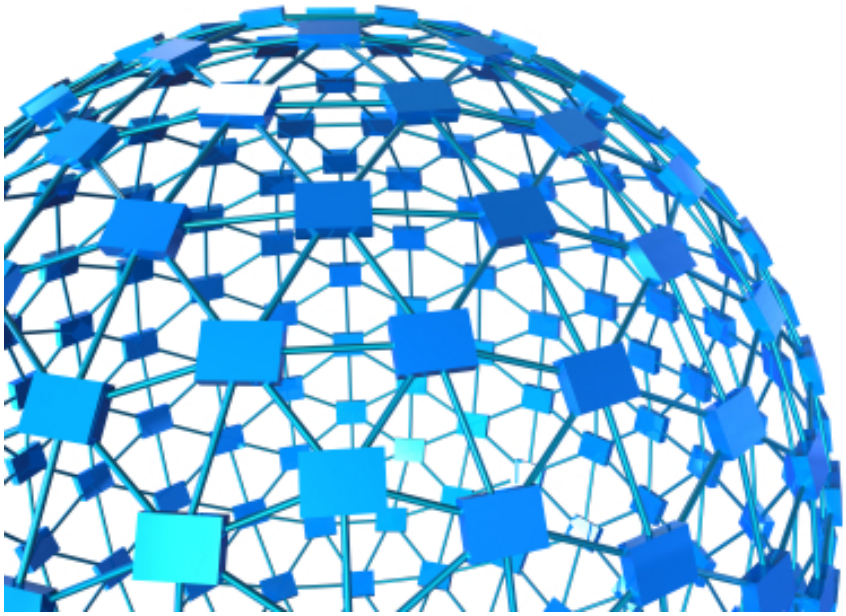
Network Imaging Module for Sapera LT

User's Manual

Edition 2.11

sensors | cameras | frame grabbers | processors | **software** | vision solutions



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NOTICE

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About Teledyne DALSA

Teledyne DALSA is an international high performance semiconductor and electronics company that designs, develops, manufactures, and markets digital imaging products and solutions, in addition to providing wafer foundry services.

Teledyne DALSA Digital Imaging offers the widest range of machine vision components in the world. From industry-leading image sensors through powerful and sophisticated cameras, frame grabbers, vision processors and software to easy-to-use vision appliances and custom vision modules.

Teledyne DALSA is based in Waterloo, ON, Canada, the company has operations in Montreal, QC; Bromont, QC; Eindhoven, NL; Munich, Germany and Tokyo, Japan.

Contents

Network Imaging Module Overview

Description

The Teledyne **DALSA Network Imaging Module** is the underlying networking component of the Genie Framework series and the Generic GigE Vision Framework. It is included with Sapera LT 8.01 or later. The user selects to install the package via a tick box show during the Sapera installation.

Default settings typically are adequate for GigE Vision camera installations. This manual describes the Teledyne DALSA Network Configuration Tool and how to fine tune network settings to optimize camera installations for differing applications.

The **Teledyne DALSA Network Configuration Tool** is a central user control for GigE Vision networking parameters. This tool provides information on all network adapters installed in the system and any connected GigE Vision cameras. The tool allows assigning a device User-Defined name, setup a DHCP server or setting a Persistent IP address instead of the default DHCP/LLA assigned IP address. Using this tool, camera network configurations are made without having to use any Windows Control Panel application.

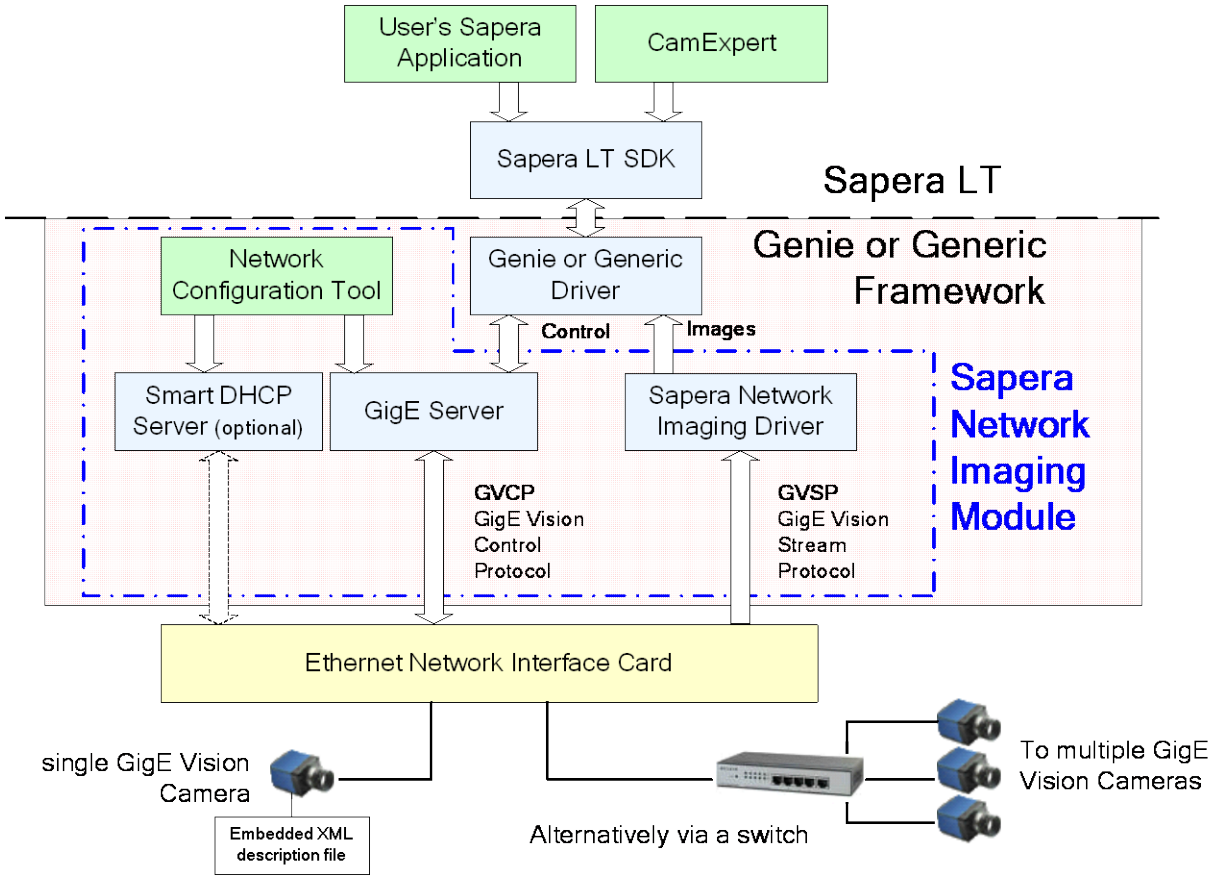
Supported Industry Standards

100% compliant with the GigE Vision 1.0 specification which defines the communication interface protocol used by any GigE Vision device. The device description and capabilities are contained in an XML file. For more information see:
http://www.machinevisiononline.org/public/articles/index.cfm?cat=167

Application Development in a GigE Vision Compliant Environment

The following graphic is the functional block diagram of a Sapera application with Genie cameras. The Genie Framework installation includes the GigE Vision driver and the Sapera Network Imaging Module.

When using a Teledyne DALSA camera, the GigE Vision Compliant XML description file is embedded within the camera firmware allowing GigE Vision Compliant applications to know camera capabilities immediately after connection.



Default Settings and Optimization

GigE Network Adapter Guideline

If the computer to be used with the Teledyne DALSA Network Imaging Module does not have an available Gigabit network adapter, a Gigabit NIC needs to be installed in an adapter slot. Typically under Windows the PCI Gigabit NIC is recognized automatically when Windows boots. An example of a high performance NIC is the Intel PRO/1000 MT adapter. Note that GigE Vision applications will function with 100 mbps networks but may have limited performance, therefore slower NIC adapters are not recommended.

Review the NIC documentation concerning any special driver required for Windows. Install the Gigabit NIC as described by the manufacture documentation.

Transparent Installation

The software package provides all components required to control GigE Vision devices such as the Teledyne DALSA Genie and Genie TS camera series. Components include the Network Imaging driver, the Sapera GigE server, and the Teledyne DALSA DHCP server.

No separate installation is required for the Teledyne DALSA Network Imaging Module.
It is automatically included with:

- Included with Sapera LT 8.01 or later. The user selects to install GigE Vision support via a tick box show during the Sapera installation.
- The Teledyne DALSA Genie Framework
- The Teledyne DALSA Genie TS Framework
- The Teledyne DALSA Generic GigE Vision Framework

Install any of these packages and the Teledyne DALSA Network Imaging Module (including its user tools) is installed as the networking layer. If multiple Teledyne DALSA packages are installed, then the most current version will be kept on the system drive. The following table lists the installed components.

Tools	Network Configuration Tool	User control for GigE Vision networking parameters. Tool provides information on all network adapters installed in the system and any connected GigE Vision cameras.
	Status Window Tool	Tray utility providing status and information on any connected GigE Vision device.
Services	DHCP Server	Teledyne DALSA DHCP server providing optimized IP address management.
	GigE Vision Server	Underlying server interfacing GigE Vision devices with the host computer. Supports **GigE Vision 1.2** for Standard and Fast Design firmware cameras. Supports **GigE Vision 2.0** for JPEG Design firmware cameras.
Driver	Optimized Filter Driver	Underlying driver managing data transfers from the GigE Vision device.
	DHCP Server Driver	Underlying driver managing the Teledyne DALSA DHCP server.

Note: With some foreign language Windows there is a problem where the installation of a required filter driver does not proceed automatically. Until this issue is resolved by Teledyne DALSA engineering, follow the instructions in Appendix A: Filter Driver Installation Issues with Foreign Language Windows.

GigE Server Verification

After a successful Framework installation, the Status Window tool places a GigE Server icon in the desktop taskbar tray area. After connecting a GigE Vision device (see following section), allow a few seconds for the GigE Server status to update. The device must be on the same subnet as the NIC to be accessed by the system. A subnet groups computers with an identical routing prefix in their IP addresses. Note that the GigE Vision service will see all GigE devices whether available or not (only if the "Automatic Conflicted Device Detection" function is enabled in the System Configuration tab of the Teledyne DALSA Network Configuration Tool).

	Device Available	Device IP Error	No Device Detected
GigE Server Tray Icon:			
	The GigE server tray icon when the device is found. It will take a few seconds for the GigE Server to refresh its state after the device has obtained an IP address.	The GigE server tray icon shows a warning when a device is connected but there is some type of IP error.	A red X will remain over the GigE server tray icon when the device is not found. This indicates a network issue. ***Or in the simplest case***, the device or camera is not connected or powered.

If you place your mouse cursor on this icon, the GigE Server will display the number of GigE Vision devices found by your PC. Right click the icon and select status to view information about those devices. See "Running the Network Configuration Tool" on page 8 and "Troubleshooting" on page 29 for more information.

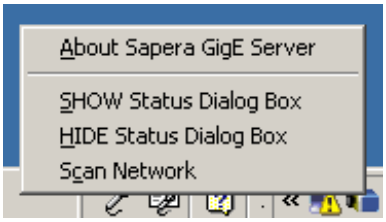
Connect a GigE Vision Device

Connect power to the device and an Ethernet cable from the device to the host computer NIC. After communication with the host computer is started, the automatic IP configuration sequence will assign an LLA IP address as described in section "IP Configuration Mode Details" on page 16, or a DHCP IP address if a DHCP server is present on your network. Note that the Teledyne DALSA Network Imaging Module can be configured as the DHCP server.

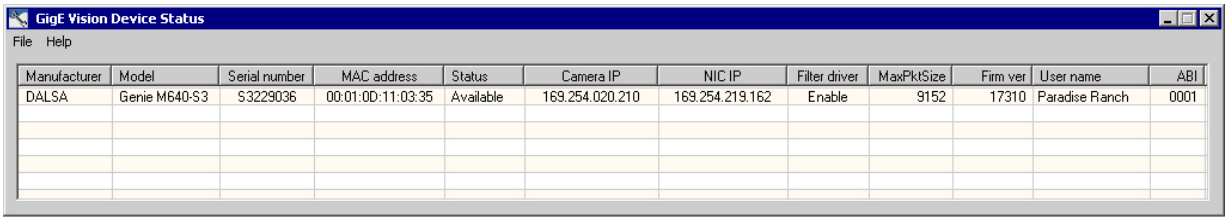
GigE Server Status

After the device is assigned an IP address the GigE server tray icon will not have a red X through it, indicating that the camera was found (see the previous section for server status icons). It might take a few seconds for the GigE Server to refresh its state after the device has obtained an IP address.

Right-click the GigE Server tray icon to open the following menu.



- Click on **Show Status** to open a window listing all GigE Vision devices connected to the host system. Each is listed by name along with important information such as the assigned IP address and device MAC address. The screen shot below shows a connected Teledyne DALSA Genie camera with no networking problems indicated.



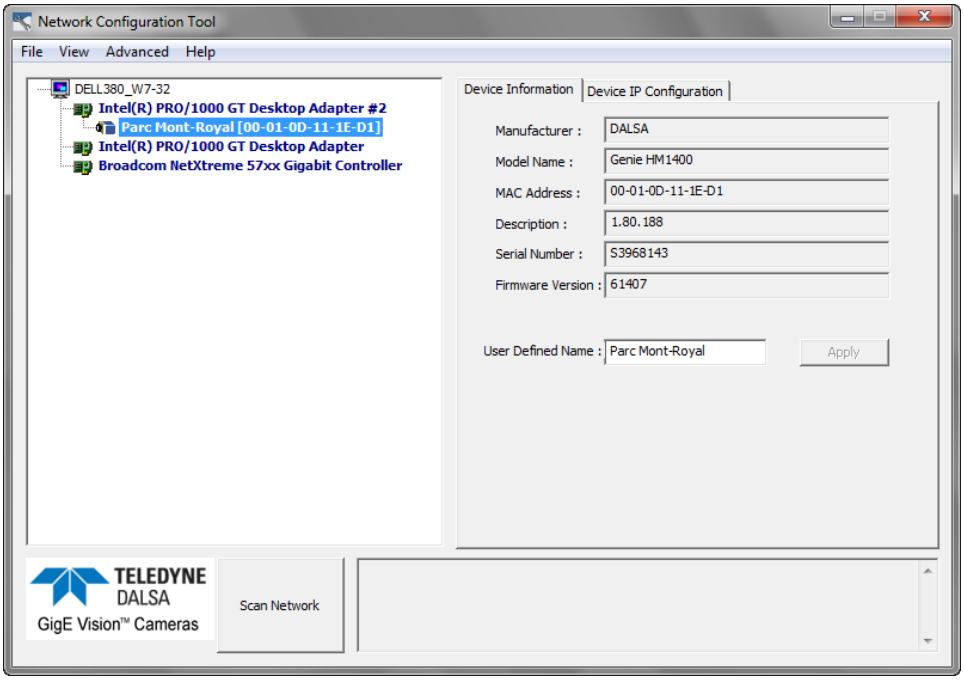
- In the event that the device is physically connected, but the Sapera GigE Server icon is indicating that the connected camera is not recognized, click **Scan Network** to restart the discovery process. Note that the GigE server periodically scans the network automatically to refresh its state. See "Troubleshooting" on page 29 for network problems.
- Selecting **Scan Network** will detect and show any device, even if unavailable, for a minimum of 2 minutes. This tool functions regardless of the setting for the "Automatic Conflicted Device Detection" function in the System Configuration tab of the Teledyne DALSA Network Configuration Tool.

Running the Network Configuration Tool

The Network Configuration tool provides information and parameter adjustments for network adapters installed in the system and any connected GigE Vision cameras, without use of any Windows Control Panel application. This tool allows you to:

- Activate the Teledyne DALSA DHCP server and the Network Imaging driver used for image acquisition on any NIC.
- Disable the imaging driver for any NIC not used with a GigE Vision camera.
- Change the Auto Discovery Interval from the default of 15 seconds.
- Add the GigE server service to the Windows firewall exception list.
- Configure the NIC and camera IP settings.
- Assign a User-Defined name to a connected GigE Vision camera.
- Assign a Persistent IP address to a camera instead of the default DHCP/LLA assigned address.
- Easily enable/disable the Teledyne DALSA DHCP server on a per NIC basis for connected GigE Vision devices.
- Recover GigE devices in conflict.
- Note: Devices connected after the tool is started may not show in the list. Simply click on Scan Network to refresh the device list especially if the connected device is behind an Ethernet switch.

See "Network Configuration Tool" on page 20 for more detailed information on using this tool. As shown below, the Network Configuration tool can quickly verify and modify the network configuration of the imaging system.



Run the tool from the Windows Start menu: **Start•Programs•Teledyne DALSA•Sapera Network Imaging Module• Network Configuration Tool**. Verify the camera appears as a child of the NIC card it is connected to. By default a Teledyne DALSA camera is identified by its serial number if no user-defined name has been assigned.

Optimizing the Network Adapter

Most Gigabit network interface controllers (NIC) allow user modifications to parameters such as Adapter Buffers and Jumbo Frames. These should be optimized for use with the GigE Vision camera during installation.

What are Adapter Buffers (receive descriptors)

Under certain conditions the host PC system CPU may be very busy with tasks other than the imaging application. Incoming image packets remain in the PC memory allocated to store packets instead of immediately being copied into the image buffer. 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.

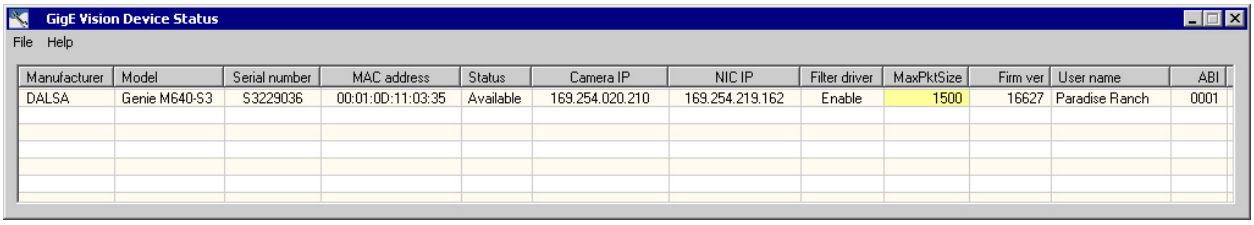
Not all network boards allow increasing their buffer count and even among those that do, such as the Intel NIC, different versions will have different maximum receive descriptor values. Refer to the NIC user documentation for details on configuring this parameter. The procedure in the following section shows how to increase the number of packet buffers for one version of Intel network adapter.

What are Jumbo Frames

With good gigabit Ethernet connections with minimal packet resend conditions, host computer performance can be further improved by increasing the data packet size. Each streaming video packet(s) causes an interrupt in the host computer. Therefore increasing the packet size reduces the CPU usage percentage required to handle video data from the GigE Vision camera.

Important: Before the camera application can set the GigE Vision feature "Packetsize" to a larger data packet, the NIC used with the camera must be configured to allow Jumbo Frames. The procedure in the following section describes increasing the size of Jumbo Frames for one version of Intel network adapter.

- The screenshot below shows that the GigE Vision camera was found and there is no IP conflict. Note that an application must connect to the GigE Vision camera first.
- The Maximum Packet Size field is highlighted in yellow, indicating that Jumbo Frames are not enabled on the NIC used with the camera or that the control application is forcing a safe packet size. Using a larger packet size improves host CPU performance, which can be critical when using multiple cameras.
- Note that the Maximum Packet Size field is updated only when an application such as CamExpert communicates with the camera.



What is Interrupt Moderation Rate

The Intel Pro/1000 Network adapter provides a configuration parameter to manually adjust the NIC interrupt rate. 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 (see following section on advanced configuration properties).

Adjust NIC Advanced Configuration Properties

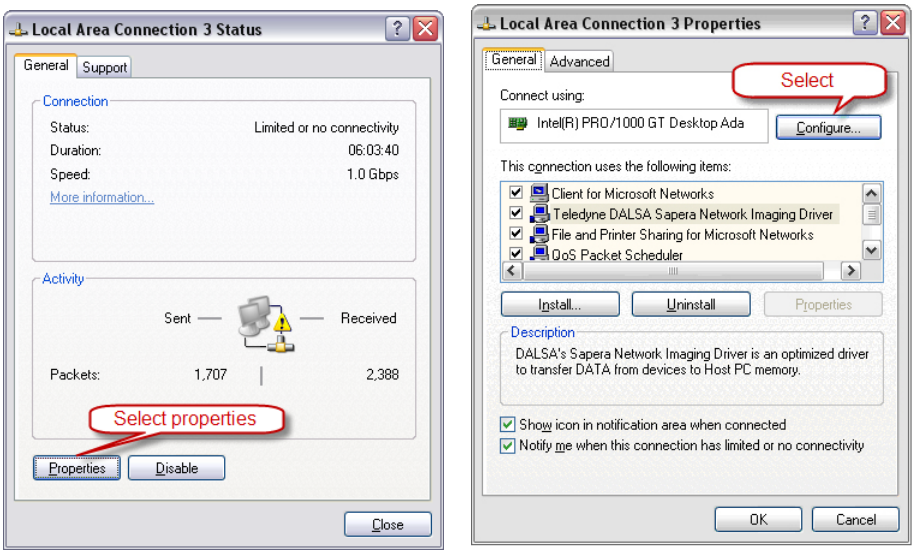
Note that the following applies to the Intel Pro NIC driver. Other NIC products may or may not have similar configuration parameters. Screen shots below were made with Intel Pro driver version 8.10.3.0.

When using Windows XP:

- From the **Start** menu go to **Settings • Control Panel • Network Connections** and select the NIC used to connect the Genie to. Open the **Properties** for the Ethernet GigE NIC used with the Genie. Click the **Configure** button.

When using Windows 7:

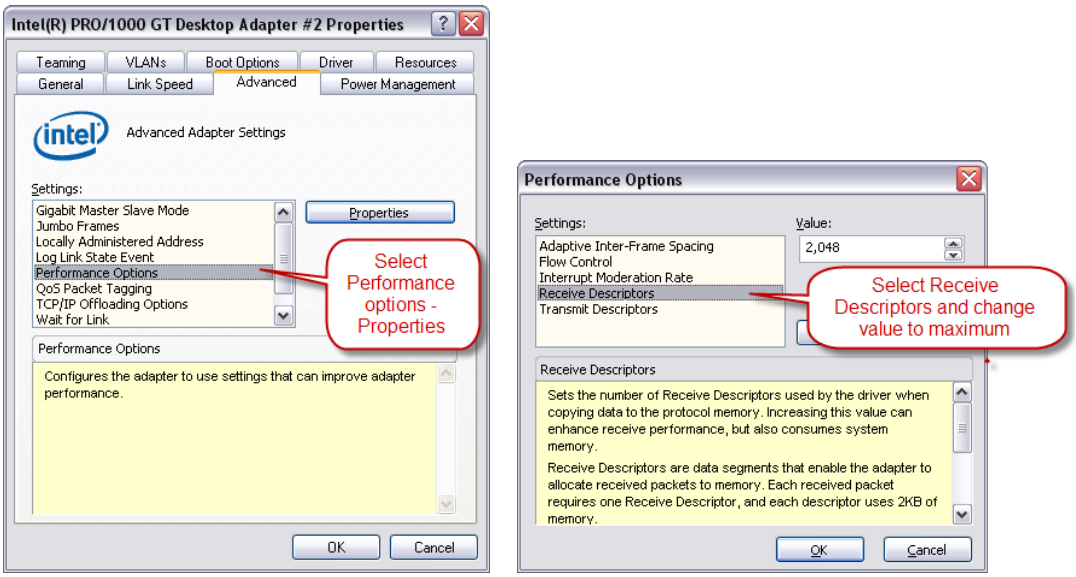
- From the **Start** menu go to **Control Panel • Network and Internet • Network Connections** and right click the NIC used to connect the Genie to. Select **Properties** and click the **Configure** button.



- The Intel Pro/1000 NIC offers a number of options but for GigE Vision camera applications the following three are typically modified to optimize capture transfers.

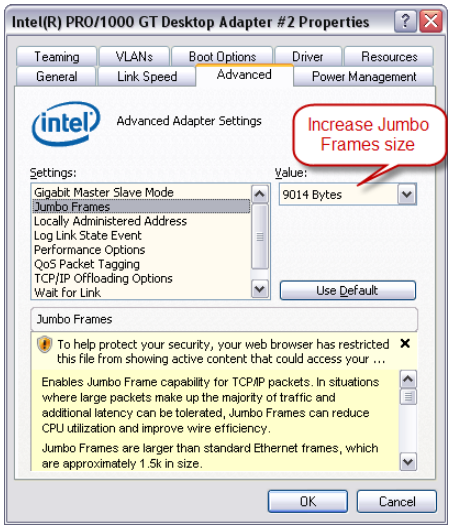
Receive Descriptors Optimization

- Select the 'Receive Descriptors' property.
- Change the value to the largest value supported by the installed NIC. In this example the value is 2048.



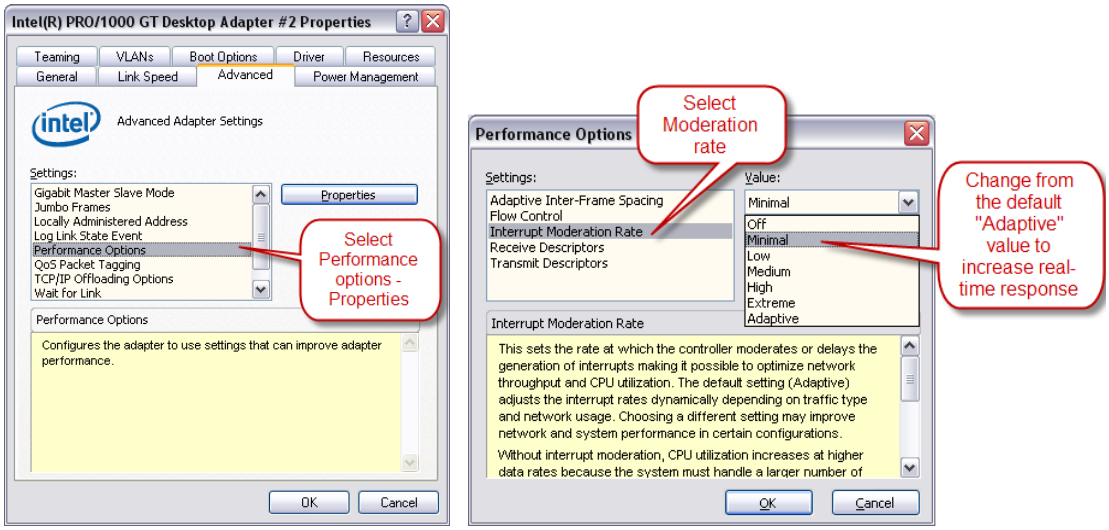
Jumbo Frames Optimization

- Select the 'Jumbo Frames' property.
- Change the value to the largest supported by the installed NIC. The GigE Vision camera can then be configured to use its maximum Jumbo Frames size. In this example the NIC value is set to 9014.



Interrupt Moderation Rate Optimization

- Select the 'Interrupt Moderation Rate' property.
- Change the value from the default 'Adaptive'. Try different values from 'Off' to improve the real-time GigE Vision camera acquisition response relative to the over-all host computer usability. Note that no interrupt moderation may make the host computer seem unresponsive to other applications.
- Change the value to 'Extreme' will minimize CPU utilization. However this will add a small latency when applications are notified that an image is ready to process.

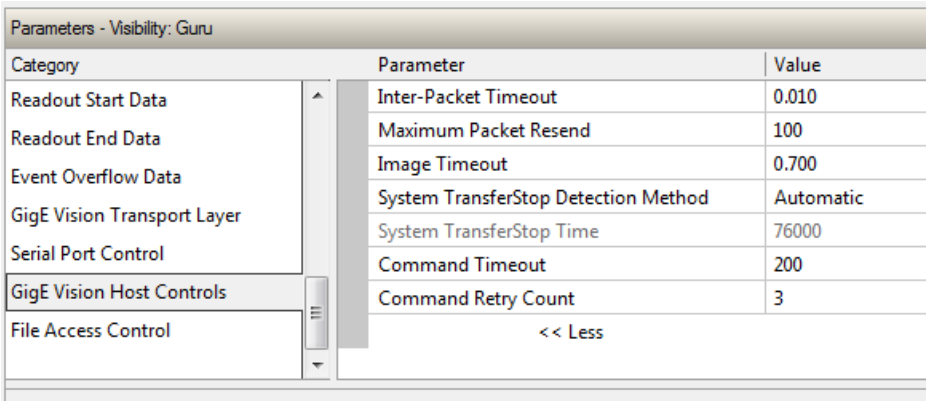


GigE Vision Host Controls

The GigE Vision Host controls as shown by CamExpert, groups parameters used to configure the host computer system GigE Vision features, which are used for connected camera networking management. None of these features are stored in the connected camera – they remain as settings to the host system control software.

These features allow optimizing the network configuration for maximum camera bandwidth. Settings for these parameters are highly dependent on the number of cameras connected to a NIC, the data rate of each camera and the trigger modes used.

Parameters in gray are read only, either always or due to another parameter being disabled. Parameters in black are user set in CamExpert or programmable via an imaging application.



GigE Vision Host Control Feature Descriptions

Display Name	Feature	Description	View
Inter-Packet Timeout	InterPacketTimeout	Specifies the inter-packet timeout period used by the GigE server running on the host computer (in seconds). The inter-packet timeout is the amount of time the GigE server will wait between successive packets. If the inter-packet timeout expires, the GigE server will issue a packet resend request to the camera. The range of permitted values is 0.000000 to 0.65535. By default this value is greater than and must be greater than the Inter-Packet Delay inserted by the Genie. Else the GigE server will force packet resends when none may be required. Increasing the timeout period is required when a NIC has a number of Genie cameras connected via an Ethernet switch, and packet resends can be avoided if the GigE server delays assuming data is lost.	Beginner

Maximum Packet Resend	packetResendMax	Maximum number of packet resend attempts when the Inter-packet Timeout is exceeded.	Guru
Image Timeout	ImageTimeout	Specifies the timeout period for an image acquisition used by the GigE server running on the host computer (in seconds – max=60). The Image timeout value is the amount of time the GigE server will wait for an image to be transferred from the camera to the host buffer memory. By default this value is greater than (and must be greater than) the time required to receive a complete frame. The time required may depend on the number of Genie cameras connected to the NIC and whether they transmit frames simultaneously. If the timeout period is too short, data will be trashed and packet resend commands will be issued. If the timeout period is too long, recovery from transmission errors may be too slow.	Beginner
System TransferStop Detection Method	systemTransferStopDetectionMethod	Specify if the systemTransferStopdetectionMethod feature is based on the GigEVsision driver or is controlled by the User, based on the SystemTransferStopTime feature. SystemTransferStopTime defines if a TransferStop is truly completed, if no data arrives from the device after the timer count is the last DATA trailer.	Guru
	Automatic	*The stream is considered stopped when it is idle for more than the current exposure time.*	
	Manual	*The transfer is considered stopped when it is idle for more than the feature systemTransferStopTime.*	
System Transfer Stop Time	systemTransferStopTime	When the feature systemTransferStopDetectionMethod is set to Manual, this is used to set the time a transfer can be inactive before been considered stopped. This time is only used by the CorXferStop and CorXferWait functions.	Guru
Command Timeout	CommandAcknowledgeTimeout	Specifies the time the host system controller will wait for a command acknowledgment from the connected GigE Vision device. Minimum and maximum values are dependent on the connected device (as defined in its XML file).	Beginner
Command Retry Count	CommandRetryCount	Specifies the number of retries for a command sent to a device.	Beginner

Transfer Stop Detection Method	transferStopDetectionMethod	The method used to detect the end of a transfer.	Invisible
Auto	*streamHidelTimeAuto*	In this mode a stream is considered stopped when it is idle for more that the current exposure time.	Invisible
Manual	*streamHidelTimeManual*	In this mode, a transfer is considered stopped when it is idle for more that the feature transferStopDetectionTime.	Invisible
Transfer Stop Detection Time	transferStopDetectionTime	This feature is used when the feature transferStopDetectionMethod is set to streamHidelTimeManual to configure the time a transfer can be inactive before been considered stopped. This time in only used by the CorXferStop and CorXferWait functions.	Invisible
Packet Resend Mode	packetResendMode	Control the method used to control the packet resend.	Invisible
Off	*Off*	*Do not allow host to request packet resend from the camera.*	
Window	*Window*	*This method is based on a window of opportunity. Packets can arrived out of order but within a window of opportunity.*	

Automatic Change for Inter-Packet Timeout with JPEG Designs

Genie TS models operating with the JPEG design firmware (GigE Vision 2.0) automatically increase the Inter-Packet Timeout feature value to 100ms from 10ms. This change is required due to the variable timing between packets from cameras performing on-board JPEG compression. Without this increased period, timeout events could occur for no valid reason – essentially false-positive timeout events.

When Genie TS cameras with JPEG design firmware are used with third party GigE Vision Host software (not Teledyne DALSA Sapera software), the user must account for the variable time possible between packets. Increasing the Inter-packet timeout feature value, such as is done by the Sapera package, is required.

Networking Variations

Using GigE Vision Cameras with Ethernet Switches

Examples where a Gigabit Ethernet switch would be used are:

- Multiple cameras are controlled by one computer and a single NIC.
- Ethernet Switches supporting Full-duplex IEEE 802.3x Pause Frame Flow Control must be used in situations where multiple cameras may transfer data simultaneously, thus exceeding the link bandwidth. See "IEEE 802.3x Pause Frame Flow Control" on page 28 for additional information.
- Multiple cameras are individually controlled by multiple computers, all located on the same subnet.

In these cases the Ethernet switch is a transparent device. The device discovery process finds all GigE Vision cameras, and presents them as ready to be controlled by an application.

Using GigE Vision Cameras with a VLAN Ethernet Switch

An Ethernet switch supporting VLAN (Virtual Local Area Network) allows multiple isolated subnets to exist on the same switch.

Within each VLAN group, the GigE Vision camera and controlling computer will behave identically as if connected to a simple Ethernet switch. But each VLAN group is isolated from each other, Therefore a camera in one VLAN group is never seen by a computer on a different VLAN group.

VLAN Ethernet Switches support configuration as Port-based or TAG VLAN groups. Port-based groups are typically easier to configure. Review your Ethernet switch manual for information on its factory default VLAN settings and configuration method.

IP Configuration Mode Details

The following descriptions provide more information on the IP configuration modes supported for GigE Vision cameras. In general automatic IP configuration assignment (LLA/DHCP) is sufficient for most installations. For multiple NIC applications, use the Teledyne DALSA DHCP server since it is the easiest to manage.

Link-Local Address (LLA)

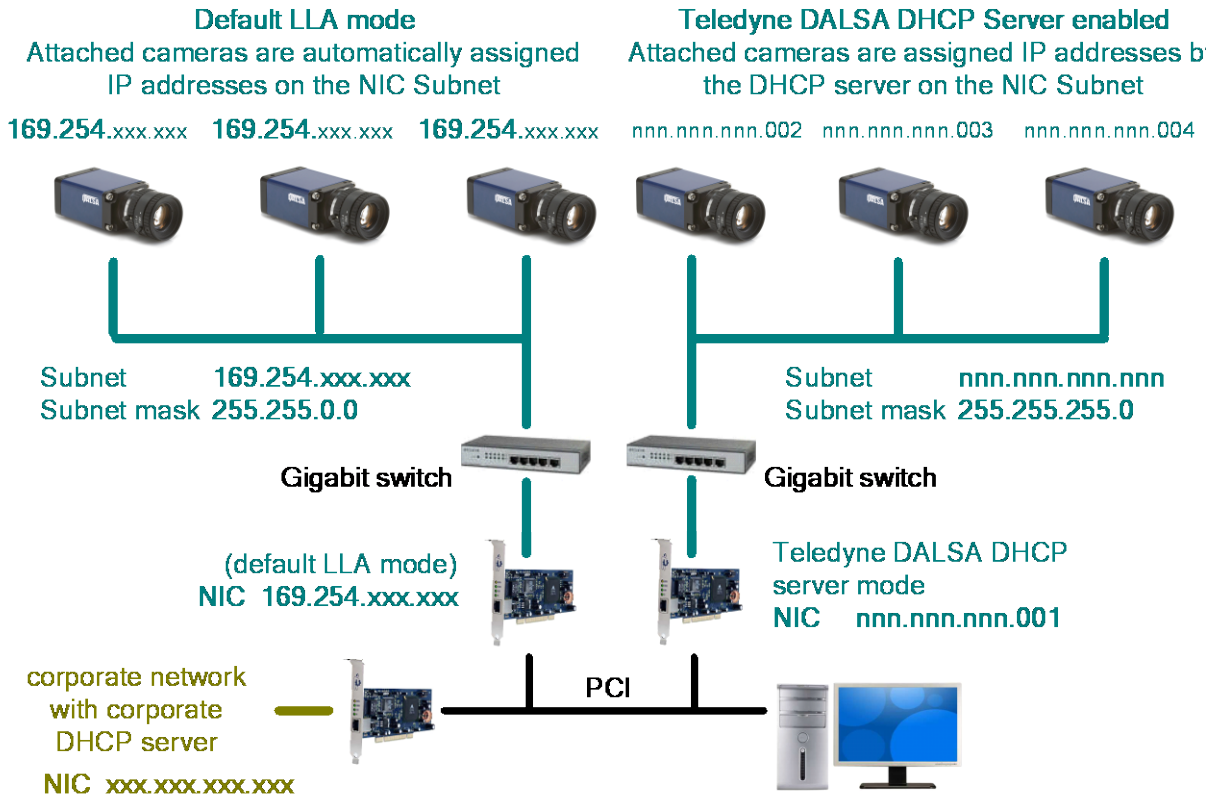
Note: that LLA mode limitations are avoided by enabling the recommended **Teledyne DALSA DHCP Server**.

- LLA is also known as Auto-IP. It is used for unmanaged networks including direct connections from a GigE Vision camera to a dedicated NIC.
- A subnet configured with LLA cannot send packets across routers but only via Ethernet switches.
- Ensure only one NIC is using LLA on your PC, otherwise IP conflicts will result.
- The NIC will automatically assign a random IP address within the 169.254.x.x subnet. The LLA protocol ensures there are no conflicts with other devices through an arbitration scheme.

- The Windows NIC configuration must be set to DHCP (the typical default case) and no DHCP server must be present on the network. Otherwise, an IP address gets assigned by the DHCP server. Windows will turn to LLA when no DHCP server answers requests coming from the NIC.
- Windows XP takes about 1 minute to obtain an LLA IP address – Windows Vista/7 will take about 6 seconds. With Windows XP, with no DHCP server involved, the network adapter icon in the system tray (in Windows XP) typically shows "limited or no connectivity".  This is normal and indicates that the network does not have connectivity beyond routers (see Microsoft KB article #892896).
- If a DHCP server becomes available on the network, the NIC will get a DHCP assigned IP address for the connected device but connections on the LLA IP address will be lost. The Teledyne DALSA Network Configuration Tool can be used to enable the Teledyne DALSA DHCP server on the NIC used for the GigE Vision network. See "Network Configuration Tool" on page 20.
- Important: If the host system has multiple NIC devices configured with LLA, then the communication stack cannot accurately resolve which NIC to forward an IP packet on the 169.254 segment. Limit the number of NIC configured using LLA to one interface. See "Warning Example 1a: IP error with multiple NICs" on page 33 for additional information.

DHCP (Dynamic Host Configuration Protocol)

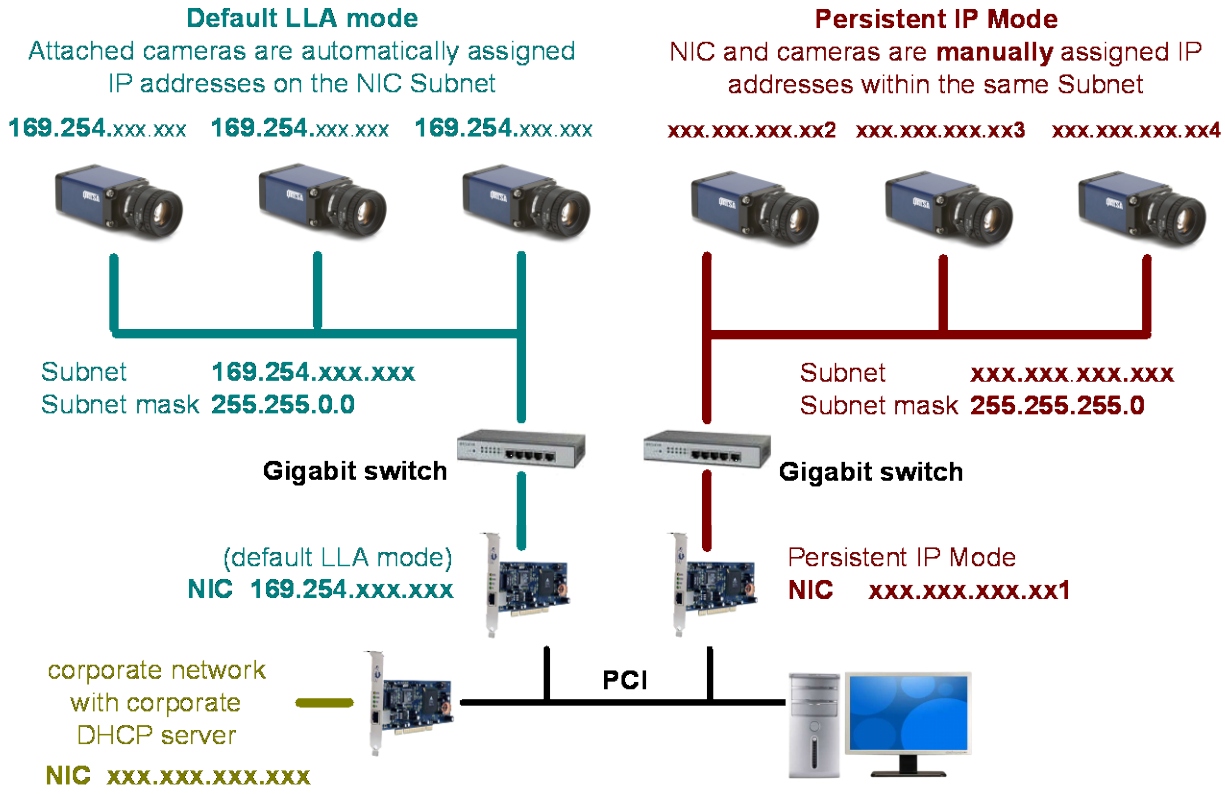
- This IP configuration mode requires a DHCP server (such as activating the Teledyne DALSA DHCP server) to allocate an IP address dynamically over the range of some predefined subnet. The GigE Vision camera must be configured to have DHCP enabled (this is the factory default setting required by the GigE Vision standard).
- The DHCP server is part of a managed network. Windows itself does not provide a DHCP server function therefore a dedicated DHCP server is required. The Teledyne DALSA Network Configuration Tool can activate the DHCP server on the NIC used for the GigE Vision network. See "Network Configuration Tool" on page 20.
- The Teledyne DALSA DHCP server is always recommended where there are multiple NIC ports with multiple GigE Vision cameras attached. Each NIC ports must use a different subnet to avoid IP address conflicts (See "Warning Example 1a: IP error with multiple NICs" on page 33 for additional information).
- Under Windows, a NIC is configured in DHCP mode by default. If no DHCP server is present on a given subnet, Windows will revert to LLA as explained in the section above.
- Subnet assignment will automatically be managed correctly when the Teledyne DALSA DHCP server is enabled on one or all subnets used for GigE Vision cameras. The graphic below illustrates a system with one NIC having the DHCP server enabled. Note that although the graphic shows one subnet using LLA mode, Teledyne DALSA strongly recommends using the Teledyne DALSA DHCP server for all subnets used for GigE Vision devices.



Persistent IP

- This protocol is only suggested if the user fully controls the assignment of IP addresses on the network and a GigE Vision camera is connected beyond routers.
- The GigE Vision camera is forced a static IP address. The NIC IP address must use the same subnet otherwise the camera is not accessible.
- If the camera is connected to a network with a different subnet, it cannot be accessed, unless the FORCEIP command is used.
- The Teledyne DALSA Network Configuration Tool is used to set a persistent IP address (see "Persistent IP" on page 18.
- An example of a Persistent IP address assignment on a class C network:
  - NIC Subnet = 192.168.1.1
  - Subnet Mask = 255.255.255.0
  - Persistent IP = 192.168.1.2
  - Default Gateway = 0.0.0.0
- Warning: an incorrect IP address assignment might make it impossible to connect to the GigE Vision camera. In such a case the Teledyne DALSA Network Configuration tool includes a function to recover a camera with an invalid persistent IP and set the camera to the factory default setting, i.e. DHCP/LLA mode. The camera MAC address must be known to use this function. See "Recovering a Camera with an Invalid IP" on page 25 and "Warning Example 2: Subnet Mask or IP error" on page 35.
- For GigE Vision applications the FORCEIP command is used to force a new persistent IP or to change the IP configuration protocol.

- The following illustration shows a functional computer setup with three NIC ports, but no DHCP server. Two NIC ports are used for private GigE Vision networks. The first uses the default LLA mode for IP addresses, while the second NIC and the cameras connected to it are configured with persistent IP addresses. An application on the computer can control each camera, on each subnet, without conflict.



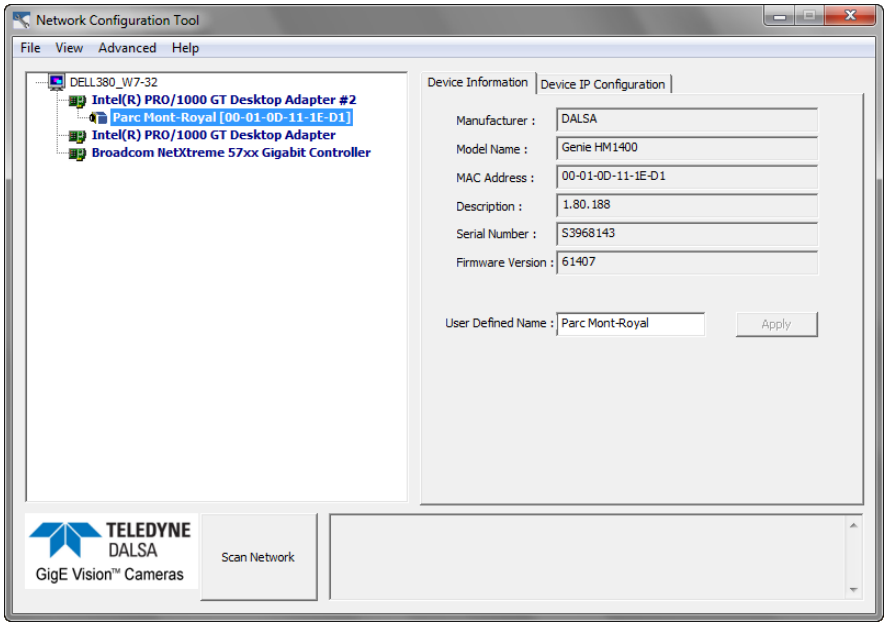
Network Configuration Tool

The Network Configuration tool provides information on all network adapters installed in the system and any connected GigE Vision devices. When using a GigE Vision camera, the tool allows a simple method to assign a User-Defined name and also to set a Persistent IP address instead of the default DHCP/LLA assigned IP address. Using this tool, GigE Vision network configurations can be easily made without having to use any Windows Control Panel application.

	**Important:** When using Genie cameras, any changes made with this tool will update the Genie flash memory. Do not remove power from the Genie camera for a minimum 10 seconds. Then cycle the Genie power to load the new flash settings. For any other device refer to its user manual.

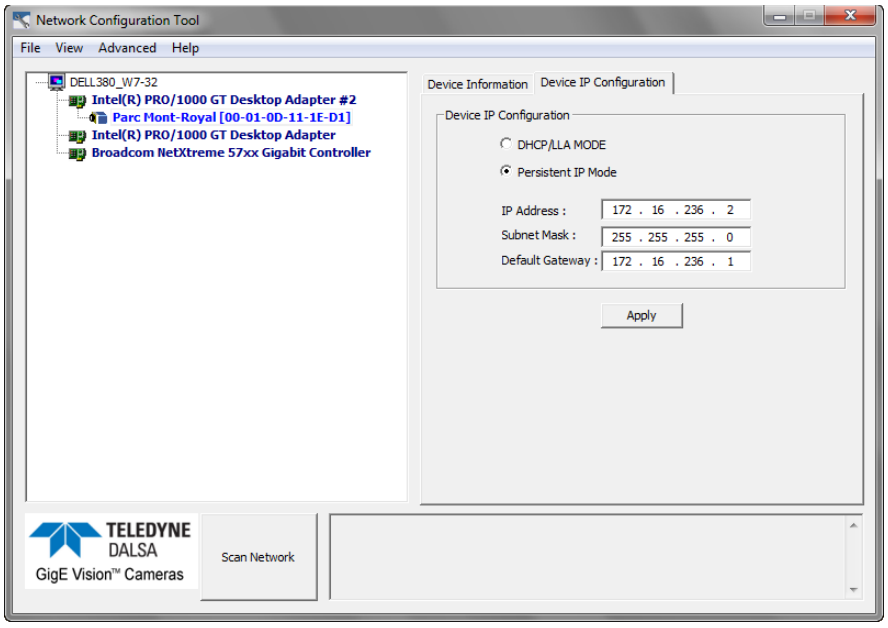
Quick GigE Vision Camera Network Configuration

- Start the Network Configuration program from the windows start menu: **Start•Programs•Teledyne DALSA•Sapera Network Imaging Module•Teledyne DALSA Network Configuration Tool**.
- The left display window will show all installed network adapters and any connected GigE Vision cameras.
- Click on a camera to see information such as MAC address, current IP address, serial and firmware numbers.
- With Genie cameras, click in the User Defined Name edit box and change the Genie User Defined Name as required. Click on the Update button to write into the Genie memory.



Genie Network Information

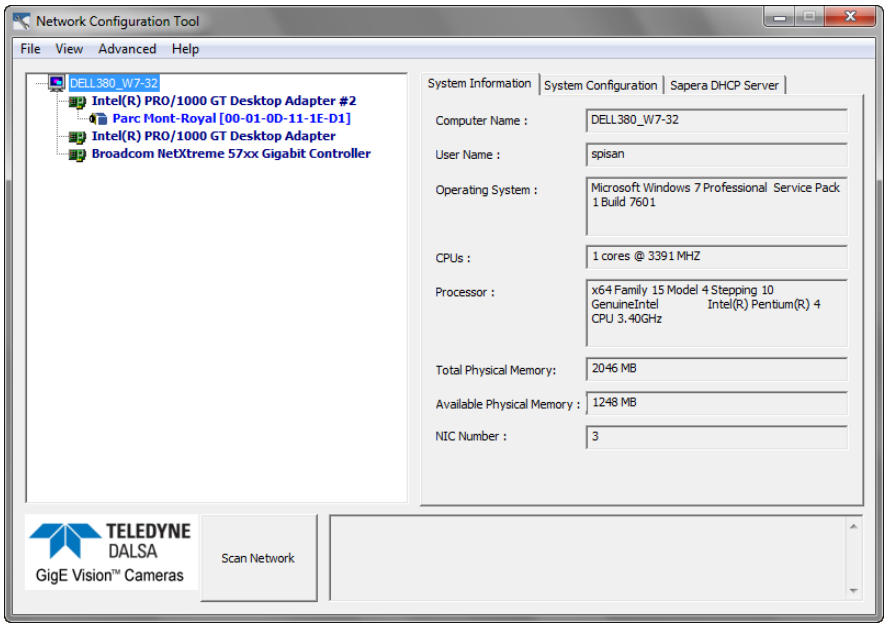
- If Persistent IP mode is selected enter the desired IP address, subnet mask, and default gateway.
  Important: To recover the camera see "Recovering a Camera with an Invalid IP" on page 25.



Camera IP Configuration

System Information, Configuration, and DHCP Server

Select the system icon (the computer symbol with computer name) in the left pane to display current system information which may be required when documenting GigE Vision installations. There are no user changeable fields in the **System Information tab**.



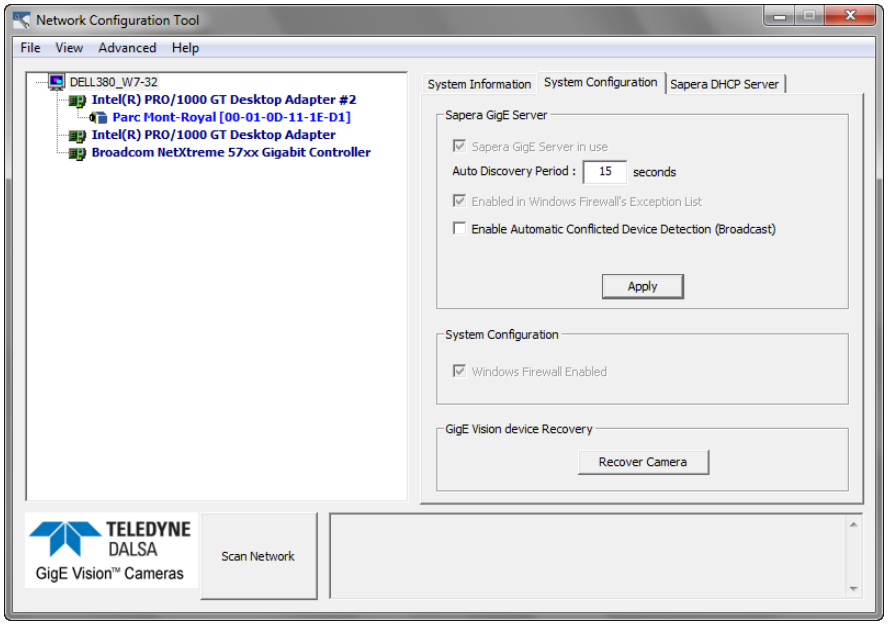
General System Information

System Configuration Parameters

In the right hand pane click on the **System Configuration tab**. Three user settings are provided which can be changed from their default settings for production systems after all configuration items are tested and debugged.

- **Auto Discovery Period**: Sets the time delay between when new GigE Vision devices are searched for on the system network connections. This time interval can be increased if changes to the number of connected cameras is seldom made.
    - The default time period is 15 seconds.
    - This time interval can be increased if changes to the number of connected cameras is seldom made.
    - Otherwise in the case where cameras are connected through an Ethernet switch, the Auto Discovery period should be shortened if most GigE Vision connect/disconnect events must be seen by the Sapera application via callbacks.
- **Windows Firewall Exception List**: By default the Teledyne DALSA GigE Server is added to the Windows Firewall exception list. This ensures the Windows Firewall remains active (if it was enabled) without having to individually put each Sapera GigE application program in the exception list. If the computer is using a different firewall software package, refer to that firewall's software manual to allow the GigE Server to have access through it.

  Alternatively, it is possible to exclude a specified NIC from using the firewall. The NIC dedicated to the GigE Vision network does not need Windows firewall. See "Disabling Windows Firewall" on page 39 for details on excluding a NIC from firewall settings.
- **Broadcast Device Conflict Detection**: By default the Teledyne DALSA GigE Server attempts to detect and identify devices with invalid IP addresses for the current network. This broadcast mechanism consumes CPU cycles which may interfere with traffic on the network. When a multiple camera system is defined, tested and declared stable, the device conflict detection function can be disabled.



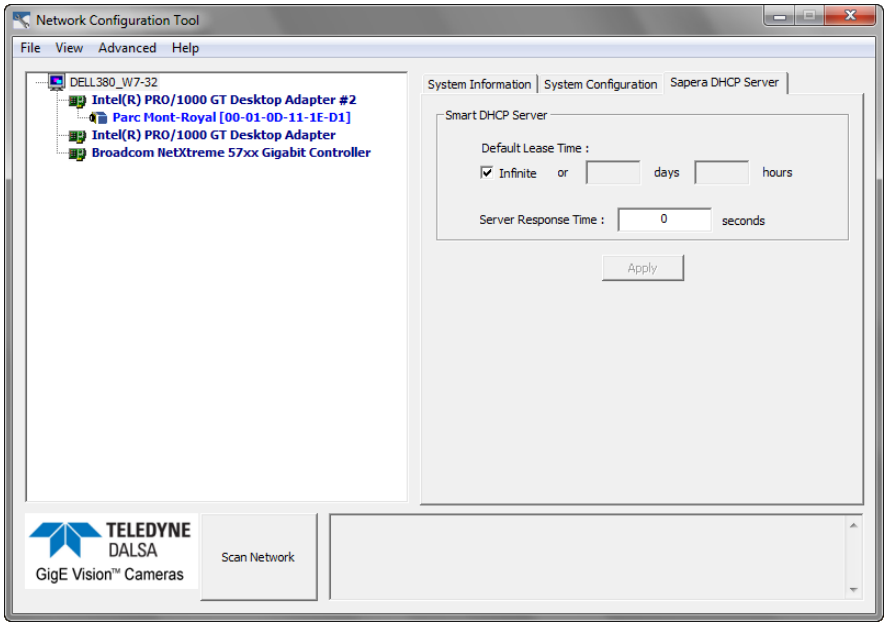
System Configuration

- Note that clicking the "Scan Network" button will force a search for devices with an invalid IP for the current network even if automatic broadcast is not enabled.

Teledyne DALSA DHCP Server Parameters

The system DHCP Server tab has configuration parameters for general DHCP server operation. For most setups the default settings are sufficient. Note that the Teledyne DALSA DHCP server is activated on a chosen NIC via a selection made on the NIC configuration (see "NIC IP and DHCP Server Configuration" on page 24).

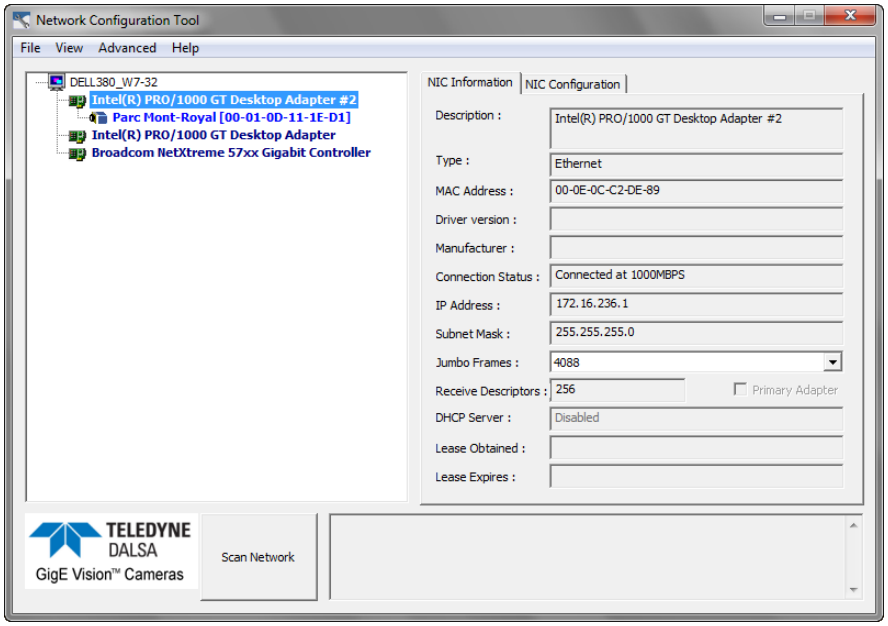
- **Default Lease Time**
  By default the DHCP server will assign a device an IP address and will always use that same address whenever that device is reconnected (the server maps the IP address to the device MAC address). If a finite time is desired, un-check the Infinite selection box and enter the lease time on hours or days.
- **Server Response Time**
  Important: The parameter sets the time interval for the Teledyne DALSA DHCP server to acknowledge a DHCP request from a device and assign an IP address. By default the default interval is 0 seconds. In the case where there is another DHCP server, this parameter can be set to a longer period to allow the primary DHCP server on the network to respond to devices.



System DHCP Configuration

Network Card Information and Configuration

Select a network card icon in the left pane to see NIC information and its configuration parameters. The Teledyne DALSA Network Configuration tool ensures that no two NIC devices installed in the computer are on the same subnet, since that would create a conflict. A warning message is displayed in such a case, indicating that a settings change is required for one of the NIC.



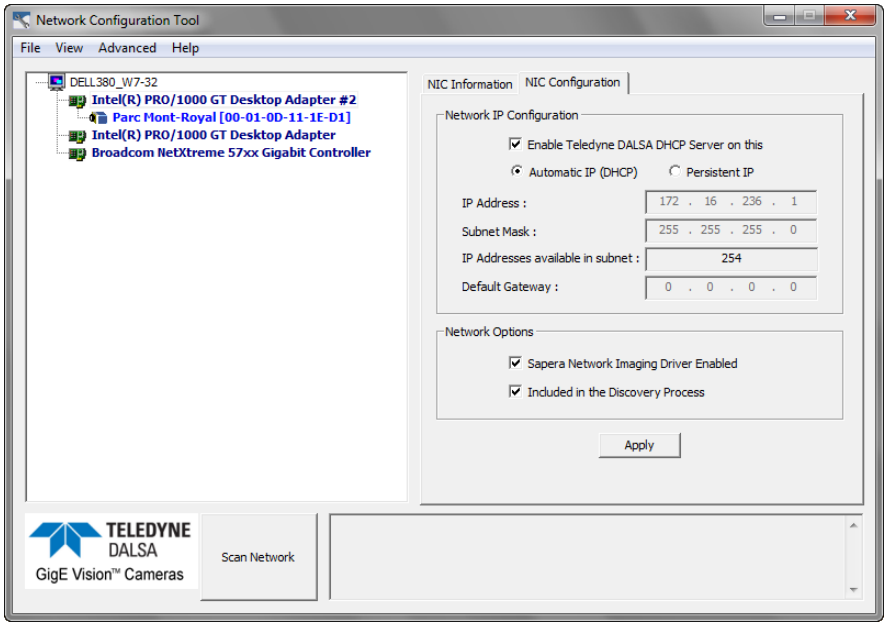
NIC Information

NIC IP and DHCP Server Configuration

For each NIC used for a GigE Vision network, select the NIC Configuration tab. Configure the IP mode (either DHCP/LLA or Persistent IP) and if required, enable the Teledyne DALSA DHCP server.

- If the DHCP server is enabled, the Teledyne DALSA DHCP server parameters are configured as described in "Teledyne DALSA DHCP Server Parameters" on page 23.
- If Persistent IP is selected (with or without the Teledyne DALSA DHCP server enabled), enter the desired IP address and Subnet Mask.

	**Warning**: Changing the NIC IP address may put it on a different subnet than the GigE Vision camera. Changing the NIC IP configuration first might cause the case where the camera becomes inaccessible from the NIC. The proper sequence is to first change the camera IP configuration then change the NIC IP, else you will need to do a camera recovery (do a ForceIP by right clicking on the conflicted device).



After installation, all system NIC devices have the Teledyne DALSA Network Imaging driver enabled, which streams image data efficiently to image buffers. Only the NIC connected to a GigE Vision camera or device requires the Network Imaging driver enabled to capture images. Other NIC ports in the system can be excluded from the Teledyne DALSA driver.

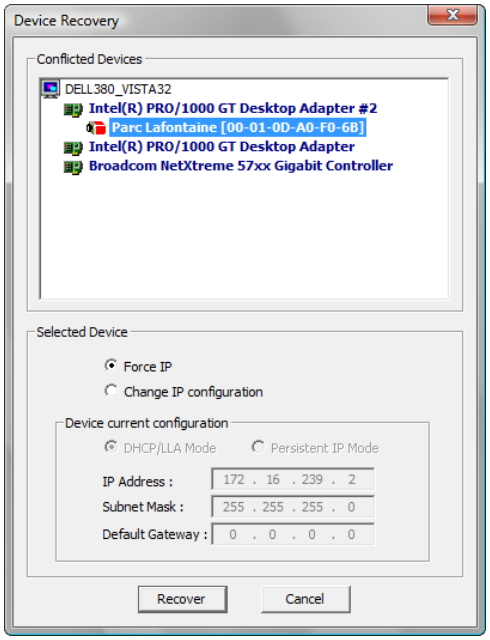
- Select other NIC devices in the system and disable the Network Imaging Driver if they are not used with a GigE Vision camera.
- Additionally, any system NIC can be excluded from the camera discovery process to eliminate unnecessary use of system resources for network connections that do not have GigE cameras, or where that network NIC should be ignored during the discovery process.

Recovering a Camera with an Invalid IP

When a GigE Vision camera has been configured with a IP address different than the NIC address range, use the Teledyne DALSA Network Configuration tool to configure both NIC or camera to the same address range.

To recover a GigE Vision camera:

- Start the Network Configuration program from the windows start menu: **Start•Programs•Teledyne DALSA•Network Interface•Teledyne DALSA Network Configuration Tool**.
- From the menu bar click on **Advanced** and then on **Recover Camera**.
- For the selected device, choose either **Force IP** or **Change IP Configuration**. The Force IP address choice is not permanent and remains valid only until the device is powered off. For permanent changes to the device select Change IP Configuration. (You can also do a ForceIP from the main dialog by right clicking on the conflicted device).



Camera Recovery Dialog

- If the camera requires a persistent IP address, select the bullet to assign a persistent IP immediately with recovery. Enter the new IP address and click on Recover Camera.

Creating a Status Report

	Before contacting Teledyne DALSA technical support, the user should review the Troubleshooting section of this manual (see "Troubleshooting" on page 29). Most installation, configuration, and imaging issues are documented along with their solutions.

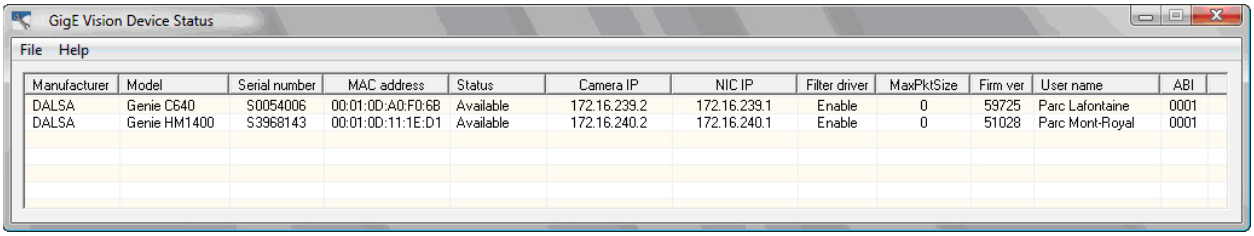
To aid technical support, the Teledyne DALSA Network Configuration tool can save a network configuration report. From the ***File*** menu select ***"Save current status"***. You will be prompted for a filename for the report text file. This file should always be sent with any request for technical support.

Sapera GigE Server Details

This section provides additional details on the GigE Server.

- The Sapera GigE Server implements the GigE Vision Control Protocol (GVCP). This provides the interface to generate GVCP messages to control and configure a GigE Vision device.
- GigE Server handles the heartbeat messages, allowing an application in development, to be single-stepped while in debug mode, without loss of the camera connection.
- GigE Server is a single application going through the firewall. This simplifies firewall settings as only this application needs to be listed in the firewall exceptions.
- The GigE Server periodically rescans the network to discover any new camera that might have been added to the network. This will also identify devices removed.
- The GigE Server Status window provides valuable information about the GigE Vision devices present on your system (see "Troubleshooting" on page 29).

Sapera GigE Vision Device Status Tool



Status Window Description

Name	Description	Standard GigE Vision
User Name	User assigned identification	Yes
Manufacturer	Manufacturer for this device	Yes
Model	GigE Vision device model	Yes
Serial Number	Device serial number	Yes
Firm Ver	Device firmware revision number	No
MAC adddress	Device MAC address	Yes
Camera IP	Device current IP address	Yes
NIC IP	NIC IP associated with the GigE server	No
Filter driver	Network driver status	No
MaxPktSize	Largest packet size that should be used for image streaming. This is found using the Test Packet mechanism of GigE Vision.	No
ABI	Sapera Application Binary Interface to communicate with the device	No
Status	General device status	No
	Note that the user can resize columns or drag any column header to reorder the displayed information. Column order is automatically saved in an .ini file when the Genie Framework is uninstalled and reinstalled.	No

Ethernet Switch Requirements

When there is more than one device on the same network or a camera-to-PC distance greater than 100 meters, an Ethernet switch is required. Since the Genie GigE camera complies with the Internet Protocol, it should work with all standard Ethernet switches. However, switches offer a range of functions and performance grades, so care must be taken to choose the right switch for a particular application.

IEEE 802.3x Pause Frame Flow Control

Ethernet Switches supporting Full-duplex IEEE 802.3x Pause Frame Flow Control must be used in situations where multiple cameras may be triggered simultaneously. In such a case the host system NIC maximum bandwidth would be exceeded if there was no mechanism to temporarily hold back data from cameras. Genie cameras support the IEEE 802.3x pause frame flow control protocol automatically so that images from many cameras can be transmitted through the NIC efficiently, without data loss.

The limiting condition is that the bandwidth sum from all cameras aggregated by the switch and then passed to the host NIC is within 1 gigabit/sec. A switch meeting the requirements will average out the simultaneous packets coming into its ports and will have enough buffer memory to support devices transmitting jumbo packets. As an example, one such switch tested at Teledyne DALSA is the NETGEAR GS716T.

	**Important**: The maximum frame rate possible from a large number of cameras which are simultaneously triggered will depend on the camera model, frame size, and network details. Each imaging system should be tested for frame rate limits. If the host system NIC is close to its maximum bandwidth, the Genie camera feature InterPacketDelay can be used to insert time between camera data packets, to prevent packet resend conditions. Using PAUSE Frame will require the user to test various values of Jumbo Frames, to determine the best data throughput. Therefore the downside to managed network traffic is that the Pause Frame control will reduce the absolute maximum transfer bandwidth possible on the network.

Ethernet to Fiber-Optic Interface Requirements

In cases of camera-to-PC distances of more than 100 meters but an Ethernet switch is not desired, a fiber-optic media converter can be used. The FlexPoint GX from Omnitron Systems converts GigE to fiber transmission and vice versa. It supports multimode (MM) fiber over distances of up to 220 m (720 ft.) and single-mode (SM) fiber up to 65 km (40 mi.) with SC, MT-RJ, or LC connector types.

	**Important**: The inclusion in this manual of GigE to fiber-optic converters does not guarantee they will meet specific application requirements or performance. The user must evaluate any supplemental Ethernet equipment.

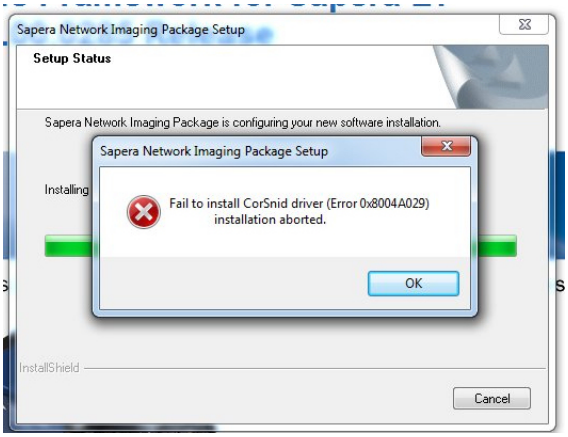
Troubleshooting

Overview

In rare cases an installation may fail or there are problems in controlling and using a camera. This section highlights possible problems. Emphasis is on the user to perform diagnostics with the tools provided, and methods are described to correct the problem.

Installation Failure of "CorSnid" Driver

Cases of a complete failure to install the Genie Framework, with a Windows error message, are caused by a Windows limitation to the number of filter drivers installed at any one time.



Windows has a hard coded limit of 14 filter drivers but the following default registry key sets the limit to 8 during a Windows installation.

- **HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\Network\MaxNumFilters**

Log in to the computer as Administrator and run *Regedit.exe*. Adjust the key value up to 14 or just delete the key (which also sets it to the max of 14). Information on this Windows registry key can be found by searching for Microsoft registry information.

Automatic Installation Stalls when using Foreign Language Windows

With some foreign language Windows there is a problem where the installation of a required filter driver does not proceed automatically. Until this issue is resolved by Teledyne DALSA engineering, follow the instructions in Appendix A: Filter Driver Installation Issues with Foreign Language Windows.

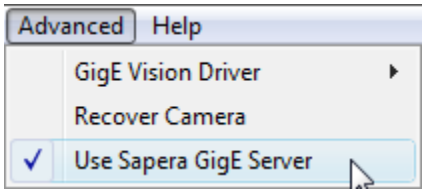
About the GigE Server Status Tray Icon

The GigE Server status provides visual information on possible camera problems. The three states are shown in the following table. Descriptions of possible conditions causing an installation or operational problem follow. Note that even a camera installation with no networking issue may still require optimization to perform to specification.

	No Device Detected	Device IP Error	Device Available
GigE Server Tray Icon: Note: It will take a few seconds for the GigE Server to refresh its state after any change.			
	A red X will remain over the GigE server tray icon when the device is not found. This indicates a network issue where there is no communication. ***Or in the simplest case,*** the camera is not connected.	The GigE server tray iconhows a warning when a device is connected but there is some type of IP error.	The GigE server tray icon when a camera is found and has obtained an IP address with no network issues. Optimization may still be required to maximize performance.

Why did the GigE Server Status Tray Icon Disappear

After a normal installation without issues, the GigE Server Status Tray Icon may have suddenly disappeared. The user may have caused this unintentionally while exploring the features of the Teledyne DALSA Network Configuration Tool. Run the program again and click **Advanced** on the menu bar. Select the Use Sapera GigE Server item again and the Server Status Icon will reappear.



Problem Type Summary

Problems are either installation types where the camera is not found on the network or setup errors where the camera is found but not controllable. Additionally a camera may be properly installed but network optimization is required for maximum performance. The following links jump to various topics in this troubleshooting section.

No Device Detected

A red X over the GigE server tray icon indicates that the camera is not found. This indicates either a major camera fault or condition such as disconnected power, or a network issue where there is no communication.

- Review the driver installation steps for the device.
- See "Network Configuration Tool" on page 20 to review networking details.

- The camera cannot acquire a DHCP address and/or the Windows firewall does not start after Windows XP service pack 2 or 3 has been installed. See "Windows XP Firewall Service Cannot Start" on page 32.
- In multiple NIC systems where the NIC for the device is using LLA mode, ensure that no other NIC is in the same mode or switches to LLA mode. It is preferable that the Teledyne DALSA DHCP server is enabled on the NIC used with the device instead of LLA mode, which prevents errors associated with multiple NIC ports using LLA mode.

Device IP Error

The GigE server tray icon shows a warning with IP errors. Review the following topics on network IP problems to identify and correct the condition.

Multiple Camera Issues

- When using multiple cameras with a computer with multiple NIC ports, confirm each camera has been assigned an IP address by checking the GigE server (see "Sapera GigE Server Details" on page 27).
- LLA mode can only be used for one NIC port. For other NIC ports use a DHCP server or persistent IP. For details see "Warning Example 1a: IP error with multiple NICs" on page 33 and "Warning Example 1b: IP error with multiple NICs" on page 34.
- When using multiple cameras connected to an VLAN Ethernet switch, confirm that all cameras are on the same subnet setup on that switch.
- If a camera installed with other GigE Vision cameras can not connect properly with the NIC or has acquisition timeout errors, there may be a conflict with the third party camera's filter driver. In some cases third party filter drivers modify the NIC properties such that the Teledyne DALSA Sapera Network Imaging Driver does not install. Verify such a case by uninstalling the third party driver and installing the driver again.

Other IP Issues

- "Warning Example 2: Subnet Mask or IP error" on page 35
- "Warning Example 3: Filter Driver Disabled" on page 36
- "Warning Example 4: Filter Driver Disabled in Windows XP 64" on page 36

Device Available but with Operational Issues

A properly installed camera with no network issues may still not perform optimally. Operational issues concerning cabling, Ethernet switches, multiple cameras, and camera exposure are discussed in the following sections:

Always Important

- To reduce network traffic in problem free systems, use the Network Configuration tool to reduce camera discovery broadcasts. See "Network Card Information and Configuration" on page 24 and "System Information, Configuration" on page 21.
- See "Cabling and Communication Issues" on page 38
- "Conflicts with Third Party GigE Vision Drivers" on page 38

Getting Timeout Messages

- See "Acquisition Error with a Timeout Message" on page 39

- Or specifically "Disabling Windows Firewall" on page 39

Other problems

- When using multiple cameras connected to an VLAN Ethernet switch, confirm that all cameras are on the same subnet setup on that switch. See "Using GigE Vision Cameras with a VLAN Ethernet Switch" on page 16.
- If a camera installed with other GigE Vision cameras cannot connect properly with the NIC or has acquisition timeout errors, there may be a conflict with the third party camera's filter driver. In some cases third party filter drivers modify the NIC properties such that the Teledyne DALSA Sapera Network Imaging Driver does not install. Verify such a case by uninstalling the third party driver and installing the Genie package again.
- Review "Ethernet Switch Issues" on page 43, which covers some complex issues and pause frame flow control.
- The GigE Vision driver Auto-Discovery process does not generate Sapera connect/disconnect events for cameras on the subnet. With multiple cameras connected via an Ethernet switch to one NIC, the default auto-discovery interval may need to be shortened. See "Sapera Disconnect-Reconnect Events are Lost" on page 38 for additional information.

Verifying Network Parameters

The Teledyne DALSA Network Configuration tool is used to verify and configure network devices and GigE vision camera parameters. See "Network Configuration Tool" on page 20.

Before Contacting Technical Support

Carefully review the issues described in this Troubleshooting section. To aid Teledyne DALSA personnel when support is required, the following **status file** should be generated and included with the request for support.

- Using the Teledyne DALSA network Configuration tool, the host computer network status file is generated by following the instructions "Creating a Status Report" on page 26.

Installation Issues and Functional Problems

This section covers issues that are apparent after installation or are indicated by the GigE server tray icon showing a warning symbol.

Windows XP Firewall Service Cannot Start

After installing Windows XP Service Pack 3, the Windows Firewall service will not start. Problems with the Framework may include:

- The camera cannot acquire a DHCP address
- Registry write failure
- Messages in the Sapera Log Viewer include "check your firewall" and the computer firewall is disabled for no reason.

After installing Windows XP Service Pack 3, the Windows Firewall service will not start. Symptoms may include the following messages:

- When you click Windows Firewall in Control Panel, you may receive the following error message:
  Windows Firewall settings cannot be displayed because the associated service is not running. Do you want to start the Windows Firewall/Internet Connection Sharing (ICS) service?

- If you try to manually start the Windows Firewall service by using Services, you may receive the following error message:
  Could not start the Windows Firewall/Internet Connection Sharing (ICS) service on Local Computer.
  Error 0x80004015: The class is configured to run as a security id different from the caller.

These symptoms are described in detail by Microsoft support at this link (http://support.microsoft.com/kb/892199).

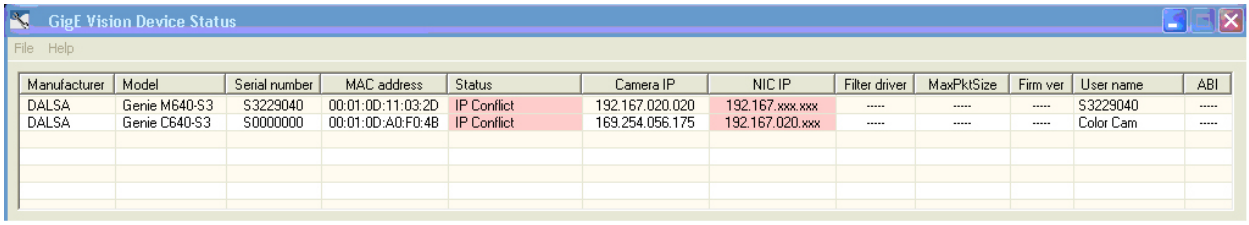
Without covering the details mentioned in the Microsoft support web page, the solution involves deleting two registry keys in the host computer. This procedure should only be done by someone comfortable with Windows registry backups and editing. These registry keys can be deleted via the following command console instructions:

- REG DELETE HKLM\SYSTEM\CurrentControlSet\Services\SharedAccess\Security /f
- REG DELETE HKLM\SOFTWARE\Classes\AppID\{ce166e40-1e72-45b9-94c9-3b2050e8f180} /f

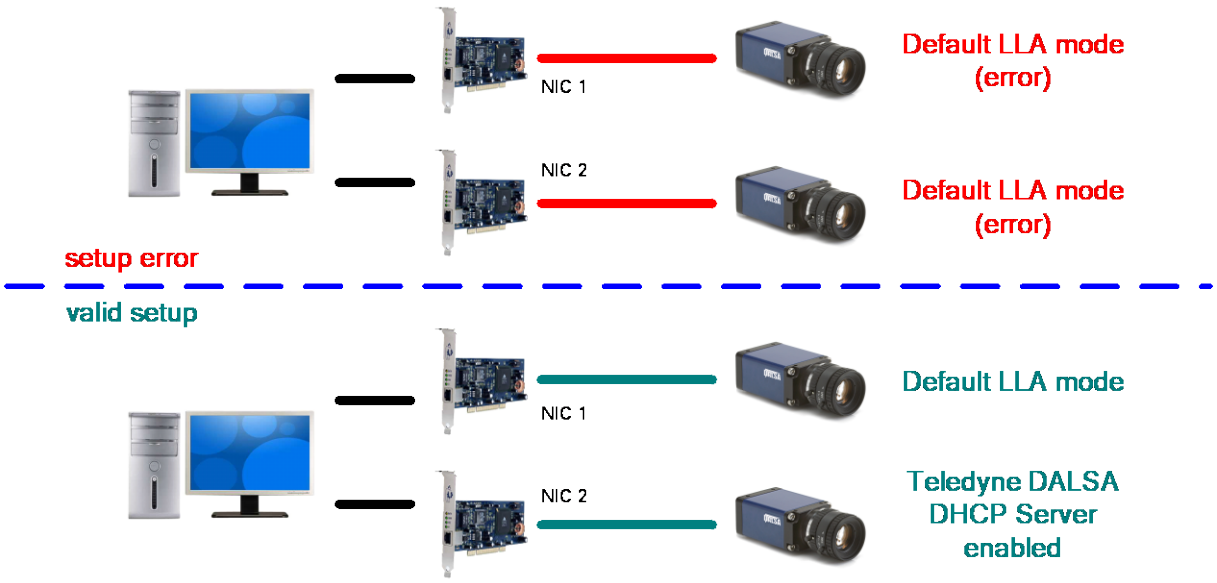
Reboot the computer after execution.

Warning Example 1a: IP error with multiple NICs

The screenshot below shows an IP conflict error due to two (or more) NICs that are all set to LLA mode. In this case both NICs are assigned the same IP subnet address preventing communication with any connected device.



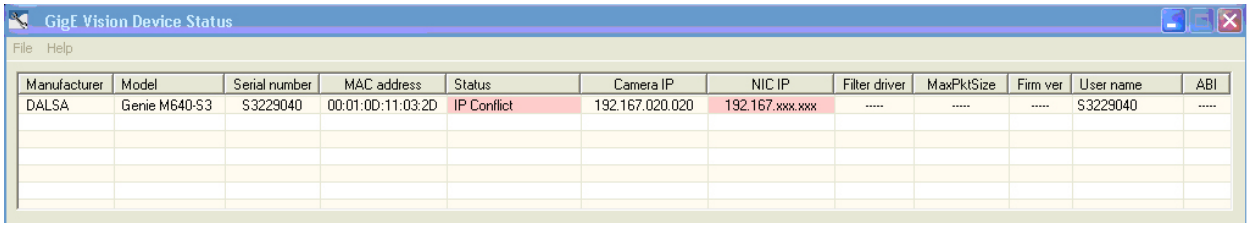
- When multiple NICs are used, only one can be set to LLA mode. A second NIC connected to a camera must use the persistent IP mode or must have a DHCP server on that subnet (note that the Teledyne DALSA Networking Tool can function as the DHCP server). The following illustration shows such a setup.



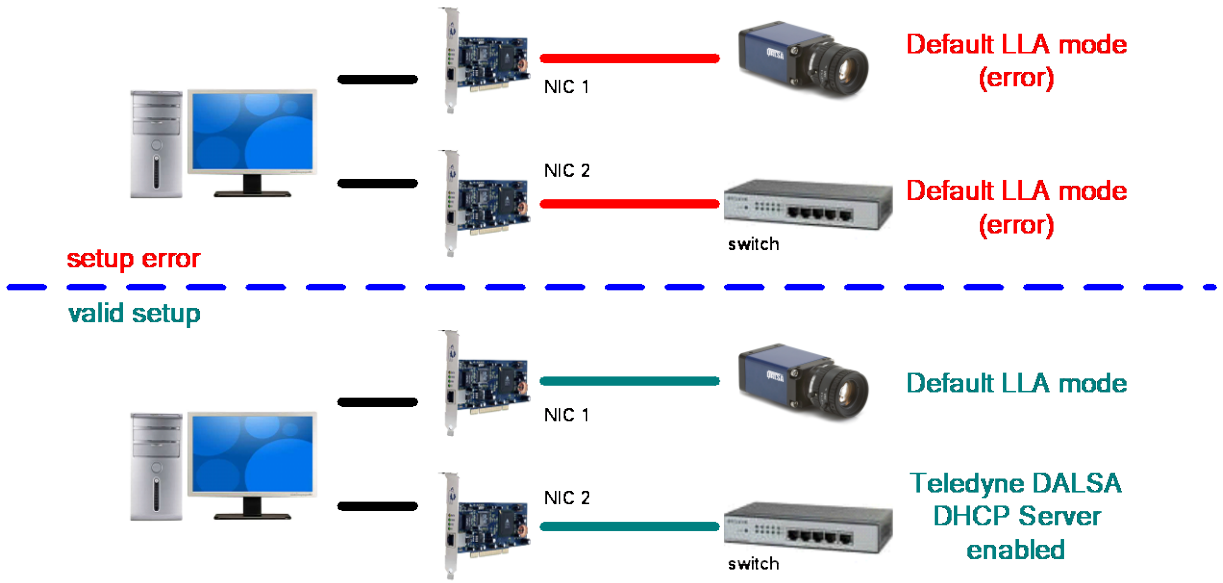
- For more information see "Using GigE Vision Cameras with Ethernet Switches" on page 16, and "IP Configuration Mode Details" on page 16.

Warning Example 1b: IP error with multiple NICs

As a second example, the screenshot below shows an IP conflict error similar to the example above but the second NIC has no camera connected (only an Ethernet switch).



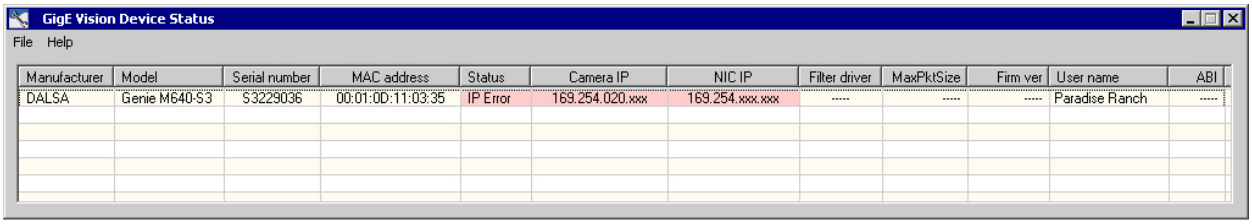
- The following illustration shows an example of this fault condition. The second NIC has no camera connected ether directly or via a switch.



- The solution again is that the second NIC must use the persistent IP mode or must have a DHCP server (available from the Teledyne DALSA Network Configuration Tool) on that subnet.
- For more information see "Multiple Camera Issues" on page 31, "Using GigE Vision Cameras with Ethernet Switches" on page 16, and "IP Configuration Mode Details" on page 16.

Warning Example 2: Subnet Mask or IP error

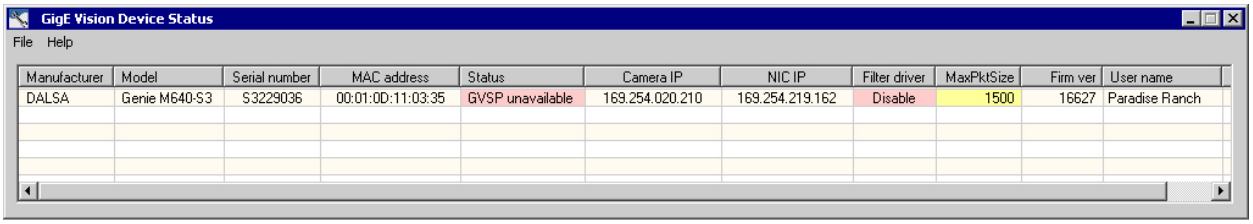
The screenshot below shows that the camera device is not accessible. This IP error is an example of the camera being assigned a persistent IP address with an incorrect subnet mask.



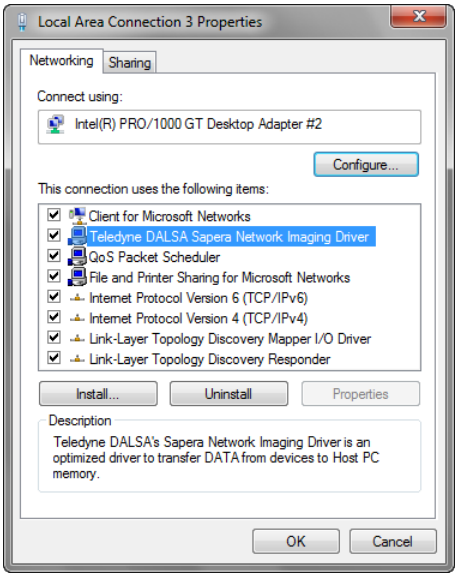
- This example error was made using the Teledyne DALSA Network Configuration tool, where the camera was set to Persistent IP mode with an incorrect subnet mask.
- Once the incorrect setting was applied, the camera was not accessible to the Network Configuration tool or any application.
- The Teledyne DALSA Network Configuration tool provides a device recovery function to force the camera back to LLA mode. See "Recovering a Camera with an Invalid IP" on page 25.
- An alternative solution is to change IP address of the NIC to match the camera subnet. This might be preferable if a DHCP server is running on this segment.

Warning Example 3: Filter Driver Disabled

The screenshot below shows that the camera device was found but there is an issue with the filter driver (Teledyne DALSA Sapera Network Imaging Driver). Such problems occur because the filter driver has become disabled or never installed correctly.



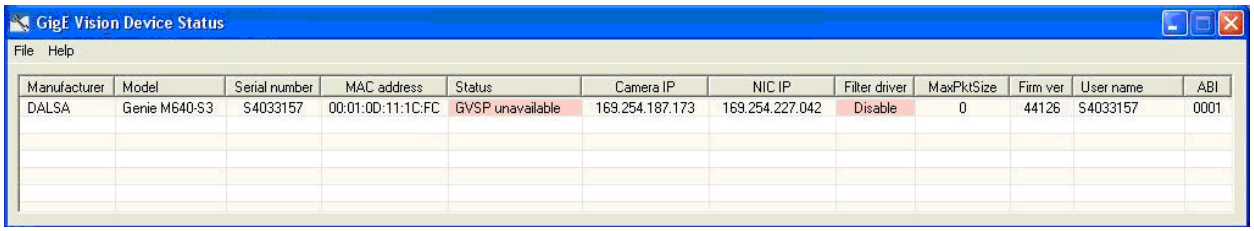
- Verify that the Filter driver is enabled in the properties for the NIC used with camera. The screenshot below shows a typical installation.



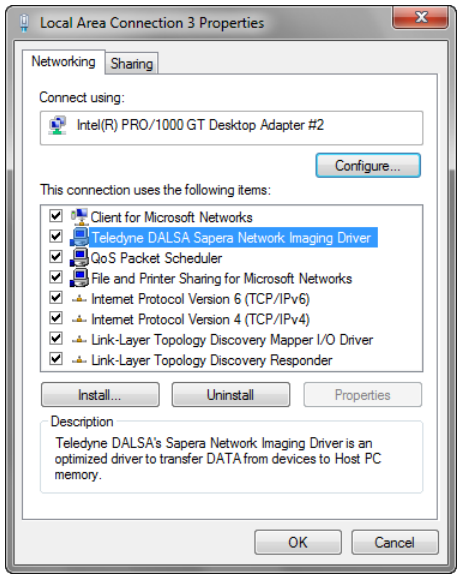
- Information about the Teledyne DALSA Network Imaging Driver is also available from in the NIC Configuration tab of the Teledyne DALSA Network Configuration tool.

Warning Example 4: Filter Driver Disabled in Windows XP 64-bit

The screenshot below shows that the camera device was found but there is an issue with the filter driver (Teledyne DALSA Sapera Network Imaging Driver). The filter driver has become disabled or never installed correctly when using Windows XP 64. This issue has not be seen with the 64-bit version of Windows Vista or Windows 7.



- Select the Status/Properties for the NIC used with the camera. The screenshot below shows a typical installation.



- The Teledyne DALSA Sapera Network Imaging Driver must be manually installed by enabling the driver and clicking install. Click on "Continue Anyway" when prompted to verify the installation as shown below.

Device Available with Operational Issues

This section considers issues with applications, cabling, Ethernet switches, multiple cameras, and camera exposure.

Sapera Disconnect-Reconnect Events are Lost

The GigE Vision server regularly polls for devices via GigE Vision DISCOVERY_CMD (Auto-Discovery). Cameras that are connected or disconnected generate Sapera events (EventServerAccessible / EventServerNotAccessible – see SapManager::RegisterServerCallback) for use by the application to identify cameras connected to a subnet. Polling is necessary because GigE cameras do not send a keep-alive signal back at a certain rate. It is thus the responsibility of the host software to poll (by design in the GigE Vision standard).

The Auto-Discovery interval is set by default to 15 seconds (see "System Information, Configuration" on page 21). If multiple camera disconnect / reconnect events occur between the polling interval, those events are lost. If an application must account for all events, the polling interval should be shortened when an Ethernet switch is used, especially since a switch masks the existence of connected devices.

But note that increased polling will increase network traffic and the polling interval may still not be short enough to guarantee that all quick camera disconnect /reconnects events will be seen.

Cabling and Communication Issues

Communication problems:

- Check that the Ethernet cable is clipped both to the camera and the NIC or switch on the other end.
- Use a shielded cable where the Hirose connector shell electrically connects the GigE Vision device chassis to the power supply earth ground. This can eliminate trigger issues in a high EMI environment.
- Verify the Ethernet cabling. Poor cables will cause connections to auto-configure at lower speeds. Ensure that the Ethernet cable is CAT5e or CAT6. This is very important with long cable lengths.
- Use a secured Ethernet cable in a high vibration environment.
- When using very long cables, up to the maximum specified length of 100m for gigabit Ethernet, different NIC hardware and EMI conditions can affect the quality of transmission.
- Minimum recommended Ethernet cable length is 3 feet (1 meter).
- Use the camera Ethernet status LED to confirm a gigabit connection. Note that a gigabit connection may still have many packet resends, rendering the connection useless. This condition has been seen with different NIC products.
- With Teledyne DALSA cameras, check the Ethernet status LEDs on the RJ45 connector (refer to each camera manual). The network speed indicator should show the expect connection speed and the activity LED should flash with network messages.
- Run the Sapera Log Viewer: **Start•Programs•Teledyne DALSA•Sapera LT•Tools•Log Viewer**. Start the acquisition program, such as CamExpert. There should not be any "packet resend" messages; else this indicates a control or video transmission problem due to poor connections or extremely high EMI environments.

Conflicts with Third Party GigE Vision Drivers

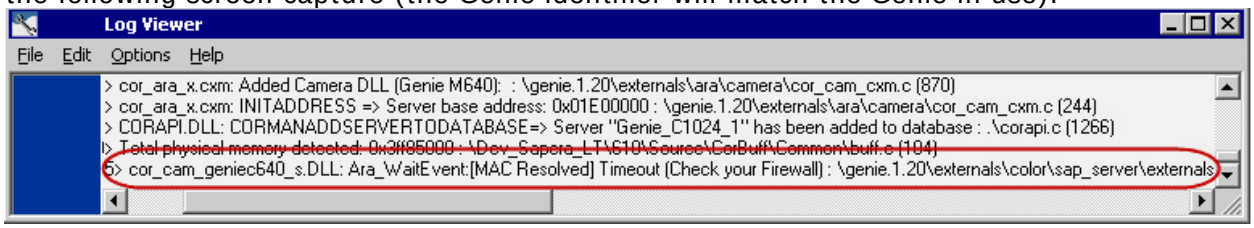
There is a potential issue when the Teledyne DALSA GigE Vision driver is installed along with other third party GigE Vision drivers. The installation proceeds without error and the device is seen by the Teledyne DALSA Network Configuration tool. But there is an error when attempting an image acquisition.

Uninstall or disable the third party GigE Vision driver before using the Teledyne DALSA GigE Vision driver.

Acquisition Error with a Timeout Message

A streaming error is typical with a firewall not allowing the filter driver through. As an example, CamExpert will run (but start slowly due to initialization timeouts), the Genie is visible in the device pane, but no parameters are shown to control the camera.

- If the host computer is using a firewall, either add the GigE Server in the firewall exception list or disable the firewall completely on the NIC used only with the Genie. Review the following information on disabling Windows Firewall on the NIC used with Genie.
- Run the Sapera log viewer program. A firewall block is identified as a timeout event as shown in the following screen capture (the Genie identifier will match the Genie in use).

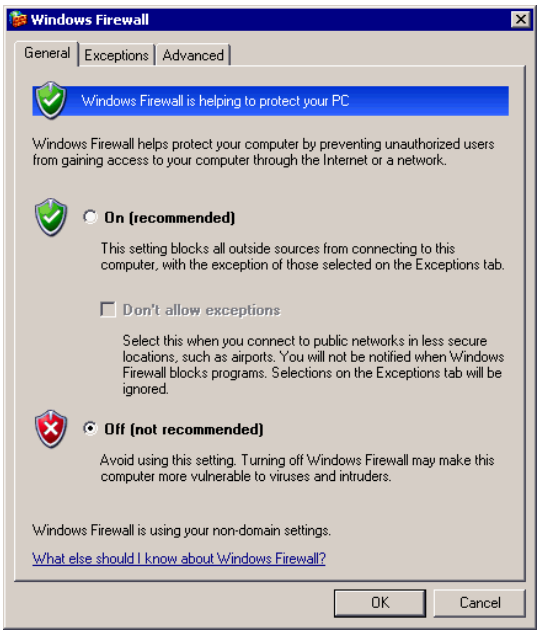


Disabling Windows Firewall

Connecting the Genie camera to a system running a firewall would require careful planning of the camera IP and the ports used by the streaming video and messaging. In general, the Genie camera is installed in a private network or within a corporate network with an external firewall. In both these cases, the host system that the Genie connects to does not need to run a firewall, therefore eliminating installation issues.

The Network Configuration tool automatically adds the Sapera GigE Server in the list of Exceptions of the Windows firewall. Therefore, in most situations, you don't have to take any special precaution to have the Genie run through the firewall.

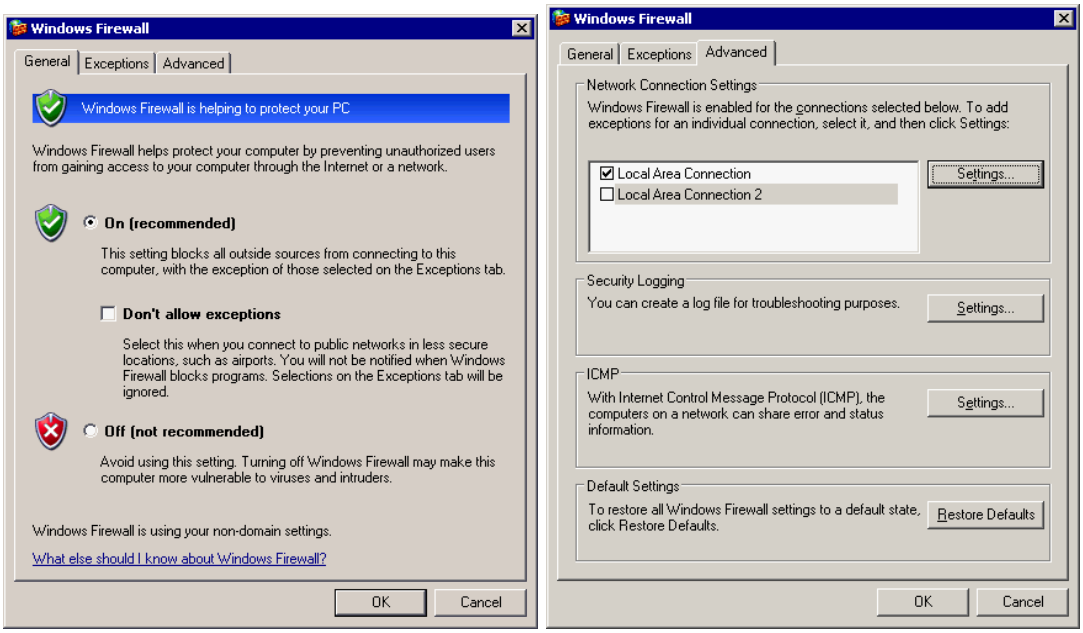
The following figure shows how to turn off the Windows XP firewall when the computer is behind a corporate network firewall. Run the Windows firewall application from the start menu **Start • Settings • Control Panel • Windows Firewall**. If the host computer is running a firewall from a third party, review the program's documentation to disable its execution.



Turning Windows Firewall Off

With a computer that is not behind a corporate firewall an alternative is to disable Windows firewall only for the network adapter dedicated for the Genie camera. Such a computer would have two or more network adapters where one NIC only connects to the Genie—never the Internet. You can use the Teledyne DALSA Network Configuration Tool to determine which network adapter is connected to the Genie.

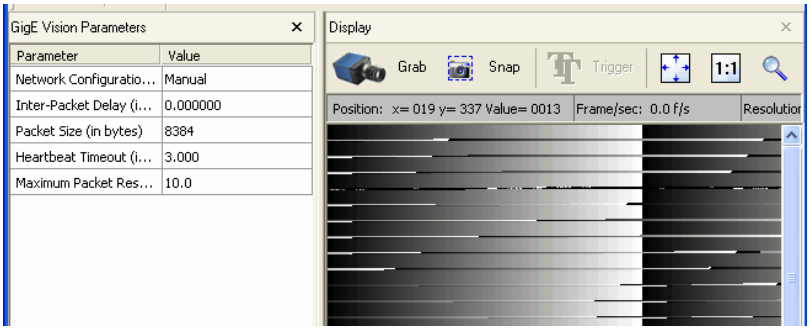
The following figures show an example of the Windows firewall On but disabled for the network adapter used by Genie.



Windows Firewall Off

Grab has Random Bad Data or Noise

This issue has all but disappeared with current NIC technology but is mentioned to ensure solutions are available for most installations. The problem is seen as random noise and missing sections of video data from the acquisition. All configuration parameters seem correct and the Ethernet cable is secure. The following image shows an example of this type of bad acquisition while testing a Genie installation with CamExpert (with the Genie set to generate its internal test pattern).



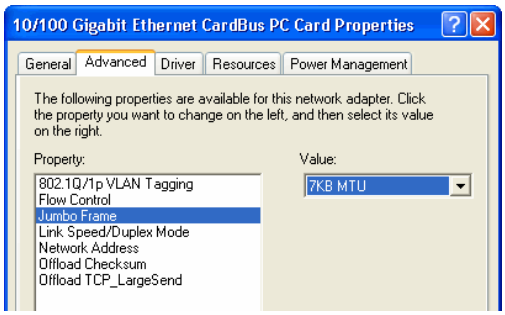
Following are various examples of this data transmission problem. The solutions vary but commonly involve reducing the maximum packet size claimed by the NIC used.

Grab has Random Bad Data or Noise – Case 1

- This problem has been seen on some computers where the NIC used does not fully support passing the maximum jumbo frame possible from the Genie.
- In the NIC configuration, keep the jumbo frame size set to the maximum allowed. See "Jumbo Frames Optimization" on page 12.
- When using a Teledyne DALSA camera with the Teledyne DALSA CamExpert tool, test for a good acquisition by reducing the camera packet size used via the GigE Vision optimization parameters. Also check for packet resend messages with the Sapera tool "Log Viewer".

Grab has Random Bad Data or Noise – Case 2

- This problem has been seen with network adapters using the Realtek RTL8169 chip and associated low-level driver. In this case the NIC reports a false maximum jumbo frame size.
- In the NIC configuration, set the jumbo frame size set to less than the maximum allowed. In this example the NIC reports supporting a maximum jumbo frame size of 8384 but good acquisitions are possible only when the size is reduced to 7k. See "Jumbo Frames Optimization" on page 12 and the image below.



- When using a Teledyne DALSA camera with the Teledyne DALSA CamExpert tool, test for a good acquisition by reducing the camera packet size used via the GigE Vision optimization parameters.
- Verify there are no packet resend messages with the Sapera tool "Log Viewer".

Grab has Random Bad Data or Noise – Case 3

- This problem has also been seen with network adapters that do not support jumbo frames but still report a false maximum packet frame size.
- When using the Teledyne DALSA CamExpert tool, if the Network Configuration Mode is left as Automatic (default), CamExpert uses the value the NIC reports as its maximum. This maximum value is actually not supported.
- Test for a good acquisition by reducing the camera packet size used. Set the value to a starting value of 1500 to verify acquisition before trying a higher value.

Older Laptop Computer Networking Issues

This issue has all but disappeared with current NIC technology but is mentioned to ensure solutions are available for most installations. Laptop computers with built in GigE network adapters may still not be able to stream full frame rates from various cameras. Laptops with gigabit Ethernet PCMCIA boards may not be able to stream video at all unless network parameters are modified. Thorough testing is required with any laptop computer.

Streaming video problems may change depending on the computer chipset and NIC combinations. Laptops running on battery power may exhibit more bandwidth issues due to the inherent power saving characteristics of laptops.

This section describes a few configuration items to modify for best performance. Verify the GigE Vision device at the frame rates required or to determine the maximum frame rate possible with the laptop used.

Problems with Disconnecting NICs

GigE Vision cameras installed in environments with physical motion, vibrations, or high EMI may be disconnected by the NIC. The following items need to be reviewed to solve the problem.

- Motion or vibrations may cause data loss because the Ethernet cable connection is not secure. Use a locking Ethernet cable (see any Genie manual for information on locking Ethernet cables).
- High EMI may cause the NIC to drop data or to disconnect and reconnect at a lower data rate. Such situations do not have simple solutions and may require shielded Ethernet cables.
- Some NIC products may not tolerate any data disruptions. Any condition causing the NIC to drop the connection may make it unrecoverable. Communication can not be reestablished without power cycling. In this case, trying a variety of NIC products is suggested.

Ethernet Switch Issues

An Ethernet switch usually works transparently and presents no problems. Review the following list when troubleshooting switch issues.

Basic Points for all Ethernet Switches

- Is the Ethernet switch powered on.
- Are all ports used configured as active; not disabled.
- Are all ports running at gigabit speeds–not low speed (i.e. not 10 or 100 Mbps).
- Is the switch configured to use or allow Jumbo Frames. Note that unmanaged switches cannot be configured; they either support jumbo frames or not.
- Verify the Ethernet cabling. Poor cables will cause connections to auto-configure at lower speeds.

More Complex Configurations

- When using a VLAN Ethernet switch, confirm that the GigE Vision camera and controlling computer are on the same VLAN group setup on that switch.
- When using a chain of switches, ensure that inter-switch connection speeds are the same (1000 Mbps).
- When using a multi-port switch with multiple cameras all grabbing, problems such as individual cameras randomly disconnecting point to a switch fault with high traffic configurations. Change the switch to one from a different manufacture or a later model. This condition was identified with an Advantech 8 Port Unmanaged Industrial Ethernet Switch EKI-2728 and the manufacturer claims to have resolved the issues with a revised version (internal identification: -BE).

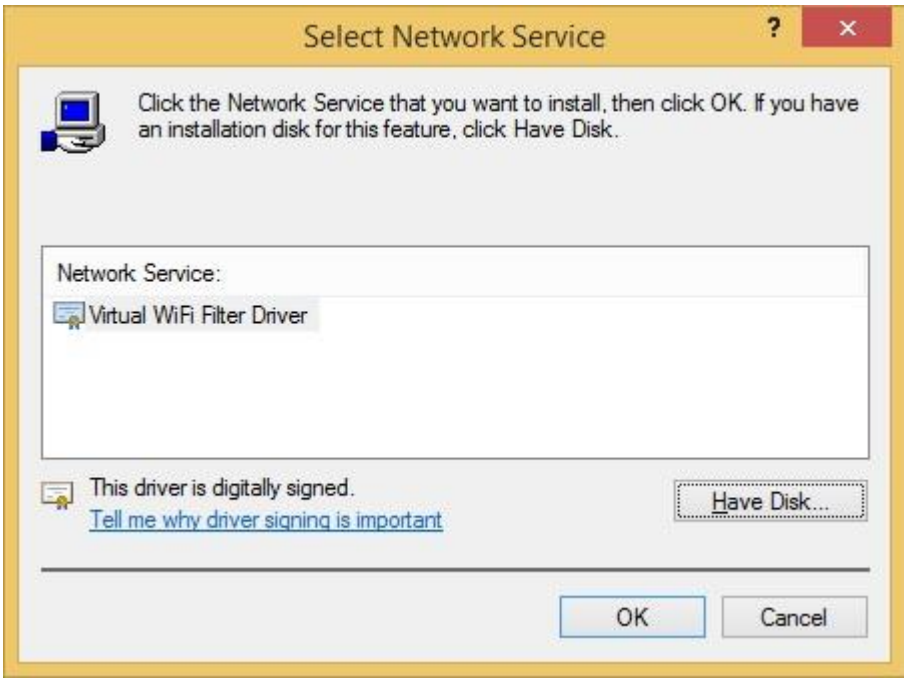
Image Loss with Many Cameras Connected to one NIC

- Example: A large number of cameras are connected to one NIC and each camera works correctly when tested. But when all cameras are triggered simultaneously, images are lost from a number of cameras. In such a case the NIC maximum bandwidth is exceeded if there is no mechanism to temporarily hold back data from cameras. Genie cameras support the IEEE 802.3x pause frame flow control protocol automatically, therefore the solution is to use an Ethernet switch that supports flow control. See "IEEE 802.3x Pause Frame Flow Control" on page 28 for additional information.

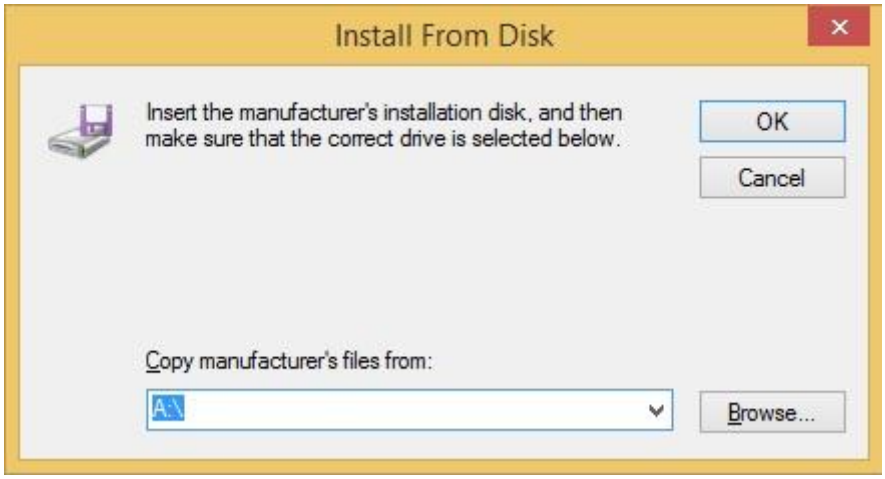
Appendix A: Filter Driver Installation Issues with Foreign Language Windows

With some foreign language Windows there is a problem where the installation of a required filter driver does not proceed automatically. Until this issue is resolved by Teledyne DALSA engineering, a user needs to follow the instructions below to complete the installation.

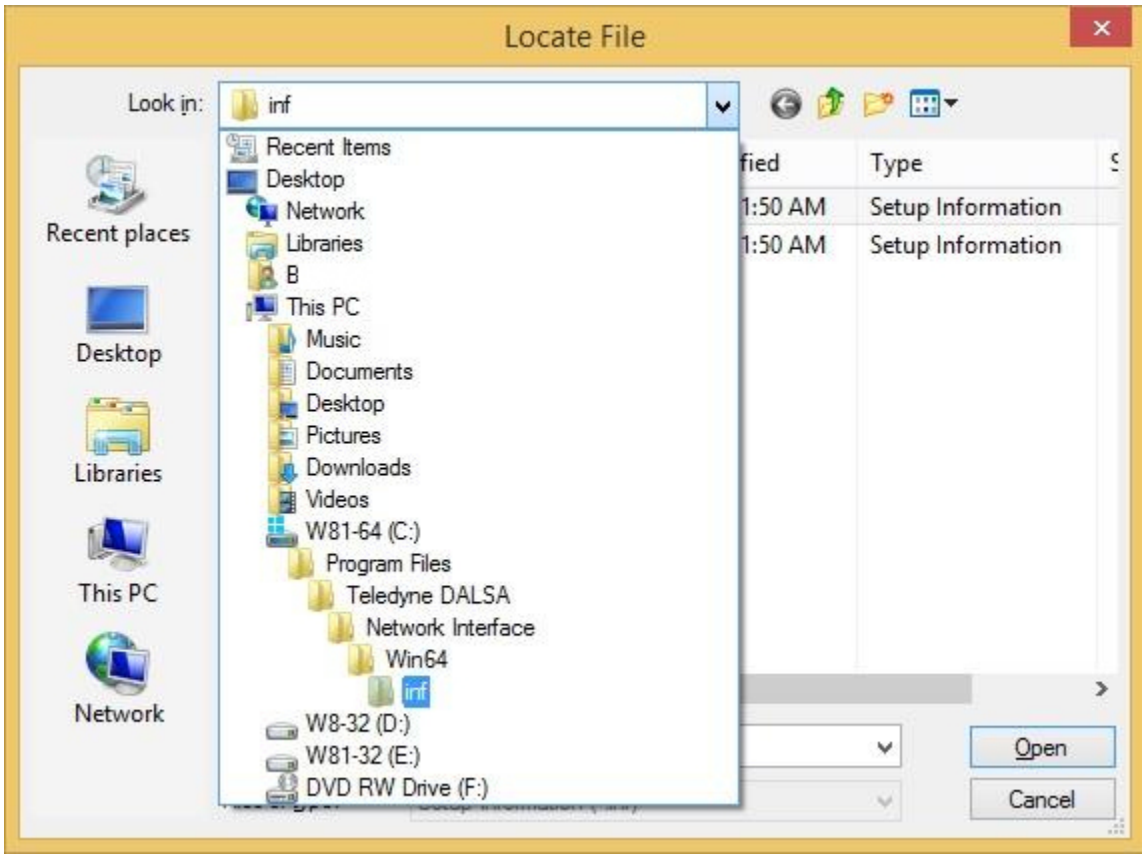
- If the installation sequence stops with this message window just click on the Have Disk button.



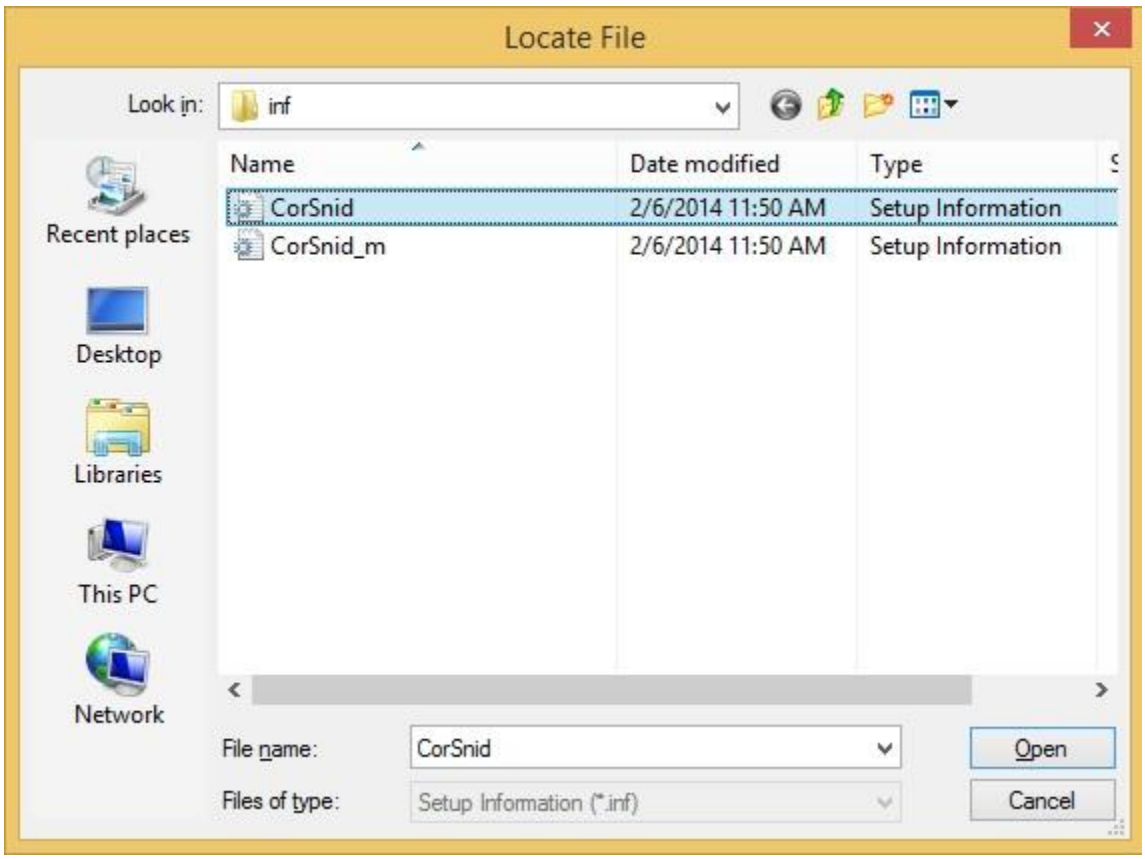
- On the next menu, click Browse. Note that no external disk is required.



- Select the local directory as shown in the following dialog. Note that this image is for a Windows 64 installation. When using a Windows 32 computer, the folder path is ..\Win32\inf.



- Within the 'inf' folder, select the "CorSnid" file and click the Open button. Ignore any other file.



- Click OK to accept this file.

- Finally select and click OK to load the driver “Teledyne DALSA Sapera Network Imaging Driver”.

- After this step the installation will progress automatically as is normal with the English version of Windows.
- These manual steps by the user in no way affect the installation, but are simply a workaround to how the foreign language Windows currently handle the Teledyne DALSA installation script.

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Glossary of Terms

ARP
Address Resolution Protocol provides a way to retrieve the MAC address associated to an IP address.

Bandwidth
Describes the measure of data transfer capacity.

CAT5e Ethernet cable
Category 5e was designed for transmission speeds of up to 1 gigabit per second (Gigabit Ethernet).

CAT6 Ethernet cable
Same as Category 5e, except that it is made to a higher standard. Supports transmission speeds greater than Gigabit Ethernet with less signal attenuation over a given length of cable.

DHCP (Dynamic Host Configuration Protocol)
Protocol which provides a mechanism for allocating IP addresses dynamically by a DHCP server on a network. Typically dedicated DHCP servers are a component of corporate networks. Used for managed networks.

Driver
Also called a device driver, a program routine that links a peripheral device to the operating system. a device driver is required for its frame grabber capabilities.

Ethernet Switch
A network device performing bridging at full wire-speed based on MAC addresses. Packet collisions are eliminated when using a full duplex switch. An Ethernet Switch operates at Layer 2 of the seven-layer OSI model.

Frame
One complete image data set or its equivalent storage space.

Frame buffer
An area of memory used to hold a frame of image data. A frame buffer may exist on the acquisition hardware or be allocated by the acquisition hardware device driver in host system memory.

GigE Vision specification
Specification of the Automated Imaging Association (AIA, www.machinevisiononline.org). Defines the communication interface protocol used by any GigE Vision device.

GenICam specification
Specification of the European Machine Vision Association (EMVA, www.emva.org). Defines the capabilities of any GigE Vision device.

GVCP – GigE Vision Control Protocol
One of the core protocols of the GigE Vision specification used to control camera. GVCP uses UDP port 3956 on the camera.

GVSP – GigE Vision Stream Protocol

One of the core protocols of the GigE Vision specification used to stream images.

Host

Refers to the computer system that supports the installed camera or frame grabber.

IP – Internet Protocol

The Internet Protocol is the method by which data is sent from one computer to another on a network or across the Internet. Each device must have an IP address to identify that device on the network or on the Internet.

LLA

Link-Local Address is a protocol providing a scheme for devices to automatically assign themselves an IP address and check for IP conflict. Used in unmanaged networks.

NIC

Network Interface Card/Controller. For the Genie products the NIC must be a Gigabit Ethernet interface to provide sufficient bandwidth.

Router

A Router device forwards packets across networks. It operates at Layer 3 of the seven-layer OSI model. Note that broadcast packets (such as GigE Vision Device Discovery message) do not cross routers.

Subnet

The subnet is identified by performing the logical AND of the IP address with its subnet mask.

TCP

Connection-oriented transport protocol providing robustness and reliability. Used by many Internet application, such as HTML.

UDP

User Datagram Protocol is a connectionless transport protocol providing no guaranty of delivery or reliability. GigE Vision Control Protocol and GigE Vision Stream Protocol are based on UDP.

VLAN

A Virtual Local Area Network is a flexible arrangement where computers connected via a VLAN Ethernet switch are not necessarily on the same LAN broadcast domain. Refer to the VLAN Ethernet switch documentation for implementation and configuration details.

VPN

A virtual private network is a private data network that makes use of the public telecommunication infrastructure, maintaining privacy through the use of a tunneling protocol and security procedures. The idea of the VPN is to give the company the same capabilities at much lower cost by using the shared public infrastructure rather than a private one. (source: www.netunlimited.com/glossary.html)

Index

T

U

V

X