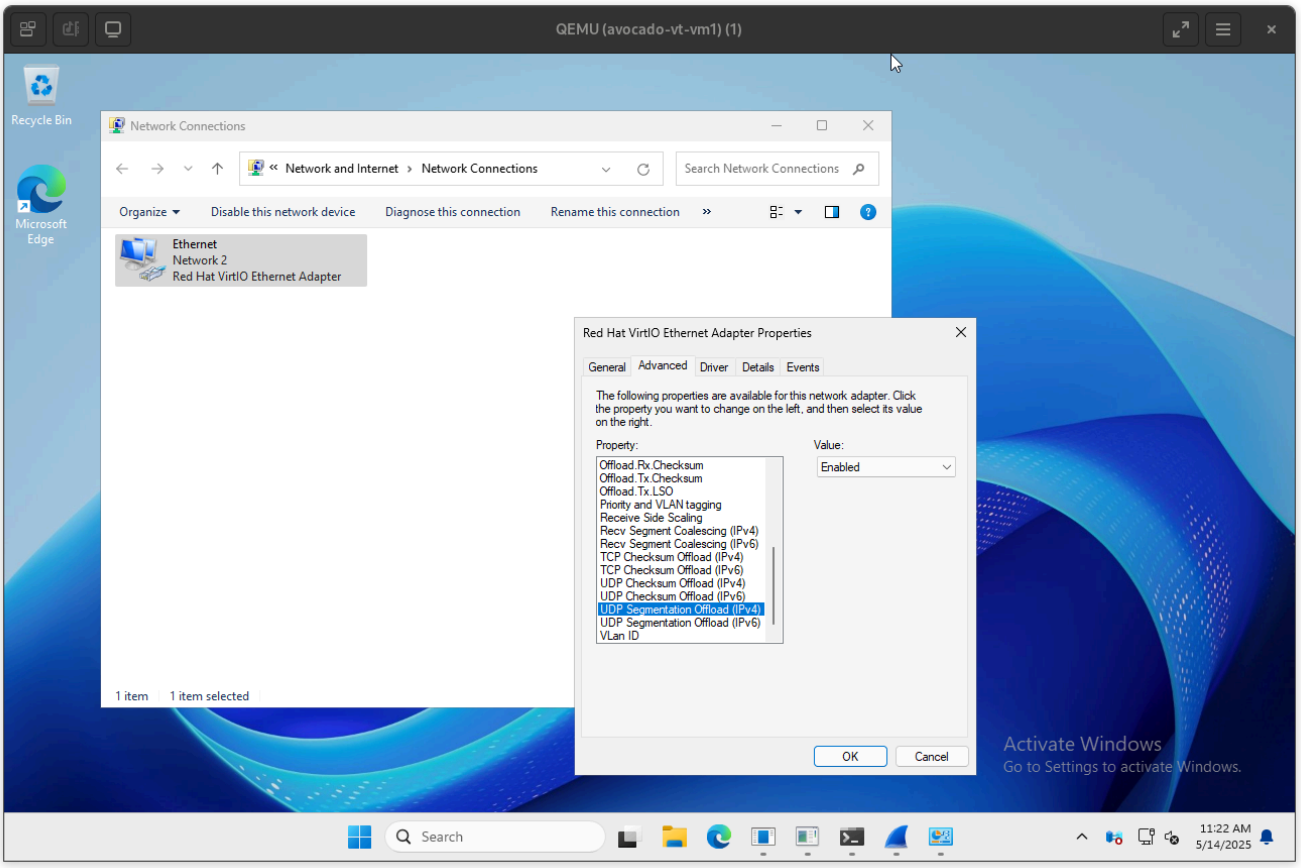
2. 网卡驱动版本



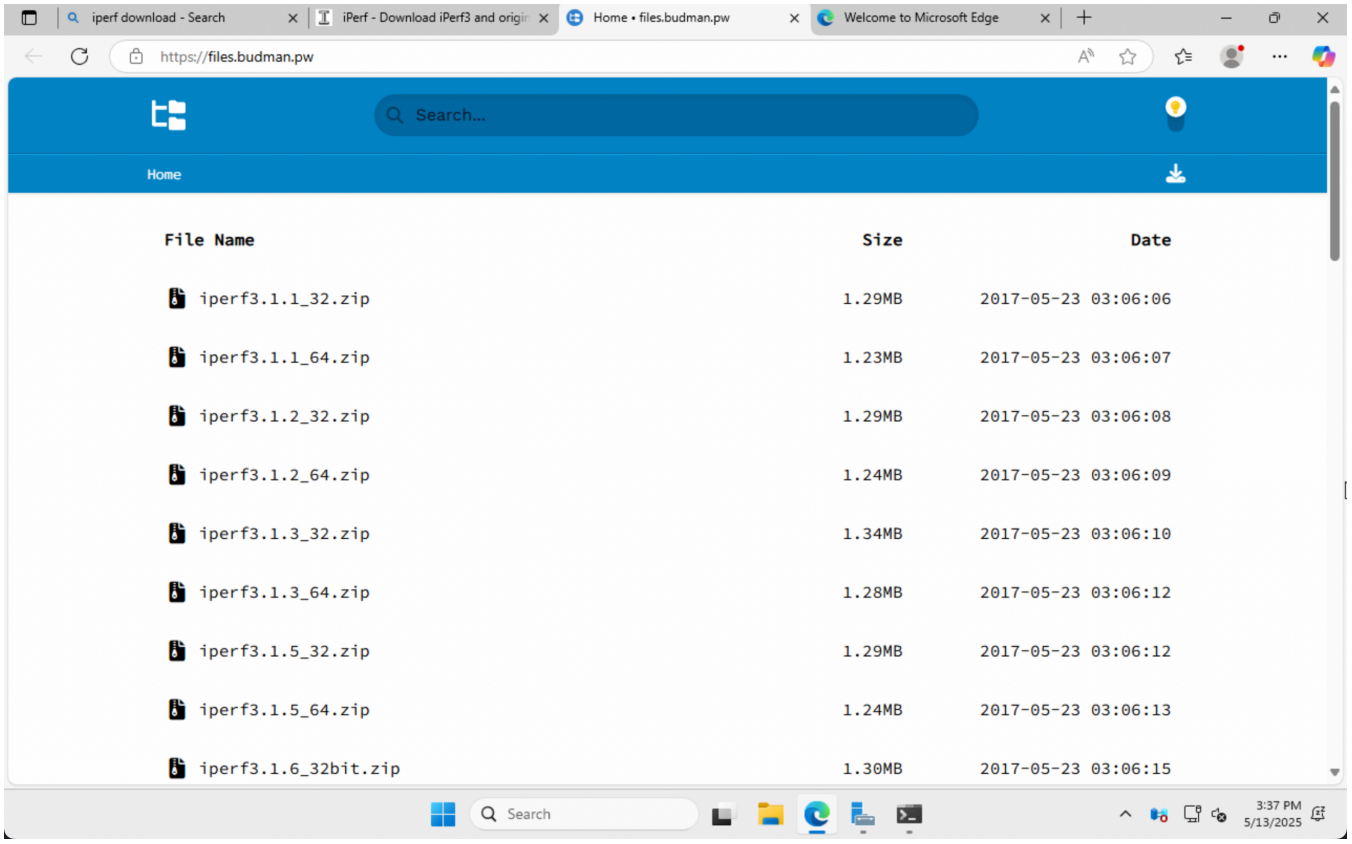
Tips: 目前客户可以拿到的最新的版本是： **virtio-win-1.9.45-0.el10_0.rpm** 需要将它解压后得到 **virtio-win-1.9.45-0.el10_0.iso** 并挂载到虚拟机内。

```
Name         : virtio-win
Version      : 1.9.45
Release      : 0.el10_0
Architecture : noarch
Size         : 258 M
Source       : virtio-win-1.9.45-0.el10_0.src.rpm
Repository   : beaker-AppStream
Summary      : VirtIO para-virtualized drivers for Windows(R)
URL          : http://www.redhat.com/
License      : Apache-2.0 AND BSD-3-Clause AND GPL-2.0-only AND GPL-2.0-or-later
Description  : VirtIO para-virtualized Windows(R) drivers for 32-bit and 64-bit
             : Windows(R) guests.
```

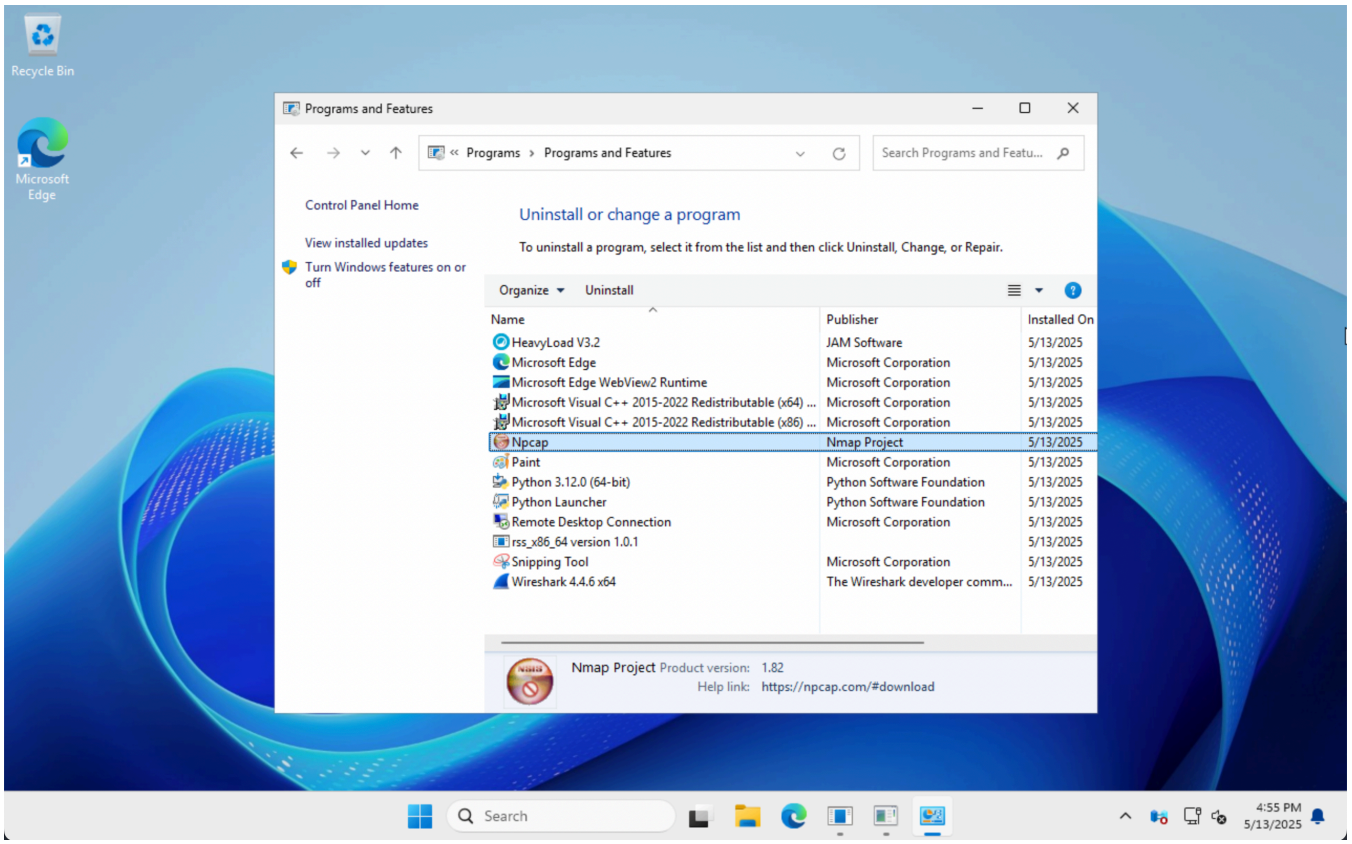




3. iperf3 测试工具



4. Wireshark & Winpcap 抓包工具



二、服务端配置

1. 系统环境

```
[root@dell-per750-51 ~]# cat /etc/redhat-release
Red Hat Enterprise Linux release 10.1 Beta (Coughlan)
[root@dell-per750-51 ~]# uname -r
6.12.0-74.el10.x86_64
[root@dell-per750-51 ~]# rpm -q qemu-kvm
qemu-kvm-10.0.0-1.el10.x86_64
```

2. 开启 Libvirt 服务

```
[root@dell-per750-51 ~]# systemctl enable libvirtd # 设置开机自启
[root@dell-per750-51 ~]# systemctl start libvirtd  # 立即启动服务
[root@dell-per750-51 ~]# virsh net-list            # 检查 libvirt Network 是否存在
 Name      State    Autostart   Persistent
----------------------------------------
 default   active   yes         yes

[root@dell-per750-51 ~]# ip addr show dev virbr0   # Linux 软件桥接（bridge）设备
16: virbr0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 9000 qdisc htb state UP group default qlen
1000
    link/ether 52:54:00:a7:62:4c brd ff:ff:ff:ff:ff:ff
    inet 192.168.122.1/24 brd 192.168.122.255 scope global noprefixroute virbr0
       valid_lft forever preferred_lft forever
[root@dell-per750-51 ~]#
```

3. 开启 iperf3 server 端

```
[root@dell-per750-51 ~]# iperf3 -s -p 12345
-----------------------------------------------------------
Server listening on 12345 (test #1)
-----------------------------------------------------------
```

4. 调整 MTU 数值

> “MTU” 是 “Maximum Transmission Unit” 的缩写，中文通常称为 “最大传输单元”。链路层 MTU 决定了“单帧”在一个网络跳（交换机→路由器→网卡）上传输时的最大长度（例如 1500 B 或 9000 B）。它指的是在一条链路层（例如以太网、Wi-Fi）上，单个数据帧（或包）的 最大 大小（以字节为单位），超过这个大小就必须拆分或分段才能发送。

- 默认 MTU：1500 字节

这是绝大多数传统以太网接口（包括大部分交换机和路由器）出厂时的标准设置，适用于 IPv4/IPv6 的一般流量。

- Jumbo Frame（巨型帧） MTU：常见 9000 字节

许多现代网卡和交换机支持将 MTU 调到更大，一般在 9000 B 左右，以降低分片开销、提升大流量吞吐（例如存储网络、虚拟化环境中常用）。

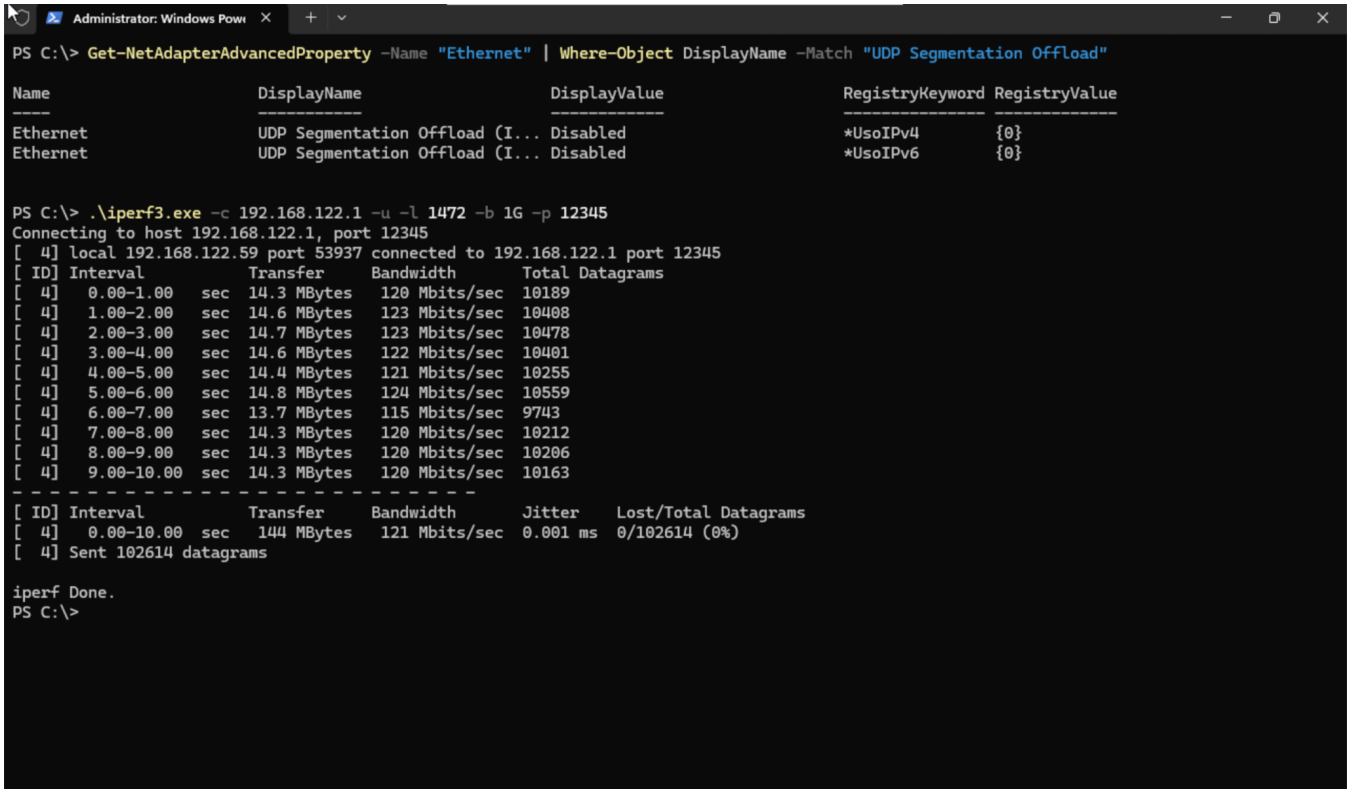
> 只要网络全链路都支持 jumbo frame，把 MTU 调大就能显著提速。

```
[root@dell-per750-51 ~]# ip link set virbr0 mtu 1500
[root@dell-per750-51 ~]# ip addr show dev virbr0
16: virbr0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc htb state UP group default qlen
1000
    link/ether 52:54:00:a7:62:4c brd ff:ff:ff:ff:ff:ff
    inet 192.168.122.1/24 brd 192.168.122.255 scope global noprefixroute virbr0
       valid_lft forever preferred_lft forever
[root@dell-per750-51 ~]#
[root@dell-per750-51 ~]# ip link set tap0 mtu 1500
[root@dell-per750-51 ~]# ip addr show dev tap0
31: tap0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc mq master virbr0 state UNKNOWN
group default qlen 1000
    link/ether 7e:59:e2:17:88:2e brd ff:ff:ff:ff:ff:ff
    inet6 fe80::7c59:e2ff:fe17:882e/64 scope link proto kernel_ll
       valid_lft forever preferred_lft forever
```

Tips: QEMU/KVM 给虚拟机分配网卡时，在 Host 创建一个 tap 二层设备，让 VM 的虚拟网卡被桥接到宿主机网络。没有开启虚拟机之前将不会存在。

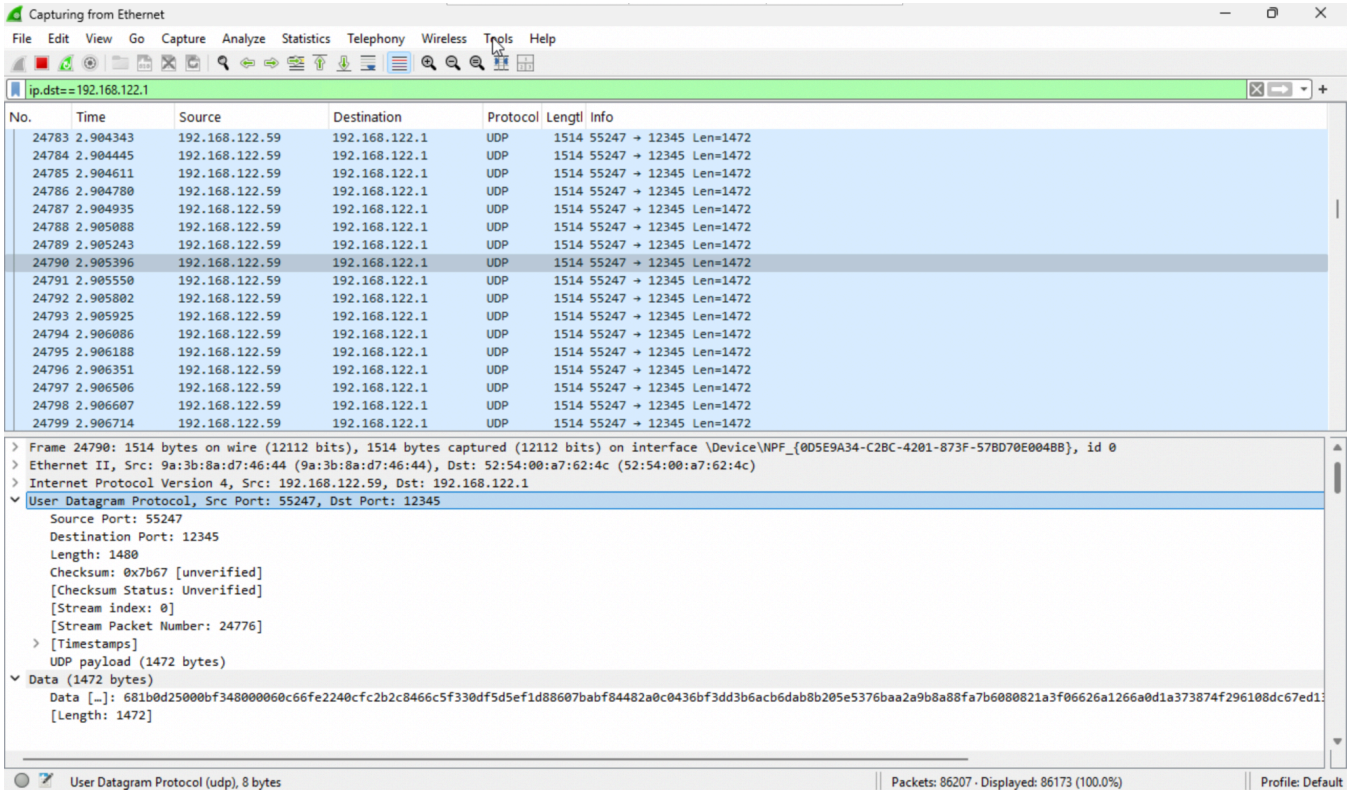
三、效果测试

1/3: 测试关闭 UDP Segmentation Offload 的 UDP 带宽

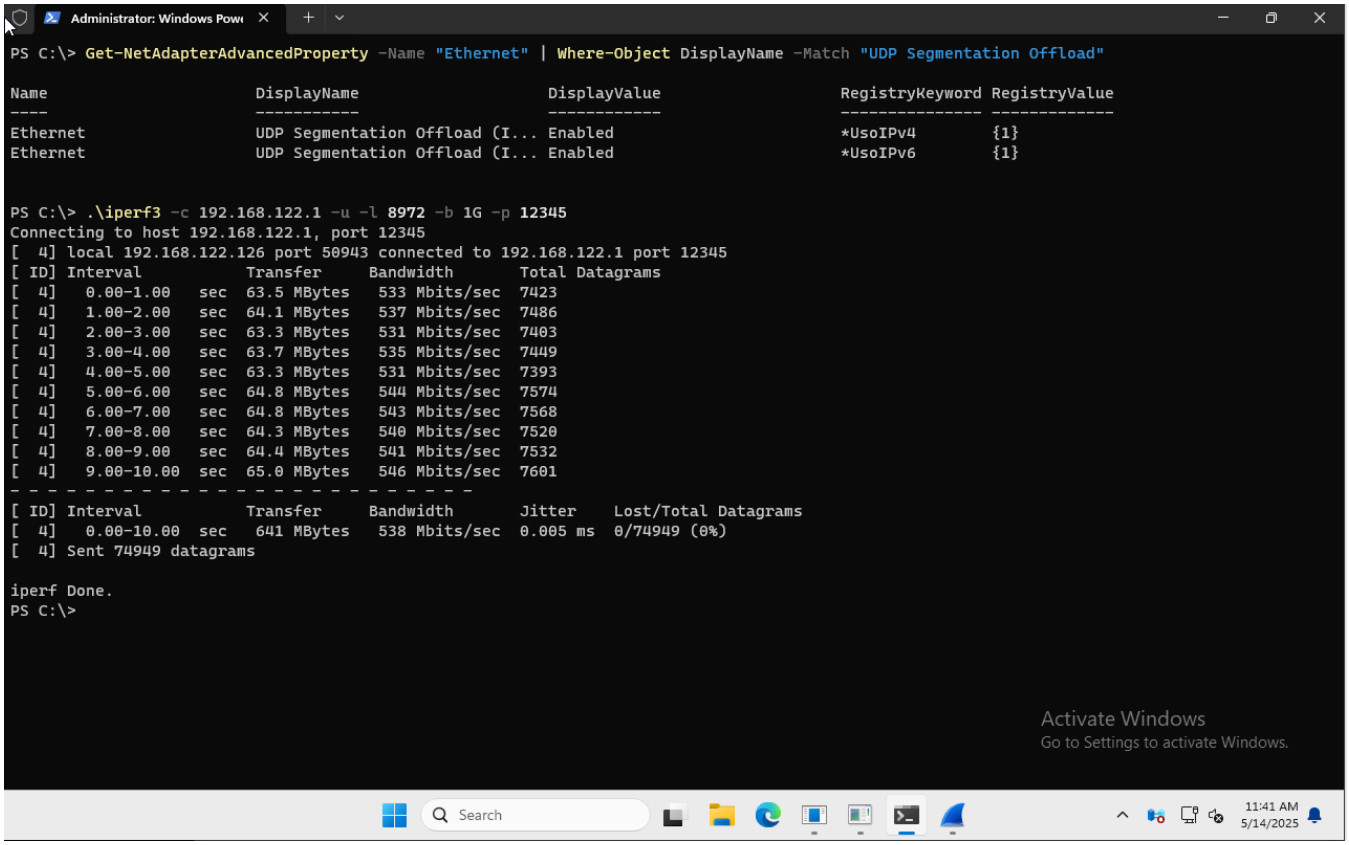


Attention: UDP 报文（包括 IP 头＋UDP 头＋UDP 载荷）总长度 ≤ 本跳链路的 MTU，就不会触发 IP 分片。

> **IPv4 + UDP**
>
> - IP 头 20 B，UDP 头 8 B
> - 最大 UDP 有效载荷 ≈ 1500 − 20 − 8 = **1472 B**



2/3: 测试打开 UDP Segmentation Offload 的 UDP 带宽 with 8972B data (Standard Mode)



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> **IPv4 + UDP**

- IP 头 20 B，UDP 头 8 B
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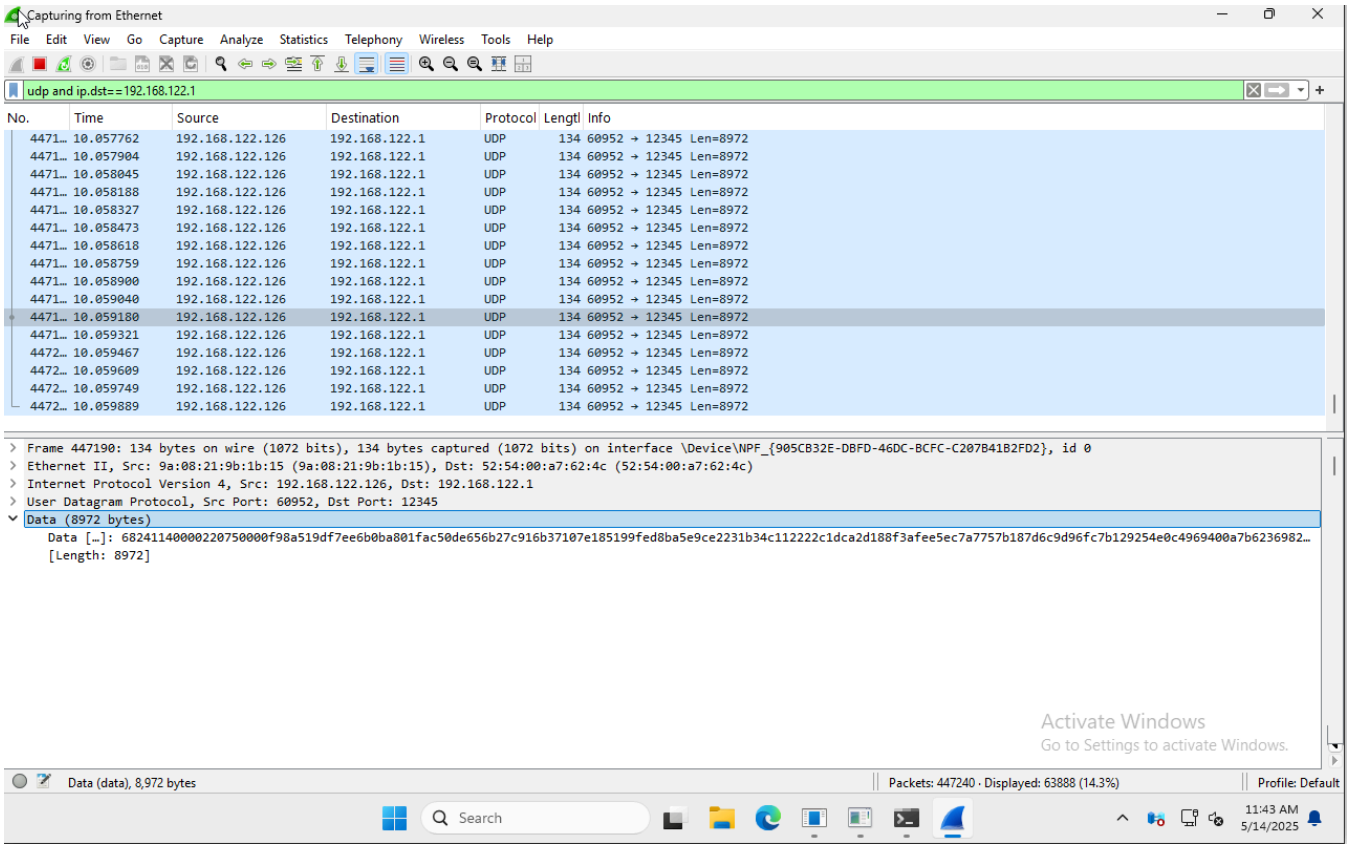
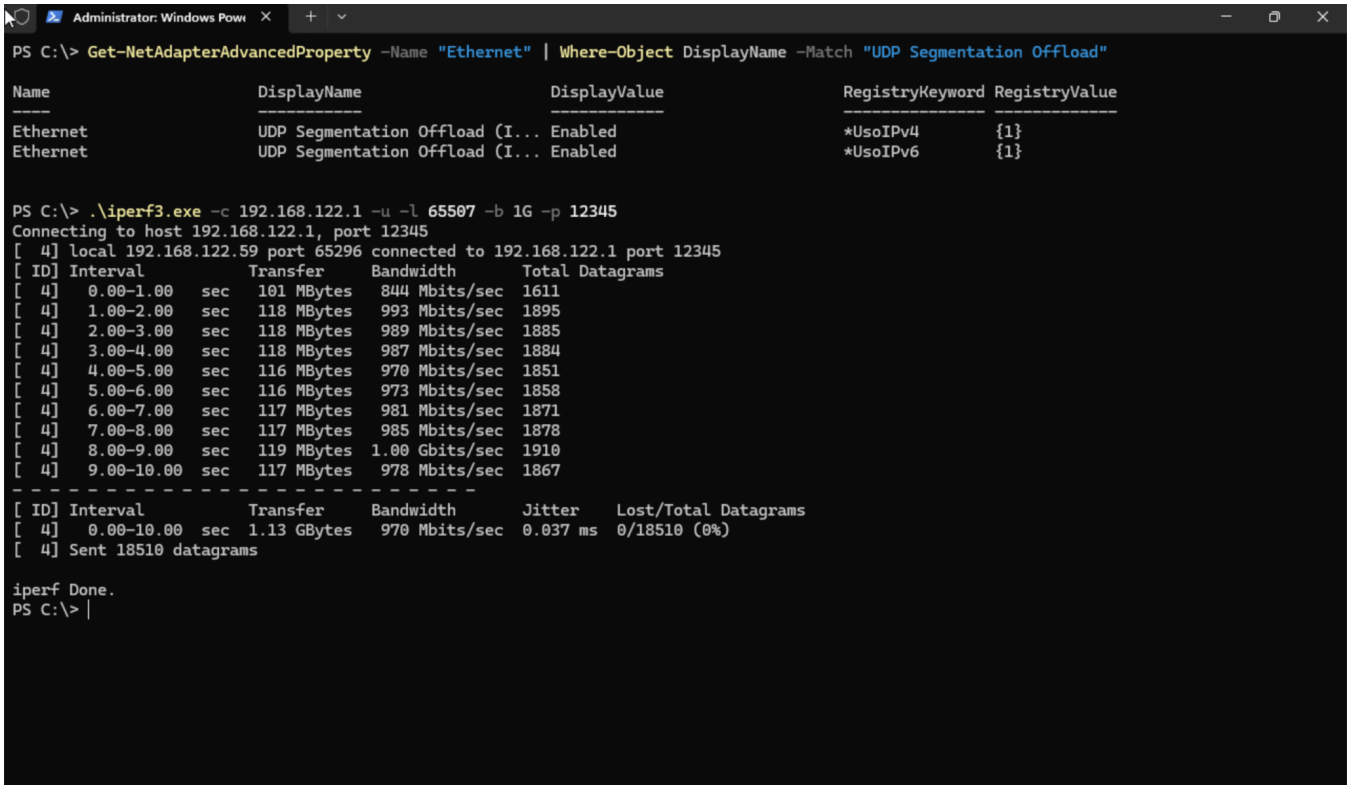
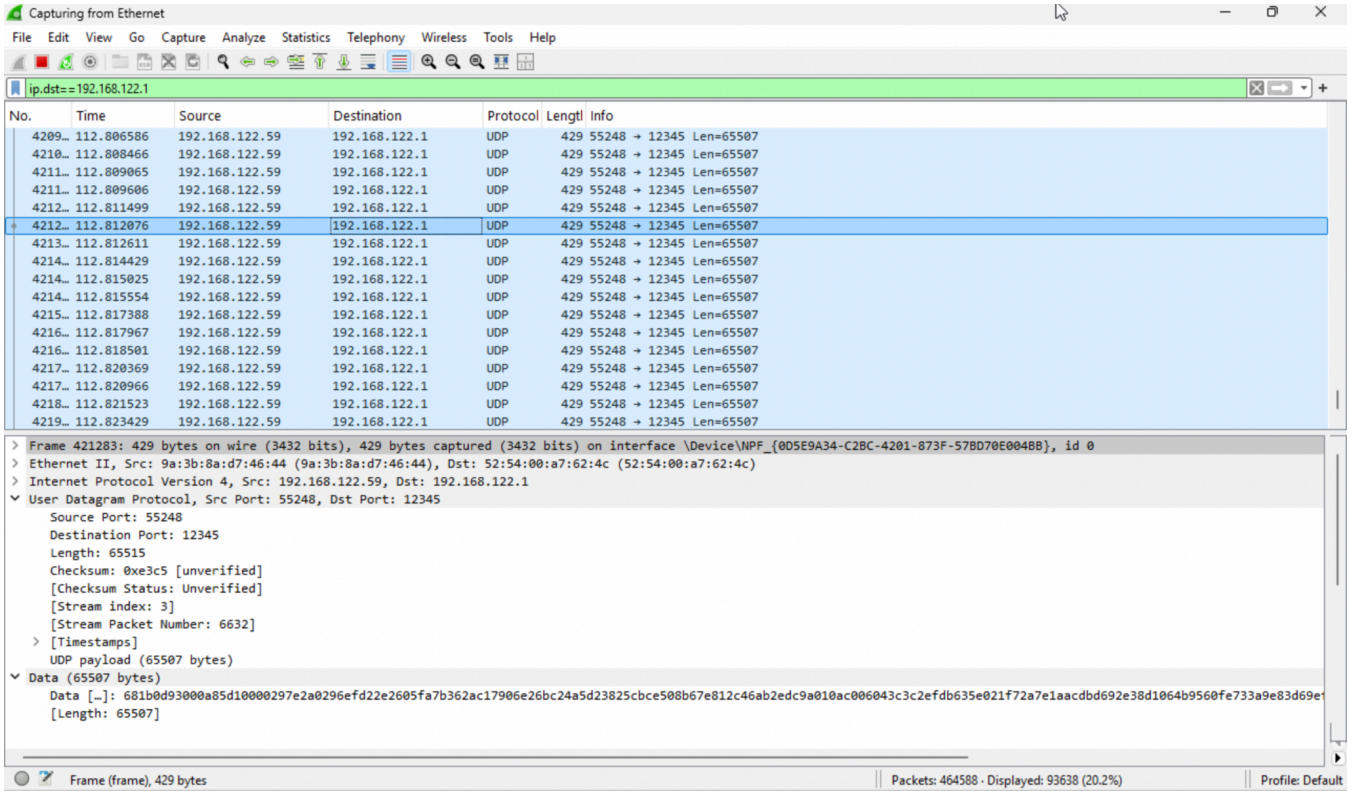


3/3: 测试打开 UDP Segmentation Offload 的 UDP 带宽 with 65507B data (Stress-test mode)



Attention: UDP 报文（包括 IP 头＋UDP 头＋UDP 载荷）总长度 > 本跳链路的 MTU，**会**触发 IP 分片。

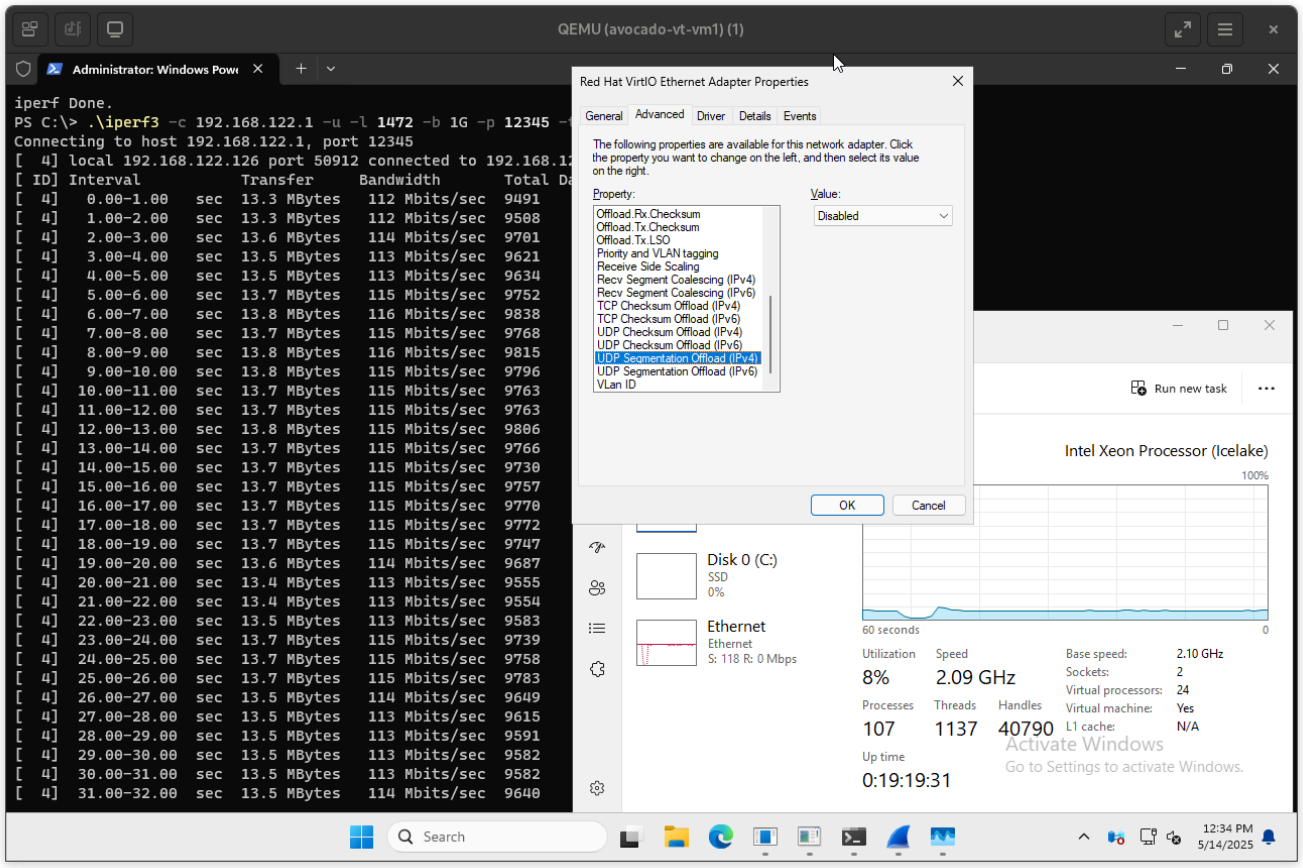
> **IPv4 + UDP**
>
> - IP 头 20 B，UDP 头 8 B
> - 最大 UDP 有效载荷 ≈ 65 535 − 20 − 8 = **65 507 B**



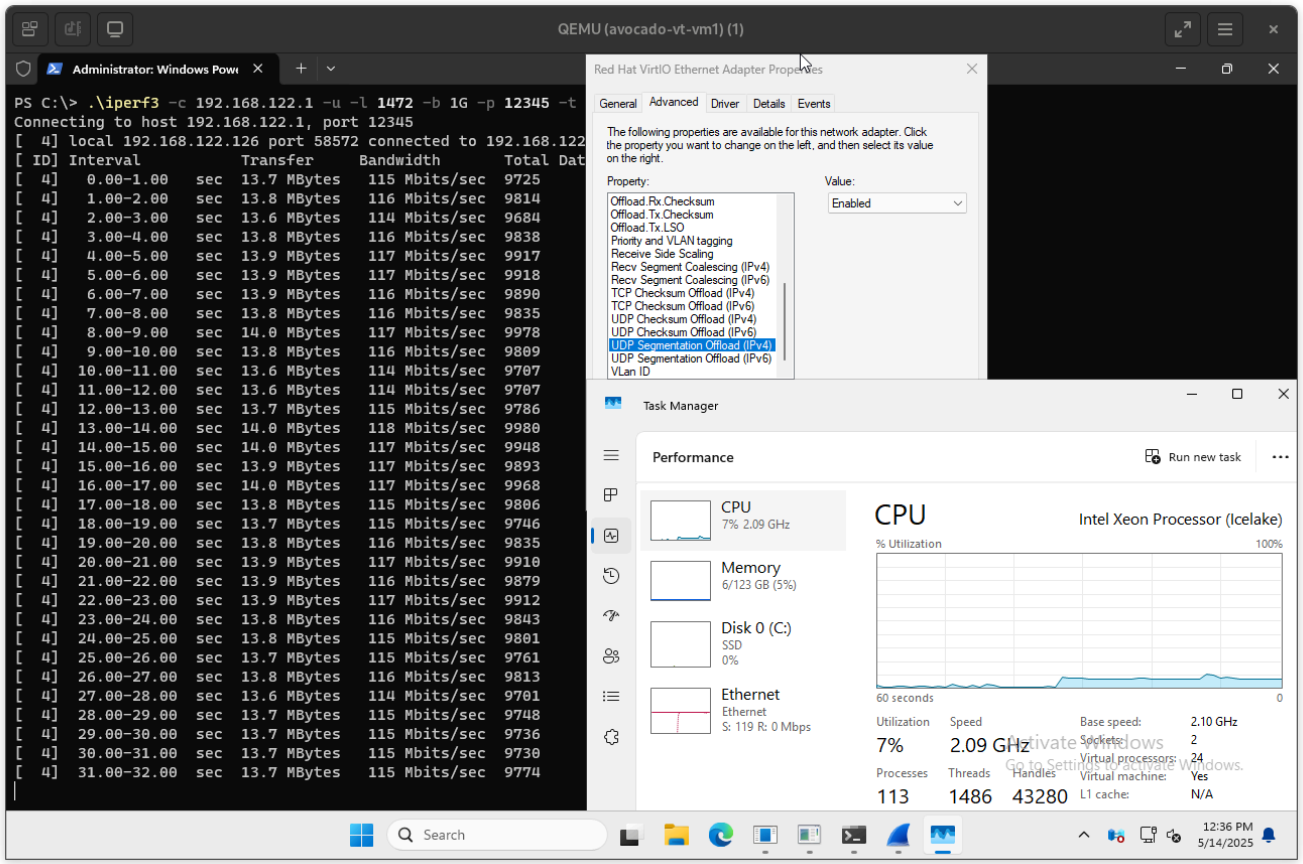
四、可能的提问。

Q0: CPU 利用率的问题

A0: 关闭 USO 后 CPU 利用率 8%



A0: 打开 USO 后 CPU 利用率 7%

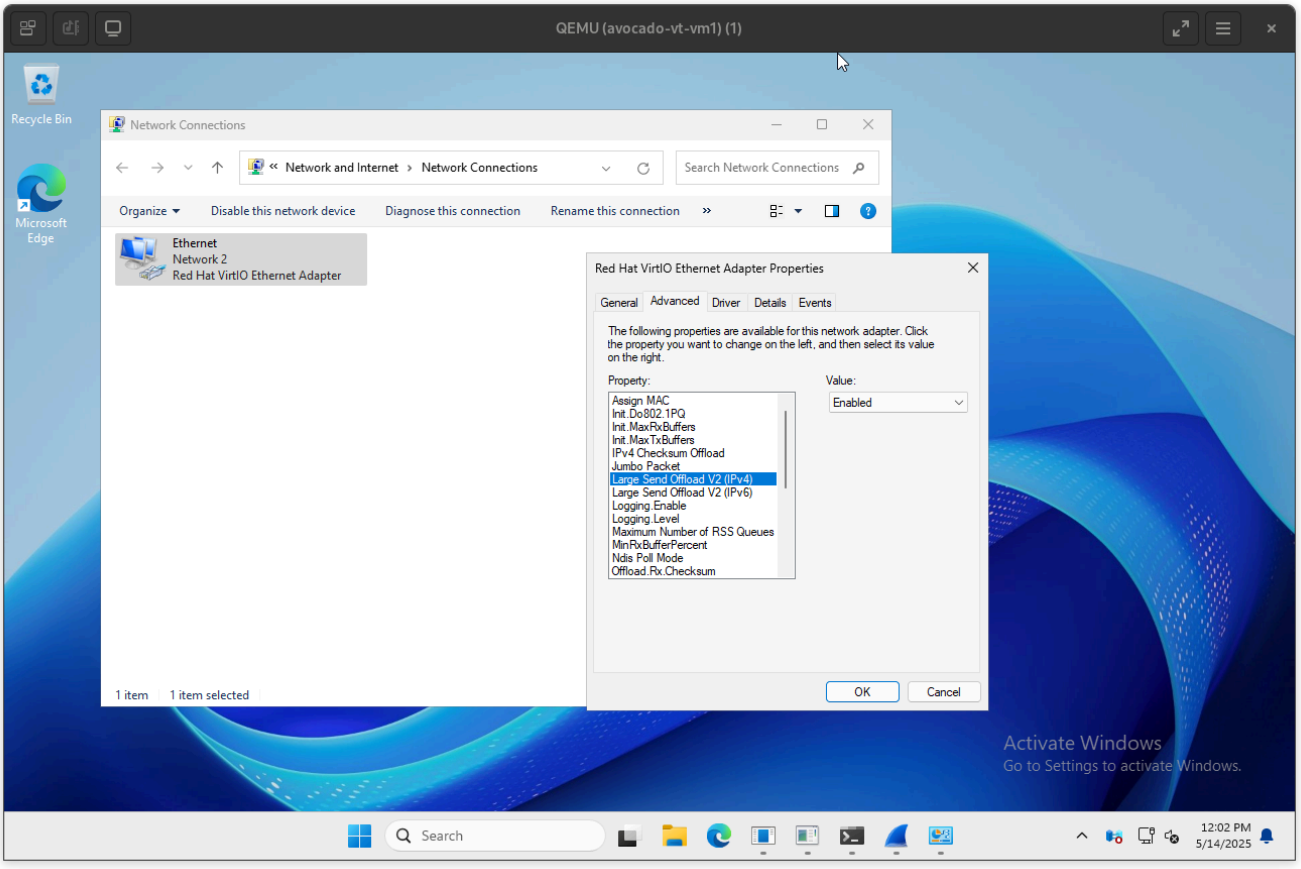


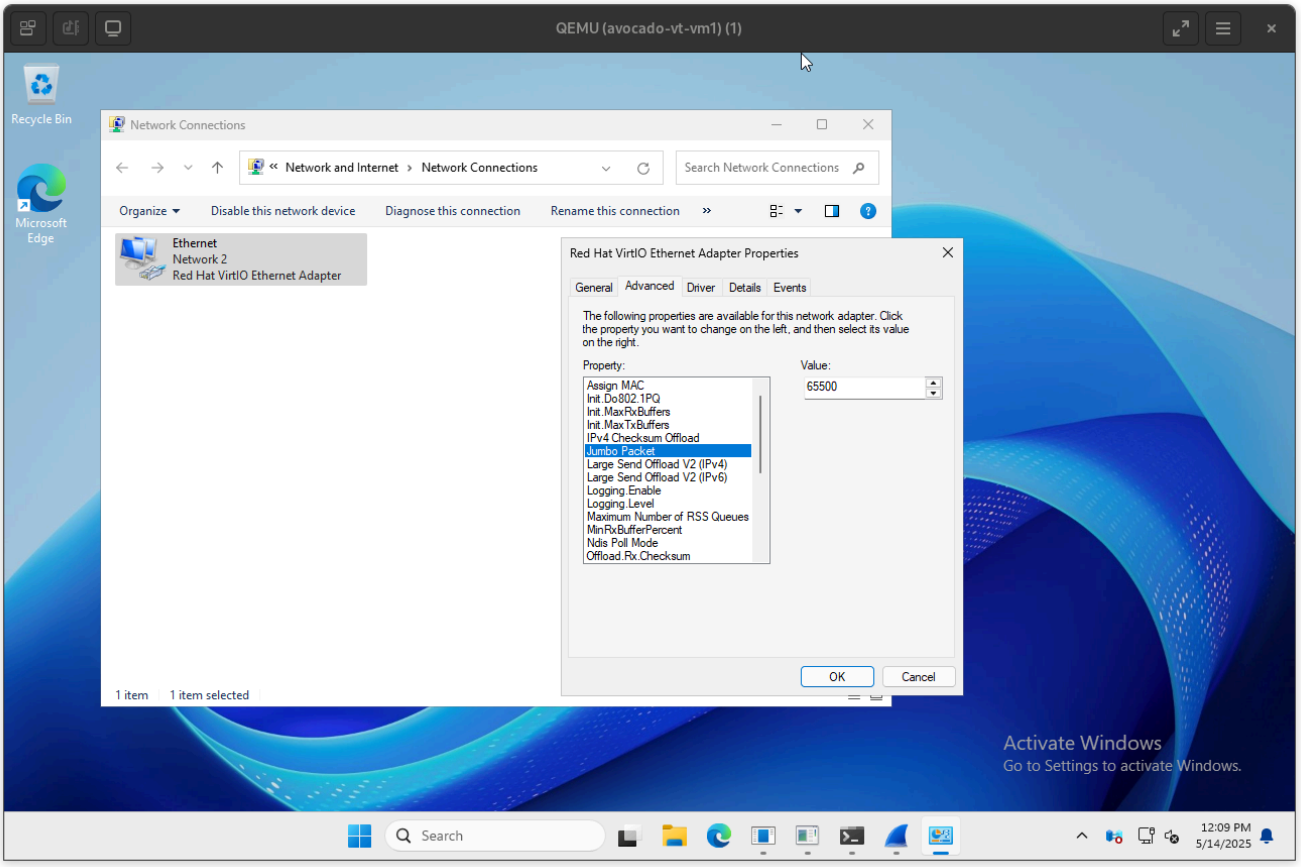
Q1: RHEL 的 UDP offload 支持吗？

A1：我不测试 RHEL 不是很清楚。昨天和 RHEL network 的 feature owner 确定还不支持。可以通过 ethtool 列举网卡的选项。

Q2. Windows 的 TCP offload 支持吗？

A2: 支持的




QEMU (avocado-vt-vm1) (1)
Recycle Bin
Microsoft Edge
Network Connections
Network and Internet › Network Connections
Search Network Connections
Organize
Disable this network device
Diagnose this connection
Rename this connection
Ethernet
Network 2
Red Hat VirtIO Ethernet Adapter
1 item
1 item selected
Red Hat VirtIO Ethernet Adapter Properties
General
Advanced
Driver
Details
Events
The following properties are available for this network adapter. Click the property you want to change on the left, and then select its value on the right.
Property:
Value:
Assign MAC
Init.Do802.1PQ
Init.MaxRxBuffers
Init.MaxTxBuffers
IPv4 Checksum Offload
Jumbo Packet
Large Send Offload V2 (IPv4)
Large Send Offload V2 (IPv6)
Logging.Enable
Logging.Level
Maximum Number of RSS Queues
MinRxBufferPercent
Ndis Poll Mode
Offload.Rx.Checksum
65500
OK
Cancel
Activate Windows
Go to Settings to activate Windows.
Search
12:09 PM
5/14/2025