



Linux and Windows Performance Optimizations for Optimal Use of GigE Cameras

**Tuning of operating systems, network interface
connectors and GigE Vision cameras**



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1. Introduction

Under certain circumstances — especially on Linux-based ARM systems — operating GigE cameras with the default camera and operating system settings may result in camera connection loss, dropped images, increased CPU load, and higher latency.

This FAQ describes the parameters that can be adjusted to achieve the best possible performance.



2. Windows Settings

The parameters described below should be configured in the settings of your network interface adapter.

Parameter	Description
Jumbo Packet Size	The size of jumbo packets, i.e., Ethernet packets that exceed the standard packet size of 1518 bytes. Set this to the maximum possible value, e.g., 16000 bytes.
Receive Buffers	The amount of system memory that can be used by the adapter for received packets. Set this to the maximum possible value, or to 2048 if the driver does not provide a registry setting.
Interrupt Moderation	Set this to On, if available.
Interrupt Moderation Rate	The number of interrupts per second. Set this to Extreme, or to the current value if the driver does not provide a registry setting.
Receive Side Scaling	Enables Receive Side Scaling (RSS). RSS balances receive traffic across multiple CPUs or CPU cores. It also sets the Receive Side Scaling Queues to 1. This is recommended when low CPU utilization is required. The RSS setting has no effect if your system has only one processing unit.

Information

If you experience buffer underruns or unexpected packet drops — for example, when running an area-scan camera in “line-scan mode,” i.e., with a small ROI height — change the Interrupt Moderation Rate (IMR) setting.

- First, try setting the IMR to Low or Minimal. This may result in higher CPU load, but it services buffers faster and requires fewer ring buffers.
- If you require low-latency performance and do not care about CPU load, you can disable interrupt moderation entirely, which enables interrupts to fire as quickly as possible. To do so, set the IMR to Disabled or Off.



3. Linux Settings

On Linux, the `ethtool` package must be installed. If necessary, install it using the following command:

```
sudo apt install ethtool
```

Parameter	Description
Maximum Transmission Unit (MTU)	The largest size of an Ethernet packet that can be sent over a TCP/IP networking connection. Set it to the maximum possible value, e.g., 16000 bytes: <pre>sudo ifconfig eth0 mtu 16000</pre>
rtprio	Modifies whether a process has real-time or idle priority. Set this to the maximum possible value: <pre>* - rtprio 99</pre> in <code>/etc/security/limits.conf</code>. This requires logging off and on or PC reboot.
rp_filter	Can be used to check the routing table against the source address of incoming packets. This ensures that packets are coming from the interface as defined in the routing table. To check whether filtering is enabled, run: <pre>sysctl -a 2>/dev/null grep '\.rp_filter'</pre> In the output, look for: <pre>net.ipv4.conf.all.rp_filter=1 net.ipv4.conf.eth1.rp_filter=1</pre> Here, “eth1” is the network adapter to which the camera is connected. The <code>net.ipv4.conf.all.rp_filter</code> parameter is a global switch that must be turned off. The <code>net.ipv4.conf.eth1.rp_filter</code> parameter indicates whether filtering is enabled for the specified network adapter. To disable filtering, you must first turn it off for “all” and for the specific network adapter (in this example, “eth1”). Use the following commands to change the filtering behavior at runtime:



```
sudo sysctl net.ipv4.conf.all.rp_filter=0
sudo sysctl net.ipv4.conf.eth1.rp_filter=0
```

Restart your application and check whether the camera(s) are detected. Reconfigure the camera(s) and use “Write Configuration” to make your changes persistent.

You can re-enable filtering by executing the same commands with a value of 1. To turn off filtering permanently, edit the corresponding values in `/etc/sysctl.conf`.

rmem_max	The size of the buffer that receives UDP packets (default: 208 KByte). In <code>/etc/sysctl.conf</code>, set: <pre>sudo sysctl -w net.core.rmem_max=33554432</pre>
Ring buffer	The ring buffer is a circular buffer that stores incoming packets to prevent buffer overflow. <code>ethtool</code> must be installed before this parameter can be set. Set it to 4096 for every GigE adapter: <pre>sudo ethtool -G ethX rx 4096 tx 4096</pre>
Interrupt Moderation Rate	The number of interrupts per second. <code>ethtool</code> must be installed before this parameter can be set. Set it to 84 for every GigE adapter: <pre>sudo ethtool -C ethX adaptive-rx off adaptive-tx off rx-usecs 84 tx-usecs 84</pre>

Information

You may have to reboot your computer after applying the optimizations.

If you experience buffer underruns or unexpected packet drops—for example, when running an area-scan camera in line-scan mode—change the Interrupt Moderation Rate (IMR) setting.

Note: these settings typically apply to modern Intel NICs:

- First, try setting the IMR to 62 μ s. Open a command line and enter:

```
sudo ethtool -C ethX adaptive-rx off adaptive-tx off rx-usecs 62 tx-usecs 62
```

- If you require low-latency performance and do not care about CPU load, you can disable interrupt moderation entirely, which enables interrupts to fire as quickly as possible. Open a command line and enter:

```
sudo ethtool -C ethX adaptive-rx off adaptive-tx off rx-usecs 0 tx-usecs 0
```



4. Camera Settings

Increase or Check the Packet Size

When Jumbo Frames are enabled on the NIC, the camera's packet size must also be configured appropriately to benefit from larger packets.

Our driver automatically sets the packet size for you, so in most cases no manual configuration is required. However, if you want to check the current setting or change it manually, you can do so as follows.

If you are working with IC Capture 4, first select and open a GigE camera. In "Dialogs" > "GenICam Settings" > "Guru," expand the "Device Control" parameter group and check or change the "Device Stream Channel Packet Size" parameter.

A value of 9000 or higher is recommended when using Jumbo Frames.

If you are writing your own application, you can use the camera API to read or set the:

`DeviceStreamChannelPacketSize`

parameter. When using Jumbo Frames, a value of 9000 or higher is recommended.

When using Jumbo Frames, make sure your network infrastructure supports them. If you are using switches and/or routers, you may also need to configure them to enable Jumbo Frames.



Revision History

Document Number	Date	Changes
AN20260918-01	18 September 2026	Initial/draft release version of this document.



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