Optimizing Performance: Intel® Network Adapters User Guide

Network Optimization Types

When optimizing network adapter parameters (NIC), the user typically considers one of the following three conditions for the imaging system. These NIC parameter options, as related to the Genie TS, are described in more detail in this document.

Optimized for Quick Response and Low Latency

- Disable Jumbo Packets
- Minimize or disable Interrupt Moderation Rate
- Disable Offload TCP Segmentation
- Increase Transmit Descriptors
- Increase Receive Descriptors

Optimized for Throughput

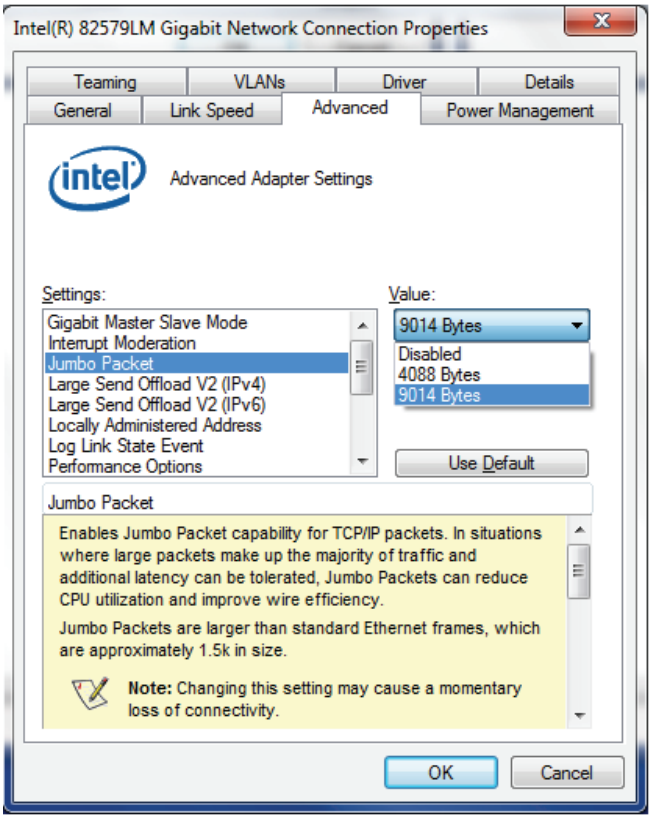
- Enable Jumbo Packets
- Increase Transmit Descriptors
- Increase Receive Descriptors
- Receive Side Scaling
- Reduce Interrupt Moderation Rate

Optimized for CPU Utilization

- Maximize Interrupt Moderation Rate
- Keep the default setting for the number of Receive Descriptors; avoid setting large numbers of Receive Descriptors.

About Jumbo Packets:
Packet Size/MTU (Maximum Transmission Unit)

The menu below shows the network adapter settings for the "Jumbo Packet" parameter. By default the adapter driver disables jumbo packets.



Third Party Technical Reference

The paper presented by the Ethernet Alliance provides a technical resource when determining the need for jumbo packets.

http://www.ethernetalliance.org/wp-content/uploads/2011/10/EA-Ethernet-Jumbo-Frames-v0-1.pdf

The Pros to Using Jumbo Packets (MTU)

Networks with good Ethernet connections, which minimize conditions that cause packet resends, are good candidates for the use of Jumbo Packets (larger MTU). Jumbo Packets provide greater efficiency in data transmission, since each frame carries more user data with the same fixed protocol overhead and underlying packet delays.

Use of Jumbo Packets results in fewer frames being sent across the network. Fewer frames results in less host system CPU processing providing greater system throughput. Overall, a quality network will support a higher continuous camera frame rate.

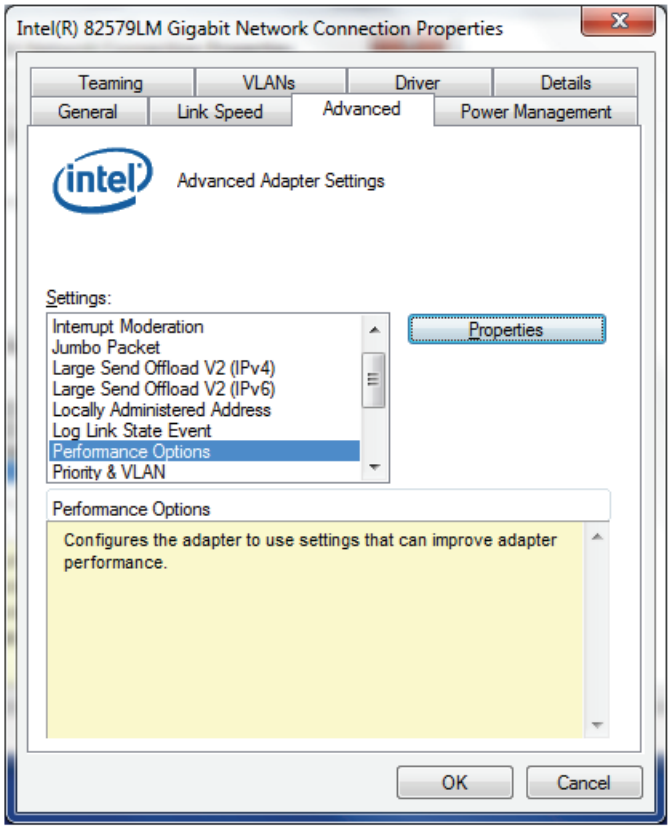
The Cons to Using Jumbo Packets (MTU)

While large frames provide greater efficiencies, they also cause greater lag time and latencies over the network. Any packet resends have a larger impact in average throughput.

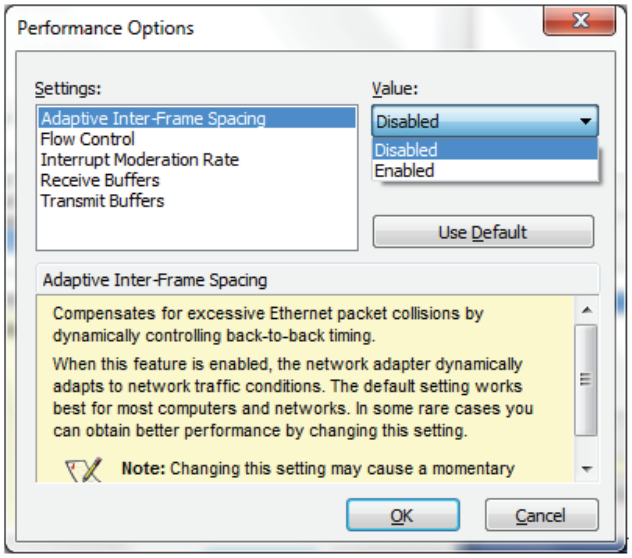
Large frames may also fill buffer queues within network equipment between the camera and host computer. Multiple cameras connected to an Ethernet switch, typically require the switch to support the PAUSE frame control, which in turn implies that the network equipment has sufficient buffers to maintain continuous camera acquisitions.

Performance Optimization Controls

Select Performance Options, then click Properties configure NIC optimization settings. A short description follows the screen images.



Adaptive Inter-Frame Spacing

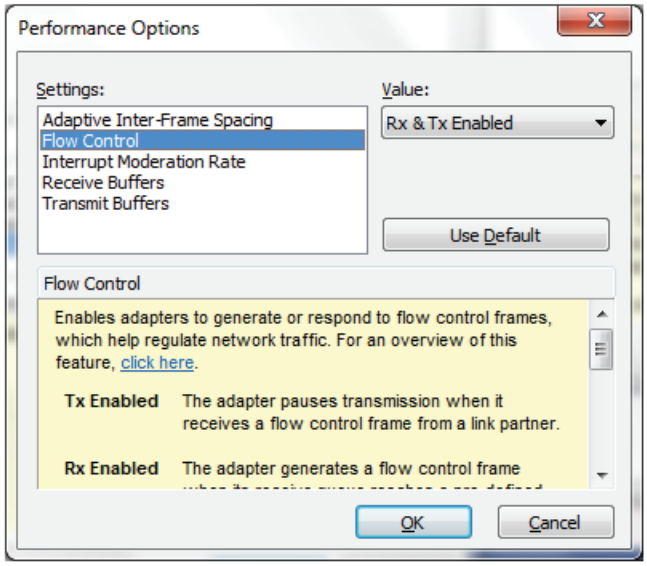


Adaptive Inter-Frame Spacing (IFS) enables the network adapter to dynamically adapt to network traffic conditions. IFS defines the space between Ethernet frames which is a required gap between Ethernet frames.

Allowing a shorter gap increases the number of frames per a specific time period, but with the possibility of frames being too close together where they are not detected as individual frames, forcing a packet resend.

Adaptive Inter-Frame Spacing is disabled by default. With gigabit networks performance gains are minimal especially with buffered Ethernet equipment.

Flow Control

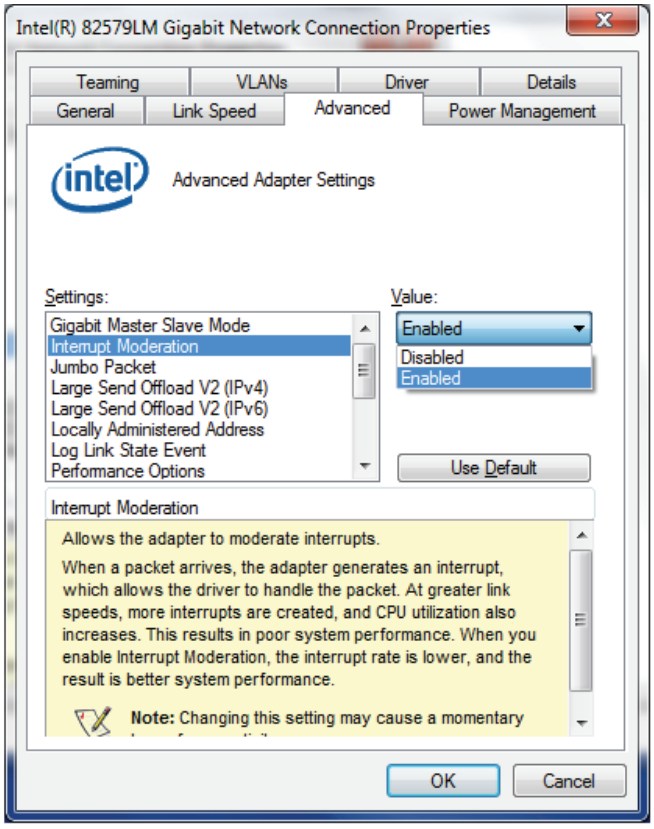


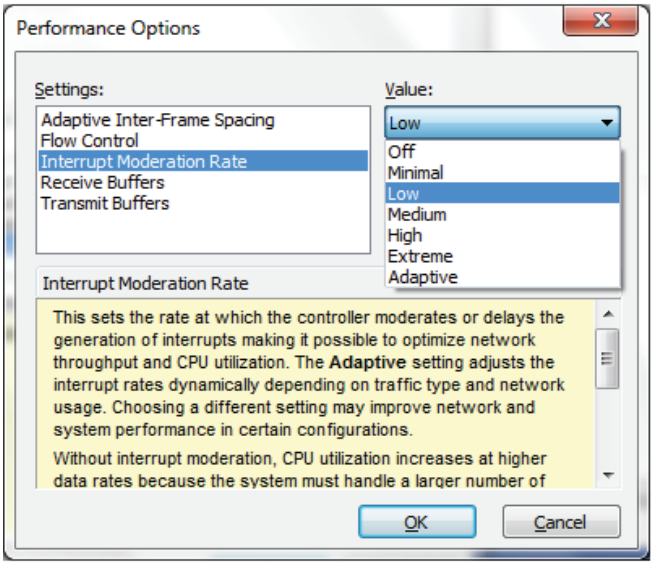
Enable Flow control in the NIC when the imaging network is comprised of multiple cameras connected to a switch which supports PAUSE Frame to manage network traffic.

The NIC or Ethernet switch can become overloaded if incoming frames (from multiple cameras) arrive faster than the device can process them. The flow control mechanism eliminates the risk of lost frames.

The downside to managed network traffic is that the Pause Frame control will reduce the absolute maximum transfer bandwidth possible on the network.

Interrupt Moderation Rate





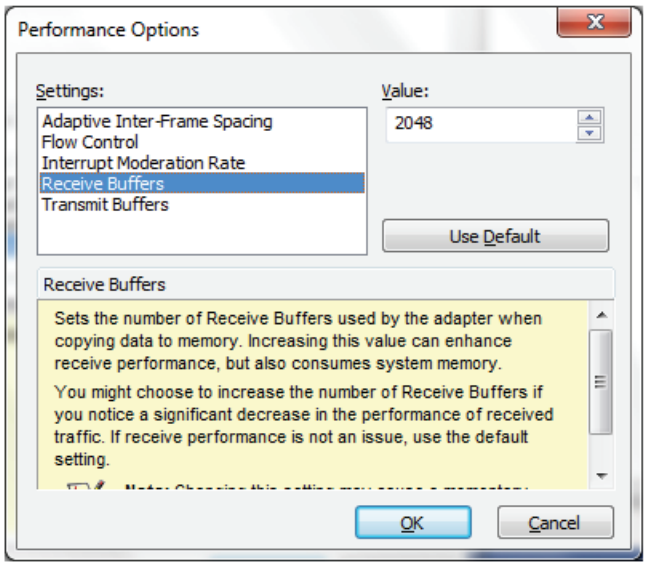
The Interrupt Moderation Rate parameter is used to manage the rate of CPU interrupts. By default the NIC driver sets this to 'Adaptive' where the interrupt rate automatically balances packet transmission interrupts and host CPU performance.

In most cases no manual optimization of the Interrupt Moderation Rate parameter is required. In some conditions, video frames from the GigE Vision camera may be transferred to host display or memory buffer as data bursts instead of a smooth continuous stream. The NIC may be over moderating acquisition interrupts to avoid over-loading the host CPU with interrupts. If priority is required for acquisition transfers (i.e. a more real-time system response to the camera transfer), the moderation rate should be reduced by manually adjusting the NIC parameter.

Interrupt Moderation Rate Options are:

- **Adaptive** — (ITR = -1), no interrupts/sec defined, dynamically changed
- **Off** — (ITR = 0), no limit
- **Minimal** — (ITR = 200 interrupts/sec)
- **Low** — (ITR = 400 interrupts/sec)
- **Medium** — (ITR = 950 interrupts/sec)
- **High** — (ITR = 2000 interrupts/sec)
- **Extreme** — (ITR = 3600 interrupts/sec)

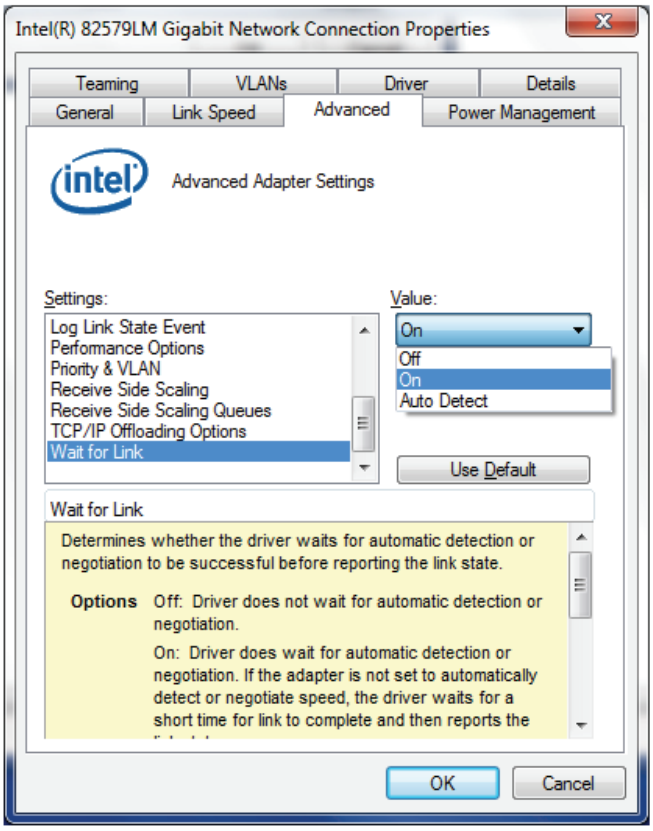
Receive Buffers



Receive Buffers are allocated in system memory by the NIC driver. When the host computer CPU is busy with tasks other than the imaging application, incoming image packets remain in the PC memory buffers allocated to store packets instead of immediately being copied into the image application buffers.

By increasing the NIC host buffers, more incoming image packets can be stored by the NIC before it must start discarding them. This provides more time for the PC to switch tasks and move image packets to the image buffer.

Wait for Link

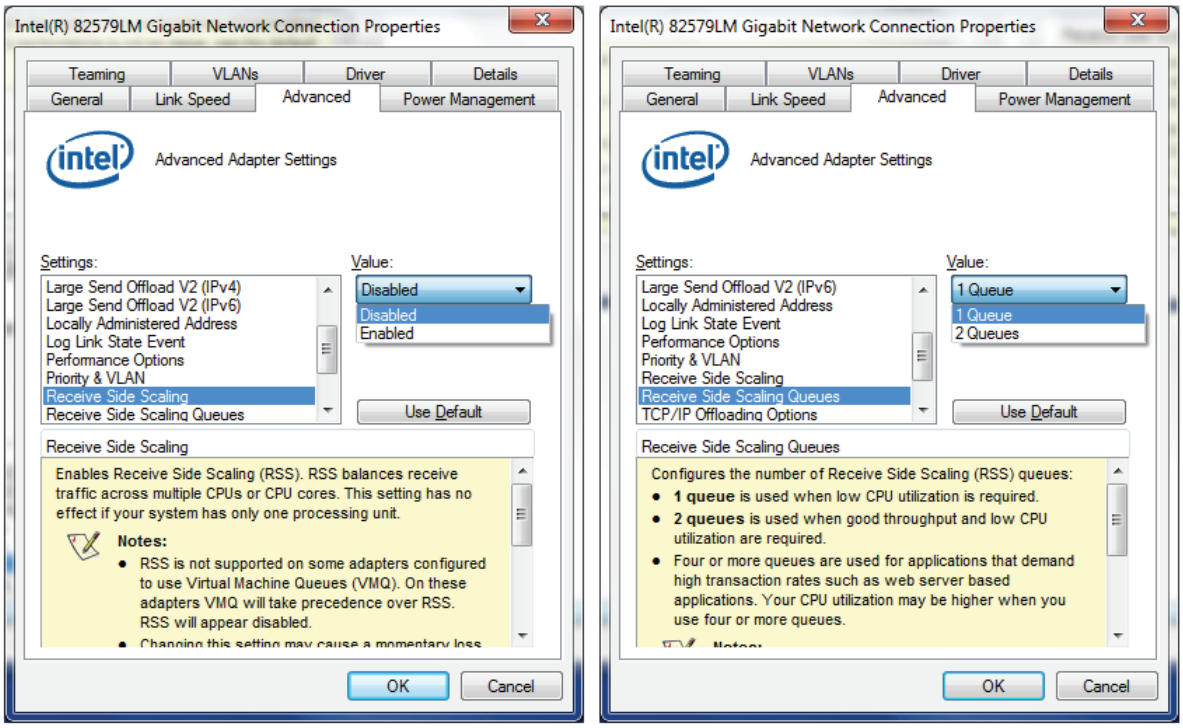


The Wait for Link parameter defines how the driver waits for Auto Negotiation to be successful before reporting the link state. Auto Detect is recommended for camera applications.

Intel NIC adapter options are:

- Off — Driver does not wait for Auto Negotiation
- On — Driver waits for Auto Negotiation. If the speed is not set to Auto Negotiation, the driver waits for a short time for link to complete and then reports the link state.
- Auto Detect — Automatically set to On or Off depending on speed and adapter type when the driver is installed.

Receive Side Scaling



Receive Side Scaling enables multiple CPU cores (multi-core CPUs are common in current host systems), to manage received Ethernet frames, which improves system cache utilization.

If your NIC supports Receive Side Scaling, enable the feature and select 2 queues, which provides good throughput and low CPU utilization.

TCP/IP Offloading Options

- The UDP Checksum Offloading option needs to be kept disabled for compatibility with the Teledyne DALSA Filter Driver.